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The Development of the NASA Aviation Safety Reporting System

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FOREWORD

Under the terms of the original agreement between NASA and the FAA, establishment of the NASA Aviation Safety Reporting System (ASRS) program development began in 1975 and was to be completed in June of 1980. The period was extended twice; the developmental phase was completed in June 1982, with the ASRS fully operational in accordance with its design objectives.

This report describes the development of the Aviation Safety Reporting System. It consists of a history of ASRS, a discussion of the process of acquiring voluntary safety reports, the development of the information processing system, database design, aviation system hazard research, and program output. These sections are compiled into a final report on the developmental phase of ASRS and are supported by referenced Appendices A through I. In addition, Appendix J provides an analysis of ASRS project costs, and Appendix K contains a list of the individuals who have participated in the program.

Both NASA and contract personnel have participated in the formulation of the report. The ASRS staff, from the project's inception, has been composed of a unique group of people. Departing from the normal procedure, under which such a project would be assigned to an existing organization, NASA and its ASRS contractor, Battelle, have recruited and assembled a body of experts, which consists mostly of retired professional pilots and air traffic controllers. Now that system development is complete, this group reviews its accomplishments with some measure of pride, and with the hope that individual dedication and collective effort have made a worthwhile impact on flight safety.

1. HISTORY OF THE AVIATION SAFETY REPORTING SYSTEM

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INTRODUCTION

Speaking before a Flight Safety Foundation International Air Safety Seminar in Madrid in November of 1966, Bobbie R. Allen, the Director of the Bureau of Safety of the U.S. Civil Aeronautics Board, referred to the vast body of accumulated aviation safety incident information as a "sleeping giant." Noting that fear of legal liability and of regulatory or disciplinary action had prevented the dissemination of this information, rendering it valueless to those who might use it to combat hazards in the aviation system, Mr. Allen commented:

> In the event that the fear of exposure cannot be overcome by other means, it might be profitable if we explored a system of incident reporting which would assure a substantial flow of vital information to the computer for processing, and at the same time, would provide some method designed to effectively eliminate the personal aspect of the individual occurrences so that the information derived would be helpful to all and harmful to none (ref. 1).

Several years earlier, in testimony before the U.S. Senate on the legislation proposing the Federal Aviation Act of 1958, the late William A. Patterson, then President of United Airlines, touched on the need to develop accurate safety trend information. "On the positive side," said Mr. Patterson, "you take your staticstics – and your records – and your exposures – and you act before the happening!" (ref. 2).

These distinguished aviation figures were articulating an objective long-recognized, but which had frustrated all efforts at accomplishment. In the years to come, frequent references to the need for information collection and dissemination would recur. One speaker at a safety conference mentioned a

> . . . cherished dream of air safety professionals everywhere . . . that the world's airlines can achieve an effective incident reporting and human factors analytic system. If we can achieve such a system we will have taken a major step toward the precise identification of the root causes of our most perplexing problems.

At 9 minutes past eleven o'clock on Sunday morning, December 1, 1974, a tragic event occurred which was to stimulate formation of the desired system. Trans World Airlines (TWA) Flight 514 was inbound to Dulles Airport through cloudy and turbulent skies when the flight crew misinterpreted an approach chart and had a different perception of certain air traffic control procedures from that held by the controllers who were working their flight. The aircraft descended below the minimum safe altitude specified for the area in which it was flying and collided with a Virginia mountain top.

The ensuing hue and cry probably would have subsided in time, as usual with such occurrences, had not a disturbing yet provocative circumstance emerged during the National Transportation Safety Board's (NTSB) investigation of the accident. Only six weeks before the TWA crash a United Airlines crew had very narrowly escaped the same fate when the same approach and the same location were used. The ambiguous nature of the charted approach procedure and the differences in its interpretation between pilots and controllers was then brought to the attention of the airline.

If this event had occurred a year earlier it is probable that it would have remained only a worrisome memory to the participants. In January of 1974, however, United had instituted a new internal reporting procedure termed its "Flight Safety Awareness Program," under which crew members were encouraged to report anonymously any incident they felt involved a safety problem to the company. The United pilots in the Dulles incident followed this course of action; other United pilots were made aware of the trap, and the FAA was notified of the circumstances. Regrettably, there was no generally accepted avenue for spreading the word. The progenitors of the United Airlines Safety Awareness Program called upon the National Aeronautics and Space Administration (NASA) for advice and counsel, aware that a group within the Agency had been devoting its resources to the study of human factors in aviation safety. Predicated on the acknowledged fact that aircraft accident investigation had been effective in the determination of what had happened, but had not seriously addressed the equally important question of why, NASA had established a project to examine the human factors involved in aviation mishaps. One of the NASA investigators at Ames Research Center in California speaks of the NASA-United relationship as a synergistic affair in which there was considerable give-and-take on both sides. United was concerned with the causes of human error in aircraft accidents; NASA hoped to penetrate the mysteries of the same subject. The NASA group conducted a series of interviews during 1974 with airline pilots, attempting to identify the problems and, they hoped, to suggest some solutions.

TWA's flight to Dulles, with its culminating tragedy, was subjected to the full glare of media publicity; United's narrow avoidance received little public recognition. TWA 514 may be seen as the actual catalyst that precipitated the Aviation Safety Reporting System (ASRS); in fact the United incident, attracting scant notice, may have been more influential because it prompted vigorous expression by the NTSB. In its report on the TWA accident, the Board stated that it was "encouraged that such safety awareness programs [as United's] have been initiated. . . . In retrospect, the Board finds it most unfortunate that an incident of this nature was not, at the time of its occurrence, subject to uninhibited reporting . . . which might have resulted in broad and timely dissemination of the safety message issued by the carrier to its own flight crews." According to the report, "Subsequent to the [TWA] accident, the Federal Aviation Administration (FAA) has . . . established an incident reporting system which is intended to identify unsafe operating conditions so that they can be corrected before an accident occurs" (ref. 3).

The notion of incident reporting was not new; however, all attempts to institute a formal program of information collection and dissemination had been stymied in the past by a pervading apprehension. "Fear of legal consequences" – the term appears often in the literature of aviation safety – had remained an effective block to the various proposals and suggestions that, over the years, had been offered in the effort to provide circulation throughout the industry of unsafe incidents, practices, and situations. As early as 1954, President Clarence Sayen of the Air Line Pilots Association (ALPA) "cautions all airlines that incident reporting systems aren't working because pilots fear disciplinary action by the carriers or the Government if they reflect dangerous occurrences." Sayen urged carriers "to grant pilots immunity from such action to encourage their participation in reporting programs." Members of the aviation community almost unanimously backed away from the concept of publicity for their involvement because they feared financial liability, personal incrimination, and disciplinary consequences. In the early 1960s a number of European airlines, by informal agreement among themselves, began to trade incident reports. This private arrangement became more formal when many members of the International Air Transport Association (IATA) agreed to a confidential information exchange among themselves.

Late in the 1960s the FAA announced a program intended to be nonpunitive in nature, to encourage reports of near midair conflicts. Although some reports were filed, and the FAA used them in designing Terminal Control Areas, the general reaction was widespread apathy because many of those asked to report such events – the pilots – lacked confidence in the promised immunity provisions of the program. That there were many such occurrences was proved by the number of reports produced when the Flight Safety Foundation (FSF) introduced its own "Project SCAN." In time these attempts at information gathering evaporated until the status quo was rudely altered by the crash of TWA 514.

ASRS BACKGROUND

"Confidentiality" and "anonymity" were announced features of the early information exchange programs. Although the IATA Safety Advisory Group, the United plan, a Swedish attempt, the FAA's Near Miss project, and others produced beneficial results locally, worry over liability, incrimination, disciplinary action, and publicity prevented widespread dissemination of information of great potential value.

It may be perceived that forces and influences had been gathering for many years as separate strands, finally to become interwoven into the embryonic ASRS. By the time of the TWA accident, public concern had become so widespread that it plainly fell to the FAA, charged with the promotion and regulation of aviation in the United States, to take – and to be seen to take – some vigorous action to eliminate, or at least to decrease, the incidence of aircraft crashes. The Near Midair Collision program had served its purpose, but no formal incident reporting system had replaced it. Now, in the early Spring of 1975, the Government acted. As a first step in an attempt to make an independent evaluation of air carrier operations and to report the results and recommendations to the FAA, a task force was formed. This group which was appointed as "The Special Air Safety Advisory Group" (SASAG) and which was called "The Six Old Men," consisted of highly experienced, retired airline pilots who all had a background in safety matters. One element of that report commented on the need for an incident reporting program (ref. 4).

The events of late 1974, highlighted by the NTSB comments and influenced by the opinions of groups such as the SASAG, finally precipitated significant action. In May 1975, the FAA issued Advisory Circular 00-46, announcing the inauguration of a confidential, nonpunitive incident reporting scheme – the Aviation Safety Reporting Program (ASRP). The ASRP was intended "to encourage the reporting and identification of deficiencies and discrepancies in the system before they cause accidents or incidents" (ref. 5). The ASRP, with a disclaimer excepting criminal actions and reportable accidents, offered limited immunity and anonymity to reporters. Within a very short time it became obvious that the FAA's good intentions would not carry the day. With the same reasoning as in the past, the aviation community failed to report to any significant degree. The old problem – fear of consequences – affected the intended participants in the new reporting program. Rightly or wrongly, the FAA, both the maker of the law and its enforcer, was not generally viewed as a properly disinterested referee. The agency, however, did not give up. Instead, it acknowledged past criticism and suggestions and turned to a neutral third party – NASA – to collect, process, and analyze the voluntarily submitted reports that it hoped would now flow in from a supportive aviation community. The two agencies collaborated in generating, in August of 1975, a Memorandum of Agreement under which, funded by the FAA, NASA would act in the capacity of "honest broker" as operator of the newly established ASRS, under the umbrella of the ASRP (ref. 6).

> This . . . is to advise that the Federal Aviation Administration (FAA) will modify the Aviation Safety Reporting Program (ASRP) effective April 15, 1976, by utilizing the National Aeronautics and Space Administration (NASA) as a third party to receive and analyze Aviation Safety Reports. This study of the National Aviation System invited pilots, controllers, and other users of the airspace or any other person to report to NASA actual or potential discrepancies and deficiencies involving the safety of aircraft operations. The program applies to that part of the system involving the safety of aircraft operations, including departure, en route, approach and landing operations and procedures, air traffic control deficiencies, pilot/controller communications, the aircraft movement area of the airport, and near midair collisions. The success of this program to improve safety depends on the free, unrestricted flow of information from the users of the National Aviation System. The objective of the modification is to increase the flow of information.
>
> – FAA Advisory Circular 00-46A (3-31-76)
> (See Appendix A for full text of AC 00-46A)

The FAA-NASA Memorandum of Agreement drastically changed the reporting program ground rules, and followed the commencement of the ASRP by only 3 months. The half year that followed this agreement and that preceded the distribution of AC 00-46A, was spent in diligent industry on the part of a small NASA group to construct a workable vehicle.

The NASA/FAA compact signed in August of 1975, following a brief summary of the background circumstances, described its rationale from the standpoints of the two separate agencies:

> The FAA has determined that the effectiveness of the ASRP would be greatly enhanced if the receipt, processing, and analysis of the raw information received were to be accomplished by NASA rather than the FAA. This would further ensure the anonymity of the reporter and consequently increase the flow of information so necessary for the effective evaluation of the safety and efficiency of the aviation system. NASA has determined that undertaking this task would be consistent with its aviation research and development responsibilities and would significantly increase its ability to fulfill those responsibilities (ref. 6).

The Memorandum of Agreement described the proposed ASRS functions as "(1) receipt, de-identification and initial processing; (2) analysis and interpretation; (3) dissemination of reports and other data; and (4) system evaluation and review" (ref. 6).

The system was to be designed "primarily to provide information to the FAA and the aviation community to assist the FAA in reaching its goal of eliminating unsafe conditions and preventing avoidable accidents. In addition, the system will be designed in a manner that will permit its operation by another party at the expiration of this agreement" (ref. 6). The last sentence will be seen as highly significant in pointing to the original developmental aspect of the system as viewed by NASA.

In addition to such procedural principles and details, two matters of great subsequent significance to the system were included. One was the provision of a waiver of disciplinary action to be offered to reporters – in fact articulation of the nonincrimination principle which had been for so long the bone of contention in incident reporting attempts. Secondly, in a provision which was to prove important in the subsequent operation of the ASRS, NASA agreed to form an ASRS Advisory Subcommittee within the framework of the NASA Research and Technology Advisory Council (RTAC) to "advise NASA on the design and conduct of the ASRS program and to provide an additional means of communication with the aviation community . . ." (ref. 6). Committee membership was to be appointed from "elements involved in the operational aspects of the national aviation system including FAA and DOD" (ref. 6). The advisory subcommittee, colloquially known as the "RTAC Subcommittee on ASRS," was also charged with surveillance over the security provisions required in connection with the preservation of anonymity inherent in the system. Membership included representatives nominated by the Aircraft Owners and Pilots Association (AOPA), the ALPA, the Aviation Consumer Action Project (ACAP), the National Business Aircraft Association (NBAA), the Professional Air Traffic Controllers Organization (PATCO), the Air Transport Association (ATA), the Allied Pilots Association (APA), the American Association of Airport Executives (AAAE), the Aerospace Industries Association (AIA), the General Aviation Manufacturers' Association (GAMA), the Department of Defense (DOD), and the FAA (see Appendix K).

Provisions for necessary financial support of the ASRS included a commitment by the FAA to reimburse NASA for amounts paid by NASA to any contractor assisting in the performance of ASRS functions up to a maximum of $560,000 for FY-1976. This could be increased or decreased thereafter by mutual agreement. NASA accepted costs incident to the "design and implementation" of the ASRS, costs of the operation of the RTAC, and other costs not specifically provided for.

Obviously, the Memorandum of Agreement represented a distillation of much thinking and of discussions by many people. The ASRS concept, as it developed, relied heavily on the precepts contained in the United Airlines Flight Safety Awareness Program, which had sprung, in turn, from the NASA/UAL cooperation. The final product, as envisioned in the Agreement and in the resultant advisory circular, gave promise that the wishful thinking of past years was to be realized. Outlining the desired objectives of ASRS and specifying general procedures for its operation required widespread cooperative effort. Execution in detail called for energetic, dedicated leadership to convert planning into effective practical result.

The work of the group at NASA Ames Research Center has been mentioned earlier. The leaders of that group were now called upon to translate the ASRS idea into reality.

In formulating the projected ASRS, it was anticipated that NASA might choose to utilize outside contracted aid. This indeed proved to be the case. Questioned by a representative of a potential bidder, during a bidders' conference held subsequent to the promulgation of the Request for Proposal (Q: Why is NASA going out of house to do this work?), NASA replied, "A determination was made, consistent with all laws and regulations, that the overall best interests of the Government would be served by contracting out for the services . . ." (ref. 7). A major factor in this determination was the obvious requirement for operationally experienced staff; this would have dictated a recruitment effort on NASA's part which was not justified in view of the specifically limited term of the program. Having made the decision to contract the detailed operation of ASRS, it now became the task of the NASA group to define closely the requirements to be met, and the actual procedures to be followed in that operation. By mandate, the ASRS was to become operational by, and to commence receiving reports on, April 15, 1976. In little more than 6 months, NASA was to prepare a proposal request, evaluate the competing bids, and to award a contract for the operation of the system.

In October, only 2 months after the signing of the FAA/NASA agreement, the formal Request for Proposal was issued to select firms and institutions and announced in the Commerce Business Daily. In that short span of time, a document was produced which spelled out a *modus operandi* for the novel organization that has required little substantive change in the ensuing years. Following thorough evaluation against rigorous selection criteria, the contract was awarded to Battelle Memorial Institute's Columbus Laboratories (BCL) on April 6, 1976. Less than 1 month later, on May 3, BCL had established an operations office in Mountain View, California – just outside the Moffett Field Naval Air Station headquarters of NASA Ames Research Center – and had assembled a small staff to commence the development of the system.

Viewed from the vantage point of 6 years, the early efforts of the NASA and BCL teams appear to have been sound. Within the limited time available to them, the two teams had designed a complex operating system that has met the test of time and fulfilled the early hopes of all concerned. The work of the original NASA Ames group in examining the human factors aspects of aviation safety permeated the thinking that went into the embryonic ASRS and provided the impetus and direction it was to take. Human factors, admittedly an intrinsic part of the safety problem, were now to figure prominently in the actual workings of the new organization. BCL's commercial interest in gaining the contract award was substantially augmented by the enthusiasm and personal interest of the staff assigned to the ASRS. The BCL proposal was assembled under the direction of a company official who was an aeronautical engineer and a licensed pilot, aided by others similarly qualified, some of whom were later to take a dominant part in directing the system. A detailed blueprint was produced by these people which could serve as a specification for the building of an efficient structure.

PROTOTYPE SYSTEM DEVELOPMENT

In its Statement of Work (ref. 8), the NASA-BCL contract announced "The Objective . . . is the design and implementation of the ASRS. . . ." Four primary functions were listed as: (1) communication with the aviation community to insure a continuing flow of data into the system; (2) receipt, processing, and deidentification of data; (3) analysis of processed data; and (4) preparation and dissemination of reports based on the data. BCL viewed the overall scheme as part of a larger aviation safety assurance system and accepted the challenge to put together a desirable, but not-yet-invented, system – and to make it work. One of the architects of the proposal was designated to lead the effort and at once began to put his directions into practice.

With a small staff on site, the time for action had arrived. Broad outlines were to be filled in with ordered details. Staff – both relocated from Battelle headquarters in Columbus, Ohio and locally hired – were faced with working out the security provisions to be placed into effect, with the assembly of necessary office equipment, and most importantly, with the development of a procedure which would enable them to carry out their assigned tasks. The first milestone was a test demonstration to be performed for NASA on July 6, 1976. With the issuance of Advisory Circular 00-46A, the FAA had notified the entire aviation community that ASRS was in business. Seven hundred thousand of the new reporting forms had been mailed out by the agency; within 8 weeks more than 1000 reports were received at Ames. ALPA, United Airlines, and many others had expressed approval of the ASRS, and encouraged their constituencies to use the system. FAA, NASA, and BCL had generated press releases and conducted briefings. System input exceeded expectations; immediately following the in-business announcement, reports flowed in at a rate of 250 each week. In time this was to taper off to a level of 100 to 150 weekly; it remained at that level, with an occasional spike stimulated by some highly publicized flying occurrence, until the air traffic controller strike of August 3, 1981.

Coinciding with the test demonstration, during which the BCL group displayed its capability and newly designed methodology, the Battelle Project Manager delivered the first draft of the Standard Operating Procedures (SOP) Manual to NASA as called for in the contract.

As the project staff continued to feel its way through its second quarter of operation, and incoming reports continued to accumulate, the difficulties posed by the information system design problem became sharply apparent. In conformance with its earlier decision, BCL engaged its first professional analyst; a recently retired senior airline pilot was independently subcontracted to Battelle. Arrangements were completed for installation of a computer terminal, and for hiring data entry assistance. At Ames, although no computer database yet existed, study of methods for researching the data now coming in with every postal delivery began. Those concerned came to the realization that the originally contemplated team size would be inadequate for the magnitude of the developing task, and an agreement was reached to renegotiate.

During the autumn months the contract was revised to reflect more realistically the task that was becoming clearer as it emerged. A few personnel changes and additions took place, procedures took on a more distinct form. A temporary group had been assembled in Columbus to assist in developing and applying a fixed-field format for report processing. Processing of reports by the California staff was still restricted to free text. Meanwhile, the backlog of unprocessed reports continued to build while the staff experimented with methodologies, and began to define its capability and potential.

By Christmas of 1976 ingestion of data had so far exceeded digestive capacity that strong measures were required. In Columbus, a team of Battelle researchers tackled the task of report processing in an effort to catch up, and by the end of the first year the ASRS staff began to bring report processing under control. A BCL researcher with previous experience in air traffic control had relocated from Columbus to California to take over the newly defined function of diagnostician. He developed, and for some time he was the only practitioner of, the process of keyword diagnostic additions to the now-developed fixed-field and free-text analysis of reports. The catch-up effort had been successful in eliminating the report processing backlog; however, it reappeared at the data entry point. During the quarter ending with June of 1977, the Air Force and the Navy agreed to participate with the ASRS in furnishing reports of incidents in which there was a military/civil interface. The RTAC committee made its first assessment of progress and expressed general satisfaction, although calling, as it continued to do so in the meetings to follow, for more active publicizing of the program, and emphasizing the importance of the immunity provision in stimulating widespread reporting.

The RTAC review was performed in compliance with a provision in the FAA-NASA Memorandum of Agreement (which also called for a comprehensive evaluation in June 1979), and was, in general, encouraging: ". . . Subcommittee wishes to state without reservation its support of, and confidence in, the Aviation Safety Reporting System." Recommendations made were to be viewed as "fine tuning" of a "program well designed and executed by the personnel of both NASA and FAA." Continuing, the RTAC report stated, "Results to date show conclusively that operation of ASRS is responsive to and compatible with the goals established for it. The subcommittee believes that the process of building a strong research and development base is now drawing to a close, and that the system's operational benefits will be demonstrated over the next 2 years." In commending the ASRS, the Committee expressed its pleasure in being associated with "an effort that . . . is providing an important contribution to aviation safety . . . we wish to call everyone's attention to a job well done" (ref. 9).

The opinion of the RTAC was encouraging to the Ames and BCL people; nevertheless, the difficulties of pioneering development remained. A close liaison between the contracting agency and the contractor was maintained. The NASA project leader and his assistant on the program, an attorney with extensive flying and aviation organization experience, were to be found in the BCL offices nearly as often as in their own offices at Ames. During this period the "fine tuning" extended to continued refinement of the computer system design and to the processing of forms and procedures. The staff had been augmented by the addition of two researchers with excellent aviation backgrounds, an additional pilot analyst and an additional controller analyst. With this staff it was now possible to begin to decentralize the diagnostician task, which had been handled up to now by one person. Accordingly, the researchers were trained in the application of the diagnostic system, and began to participate in the processing of reports.

Dissatisfaction, shared by NASA's and Battelle's information management experts, led to a decision to conduct a thorough design review of the system as it had evolved. Although information was flowing in and analysts were busy preparing it for computer storage, researchers attempting to utilize it for meaningful research results were finding serious shortcomings in the prototype system. It was evident that the time had come for a critical examination of the prototype system design, and for modification of some of the procedures as required, to improve the effectiveness of the system. Plans were laid for the design review to commence in January of 1978.

FROM PROTOTYPE TO OPERATIONAL SYSTEM

With the start of 1978 came the commencement of the design review. The full staff – both BCL and NASA – participated in a series of group meetings supplemented by individual study efforts. Every aspect of the procedures that had been developed to date was examined and recommended alterations were put into effect. Important among the staff changes and additions was the indoctrination and training of two new researchers with extensive flying experience who, as the ultimate users of the database, were felt to be the best choices to take on the diagnostic function. As a result of the review it was concluded that a revised database was needed; accordingly, following revision of coding forms and corollary changes to the SOP, reports were entered in the new Database 2 starting on May 1, 1978. At the beginning of the year, approximately 7100 reports had been entered in Database 1, the prototype. However, many were incomplete since a considerable number of these had not yet been subjected to diagnostic treatment; the backlog remained. With the inauguration of the new Database 2, and with diagnostics now performed by the researchers following completion of analysis, currency could be maintained in Database 2. The design review meetings, with all personnel participating, had the unexpected benefit of keeping the entire staff current on the workings of the project; it broadened viewpoints and created a climate of acceptance of change. The operating information system has since been maintained dynamically so that it could be adjusted to meet changing conditions and new knowledge on the part of the staff .

As the second year of the ASRS operations ended, the database representative function was no longer required on site and it was returned to the BCL organization in Ohio where the computer itself and the headquarters of the data management experts were located. The end of the original NASA-BCL contract was a milestone for the ASRS, signaled by NASA calling for a new proposal to cover project continuance through September of 1980. BCL, as the sole-source vendor, responded and was duly awarded a new contract. Prominent in its provisions was a work statement covering the details of the "turn-key" operation that had been implicit in the earlier proposal. The SOP, now mature, became the accepted Bible, and operations took on an established, relatively stable form. The analyst staff now included three experienced former air traffic controllers and three retired airline captains, some of whom worked on a part-time basis. In addition, the research staff included two former airline pilots. Following the early policy, all analyst effort was provided under the terms of personal services subcontracts, whereas the research database managers and project management staff members were Battelle employees.

Time had shown that the data transcribing process through which the analyzed reports were prepared for computer entry by an outside firm, would be accomplished much more effectively (and accurately) inhouse, and this was begun after training of personnel in the use of new computer terminals that had been installed in the Mountain View offices. Researchers were now given training in computer use and were henceforth able to query the database directly. A new staff position, "Output Supervisor," was established and filled by a retired pilot with experience in publication writing. The job, as envisioned, involved provision of editorial aid on the research studies that were beginning to emerge, as well as participation in the diagnostic portion of reporting processing, responsibility for Alert Bulletin preparation, and ultimately, preparation of a monthly bulletin. Late in the year, the flow of reports increased dramatically, although temporarily, as a result of the disastrous midair collision at San Diego and the attention thus drawn to aviation safety.

Steps now began in earnest toward making the ASRS self-contained, in compliance with the objective spelled out in NASA program direction. The contractor was expected to develop a workable system which, at the completion of the contract, could be turned over to another party. In this concept, NASA would gradually transfer to BCL those functions it was continuing to perform, as the contractor's experience and competence developed. In the meantime, NASA continued to screen all incoming reports to exclude those involving criminal offenses or reportable accidents. Reports were logged in for accountability by NASA before being sent to Battelle for processing; NASA also scrutinized input for evidence of "time-critical" situations, which were reported immediately to the FAA (or other organizations in a position to clarify or rectify matters). As time passed, these time-critical communiques acquired a new name: Alert Bulletins (ABs). While subjects for many of these ABs were spotted by NASA during original screening, others were identified by BCL analysts, who then drafted suggested bulletins to be submitted as recommendations to NASA.

This Alert Bulletin responsibility was passed to the new Output Supervisor as one of the first steps in the project self-containment process. A large backlog of unissued ABs was attacked and soon eliminated, after which the AB function was officially assumed by BCL, with NASA retaining final editorial and approval authority. Vigorous effort by the group as a whole soon managed the task of completing the backlogged diagnostics that had left Database 1 open, and ASRS-1, as it was known to the computer, was completed and closed out during the first quarter of 1979 with 8347 processed reports that had been entered into the system. Aided by the inhouse data entry and stringent efforts by the staff, backlogs in all aspects of report processing were tackled and, within a few months, completely eliminated. Achievement of currency provided a psychological lift to the staff and encouraged efforts toward a standardized and a more consistent report processing routine. Greater accuracy and recognizable higher quality in the database content were the results of these efforts. Familiarity with the job, and experience in performing it were beginning to be realized.

An unexpected event signalled the commencement of a new period of concern and uncertainty before this well-organized establishment could become complacent. In a Washington, D.C. speech before the National Aviation Club on March 16, 1979, FAA Administrator Langhorne Bond confirmed a unilateral decision made the previous month that the ASRS was to be altered drastically effective on April 30. To the consternation of a large part of the aviation community, Bond proposed to remove the immunity provisions which had come to be considered essential to the program. It had been the consensus of all early proposers of incident reporting programs that no such scheme could succeed if it lacked a waiver of disciplinary action against those reporting. It was the confidence of the potential reporting population in NASA's promise of anonymity and confidentiality, augmented by the FAA's immunity assurance, that had made ASRS more effective in attracting reports than any previous effort. Despite the apparent successful development of the program, however, in some quarters there was a perceptible undercurrent of dissatisfaction – even of opposition. In its initial sponsoring of the ASRS, the FAA had acted quickly and directly from Washington headquarters; the FAA regional officials had not been consulted, and explanations to and indoctrination of the staff in the field offices had been insufficient and largely ineffective. A substantial number of agency employees, most notably those responsible for enforcement of regulations, had not accepted implementation of the system happily; queries by FAA Headquarters had been consistently unsuccessful in bringing forth expressions of support from officials in the field.

Rumblings of discontent had been felt occasionally by the ASRS supporters, but those concerned with the program felt that these were not significant. In a reply dated March 8, 1978, to a letter from NASA Administrator Robert Frosch, Langhorne Bond himself confirmed his earlier approval. "ASRS," wrote Bond, "is providing needed and valuable insight . . . I am confident that an increased FAA familiarity with the ASRS database will further substantiate the merit of the program. . . ." In the same letter Bond stated, "The FAA is not contemplating a change of the provision for waiver of disciplinary action as set forth in AC 00-46A." Within a year Administrator Bond was to reverse his stand to the extent of proposing revocation of the "blanket immunity" provision of ASRS. In the words of Eric C. Eisenbraun, writing in the *Journal of Air Law and Commerce,* "The reaction to Bond's proposal was instant and unfavorable" (ref. 10).

Typical of this reaction was a report submitted to the RTAC Committee by a task group appointed by Chairman John H. Winant (NBAA) to investigate the situation. Captain C. W. Blair, in summarizing, wrote, ". . . it appears to the task group that waiver of disciplinary action is fundamental to a successful program, as is the FAA support by the education of its people regarding the small impact the ASRS waiver of disciplinary action has on enforcement actions, as well as what the system offers their organization as a safety research tool" (ref. 11). Captain Blair, the ALPA representative on the RTAC, chose strong words: "Shock waves ran throughout the aviation industry upon receiving word of the Administrator's intentions. The advisory committee representatives find this action to be without merit, and to cause considerable disruption to the submission of ASRS reports. . . . If the Administrator is willing to sharply reduce the effectiveness of an outstanding safety program, then future problems which the ASRS would have otherwise revealed, may result in accidents that could have been prevented" (ref. 11).

The uncertainty rife in the community led to an immediate drop-off in report receipt as pilots and controllers awaited clarification of the situation. Would submission of a report describing a violation of regulations prove incriminating? Would confidentiality and anonymity be compromised? Mustered into a solid block of ASRS support, industry groups registered their strong objection to the threatened loss of immunity. A Congressional subcommittee under Representative John Burton began a series of hearings on April 3, 1979, which in effect called upon Bond to defend his unpopular action.

In the end, a reasonable compromise was reached. The FAA's revocation was stayed before it was to take effect, and Advisory Circular 00-46B (see Appendix B) was issued which revised the ASRS immunity provisions effective July of 1979. In the earlier concept a limited form of immunity was granted when a report was filed. Under the initial dispensation, all persons in any way involved in an occurrence were automatically exempted from enforcement action with the filing of an ASRS report that met the qualifications for the waiver of disciplinary action. This was the most objectionable (to FAA) feature of the ASRS. There is no doubt that some – relatively few – enforcement proceedings were hampered, and subsequently not pursued, when investigators came up against this enveloping sterilization of all participants in an occurrence. In addition, the administrative workings of the system in this respect were cumbersome. In practice, it was necessary for NASA to maintain a file of specific, but nonincriminating, incident descriptors for 45 days. Spotting an alleged violation, the FAA investigators were required to query this file to determine if the incident had been reported. If not, and the 45 days had not elapsed, the investigation might proceed. At the end of the specified period, the descriptor file was destroyed.

Under the revised rules, only the reporter himself was to be protected. The date-stamped identification portion of his report, routinely returned to him as soon as possible after receipt by the ASRS, was to be used thereafter as proof that he had reported within the 10 days allowed. Subject to certain qualifications (inadvertent violation, timely filing, no previous finding of guilt since the start of the ASRP) no penalty was to be assessed, although the FAA, if it learned of the violation through sources other than the ASRS, might investigate and make a finding of a violation.

Implementation of these rules has made administrative aspects of the immunity program less cumbersome and has simplified enforcement and the investigative procedures for the FAA, without seriously denigrating the value of the system. With the issuance of the Advisory Circular announcing these changes, some publicity in the aviation press, and a mailing by the FAA of details to all licensed pilots and to all the FAA facilities, doubts were put to rest and report volume soon returned to normal. In fact, there was an initial surge, induced by the publicity given by the FAA and the aviation press, with an especially notable bulge in controller reports. In the past, pilot reports had slightly led controller reports. This proportion was now reversed and for a considerable time was moderately biased by the large flow from the ATC facilities. Ultimately it settled down to the previously normal approximation of fifty-fifty relationship of pilot-controller input. A minor, but significant, change in reporting patterns emerged as a result of the immunity modification. Formerly a report from only one participant in an occurrence was sufficient to extend the disciplinary waiver to everyone involved. Now only the reporter received this benefit. The result was a substantial increase in multiple reports of a single occurrence. A failure of coordination in an ATC facility might, for example, be reported by two or three – or even more – controllers. While adding to the data entry workload and computer storage, this has proved to be beneficial to the program by offering, in many cases, differing viewpoints and thus greater insight into problem causes.

SYSTEM MATURITY

From the point of view of the ASRS staff, resolution of the immunity question, with the widespread attention that resulted, put an end to a period of unsettled speculation, concern, and confusion, and had a distinctly stabilizing effect on project operations. Formal resolution of the disagreement put a *de facto* termination to such opposing views as, "... the ASRS immunity feature impedes the safety work of the FAA by frustrating its enforcement of the FARs" (ref. 12) and "The Advisory Committee, before and since the March 16th speech, has voiced a united and deep concern that such a change will effectively kill the system and thereby shut off a unique and effective channel for identifying and correcting safety deficiencies in the national aviation system" (ref. 13). The unintended, but perceptible, antagonism which had grown with the program was, at least nominally, at an end and all concerned displayed a cooperative intent.

The RTAC Committee, meeting for a June evaluation, reviewed the results of a survey undertaken the previous month by the Civil Air Patrol at the behest of the Committee. This served to emphasize the points made so often in the past: A large proportion of the flying population lacked knowledge of the ASRS, and in particular lacked an understanding of the immunity feature; in addition, suspicion of the FAA's credibility was widespread. Richard Clarke, again: "[... various groups] published announcements of the program. Since that time, the Air Line Pilots Association, the National Business Aircraft Association, and the Professional Air Traffic Controllers Organization have been the only industry groups which have done more than provide token encouragement for use of ASRS reports" (ref. 14). With the resolution of the immunity question, several steps were taken to fill the awareness and credibility gaps that had been noted. A means of regular communication with potential users of the ASRS had been recommended repeatedly; the project's Output Supervisor was assigned the task of preparing a monthly bulletin, although it was far from clear to anyone just what form the bulletin was to take – or to whom it was to be distributed. It was hoped that this step would provide, as suggested by RTAC member Captain James LeBel of Western Airlines, "Continuous, imaginative publicity on ASRS, ... increase the timeliness and the readability of flight safety information to the aviation community" (ref. 15).

CALLBACK #1 (the title was derived from the term used in report processing to indicate that an ASRS analyst had established telephone contact with a reporter) appeared on July 15, 1979, and was posted to about 3000 organizations, companies, publications, agencies, airlines, and individuals (the mailing list has grown, largely through requests, until by #38 in August 1982, it had reached a circulation of 18,000). NBAA cooperated in this venture by including a copy of each issue with its own organizational mailing to its members, while a number of airlines have requested bulk quantities for flight crew distribution or have publicized the bulletin's availability, on request, to its employees. CALLBACK #1 described itself as "an informal monthly bulletin from the office of the NASA Aviation Safety Reporting System"; as with the telephone callbacks to reporters, "The idea is to establish a dialogue in the interest of aviation safety. ... Safety is a serious subject, but we hope you will find this bulletin interesting, instructive, and even – sometimes – entertaining. We intend to bring you a summary of report processing activity and safety suggestions received, news of trends we have noted, briefs of unusual occurrences, suggested Alert Bulletins." The first two CALLBACKs described the staff and the operating methods of the System, noted the new immunity rules, made an appeal for readers to report safety-related incidents and included a few humorous anecdotes from ASRS narratives.

The new publication has received general approval and has, apparently, been successful in its aims of informing the avaiation public about ASRS and encouraging reporting. It has received a large number of responses from readers indicating favorable reaction to the safety lessons inherent in the typical reports printed each month. In November 1981, the FSF made its Publications Award to NASA citing CALLBACK for "analyzing trends and lessons learned through ASRS that provide invaluable insights into the attainment of even higher degrees of flight safety standards on an international basis."

In mid-1979, with its long-talked-of bulletin now an accomplished fact, all processing backlogs eliminated, and the AC 00-46B induced upsurge of reports, the ASRS now launched a tour to attempt to indoctrinate the FAA field personnel in the workings and potential benefits of the program. In an effort to gain understanding and acceptance from the sector hitherto most cool to the ASRS, representatives of NASA, BCL, and FAA took to the road on a one-week tour, visiting two FAA regional headquarters each day. Utilizing a prepared presentation, the three attempted to dispel doubts and to demonstrate how the ASRS database could serve the FAA. They returned with a number of requests for information from the database and research ideas gleaned from attendees at the meetings.

Greater awareness and acceptance of ASRS by the FAA, perhaps fostered in part by such informative efforts as CALLBACK and the traveling embassy, were given tangible form when, in December, the agency requested NASA, and NASA in turn requested BCL, to extend the allotted life span of the program to September of 1981. With the announcement of the extension, and the realization that the team of scientists and research people, retired pilots and controllers, and auxiliary aides had by now become a smoothly operating unit, attention was directed to intensified efforts on the part of the research team to generate more and more useful output. A research workshop was planned, and in early 1980, a group from the ASRS met in Washington with more than 40 invited attendees from the FAA, the NTSB, and other elements of the aviation community to explore subjects suitable for database research. A lengthy list was compiled and serious planning efforts were begun to organize an orderly research policy. Research topics were assigned, some to inhouse researchers, other to outside experts in various fields working as subcontractors. A substantial flow of papers came from this effort, justifying to a considerable degree the accumulation and processing of the large body of information now in the ASRS computer files.

In its December 1980 meeting, the RTAC members deliberated on the future of the ASRS. A detailed examination was conducted of the costs (Appendix J) and benefits of the program as perceived by the FAA and the aviation community. In summarizing its findings, the committee strongly recommended that the program be given permanent status, that it remain under the aegis of NASA, and that existing procedures be continued. Neutrality, expertise, community trust, and value of the ASRS data in aviation human factors research were mentioned as influencing factors in the recommendation that the *status quo* be established on a permanent basis.

In its deliberations the RTAC reiterated an earlier feeling: that full utility of the deidentified ASRS data could only be achieved if it were to become accessible to the FAA. The members again recommended that FAA personnel be trained in the use of – and that they become familiar with – the database so that the stored information could be directly available as needed. Pending that time, the ASRS staff has continued to respond to requests from the FAA for data on many topics. During 1981 the intensive research effort began to show tangible results in the form of technical reports on the various subjects that had earlier been viewed as good candidates for study. Of these papers, a number have been reproduced in the NASA ASRS Quarterly Reports or otherwise released by NASA, and have been used, in several cases, by airlines in their own flight crew bulletins. Some have served as material for abridged treatment by the aviation press, some have been cited by FAA in rule-making. Once again the committee urged NASA and the FAA to publicize more widely the existence and value of the ASRS to the aviation community.

During the first half of 1981 the ASRS activities proceeded on an orderly course, the project having been consolidated and its resources stabilized. The report diagnostic process was gradually transferred from researchers to the individual analysts, who were trained in use of the specialized diagnostic vocabulary. With this change the entire processing of each incoming report was accomplished by one individual analyst, who prepared the report from the fixed-field information through the callback, free text analysis and synopsis, and diagnostic sections. Each report was then given a quality control final check by a senior staff member before being released for data entry. Currency has been maintained through all phases of the processing, providing current data with which to answer search requests. The extensive research program which commenced in 1980 continues to produce studies on various aspects of flight safety, with the emphasis on understanding human factors.

The original termination date of September 30, 1980 for the developmental and demonstration phase of the ASRS has been extended, as noted earlier, by a 1-year renewal of the FAA-NASA agreement. Threatened in mid-1981 with the enormous anticipated complications – and soon to be realized – strike of a majority of the air traffic controller force, the FAA naturally gave first priority to the development of revised procedures to cope with the needs of air traffic control and were thus unable to effect the required thorough review of the ASRS so that its future course could be determined; accordingly, the agency executed a second 1-year renewal with NASA, extending the program to September 30, 1982. NASA, in turn, negotiated the necessary extension with its contractor, Battelle. During the early part of 1982, at FAA Administrator Helms' request, the ASRS staff compiled a comprehensive document which detailed every aspect of the program's performance, with tables and summaries covering system development, database management, all forms of output, research results, and personnel organization. Submission of this document was followed by a visit from agency officials to inspect, onsite, the actual day-to-day operation of the project. Based on the data supplied, augmented by the direct inspection impressions and the April 1982 recommendations of the advisory committee, the FAA announced its decision to extend the ASRS through September 1987.

The walkout of the controllers on August 3, 1981 had immediate and continuing consequences for the ASRS. The first impact was an immediate drop in report volume from approximately 400 received per month to about half that number. Significantly, the decrease was almost entirely accounted for by a drastic reduction in reports from controllers, which had hitherto constituted about 50% of the total. In expectation of the strike, the staff had formulated contingency plans. Included in these was a substantially increased rate of callbacks to reporters and a collaborative effort to maintain a close watch on safety aspects of the highly modified Air Traffic Control (ATC) system. In several instances the ASRS perception of apparent unsafe practices within the post-strike system stimulated issuance of Alert Bulletins.

An unexpected and gratifying result of the strike was a strengthening of the relationship between the FAA and the ASRS project. Direct ties between the two had been spasmodic and seldom close; with the onset of the PATCO action, the agency set into motion an attempt to make immediate use of current ASRS data. The project, at the FAA's request, began the recording of certain de-identified information from the reports received, for weekly telephone transmission to Washington. This activity has been continued and expanded, emphatically demonstrating the capability of the ASRS to provide timely and essential intelligence. Regular scrutiny of the ATC situation, as revealed in the reports received, led to special studies and two staff members were drafted to serve on federally funded task forces to evaluate the effects of the strike on safety.

During 1982 report coding methods were revised and the SOP was updated. There was a continuation of unfinished research efforts in progress and several reports reached publication. Revised definition of the research effort, and a planned scale-down, coupled with the lowered report rate, resulted in minor alterations of research and analysis staff. The NASA-ASRS project monitor was called to testify before a Congressional Committee concerned with the controller strike and air safety in general. Refinements in database management were made, and preliminary investigation and planning were directed toward the possible future implementation of a telephone "hotline" (800 number) for the reporting of incidents to the ASRS. With the completion of its developmental phase, the project demonstrated that it had attained a smooth-running routine and a viable operational status. Evaluations by the FAA and the aviation community, as well as the experience of those concerned with its development, confirm that the ASRS is a valuable resource.

2. THE ACQUISITION OF INCIDENT DATA

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INTRODUCTION

In an age of information and communication, the acquisition of data regarding aviation incidents should not present a significant challenge to program planners and managers; and in fact, most members of the aviation community have historically exhibited a willingness to share information, especially about accidents, hardware, and other parties' actions. However, the mission of the ASRS is to obtain incident data provided by the participants in those events; more specifically, the ASRS database is designed to reflect the participant's assessment of the situation or occurrence and his or her role in that condition. Other information systems exist to assemble descriptive, statistical, or second- and third-party data; but the ASRS mandate involved the task of gathering analytical first-party data, especially information that addressed the "why" of an event as reflected in the human behavior exhibited by the participants.

The first step in satisfaction of the ASRS mandate was to design a system in which the aviation community, both individually and collectively, could place a high degree of trust; furthermore, that trust from the community needed to be matched by consistent credibility on the part of the ASRS program and the program's management. It was decided that the elements of trust and credibility could be best served by an incident reporting system that was voluntary and that promised total confidentiality.

While mandatory reporting systems may produce a greater quantity of data, the quality of data from such a system may suffer from superficiality and doubt on the part of the report source as to its ultimate use. Voluntary information systems, on the other hand, have usually been characterized by higher quality reporting from individuals motivated by a genuine desire to see an issue pursued beyond the "filling-in-the-blanks" phase of safety investigation. By providing the motivated volunteer with the equally important assurance of absolute confidentiality, the ASRS design accommodates both the researcher's need for high quality, comprehensive data and the reporter's desire for selectivity and anonymity.

Of equal importance to the elements of voluntariness and confidentiality, is the lack of an enforcement mandate in the charter of the organization vested with the responsibility for the incident reporting program's administration, data analysis, and information management. This consideration made the selection of NASA, a respected research organization with no regulatory authority, a logical one in the search for a disinterested third-party. NASA's role as third-party intermediary between the members of the aviation community and the FAA has often been characterized as that of an impartial participant attending to the best interests of both sides.

To summarize, the ASRS was structured to encourage individuals to report incidents; to do so the first step was to design a program that: (1) called for voluntary participation, (2) promised confidentiality, and (3) resided in an organization which lacked any enforcement authority.

IMMUNITY

An issue collateral to the design of a system that encourages voluntary incident reporting was that of immunity for those individuals electing to report to the ASRS. The issue of immunity is bifurcated. Immunity protection can apply to the use of the data obtained, in which case the issue is termed "use immunity"; on the other hand, immunity protection can refer to the shielding that the reporter obtains from disciplinary action in exchange for his or her information. This is referred to as "transactional immunity." In conjunction with the NASA pledge of confidentiality for report sources, the FAA offered both forms of immunity to contributors to the ASRS program. The first, use immunity, was established in the form of promises contained in the FAA Advisory Circular and the FAA/NASA Memorandum of Agreement which set forth that "... FAA will not seek and NASA will not release to the FAA any information that might reveal the identity of [persons filing reports and persons named in those reports]." The concept of use immunity was further strengthened in 1979 with the adoption of Federal Aviation Regulation 91.57 which states:

> The Administrator of the FAA will not use reports submitted to the National Aeronautics and Space Administration under the Aviation Safety Reporting Program (or information derived therefrom) in any enforcement action, except information concerning criminal offenses or accidents which are wholly excluded from the program.

To a large degree use immunity and confidentiality are intertwined; in the context of the ASRS program neither of these two basic elements has been altered or even challenged by any party to the system.

The same cannot be said with regard to the issue of transactional immunity. From the beginning of the ASRS program in April of 1976, the issue of reporter protection from enforcement actions, the "waiver of disciplinary action," has been a point of contention. Although it was not specifically requested by the aviation community in the 1975-1976 period, the waiver of disciplinary action was offered by the FAA as an element of the ASRP concept.

It should be noted at this point that the waiver of disciplinary action element of incident reporting has always been viewed by NASA as an issue between the FAA and the aviation community. While recognizing it as an element of the overall ASRS concept, NASA, which has no authority to pursue any enforcement actions and similarly cannot grant any immunity from such actions, has essentially taken an observer position on the issue of transactional immunity.

The waiver of disciplinary action that accompanied the ASRS in April of 1976 was set forth in FAA Advisory Circular 00-46A (Appendix A) as follows:

> WAIVER OF DISCIPLINARY ACTION
>
> a. Provided a timely report has been filed, FAA disciplinary action is waived against all persons involved in the incident, as follows:
>
> (1) FAA has a period of forty-five days following an incident to ask NASA whether a timely report has been filed on that incident. Except as provided in paragraphs a.(2) and a.(3) below, the waiver of disciplinary action applies if FAA does not make this request within the time period specified, or FAA ascertains through NASA that a timely report was filed.
>
> (2) FAA disciplinary action is not waived for cases involving accidents or criminal offenses, which are wholly excluded from the program.
>
> (3) Reports involving reckless operation, gross negligence or willful misconduct may not be used for FAA disciplinary purposes. Disciplinary action may be taken in such cases, however, on the basis of information obtained independently of the Aviation Safety Report.

b. The following are examples of conduct that has, in the past, been identified as reckless operation, gross negligence, or willful misconduct:

(1) Intentional buzzing dangerously close to persons or property.

(2) Intentional operation of an aircraft in instrument flight rule weather conditions without proper air traffic control clearances or authorization.

(3) Knowlingly performing acrobatic flight within a control zone or a Federal airway.

(4) Intentional unauthorized descent below published decision height or minimum descent altitudes while conducting an actual instrument approach.

(5) Knowingly executing an unauthorized instrument approach in controlled airspace.

(6) Intentional operation of an aircraft that is substantially overweight.

c. The waiver of disciplinary action, where applicable, covers all persons involved in a reported incident, not only persons making, or named in, an Aviation Safety Report.

d. Each Aviation Safety Report has a tear-off portion which contains the information that identifies the person submitting the report. This tear-off portion will be removed by NASA, time stamped, and returned to the reporter as his receipt. This will provide the reporter with proof that he filed the report on a specific incident or occurrence.

The original version of the waiver of disciplinary action stayed in force until July 1, 1979. At that time the waiver of disciplinary action was modified to reflect the provisions as set forth in paragraph 9 of FAA Advisory Circular 00-46B (Appendix B):

> The filing of a report with NASA concerning an incident or occurrence involving a violation of the Act or the Federal Aviation Regulations is considered by the FAA to be indicative of a constructive attitude. Such an attitude will tend to prevent future violations. Accordingly, although a finding of a violation may be made, neither a civil penalty nor certificate suspension will be imposed if:
>
> 1. The violation was inadvertent and not deliberate;
>
> 2. The violation did not involve a criminal offense, or accident, or action under Section 609 of the Act which discloses a lack of qualification or competency, which are wholly excluded from this policy;
>
> 3. The person has not been found in any prior FAA enforcement action to have committed a violation since the initiation of the ASRP of the Federal Aviation Act or of any regulation promulgated under that Act; and
>
> 4. The person proves that, within 10 days after the violation, he or she completed and delivered or mailed a written report of the incident or occurrence to NASA under ASRS. See Paragraphs 5c. and 7b., above.

Note: Paragraph 9 does not apply to air traffic controllers. Provisions concerning air traffic controllers involved in incidents reported to NASA under ASRS are addressed in internal FAA directives.

Without discussing the differences in administrative mechanics of the first waiver of disciplinary action versus the post-July 1979 version, it is important to point out the major differences as perceived by the report community.

First, whereas the first version protected all event participants if even one of them filed an ASRS form, the modified version protected only the individual filing the ASRS report.

Second, reporters had 10 days to file a report under the modified version as opposed to 5 days under the original provisions.

Third, the action for which the reporter might seek protection in the original version could not have been the product of reckless operation, gross negligence, or willful misconduct; in the modified version the action simply had to be "inadvertent and not deliberate" to be protected.

Finally, whereas in the original version the waiver of disciplinary action could be successfully asserted in more than one event, the modified version permitted only a single claim of immunity from disciplinary action in the event of a guilty finding against the claimant.

Transactional and use immunities have become primary considerations in the ASRS concept. It is conceivable that a successful incident reporting system could be launched without transactional immunity, but use immunity is essential. However, it is unlikely that a system that has once offered transactional immunity, and then withdraws that immunity, will succeed in attracting the quantity or quality of data necessary for effective safety analysis and program product.

As established in the NASA/FAA Memorandum of Agreement, and as set forth in both Advisory Circulars 00-46A and 00-46B, reports containing information relating to aviation accidents (as defined by NTSB Regulation 830.2) and criminal activities (as codified in Title 18 of the U.S. Code, Annotated) are exempt from both the immunity and confidentiality provisions of the ASRS program. Because the ASRS and its staff members cannot be above the law in the sense of withholding accident or criminal information, all such information is forwarded to the appropriate investigatory bodies and not retained in the ASRS database. Accident data is forwarded to the NTSB and information regarding criminal activities is sent directly to the Department of Justice for distribution to the appropriate field office of the Federal Bureau of Investigation. It should be noted that the individuals who have submitted the reports of accidents or criminal activity are notified after the data's receipt of the requirement placed on the ASRS to forward the information to the proper Federal agency; this courtesy is extended primarily to let the person know what happened to the data; it is also done to explain the loss of immunity and confidentiality.

DATA ACQUISITION

In addition to the conceptual elements of confidentiality, voluntariness, and immunity, three other program elements are basic to the success of effective incident reporting. The first is ease of data submission; the second is program publicity; the third is evidence of information use and research productivity.

In many respects voluntary incident reporting has much in common with mail-order catalog sales. The program (or product) must be effectively publicized (or advertised), a desire to participate (or buy) must be generated, and finally, the means of reporting (or ordering) must be made as easy as possible.

Since its inception, the ASRS program has attempted to make incident reporting as easy, convenient, and inexpensive as possible. First, the ASRS form (see Appendix I) was designed by experienced research psychologists to gather a maximum of data while at the same time not discouraging reporters by its complexity or length. The report form layout was designed to gather the detail necessary to satisfy the needs of ASRS administrative, analytic, and research personnel.

Since the upper part of the ASRS form had to serve as an event identifier for immunity purposes, as address label for returning mailing purposes, and as a source of telephone information for possible callback purposes, the upper quarter of the front of the form was designed to contain all the specific individual and event identifiers needed by the ASRS prior to de-identification of the report.

The remaining three-quarters of the inside of the form and half of the reverse side of the form were designed to accommodate the generic event data and the narrative description of the event as provided by the reporter. Because of the need for some degree of structured vocabulary for data retrieval and research purposes, and as an aid to reporter recall, "cueing" in the form of a fixed field of elements and words was provided in the first 14 of the 15 report form items. The fifteenth item provides space, following some cueing questions, for reporters to describe the event in question in their own words. The designers of the report form sought to provide a structured environment for the benefit of both the forms' submitters and the ASRS data researchers; at the same time it was thought that the most valuable information would be obtained by encouraging the reporter to "talk-it-out" in the narrative sections of the form. This approach constitutes the rationale for the presence of both subjective and objective data gathering elements on the single-page form.

As a final element in the ASRS form's design, the form was printed to serve as a postage-paid self-mailer. One of the panels on the outside of the form was printed with the appropriate Government indicia to permit NASA to pay the postage on forms submitted to the ASRS. In addition, the ASRS address was printed on the mailing panel, thereby making it unnecessary for the reporter to do anything other than complete the 15 report items and deposit the form in the mail. All of this planning was toward the objective of making incident reporting easy.

In the course of this discussion of reporter motivation and facilitation of report form submission, one interesting side note deserves attention. Since early in the program a consistent comment from ASRS reporters has reinforced the form's design and one of the subtle values of incident reporting. The essence of that comment can be paraphrased best as "I don't care if ASRS does anything with the report, just taking the time and the effort to fill it out has helped me to appreciate better the lessons from this incident." The act of filling out the form itself has become a learning experience for the reporter.

FEEDBACK

Two coincidental, but different categories of motivation prompt contributors to the ASRS program to report their experiences. The first category, direct personal advantage through confidentiality and immunity, has already been discussed. The second, enhanced system safety, is a product of what the ASRS staff does with the data that have been volunteered. In essence this issue simply requires the ASRS to recognize that it must achieve and feed back program results, or the majority of data submitters will stop seeing value in program participation and not report their experiences.

Feedback to the aviation community can be both direct and indirect. The most immediate response to the reporter community is the direct feedback provided to the reporter following submission of an ASRS report. Few frustrations match that of voluntarily submitting data derived from personal experience to a governmental body which has been requesting such data and then not having that contribution acknowledged. Immediately upon de-identification of each ASRS report form, the individual submitter receives, by return mail, the following:

1. The identification strip section of the ASRS report form, date-stamped and bearing the internal tracking number for that identification (ID) strip (see Appendix I); in addition, where possible, ASRS analysts are encouraged to add a short, noncontroversial personal note to each ID strip from reports they have worked;
2. Two blank ASRS Reporting Forms to replace the one submitted to the ASRS;
3. A letter of appreciation (see Appendix I) to the reporter for his contribution to the ASRS program; this letter is standardized and reproduced in quantity, but the message is changed periodically.
4. A copy of the current issue of CALLBACK, the ASRS safety information publication (see Appendix I). This enclosure not only passes on safety information, it also exhibits the ASRS capability for constructive data usage and timely dissemination of contributed data.

This direct return response is accomplished usually within 4 or 5 days of the date of receipt of the report at the ASRS offices. Not only has the reporter received his ID strip for immunity purposes, but the reporter is also made aware immediately of the report's receipt, data usage, and receives acknowledgment of the Government's appreciation for his or her efforts and concern in pursuit of enhanced aviation safety.

The indirect feedback to the reporter community takes the form of evidence of data usage through alert bulletins, periodic technical reports, the monthly publication of CALLBACK, and awareness of the community's access to the ASRS database for legitimate organizational or personal safety investigations. In other words, the individual reporters and their professional organizations or trade associations are made aware of the fact that the ASRS process produces useful information.

In the case of alert bulletin issuance, if a reporter's information has been used in the generation of an alert bulletin, that reporter is notified of that fact at the time the ID strip is returned (see Appendix I). Because the ASRS office cannot keep a record of a reporter's name or address, the reporter is advised of the option to return the "coupon" on the thank you letter if he or she would like to know the results of the alert bulletin. If the reporter so elects, the coupon is returned to the ASRS where it is kept on file by alert bulletin number, not by ASRS report number, until a response to the alert bulletin has been received by the ASRS office, at which time the original reporter is sent a copy of the alert bulletin and its response.

The other products of ASRS data usage are distributed to the aviation community by several means so that the uses and value of the incident reporting system (see Section 6) can be publicized. ASRS Quarterly Reports are released to over 40,000 individuals through company or organizational distribution channels, direct mailings from a list maintained by the ASRS staff, and through the National Technical Information Service. Technical and contractor reports are distributed by direct mail from a recipient list created and maintained by the ASRS staff. The CALLBACK publication is provided to any member of the aviation community who has expressed to the ASRS office a desire to be placed on the mailing list. Finally, special requests for de-identified information from the ASRS database may be made by the community for legitimate safety investigations, as well as for training activities.

PUBLICITY

Program publicity and reporting form availability constitute the final elements in the procuring of safety data from the incident participants for use in the ASRS program.

Following the initial formulation of the ASRS program concept, representatives from NASA Headquarters and the ASRS office launched a campaign to acquaint the aviation community with the forthcoming incident reporting system. That publicity groundwork with the community, particularly the major aviation professional and trade groups, proved to be the single most productive public relations effort associated with the early stages of program development. Because the community, through its national spokesmen, was convinced of the potential effectiveness and security of the proposed NASA-managed ASRS, the reporting system developed local and organizational advocates. Not only were NASA and the FAA promoting the ASRS, but more importantly, elements of the community itself were speaking in favor of and encouraging ASRS incident reporting.

The advisory group (RTAC) was formed for the purpose of program oversight and guidance. One of the functions of the advisory group members was to carry the word about ASRS program plans and accomplishments back to their respective constituencies; again, ASRS was to be promoted from within the community as well as from the ASRS organization itself. History reflects the fact that during the program's existence, the most effective and most consistent ASRS publicity has come from the major organizations within the aviation community.

Following an initial flurry of promotional activity it became apparent that the ASRS effort was not receiving the publicity support originally envisioned from either of the sponsoring governmental agencies.

In the first 18 months of the ASRS program, NASA initiated and funded two promotional efforts. The first, creation, publication, and distribution of an orange brochure which described the ASRS, and which contained a blank reporting form, was well received (see Appendix I). Approximately 90,000 copies of that brochure were printed and distributed before July of 1979 when the change in immunity rules dictated revision of the brochure's text and its blank form. Because the future of the ASRS program was in doubt beyond the 1-yr term beginning in July of 1979, the brochure was not revised and reissued at that time.

The second NASA effort at promotion took the form of a multicolored 22-in. by 17-in. poster (see Appendix I) for use by fixed-base operators, FAA field offices and ATC facilities, as well as at airline crew facilities. The poster contained a "pouch" which held a supply of the orange brochures. More than 5000 facilities were provided with the poster and a supply of brochures; each poster came with instructions for replenishment of the brochure supply. The posters were prominently displayed for a period at most locations but as brochure supplies were depleted, the posters were removed in lieu of reordering the brochures. This failure to restock has been attributed, in part, to NASA's reluctance to spend any more funds to remind poster recipients of the means for resupply; in addition, the nature of many operations, both commercial and governmental, simply made it easier to do nothing in lieu of making an active decision and effort in favor of restocking the brochures and promoting the incident reporting system.

The FAA in April of 1976, and again in July of 1979, issued copies of Advisory Circulars 00-46A and 00-46B respectively to all airmen and air traffic controllers with active medical certificates. The FAA has always been vested with the responsibility for promoting the ASRS within its own organization and to its field offices. While the initial announcements of the existence and character of the incident reporting system were relatively widespread, follow-up program promotion has ranged from marginal to nonexistent. With the exception of a brief period of notification, not even necessarily promotion, following the 1979 changes to the ASRS program, FAA publicity efforts with regard to ASRS have been modest.

The largest single problem associated with program publicity relates to reporting form availability. Though reporting forms were twice supplied to all active airmen and air traffic controllers (in 1976 and 1979), and many industry organizations have both stocked ASRS forms and made mass mailings to their membership, reporting forms still seem to be unavailable to many of those wishing to participate in the ASRS.

One of the major issues associated with reporting form availability is noncompromising access to a supply of ASRS forms. Reporting is discouraged if an air traffic controller has to ask his or her supervisor or facility management for a reporting form; likewise, if an airman must visit an FAA office and be confronted with mild interrogation in response to a request for a reporting form, he is apt to opt in favor of silence. A readily accessible supply of ASRS forms should be available, without fear of intimidation, for air traffic controllers, pilots, and any other potential reporters. Incident report forms should be at all sites and facilities where members of the aviation community are likely to gather or from which they operate.

Both the incident reporting system management and industry groups that support the reporting program should be alert to the necessity of providing the community or its membership periodically with one or two unsolicited blank reporting forms. This serves the purpose of assuring the forms' availability while at the same time providing reassurance that the incident reporting system is still in business; in the case of organizational mailings, this periodic reminder also reinforces the fact that the reporting program has that group's endorsement and active support.

Adequate publicity and continual availability of reporting forms are crucial to the success of any voluntary incident reporting system. Even if all the other motivators are present in the reporter community, a lack of appreciation for the purpose and scope of the program or difficulty in obtaining the means to communicate will eventually result in the termination of an effective and valuable safety system.

3. DEVELOPMENT OF THE ASRS INFORMATION PROCESSING SYSTEM

3. DEVELOPMENT OF THE ASRS INFORMATION PROCESSING SYSTEM

INTRODUCTION

The most striking and dynamic feature of the ASRS is the continual flow of a large variety of information about aviation safety. The flow originates with the reporters in the aviation community and, as far as the input information processing system is concerned, ends with the insertion of the information, in highly processed form, into the computerized database. This feature reflects two essential aspects of ASRS: (1) information is the basic commodity being conveyed through it and (2) information processing is its core activity.

The design of the ASRS information processing system was evolutionary, although early project operating circumstances forced an uncomfortably rapid pace. That evolution is still proceeding, but the system has achieved maturity and stability, and has demonstrated a considerable degree of practical utility with respect to the goals set for its design. This chapter of the reference paper reviews the design goals toward which the information system development was shaped, considers the design issues thus posed, and records the process by which ASRS arrived at a particular set of solutions.

SYSTEM DESIGN GOAL

The goal toward which all ASRS information system design and development effort has been shaped is to create a data flow process and storage facility resulting in an information data base that is capable, when properly interrogated, of effectively supporting research on, and responding to queries about, deficiencies or discrepancies involving the safety of U.S. aviation operations. This goal was implied in the language of the original Memorandum of Agreement between the FAA and NASA, and was made more explicit in subsequent documents such as NASA's Request for Proposal and BCL's responding Proposed Research Program.

Several subgoals are implied in the general statement above; they provide more tangible criteria for evaluating the developed information system's performance.

- Information design aspects of the origin of the flow process – the generation of reports to ASRS – must be such so as to encourage and to facilitate the volunteering of useful reports by participants in the aviation system.

- The information process must produce reasonably consistent results with more than one person participating, and where the flow of information may be either parallel or sequential with respect to the participants.

- The information in the database must command a high order of credibility in the eyes of potential users. This means that the stored information must reflect thorough and accurate understanding of the technology, procedures, rules, actual practices, and special language of the operating aviation system.

- The emphasis on research and query support as being the main utility of the information database implies two requirements of crucial importance: (1) retrievability – the system must lend itself to recovering sets of reports pertinent to any arbitrarily defined topic related to aviation safety that may arise, and (2) representativeness – the refined information must be an accurate surrogate for the source information.

- The cost of generating and using the information database must be acceptable in the view of the FAA, NASA, and the aviation user community.

All aspects of the development of the information system were subject to one overriding and strict constraint – the requirement that the identity of any reporter must not be disclosed.

DESIGN ISSUES

In pursuit of the developmental goals, the design team confronted a number of issues requiring decisions before subsequent developmental actions could be implemented. The following discussion describes those issues and the options considered with respect to each. The issues have been identified through application of hindsight and reflection about the actual development process. Figure 3-1 illustrates the topical subdivision of the design task down to the first level of alternatives considered. The issues are discussed in this logical manner, i.e., source related issues followed by refinement process related ones, but that is not the order in which they were addressed in the necessarily somewhat disjointed and uncoordinated atmosphere of the real life developmental process. The actual sequence of confrontation and decision making through which the design issues were resolved, and what those resolutions were, are described later in this chapter.

Issues Related to the Information Source

Three design issues related to the origination of the information flow are perceivable now. They have to do with the format of the source data, the mode by which source information should be transmitted to the processing center, and what sources of supplemental information can or should be tapped.

Reporter Data Format

It is axiomatic – not a design issue – that the original reporter in a voluntary reporting system must be provided format guidance for preparing the report. This is true whatever the medium of transmittal – the guidance may be in a telephone or face-to-face interviewer's checklist or in the design of the form on which a written report is to be submitted. In the case of the ASRS program, it was an early decision that the reports would be written.

The format of the report form was the most critical of the design issues confronted during the development period. If too complex or lengthy, the form would be intimidating, tending to inhibit the flow of reports; if too brief, the program would suffer from sparse and shallow information.

These considerations resolve themselves into three format design issues which, though described separately, are highly interrelated.

Specified content– What categories of information should the reporter be cued to provide? An obviously necessary category, for example, is the story of the incident – the narrative of relationships in time among actors and actions. This could be the only category of information specified in the reporting format. Conversely, the reporter might also be cued to provide separate blocks of information about the aircraft involved, the weather, the people, the airspace, the ATC environment, etc.

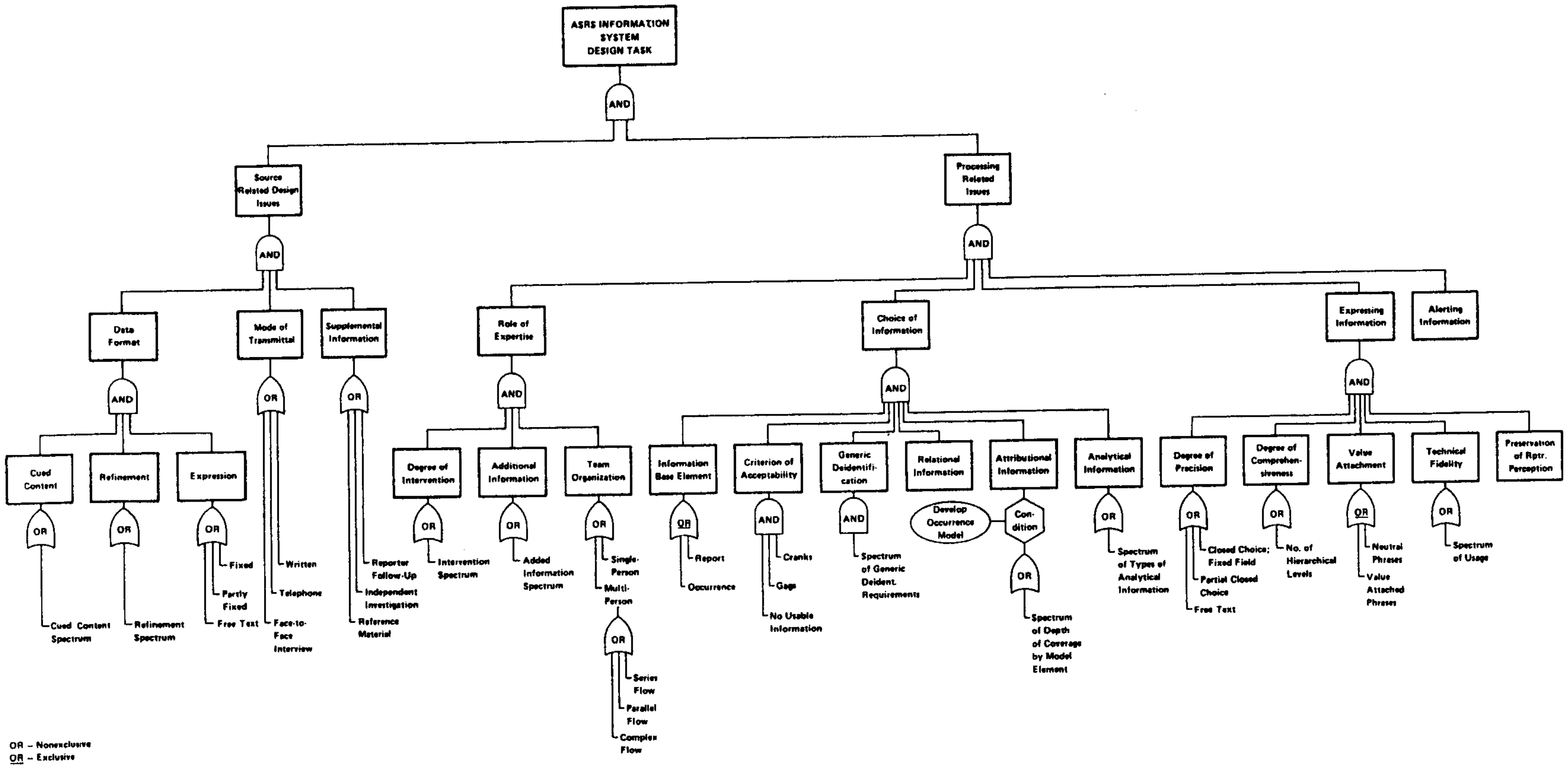

Figure 3-1.– Relationships among information system design issues.

Level of detail– To what degree of detail should each chosen category of information be subdivided in the reporting format? An aircraft block, for example, could simply call for the type/manufacturer designation, or it could be subdivided into any number of configuration and performance descriptors. An information block concerning a pilot reporter could ask only for certification and total hours, or it could be developed into a combined psychological and human factors questionnaire. The greater the degree of detail, the more intimidating and difficult the format; the more difficult it becomes to persuade voluntary reporters to go to the trouble of filling it out.

Expression– How should each category of information be expressed in the reporting format? The options are: (1) forced choice, fixed format, predetermined number of choices (circle the applicable term); (2) free choice, partially fixed format (fill in the blanks in a formatted statement with your own terms); and (3) free choice, unformatted, in natural language (narrative description). This progression runs the gamut from a highly structured and rigid format to a minimally structured and completely free format. The former is easier for the reporter to use and provides for the most precise indexing of reports because of the rigid control of the number of different expressions that can be entered. However, it is the most limited in its capacity for expressing subtle shadings of meaning (a severe constraint in the context of the aviation system with its rich and useful jargon) and it is unable to comprehend changes in subject technology. The latter permits the reporter to enter all the information thought pertinent without constraint and with meaning described as precisely as the reporter's capacity for expression permits; however, the reporter is burdened with the job of composition at which he or she may be unskillful, and there is no possibility of direct indexing of the information provided.

Mode of Transmittal of Source Information

Reporter generated source information can flow to the processing center in several ways, each of which imposes different requirements on the design of both the source information format and processing center procedures.

Written reports– The major advantage of the written report is that it is a semipermanent record and can be dealt with deliberately and systematically. Its disadvantages are: delay in transmittal, reporter-only control of what is reported, inflexibility in the event that changes in format become necessary, and the need to design an effective reporting form and get it well distributed so it is conveniently available to the potential reporting community.

Telephoned reports– The "hotline" concept is best for reducing delay and, since it inherently involves an interview, it can assure a degree of system control over the completeness and depth of the reported information. Also, the format – the interviewer's checklist – is more readily adaptable to changing conditions. The disadvantages are loss of "flavor" of the original reporter's viewpoint (since the information must pass through the agency of the interviewer before being recorded) and the need to maintain high grade, expert staff in constant readiness to take the calls.

Face-to-face interview– Having the reporter come to the processing center to make his or her report is the ultimate opportunity to ensure completeness and depth of information but the disadvantages of cost, delay, and loss of potential reports because of inconvenience are obvious.

Sources of Supplemental Information

Intuition alone predicts that one will need additional information to help interpret and evaluate voluntarily submitted reports. The sources of such information and the considerations pertinent to each are:

Reporter followup– Should a procedure be established for recontacting an original reporter? By what mode of communication? How might this be done without compromising the reporter's identity? It is evident that these issues bear on a crucial underlying question: whether to design the system as an anonymous or a confidential one.[1] Obviously, if one chooses the anonymous type there can be no mechanism for followup contact, but reporter identification is most effectively protected and the reporter can have the greatest confidence that his or her identity will not be inadvertently divulged since it isn't revealed in the first place. A choice of a confidential system makes followup possible but involves a significant addition of administrative overhead.

Separate investigation of reported circumstances– Should system personnel interrogate original sources such as ATC facility officials, airline dispatch offices, or tapes of ATC-aircrew communications to check on specific circumstances described in the volunteered reports? In the complex technology of the aviation system, it would be extremely beneficial to be able to do this – it would make the information database more complete and considerably more credible since the information in it would no longer be based on unverified allegations in the original reports. However, how could such investigations be undertaken without pointing to the reporter – even in an anonymous system – and how could such investigations be supported at acceptable cost?

Use of reference material– Should the plan for processing the reports provide an extensive reference resource (current and past navigation charts, manuals, handbooks, FAR library, etc.) to be used in refining reported information? In the context of an aviation safety analysis effort the answer to this question seems obviously "yes," but the yes answer involves not only the expense of providing the reference resource, but also the expense of providing staff with the expertise and experience to use these highly specialized information sources effectively. (This issue impinges on that of clerical versus professional expert processing staff discussed in a later part of this section.)

Issues Related to the Processing of Information

Information "processing" includes all activities pertaining to the information flow from the receipt of the source data in raw form to the preparation of the information in final, encoded form ready for insertion into the computerized files. Although it is conceptually possible that source information could be so skillfully formatted that no refinement or re-expression of the information would be needed, it is not practical in a real-world, voluntary reporting system, to avoid the requirement to refine the information extensively before it is in condition for storage and subsequent use in research and analysis.

Four design issues required resolution. The first concerns the role and extent of utilization of subject matter expertise in the refinement process. Second is the issue of what information is to be stored (as opposed to the source-related one of what information the reporter is to be cued to provide). The third issue concerns how the stored information is to be expressed. Finally, in a safety reporting program, an inevitable issue is how to deal with information revealing the possible presence of a hazard requiring prompt alerting.

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[1] In the case of the ASRS program, the confidentiality versus anonymity issue was also affected by the FAA's intent to create an incentive for volunteering reports by offering reporters limited immunity from penalties for inadvertent violations. This required that the reporter be identified long enough to return to him evidence verifying his providing a report, thus dictating a confidential rather than anonymous system.

The Role of Expertise

The utilization of expertise in the refinement of the raw information is the only conceivable response to the third program subgoal – the one concerned with the requirement that the database have a high degree of credibility in the eyes of users. What, however, is to be the specific contribution of the subject matter specialist? What organizational techniques might utilize the services of subject matter specialists most effectively?

Three design issues manifested themselves in connection with the role expertise should play in the refinement process.

Degree of intervention– It is obvious that subject matter experts must review the reports to ensure that the reporter's facts and figures are accurate and consistent – that a designation of "type of airspace," for example, is consistent with the reported position of the aircraft. How far this process should go, however, is a critical design issue. Should an expert rewrite the reporter's narrative using a standardized format, or supplement it with a standardized synopsis? To what extent should an expert be allowed or required to presume a resolution of internal inconsistencies that might be contained within a report? A large degree of such intervention would enhance the consistency and apparent accuracy and precision of the refined information, but the penalty of such enhancement is potentially severe – loss of reporter flavor and viewpoint, possible inadvertent introduction of error and greater staff time cost.

Contribution of additional information– Should subject matter experts be called upon to contribute additional items of information to the report record based on their own analysis, judgment and experience? Beyond this, however, expertise could contribute such information as: standardized descriptors, standardized synopses, analytical discussion of the significant factors present in an occurrence, commentary on the qualifications and actions of the reporter and others involved in a reported occurrence, and type and nature of remedial actions that might or should be taken to control an alleged hazard. The tradeoff to be considered in resolving this design issue is the utility to the database user group of having these kinds of authoritative but judgmental information available versus the liability risk incurred by the program of having formed and *recorded* judgments as to causes and recommendations for remedies with respect to actual but unverified occurrences.

Processing team organization– Should expertise be utilized as a single individual processing all reports in the category of his or her expertise, or is multiperson processing feasible and desirable? It can be argued that, in a process characterized by the constant rendering of judgments, only single-person processing can assure consistency in report-to-report treatment. However, practical considerations such as inevitable staff turnover and report volume exceeding one person's capacity may dictate the multiperson approach. Furthermore, in the case of the ASRS program, the subject technology subdivides into the sharply separated categories of flight crew oriented and ATC oriented reports requiring that, as a minimum, those two categories of expertise be present in the processing team.

In connection with the multiperson option, another interesting design issue arises. Should the reports be processed in parallel (each report is worked by one person to completion) or sequentially (process is subdivided among the team members, each performing one part on every report)? Parallel flow is the more efficient, but it does not have the cross-checking feature inherent in the sequential flow plan, and is more subject to interanalyst inconsistencies.

Choice of Information to be Stored

The choice of what information should be stored in the computerized database could be made, in principle, by noting the contribution of each bit of data to answering the traditional "w-questions" ("who," "what," "when," "where," and "why") about the reported occurrence or situation. Experience has shown, however, that where an information system dealing with a complex and multifaceted technology is to be developed, this approach is too simplistic. Occurrence reports in such a technology tend to be complex, consisting of interwoven, multiple sequences of events, and there is characteristically a number of identifiable attributes and factors pertaining to each that could be included logically, but that would tend to make the records excessively large. A more sophisticated approach recognizes that there are a few high-level categories of information generically present and necessary to each stored report record, and that the design issue is the extent and level of detail to which each generic category is to be represented. Experience in developing and using the ASRS information database reveals the generic categories that must be present:

- Relational information – the "story" of each occurrence or situation reported; the story names the events and actors comprising it and describes sequential and other relationships among them. This information comes from the reporter.

- Attributional information – factual and circumstantial data pertaining to each occurrence or situation. In the case of the ASRS program, this information includes such items as weather conditions, altitudes of aircraft, aircraft types and characteristics, kinds and status of ATC facilities, and descriptive terms regarding human participants. Most of this attributional information is either supplied directly by the reporter or it can be derived unequivocally from the reporter's context by expertise in conjunction with standard reference resources.

- Analytical information – information pertaining to the occurrence that originates as judgmental/analytical thinking by experts processing the reports. Examples are the expert's findings as to causal factors that can be associated with the occurrence, key descriptors to be applied, and judgments as to the credibility or competence of the reporter and the critical nature of the occurrence or situation depicted. None of this information originates with the reporter; all of it is provided by the processing analyst.

- Administrative information – management information pertaining to the report (as opposed to the occurrence or situation depicted in the report) such as accession number, type of reporter, numbers of multiple reports, whether a callback was made, and the like. This information originates largely in the refinement process itself although a small part comes from the reporter.

Thus the "choice" issue is centrally concerned with the depth of detail to which each of these categories is to be represented. Before considering the tradeoffs involved, however, there are three other critically important choice considerations that enter this aspect of the design process. These are, first, the choice of the database's base element; second, the establishment of a criterion of acceptability to use in screening out reports that do not contain enough useful information; and third, the necessity to de-identify some parts of the information passing into storage.

Information base element– The base element of the information system is the single record, uniquely identifiable, of which the database may be said to be composed. In a complex system, there are likely to be several different information components that could be defined as base elements. In the case of the ASRS information system, two were given serious consideration: (1) the record that could be built from each submitted report – the report element, and (2) the record that could be built for each separate occurrence or situation – the occurrence element. That these two were different stemmed from the circumstance of multiple reporting where more than one person turns in a report on a given occurrence. The choice in such cases depends mainly on the system designer's estimate of what entity will command the most interest on the part of the future users of the information database. Where the margin of choice is narrow, as was true in the ASRS case, it is necessary to provide some form of direct cross-indexing so that a retrieval made in terms of one element can readily be converted into another one.

Criterion of acceptability— In a voluntary system three types of unusable material may come in: crank reports, gag reports, and well-intentioned reports that do not contain useful information. The first two are easily identified; such reports can be rejected upon receipt unless the screener senses the presence of a hazard directly related to the mental attitude of the crank or gagster involved. The acceptance of the third kind of report is made more difficult because of the tendency of the screener to try to "read value" into the reports that do not contain even "inferred" relevant information concerning an aviation safety matter. Given a safeguard against this through awareness on the part of the screener, the decision becomes a matter of opinion, where the opinion has been cultivated through close observation of the uses of the database in practical applications.

Generic de-identification— Depending on the institutional setting of an information system based on volunteered reports, it may be necessary to remove or mask identifying information pertaining to entities other than the reporter. This leads to a loss of information which is inevitably damaging to the utility of the database. The design issue posed is to minimize this damage by inventing nonidentifying surrogates for the data that must be removed. For example, in the ASRS program, representatives of the airframe manufacturing industry requested that aircraft involved in safety related occurrences recorded in the database not be specifically identified by make and model. Acceding to the request, database designers provided several blocks of generic descriptors for aircraft involved (i.e., gross weight class, airframe configuration, number and type of engines, number of seats, type of operator, etc.) that answer most, though by no means all, of the questions database users have regarding the aircraft involved in reported occurrences.

Choice of relational information— Given that a depiction of actor-action sequential relationships in some form is obviously essential in an occurrence reporting information system, the only design issue to be considered is how the information is to be expressed – in terse, synopsis form or elaborately with full narrative detail – and whether it is written in the reporter's original language or rewritten in some stylized form. This issue is considered further in the section on "Expressing information to be stored."

Choice of attributional information— What categories of attributional information should be provided and at what level of detail? This design decision is one of the more difficult ones because in most cases the subject matter of the database is such that a large volume of attributional information bits could be identified and included, thus bloating the computerized record. Three considerations affect the decision: pertinence of each candidate information bit with respect to future use, the cost of analyst processing time, and the cost of computer storage. Since design precedes use, the pertinence issue – the most significant of the three listed – must be answered initially on the basis of the designer's intuition and experience with any precedent systems that may be found applicable. It is most important that the design of the system incorporate adaptability so that it can be changed in the light of experience.

Choice of analytical information— What categories of analytical information should be provided? This issue was discussed in the previous consideration of the role of expertise in processing reports. Aside from providing essential information on causes, the main contribution of analytical information is to fill gaps in coverage of individual reports and lend additional insight into interpreting them. Such a contribution tends to raise the quality of reports to a uniform level so that a more direct comparison can be made and so that their composite meaning can be more accurately assessed.

Expressing Information to be Stored

This issue concerns the procedures by which report processors select the final form of expression for the ideas going into each information block of the database. This is an important issue; the final expression must accurately preserve the semantic meaning intended by the reporter or analyst; at the same time, the expression's utility as a possible indexible retrieval term must be considered.

The principal tradeoff involved in selecting a mode of expression is precision versus ease of retrievability. Other tradeoffs to be considered are: comprehensiveness versus discrimination, value attachment versus neutrality of expression, and preservation of reporter viewpoint and perception versus standardization.

Precision versus ease of retrievability– Given a competent writer, narrative or free text can be the most precise way of expressing an idea. However, free text cannot be searched efficiently for retrieval terms. Forced selection from a predetermined number of pre-expressed choices accommodates efficient retrieval because the retrieval terms are the pre-expressed and precisely located data entries themselves. The intermediate form combining free choice and partially fixed format is a compromise retaining some of the narrative's freedom of expression with the efficient retrievability of the forced choice. Note that the feature of the forced-choice form that makes it more proficient for report retrieval also makes this form more amenable to quantitative manipulation for statistical purposes.

Comprehensiveness versus discrimination– The issue of comprehensiveness versus discrimination really centers on whether or not a hierarchical structure should be incorporated into the stored information. In a forced-selection form, the choices are at some level of detail, and higher aggregations are identified by labels. In a narrative form, a hierarchical structure would be unnatural so only one level of detail at a time would be treated. In the compromise form (free choice, partially fixed format) an explicit hierarchy can usually be accommodated.

Value attachment versus neutrality of expression– One of the more interesting aspects of the question of how to express ideas in a database is the issue of value attachment to an entry; i.e., whether or not to apply modifiers indicating position or negative value to factors that are significant to an occurrence. On the one hand the "call a spade a spade" approach is handicapped by the limited perception of the reporter whose testimony as to causation cannot be investigated independently. On the other hand, a neutral expression suggests only the association of an information item with a report and leaves value attachment to the user's judgment. For example, if a pilot appears to have made an error in judgment, a report processor might attach value by entering the classic "pilot error." The neutral expression would be "pilot discretion" – simply indicating that the pilot's decision making was a significant factor.

Preservation of reporter perception/viewpoint versus standardization– Inevitably, volunteered narrative descriptions of occurrences or situations are nonuniform with respect to completeness of coverage and felicity of expression. The design issue arises whether to store these narratives with their imperfections and unevenness or to re-express them in a standardized format. The advantage of the latter, obviously, is an apparent high and uniform quality of the narrative information in the database. However, the disadvantages can be severe. It can be argued that much of the "truth" contained in a report resides in the style and flavor with which the reporter has expressed himself; indeed, gaps in a reporter's description may have as much meaning for the insightful reader as do the points he has covered well.

Individual Reports Containing Information Meriting Early Action

In a safety related program there is a vitally important information management issue concerned with individual reports. This is assessing a report that, by itself, sufficiently describes some type of continuing hazard, for example, a visually deceptive night approach to a runway or a conflict caused by a traffic pattern overlap between airports in close proximity. Such a report necessitates prompt action on the part of the program to intercede in the matter without waiting for analysis of the composite information in the database. Thus, the issue is establishment of a criterion for information which merits early action and an administrative procedure for getting that information to the appropriate parties. In the case of the ASRS program, this consideration resulted in the development of the alert bulletin procedure described in a later subsection.

ASRS INFORMATION SYSTEM DEVELOPMENT

The ASRS program's information system was developed by a series of design decisions resolving the issues described above. The decision making began in mid-1975 during early concept formulation and continued throughout a period of exploratory development that lasted about 3 yr. With regard to the information system, the development period included four stages: (1) concept formulation – the period when the FAA and NASA officials collaborated in thinking out the broad outlines of the shape the program might take, (2) program definition – the period during which the NASA leadership refined and extended their thinking about the program to a more definitive basis for taking specific, initial developmental action, (3) prototype system development – the period that saw the development of the first operating database and its experimental utilization, and (4) design review – the period of re-examination and redesign of the information system in the light of the experimentation with the prototype. During this succession of development stages, the decision making about the information system passed steadily from the strategic and general to the tactical and specific.

At no point was this design and development process the objective and cerebral one implied in the previous discussion of design issues. Aviation safety is a public interest topic of high volatility; it has enormous leverage within the powerful and important aviation industry and its related governmental apparatus. Accordingly, the ASRS program is, and has been from the beginning, a focus of attention and controversy subject to conflicting pressures from the FAA, the aviation establishment, the reporting community, and the media. Any developmental program in such an environment finds technical decision making strongly affected – not always for the worst – by arbitrary deadlines and political pressures. The following discussion sets forth the basis for the development process that gave the ASRS information system its present configuration.

Concept Stage Decisions

The ASRS was conceived as a "next step" following the FAA's initial effort with ASRP. The developers' conceptual thinking, therefore, tended to view ASRP as a point of departure for visualization of the possible configurations of ASRS. Although drastic changes from ASRP were to be incorporated into the ASRS, there was also some design continuity. For example, the expected reporting community in both systems consisted of participants in the *operating* segment of the national aviation system.

Similarly, it was a very early decision that ASRS reports would be filed in written form. A dominant consideration here was to have the reporters' own versions of the occurrences available in permanent form while the program went through the process of learning how to deal with and how to use them.

Probably the most significant design factor explored during the conceptual stage of ASRS development was the all-important constraint of maintaining any reporter's identity absolutely secure from disclosure. The developers of ASRS believed this to be the most critical factor in the design of the information system.

The decision that ASRS would be a confidential rather than anonymous system originated in part because of uncertainty in the minds of the developers as to the quality of the incoming reports once program operations began. They believed it essential that the program be designed so that analysts would be able to recontact reporters via telephone after the reports had come in and the experts had had an opportunity to examine them and decide where followup questioning might be needed. Note at this juncture, the emergence of not one, but three, important design decisions about the information system's configuration: that the ASRS would be a confidential system so that the post-submission reporter access could be provided; that an operational role for expertise would exist in the system; and that the reports would be "processed" by those experts in an organized and purposeful way so that the information in them can be brought to a threshold level of utility.

Another decision followed these without a great deal of critical examination: that it would be necessary to store the processed information in a computerized information management system capable of rapid and accurate retrieval and effective support of statistical analysis. The latter capability was decided upon in part because of the incorporation in the Memorandum of Agreement's description of the ASRS mission that ". . . any trends of interest are to be described." With this recognition, there began an explicit information system design effort as part of the overall program development process.

The reporter identity security constraint had to be dealt with at every step of that design effort. The decision for a confidential system meant that the report form design would have to include not only provisions for the identifying material, but also a means for keeping this material secure while it remains at the processing center, a way to remove or obliterate it safely when it is no longer needed, and, most important, an assurance in the printed matter on the form that NASA will protect the reporter's identity from disclosure. In addition to these effects on the reporting form's design and handling procedure, the security constraint could be foreseen to have an important effect on how narrative, locational, and situation-specific information could be incorporated in the permanent database.

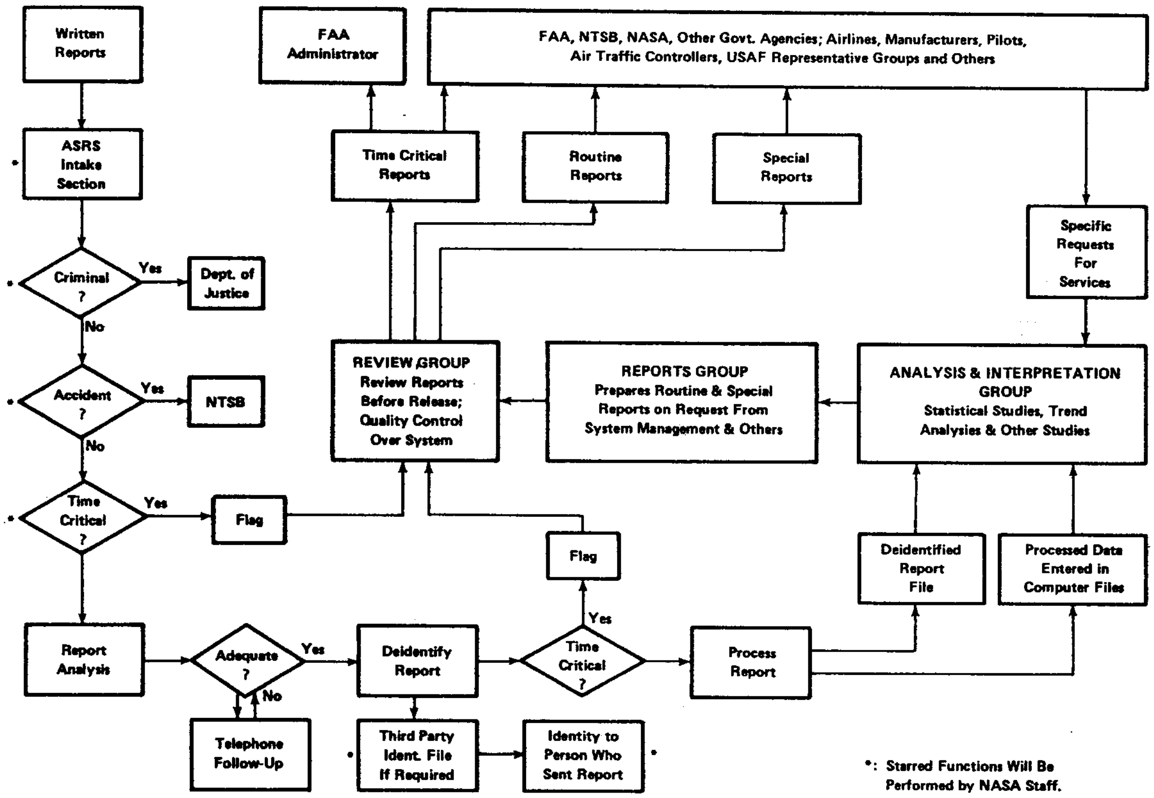
Another basic requirement became obvious during this period: that certain kinds of information meriting preprocessing action in behalf of aviation system safety would inevitably be forthcoming. Previously discussed as a design issue, the developers termed this kind of information "time critical" and, as an important aspect of the system design process, included development of a criterion for its recognition and a procedure for feeding it back to the aviation community.

Program Definition Stage Decisions

Program definition stage activity began with the NASA and the FAA agreement on the ASRS program and ended with the opening of the ASRS operating office in April 1976. Program definition was further refined by NASA's leadership in regard to ASRS to the point where a request for a proposal (RFP) which contained a report processing flow diagram could be issued, and a contractor to further develop and, eventually, operate the ASRS could be selected. Battelle's successful proposal, and several other excellent competing ones, demonstrated further thinking about how the program's information system might be designed. Figure 3-2(a) contains the processing flow chart in the RFP and figure 3-2(b) is the elaboration of it in Battelle's proposal. These early visualizations of ASRS information operations accurately foreshadowed those eventually developed and described later in this section.

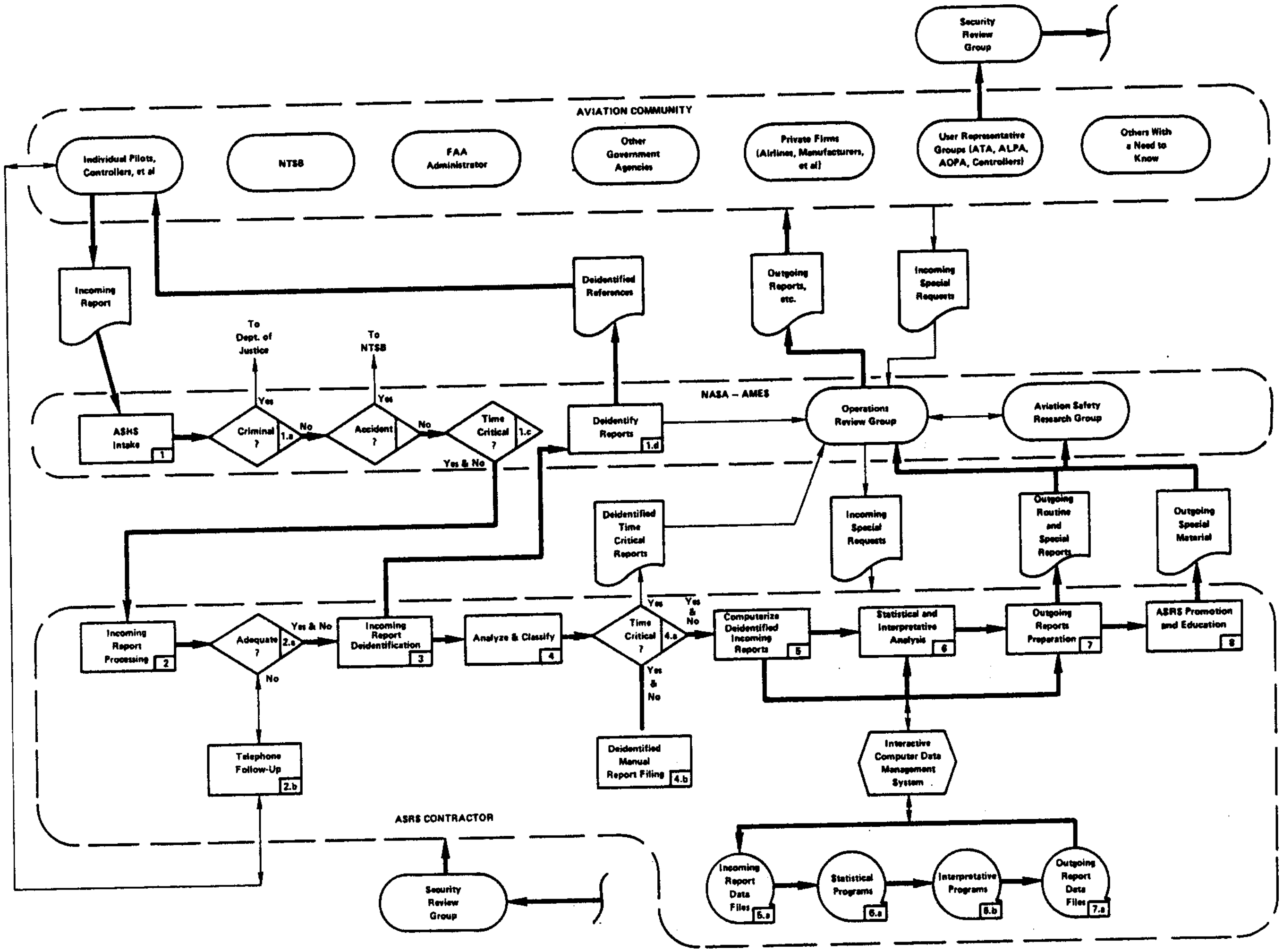
The most significant design action during the program definition stage was the design and distribution of the ASRS reporting form. Given the time lags involved in designing the form, obtaining Office of Management and Budget approval for it, and then printing, distributing, and publicizing the program to the prospective reporters, coordination between the two tasks of designing the reporting form and designing all the other aspects of the information system was precluded because of the considerable interval of time which had elapsed between these tasks.

The reporting form and the procedures associated with its use, described in detail in section 2 and shown in appendices figures C-2 and I-1, have served effectively during the six-plus years of the ASRS



(a) NASA RFP Flow Diagram.

Figure 3-2.– Flow diagram of ASRS operations generated during program definition stage.



(b) Battelle Proposal Flow Diagram.

Figure 3.2.– Concluded.

development period. During this time, in the absence of any serious flaws, the form has not been redesigned; however, there are plans to modify it in the near future.

In designing the form, the developers reviewed the makeup of reporting forms previously developed by the military services, the NTSB, and the predecessor reporting programs in the FAA, especially the ASRP. The ASRS form reflects three main format design compromises.

- Specified content – the reporter is cued to provide 16 different categories of information in addition to the narrative and the identifying/recontact material. Further, the narrative block contains cues for specific aspects to be covered that further promote comprehensiveness.
- Refinement – with the exception of the aircraft related blocks (2 and 3), the information is called for in unrefined, quite simple form making the report as easy as possible to fill out. The aircraft blocks are more complex, calling for a number of generic descriptors.
- Expression – all three classes of expression mentioned in the previous discussion of design issues are represented in the form's makeup. The highly structured format (forced choice; fixed format) is most used, however, since it is easiest for the reporter and is fully compatible with the level of refinement at which the information is specified; the least structured format (free choice; unformatted; natural language) is used only where it had to be – in the narrative.

Thus the designers opted for simplicity in the reporting form, counting on the availability of the callback mechanism to supplement the raw information and bring it to a usable level of quality where necessary.

Prototype System Development Stage Decisions

Development of the prototype information system began with the establishment of Battelle's ASRS Office in April 1976; it ended in March 1978 with the start of the design review. As this stage of activity opened, ASRS reports were arriving at a lively rate that built to over 400 received in May, the first full month of operation. Although the system's operational plan had been thought out in strategic terms (flow diagrams, etc.), no detailed work had been done on what, exactly, one did with an ASRS report that had been received, opened and was out on one's desk. The daily arrival of filled mailbags lent great urgency to the newly formed staff's effort to develop (1) an administrative report handling procedure, (2) an information refining processing procedure, and (3) a Battelle's automated search information system (BASIS) field structure to receive the refined data.

In this kind of operating environment, the design decision making followed a "first-thing-first" sequence. The first needs were to establish satisfactory procedures, to get identification slips returned to the reporters promptly, and to establish administrative control over the rapidly growing stacks of reports. A number of far-reaching, specific decisions regarding report flow had to be made in short order, and with no opportunity to integrate them with a developed picture of how the refined information record would be structured.

Early, Exigency Decisions

Choice of base element– It was obviously necessary to assign serial accountability numbers – accession numbers – to the incoming units of raw information as a basis for keeping track of them. The first substantive system design decision, therefore, concerned what that unit of information was to be – the individual report or the unique occurrence (a multiple reported occurrence turned up in the first day's receipts emphasizing the need to deal with the question immediately). The individual report was chosen on the ground that human performance, as revealed in individual reporter's perceptions, would be the main topic of study when the database was put to use. This decision was correct, but it was flawed in that no one realized at the time the importance of configuring the system so that multiple reports could be identified easily and sorted out of retrieved document sets.

Security accountability procedure– Two independent accountability numbering procedures, one concerning the accession number and the other the ID strip security number, were established. The security number was associated with a computerized log-in process that not only assisted in keeping track of ID slips in residence, but provided, on request, data essential to the FAA for operation of its immunity program.

Recording of time information– The question arose as to what information regarding report or occurrence timing should be attached to each report record.[2] The importance of the question to the database's future utility in the analyses of trends was recognized, but so was the potential that such information might have for revealing reporter identity. The newly formed project team's first consideration was to conduct all project operations in such a way so as to obtain and keep the full trust of the reporting community; at nearly every juncture, therefore, design issues were resolved conservatively with respect to this consideration. Thus, it was decided to indicate, as an item of administrative information, only the month during which a report was received at NASA. The first experiments with statistical trend analysis showed that this early decision was a serious error. The risk of identification through recording the *month* of an occurrence is now considered negligible, whereas the damage done to the utility of the stored information by not being able to locate the occurrences in time definitively – even to a coarse time unit – is enormous.

First classification by type– The developers recognized intuitively the need for assigning an aviation safety related "type classification" to each report using a closed list of mutually exclusive categories. This was the first attempt to classify ASRS reports with respect to a technical issue. The developers conceived a useful categorization – the "primary problem" reflected in the report. The information field has been much used in partitioning the database for a variety of search purposes and, most importantly, in monitoring the condition of the aviation system by observing changes in the distribution of incoming reports. The seven problem areas are labeled and defined as:

ATC: Human factors or failures on the part of ATC personnel performing controller related functions anywhere in the ATC system.

FLC: Human factors or failures on the part of flight crew including pilots, copilots, flight engineers, other cockpit personnel, or cabin service personnel.

ACF: Failure in any part of an aircraft or its equipment including navigation and communications equipment and software.

APT: Problems directly related to an airport or its facilities.

NAV: Problems directly related to malfunction or failure in navigation aids and equipment (including communications equipment) that is not airborne.

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[2] The specific date/time information regarding a reported occurrence is part of the ID slip that must be returned to the reporter uncopied; consequently it was necessary to decide what, if any, of these timing data were to be kept before starting to return the slips.

PUB: Problems directly related to the form, accuracy, or appropriateness of publications.

OTH: Problems that cannot reasonably be assigned to one of the preceding categories. This includes weather where it is judged to be a primary problem with respect to the occurrence or situation.

Development of a report evaluation process– Pressure to return ID slips forced quick development of the query processes involved in evaluating the "adequacy" of an ASRS report because, of course, the return precludes calling the reporter back regarding an inadequate one. Thus it was necessary at the outset to attempt to establish an adequacy criterion and a means of measuring reports against it. It was in this regard that the importance of expertise became most evident; the reports are so varied in topic and type of event depicted that the ASRS staff has not, even now, been able to formulate a single criterion of adequacy. Instead, early experience showed that each report would have to be studied and evaluated on its own merits with the judgment of the analyst dictating whether or not a callback is needed.

As an integral part of this initial evaluation, the analysts had to learn to decide about reports that were of no value and therefore should not be processed. There have been few of these (less than 1% of total receipts) and it has not proven difficult to identify them; in fact, present practice is to remove such reports at first inspection before they even get to an analyst. The ID slips are numbered and returned in the usual way and the de-identified reports are stored without further processing.

It was necessary, as soon as reports began to arrive, to deal with the time critical information about alleged unsafe conditions that some of them contained. The possibility that ASRS would receive such information was foreseen and provided for during the concept stage; under the terms of the letter of agreement, the system is required to notify the FAA, and others as appropriate, of such reported conditions. Detecting this information, deciding if it merits alerting, and formulating the alerting notification (now called "ASRS Alert Bulletin") became an important aspect of the report analysis process. In connection with alerting, a useful classification of reports into the categories of "occurrence" or "situation" emerged. An occurrence report describes an event or chain of events that come to a distinct end in a relatively short time, whereas a situation report describes a persisting condition. Most of the reports containing information that should be alerted, fall in the latter category.

These fragments of what was to become the stored information structure had to be generated and recorded on hurriedly designed log sheets attached to the de-identified original reports. The small staff was able to stay current with the incoming report flow doing only this much processing. The partially completed records were placed in holding files. Further processing awaited the detailed design of the final report record and the BASIS[3] field structure.

Development of the Prototype System Record Structure

The growing backlog of reports awaiting processing created a sustained climate of urgency in which the staff expanded the prototype system design by making a series of decisions more or less in the sequence indicated below.

Relational information– After a brief, unsuccessful experiment in formulating a standardized ASRS narrative, the designers made, as later events have convincingly shown, the correct decision to store the reporter's original narrative, minimally edited but fully de-identified, in the record. It was also decided that analysts would prepare a one- or two-sentence synopsis of each narrative as a quick reference tool for database searchers.

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[3] BASIS is the proprietary software system on which the ASRS database is mounted. See Chapter 4 for a description.

Analytical information: diagnostics– NASA leadership had applied epidemiological principles in developing an ASRS philosophy regarding identifying and categorizing causal factors of reported occurrences/situations. The philosophy recognized that *post hoc* analysis (which is what the study of incident reports necessarily is) cannot prove causation – it can only observe a significant association of certain possibly causal factors with a class of occurrence. The philosophy also recognized that causal factors may be subclassified with respect to specific events as "enabling," meaning that without the presence of the factor, the occurrence probably would not have taken place, and "associated," meaning that the factor was observed to be present and pertinent, but does not fulfill the requirements of an enabling factor.

Based on this thinking, the two causal information blocks, enabling factors and associated factors, were established as part of the record structure and one analytical member of the staff with experience in both ATC and flight aspects of aviation operations evolved a lexicon of key words and a structure of phraseology to provide entries for the two fields that could be indexed and used efficiently in searching the database. Thus began the development of what has come to be known as the "diagnostics" part of the ASRS record structure.

The scope of the diagnostics fields expanded when the designers decided to create a descriptor's field utilizing pre-invented key words and phraseology similar to that being developed for the causal fields. As the diagnostics lexicon grew, the designers became impressed with the descriptor field's potential for expressing precise meaning in characterizing the different facets of occurrences. Since all the diagnostics fields were to be indexed, the promise offered by the design was great power for retrieval coupled with sensitive discrimination in sorting document sets to search specifications.

In view of this, the three-field structure was again expanded to five with the addition of a "recovery factors" field and a "supplementary key-words" field. Recovery factors are those that account for an occurrence's not progressing to an accident; they are, therefore, essentially remedial and utilize the same lexicon as the other causal factors fields.

It was partly in connection with the construction of the recovery factors field that the issue of neutrality of expression came into operational consideration. By avoiding value attachment in the construction of the diagnostic phraseology, causal phrases could be used much more flexibly. For example, the phrase "pilot response" entered in the enabling factors field would indicate that the unsafe occurrence depicted in the report probably resulted from the pilot's poor response to some initiating event; the same entry in the recovery factors field would indicate that a pilot's excellent response probably avoided the accident implicit in an unsafe occurrence. The decision for neutrality of expression led to additional flexibility and capacity for expressing meaning in both the causal and descriptor parts of the evolving diagnostics lexicon.

Attributional information– Development of a pattern for the kind and detail of attributional information to be attached to an ASRS record proved the most difficult and time-consuming aspect of the design task. The design group did not define the basic structure until mid-December of 1976 – 6 months after reports began arriving in quantity.

Retrospective examination of that period suggests that there was a perceived problem that may have been merely a specialized manifestation of a basic problem in designing an information system. The perceived problem was simply the large and unorganized mass of information bits, all pertinent to an aviation occurrence, that any person experienced in the field could think of – and at exhaustive levels of detail. Virtually all this material could be conceived as useful in some way for future interrogators of the database. Most of it, however, could be expressed for entry into the record only as a result of considerable supplementary reference research work by analysis. At this stage, the design team was concerned about budgetary constraints – intensified by the unexpectedly large reporting rate – and was trying to design a system that would operate within a reasonable limit of net processing time per report. Many, if not most, of the proposed lists of attribute codes would have increased the unit processing time and cost by factors of two or three. The most significant aspect of this design problem, however, was the frustration the staff experienced when they tried to produce smaller, simplified listings by selecting information bits for discard; no consistently applicable selection criterion could be located until what is now termed the "participants model" emerged from the group's discussions and thinking.

In retrospect, it appears that this absence of a model may have been the underlying problem. A model provided a consistent way of aggregating the unorganized mass of information bits into hierarchical arrays of more manageable size. The participants' model is not a complicated matter but does require the user to depersonalize the idea of a "participant." This done, it is not difficult to see that all of the entities which interact significantly in an aviation occurrence can be included in: (1) the potential conflicts (when present in a report); (2) the aircraft involved; (3) the individual people involved; (4) the ground facilities involved; (5) the weather and other environmental factors present; and (6) the software (communications) factors present.

It proved feasible for the staff to construct information blocks for each of these participants. For example, the hazard block consisted originally of only four items: horizontal miss distance (MDH), vertical miss distance (MDV), unspecified miss distance (MDU), and type of evasive action (EVAC). The aircraft block, on the other hand, consisted of eleven items including such things as a generic type description (ATYP), airframe characteristics (AFRAM), number of engines (NENG), airspace at time of occurrence (AIR), type of flight plan (FPLAN), etc. Space for ten of each participant was provided in the computer field structure. This model shape – a set of mutually exclusive major categories each subdivided independently as appropriate – led directly to the matrix field structure for the BASIS file described later in this section.

Because of the nature of the attributional information, the file space provided for it in the database is of the fixed-field variety; this naturally became the generic term used within the ASRS staff for the attributional segment of the record structure, and will be used in this manner in this report.

In considering the way the fixed-field data would be expressed, the designers resolved another basic problem in what proved to be a seriously erroneous way. The mode of expression for most of the fixed-field items was of the forced-choice, closed-field variety. The problem of design was to pre-invent all the terms that should be present in each closed field. At the outset, the designers were doubtful of their ability to do this satisfactorily and, at the same time, the analysts were very concerned that they be able to express exactly the correct thought for each item. This led to use of a mode of expression in most of the fixed-field items wherein an array of specific choices is offered but, if none of these serve, the analyst is allowed to write in his own word. Aviation possesses a rich and useful jargon; "exact meaning" entries proliferated and thereby severely weakened the retrieval power and representativeness of the fixed-field index. This error in designing the prototype system was recognized early and was rectified during the design review. Subsequent experience has fully confirmed the essential correctness and usefulness of the participants model as the basis for designing the fixed field.

Processing procedures and organization– At the outset the processing plan was multiperson with a series-parallel-series flow path. Figure 3-3 is a schematic summarizing the processing plan.

The following considerations led to the adoption of this schema.

- As described in Section 2, it was required that all reports pass through the initial, legal screening.

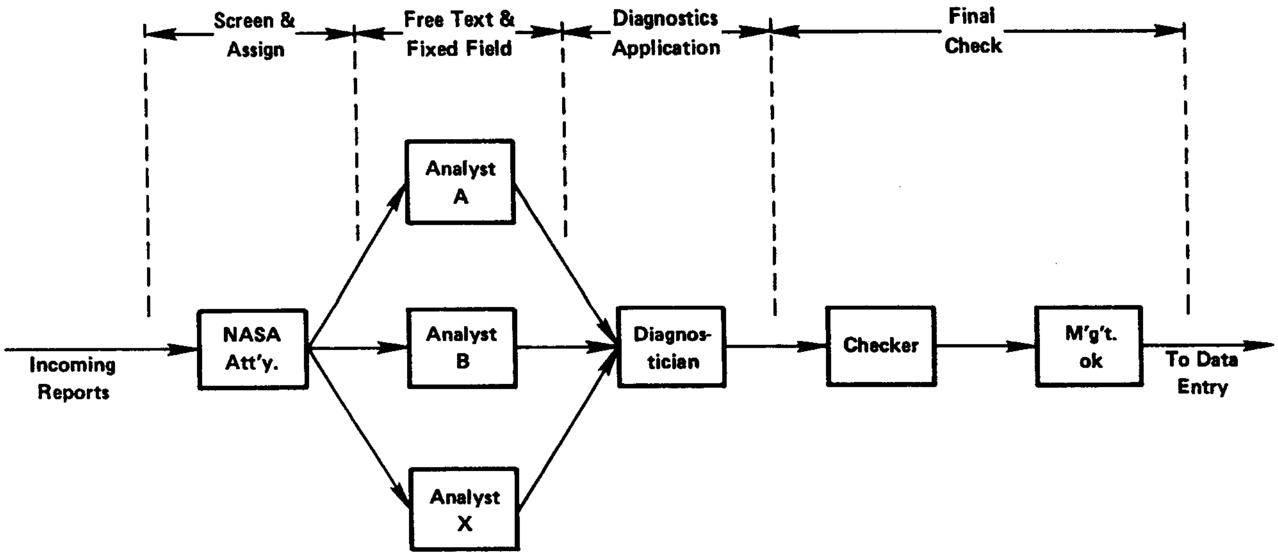

Figure 3-3.– Processing flow, prototype information system.

- Each screened report was then assigned to be processed by the most applicable field of expertise. During the prototype system period, these fields were: airline pilot, general aviation pilot, and controller. The flow rate exceeded the capacity of a single-analyst processor in the airline pilot and controller categories thus mandating the multiperson, parallel-flow segment of the processing plan.

- The evolving diagnostics lexicon was proving to be so powerful and yet so flexible in application that the design group was convinced that report-to-report consistency could be achieved only by one highly qualified person applying diagnostics to all reports. This accounts for the downstream series design.

- With a prototype system and the preponderance of the fields in either free-text or "open" fixed-field format, it was inappropriate and wasteful to go to the expense of designing an input editing module. Therefore, the only quality control for the input data was a two-stage, manual-checking process applied to the complete encoded package.

This operation demonstrated three significant lessons. First, the multiperson, parallel-flow segment was highly satisfactory with reasonable consistency in report-to-report treatment, and a good atmosphere of collaboration and informal cross checking existed among analysts. Second, it proved impossible for a single diagnostician to keep up with the report flow and maintain acceptable quality; also, it appears that a task of this kind cannot be performed steadily through an 8-hr work period. Third, as expected, the manual final check procedure permitted an unacceptable error rate in the stored information emphasizing the need for inclusion of automated quality control checks in the data entry process.

Design Review Decisions

The design review began early in 1978, and except for two aspects, ended May 1st with the start of processing reports to a redesigned procedure and data format. The two aspects completed later were: the development of a redesigned, specialized data entry procedure providing an editing screen for input data (January 1979); and the simplification of the diagnostics function so it became amenable to multiperson processing.

The work in early 1978 focussed on the structure of the fixed field and diagnostics. The prototype database, which closed with a total of 8347 records, had been used in support of five major research studies, approximately 50 listed special requests, and numerous talks and presentations. It functioned well enough to give the designers full confidence in the program concept, the source data design, the record structure, and the BASIS field structure. However, serious flaws in execution could be seen in several respects. First, already discussed, was the undisciplined fixed field format. Second, the highly sophisticated phrase formulation process for the diagnostics was not contributing additional information quality – the retrieval power of the diagnostics was not derived from this process – and it was making the diagnostician's task dauntingly difficult. Third, there were many detailed design matters which needed attention, most of which concerned getting a correct array of terms into each of the now fully closed fixed-field blocks. Other details involved adding some subfields where experience had shown the need for additional information and removing about the same number of subfields where they were not needed.

The detailed alterations and tightening of the fixed-field format proceeded without delay. The diagnostics lexicon lent itself to being reworked into a more controlled list of acceptable phrases cross-indexed by key words. The processing flow path could then be changed to provide for the training of several individuals who could then apply the diagnostic phrases. Thus, the flow process became series-parallel-parallel-series. This plan made the diagnostician's job feasible yet retained the desirable cross-check process inherent in the two-stage processing plan.

As rapidly as possible, Battelle designed and installed a fully integrated data entry procedure containing a verification and editing function for the fixed-field data. This solved the major part of the quality control problems which were associated with the manual final check procedure for the prototype system.

The conduct of the design review emphasized the need to administer the database dynamically, allowing for changed conditions as they occur, or as software enhancements become available. This climate of receptivity to change has resulted in additional alterations of significance since the operational database was implemented.

- Procedures for recording changes in field structure or definition were incorporated so that such alterations would not create chaotic conditions.
- A method for saving retrieved document sets between sessions – not originally a BASIS capability – was developed in response to unique ASRS requirements.
- A method for sorting out multiple reports while on line was developed and the operating database files were all reworked to incorporate the additional information.
- An original design error involving the decision to enter the month of receipt rather than the month of occurrence was recitifed simply by changing the coding procedure. Records previous to the change were reconciled as to date of occurrence by a special computer run of an algorithm based on a delay time estimate.

CURRENT CONFIGURATION OF THE ASRS INFORMATION SYSTEM

The present ASRS information system design consists of a record structure and a processing procedure. Both are presented as implemented in July of 1982.

Structure of the Stored Records

The structure of the documents (reports) in the ASRS database is shown and discussed in detail in Appendix C. In the computer, each document exists as a complete record, and contains all administrative and fixed-field entries, the diagnostic terms, and the narrative for each record. This information is contained in a heavily protected "head file" that cannot be inadvertently altered while the data are being used. Reports in the head file are addressed by accession number, or the "master locator" of each record.

A second file contains all indexed terms. Each term is associated with a list of the accession numbers of all reports or records indexed by that term. The index file thus lists the attributes coded by the ASRS analysts and serves as a locator of all reports containing those attributes.

Appendix C depicts the document structure graphically, as a table of data, and as seen in the coding sheets used in processing the reports. The graphic presentation shows the relationships among the various data elements; the table of data provides detailed information on the contents of each record; the coding sheets provide an example (hypothetical) of a report and the information derived from it by ASRS analysts when they prepare the report for entry into the database.

Processing Procedure

The procedure currently in use for the information processing of ASRS reports is illustrated in figure 3-4. The sequence of steps shown comprises the information processing of part of the ASRS operations taken as a whole. The flow diagrams generated during the program definition stage, as displayed in figure 3-2, show the whole of the ASRS operations; examination of the report processing portions of those diagrams indicates that they are very similar to the actual operation evolved in 5-plus years of development. Several details and variants of the steps illustrated in figure 3-4 deserve brief comment.

After the NASA legal screen (discussed in Chapter 2) the reports arrive via secure transportation, in identified form, at the ASRS-BCL operations office. The first processing step is log-in with an added "tentative multiple check." The log-in step involves date-time stamping of the ID-slip part of the report, attaching a security number to the ID strip, assigning an accession number to the body of the report, logging the security number into a computer file that tracks the number as long as it is in residence, and attaching a blank processing package to the report with suitable entries made on the log sheet. The accession numbers are sequentially assigned to the reports as are the security numbers to the ID slips, but these numbers have no relationship of any kind to one another and are never recorded together. The security number leaves the operation completely without recorded residue when the ID slip is returned to the reporter.

In conjunction with the log-in process, a project secretary also exercises a computerized check routine that identifies possible multiple reports by correlating state and date information with reports logged in during the prior 45 days. This task, identifying multiple reports, has proved to be a persistent and difficult problem that is probably inherent in a voluntary reporting system. There is no deterministic way to correlate multiple reports because reporters express themselves differently and use different means of locating the airborne occurrences. The only fully reliable method is date correlation coupled with in-depth study of the possible multiples by a qualified analyst. In the early experience of ASRS, corporate memory was the only tool available to spot multiples and there is little doubt that some were missed – especially when the multiple was submitted much later than the primary report. Memory remains the most important means of dealing with this problem, and an effective aid to memory is the computer routine exercised at log-in.

After log-in, the raw report packages with the daily candidate multiple pairs list attached are turned over to a senior analyst who performs what is essentially a dispatching function. He first verifies the

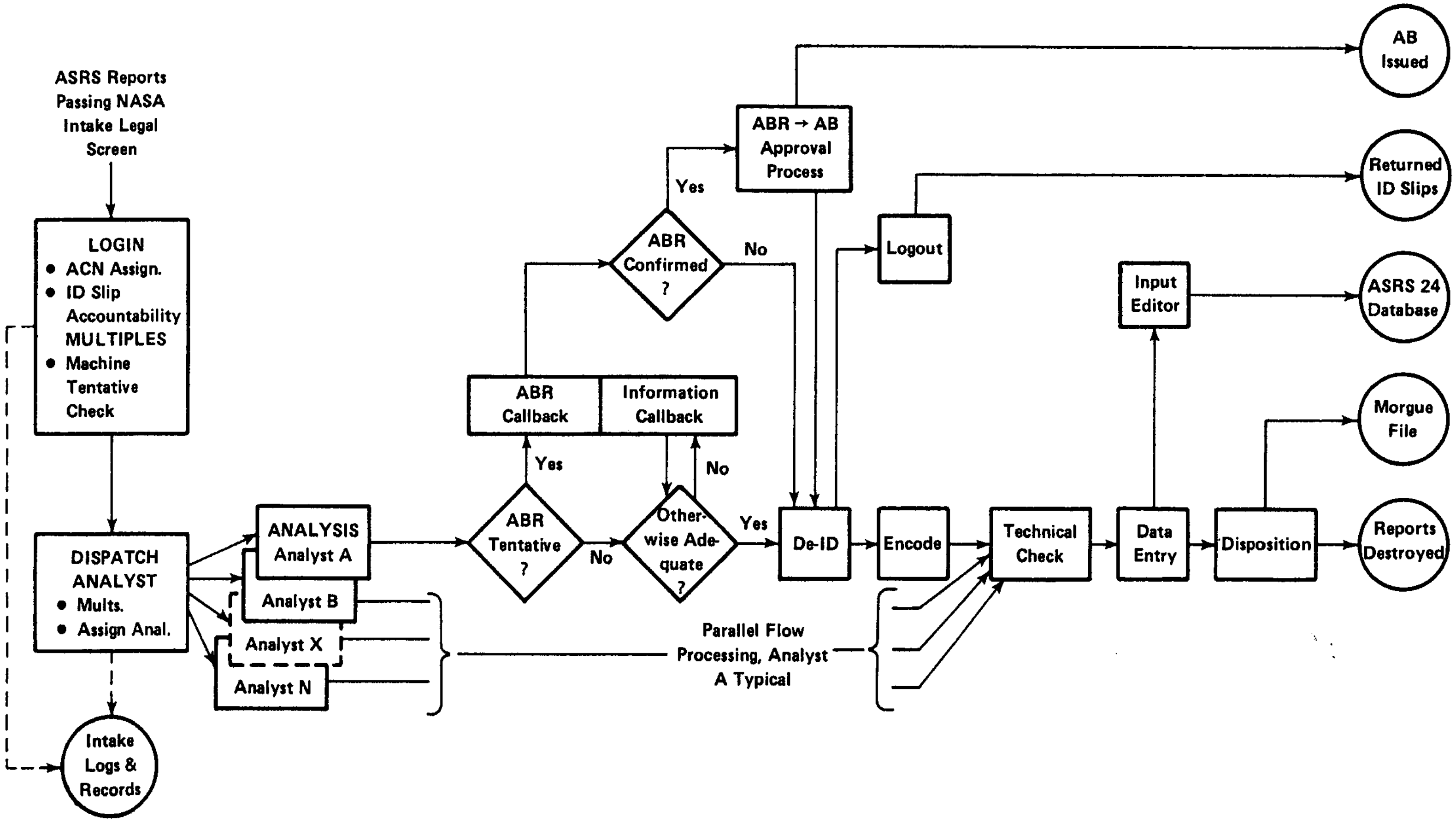

Figure 3-4. Flow diagram of the information processing phase of ASRS program operations.

multiples by an in-depth study, then assigns the incoming report packages to individual analysts for full processing. Multiples go to the analyst handling the prior reports. Assignments are generally made on the basis of the most applicable, available expertise, although this is modified, on occasion, by workload leveling considerations.

The assigned analyst's first task is to read the report and gain as full an understanding of it as possible. He then reviews the completeness of the attribute information available and attempts to formulate analytical thinking in terms of a tentative discussion of the merits of the report (eventually to become information block 311) and the causal and descriptor entries in the diagnostics fields. During this process of in-depth analysis of the report he will note – usually in the first stages of the study – whether there may be alerting information present and whether there are deficiencies in the report that might be rectified by recontacting the reporter. In either of these cases, as shown on the flow chart, there are steps to be taken before proceeding with encoding the report.

When a report describes an aviation hazard that is an ongoing one, the possibility for the issuance of an alert bulletin exists. When a report alleges such a condition, the analyst should recommend an alert bulletin regarding it if, in his judgment, the situation meets three criteria: (1) the situation described is credible – in the analyst's experience it is possible that the situation could exist, (2) the hazard that is implied is significant – there is a real possibility of a nontrivial accident present, and (3) there exists a practicable means of controlling the hazard. If the situation appears to meet these tests, then the analyst is required by policy to call the reporter, even if the information in the report would ordinarily be considered adequate, to double check the circumstances alleged and, incidentally, to advise the reporter than an alert bulletin with respect to his report is under consideration. If the results of the callback still favor issuance of an AB, the analyst generates a recommendation (ABR) for it and it is released as an AB when duly approved.

If the analyst judges a report inadequate or if he believes there is a possibility of obtaining more in-depth information – especially with respect to prior causes associated with the occurrence – then he is required to attempt a callback for information. The information callback is of crucial importance in the ASRS program for two reasons; first, it is a powerful means for enhancing the quality of the information in the database; second, it provides direct communication between the program and its reporters, and is therefore an excellent means of building program awareness and appreciation among the members of the reporting community.

The report is next ready for de-identification and encoding. De-identification consists of logging out the ID strip's security number from the computerized accountability file and sending the date-time stamped ID slip back to the reporter by mail along with a letter of appreciation for sending the report.

The analyst then encodes the report in the manner exemplified in Appendix C. This completes information processing, but several physical steps remain before the information module is completed.

- The encoded information is given a technical check by a qualified final checker whose main job is to review the analyst's judgments, challenging and resolving them as necessary. This provides a nominal 2-expert assessment of each report.

- The refined information is transcribed onto tape cassettes. These are mailed to BCL's computer center where the information enters BASIS through an input editor that automatically checks the information for mechanical errors, unacceptable entries, violations of mandatory entry rules, etc.

- After successful entry is verified and an arbitrary waiting period has transpired, the report record undergoes final disposition. This consists of destroying (shredding or burning) all parts of each coding package including the original report except for the logsheet and any graphics that the reporter sent or that the analyst added to the package. The latter parts are held indefinitely in a morgue file.

4. ASRS INFORMATION MANAGEMENT SYSTEM

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INTRODUCTION

This chapter presents a brief overview of the architecture and structure of the ASRS information management system (IMS). It is not a user's manual; the ASRS Standard Procedures Handbook (unpublished document, NASA Aviation Safety Reporting System: Standard Operating Procedures Manual, Battelle's ASRS Office, Mountain View, California, 1977–1982) and the BASIS User's Manual (ref. 16) serve that purpose. This chapter describes the unique requirements of the ASRS with respect to information storage and retrieval, and describes the structure of the software system implemented to meet those requirements.

DEFINITION OF REQUIREMENTS

The FAA implemented a computer database for storage and retrieval of safety reports when it began its Aviation Safety Reporting Program in 1975. The system permitted only batch entry and retrieval of reports; it was cumbersome and made searching for data a time-consuming task.

The designers of the ASRS had more freedom to conceptualize its information management system as they chose, since they had less time constraints than the FAA did. Early in the conceptual phase of ASRS, NASA entered into a contract with Informatics, Inc., under which Informatics was to identify computer systems potentially suitable for the ASRS database. The study examined both hardware and software, with emphasis on the latter (ref. 17).

It was recognized almost from the outset that the ASRS database would differ significantly from most other databases, both in complexity of the information within it and in the uses that would be made of it. All data would be entered into the system from a single point: the ASRS Office. A high degree of standardization could be imposed on the format of the data. On the other hand, the variety in the report content would be great, which would make standardization of content extremely difficult.

Since ASRS was implemented in a research environment, the data had to be easily usable for research. The questions to be asked during subsequent research were not known in advance; the system had to be flexible enough to permit retrieval of data based on any of a large number of attributes. This implied that a sophisticated and complex indexing system would be required.

It was necessary that an on-line, interactive data retrieval module be available to permit flexibility in searching the database. The simple retrieval of reports would probably not be as important as the ability to summarize, analyze, correlate, and tabulate various attributes of those reports. This dictated that statistical and graphic analysis packages be available.

It became apparent early in development that ASRS might eventually be a multi-user system. If that occurred, the information management system would have to support simultaneous searches by several users in a variety of locations. Rapid response time to queries was considered essential for the maintenance of a psychologically attractive man-computer interface.

Whereas it was considered essential that the information management system support on-line search and retrieval, it was not necessary that reports be inputted on-line. This simplified the information management task, since the data within the system could be protected easily against inadvertent modification during interactive searches.

BATTELLE'S AUTOMATED SEARCH INFORMATION SYSTEM

BASIS was offered by Batelle Columbus Laboratories, the successful bidder for the ASRS contract, as the information management system for the ASRS database. The system was developed by Battelle and serves as the IMS for a substantial number of information storage and retrieval systems. BASIS provides interactive query facilities and an array of statistical and graphics packages. It is an inverted index system (each index term is listed in an index file together with a list of accession numbers of all reports indexed under that term).

As indicated in the preceding chapter, the index structure associated with ASRS reports in the database is extremely rich. This structure permits the retrieval of reports based on any combination of a large number of attributes. BASIS supports complex searches with a simple inquiry language that makes use of Boolean (and, or) and relational (equal to, greater than, less than, not equal to) operators to specify attributes of the reports to be retrieved.

The closed-form, fixed-field data conventions adopted during the design review of the database in 1978 provided, in the operational database, a large number of attributes that are amenable to statistical manipulation. BASIS is interfaced with statistical routines in the statistical package for the social sciences (SPSS) and with other packages which have been useful in several research studies. BASIS also contains graphic options that can be invoked directly during an interactive search session.

The operational database, "ASRS-24," currently contains over 57 million characters in its "head file" or master record file. The inverted index file contains 17 million characters, with another 500,000 characters in a "range file" of numerical data, a total of 75 million characters or bytes of data.

OPERATIONS USING THE ASRS INFORMATION MANAGEMENT SYSTEM

Originally, data were keypunched onto magnetic tape by a subcontractor. The tapes were then sent to Columbus for entry into Battelle's Control Data Corporation computers. This proved unwieldy, and excessive numbers of errors were noted in the keypunched records. More recently, input preparation has been performed by Battelle at the ASRS office in California. The data are stored on tape cassettes which are mailed to Columbus for computer entry. Quality control is maintained by a combination of editing routines in the input terminals, manual scrutiny of the typed records before the cassettes are mailed, and a screening routine incorporated into the input software at Columbus.

Most searches are performed at the Battelle ASRS Office, using time-share networks. The interactive query mode of the BASIS system has been useful even for complex searches, though a few interactive sessions have required extensive preplanning because of system limitations on search length. Many searches have involved the partitioning of 5000 or more documents. Most large printouts are done in batch mode in Columbus rather than on-line. Such printouts may run to over 100,000 lines of data. Shorter printouts (up to approximately 100 documents) are accomplished on-line.

Little skill is required to operate at an elementary level in the BASIS system; facility in searching the ASRS database requires more knowledge of aviation than of the software. It has been found, however, that the complexity of the indexing used in this application requires that the prospective user have a considerable understanding of the structure of the index and the coding that is used in the index terms. An experienced aviation professional can become reasonably proficient in the use of the database in approximately 1 month.

It was originally contemplated that the ASRS information management system would be initially implemented by Battelle on its own computers, then moved to a dedicated NASA computer for subsequent maintenance. For a variety of reasons, this has not occurred. Perhaps the primary reason has been the ease and cost-effectiveness of system maintenance of a Battelle software system, on a Battelle computer, by Battelle staff. Few ASRS-specific analytic routines have been required, a tribute to the flexibility of the parent system. The BASIS "Profile" utility has made it possible for users to create such searches, then store them as user-specific utilities.

It is estimated by ASRS management that the BASIS information management system as presently configured will be able to accommodate all ASRS needs for the indefinite future. Consideration will be given during the current year to removing some of the oldest records from the headfile, while leaving their accession numbers in the inverted index file so that they can be accessed off-line if needed. The current operational database was implemented on May 1, 1978; it may well be that the most recent 5 yr of fully accessible data is sufficient for nearly all purposes for which the system is likely to be used.

5. USES OF ASRS DATA

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INTRODUCTION

The NASA ASRS was designed to detect and to disseminate information regarding "deficiencies and discrepancies in the national aviation system." It can only be considered effective if it has fulfilled that mandate. One mechanism by which the objective is attained is analytic study of the ASRS database – research.

This section describes research methods developed for the manipulation, analysis, and interpretation of ASRS data. It discusses the strengths and shortcomings of these data for detection and evaluation of aviation system hazards. It describes known biases in the data and methods for taking account of these biases in the conduct of aviation system hazard studies. Examples are drawn from research performed by the project staff and others during the developmental phase of ASRS operations. No attempt is made to chronicle all of the research performed; such a listing can be found in Appendices D–G.

THE INFORMATION CONTENT OF ASRS DATA

Information in Incoming Reports

The raw material from which an ASRS database entry is constructed is a report, submitted by some person centrally or peripherally involved in aviation. The report form (Form ARC-277) contains spaces for entry of some specific data, and space for a narrative description of an occurrence or situation. A few reports do not contain narratives, or contain only a single statement such as "near midair collision." In others, the narratives and attachments may amount to as much as 60 pages of relevant data. Some reports are submitted by nonaviation observers whose understanding of what they are reporting may be miniscule or in error. Others are submitted by persons who are obviously fountainheads of knowledge. Some reports are obviously submitted to gain the benefits of a waiver of disciplinary action; others clearly involve no such motive.

Despite these differences, nearly all ASRS reports convey at least some potentially useful information. While the information is obviously biased by a reporter's perception of an event or situation, it is usually not otherwise biased and can generally be taken, when a clear description is furnished, as a perceived event. Whether the perception is correct depends, of course, on the reporter's position, knowledge, and objectivity.

The structured information provided in fields 1–14 of the ASRS report is generally accurate, though it is often incomplete. Locational data represent a particular problem; there is no standard method by which reporters indicate the location of an occurrence, yet accurate location data may be critical to the later use of a report in research.

As stated earlier, ASRS narratives have been retained in the database. The decision to save the narratives was made because of uncertainty about our ability to provide adequate surrogates for the original data. The decision has turned out to be perhaps the most farsighted one made by the system's designers, for it permits the investigator to re-evaluate the raw material provided by a reporter. Biases can be re-evaluated; experience can be re-assessed. It is this characteristic, more than any other, that permits the interested researcher to utilize ASRS data (once retrieved) relatively unencumbered by the views of those who may have analyzed the data when it was received.

Information Added by ASRS Analysts

ASRS analysts, all experts in some facet of aviation, perform three functions of importance to the later user of the data. They collect additional and amplifying data from reporters and from charts, manuals, and the like; they standardize the input of attributional data for entry in fixed fields; and they append to the report certain descriptive and diagnostic terms to aid in later retrieval of the report. (A few coded fixed fields also contain diagnostic data, the behavioral field being an example.)

Because of the analysts' expertise in aviation matters, it is reasonable to assume that attributional data will be correctly and completely coded. The preparation of descriptive and diagnostic material, on the other hand, involves judgments that in some cases are intensely subjective. With respect to an altitude deviation, for example, all analysts might cite a perceptual failure as enabling; some might also cite a lack of flight crew vigilance. Under behavioral characteristics, however, some analysts might well cite complacency whereas others would not. Whether such citations are made depends not only on the coding instructions and definitions, which have been carefully standardized, but also on the analyst's mental set regarding the occurrence. The decision to employ aviation experts in this role, a cornerstone of the ASRS methodology, makes this sort of between-analysts variance inescapable.

It must be recognized, therefore, that when search terms involving such subjective judgments are utilized in research on the database, one is utilizing a technique that involves reporter bias and analyst bias as well as that of the investigator performing the research. This is also true, though to a lesser extent, when the researcher uses synopses to locate reports of interest.

Information Removed from Reports by Analysts

By strict convention, identifying material is removed from reports during initial processing. In the course of this process, air carrier or other operator information is lost, as are flight numbers. The aircraft manufacturer identity, if known, is also lost. Exact occurrence time is lost, though surrogates in terms of quarter of day and light conditions are coded. Occasionally, reports are so specific to a specific named organization or persons that substantive information about the occurrence is lost in the course of de-identification, though this does not occur frequently.

Location data, and data regarding government installations, aircraft, and services are not removed. The data may be used, therefore, to compare government services across facilities or regions, whereas they cannot be used to compare, for example, air carriers. The disadvantages of this convention have been known and understood since the inception of the system, but it was also recognized that the data could be used for nefarious as well as for useful purposes, and that such data could cause harm to corporate as well as to individual persons.

Aggregation of Reports in the Database

The ASRS database was designed to be useful for the answering of questions not thought of by the designers. A great deal of information was therefore coded in indexed fields, much of which has proved useful for retrieval purposes, some of which has not. The information management system in which the database is embedded is an extremely complex one; ASRS research personnel are still discovering new "tricks" that enable them to retrieve and manipulate data more efficiently. The key to an effective information management system is that it permits one to obtain all, or essentially all, of a given kind of data.

The ability to obtain a substantial number of instances of a specific type depends on two conditions: first, that a substantial number of reports containing the characteristics of that type have been received, and second, that identifiers of the type exist or can be constructed. In a great majority of cases, it has been possible to design a search strategy that is responsive to the request for data, though the search may be cumbersome and sometimes requires great ingenuity of the designers. In some cases, however, the proper strategy has been elusive even after the expenditure of much effort.

An example of an extremely difficult type of search is one that was requested by an organization that wanted information concerning the effectiveness of the "party line" concept of air-ground communications in preventing hazardous occurrences (ref. 18). The search was difficult for two reasons: first, though relevant reports were known to exist, there was then no coding convention to identify events which did *not* occur, for whatever reason. Second, at the time of the request, factors that aided in recovery from an occurrence were not coded in a discrete field, though they were noted. The latter problem was solved subsequently; the first remains to be solved.

Although the design of a search strategy to retrieve reports on an attribute not considered by the designers is difficult, it can usually be accomplished. Much use can be made of diagnostic factors, despite their subjectivity and generality. It should be noted that such complex searches will often not retrieve all examples of a given type; this is an inherent disadvantage when subjective judgments are made in the coding phase. One way around this disadvantage is to design the best possible search strategy *a priori,* then to examine the indexed fields to find common points that may make it possible to retrieve additional examples. A study of emergencies in flight is a good example (ref. 19). The investigators wished to study in-flight emergencies, whether or not they had been coded as such. Their initial retrieval strategy made use of the "emergency" designator. After retrieval of the data set, they examined the types of anomalies and other descriptive and diagnostic designators, then conducted a second successful search to uncover other examples of those anomalies, though they had not originally been coded as emergencies.

Because of the generality of many of the codes, many false drops will occur in a generalized search. In general, it has been found that one-half to two-thirds of the reports retrieved by any technique are of the type desired. Therein lies the critical importance of the narratives: the investigator can read them, then decide whether or not the reports contain the needed information. The disadvantage of this is, of course, that it takes considerable time to read a large number of reports in detail. The "false-positive" reports are a bother – the "false-negative" reports an unknown.

Advantages and Disadvantages of Indexing Reports

Because ASRS is a voluntary system, it was not thought by its designers that it would be particularly useful in developing incidence or prevalence data. In general, it has not provided such data, though in some cases more examples of a particular kind of data are reported to ASRS than to other systems, and the data thus become a benchmark despite their known inadequacies. This has been the case with near-midair collision data, despite the fact that there is no requirement that such events be reported to ASRS, or to anyone else. In such cases, however, "false-negative" reports that fail to drop in a search, can be important.

This issue relates to the more general question of the value of, and the problems involved in, indexing reports. The value can be stated simply. Index terms are the only way a search of the database can be performed efficiently. The problems, however, relate to the fact that any indexing system makes the assumption that reports have attributes in common. Given the almost infinite variety of occurrences in a very complex aviation system, aggregation of reports under a given index term involves the complexities mentioned above and others as well, including the problem of simple errors in coding, particularly omissions. More important is the loss of information inherent in hierarchical classification schemes.

Because of the importance of the near-midair collision data, a study of the use of index terms as surrogates for the narratives was conducted (unpublished report, W. Graham, A Study of Near Midair Collision Reports, for FAA Office of Aviation Policy, January 1980). The study compared computer and manual retrieval of a given class of reports to ascertain both the sensitivity and specificity of the computer search techniques.

A search for the specific event of interest was conducted, using a strategy based on fixed-field codes. Thereafter, a second search was conducted using a much broader screen based simply on a code indicating that more than one aircraft was involved; the yield from the second search was screened manually. A comparison of the results of the two retrievals is shown in table 1. The sensitivity of the original search strategy was 94%; the specificity was 89%. Note, however, that to find 495 valid reports in the original computer sample, 712 had to be evaluated by the investigator after retrieval, a "yield" in that data set of only 70%.

TABLE 1.– COMPARISON OF SEARCH RESULTS

Computer screen for specific event	Subsequent manual screen for specific event		Total
	Event present	Event absent	
Screen positive	495	217	712
Screen negative	33	1,767	1,800
Total	528	1,984	2,512

The yield of a more complex search using diagnostic terms is likely to be substantially lower than the yield of a comparatively simple search. Perhaps the most complex search performed to date was done in support of a study of cockpit resource management (ref. 20). Diagnostic terms were relied upon almost exclusively, and over one hundred were finally used. The search yielded 564 reports; 250 were relevant to the topic under study. Although the selected reports provided insights of considerable value, the effort involved in screening the retrieved data was formidable. In general, the more specific the search, the more likely it is to be productive and to have a high yield. In almost no studies is it possible to use index terms as a full surrogate for the reports themselves, though a few exceptions are discussed below.

THE POTENTIAL USES OF ASRS DATA

There are many uses that can be made of the ASRS data – and some uses that cannot legitimately be made of the data. This section summarizes our experience during the developmental period and suggests other possible uses yet untested.

Existence of a Hazard

The basic purpose of the FAA's ASRP of which ASRS is the data collection arm, is to obtain and disseminate information regarding "discrepancies and deficiencies in the national aviation system." It is clear that the data can be used for that purpose; over 700 alert bulletins attest to this. Most alert bulletins, however, are created as the result of one, or a few, reports. The hazards involved are usually obvious to a trained observer. Equally important is the existence of covert, or nonobvious hazards. There have been several cases in which insights gained from a collection of data were invaluable to the understanding of why a problem existed, but in most cases the existence of the hazard was known or suspected before a search was done (refs. 21 and 22). No method has yet been devised that will automatically point out new or unknown hazards.

The value of the database in confirming suspicions, however, is considerable. Many searches have been conducted because an ASRS analyst thought he was beginning to see a pattern in a few reports passing his desk. The results of these intuitive searches have been negative in some instances, positive in many more. They have led to alert bulletins, to special studies, and to major technical reports.

The human being is excellent at detecting signals in the midst of noise. Though the ASRS database is a most useful analytical tool, there is still no substitute for human screening of the data with respect to hazard detection. Human insights have led to hypotheses regarding previously unsuspected hazards; the data have been used to test these hypotheses.

Quantitative Evaluation of Known Hazards

The designers of ASRS did not intend that this voluntary system would be used to derive incidence data regarding events in the national aviation system. It can be argued that a system such as ASRS should never be used for this purpose, because it can never be known whether ASRS data are either qualitatively or quantitatively representative of events in the national system. Yet if events are reported to ASRS that are not reported elsewhere, there is a great temptation to take account of the ASRS reports, and sometimes to consider them as representative.

It is important that this temptation be resisted, but there is wide misunderstanding of how the data *can* be used, if not in this way. First, it can be said that if a group of reports of a common type exists, if those reports have been submitted by knowledgeable reporters, if they do not appear to have been submitted in pursuit of a political objective, and if the content of the reports accords with reasonable expectation, they may be considered as indicative of the existence of a type of event. Further, their numbers may be considered indicative of a lower bound upon the frequency of that event in the system. The group of events described in the reports may be considered to be a sample, albeit not necessarily a random or representative sample, from a population of such events.

Much can be done with such a sample despite its limitations. One may legitimately use the sample over time for trend analyses (see following section). While it cannot be inferred that such a sample is representative, one may reasonably assume that it is a consistent and stable sample.

The sample may legitimately be used, therefore, to provide a first-order characterization of the event under study. If a pertinent variable has a range of values, it may be assumed that the range is a lower bound for the range of that variable in the population of events. The mean and variance of that variable may likewise be used as rough estimates of the population mean and variance, though only with the caveat that the sample may be biased.

If an attribute is present in the sample, it will be present in the population. If it is consistently present, one may be able to hypothesize reasons for its presence. Frequently observed predisposing or enabling factors may lead to a hypothesis as to cause and effect. It may be possible to design intervention strategies to ameliorate the hazard (though with the knowledge that they rest upon an unproven relationship).

In summary, the incidence of a hazard cannot be inferred from ASRS data. If, however, reports of a given type are received frequently over time, it *must* be inferred that the hazard exists over that time, and that it is not an isolated circumstance. It may be possible to tell a good deal about the hazard, always realizing that the picture may be incomplete because of the nature of the data.

Determination of Trends in ASRS Data

Trend analyses have been conducted on ASRS data on an experimental basis for several years. The design of trend detection algorithms is not difficult; their implementation is trivial. The challenging task, however, is to identify a set of attributes that defines with precision, over time, a type of event for which trends are desired. If the definition is not sufficiently precise, changes over time in the application of the coding conventions can lead to changes in the number of reports retrieved that are unrelated to the event under study. Problems in the definition of trends in ASRS data have been largely problems in the definition and coding of the events under study.

These are illustrated by a study of trends in altitude deviation reports. It was not apparent at the inception of the program that altitude deviations were an important class of anomaly. Experience during the first year of the program, however, suggested that these events warranted examination. An initial study of the events was performed (ref. 23). When a trend analysis package was implemented in 1978, altitude deviations were among the classes of data examined on a periodic bases.

The data from these studies indicated an almost linear rise in reports entering the ASRS database over time. Whereas there was considerable variability in the data from month to month, the trend was stable. Several attempts were made to ascertain reasons for this phenomenon (ref. 24); none was found that explained the consistency of the trend. Finally, all of the reports that had contributed to the trend were retrieved and examined.

The results of this examination showed, first, that the coding conventions by which the reports were detected were insufficiently precise. This straightforward problem was corrected. More important, however, it was found that an increasing number of altitude deviations were being reported by more than one person. When numbers of occurrences were evaluated, it was found that the apparent upward trend was an artifact. Later changes in the coding of the database have made it possible to examine both numbers of reports and numbers of occurrences.

Trend analysis remains an important goal of the ASRS group, and research in this area continues to be pursued aggressively. In recent months, trends in traffic conflicts have been reported to FAA on a regular basis, using a coding system devised some years earlier. In this case, the phenomenon of interest was defined rigorously and a new code was developed for all data received after a certain date.

Analysis of Hazard Causation

In was mentioned earlier that causation cannot be proved by retrospective data. Nonetheless, causation can be inferred from such data. If the inference is reasonable, it may be useful. It may lead to further, more focused studies in an attempt to understand in greater detail why the hazard exists and what can be done about it. An example was a study of runway incursions (ref. 25), performed at the request of the NTSB. The study demonstrated the ubiquitous nature of such events, and showed that information transfer problems pervade the data. A more detailed, continuing study of runway incursions was commissioned and has been conducted by the Transportation Systems Center for the FAA. The data have been used for development of both procedures and improved runway/taxiway marking systems, as well as for other purposes.

Such studies may also be useful as a way of determining when and why a particular event involves a hazard. A study of go-arounds (ref. 26) served just this purpose, by pointing out that this maneuver, usually performed to avoid a conflict, often involved the aircraft that executed it in another conflict, sometimes more difficult to resolve.

Analytic studies of ASRS data are almost always time-consuming if they involve review of a large number of reports. One such study took several months of unremitting effort (ref. 27). It appears necessary, on the basis of experience to date, to conduct such studies in several steps. One must first screen the retrieved reports for relevance. More than one search is frequently required. After segregation of the relevant reports, it has been necessary in almost every case to devise classification schema specific to the topic under study, then to reread and reclassify the reports before proceeding with the analyses. Thereafter, a variable but often lengthy period of "living with" the data has usually resulted in a reasonable understanding of the phenomenon of interest and why it occurs. Analytic studies are rarely easy, but they have also been among the most rewarding tasks attempted by the ASRS staff, for they have illuminated the probable causes of many known and a few previously undetected hazards.

Amelioration of Aviation Hazards

A knowledge of hazard causes is indispensable to the amelioration of the hazard. To the extent that ASRS data point to the causes of a particular problem, they may also point toward possible strategies for the solution of the problem. However, it is necessary to be careful about inferences in this area. Because of the voluntary nature of the system, it is not possible to be certain that all relevant facets of a problem have been observed, even after study of a large body of data. One must, therefore, infer causation with care, with the knowledge that other unknown factors may be present. These unknown factors may, in turn, vitiate the effectiveness of a solution that appears to be appropriate based on the data at hand.

Verification of the Effects of Intervention

Once a problem has been identified and a solution devised, ASRS data may be used effectively to evaluate whether or not the solution is working. If reports were received describing the problem, there is no valid reason to believe that they will not continue to be received until the problem is solved.

The implementation of profile descents at Denver and Atlanta was followed by a spate of reports of altitude deviations during descents at these locations. A revision of the Denver profile descent charts following an ASRS study of the phenomenon (ref. 24) was followed by a drop in the number of such reports, while reports continued unabated from Atlanta.

In another case, following receipt of a substantial inflow of reports describing problems with a letter of agreement between two ATC facilities, the FAA investigated and made changes that were followed by a precipitous decline in the number of such reports.

If it is known that reports of a problem have been received, and if ASRS analysts are aware that a change is contemplated, the System can do an effective job of tracking the problem through the implementation of the proposed solution. There have been other cases in which changes have not been followed by a decline in reports; when the changes were known in advance, it has been possible to provide prompt, continuing feedback to appropriate authorities. The system may also be able to alert authorities that the implementation of a solution appears to be leading to new problems. In these cases, trend analyses are done, but on a type of event that can be defined precisely. It is believed that ASRS can be utilized profitably for more of these sorts of studies.

In summary: ASRS data can and do reveal the presence of hitherto unperceived hazards, but the data are more often useful for the understanding and explanation of known or suspected hazards. In this use, the data can be invaluable, for they provide insights lacking in most other safety data.

Once a possible hazard is defined, ASRS data are useful in proving its existence, providing a first-order estimate of its scope and attributes, understanding its possible causes, helping to define potentially useful intervention strategies, and tracking the problem once intervention has occurred. The use of the system for these purposes requires that ASRS analysts be aware of others' perceptions of problems, and of impending changes in the national aviation system. This is best brought about by close, continuing liaison and interaction between system personnel and key personnel in the operating arms of the FAA.

RESEARCH METHODS APPROPRIATE FOR ASRS DATA

This section discusses in some detail the research methods that have been used for the analysis of ASRS data. It describes methods that have been effective and others that have not. The section does not cover search methodology.

It should be noted that the ASRS is an evolving system. While those who have developed it have tried to explore it in many ways, they have not exhausted its resources by any means. The development of appropriate methods for studying the data is a dynamic process; other users of the data are constantly devising new methods not thought of by the system's designers. This section, therefore, will focus on the constraints that must be observed if errors of interpretation are to be avoided. Within those constraints, there are many approaches to the data that await testing.

Methods of Retrieval

As noted in the introduction above, the retrieval of data is covered in depth in other ASRS documents (unpublished document, NASA Aviation Safety Reporting System: Standard Operating Procedures Manual. Battelle's ASRS Office, Mountain View, California, 1977–1982). The only points that need to be made here relate to the inclusiveness of search strategies.

If one is dealing with a complex or difficult topic, it is not highly likely that the first search will yield all, or nearly all, of the reports relevant to that topic. This is not necessarily a problem; if one wishes only to exemplify the topic under consideration, the initial strategy may provide enough reports to permit the study to proceed. If, on the other hand, the search does not produce a 50% yield, caution should be exercised. It may be that the topic is particularly difficult to define, but it is more likely that the search was not properly constructed.

"False positives" (reports retrieved that are not relevant) are not a serious problem – they simply take time to read and exclude. "False negatives" reports, however, are more difficult. Is it necessary to retrieve all reports that may relate to the issue? A second, broader search (excluding data retrieved on the first pass) will often help, albeit with a much larger yield of false positives.

The more precisely an objective is defined before the work begins, the less wasted effort there will be in its attainment. The "proper" approach depends on the gravity of the question and the resources available to answer it. These issues are best addressed before the study commences, for there may be a ten-fold difference in study costs depending on the answers.

Method of Analysis

Qualitative analysis– Qualitative analysis of ASRS data, like qualitative analysis in chemistry, seeks to answer the question, "Is it there?" Unlike analytical chemistry, which yields either a positive or negative answer, one must always worry, after a datum has been searched for without result, whether the question has been asked properly. Is there a false negative report lurking, well disguised, in the underbrush? Has it been looked for in every reasonable way? The answer to the first of these questions may be positive or negative; the answer to the second is usually, "No."

Qualitative searches are difficult because they often demand that the net be cast very broadly, with the certain knowledge that they will yield a great many irrelevant reports. The temptation, therefore, is to be rather specific, then to accept a negative answer if nothing turns up. A negative answer, on the contrary, should serve as a mandate to try again, using a different strategy. One of the most difficult questions posed to the ASRS was a request for reports in which the second officer, or flight engineer, was materially involved either in the genesis of an occurrence or in recovery from it (ref. 28). After consideration of a number of search strategies that were unsuccessful, the one that finally worked was a stem search for the terms, "S/O," "second officer" or "flight engineer" in the report synopses, which were never designed for this purpose. This is the only time, to our knowledge, that synoptic material has ever been used in a search.

Numerical and statistical analysis– While it is not appropriate to assume that a set of reports necessarily characterizes all aspects of a type of event, it is often posisble to design a study in such a way that this assumption is not critical. If a set of reports can be divided into two mutually exclusive subsets, it may be assumed that the two subsets are alike except for the attribute used to divide them (since they were drawn using a single search strategy). Much can be done with such partitioned sets. In a study of fatigue, Lyman and Orlady (ref. 29) evaluated flight crew errors in occurrences attributed to fatigue and compared them with a sample of flight crew errors retrieved in the same way but which lack the fatigue attribution (ref. 29). Using chi-square analysis, they found significant differences in the frequencies of errors of various types in the two samples and were able to conclude that fatigue is associated with deficiencies in monitoring behavior.

A more recent study of flight crew errors examined the issue of crew complement (ref. 30). Using the same approach, Babcock normalized the ASRS error data on the basis of segments flown by 2- and 3-person crews. He found that two types of errors, altitude deviations and clearance deviations, were reported significantly more frequently in proportion to segments flown in 2-crew aircraft. It is worth noting that whereas this study made use of total operations to normalize and to compare the data, it did *not* rely on the assumption that the ASRS reports are a representative sample of the population of such errors. It made only the assumption that such errors are as likely to be reported by a 2-crew operation as by a 3-crew operation. In fact, it is possible that the likelihood of at least one ASRS report, given an occurrence, is higher when three people observe the occurrence than when only two have observed it.

One must be careful, in such studies, to observe appropriate constraints. It is necessary that the data be divisible into mutually exclusive categories, as an instance. It is also necessary that the reports be drawn from the database in an unbiased manner unrelated to the attribute being used to divide them into subsets. If these constraints are not violated, analyses of this type can be extremely useful (see ref. 31).

Numerical analysis has also been useful in characterizing subsets of the data, though again one must be careful not to assume that the data are representative of the parent population. Thomas and Rosenthal have performed a careful analysis of the magnitudes of altitude deviations (ref. 32); they found that the frequency distribution of such deviations was log-normal. Their finding has implications with respect to the probability of detecting an error signal presented in a specific manner. This suggests the possibility that ASRS data can be used to validate certain models of human operator performance, though this possibility has not been further explored to date.

Graham has used ASRS near-midair collision data to refine a model of such conflicts in the national airspace system (unpublished report, Graham, W.: A study of Near Midair Collision Reports. For FAA Office of Aviation Policy, January 1980). His model relates near midair collisions to traffic density in various categories of airspace serving airports of various configurations.

Interpretation– The interpretation of studies based on ASRS data must be done with the understanding that they rest upon voluntarily submitted reports from people whose knowledge of the aviation system varies widely. Because of the limited waiver of disciplinary action made available to reporters, it is likely that ASRS receives a relatively large number of reports describing occurrences that involve violations of the FAA regulations. Whether other types of occurrences that do not involve violations are reported as frequently is a matter of conjecture.

Attempts have been made to relate data used in ASRS studies to the population of events from which they came. One interesting approach was taken by Lyman in a study of en route ATC contingencies involving controller errors (ref. 33). He examined the geographic distribution of the data and found them significantly, but weakly, associated with total center operations. He then compared the geographic distribution of his errors with that observed by Kinney et al., in a previous study of human factors involved in system errors (ref. 34). The correlation between the two sets of data was +0.91, an extraordinary degree of association considering that the time periods covered by the two studies did not overlap.

There are other techniques and other attributes that have been or might well be used to assess the representativeness of particular subsets of ASRS data. Where such methods have been devised and data were available for comparison, the ASRS data have usually been similar.

The ASRS database is a rich resource. Each new group that has used it has contributed insights and methods for studying the data. No method for the study of these data is better or worse than another, if logical and statistical constraints are observed and the data are understood for what they are – and are not.

ASRS Data: Limitations

The limitations of ASRS data reside partly in what the data are, and partly in what they are not. These will be examined in turn.

ASRS data are voluntary. They only describe those things that someone – who knows about the system – preceives, thinks important, and communicates. The "market penetration" of ASRS is by no means complete, particularly within the community of those who fly for pleasure. The data consequently under-represent the types of problems encountered by that segment of the community. Thus far, reporters have been required to communicate initially in writing. Forms are not, unfortunately, universally available; prospective reporters may, or may not, take the time to write a report. If they do, their perceptions may be faulty, their memory short, or their tolerance for pen and paper limited. The data must be viewed with all these shortcomings in mind.

ASRS data are not verified by independent investigation or inquiry. A plausible, but untrue, report would enter the database; a few undoubtedly have, though others have been detected because of the expertise of ASRS analysts. While it cannot be proved in most cases that a particular report is true, there is great safety in numbers. The likelihood of 100 reports of a type of event being untrue is vanishingly small.

ASRS indexing involves the biases of ASRS analysts, despite their best efforts to minimize the effects of those biases. What is retrieved may therefore be biased, though the investigator is free thereafter to utilize the reporter's own narratives. This is a minor problem in the vast majority of cases, but it has been a serious shortcoming in a small number of difficult searches for elusive reports.

ASRS reports, by the time they reach the database, are anonymous. This can be a more serious problem than it seems. Despite good initial reporting, callbacks, and excellent indexing, there have been a few cases in which a few days of later telephone interviews could have saved weeks of hard, unsatisfying labor with the reports. This is an inherent defect in a system that requires that the analyst know or assume, a priori, all of the questions that a researcher may wish to ask at a later point in time.

ASRS data are also limited by what they are not. They are not, for instance, balanced discussions of all sides of a particular question. If a new procedure is found to be a problem by pilots, ASRS will hear of it promptly and repeatedly. The fact that the procedure has helped controllers to do a uniformly better job will not usually be represented in the database; nonproblems rarely are. This information must be secured through other channels; it emphasizes the importance of continuing liaison between ASRS analysts and the other experts in the communities they represent.

ASRS data do not contain product or service identification. This was alluded to earlier; it makes the data useless for comparative studies of the merits and faults of such products or services. The limitation is inherent; it will remain, for without the support of those who provide the products and services, there would be no system.

Finally, but perhaps most important, ASRS data do not contain evidence concerning unperceived problems except by luck or serendipity. If a pilot or controller does not perceive that a deficiency or discrepancy exists, he will have no reason to submit a report. This problem has been discussed in a previous paper on the uses and limitations of ASRS data (ref. 35) with respect to visual illusions during limited visibility approaches. If an illusion is not apparent, it will not be reported as such.

It is exceedingly fortunate that large numbers of people in aviation are intelligent, perceptive, and strongly motivated. It is these people who have detected latent dangers in things they have seen or heard, and have reported them. It is hoped that they will continue to do so, for the ASRS *is* able, given such information, to fulfill its mandate to disseminate the information to those people and organizations in the aviation community who are in the best position to do something about such hazards.

ASRS Data: Strengths

The greatest strength of ASRS data is clarly the information it conveys about human error in the aviation system. A comparative study of three national incident reporting systems, performed by the Human Factors Working Group of the United Kingdom Civil Aviation Authority (unpublished report, Report of the Human Factors Study Group: The Encouragement of Human Factors Reporting. Civil Aeronatucis Authority (Great Britain), December 1980), made the following observations after examining a random sample of 400 ASRS reports:

> Almost all the reports have human factors content ... (the system) does seem to have achieved a measure of success, both in attracting reports and in terms of report content ... the pursuit of air dafety will be significantly advanced if more and higher quality human factors occurrence reports can be brought forward ... the confidential schemes run by NASA and the RAF have brought clear benefits; occurrences have been reported that would seem likely to have remained unreported without confidential reporting ... we recommend the

institution (in Great Britain) of a trial confidential reporting system aimed at encouraging pilots to report human factors incidents. . . .

In the past, human errors have been reported incompletely, if at all. Even in aircraft accidents in which the principals survived, it has been difficult, in an adversary environment, to obtain full information about what happened and why. The ASRS is not an adversary system. People may tell it as much, or as little, as they wish, but the report analyses and follow-up interviews are conducted as a cooperative search for truth. It is known that the data collected by ASRS are often incomplete, but there is also reason to believe that they are very rarely false. Indeed, it has been pointed out by Winant (ref. 36) that they may well be less biased than other sources because of the confidentiality of the system.

The second major strength of the ASRS database is that it brings together in one place the experiences and perceptions of flight personnel and air traffic controllers. In this respect, the system is unique. ASRS data present, often forcefully, the similarities and differences in the ways these two groups view aviation system operations. The data make it plain that modifications in one part of the system may be expected to have effects, sometimes unanticipated, in the other parts of that system.

The third strength of ASRS data is that the occurrences reported and placed in the database do not involve pecuniary or other liability to persons or corporate entities in the national aviation system. This is not to say that subsets of the data may not be embarrassing, nor to say that they may not be perceived as threatening. On various occasions, ASRS data, including some cited here, have been used in advocacy for change, and in passionate defense of the status quo. They have been used, and sometimes misused, by the media to support allegations about the dangers of "the crowded skies." They have occasionally been used to harass public officials.

No program designed to provide evidence of deficiencies and discrepancies in the national aviation system can provide a balanced view of the very high level of safety in that system. That view must be presented by others. But during its 6 yr of development, the ASRS has produced perhaps a thousand documents and data packages describing deficiencies and discrepancies without, thus far, posing the threat of irreparable harm to any element of the aviation industry. That a system can provide these data without posing such a threat must surely be counted among its strengths. That the data can be used to provide evidence of system hazards, yet be used constructively in a search for solutions of the problems, is a testament to those persons in the national aviation system and in the FAA who believed it was better to light a candle than to curse the darkness.

6. ASRS PROGRAM PRODUCTS

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One of the obligations recognized by planners and managers of the ASRS was the need for constructive products of the ASRS analysis process and the database. For the ASRS concept to be regarded as successful, data received by the program had to be converted into effective and timely safety information for use by the FAA and other members of the aviation community. This responsibility to provide safety information was summarized in the Memorandum of Agreement between the FAA and NASA which established the ASRS program. That document specified that:

> NASA will prepare periodic reports, statistical summaries, and other data necessary to depict the results of the analysis and interpretation of the safety reports. This material will be transmitted to the FAA and other users of the system to facilitate their evaluation and action to eliminate unsafe conditions or practices.

The products of the ASRS program have evolved in several categories.

PRIMARY PRODUCTS

The four principal vehicles of published safety data dissemination are: (1) Alert Bulletins, (2) program (quarterly) reports, (3) contractor reports and technical papers, and (4) monthly safety newsletter. Each of these categories of published information are generally available and widely distributed within the aviation community. In addition to those publications designed for use throughout the community, another major product of the ASRS is responses to special data requests from specific elements of the community. Each of these information devices is discussed in the following paragraphs.

Alert Bulletins (ABs)

These brief, single-topic messages act to promptly notify the appropriate authority or organization of reported hazards that have been detected from analyses of individual or multiple ASRS reports. The criteria for issuance of an alert bulletin require that the report or reports contain credible data, that the hazard reported represents a continuing, non-negligible risk, and that the hazard identified be a correctable one. Alert bulletins always have as a recipient one "major" addressee, and frequently are sent to multiple "information" addressees at the time of initial issuance. The major addressee is the authority or organization in the best position to investigate the alleged hazard and to cure the problem if investigation reveals the need for some form of remedy. The informational addressees are in a position to convey the essential information of the AB to their memberships, constituencies, or managers. As of the date of preparation of this report more than 750 alert bulletins had been issued by the ASRS program. While all alert bulletins are considered constructive products of incident reporting, the ABs listed in Appendix D are considered to be particularly illustrative of the importance of the AB process in the pursuit of aviation safety.

ASRS Program Reports

Also referred to as quarterly reports, these publications are one of two vehicles for the dissemination of ASRS research papers and related safety issues. To date, fourteen program reports have been published; a listing of report dates, publication numbers, and the issues addressed in each report are provided in Appendix E. It should be noted that, with few exceptions, each of the program reports has consisted of three separate sections. One section presents several samplings of de-identified reports addressing common aviation issues (e.g., winter operations); these de-identified reports are selected and grouped primarily for their value in safety education and flight training. A second section presents examples of ASRS alert bulletins issued and for which responses have been received from the major addressee; the AB section of program reports, in addition to exhibiting one of the capabilities of the ASRS program, serves to alert the community to problems recognized but not yet resolved because of budgetary or lead-time requirements. The third section of the program report presents major research reports; contractor reports or research reports that were not published as separate technical papers appear in program reports as products of the ASRS analysis and research process.

Contractor Reports and Technical Papers

As the ASRS program matured it became posisble to identify significant safety issues for in-depth research. The products of those research efforts were often published as NASA Technical Papers (TPs), Technical Memoranda (TMs), or Contractor Reports (CRs). Usually longer, and sometimes more detailed than the research reports contained in the program reports, CRs and TPs addressed a variety of issues; the list of subjects, publication numbers and dates appear in Appendix F. A perusal of the research report list will reveal the fact that TPs, TMs, and CRs dealt primarily with the human factors aspect of basic aviation safety issues; this orientation to human error research was a logical product of the frank, personal factors and observations expressed in many ASRS reports. Contractor reports and technical papers are often subject to constructive second usage through their use as presentational material and as the source of articles appearing in technical journals and professional publications.

Monthly Safety Newsletter

Several years into the ASRS program it became very apparent that some form of short, easy to read publication was necessary to carry the program's various safety messages to the aviation community, particularly to operational personnel. To meet this need, CALLBACK, a monthly safety newsletter, was created. CALLBACK was designed from its inception to be an instructive, single-page document that addresses a serious subject, safety, in deft, easy to read terms. In addition to its persistent safety messages, CALLBACK was intended to inform members of the aviation community of the program's report processing and research activity, and to share with the community interesting and informative reports received through the ASRS. As of the date of preparation of this report thirty-eight issues of CALLBACK have been produced. Appendix H contains a listing, by issue, of the aviation safety topics dealt with in CALLBACK.

Special Data

The capability of the ASRS database to respond to both the research and operational needs of the aviation community is exemplified by the program's ability to satisfy specific requests for special data. As the ASRS database grew, many members of the community recognized the value of the unique information in the database; requests for specific data came from virtually all segments of aviation. With only a few exceptions, these special data requests did not require that program personnel perform research on the data retrieved. ASRS staff members did spend a considerable amount of time and effort structuring the data requests; however, once the scope of the database interrogation was defined and the printout produced, the data were provided directly to the requester. In some instances the ASRS data were to be used for research to be performed by the requesting party, in other cases management, flight, and air traffic control personnel used the data for direct application to operational activities. The data provided were always in de-identified form and were commonly restricted to a selected number of data fields; for example, a typical special request printout of an ASRS report would reflect the report accession number, report source (by generic category only), report date (by month and year only), aircraft type (generic description only), location identifier (three-letter code), location (nearest city and state), the report's de-identified narrative and any recommendations provided by the report's source. A complete list of topics addressed in special data requests is contained in Appendix G.

OTHER APPLICATIONS OF ASRS PRODUCT

In addition to the discussion which has summarized the four principal ASRS published products and special data requests, it is appropriate to note three other categories of program product or accomplishment.

First, the issue of "secondary" distribution of ASRS safety publications. The program's managers have always encouraged the use of ASRS products in other organizations' publications; that encouragement has yielded significant secondary usage of incident report data and research. ASRS published material has been reprinted in the flight crew bulletins of most major air carriers, many general aviation publications, and numerous other aviation-oriented educational and training materials. A number of schools, colleges, and flight training academies have used ASRS publications in their courses. The products of the ASRS process have been reproduced and used in a variety of ways. In many cases it has been possible to track the "footprint" of a particular ASRS utterance as it made its way through several fields and levels of aviation activity.

In addition to the ASRS contributions cited above as a product of database research and alert bulletin issuance, the incident reporting system has been a key source of data for several aviation safety review bodies and others who have assisted in the formulation of national aviation policy. Extensive incident information was supplied from the ASRS database for:

1. The President's Task Force on Aircraft Crew Complement.
2. The National Institutes of Health Select Panel on Mandatory Pilot Retirement.
3. The Flight Safety Foundation's Air Traffic Control Evaluation Task Force.
4. The Air Traffic Control Association Review and Analysis of Air Traffic Control Terminal Area Operations.
5. The National Transportation Safety Board's Review of the U.S. Air Traffic Control System (1981 and 1982).

Finally, nondocumentable and intangible contributions to safety constitute another class of program accomplishments from the ASRS. The aviation community's access to a confidential information system, coupled with the wide distribution of the published products of ASRS operations, has significantly improved the flow of safety-related information. In a complex system in which the most pervasive problems are failures of information transfer, this is perhaps one of the ASRS program's most important achievements.

ASRS has significantly improved communication among the various segments of the aviation community, including the FAA, the DOD, the NTSB, and NASA. All elements of the community have worked together on the system; all have used its data in the pursuit of solutions to safety problems. The common database has made it possible to reach consensus on some issues; in other cases, it has permitted more rational and focused advocacy by the proponents of differing points of view. In several cases involving national aviation policy, ASRS has been virtually the only source of incident, as opposed to accident, data.

There is no other similar database, and there is considerable doubt whether one could be accumulated under different ground rules.

Among the subtleties of the impact of ASRS activities on system safety is that of moral persuasion for the purpose of leverage. It is not an uncommon occurrence for a request to be made of the ASRS staff to provide data or a publication to support a legitimate safety improvement that is on the verge of acceptance but needs a little extra push. Because of the depth of human error data submitted to ASRS, and because of the program's credibility within the aviation community, ASRS alert bulletins or research data are not infrequently used to achieve safety objectives in need of support. This use of ASRS product has been evident in actions and communications instituted by elements of the community, the military, and governmental agencies; examples of such activity have included the use of ASRS alert bulletins by an FAA organization to seek corrective action from an airport manager, a military organization, or another FAA office.

One of the important benefits of incident reporting to a program like ASRS takes place before the report ever reaches the program office. Program participants have expressed the notion that the act of having to organize and express the relevant facts and issues associated with a given event or situation has proven to be an extremely valuable learning experience for the reporter. Because of the program's assurance of confidentiality, reporters have often gone beyond a basic recitation of the facts to probe their own motivations, misconceptions, proficiency, and other considerations that may have contributed to the factors that made up the incident. The event analysis and performance critique that takes place at both ends of the reporting process is clearly a significant, but unmeasurable, benefit of the ASRS program.

Another aspect of ASRS involvement in the enhancement of system safety involves the informal discussion of specific, de-identified incident data with elements of the aviation community. The ASRS staff has periodically initiated communications with various safety and trade representatives to apprise those organizations of safety issues highlighted by information contained in one or more incident reports. A frequent use of one such relationship involves the Jeppesen Co., a commercial chart manufacturer. On many occasions the ASRS staff has contacted the manufacturer to discuss aspects of charts that are not necessarily in error, but have been the subject of reporters' suggestions for improvement or innovation. Beneficial changes have resulted from this type of dialogue. In the nearly 6 yr of the ASRS program's existence numerous similar informal contacts have produced results from aircraft manufacturers, trade associations, airlines, fixed-base operators, military organizations, as well as national, regional, and local elements of the FAA.

The most obvious, as well as the most undocumentable, category of ASRS achievements is the element of accidents avoided and deaths prevented; it is impossible to document a nonevent. However, given the array of research, alert bulletins, publications, and assistance offered and utilized as a result of ASRS operations, it seems reasonable to assert that the presence and product of the ASRS has prevented accidents and saved lives.

TECHNOLOGY TRANSFER

One of the objectives of a developmental program's management, and a basic tenet of NASA research, is to create a system or methodology that is capable of duplication in other environments or disciplines should the need, opportunity, and resources permit such duplication. This duplication, in identical or modified forms, is often referred to as technology transfer.

The ASRS has been the subject of a number of plans to transfer the technology of incident reporting to other geographic areas and disciplines. In some areas or activities there are no incident reporting procedures in existence; in other areas or activities some form of incident reporting exists, but those efforts may not have been as successful or productive as the ASRS program. As a consequence of either of those conditions a great deal of interest in using the ASRS concept, or parts of it, has been expressed to the program's management. As of the date of preparation of this report, none of the likely prospects for incident reporting programs influenced by the ASRS technology has become operational, although several are within months of implementation. Readers of this report should note that the following examples are likely to occur, some are imminent, but no documentation currently exists to define the character or effectiveness of the proposed systems.

Examples of possible technology transfer from the ASRS concept fall into two categories, international and interdisciplinary. The category of international examples includes other aviation organizations outside the United States that have pursued, or plan to pursue, an incident reporting system based on the ASRS experiences. Among the international examples are:

1. Great Britain – current plans call for the initiation of a voluntary, confidential, nonpunitive incident reporting system during the latter half of 1982. This ASRS-type program would be in addition to the present Mandatory Occurrence Reporting System; the difference would be that the voluntary system would be administered within the RAF Institute of Aviation Medicine instead of by the Civil Aviation Authority.

2. Canada – This country's Ministry of Transport intends to initiate incident reporting based on the ASRS concept sometime in the very near future. While a firm date has not been set, the issue is not whether a program will appear; rather it is simply a question of when and in what form.

3. Ireland – Following a visit by several pilot-employees of Aer Lingus, ASRS managers were notified that the airline was planning to institute an inhouse, modified version of the ASRS program.

4. Japan – The Japan Aircraft Pilots Association has proposed that Japan's aviation authorities, in conjunction with the major air carriers and JAPA, explore the possibility of instituting an ASRS-type incident reporting system for domestic and international aviation operations.

Examples of interdisciplinary interest in ASRS include both foreign and domestic organizations outside the realm of aviation that have pursued the feasibility of instituting a voluntary, confidential incident reporting system in their industries or regulatory organizations. These nonaviation interests have been attracted to the ASRS concept because of its proven ability to obtain valid human error data. The reason for this attraction to a system of human error detection can best be understood by recognizing that the following list is comprised predominantly of activites that are labor intensive and rely heavily on humans interacting with increasingly sophisticated automation. Interdisciplinary examples include:

1. The U.S. Nuclear Regulatory Commission (NRC) – This organization is actively pursuing an ASRS-type system for use in monitoring the activities of operators of nuclear power facilities.

2. Institute of Nuclear Power Operators (INPO) – As with the NRC, this industry group is investigating the possibility of an incident reporting system for operators of nuclear power plants; the INPO concept envisions a system managed by industry as opposed to a government program.

3. Electric Power Research Institute (EPRI) – EPRI's interest in an ASRS-type system is similar to those of the NRC and INPO. The major difference would be the scope of operator involvement; EPRI's plan would extend the incident reporting system to all power plant operators, not just nuclear facilities.

4. Nassau County (New York) Criminal Justice Commission – This investigatory body is interested in patterning an anonymous witness program after the characteristics of the ASRS program.

5. University of Washington/U.S. Coast Guard – The University, as part of a study for the Coast Guard, is pursuing the possibility of using an ASRS-type system to permit operators of vessels on Puget Sound to report conflict situations and related marine hazards.

6. Swedish Department of Labor – In a circumstance that fits both the international and interdisciplinary categories, this government agency is planning to institute incident reporting capabilities in several labor-intensive industries (e.g., mining and fishing) in an effort to reduce the number of job-related injuries in those occupations.

The potential exists for other applications of ASRS technology in a multitude of disciplines and geographic areas. The technology is neither subject or culturally limited; incident investigation is just one more means of enhancing the sciences of risk management and system safety. The success of the ASRS confirms that it is possible to investigate fundamental human errors in complex systems. The ASRS experience in the field of aviation suggests that incident investigations in other systems would be fruitful where it is important to understand how the systems work and why they fail.

7. THE ASRS RESEARCH AND DEVELOPMENT PROGRAM: LESSONS LEARNED

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INTRODUCTION

The final chapter of this report, titled "Lessons Learned," is a subjective accounting of what the senior staff members of the project believe was learned in the process of developing the ASRS. It fulfills a need to communicate what the staff feels was learned to the person who may have to develop an analogous program in the future. Not all of the lessons will apply to a different system, operating in a different context and environment, but many of them will be relevant.

This chapter incorporates some of the conclusions about ASRS that do not fit elsewhere in this report. The ASRS staff hopes it will be helpful to others with responsibility for other safety surveillance systems.

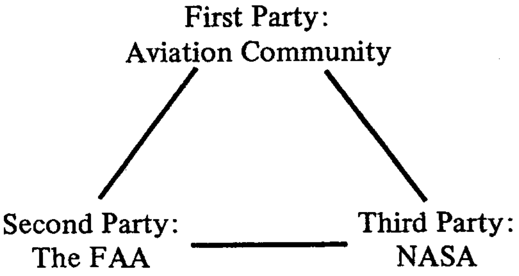
PROGRAM CONCEPT AND PHILOSOPHY

The Third Party Concept

The reasons for NASA's involvement in the FAA's ASRP are detailed in Chapter 1; it is clear, however, that "not just any third party" will do. Any organization called upon to manage and direct a program as sensitive as ASRS has proved to be must meet several criteria, among which are the following: (1) credibility with users, the relevant community, and the bureaucracy; (2) unquestioned integrity; (3) experience in gathering and handling information; (4) technical proficiency; and (5) an understanding of the community, the operational context and an appreciation of the relevant political issues.

Commitment to the Program

Any system such as ASRS requires the participation of three parties, all of which must be involved in, and committed to, the undertaking. They may be conceived of in this way:



A sense of committment must exist among all parties at the outset if the undertaking is to have a reasonable chance for success. This sense of commitment must go beyond an informal understanding of the purpose of the program. It must include a clear understanding of the way in which the program will operate, what and how it will communicate, and with whom, and what the scope and limits of the program are to be.

The program must be given sufficient time for development before it is expected to produce results; the lack of a development period severely handicapped ASRS during its first two years of operation.

Thereafter, the program must be given a reasonable period of time in which to prove its worth. Its finances, from whatever source, must be sufficient to carry it through the period of development and initial operation.

Design Philosophy

It should be decided at the outset whether the program is to be open, confidential, or anonymous; if either of the latter, program and data security must be defined very early. The security should be preplanned with community participation and implemented with community involvement.

If immunity is to form an incentive for reporters, the nature and extent of the immunity should be defined by joint agreement among the three parties at the outset. Use immunity (discussed in Chapter 2) is critical to any viable safety reporting program; reporters must be assured that the information provided to the program cannot be used against them. Transactional immunity, which protects the reporter against sanctions if an incident becomes known, is probably negotiable, as long as such negotiations are conducted among the parties in advance of the program's announcement and implementation.

PROGRAM MANAGEMENT AND STRUCTURE

Program Management

A considerable degree of management flexibility is necessary to accommodate changes in staffing, internal structure, level of effort, and functions, in a developmental program. If the program is new, it cannot be expected that all details of its a priori design will be correct. The management must also be prepared for surges in input, including an initial surge if the program is new.

Management must make a continuing effort to make, and keep, users of the data aware of the strengths and limitations of such data. Caveats, no matter how carefully stated, tend to be forgotten. The parties should attempt to limit direct access to the data to those who have a clear need for it, in order that a limited set of direct users may be kept completely informed of trends, software modifications, and other technical details of the program. If access is limited, however, program management must provide continuing assistance to other potential data users with regard to the framing of requests for data, so that all potential users may be equally served by the data. It is necessary that the persons who interface with such users be extremely knowledgeable, both of the data and of the system used to store and access it; they play a key role in the acceptance of the program.

Program management must make provisions for continuing or periodic review of the program's output. This review should be constructive, critical, timely, and responsive to the needs both of the community and the program. The reviewers, in addition to being technical experts, must recognize and understand the political realities of safety data research and of the environment in which the program is being conducted.

Program Structure

A program such as ASRS must be characterized by flexibility in certain respects – and by inflexibility in others.

Flexibility– A modular approach to a safety surveillance program of this sort is possible. It is possible, and reasonable, to design a limited program encompassing only data collection, processing, storage and retrieval, as an instance. It is also possible to design a separate module specifically for analysis of these, and other, data. The marketing portion of such a program can be, and perhaps should be, a separate module, performed by persons with special expertise in that area. Having no prior knowledge of how ASRS should be designed, the project's planners attempted to design it as an integrated whole, but the staff is now convinced that that was not the only way, nor necessarily the most efficient way, to accomplish the task. As it was, it became necessary to implement the program one step at a time; this would have been easier had the design been modular to begin with. The need for flexibility in this regard cannot be overemphasized.

The scope of de-identification of data entering ASRS was decided prior to implementation of the system. It appears that proper decisions were made, given the climate in which the system was conceived, but it should not be considered by others that the solution adopted would be correct for another system, operating in another environment. Data have certainly been lost that would have been useful in answering important safety questions, though such data could also have been misused to indict corporate or other entities. Again, future designers should be flexible.

The database in which ASRS was implemented is fast, effective and flexible. It is cumbersome for the newcomer, however, and difficult to use until a degree of proficiency is attained. A more flexible system could be designed to serve as an interface between the database management system and the users with direct access to the data. Such an interface, now being designed for another system similar to ASRS, would appreciably enhance user acceptance of the system, and therefore of the program.

Inflexibility– While it is highly desirable to be flexible, there are certain aspects of ASRS in which inflexibility is of great importance to the success of the system. The program management's insistence, from the outset, on the use of subject matter experts to conduct both input and output has been an important contributor to the system's success. ASRS data have been immeasurably enhanced by the insights of the experienced aviation professionals through whose hands they have passed. Similarly, the expertise of ASRS research analysts has served as a critical bridge between potential data users and the resource they sought to use.

Chapter 3 refers to the need for a systematic and carefully constructed diagnostic vocabulary and to the design review made necessary by inadequate vocabulary control during the early days of the program. This is an area in which inflexibility is required. The vocabulary should be developed, defined and implemented as early as possible in the program, though provisions must be made for later changes and additions. Both the vocabulary and the coding conventions must be inflexible to minimize analyst variance or bias.

Finally, the inflexible decision to keep, store and be able to retrieve raw narrative data has been an important contributor to the success of ASRS. At the outset, the system's designers were not sure that they could devise a coding system sufficiently comprehensive to serve as a surrogate for the narratives. Seven years later, the project staff still believes that the narratives are a necessary part of the data in such a system.

EXTERNAL RELATIONS

Neither ASRS nor any similar system can survive in a vacuum. The "first party" – the user – must be involved from the beginning if he is to feel a stake in the program sufficiently to motivate him to report to it. The ASRS Advisory Subcommittee, representing virtually every segment of the aviation industry, has been critical to the success of the program, both as advocate and critic. Through it, the entire industry has been a part of ASRS since its inception.

Promotion and Feedback to the Community

Even an advisory committee cannot reach all of its constituents on a regular basis. Continuing promotion and publicity are necessary ingredients of a safety data system that relies on input, particularly if that input is voluntary, as in this case. Publicity, carefully designed to present the system in a constructive light, must be planned, executed, and continued if the system is to be successful.

ASRS relied heavily upon the FAA and constituent organizations for its early publicity. This was soon recognized to be necessary but not sufficient, and NASA Headquarters provided invaluable help in the design and implementation of a poster campaign. Publicity efforts have been sporadic, however, and more is required on a continuing basis. Thought must be given to this by the designers of any future system. Continuing promotion must be an integral part of the program; it must be planned, and funded, as an essential element of the system, fully as important as a competent database management system. The promotional effort is, we have found, the critical.element of a data input system.

Promotion, while an essential, is not in itself an adequate stimulus to reporting in the long term. Equally important, as the program begins to show results, is the feedback of those results to the community. There are many elements to a feedback program. Earlier chapters have described individual feedback to reporters, mass feedback through publications and a monthly newsletter, and talks to aviation groups, given by program personnel. All of these are important, though not sufficient unless they reach the widest possible spectrum of reporters. Potential reporters will continue to provide support only if they see that the system is producing tangible results. Many such systems have been implemented; only a few have survived and have been productive over considerable periods of time.

Relations With the Ultimate User of the Data

The ultimate user of safety data is the organization or entity with the ultimate responsibility for safety, in this case the FAA. Chapter 1 indicates that the relationship between ASRS and the ultimate user of its data has not always been smooth, or even effective. Perhaps the most important lessons have dealt with this relationship.

There is an inherent potential conflict between a regulatory authority with the ultimate responsibility for aviation safety and a party which seeks to collect to collect and analyze data dealing with, to quote from the enabling circular, "deficiencies and discrepancies in the national aviation system." If, and only if, this potential conflict is recognized, discussed, and dealth with at the outset, the relationship between the parties can at worst be one of constructive tension. This potential problem was neither fully recognized, nor adequately dealt with, by the respective parties at the inception of ASRS. This failure has led to much concern, considerable antagonism and many unnecessary handicaps to the full realization of the program's potential in the intervening years. Such discussion should precede the commitment of both parties to the program.

Both parties must recognize that the problems that will arise will not be only technical. The safety data system, and the participants, must operate in a political environment, for safety has high political visibility. A clear recognition of this indisputable fact – before the system is implemented – can likewise do much to defuse potential problems downstream. Both parties must be committed to the program, not only at top management levels, but at working levels as well, if the program is to be useful to the working levels of the respective organizations after implementation.

Can such potential, but inherent, problems be minimized? The ASRS management staff believes they can be minimized, though not eliminated, by two strategies, each thought out and agreed to by the respective parties at the inception of the program.

First, and probably most important, there must be an effective and continuing liaison between the parties at three levels: workers must have effective liaison with workers; managers must have effective liaison with managers; and most important of all, overseers or top managers must have effective liaison with their counterparts. The agreements that enable a third-party safety reporting system must be periodically reinforced by recommitment of the various levels of program management. A breakdown in liaison at any of the three levels can be confidently expected to cause serious problems in the future.

Second, there must be effective two-way communication between the parties with respect to the safety data being collected by the third party, and with respect to the interpretations being placed on those data. It is not necessary, and in any event it is highly unlikely, that there will always be agreement between the parties regarding the meaning of the data. Disagreement can be tolerated (the "constructive tension" referred to above) if, and only if, effective communication continues. Neither party should be exposed to "surprises" by the other; unanticipated decisions or actions by either party inevitably lead to a degradation of confidence between the parties, and thus to degradation of the system's effectiveness as an instrument of safety surveillance.

Both parties to the ASRS have had to learn this lesson; it has not been easy for either party, and the system's effectiveness has been lessened as a result. It is hoped that both parties, having learned this painful lesson over a protracted exposure, will be able to remember how these problems arose and thus how to avoid them in the future; equally, it is hoped that others who may implement a similar system will be able to profit from this one's mistakes.

CONCLUDING COMMENTS

The NASA ASRS has now reached a state of maturity; it has become a recognized and accepted part of the nation's aviation safety surveillance system. It has done so because of the willingness of the nation's airmen – pilots and controllers alike – to share potentially sensitive but important information. Some of those airmen have exposed themselves to considerable risk by reporting; they deserve great commendation for doing so.

Without the enthusiasm and resolve of virtually every segment of the aviation industry, the ASRS could never have existed, nor survived as it has. The organizations that make up that community have contributed heavily to making the system an effective one.

The FAA, which had the most to gain, but also the most to lose, has sponsored, financed and nurtured ASRS, despite doubts on many occasions as to its usefulness or effectiveness. Its patience during the developmental phase of a program which was not without growing pains has been commendable; the ASRS staff looks forward to a continuing effort to support the program's ultimate user more and more effectively during years to come.

Finally, NASA, the organization that gave its support to the birth and development of the ASRS, a politically visible and sensitive program quite at variance with its usual research and development programs, should receive recognition for providing the time necessary to bring the program to maturity. The designers and developers of the ASRS are grateful to the agency for the help without which their efforts could not have come to fruition.

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APPENDIX A

ADVISORY CIRCULAR 00-46A

AC NO: 00-46A

DATE: 3-31-76

ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: AVIATION SAFETY REPORTING PROGRAM

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1. PURPOSE.

This circular is to advise that the Federal Aviation Administration (FAA) will modify the Aviation Safety Reporting Program (ASRP) effective April 15, 1976, by utilizing the National Aeronautics and Space Administration (NASA) as a third party to receive and analyze Aviation Safety Reports. This study of the National Aviation System invites pilots, controllers, and other users of the airspace or any other person to report to NASA actual or potential discrepancies and deficiencies involving the safety of aircraft operations. The program applies to that part of the system involving the safety of aircraft operations, including departure, enroute, approach and landing operations and procedures, air traffic control deficiencies, pilot/controller communications, the aircraft movement area of the airport, and near mid-air collisions. The success of this program to improve safety depends on the free, unrestricted flow of information from the users of the National Aviation System. The objective of the modification is to increase the flow of information.

2. CANCELLATION.

Advisory Circular 00-46 dated May 9, 1975, is cancelled.

3. BACKGROUND.

a. The primary mission of the FAA is to promote aviation safety. To further this mission, the FAA instituted a voluntary Aviation Safety Reporting Program on April 30, 1975, designed to encourage the reporting and identification of deficiencies and discrepancies in the system before they cause accidents or incidents.

b. The FAA has determined that the ASRP effectiveness would be greatly enhanced if the receipt, processing, and analysis of the raw data were accomplished by a third party. This would further ensure the anonymity of the reporter and of all persons involved in a reported incident, and, consequently, increase the flow of information necessary for the effective evaluation of the safety and efficiency of the system. Accordingly, the FAA and NASA have agreed that NASA will establish an Aviation Safety Reporting System (ASRS) to perform these functions.

4. NASA RESPONSIBILITIES.

a. NASA will establish an Aviation Safety Reporting System to provide for the receipt, analysis, and periodic reporting of findings obtained through the reporting program to the public, the aviation community and FAA.

b. NASA will form an ASRS advisory committee comprised of representatives from the aviation industry, consumers, DOD, NASA, and FAA to advise NASA on the conduct of the

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Initiated by: ASA-10

ASRS. The committee will conduct periodic meetings to determine and ensure the effectiveness of the reporting system.

5. PROCESSING OF REPORTS.

a. NASA will develop procedures to process Aviation Safety Reports. These procedures will assure that reports are initially screened for:

(1) Time-critical information which, after de-identification, will be promptly referred to FAA and other interested parties.

(2) Information concerning criminal offenses, which will be promptly referred to the Department of Justice and FAA.

(3) Information concerning accidents, which will be promptly referred to the National Transportation Safety Board and the FAA.

b. Information that might assist identification of persons filing reports and persons named in those reports will be deleted, except for reports covered under Paragraphs a.(2) and a.(3) above. This will be accomplished normally within 24–48 hours if no further information is requested from the reporter.

6. WAIVER OF DISCIPLINARY ACTION.

a. Provided a timely report has been filed, FAA disciplinary action is waived against all persons involved in the incident, as follows:

(1) FAA has a period of forty-five days following an incident to ask NASA whether a timely report has been filed on that incident. Except as provided in paragraphs a.(2) and a.(3) below, the waiver of disciplinary action applies if FAA does not make this request within the time period specified, or FAA ascertains through NASA that a timely report was filed.

(2) FAA disciplinary action is not waived for cases involving accidents or criminal offenses, which are wholly excluded from the program.

(3) Reports involving reckless operation, gross negligence or willful misconduct may not be used for FAA disciplinary purposes. Disciplinary action may be taken in such cases, however, on the basis of information obtained independently of the Aviation Safety Report.

b. The following are examples of conduct that has, in the past, been identified as reckless operation, gross negligence, or willful misconduct:

(1) Intentional buzzing dangerously close to persons or property.

(2) Intentional operation of an aircraft in instrument flight rule weather conditions without proper air traffic control clearances or authorization.

(3) Knowingly performing acrobatic flight within a control zone or a Federal airway.

(4) Intentional unauthorized descent below published decision height or minimum descent altitudes while conducting an actual instrument approach.

(5) Knowingly executing an unauthorized instrument approach in controlled airspace.

(6) Intentional operation of an aircraft that is substantially overweight.

c. The waiver of disciplinary action, where applicable, covers all persons involved in a reported incident, not only persons making, or named in, an Aviation Safety Report.

d. Each Aviation Safety Report has a tear-off portion which contains the information that identifies the person submitting the report. This tear-off portion will be removed by NASA, time stamped, and returned to the reporter as his receipt. This will provide the reporter with proof that he filed the report on a specific incident or occurrence.

e. NASA will maintain a separate record of each report received for 45 days following the incident, which will include the date, time, location, and type of incident (but not the identity of the person making the report). Retention of this data is necessary to determine whether an individual is entitled to protection under the ASRP. When the FAA receives information concerning a specific incident, it requests NASA to advise whether or not the incident has been reported. (See paragraph 6.a.).

f. Based on information obtained from this program, including the time critical information from NASA mentioned above, the FAA will take whatever corrective or remedial action is necessary to remedy defects or deficiencies in the National Aviation System. However, as stated above, this action will not include disciplinary action waived under the ASRP.

7. REPORTING PROCEDURES

a. The waiver of disciplinary action, if otherwise applicable, will be assured if a written report is completed and delivered or postmarked and forwarded to NASA within 5 days of the incident, or if NASA is notified in writing within 5 days of the date and location of the incident or occurrence, and a complete written report is filed within 15 days of the incident. Such notification should be directed to: Aviation Safety Reporting System, P.O. Box 189, Moffett Field, CA 94035.

b. NASA ARC Form 277, which is preaddressed and postage free, will be available at FAA offices for persons who wish to participate in the program. This form or narrative report should be completed to describe the discrepancy or deficiency and mailed to: Aviation Safety Reporting System, P.O. Box 189, Moffett Field, CA 94035.

c. This program does not eliminate responsibility for reports, narratives, or forms presently required by existing directives.

John McLucas

JOHN L. McLUCAS
Administrator

8. EFFECTIVE DATE.

The modified Aviation Safety Reporting Program described by this Advisory Circular is effective April 15, 1976. On and after that date, all Aviation Safety Reports should be sent to NASA rather than the FAA.

9. AVAILABILITY OF FORMS.

a. Additional copies of the attached reporting form (NASA ARC Form 277) may be obtained free of charge from FAA offices.

b. Government, State and organized industry groups may obtain forms in quantity by submitting requests to the Department of Transportation, Federal Aviation Administration, Aeronautical Center, Distribution Section, AAC–45C, P.O. Box 25082, Oklahoma City, Oklahoma 73125.

c. NASA ARC Form 277, Aviation Safety Report, will be available approximately April 15, 1976. An initial distribution will be made to regions, centers and FAA facilities. Forms will be stocked in the FAA Depot and will be available through normal supply channels, NSN 0052–00–845–4001, unit of issue: sheet.

APPENDIX B

ADVISORY CIRCULAR 00-46B

AC 00–46B

DATE 6–15–79

ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration
Washington, D.C.

Subject: AVIATION SAFETY REPORTING PROGRAM

1. PURPOSE.

This circular describes the Federal Aviation Administration (FAA) Aviation Safety Reporting Program (ASRP) which utilizes the National Aeronautics and Space Administration (NASA) as a third party to receive and analyze Aviation Safety Reports. This cooperative safety reporting program invites pilots, controllers, and other users of the National Aviation System or any other person, such as maintenance personnel, to report to NASA actual or potential discrepancies and deficiencies involving the safety of aviation operations. The operations covered by the program include departure, enroute, approach and landing operations, and procedures, air traffic control procedures and equipment, pilot/controller communications, aircraft movement on the airport, and near mid-air collisions. The effectiveness of this program in improving safety depends on the free, unrestricted flow of information from the users of the National Aviation System. Based on information obtained from this program, the FAA will take corrective action as necessary to remedy defects or deficiencies in the National Aviation System. The reports may also provide data for improving the current system and planning for a future system.

2. CANCELLATION.

Advisory Circular 00–46A dated March 31, 1976, is cancelled.

3. BACKGROUND.

a. The primary mission of the FAA is to promote aviation safety. To further this mission, the FAA instituted a voluntary Aviation Safety Reporting Program on April 30, 1975, designed to encourage the reporting and identification of deficiencies and discrepancies in the system.

b. The FAA determined that ASRP effectiveness would be greatly enhanced if the receipt, processing, and analysis of the raw data were accomplished by NASA rather than the FAA. This would ensure the anonymity of the reporter and of all parties involved in a reported occurrence or incident, and, consequently, increase the flow of information necessary for the effective evaluation of the safety and efficiency of the system. Accordingly, NASA designed and administers the Aviation Safety Reporting System (ASRS) to perform these functions in accordance with a Memorandum of Agreement executed by FAA and NASA on August 15, 1975, as modified April 24, 1979.

4. NASA RESPONSIBILITIES.

a. The NASA Aviation Safety Reporting System provides for the receipt, analysis, and deidentification of aviation safety reports; in addition, periodic reports of findings obtained through the reporting program are published and distributed to the public, the aviation community and FAA.

b. A NASA ASRS advisory committee comprised of representatives from the aviation in-

Initiated by: ASF–20

dustry, consumers, Department of Defense, NASA, and FAA advises NASA on the conduct of the ASRS. The committee conducts periodic meetings to evaluate and ensure the effectiveness of the reporting system.

5. PROHIBITION AGAINST USE OF REPORTS FOR ENFORCEMENT PURPOSES.

a. Section 91.57 of the Federal Aviation Regulations (14 CFR 91.57) prohibits the use of any report submitted to NASA under the ASRS (or information derived therefrom) in any disciplinary action except information concerning criminal offenses or accidents which is covered under Paragrah 7a.(1) and (2) below.

b. When a violation of the Federal Aviation Regulations comes to the attention of the FAA from a source other than a report filed with NASA under ASRS, appropriate action will be taken. See Paragraph 9, below.

c. The NASA ASRS security system is designed and operated by NASA to ensure the confidentiality and anonymity of the reporter and all other parties involved in a reported occurrence or incident. The FAA will not seek and NASA will not release or make available to the FAA any report filed with NASA under ASRS or any other information that might reveal the identity of any party involved in an occurrence or incident reported under ASRS. There has been no breach of confidentiality in the over 17,000 reports filed under ASRS.

6. REPORTING PROCEDURES.

NASA ARC Form 277 (Revised June 1979), which is preaddressed and postage free, is available at FAA offices. This form or a narrative report should be completed and mailed to: Aviation Safety Reporting System, P.O. Box 189, Moffett Field, CA 94035.

7. PROCESSING OF REPORTS.

a. NASA procedures for processing Aviation Safety Reports assure that reports are initially screened for:

(1) Information concerning criminal offenses, which will be promptly referred to the Department of Justice and FAA.

(2) Information concerning accidents, which will be promptly referred to the National Transportation Safety Board and the FAA.

NOTE: Reports discussing criminal activities or accidents are not de-identified prior to their referreal to the agency outlined above.

(3) Time-critical information which, after de-identification, will be promptly referred to FAA and other interested parties.

b. Each Aviation Safety Report has a tear-off portion which contains the information that identifies the person submitting the report. This tear-off portion will be removed by NASA, time stamped, and returned to the reporter as his receipt. This will provide the reporter with proof that he filed a report on a specific incident or occurrence.

The identification strip section of the ASRS form provides NASA program personnel with a means by which reporters can be contacted in case additional information is sought in order to understand more completely the report's content. Except in the case of reports describing accidents or criminal activities, no copy of an ASRS form's identification strip is created or retained for the ASRS files. Prompt return of identification strips is a primary element of the ASRS program's report de-identification process and assures the reporter's anonymity.

8. DE-IDENTIFICATION.

All information that might assist in or establish the identification of persons filing ASRS reports and parties named in those reports will be deleted, except for reports covered under Paragraph 7a.(1) and (2) above. This de-identification will be accomplished normally within 24–48 hours after NASA's receipt of the reports if no further information is requested from the reporter.

9. ENFORCEMENT POLICY.

a. It is the policy of the Administrator of the FAA to perform his responsibility under the Federal Aviation Act for the enforcement of the Act and the Federal Aviation Regulations in a manner that will best tend to reduce or eliminate the possibility of or recurrence of aircraft accidents. The FAA enforcement procedures are set forth in Part 13 of the Federal Aviation Regulations (14 CFR Part 13) and FAA enforcement handbooks.

b. In determining the type and extent of the enforcement action to be taken in a particular case, the following factors are considered:

(1) Nature of the violations;

(2) Whether the violation was inadvertent or deliberate;

(3) The certificate holder's level of experience and responsibility;

(4) Attitude of the violator;

(5) The hazard to safety of others which should have been foreseen;

(6) Action taken by employer or other Government authority;

(7) Length of time which has elapsed since violation;

(8) The certificate holder's use of the certificate;

(9) The need for special deterrent action in a particular regulatory area, or segment of the aviation community; and

(10) Presence of any factors involving national interest, such as the use of aircraft for criminal purposes.

c. The filing of a report with NASA concerning an incident or occurrence involving a violation of the Act or the Federal Aviation Regulations is considered by the FAA to be indicative of a constructive attitude. Such an attitude will tend to prevent future violations. Accordingly, although a finding of a violation may be made, neither a civil penalty nor certificate suspension will be imposed if:

(1) The violation was inadvertent and not deliberate;

(2) The violation did not involve a criminal offense, or accident, or action under section 609 of the Act which discloses a lack of qualification or competency, which are wholly excluded from this policy;

(3) The person has not been found in any prior FAA enforcement action to have committed a violation since the initiation of the ASRP of the Federal Aviation Act or of any regulation promulgated under that Act; and

(4) The person proves that, within 10 days after the violation, he or she completed and delivered or mailed a written report of the incident or occurrence to NASA under ASRS. See Paragraphs 5 c. and 7 b., above.

Note: Paragraph 9 does not apply to air traffic controllers. Provisions concerning air traffic controllers involved in incidents reported to NASA under ASRS are addressed in internal FAA directives.

10. OTHER REPORTS.

This program does not eliminate responsibility for reports, narratives, or forms presently required by existing directives.

11. EFFECTIVE DATE.

The modified Aviation Safety Reporting Program described by this Advisory Circular is effective July 1, 1979.

12. AVAILABILITY OF FORMS.

a. Additional copies of the attached reporting form (NASA ARC Form 277 (Revised June 1979)) may be obtained free of charge from FAA offices, including Flight Service Stations.

b. Government, State and organized industry groups may obtain forms in quantity by submitting requests to the Department of Transportation, Federal Aviation Administration, Aeronautical Center, Distribution Section, AAC-45C, P.O. Box 25082, Oklahoma City, Oklahoma 73125.

c. NASA ARC Form 277 (Revised June1979), Aviation Safety Report, will be available approximately June 15, 1979. An initial distribution will be made to regions, centers and FAA facilities. Forms will be stocked in the FAA Depot and will be available through normal supply channels, NSN 0052-00-845-4002, unit of issued: sheet.

Langhorne M. Bond

LANGHORNE M. BOND
Administrator

APPENDIX C

ASRS RECORD STRUCTURE

The ASRS record structure is depicted in three ways in the following discussions: (1) graphically, (2) as a table of data, and (3) as seen in the encoding sheets used in processing the reports. The first shows the overall relationships among the individual field groups; the second gives detailed information on the content of each field group; and the third displays the way the information finds final expression in the hands of processing analysts.

Figure C-1 is the graphic portrayal showing the full record structure as an array of 12 logical field groups. These are:

- Administrative
- Time
- Aircraft
- Location (Facilities)
- Person
- Weather
- Software (Information Transfers)
- Conflicts
- Major Classifications
- Text
- Diagnostics

Together, these fields cover the full spectrum of information contained in ASRS reports, as well as providing the means for promptly and precisely retrieving reports from the database for the numerous research applications of ASRS data.

The report narrative and other textual fields, and the numeric entry fields are, by necessity, free form. With minor exceptions,[4] entries into all of the remaining fields are strictly structured and controlled. This control is effected by a computerized data input processor which checks all entries against listings of authorzed field values.

The ASRS database readily accommodates the encoding of multiple aircraft, persons, locations, etc. Thus, each field group may be present several times in the data record describing a particular occurrence or situation. The constellation of attributes possessed by each of the participants encoded (aircraft, person, ocation, etc.) are linked and their separate identities are maintained.

The processing analysts encode in the database record only those participants which they judge to have ignificant relevance to the report. Thus, even though a controller report of an airborne conflict might describe his traffic as consisting of 12 aircraft (demonstrating his heavy workload at the time of a conflict occurrence) the analyst would properly code only the two or three aircraft actually involved in the conflict. Only rarely has more than one conflict appeared in a record. There are usually two to five aircraft, people, ocations, or software participants. On two occasions, all ten aircraft field groups were entered.

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[4] Input batch identification (BATCH), dates entered or changed (DTENT, DTCHG), supplementary locational information (RWHD), ground facility name (GNAME), and supplementary keywords (SUP).

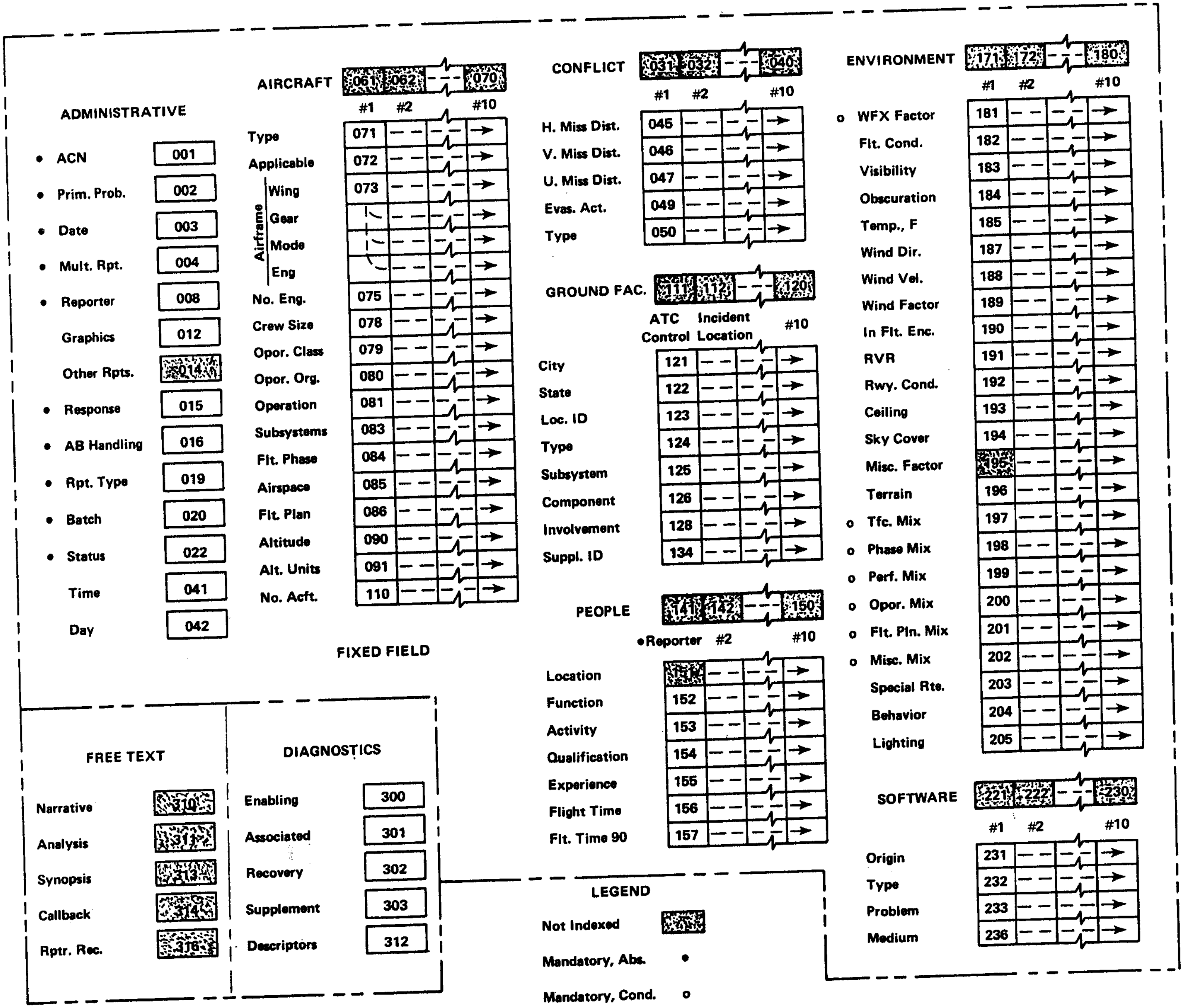


Figure C-1.– ASRS Information system structure.

There are three important conventions covering the coding of participants in the data record. The first location (ground facility), is always the ATC facility exercising control at the time of the occurrence. If there was none, i.e., a pure VFR occurrence in the see-and-avoid environment not in an ATA, then the first location field group is left blank. Similarly, the second location coded corresponds to the chart location of the aircraft at the time of an occurrence. Finally, the first person coded is the occurrence/situation reporter.

Certain fields in the data record are "mandatory, absolute." They must have entries – even though that entry may be unknown (UNK) – for the record to qualify for admission into the database. Other fields are "mandatory, conditional." Entries must be made if entries are made in any other field in the logical field group and requisite information is available. "Mandatory, absolute" fields are denoted in the coding sheets (fig. C-2) as circles about the field numbers. Conditionally mandatory fields are designated by triangles. A broken triangle indicates that criteria in addition to the one cited above dictate whether the field coding is mandatory.

The ASRS information system's great power for retrieving reports lies in its extensive indexing of data records. Virtually every nontext field in the data record is indexed. Some fields are indexed in two or more ways to further simplify searches. Even the unindexed fields can be effectively searched, but less readily and at greater expense.

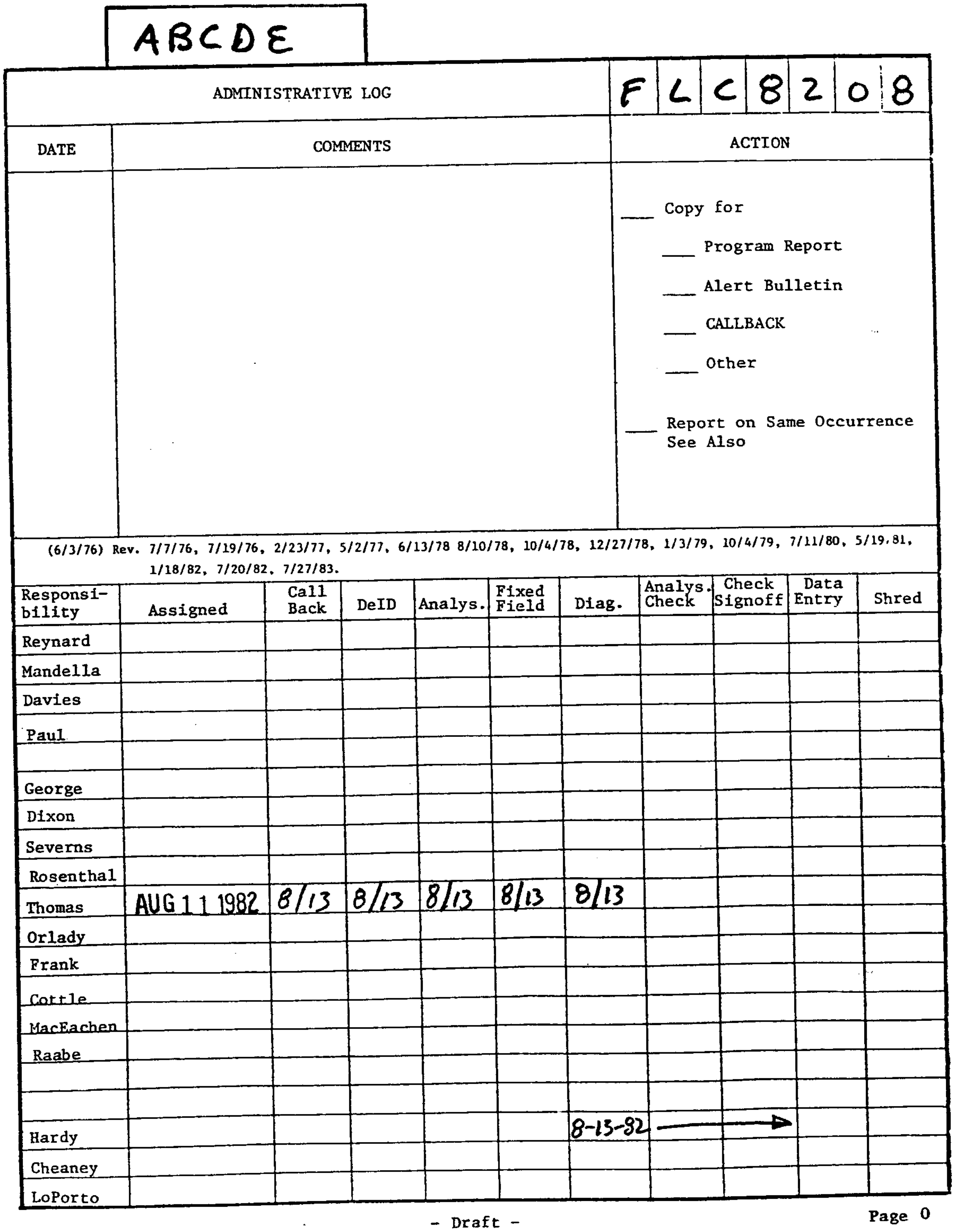
Details of the information present in each field group are presented in table C-1. The table is long because every field group shown in figure C-1 is covered. The "field prefixes" shown in table C-1 are the names associated with each field in the database. The "field values" are the values present in the fields. For controlled fields, entries are restricted to those listed in table C-1 and the authorized list of diagnostic terms. Fields other than those marked mandatory in figure C-1 are left blank if a report does not provide a basis for making an entry and UNK is not a field value option. The "field label and description" column in table C-1 provides a brief definition of each field and each field value. Finally, the right-hand column indicates whether a field is indexed and the type of indexing which is done.

Entries in the diagnostic field group are specified in a diagnostic authority list. This is the list of expressions used to code descriptive or causative aspects of occurrences/situations. The listing, as of the preparation of this report, consisted of approximately 2500 different phrases alphabetically cross-indexed by keyword. The listing has evolved throughout the period of exploratory development of the ASRS information system and is, therefore, representative of project experience in dealing with the 30,000-plus reports received to date. Too bulky to be included in the body of this report, the current phrase list is in the ASRS SOP Manual.

ASRS data records have recently begun to employ sets of field values known as "pointers" and "bridges." These are also shown in figure C-1. They allow linkages and cross-references to be made *among* field groups (e.g., among two aircraft and a control facility involved in a conflict). These fields amplify the ability of the data record to capture important relational information.

ASRS is currently operating under the "Status 16" database regime. The shift to Status 16 produced a considerable upgrade in database quality without creating any fundamental discontinuities in the database structure. For a fiew fields, the entries made under Status 15 were less discriminating than those which are presently being made under Status 16. In other cases, database information has migrated from one field to another. Where either is the case, both Status 15 and 16 field values are shown in table C-1 as an historical record of the transformation and data migrations which have occurred.

Figure C-2 depicts the forms used by analysts to encode a report for entry into the database. The sheets are filled out with typical entries for the hypothetical occurrence described in the report-item b in figure C-2. Note the light editing and de-identification applied to the narrative. All the sheets are filled out as they would have been were this an actual report to ASRS. The information on the sheets is self explanatory. Field numbers are coordinated with the information in figure C-1 and table C-1.



ABCDE

ADMINISTRATIVE LOG

F	L	C	8	2	0	8

DATE	COMMENTS	ACTION
		___ Copy for ___ Program Report ___ Alert Bulletin ___ CALLBACK ___ Other ___ Report on Same Occurrence See Also

(6/3/76) Rev. 7/7/76, 7/19/76, 2/23/77, 5/2/77, 6/13/78 8/10/78, 10/4/78, 12/27/78, 1/3/79, 10/4/79, 7/11/80, 5/19.81, 1/18/82, 7/20/82, 7/27/83.

Responsibility	Assigned	Call Back	DeID	Analys.	Fixed Field	Diag.	Analys. Check	Check Signoff	Data Entry	Shred
Reynard										
Mandella										
Davies										
Paul										
George										
Dixon										
Severns										
Rosenthal										
Thomas	AUG 11 1982	8/13	8/13	8/13	8/13	8/13				
Orlady										
Frank										
Cottle										
MacEachen										
Raabe										
Hardy						8-13-82 →				
Cheaney										
LoPorto										

- Draft -

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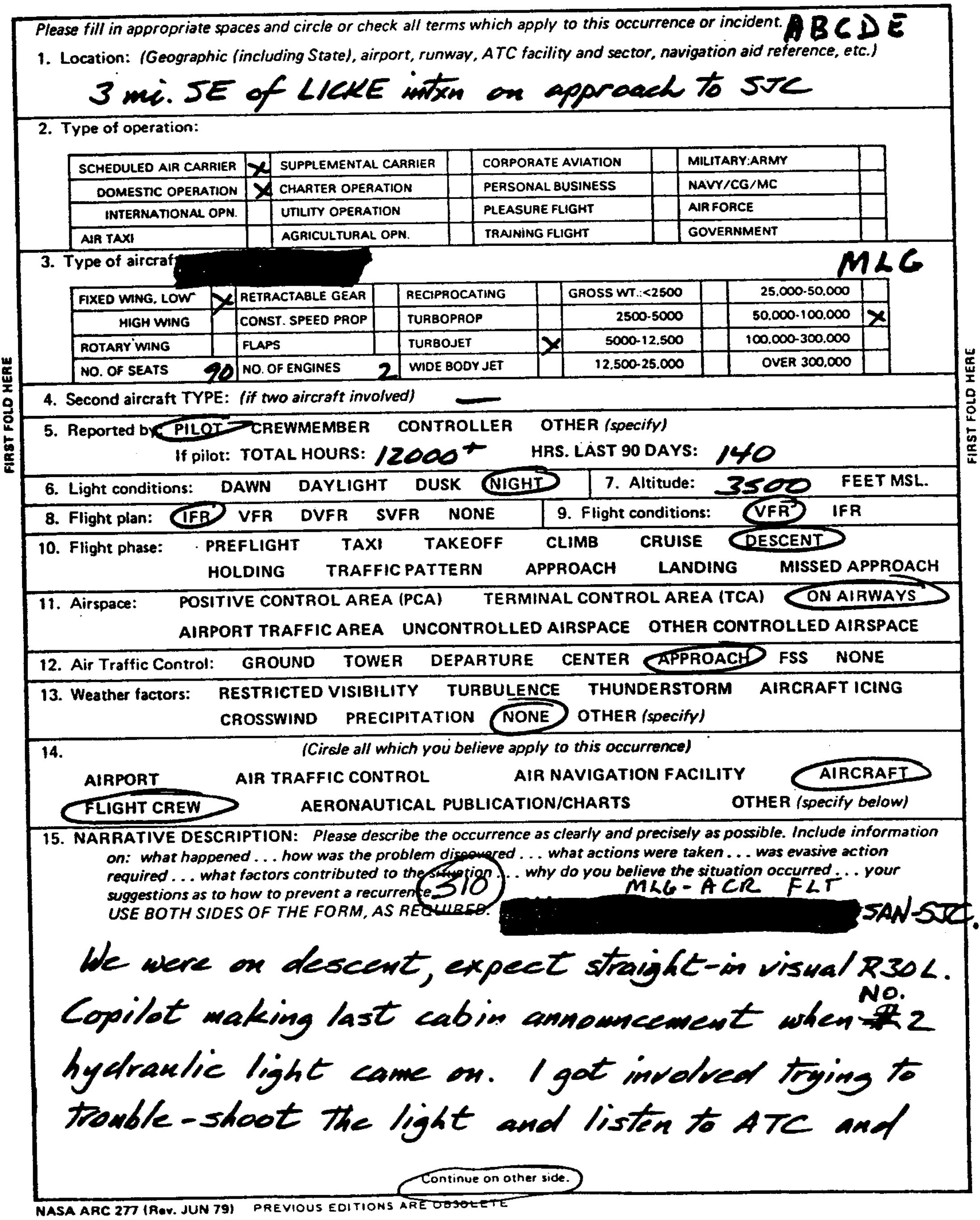
(a) Log sheet.

Figure C-2.– ASRS record encoding forms hypothetical example.



Please fill in appropriate spaces and circle or check all terms which apply to this occurrence or incident. ABCDE

1. Location: *(Geographic (including State), airport, runway, ATC facility and sector, navigation aid reference, etc.)*

3 mi. SE of LICKE intxn on approach to SJC

2. Type of operation:

SCHEDULED AIR CARRIER	☒	SUPPLEMENTAL CARRIER	☐	CORPORATE AVIATION	☐	MILITARY:ARMY	☐
DOMESTIC OPERATION	☒	CHARTER OPERATION	☐	PERSONAL BUSINESS	☐	NAVY/CG/MC	☐
INTERNATIONAL OPN.	☐	UTILITY OPERATION	☐	PLEASURE FLIGHT	☐	AIR FORCE	☐
AIR TAXI	☐	AGRICULTURAL OPN.	☐	TRAINING FLIGHT	☐	GOVERNMENT	☐

3. Type of aircraf[redacted] MLG

FIXED WING, LOW	☒	RETRACTABLE GEAR	☐	RECIPROCATING	☐	GROSS WT.:<2500	☐	25,000-50,000	☐
HIGH WING	☐	CONST. SPEED PROP	☐	TURBOPROP	☐	2500-5000	☐	50,000-100,000	☒
ROTARY WING	☐	FLAPS	☐	TURBOJET	☒	5000-12,500	☐	100,000-300,000	☐
NO. OF SEATS 90		NO. OF ENGINES 2		WIDE BODY JET	☐	12,500-25,000	☐	OVER 300,000	☐

FIRST FOLD HERE

4. Second aircraft TYPE: *(if two aircraft involved)* —

5. Reported by: [✓ PILOT] CREWMEMBER CONTROLLER OTHER *(specify)*

If pilot: TOTAL HOURS: 12000+ HRS. LAST 90 DAYS: 140

6. Light conditions: DAWN DAYLIGHT DUSK [✓ NIGHT]

7. Altitude: 3500 FEET MSL.

8. Flight plan: [✓ IFR] VFR DVFR SVFR NONE

9. Flight conditions: [✓ VFR] IFR

10. Flight phase: PREFLIGHT TAXI TAKEOFF CLIMB CRUISE [✓ DESCENT] HOLDING TRAFFIC PATTERN APPROACH LANDING MISSED APPROACH

11. Airspace: POSITIVE CONTROL AREA (PCA) TERMINAL CONTROL AREA (TCA) [✓ ON AIRWAYS] AIRPORT TRAFFIC AREA UNCONTROLLED AIRSPACE OTHER CONTROLLED AIRSPACE

12. Air Traffic Control: GROUND TOWER DEPARTURE CENTER [✓ APPROACH] FSS NONE

13. Weather factors: RESTRICTED VISIBILITY TURBULENCE THUNDERSTORM AIRCRAFT ICING CROSSWIND PRECIPITATION [✓ NONE] OTHER *(specify)*

14. *(Circle all which you believe apply to this occurrence)*

AIRPORT AIR TRAFFIC CONTROL AIR NAVIGATION FACILITY [✓ AIRCRAFT] [✓ FLIGHT CREW] AERONAUTICAL PUBLICATION/CHARTS OTHER *(specify below)*

15. NARRATIVE DESCRIPTION: *Please describe the occurrence as clearly and precisely as possible. Include information on: what happened . . . how was the problem discovered . . . what actions were taken . . . was evasive action required . . . what factors contributed to the situation . . . why do you believe the situation occurred . . . your suggestions as to how to prevent a recurrence.* 310 *USE BOTH SIDES OF THE FORM, AS REQUIRED.*

MLG - ACR FLT [redacted] SAN-SJC.

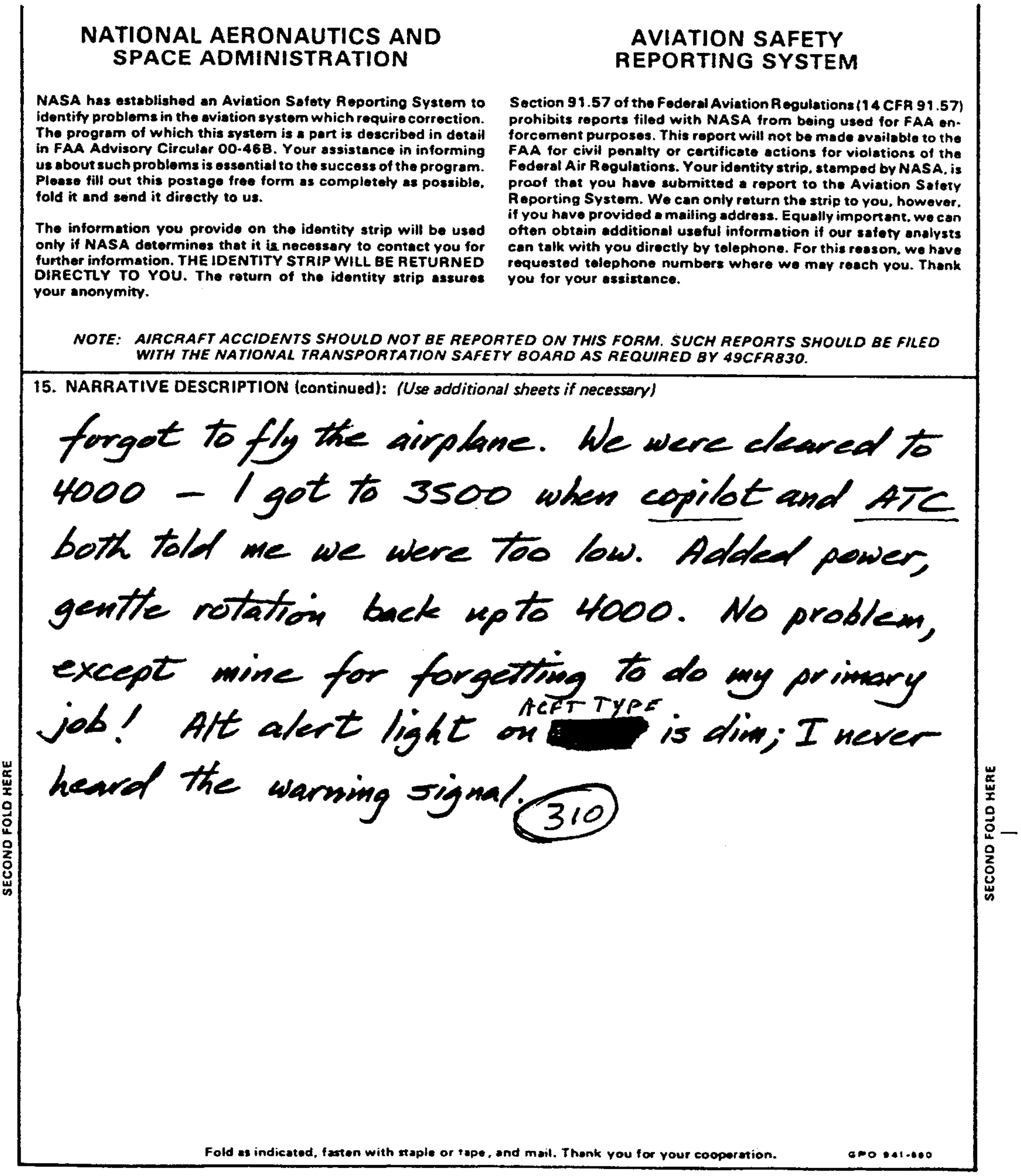
We were on descent, expect straight-in visual R30L. Copilot making last cabin announcement when NO. ~~#~~2 hydraulic light came on. I got involved trying to trouble-shoot the light and listen to ATC and

Continue on other side.

NASA ARC 277 (Rev. JUN 79) PREVIOUS EDITIONS ARE OBSOLETE

(b) ASRS report.

Figure C-2.– Continued.



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

AVIATION SAFETY REPORTING SYSTEM

NASA has established an Aviation Safety Reporting System to identify problems in the aviation system which require correction. The program of which this system is a part is described in detail in FAA Advisory Circular 00-46B. Your assistance in informing us about such problems is essential to the success of the program. Please fill out this postage free form as completely as possible, fold it and send it directly to us.

The information you provide on the identity strip will be used only if NASA determines that it is necessary to contact you for further information. THE IDENTITY STRIP WILL BE RETURNED DIRECTLY TO YOU. The return of the identity strip assures your anonymity.

Section 91.57 of the Federal Aviation Regulations (14 CFR 91.57) prohibits reports filed with NASA from being used for FAA enforcement purposes. This report will not be made available to the FAA for civil penalty or certificate actions for violations of the Federal Air Regulations. Your identity strip, stamped by NASA, is proof that you have submitted a report to the Aviation Safety Reporting System. We can only return the strip to you, however, if you have provided a mailing address. Equally important, we can often obtain additional useful information if our safety analysts can talk with you directly by telephone. For this reason, we have requested telephone numbers where we may reach you. Thank you for your assistance.

NOTE: AIRCRAFT ACCIDENTS SHOULD NOT BE REPORTED ON THIS FORM. SUCH REPORTS SHOULD BE FILED WITH THE NATIONAL TRANSPORTATION SAFETY BOARD AS REQUIRED BY 49CFR830.

15. NARRATIVE DESCRIPTION (continued): *(Use additional sheets if necessary)*

forgot to fly the airplane. We were cleared to 4000 – I got to 3500 when copilot and ATC both told me we were Too low. Added power, gentle rotation back up to 4000. No problem, except mine for forgetting to do my primary job! Alt alert light on ACFT TYPE [redacted] is dim; I never heard the warning signal. (310)

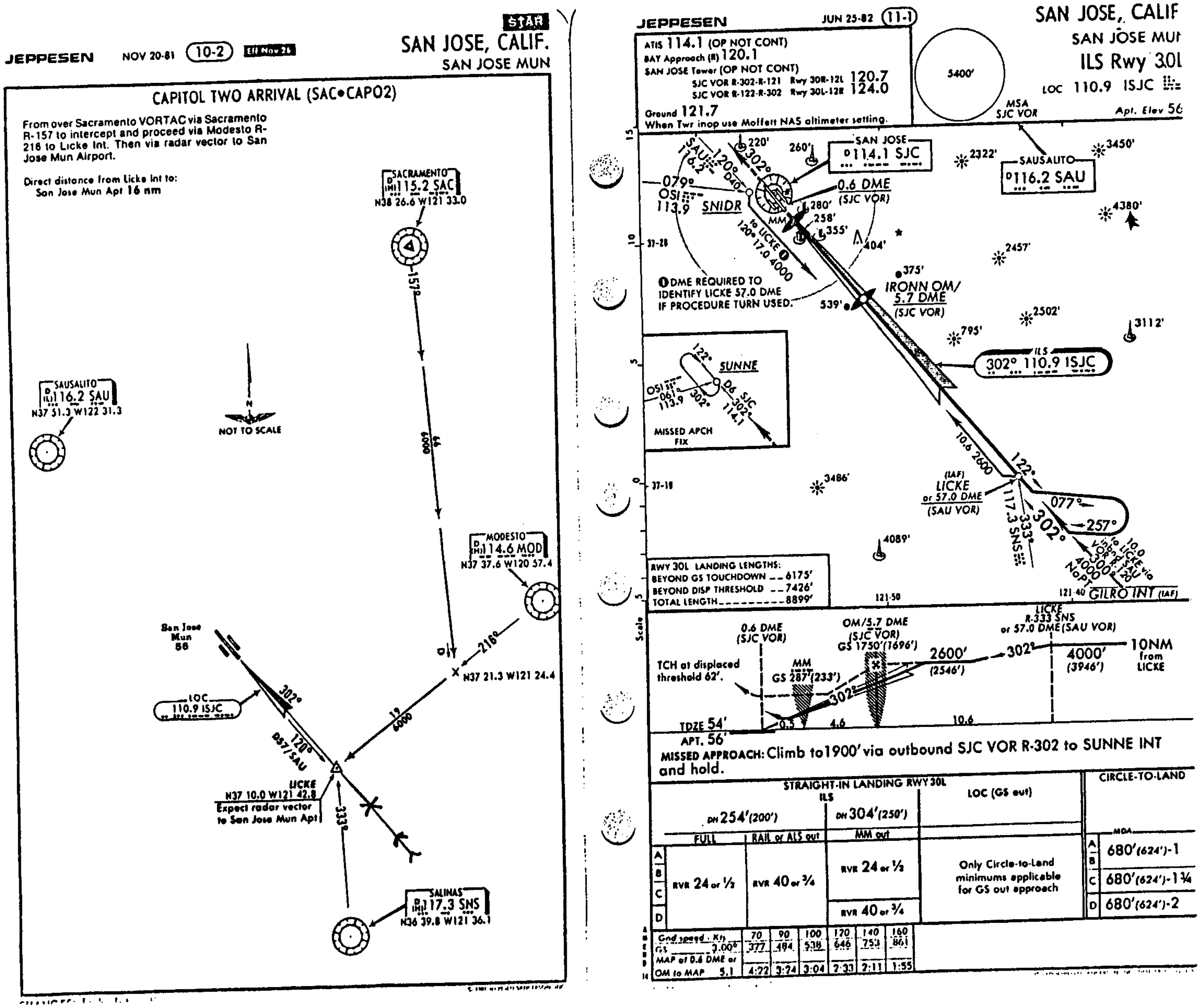
SECOND FOLD HERE

SECOND FOLD HERE

Fold as indicated, fasten with staple or tape, and mail. Thank you for your cooperation. GPO 941-860

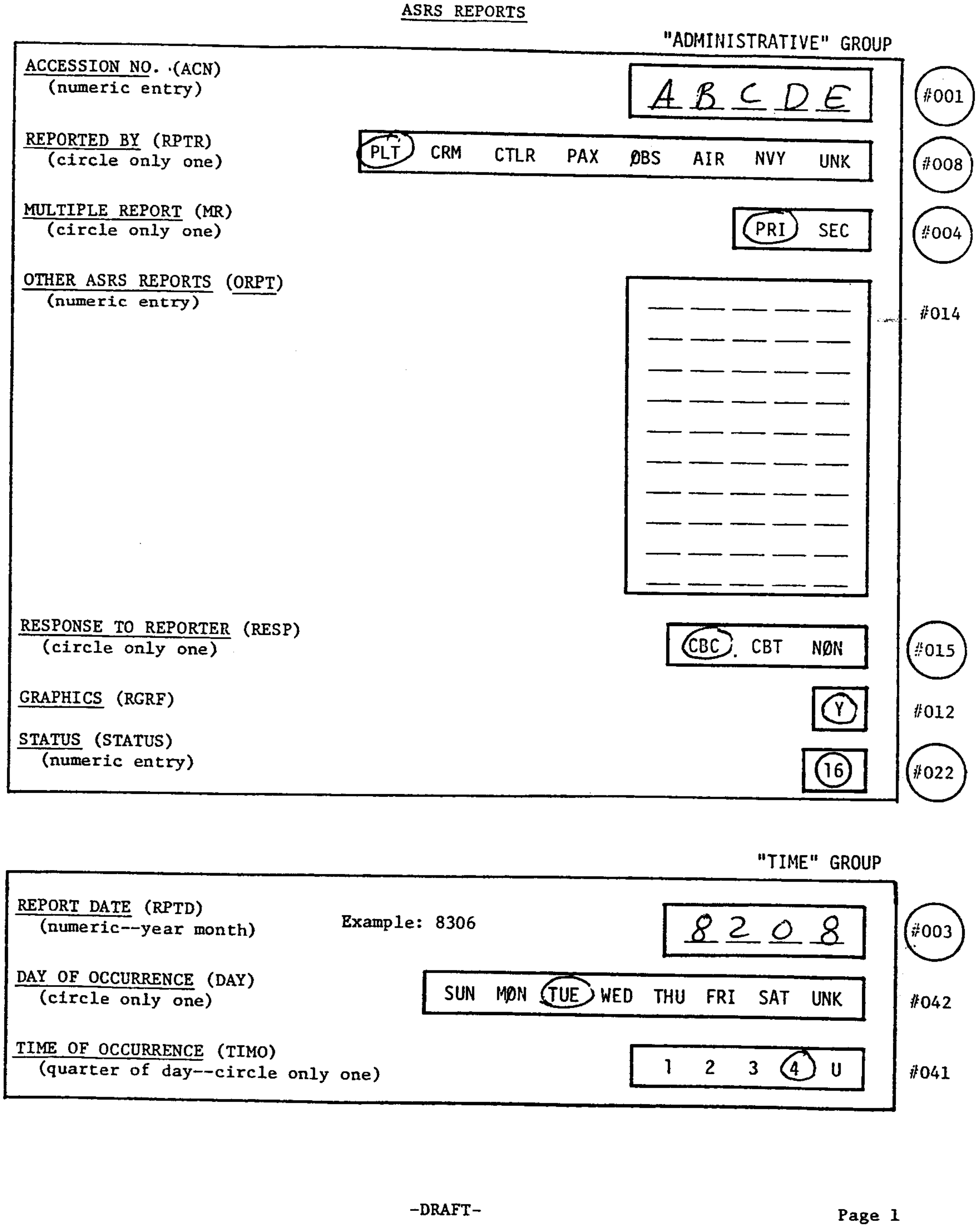
(b) Concluded.

Figure C-2.– Continued.



(c) Analyst graphic.

Figure C-2.– Continued.



ASRS REPORTS

"ADMINISTRATIVE" GROUP

ACCESSION NO. (ACN) (numeric entry) A B C D E #001

REPORTED BY (RPTR) (circle only one) [✓ PLT] CRM CTLR PAX OBS AIR NVY UNK #008

MULTIPLE REPORT (MR) (circle only one) [✓ PRI] SEC #004

OTHER ASRS REPORTS (ORPT) (numeric entry) #014

RESPONSE TO REPORTER (RESP) (circle only one) [✓ CBC] CBT NON #015

GRAPHICS (RGRF) [✓ Y] #012

STATUS (STATUS) (numeric entry) 16 #022

"TIME" GROUP

REPORT DATE (RPTD) (numeric--year month) Example: 8306 8 2 0 8 #003

DAY OF OCCURRENCE (DAY) (circle only one) SUN MON [✓ TUE] WED THU FRI SAT UNK #042

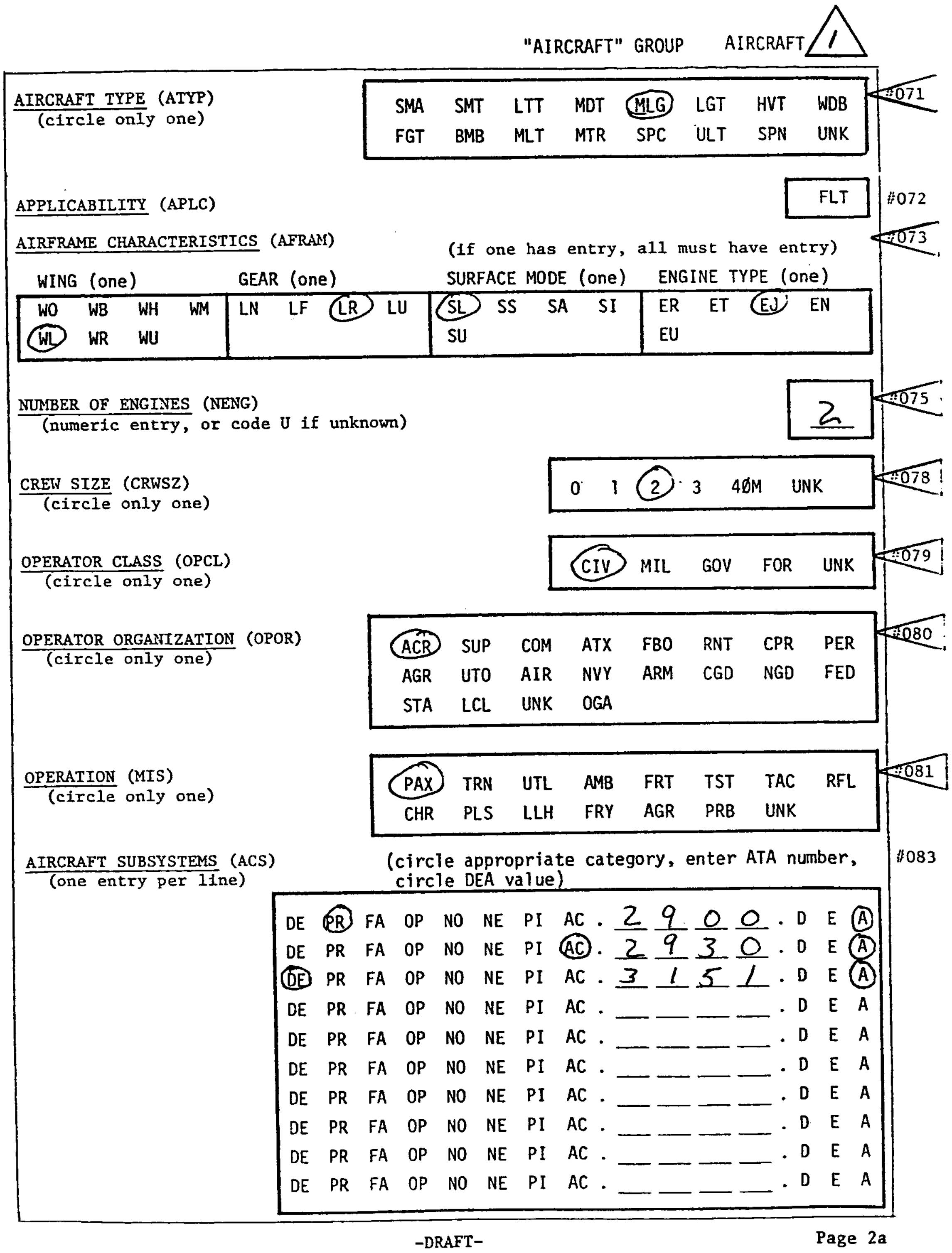
TIME OF OCCURRENCE (TIMO) (quarter of day--circle only one) 1 2 3 [✓ 4] U #041

-DRAFT-

Page 1

(d) Fixed-field sheets.

Figure C-2.– Continued.



"AIRCRAFT" GROUP AIRCRAFT 1

AIRCRAFT TYPE (ATYP) (circle only one) #071

SMA SMT LTT MDT [✓ MLG] LGT HVT WDB
FGT BMB MLT MTR SPC ULT SPN UNK

APPLICABILITY (APLC) FLT #072

AIRFRAME CHARACTERISTICS (AFRAM) (if one has entry, all must have entry) #073

WING (one)	GEAR (one)	SURFACE MODE (one)	ENGINE TYPE (one)
WO WB WH WM [✓ WL] WR WU	LN LF [✓ LR] LU	[✓ SL] SS SA SI SU	ER ET [✓ EJ] EN EU

NUMBER OF ENGINES (NENG) (numeric entry, or code U if unknown) 2 #075

CREW SIZE (CRWSZ) (circle only one) 0 1 [✓ 2] 3 40M UNK #078

OPERATOR CLASS (OPCL) (circle only one) [✓ CIV] MIL GOV FOR UNK #079

OPERATOR ORGANIZATION (OPOR) (circle only one) #080

[✓ ACR] SUP COM ATX FBO RNT CPR PER
AGR UTO AIR NVY ARM CGD NGD FED
STA LCL UNK OGA

OPERATION (MIS) (circle only one) #081

[✓ PAX] TRN UTL AMB FRT TST TAC RFL
CHR PLS LLH FRY AGR PRB UNK

AIRCRAFT SUBSYSTEMS (ACS) (one entry per line) (circle appropriate category, enter ATA number, circle DEA value) #083

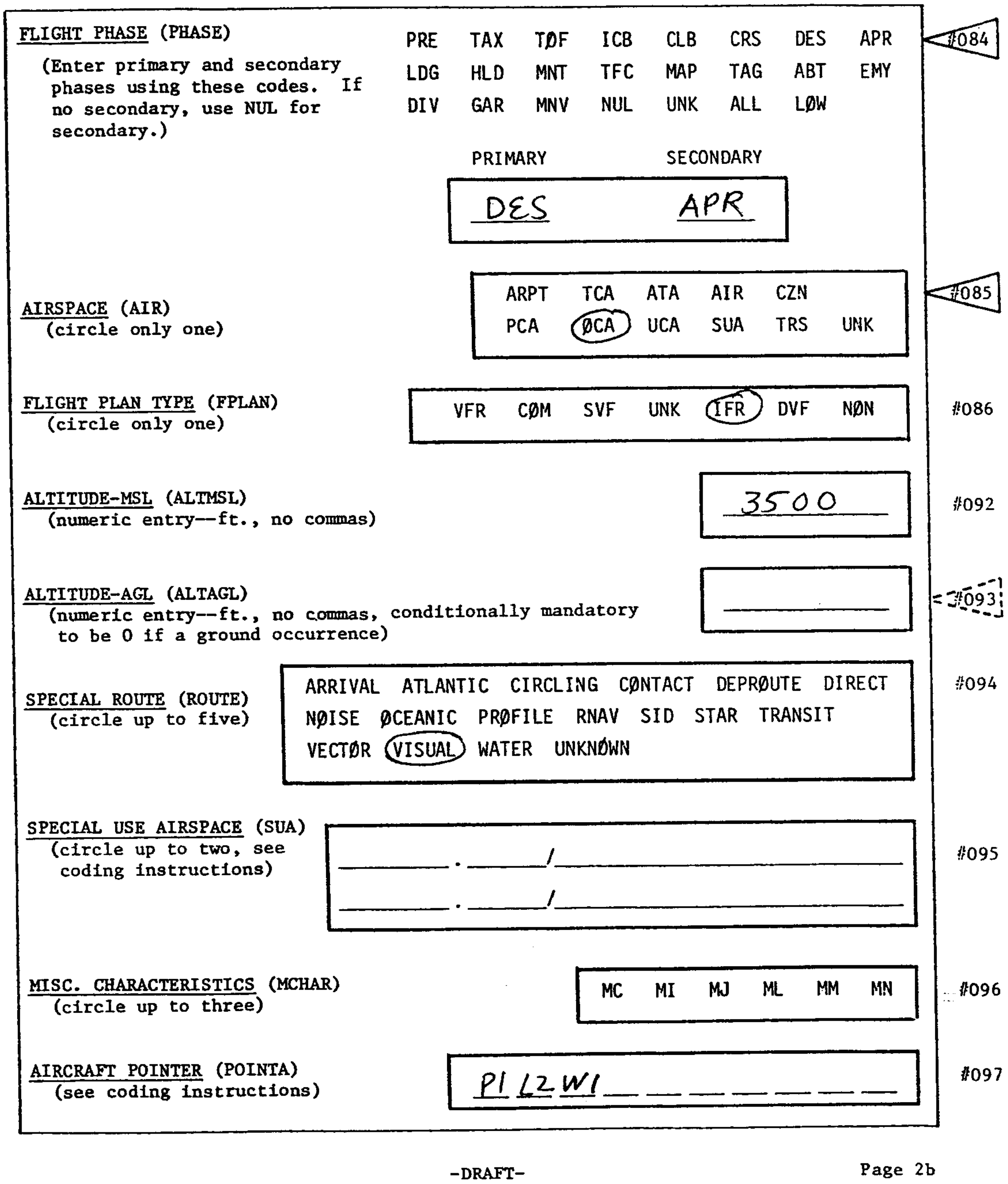
DE	[✓ PR]	FA	OP	NO	NE	PI	AC	.	2 9 0 0	.	D	E	[✓ A]
DE	PR	FA	OP	NO	NE	PI	[✓ AC]	.	2 9 3 0	.	D	E	[✓ A]
[✓ DE]	PR	FA	OP	NO	NE	PI	AC	.	3 1 5 1	.	D	E	[✓ A]
DE	PR	FA	OP	NO	NE	PI	AC	.	___ ___ ___ ___	.	D	E	A
DE	PR	FA	OP	NO	NE	PI	AC	.	___ ___ ___ ___	.	D	E	A
DE	PR	FA	OP	NO	NE	PI	AC	.	___ ___ ___ ___	.	D	E	A
DE	PR	FA	OP	NO	NE	PI	AC	.	___ ___ ___ ___	.	D	E	A
DE	PR	FA	OP	NO	NE	PI	AC	.	___ ___ ___ ___	.	D	E	A
DE	PR	FA	OP	NO	NE	PI	AC	.	___ ___ ___ ___	.	D	E	A
DE	PR	FA	OP	NO	NE	PI	AC	.	___ ___ ___ ___	.	D	E	A

-DRAFT-

Page 2a

(d) Continued.

Figure C-2.– Continued.



FLIGHT PHASE (PHASE)

(Enter primary and secondary phases using these codes. If no secondary, use NUL for secondary.)

PRE	TAX	T0F	ICB	CLB	CRS	DES	APR
LDG	HLD	MNT	TFC	MAP	TAG	ABT	EMY
DIV	GAR	MNV	NUL	UNK	ALL	L0W	

#084

PRIMARY DES

SECONDARY APR

AIRSPACE (AIR)
(circle only one)

ARPT TCA ATA AIR CZN
PCA [✓ 0CA] UCA SUA TRS UNK

#085

FLIGHT PLAN TYPE (FPLAN)
(circle only one)

VFR C0M SVF UNK [✓ IFR] DVF N0N

#086

ALTITUDE-MSL (ALTMSL)
(numeric entry--ft., no commas)

3500

#092

ALTITUDE-AGL (ALTAGL)
(numeric entry--ft., no commas, conditionally mandatory to be 0 if a ground occurrence)

____

#093

SPECIAL ROUTE (ROUTE)
(circle up to five)

ARRIVAL ATLANTIC CIRCLING C0NTACT DEPR0UTE DIRECT
N0ISE 0CEANIC PR0FILE RNAV SID STAR TRANSIT
VECT0R [✓ VISUAL] WATER UNKN0WN

#094

SPECIAL USE AIRSPACE (SUA)
(circle up to two, see coding instructions)

________ . ______/____________________
________ . ______/____________________

#095

MISC. CHARACTERISTICS (MCHAR)
(circle up to three)

MC MI MJ ML MM MN

#096

AIRCRAFT POINTER (POINTA)
(see coding instructions)

P1L2W1

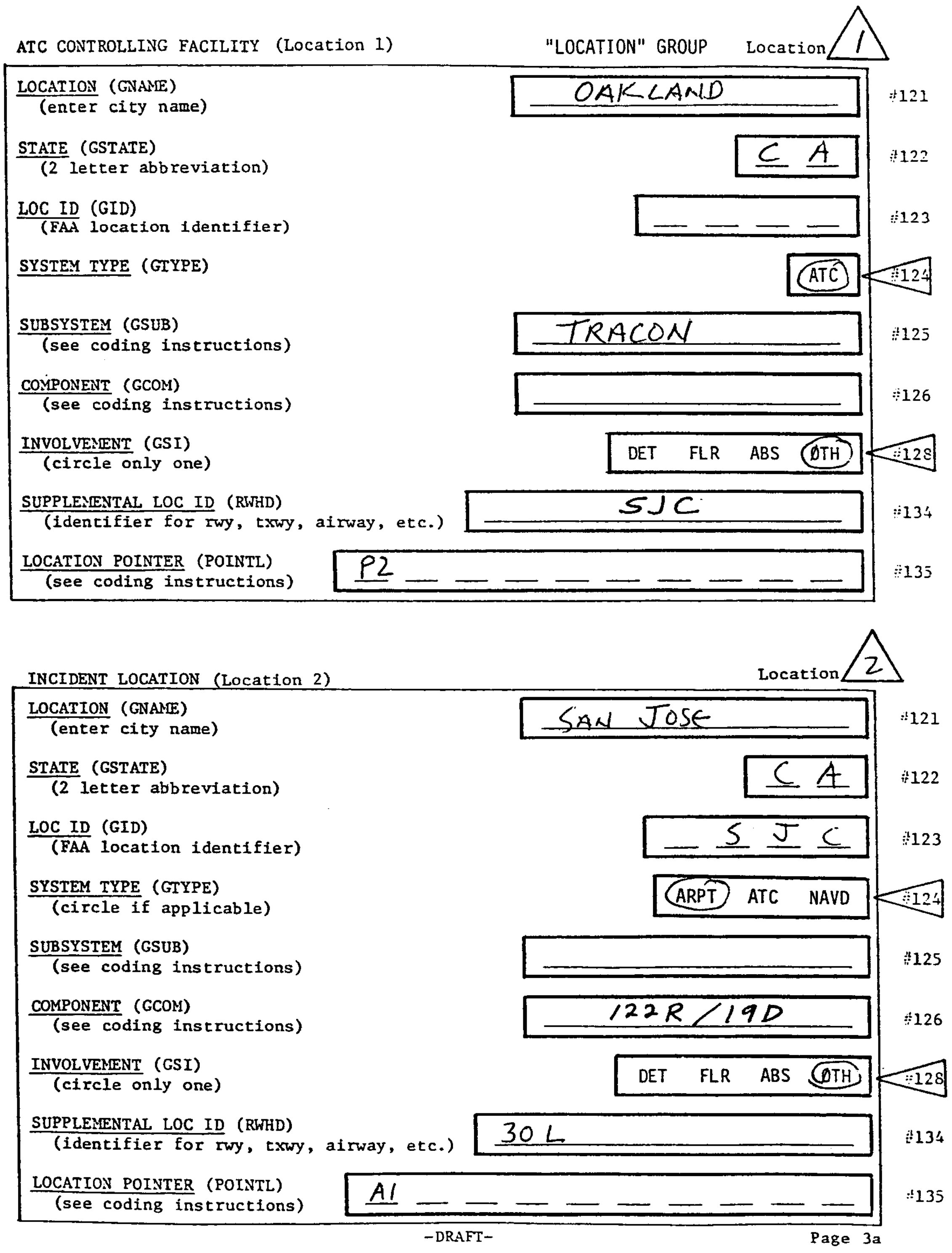
#097

-DRAFT-

Page 2b

(d) Continued.

Figure C-2.– Continued.



ATC CONTROLLING FACILITY (Location 1) "LOCATION" GROUP Location 1

LOCATION (GNAME) (enter city name): OAKLAND #121

STATE (GSTATE) (2 letter abbreviation): C A #122

LOC ID (GID) (FAA location identifier): _ _ _ _ #123

SYSTEM TYPE (GTYPE): [✓ ATC] #124

SUBSYSTEM (GSUB) (see coding instructions): TRACON #125

COMPONENT (GCOM) (see coding instructions): #126

INVOLVEMENT (GSI) (circle only one): DET FLR ABS [✓ 0TH] #128

SUPPLEMENTAL LOC ID (RWHD) (identifier for rwy, txwy, airway, etc.): SJC #134

LOCATION POINTER (POINTL) (see coding instructions): P2 _ _ _ _ _ _ _ _ _ #135

INCIDENT LOCATION (Location 2) Location 2

LOCATION (GNAME) (enter city name): SAN JOSE #121

STATE (GSTATE) (2 letter abbreviation): C A #122

LOC ID (GID) (FAA location identifier): _ S J C #123

SYSTEM TYPE (GTYPE) (circle if applicable): [✓ ARPT] ATC NAVD #124

SUBSYSTEM (GSUB) (see coding instructions): #125

COMPONENT (GCOM) (see coding instructions): 122R/19D #126

INVOLVEMENT (GSI) (circle only one): DET FLR ABS [✓ 0TH] #128

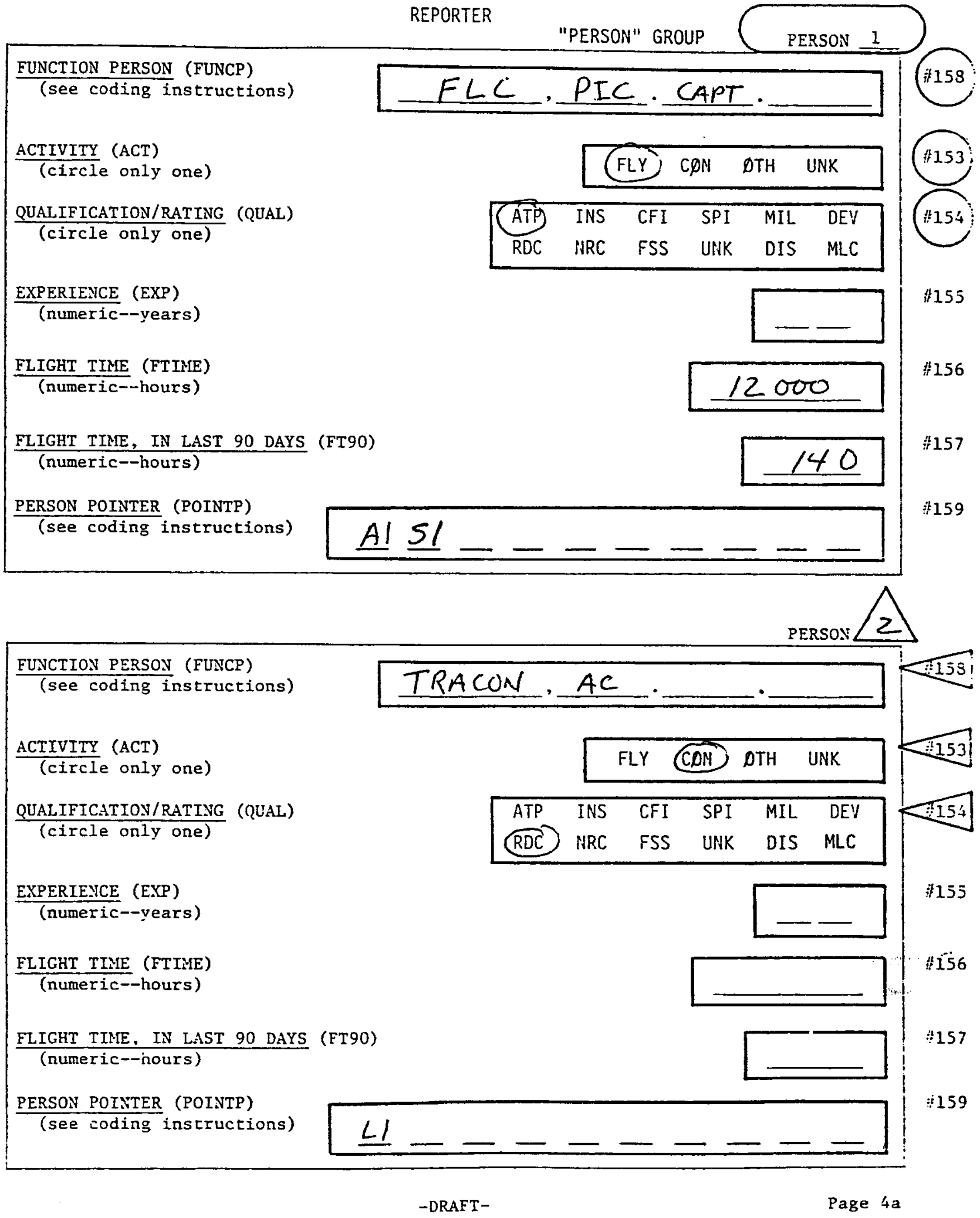
SUPPLEMENTAL LOC ID (RWHD) (identifier for rwy, txwy, airway, etc.): 30 L #134

LOCATION POINTER (POINTL) (see coding instructions): A1 _ _ _ _ _ _ _ _ _ #135

-DRAFT- Page 3a

(d) Continued.

Figure C-2.— Continued.



REPORTER
"PERSON" GROUP
PERSON 1

FUNCTION PERSON (FUNCP) (see coding instructions): FLC , PIC . CAPT . ______ #158

ACTIVITY (ACT) (circle only one): [✓ FLY] CØN ØTH UNK #153

QUALIFICATION/RATING (QUAL) (circle only one): [✓ ATP] INS CFI SPI MIL DEV RDC NRC FSS UNK DIS MLC #154

EXPERIENCE (EXP) (numeric--years): __ __ #155

FLIGHT TIME (FTIME) (numeric--hours): 12 000 #156

FLIGHT TIME, IN LAST 90 DAYS (FT90) (numeric--hours): 140 #157

PERSON POINTER (POINTP) (see coding instructions): A1 S1 __ __ __ __ __ __ __ __ #159

PERSON 2

FUNCTION PERSON (FUNCP) (see coding instructions): TRACON , AC . ______ . ______ #158

ACTIVITY (ACT) (circle only one): FLY [✓ CØN] ØTH UNK #153

QUALIFICATION/RATING (QUAL) (circle only one): ATP INS CFI SPI MIL DEV [✓ RDC] NRC FSS UNK DIS MLC #154

EXPERIENCE (EXP) (numeric--years): __ __ #155

FLIGHT TIME (FTIME) (numeric--hours): ______ #156

FLIGHT TIME, IN LAST 90 DAYS (FT90) (numeric--hours): ______ #157

PERSON POINTER (POINTP) (see coding instructions): L1 __ __ __ __ __ __ __ __ __ #159

-DRAFT- Page 4a

(d) Continued.

Figure C-2.– Continued.

"WEATHER" GROUP (Enter all available information)

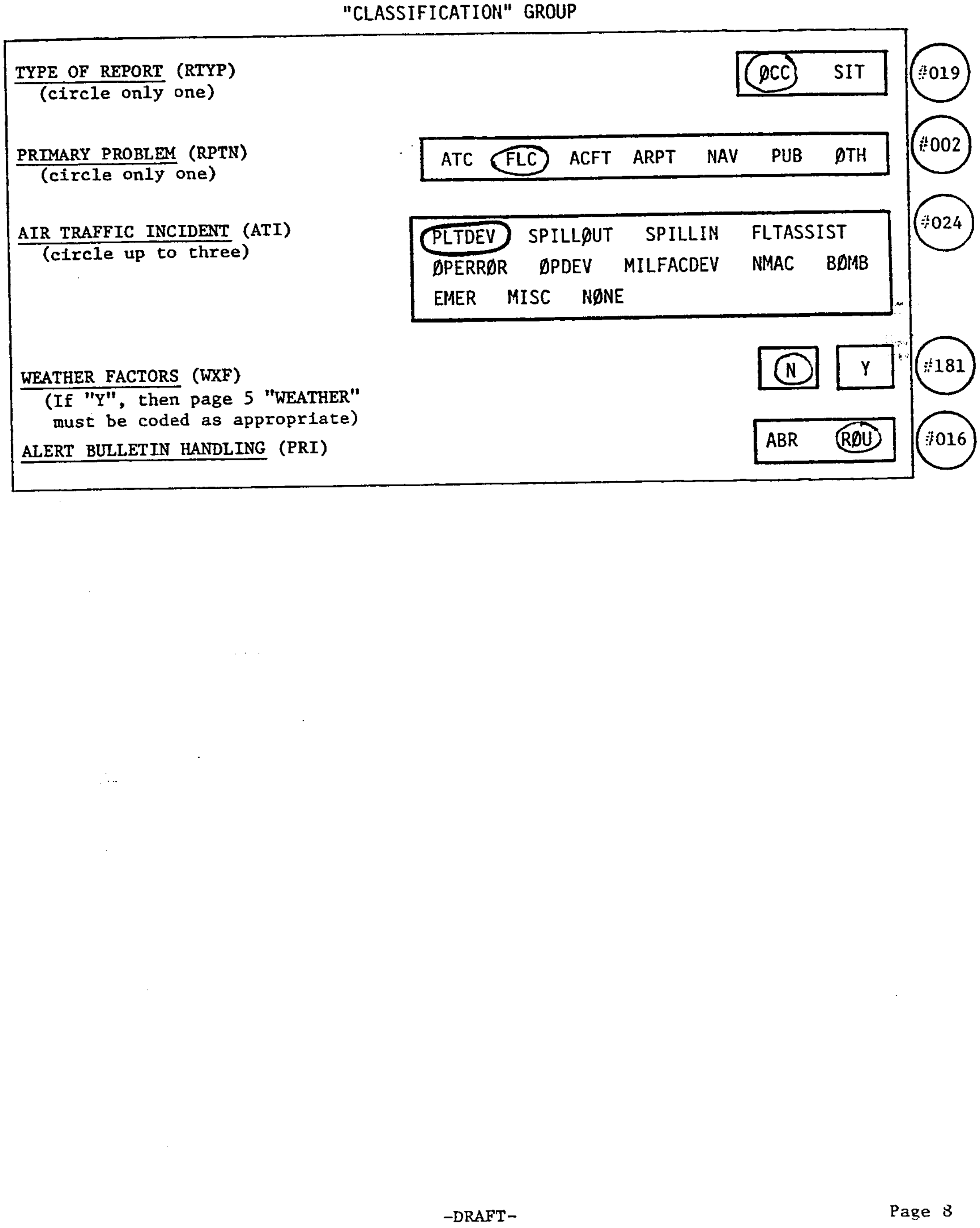
FLIGHT CONDITIONS (FCON) (circle only one)	[✓ VMC] MXD SVF IMC MVF UNK	#182
VISIBILITY (VIS) (numeric--statute miles + tenths or hundredths)	______	#183
OBSCURATION FACTOR (OBSC) (circle up to five)	RAIN F0GG BLDS DUST FRRN DRZZ HAZE BLSD SN0W SM0K BLSN UNKN SM0G FRST SUNP CLDS	#184
TEMPERATURE (TEMP) (numeric--°F.)	______	#185
WIND DIRECTION (WID) (numeric--deg.)	______	#187
WIND SPEED (WIS) (numeric--knots)	______	#188
WIND GUST DIRECTION (WIDG) (numeric--deg.)	______	#208
WIND GUST SPEED (WISG) (numeric--knots)	______	#209
WIND FACTOR (WIND) (circle up to five)	CLM GST SHR TLW LGT SHF XWD STR HDW DUD	#189
IN-FLIGHT ENCOUNTER (IFE) (circle up to five)	THUN TURB CATB LTNG ICNG HAIL FRNT T0RN WTRB DTWX AL0F CBLD LYRS UCST	#190
RUNWAY VISUAL RANGE (RVR) (numeric--feet)	______	#191
VARIABLE RVR (RVRVAR) (numeric--feet)	______	#210
CEILING (CEIL) (numeric--feet)	______	#193
SKY COVER (COVER) (circle up to five)	SCTRD RAGGD BR0KN 0BSCR 0VCST MTLRS	#194
MISC. WEATHER FACTOR (WXR) (specify--max of 80 characters)	______ ______ ______	#195
LIGHTING (LIGHT) (circle only one)	DAWN DYLT DUSK [✓ NITE] MANY UNK	#205
WEATHER POINTER (POINTW) (see coding instructions)	41 __ __ __ __ __ __ __ __ __	#207

-DRAFT-

Page 5

(d) Continued.

Figure C-2.— Continued.



"CLASSIFICATION" GROUP

TYPE OF REPORT (RTYP)
(circle only one)
[✓ ØCC] SIT
#019

PRIMARY PROBLEM (RPTN)
(circle only one)
ATC [✓ FLC] ACFT ARPT NAV PUB ØTH
#002

AIR TRAFFIC INCIDENT (ATI)
(circle up to three)
[✓ PLTDEV] SPILLØUT SPILLIN FLTASSIST ØPERRØR ØPDEV MILFACDEV NMAC BØMB EMER MISC NØNE
#024

WEATHER FACTORS (WXF)
(If "Y", then page 5 "WEATHER" must be coded as appropriate)
[✓ N] Y
#181

ALERT BULLETIN HANDLING (PRI)
ABR [✓ RØU]
#016

-DRAFT-

Page 8

(d) Continued.

Figure C-2.– Continued.

"SOFTWARE" GROUP SOFTWARE 1

MESSAGE ORIGIN (MORG)
(circle only one)
CTLR FLC [✓ 0TH]
#231

MESSAGE TYPE (MTYPE)
(circle only one)
CLRNC C00RD RQST [✓ WRNG] CTL
INTN DATA AVSY C0NF INST
#232

MESSAGE PROBLEM (MPROB)
(circle only one)
CAPT DID NOT SEE ALT ALERT LIGHT
OR HEAR WARNING
PHN TPN 0AC CPL FLS AMB
TIM GBL ABS FLR [✓ NMN]
#233

MESSAGE MEDIUM (MEDIA)
(circle only one)
PUB RD0 INP VID TAP
CHT TLE V0X [✓ VIS] CP0
#236

SOFTWARE POINTER (POINTS)
(see coding instructions)
A1 __ __ __ __ __ __ __ __ __ __
#237

SOFTWARE

MESSAGE ORIGIN (MORG)
(circle only one)
CTLR FLC 0TH
#231

MESSAGE TYPE (MTYPE)
(circle only one)
CLRNC C00RD RQST WRNG CTL
INTN DATA AVSY C0NF INST
#232

MESSAGE PROBLEM (MPROB)
(circle only one)
PHN TPN 0AC CPL FLS AMB
TIM GBL ABS FLR NMN
#233

MESSAGE MEDIUM (MEDIA)
(circle only one)
PUB RD0 INP VID TAP
CHT TLE V0X VIS CP0
#236

SOFTWARE POINTER (POINTS)
(see coding instructions)
__ __ __ __ __ __ __ __ __ __
#237

SOFTWARE

MESSAGE ORIGIN (MORG)
(circle only one)
CTLR FLC 0TH
#231

MESSAGE TYPE (MTYPE)
(circle only one)
CLRNC C00RD RQST WRNG CTL
INTN DATA AVSY C0NF INST
#232

MESSAGE PROBLEM (MPROB)
(circle only one)
PHN TPN 0AC CPL FLS AMB
TIM GBL ABS FLR NMN
#233

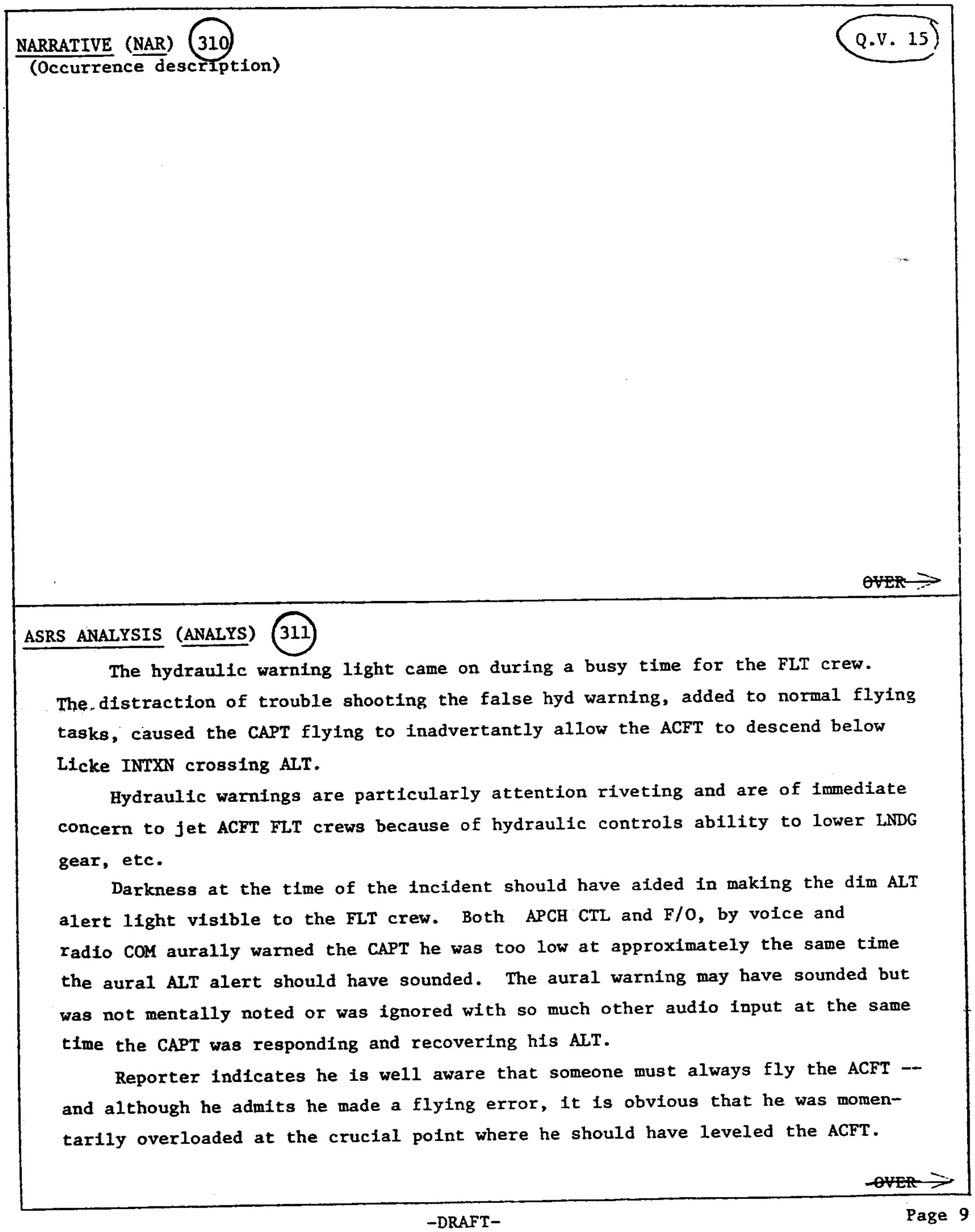
MESSAGE MEDIUM (MEDIA)
(circle only one)
PUB RD0 INP VID TAP
CHT TLE V0X VIS CP0
#236

SOFTWARE POINTER (POINTS)
(see coding instructions)
__ __ __ __ __ __ __ __ __ __
#237

-DRAFT-

(d) Concluded.

Figure C-2.– Continued.



NARRATIVE (NAR) (310) (Q.V. 15)
(Occurrence description)

~~OVER~~ →

ASRS ANALYSIS (ANALYS) (311)

The hydraulic warning light came on during a busy time for the FLT crew. The distraction of trouble shooting the false hyd warning, added to normal flying tasks, caused the CAPT flying to inadvertantly allow the ACFT to descend below Licke INTXN crossing ALT.

Hydraulic warnings are particularly attention riveting and are of immediate concern to jet ACFT FLT crews because of hydraulic controls ability to lower LNDG gear, etc.

Darkness at the time of the incident should have aided in making the dim ALT alert light visible to the FLT crew. Both APCH CTL and F/O, by voice and radio COM aurally warned the CAPT he was too low at approximately the same time the aural ALT alert should have sounded. The aural warning may have sounded but was not mentally noted or was ignored with so much other audio input at the same time the CAPT was responding and recovering his ALT.

Reporter indicates he is well aware that someone must always fly the ACFT -- and although he admits he made a flying error, it is obvious that he was momentarily overloaded at the crucial point where he should have leveled the ACFT.

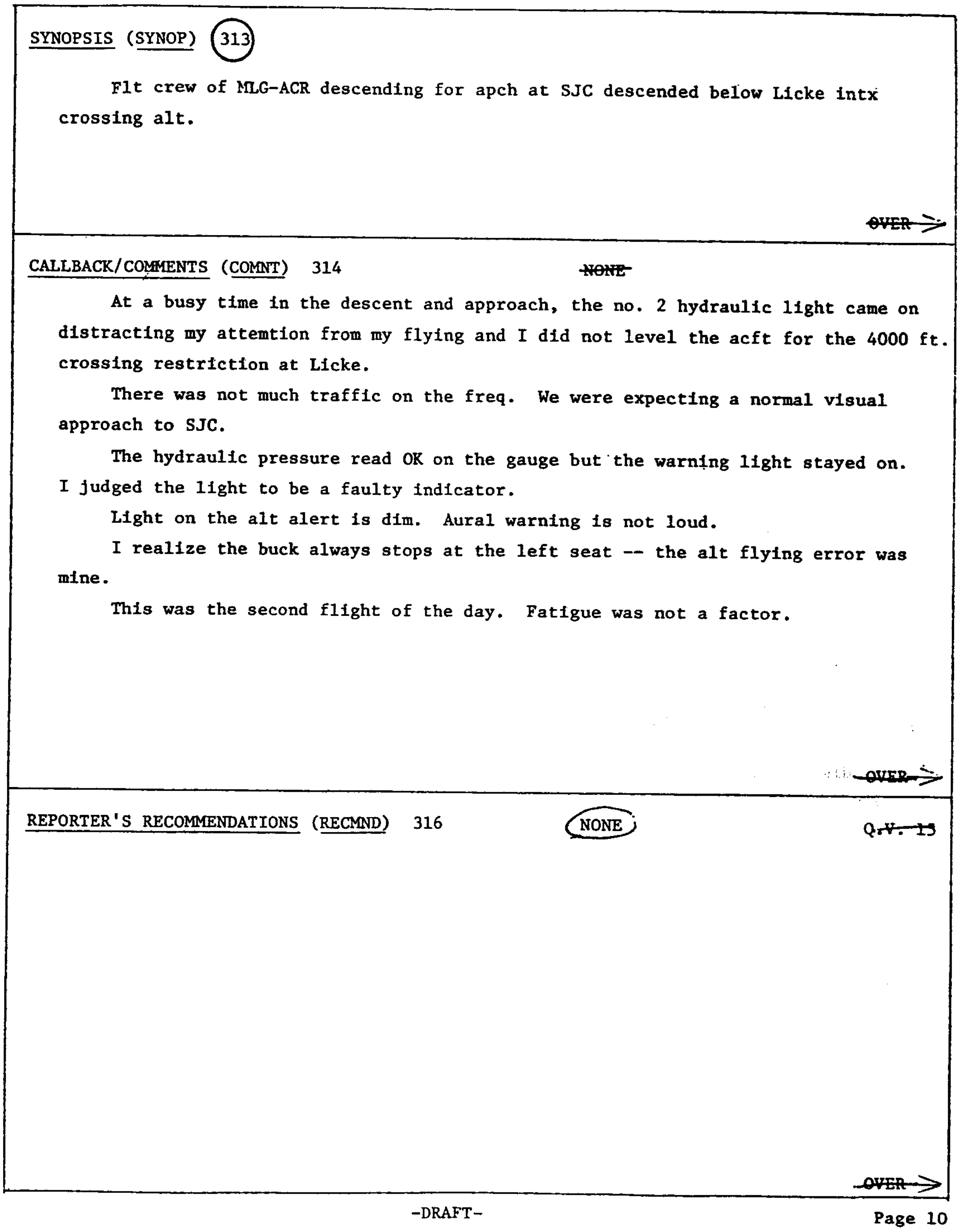
~~OVER~~ →

-DRAFT-

Page 9

(e) Free-test sheets.

Figure C-2.– Continued.



SYNOPSIS (SYNOP) (313)

Flt crew of MLG-ACR descending for apch at SJC descended below Licke intx crossing alt.

~~OVER~~ →

CALLBACK/COMMENTS (COMNT) 314 ~~NONE~~

At a busy time in the descent and approach, the no. 2 hydraulic light came on distracting my attemtion from my flying and I did not level the acft for the 4000 ft. crossing restriction at Licke.

There was not much traffic on the freq. We were expecting a normal visual approach to SJC.

The hydraulic pressure read OK on the gauge but the warning light stayed on. I judged the light to be a faulty indicator.

Light on the alt alert is dim. Aural warning is not loud.

I realize the buck always stops at the left seat -- the alt flying error was mine.

This was the second flight of the day. Fatigue was not a factor.

~~OVER~~ →

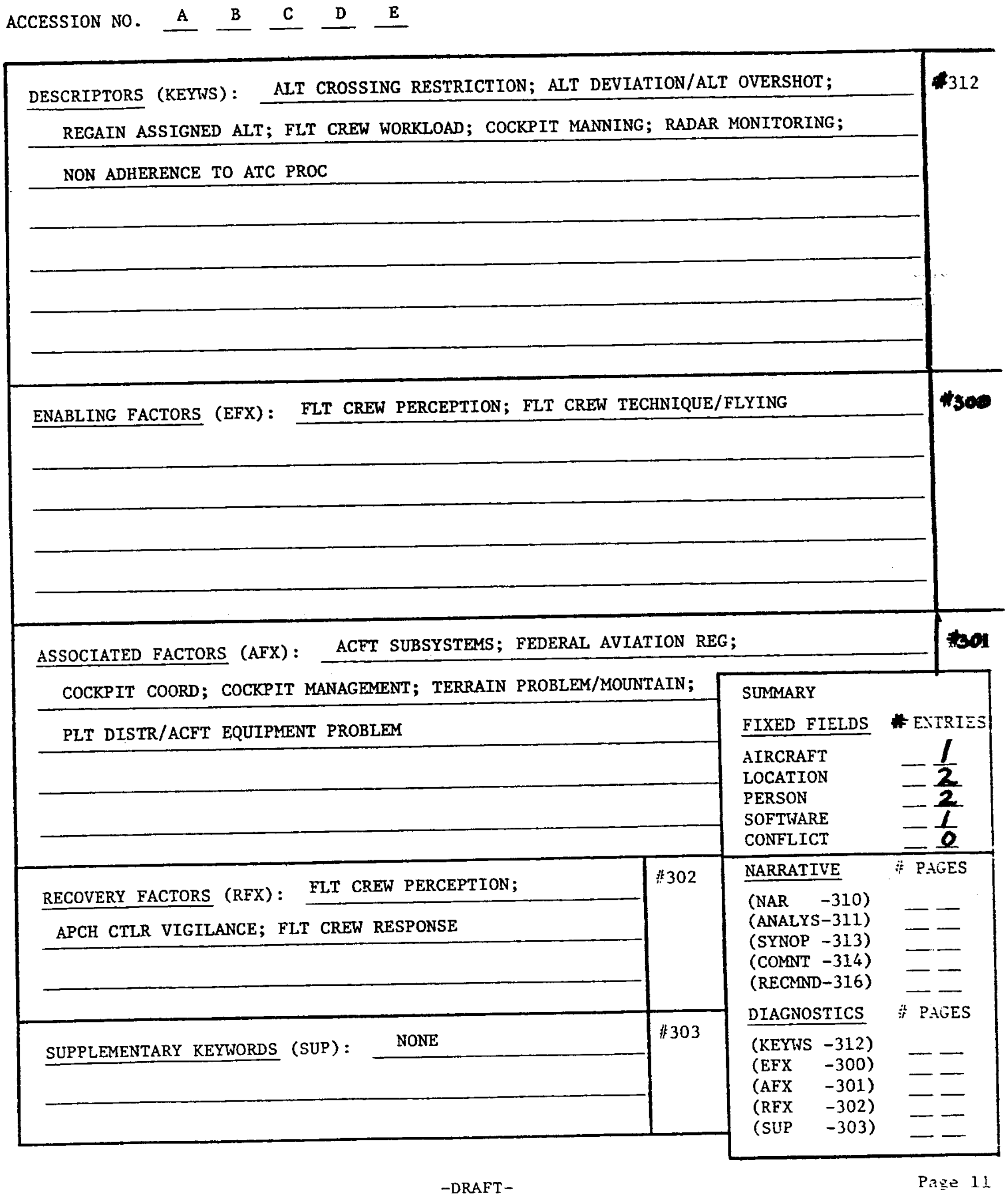
REPORTER'S RECOMMENDATIONS (RECMND) 316 [✓ NONE] Q~~.V. 15~~

~~OVER~~ →

-DRAFT- Page 10

(e) Concluded.

Figure C-2.– Continued.



ACCESSION NO. A B C D E

DESCRIPTORS (KEYWS): ALT CROSSING RESTRICTION; ALT DEVIATION/ALT OVERSHOT; REGAIN ASSIGNED ALT; FLT CREW WORKLOAD; COCKPIT MANNING; RADAR MONITORING; NON ADHERENCE TO ATC PROC

#312

ENABLING FACTORS (EFX): FLT CREW PERCEPTION; FLT CREW TECHNIQUE/FLYING

#300

ASSOCIATED FACTORS (AFX): ACFT SUBSYSTEMS; FEDERAL AVIATION REG; COCKPIT COORD; COCKPIT MANAGEMENT; TERRAIN PROBLEM/MOUNTAIN; PLT DISTR/ACFT EQUIPMENT PROBLEM

#301

RECOVERY FACTORS (RFX): FLT CREW PERCEPTION; APCH CTLR VIGILANCE; FLT CREW RESPONSE

#302

SUPPLEMENTARY KEYWORDS (SUP): NONE

#303

SUMMARY

FIXED FIELDS	# ENTRIES
AIRCRAFT	1
LOCATION	2
PERSON	2
SOFTWARE	1
CONFLICT	0

NARRATIVE	# PAGES
(NAR -310)	__ __
(ANALYS-311)	__ __
(SYNOP -313)	__ __
(COMNT -314)	__ __
(RECMND-316)	__ __

DIAGNOSTICS	# PAGES
(KEYWS -312)	__ __
(EFX -300)	__ __
(AFX -301)	__ __
(RFX -302)	__ __
(SUP -303)	__ __

-DRAFT-

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(f) Diagnostics sheet.

Figure C-2.– Concluded.

TABLE C-1.– ASRS DATABASE FIELD SUMMARY

Field No.	Field Prefix	Field Label	Description	Searchable
001	ACN		ACCESSION NUMBER. The unique identifying number assigned to a report (Numeric entry).	X
002	RPTN		PRIMARY PROBLEM code. The single most appropriate designator is assigned from the following list:	X
		ATC	Human performance problems within the Air Traffic Control System	
		FLC	Performance problems of pilots or other flight crew members	
		ACF	Failures of aircraft or subsystems, including communications and navigation equipment	
		APT	Problems involving airports or related facilities	
		NAV	Malfunctions or failures of non-airborne navigation aids or equipment, including ground communications equipment	
		PUB	Problems related to procedures and their presentation, including charts, manuals, regulations, etc.	
		OTH	Problems that cannot reasonably be assigned to any of the above categories. Includes weather when this is the primary problem	
003	RPTD		DATE OF REPORT: year and month of occurrence or situation.	X
004	MR		MULTPLE REPORT TYPE:	
		PRI	Primary	
		SEC	Secondary	
		UNK	Unknown	
008	RPTR		REPORTED BY:	
		PLT	Pilot	
		CRM	Crewmember	
		CTR	Controller	
		PAX	Passenger	
		OBS	Observer	

TABLE C-1.– Continued

Field No.	Field Prefix	Field Label	Description	Searchable
		AIR	Air Force (Hazardous Air Traffic Report)	
		NVY	Navy (Air traffic conflict from Naval Safety Center)	
		UNK	Unknown	
012	RGRF	Y	GRAPHICS form a part of the report.	
014	ORPT		OTHER ASRS REPORTS. Accession numbers of other ASRS reports of same occurrence (numeric entries).	
015	RESP		RESPONSE TO REPORTER:	X
		NON	None	
		CBC	Callback attempted and completed	
		CBT	Callback attempted	
		OTH	Other	
016	PRI		ALERT BULLETIN HANDLING:	X
		ROU	Routine	
		ABR	Alert bulletin recommended	
019	RTYP		TYPE OF REPORT:	X
		OCC	Occurrence	
		SIT	Situation	
020	BATCH		INPUT BATCH IDENTIFICATION.	X
022	STATUS		STATUS. An administrative code (numeric entry).	
041	TIMO		TIME OF OCCURRENCE (24 hour clock):	X
		1	0000-0600	
		2	0601-1200	
		3	1201-1800	
		4	1801-2400	
		U	Unknown	

TABLE C-1.– Continued

Field No.	Field Prefix	Field Label	Description	Searchable
042	DAY		DAY OF OCCURRENCE:	X
		SUN	Sunday	
		MON	Monday	
		TUE	Tuesday	
		WED	Wednesday	
		THU	Thursday	
		FRI	Friday	
		SAT	Saturday	
		UNK	Unknown	
031-040	HAZ1-HAZ10-		A POTENTIAL CONFLICT (up to 10). Described by using prefixes and labels of fields 045-050. (Source Field)	
045	MDH		HORIZONTAL MISS DISTANCE (numeric entry).	X
046	MDV		VERTICAL MISS DISTANCE (numeric entry).	X
047	MDU		Miss distance estimate, direction unspecified (numeric entry).	X
049	EVAC		EVASIVE ACTION, if reported:	X
		YES	Yes	
		NON	None	
		NTM	No time for evasive action	
		ATC	Evasive action directed by ATC	
		UNK	Unknown	
050	PC		TYPE OF POTENTIAL CONFLICT:	X
		GP	Ground potential	
		TP	Terminal area potential	
		EP	Enroute potential	
		GH	Ground hazard	
		TH	Terminal area hazard	
		EH	Enroute hazard	
		GC	Ground conflict	
		TN	Terminal near midair (NMAC)	
		EN	Enroute near midair (NMAC)	

TABLE C-1.– Continued

Field No.	Field Prefix	Field Label	Description	Searchable
061–070	ACFT A–ACFT J		AIRCRAFT involved (up to 10). Described by using prefixes and labels of fields 071-091.	
071	ATYP		AIRCRAFT TYPE:	X
		SMA	Small aircraft (less than 5000 lb)	
		SMT	Small transport (FAR-135 limit), 5000-14,500 lb	
		LTT	Light transport (FAR-135, Cat. A)	
		MDT	Medium transport (Cat. B)	
		MLG	Medium large transport (Cat. C)	
		LGT	Large transport (Cat. D)	
		HVT	Heavy transport (greater than 300,000 lb)	
		WDB	Wide-body transport	
		FGT	Fighter aircraft	
		BMB	Bomber	
		MLT	Military transport	
		MTR	Military training aircraft	
		SPC	Special purpose aircraft	
		ULT	Ultralight	
		UNK	Unknown	
072	APCL	FLT	APPLICABILITY – fleetwide.	X
073	AFRAM		AIRFRAME CHARACTERISTICS:	X
			Wing configuration –	
		WO	Lighter-than-air	
		WB	Biplane	
		WH	Fixed wing high	
		WM	Fixed mid-wing	
		WL	Fixed wing low	
		WR	Rotary wing	
		WU	Unknown	
			Landing gear configuration –	
		LN	None	
		LF	Fixed gear	
		LR	Retractable gear	
		LU	Unknown	
			Surface mode –	
		SL	Land	
		SS	Sea	

TABLE C-1.– Continued

Field No.	Field Prefix	Field Label	Description	Searchable
		SA	Amphibian	
		SI	Ski	
		SU	Unknown	
			Engine type -	
		ER	Reciprocating	
		ET	Turboprop	
		EJ	Turbojet	
		EN	None	
		EU	Unknown	
075	NENG		NUMBER OF ENGINES (numeric entry).	X
078	CRWSZ		Crew Size:	X
		1	One	
		2	Two	
		3	Three	
		4OM	Four or more	
		UNK	Unknown	
079	OPCL		OPERATOR CLASS:	X
		CIV	Civil	
		MIL	Military	
		GOV	Government	
		FOR	Foreign	
		UNK	Unknown	
080	OPOR		OPERATOR ORGANIZATION:	X
		ACR	Air carrier	
		SUP	Supplemental air carrier	
		COM	Commuter air carrier	
		ATX	Air taxi	
		FBO	Fixed base operator	
		RNT	Rental	
		CPR	Corporate	
		PER	Personal	
		AGR	Agricultural operator	
		UTO	Utility operator	
		AIR	Air Force	
		NVY	Navy	
		ARM	Army	

TABLE C-1.– Continued

Field No.	Field Prefix	Field Label	Description	Searchable
		CGD	Coast Guard	
		NGD	National Guard	
		FED	Federal Government	
		STA	State Government	
		LCL	Local Government	
		UNK	Unknown	
		OGA	Other General Aviation	
081	MIS		OPERATION (mission):	X
		PAX	Passenger	
		TRN	Training	
		UTL	Utility	
		AMB	Air ambulance	
		FRT	Freight	
		TST	Test	
		TAC	Tactical	
		RFL	Refueling	
		CHR	Charter	
		PLS	Pleasure	
		LLH	Low level, high speed	
		FRY	Ferry	
		AGR	Agricultural application	
		PRB	Personal business	
		UNK	Unknown	
083	ACS		AIRCRAFT SUBSYSTEMS:	X
		R----	Relevant (ATA chapter code)	
		F----	Failure (ATA chapter code)	
		D----	Design (ATA chapter code)	
		P----	Problem (ATA chapter code)	
		F----	Failure (ATA chapter code)	
		OP----	Operating procedure (ATA chapter code)	
		NO----	Not operating (ATA chapter code)	
		NE----	Not equipeed (ATA chapter code)	
		PI----	Positive influence (ATA chapter code)	
		A----	Activated (ATA chapter code)	
084	PHASE		FLIGHT PHASE (2 entries, a primary and a secondary, if no secondary then enter NUL.	X
		PRE	Preflight	
		TAX	Taxi, from brake release to runway alignment for takeoff	

TABLE C-1.– Continued

Field No.	Field Prefix	Field Label	Description	Searchable
		TOF	Takeoff, from roll to liftoff	
		ICB	Initial climb, from liftoff through noise abatement and clean-up	
		CLB	Climb	
		CRS	Cruise, maintaining altitude	
		DES	Descent	
		APR	Approach, from airport traffic area, IAF or targeting for runway, to touchdown	
		LDG	Landing, from touchdown until clear of active rwy	
		HLD	Holding, visual or radio fix	
		MNT	Interrupted climb/descent, short periods of level flight at intermediate altitudes	
		TFC	Traffic pattern	
		MAP	Missed approach	
		TAG	Touch-and-go	
		ABT	Aborting, termination of planned aircraft maneuver, e.g., takeoff	
		EMY	Emergency	
		DIV	Diverting to alternate airport	
		GAR	Go around	
		MNV	Maneuver, other variations from straight and level flight	
		NUL	Null	
		UNK	Unknown	
		ALL	All phases involved (situation reports)	
		LOW	Low approach	
085	AIR		AIRSPACE:	X
		AIR	Airway	
		CZN	Control zone	
		SUA	Special use airspace, e.g., MOA	
		UCA	Uncontrolled airspace	
		APT	Airport	
		OCA	Other controlled airspace, continental control area	
		TCA	Terminal control area	
		ATA	Airport traffic area	
		PCA	Positive control airspace	
		TRS	Terminal radar service area	
		UNK	Unknown	
		MOA	Military operating area	
		ALA	Alert area	

TABLE C-1.– Continued

Field No.	Field Prefix	Field Label	Description	Searchable
086	FPLAN		FLIGHT PLAN TYPE:	X
		VFR	Visual flight rules	
		COM	Combined flight plan, VFR and IFR	
		SVF	Special VFR flight plan	
		IFR	Instrument flight rules	
		DVF	Defense VFR flight plan	
		NON	None	
		UNK	Unknown	
090	ALT		FLIGHT ALTITUDE (numerical entry).	X
091	ALTUN		ALTITUDE MEASURED IN:	X
		MSL	Feet above mean sea level	
		AGL	Feet above ground level	
110	TACFT		TOT. NO. OF AIRCRAFT INVOLVED	X
		1	One	
		2	Two	
		3	Three	
		4	Four	
		5	Five	
		6	Six	
		7	Seven	
		8	Eight	
		9	Nine	
		10	Ten	
111	GFAC1		ATC CONTROLLING FACILITY, ground facility described by using prefixes and labels of fields 121-134. (Source Field)	
121	GNAME		LOCATION (city name).	X
122	GSTATE		Location (STATE, 2 letter abbreviation).	X

TABLE C-1.– Continued

Field No.	Field Prefix	Field Label	Description	Searchable
123	GID		LOCID, FAA Location identifier.	X
124	GTYP		Ground facility SYSTEM TYPE:	X
		ARPT	Airport	
		ATC	Air Traffic Control	
		NAVD	Navigation aid	
125	GSUB		Ground facility SUBSYSTEM (name).	X
			For GTYP,ARPT --	
		RWY	Runway	
		TXWY	Taxiway	
		RAMP	Ramp	
		SERVICES	Services	
		INST	Installation	
			For GTYP,ATC --	
		TWR	Tower	
		TRACON	Approach Control	
		CENTER	Air Route Traffic Control Center	
		FSS	Flight Service Station	
		MIL FAC	Military facility	
		COM RDO	Commercial radios	
			For GTYP,NAVD --	
		VOR	Variable omnidirectional range	
		VORTAC	Vortac	
		TACAN	Tacan	
		NDB	Non directional beacon	
		BCSTN	Broadcast station	
		ILS	Instrument landing system	
126	GCOM		Ground facility COMPONENT (name).	X
128	GSI		Ground facility INVOLVEMENT:	X
		DET	Detrimental operation	
		FLR	Functional failure	
		ABS	Absent, e.g., radar equipment	
		OTH	Other	

TABLE C-1.– Continued

Field No.	Field Prefix	Field Label	Description	Searchable
134	RWHD		SUPPLEMENTAL LOC ID. Identifier for runways, taxiways, intersections, airways, etc.	X
112	GFAC2		INCIDENT LOCATION ground facility, described by using prefixes and labels of fields for fields 121-134.	
113-120	GFAC3-GFAC10		GROUND FACILITY, other pertinent facilities, described by using prefixes and labels of fields for fields 121-134.	
141	PERS1		REPORTER. Described by using prefixes and labels of fields 151-157. (Source Field)	
142-150	PERS2-PERS10		PERSON, Other persons described by using prefixes and labels of fields 151-157. (Source Field)	
151	LOCP		LOCATION OF PERSON described in field.	
152	FUNC		FUNCTION of person described in field:	X
		PIC	Pilot in command	
		OCM	Other flight crew member (F/O, S/O)	
		CAB	Cabin service crewmember	
		PAX	Passenger	
		TRC	Trainee controller	
		TWC	Tower controller	
		GC	Ground controller	
		AC	Approach controller	
		DC	Departure controller	
		ARTCC	Center enroute controller	
		FSS	Flight Service Station specialist	
		SPVR	Supervisor	
		UNI	Unicom operator	
		FBO	Fixed base operator or employee	

TABLE C-1.– Continued

Field No.	Field Prefix	Field Label	Description	Searchable
		AMGR	Airport manager or employee	
		VD	Vehicle driver	
		OBS	Observer	
		CGP	Company ground personnel	
		OTH	Other	
		UNK	Unknown	
		TADV	Tower advisory	
		DISP	Dispatcher	
153	ACT		ACTIVITY:	X
		FLY	Pilot flying	
		CON	Controller controlling	
		OTH	Other	
		UNK	Unknown	
154	QUAL		QUALIFICATION/RATING:	X
		ATP	Airline transport pilot	
		INS	Instrument rated	
		CFI	Certified flight instructor	
		SPI	Student pilot	
		MIL	Military pilot	
		TRC	Trainee controller	
		RDC	Radar controller	
		NRC	Non-radar controller	
		FSS	Flight Service Station specialist	
		UNK	Unknown	
		DIS	Dispatcher	
155	EXP		EXPERIENCE, years (numeric entry).	X
156	FTIME		FLIGHT TIME, TOTAL HOURS (numeric entry).	X
157	FT90		FLIGHT TIME, IN LAST 90 DAYS, hours (numeric entry).	X
171-180	ENV1-ENV10		ENVIRONMENT, pertinent weather factors described by using prefixes and labels of fields 181-205. (Source Field)	

TABLE C-1.– Continued

Field No.	Field Prefix	Field Label	Description	Searchable
181	WFX		WEATHER FACTORS pertinent:	X
		Y	Yes	
		N	No	
182	FCON		FLIGHT CONDITIONS:	X
		VMC	Visual meteorological conditions	
		MXD	Mixed flight conditions	
		SVF	Special VFR conditions (IFR)	
		IMC	Instrument meteorological conditions	
		MVF	Marginal VFR conditions	
		UNK	Unknown	
			<u>Note</u>: The following fields (183-195) are coded only if WXF (181) is coded Y (yes) and the information is available.	
183	VIS		VISIBILITY (numeric: statute miles and tenths).	X
184	OBSC		OBSCURATION FACTORS:	X
		RAIN	Rain	
		FOGG	Fog	
		BLDS	Blowing dust	
		DUST	Dust	
		FRRN	Freezing rain	
		DRZZ	Drizzle	
		HAZE	Haze	
		BLSD	Blowing sand	
		SNOW	Snow	
		SMOK	Smoke	
		BLSN	Blowing snow	
		SMOG	Smog	
		FRST	Frost	
		SUNP	Sun position	
		CLDS	Clouds	
		UNKN	Unknown	
185	TEMP		TEMPERATURE, degrees F (numeric entry).	X

TABLE C-1.– Continued

Field No.	Field Prefix	Field Label	Description	Searchable
187	WID		WIND DIRECTION, degrees (numeric entry).	X
188	WIS		WIND SPEED, knots (numeric entry).	X
189	WIND		WIND FACTOR:	X
		GST	Gusting	
		SHR	Shear	
		TLW	Tailwind	
		LGT	Light	
		SHF	Shifting/shift	
		XWD	Crosswind	
		STR	Strong	
		HDW	Headwind	
		DUD	Down/updraft	
190	IFE		IN-FLIGHT ENCOUNTER:	X
		THUN	Thunderstorm	
		TURB	Turbulence	
		CATB	Clear air turbulence	
		LTNG	Ligntning	
		ICNG	Icing	
		HAIL	Hail	
		FRNT	Front	
		TORN	Tornado	
		WTRB	Wake turbulence	
		DTWX	Deteriorating weather	
191	RVR		RUNWAY VISUAL RANGE, feet (numeric entry).	X
192	RCON		RUNWAY CONDITION:	X
		WETT	Wet	
		SLSH	Slush	
		GRAD	Gradient	
		LGTG	Lighting	
		WATR	Standing water	
		RUFF	Rough	
		OBST	Obstruction	
		OTHR	Other	
		SNOW	Snow	
		SHRT	Short	
		MRKG	Marking	

TABLE C-1.– Continued

Field No.	Field Prefix	Field Label	Description	Searchable
		BRKG	Braking	
		ICEE	Ice	
		PLOW	Plowed	
		ISAND	Sanded	
		RUBR	Rubber deposits	
		TRSH	Trash	
		VEGA	Vegetation	
		DRIF	Deifting snow	
193	CEIL		CEILING, feet (numeric entry).	X
194	COVER		SKY COVER:	X
		SCTRD	Scattered	
		RAGGD	Ragged	
		BROKN	Broken	
		BLYRS	Between layers	
		OBSCR	Obscuration	
		OVCST	Overcast	
		MTLRS	Multiple layers	
		UNCST	Undercast	
195	WXR		MISC. WEATHER FACTOR (specify).	X
196	TER		TERRAIN FEATURE:	X
		MTN	Mountain	
		HIL	Hill	
		TWR	Tower, other than an ATCT	
		BLD	Building	
		WIR	Wire	
		OTH	Other	
		DIT	Ditch	
		TRE	Tree	
		WTR	Over water	
		LIT	Lighting problems	
			NOTE: If one traffic field (197-202) is utilized then all must have entries.	

TABLE C-1.– Continued

Field No.	Field Prefix	Field Label	Description	Searchable
197	TMIX		TRAFFIC TYPE MIX:	X
		TA	Single aircraft	
		TB	Mixed aircraft/aircraft	
		TC	Mixed aircraft/ground vehicles	
		TD	Mixed aircraft/water vehicles	
		TE	Mixed rotary wing/fixed wing	
		TO	Unknown or not significant	
198	TPHASE		TRAFFIC FLIGHT PHASE MIX:	X
		FA	Taxiing	
		FB	Ground holding	
		FC	Departing (including takeoff)	
		FD	Climbing	
		FE	Enroute	
		FF	Maneuvering	
		FG	Descending	
		FH	Holding	
		FI	Arriving (including landing)	
		FJ	Touch-and-go	
		FK	Arriving/departing	
		FL	Arriving/ground holding	
		FM	Arriving/taxiing	
		FN	Departing/ground holding	
		FP	Departing/taxiing	
		FQ	Departing/touch-and-go	
		FR	Taxiing/ground holding	
		FS	Enroute/climbing	
		FT	Enroute/descending	
		FU	Enroute/holding	
		FV	Climbing/descending	
		FW	Climbing/holding	
		FX	Descending/holding	
		FY	Taxiing/parked	
		FZ	Enroute/maneuvering	
		FO	Unknown or not sigfniciant	
199	TPER		TRAFFIC PERFORMANCE MIX:	X
		PA	Airspeed differential	
		PC	Rate-of-climb differential	
		PD	Rate-of-descent differential	
		PT	Rate-of-turn differential	
		PO	Unknown or not significant	

TABLE C-1.– Continued

Field No.	Field Prefix	Field Label	Description	Searchable
200	TOP		TRAFFIC OPERATOR CLASS MIX:	X
		CA	GA/air carrier	
		CB	GA/military	
		CC	Air carrier/military	
		CD	GA/air carrier/military	
		CE	Air carrier traffic mix	
		CF	GA traffic mix	
		CG	Military traffic mix	
		CO	Unknown or not significant	
201	TFP		TRAFFIC FLIGHT PLAN MIX:	X
		QA	IFR/VFR traffic mix	
		QB	IFR mix	
		QC	VFR mix	
		QO	Unknown or not significant	
202	TCHAR		MISC. TRAFFIC CHARACTERISTICS:	X
		MA	Unknown VFR traffic in area	
		MB	Congested ramp traffic	
		MC	Overflight traffic	
		MD	NORAC traffic	
		ME	Traffic pattern deviation	
		MF	Traffic congestion/volume	
		MG	Multiple runways/parallel	
		MH	Multiple runways/intersecting	
		MI	Opposite direction traffic	
		MJ	Converging	
		MK	Emergency	
		ML	Overtaking	
		MM	Pop-up	
		MN	Same direction	
		MP	Direction finding	
		MQ	Performing acrobatics	
		MO	Unknown or not significant	
203	SPRT		SPECIAL ROUTE IN USE:	X
		SIDX	Standard instrument departure	
		TRRT	Transition route	
		RNAV	Area navigation route	
		NOIS	Noise abatement procedure	
		STAR	Standard terminal arrival route	
		ARRT	Arrival route	

TABLE C-1.– Continued

Field No.	Field Prefix	Field Label	Description	Searchable
		DRCT	Direct route	
		ATRT	Atlantic route	
		PROF	Profile descent	
		DPRT	Departure route	
		VECT	Vector (radar)	
		ORGR	Organized oceanic route	
		UNKN	Unknown or not significant	
		CTCA	Contact approach	
		VISA	Visual approach	
		CIRC	Circling approach	
		MLVR	Military visual route	
		MLIR	Military instrument route	
204	BEH		BEHAVIOR FACTORS:	X
		DISC	Physical discomfort	
		PINJ	Personal injury	
		SCPR	Social pressure	
		VCOM	Noisy voice communications	
		FATG	Fatigue	
		WKLD	Workload excessive	
		RSUT	Resource utilization	
		UNFM	Unfamiliar with operation	
		INCP	Incapacitation	
		DIST	Distraction	
		IRSC	Inadequate human resources	
		SCHD	Schedule pressure	
		SICK	Illness	
		IPER	Interpersonal relationships	
		RCOM	Noisy radio communications	
		EMOT	Emotional trauma or stress	
		CMPL	Complacency	
		UPAT	Unprofessional attitude	
205	LIGHT		LIGHTING CONDITIONS at time of occurrence:	X
		DAWN	Dawn	
		DYLT	Daylight	
		MANY	Many	
		DUSK	Dusk	
		NITE	Night	
		UNK	Unknown	

TABLE C-1.– Continued

Field No.	Field Prefix	Field Label	Description	Searchable
221-230	SOFT1-SOFT10		SOFTWARE ASSOCIATION. Information transfer and software problems, described by using prefixes and labels of fields 231-236. (Source Field)	
231	MORG		MESSAGE ORIGIN:	X
		CTL	Controller	
		FLC	Flight crew	
		OTH	Other	
232	MTYPE		MESSAGE TYPE:	X
		CLNC	Clearance, instruction with regulatory force	
		CORD	Coordination, information for coordinating control of aircraft	
		RQST	Request, e.g., for amended clearance	
		WRNG	Warning of impending dangerous condition or system malfunction	
		CNTL	Control, other information for air traffic control	
		INTN	Intentions, present status or planned actions	
		DATA	Data, text, graphic or instrument readings	
		AVSY	Advisory, e.g., traffic, weather, airport condition	
		CONF	Confirmation, including readback	
		INST	Instruction, directions, usually as to prescribed procedures	
233	MPROB		MESSAGE PROBLEM:	X
		PHN	Phonetic similarity (similar sounds)	
		TPN	Transposition (order inversion)	
		OAC	Inaccuracy for other reasons	
		CPL	Incomplete	
		FLS	False	
		AMB	Ambiguous or misleading	
		TIM	Untimely	
		GBL	Garbled in transmission or presentation	

TABLE C-1.– Concluded

Field No.	Field Prefix	Field Label	Description	Searchable
		ABS	Absent	
		FLR	Equipment failure prevented transmission	
		NMN	Message not monitored, not seen or heard	
236	MEDIA		MESSAGE MEDIUM:	X
		PUB	Publication	
		RDO	Radio	
		INP	Interphone; internal to acft or ground facility	
		VID	Video (including radar scope)	
		TAP	Tape recording	
		CHT	Chart or similar graphic	
		TLE	Telephone	
		VOX	Voice (direct)	
		VIS	Visual, e.g., reading instruments	
		CPO	Computer printout	
300	EFX		ENABLING FACTORS	X
301	AFX		ASSOCIATED FACTORS	X
302	RFX		RECOVERY FACTORS	X
303	SUP		SUPPLEMENTARY KEYWORDS	X
310	NAR		NARRATIVE (Occurrence description)	
311	ANALYS		ASRS ANALYSIS	
312	KEYWS		DESCRIPTORS	X
313	SYNOP		SYNOPSIS	
314	COMNT		CALLBACK/COMMENTS	
316	RECMND		REPORTER'S RECOMMENDATIONS	

APPENDIX D

EXAMPLES OF ASRS ALERT BULLETINS

AB#	
76-37	Alerted the FAA to hazards resulting from minimum terrain VFR vectors in the Las Vegas TCA.
76-136	Alerted the FAA to misunderstandings between pilots and ATC regarding requests for practice instrument approaches.
76-151	Alerted the U.S. Air Force and the FAA to problems involving misunderstandings between ATC personnel and aircrews as to when a military air refueling activity is in effect.
77-45	Alerted FAA to the confusion regarding clearance limits or routes of flight when an airport and a VOR/VORTAC are named the same but not colocated.
77-56	Alerted FAA to ATC clearances which placed aircraft on IFR flight plans below MEA or MOCA levels.
77-82	Alerted FAA and aviation community to the need to avoid confusion regarding the meaning of a ". . . cleared for approach . . ." clearance.
77-96	Alerted FAA to hazards resulting from minimum terrain VFR vectors in the Tucson area.
77-124	Alerted FAA and NOAA to potential hazards of identifying airway intersections by names that are the same as words in the phonetic alphabet.
78-54	Alerted FAA to the critical confusion resulting from parachute jump aircraft reporting their altitude in feet AGL while most aircraft and ATC operations relate to altitudes in feet MSL.
79-55	Alerted FAA and Department of Defense to a critical discrepancy in the respective organizations' definitions of "Time En Route."
79-69	Alerted FAA to ATC, traffic, and language problems being experienced by pilots and controllers in the area of Tucson, AZ.
79-71	Alerted FAA, airline management, pilot organizations, and aircraft manufacturers to a hazardous fuel management problem in a new model of turbojet transport aircraft.
79-86	Alerted FAA and pilot community to the increasing popularity, attendant hazards, and need for regulation of powered hang-glider operations.
80-3	Alerted FAA to ATC clearances which directed instrument flight-planned aircraft toward terrain higher than the designated flight altitude.
80-42	Alerted FAA to a critical practice by FSS of not forwarding alternate airport information along with other flight plan data.

81-3 Alerted the U.S. Air Force to a potential conflict hazard resulting from aircraft on military training routes encountering petroleum exploration helicopters.

81-15 Alerted FAA to confusing and complicated Standard Instrument Departure charting and procedure deficiencies in the Tucson, AZ area.

81-24 Alerted the FAA and the aviation community to the hazards associated between 12,500 ft and 18,000 ft by high-performance aircraft trying to off-load the ATC system.

APPENDIX E

ASRS PROGRAM REPORTS

Program Report #	Report Date	Issues Addressed
TM X-3445 (QR#1)	September 1976	• Origins and Development of the ASRS
TM X-3494 (QR#2)	December 1976	• ASRS Statistics • Various Safety Topics
TM X-3546 (QR#3)	May 1977	• Altitude Overshoots, Excursions and Undershoots • ASRS Information Processing • Misunderstandings of Communications Between Pilots and Controllers
TM 78433 (QR#4)	October 1977	• Operational Problems in Terminal Radar Service Areas
TM 78476 (QR#5)	April 1977	• Human Factors Associated with Profile Descents • Ground Proximity Warning Systems • Communications Problems • Decision Making and Judgment Factors • Procedures: Descent Clearances
TM 78511 (QR#6)	July 1978	• Human Factors Associated with Altitude Alert Systems • Thunderstorm Information and Flight Operations • Wake Turbulence and Jetwash • Pilot and Controller Performance
TM 78528 (QR#7)	August 1978	• Human Factors Associated with Potential Conflicts at Uncontrolled Airports • Winter Operations • Judgment and Decision-Making • Charts and Flight Information
TM 78540 (QR#8)	October 1978	• Human Factors Associated with Runway Incursions • ATC Coordination • Skydiving • Judgment and Decision-Making
TM 78608 (QR#9)	June 1979	• Distraction – A Human Factor in Air Carrier Hazard Events • ASRS Statistics
TM 81197 (QR#10)	April 1980	• Human Factors in Air Carrier Operations: Knowledge of the Limitations of the ATC System in Conflict Avoidance Capabilities • Proficiency of General Aviation Pilots • Calls for Help • Negative Stage III Operations

Program Report #	Report Date	Issues Addressed
TM 81225 (QR#11)	August 1980	• A Study of Near Midair Collisions in U.S. Terminal Airspace • Airport Perimeter Security • Unauthorized Takeoffs and Landings • Winter Operations
TM 812522 (QR#12)	December 1980	• Problems in Briefing of Relief by Air Traffic Controllers • Altimeter Reading and Setting Errors as Factors in Aviation Safety • ATIS Broadcasts • Readbacks
TM 81274 (QR#13)	September 1981	• The Go-Around Maneuver in Air Carrier Operations: Causes and Resulting Problems • Loss of Control in Flight • Similar Sounding Alphanumerics • Incapacitation
TM XXXXX (QR#14)	January 1983	• Operational Problems Experienced by Single Pilots in Instrument Meteorological Conditions • Pilot-Controller Reaction to the Post-Strike ATC System

APPENDIX F

LISTING OF ASRS CONTRACTOR REPORTS AND TECHNICAL PAPERS

NASA CR 166165: Potential Effects of the Introduction of the Discrete Address Beacon System Data Link on Air/Ground Information Transfer Problems; Grayson, R. L.; March 1981.

NASA CR 166166: A Review of In-Flight Emergencies in the ASRS Data Base; Porter, R. F.; May 1981.

NASA CR 166167: Fatigue and Associated Performance Decrements in Air Transport Operations; Lyman, E. G., and Orlady, H. W.; March 1981.

NASA CR 166212: A Study of ASRS Reports Involving General Aviation and Weather Encounters; Rockwell, T. H., Roach, D. E., and Griffin, W. C.; June 1981.

NASA CR 166230: An Investigation of Reports of Controlled Flight Toward Terrain (CFTT); Loomis, J. P., and Porter, R. F.; June 1981.

NASA CR 166236: Operational Problems Experienced by Single Pilots in Instrument Meteorological Conditions; Weislogel, S.; August 1981.

NASA CR 166339: Probability Distribution of Altitude Deviations; Thomas, R., and Rosenthal, L.; August 1981.

NASA CR 166231: ATC Contingency Operations in the En Route Flight Regime; Lyman, E. G.; May 1981.

NASA CR 166433: Flight Crew Performance When Pilot Flying and Pilot Not Flying Duties Are Exchanged; Orlady, H. W.; June 1982.

NASA CR 166462: Addressee Errors in ATC Communications: The Call Sign Problem; Monan, W. P.; January 1983.

NASA Technical Paper 1875: "Information Problems in the Aviation System"; edited by Billings, C. E., and Cheaney, E. S.; September 1981; compilation of seven study reports.

1. "Dimensions of the Information Transfer Problem" by Billings, C. E., and Reynard, W. D.
2. "Information Transfer in the Surface Component of the System: Problems Associated with Briefing of Relief Controllers" by Grayson, R. L.
3. "Information Transfer in the Surface Component of the System: Coordination Problems in Air Traffic Control" by Grayson, R. L.
4. "Information Transfer Between Air Traffic Control and Aircraft: Communication Problems in Flight Operations" by Grayson, R. L., and Billings, C. E.
5. "Information Transfer Within the Cockpit: Problems in Intracockpit Communications" by Foushee, H. C., and Manos, K. L.

6. “Information Transfer During Continency Operations: Emergency Air-Ground Communications” by Porter, R. F.

7. “The Information Transfer Problem: Summary and Comments” by Billings, C. E., and Cheaney, E. S.

APPENDIX G

SPECIAL REQUESTS FOR INFORMATION FROM THE ASRS DATABASE

Number	Date	Topic	Requested by	Status
1	2-21-77	Flight crew fatigue reports	FAA AGC	Complete
2	2-21-77	Wake turbulence reports	FAA AWE	Complete
3	2-22-77	Altitude deviations	NASA ASRS	Complete
3a	2- -77	Clearance misunderstandings	NASA ASRS	Complete
4	2-25-77	Controller perceptual problems	BCL ASRS	Complete
5	2-28-77	Potential conflicts	NASA ASRS	Complete
6	3- 7-77	Reading, PA, LOM problems	Attorney	Complete
7	3-14-77	Severe weather during take-off & apch	NY Court	Complete
8	3-15-77	Selected reports: phase of flight	NASA ASRS	Complete
9	3-23-77	Reports involving BRITE radar	BCL ASRS	Complete
10	3-22-77	TCA/TRSA design and procedures	NASA RTAC	Complete
11	3-20-77	Advisories to IFR aircraft	BCL ASRS	Complete
12	4-19-77	Fairchild-Spokane coordination problems	NASA ASRS	Complete
13	5- 4-77	"Black hole" effect in night opns	ALPA Hq	Complete
14	5-20-77	ATC Transmitter power reductions	FAA AAF	Complete
15	6- 2-77	Comm Probs due to language differences	Canadian Inq. Comm.	Complete
16	5-20-77	Cockpit warning system problems	NASA LM	Complete
17	5-24-77	ANC intersecting runway operations	Sen. Stevens	Complete
18	5-25-77	Edwards RAPCON coordination problems	USAF DAS	Complete
19	6- 1-77	Military/civil potential conflicts	NASA Code D	Complete
20	6-24-77	Potential conflicts, partitioned	FAA ASF-10	Complete
21	6-28-77	Patrick AFB/Melbourne, FL, operations	USAF DAS	Complete
22	6-28-77	PUB coded reports for QR-4	NASA ASRS	Complete

Number	Date	Topic	Requested by	Status
23	7-11-77	Coord problems in Boston TRACON	ASRS BCL staff	Complete
24	9- 8-77	Source reports for selected AB's	FAA AAT-300	Complete
25	9- 6-77	Altitude deviations, partitioned	FAA SRDS	Complete
26	9- 6-77	Potential conflicts, partitioned	FAA OSEM	Complete
27	9- 8-77	Reduced approach light systems	FAA ASF-10	Complete
28	9- 8-77	Source reports for QR-3 quotation	FAA AAT-300	Complete
29	9- 9-77	Bergstrom/Austin RAPCON problems	USAF DAS	Complete
30	8-30-77	Profile descent problems	NASA ASRS	Complete
31	9-19-77	Reports on all USAF ATC facilities	USAF DAS	Complete
32	10-11-77	Interfacility coordination problems	BCL ASRS	Complete
33	10-11-77	Enabling and associated factors dump	BCL ASRS	Complete
34	10-27-77	Runway conflicts	FAA NAFEC	Complete
35	11- 9-77	Conflicts in SFO-SJC-OAK area	FAA AFS-84	Complete
36	12- 5-77	Airspace problems in Florida	FAA AVP-201	Complete
37	1- 3-78	General aviation reports	BCL ASRS	Complete
38	1- 9-78	ATC situations and occurrences	BCL ASRS	Complete
39	1- 5-78	Potential conflict	NASA Reynard	Complete
40	1-12-78	Potential conflicts/similar call signs	NASA Reynard	Complete
41	1-24-78	Demonstration for representatives	ALPA	Complete
42	1-27-78	Conflicts on Atlantic Route 1	FAA AAT-300	Complete
43	1- 9-78	Language problems in ATC	CALPA-CATCA-TC	Complete
44	12- -77	Landings to hold short of intxn	FAA AGL	Verbal rpt
45	10- -77	Visual illusions in flight	NASA Code LM	Complete
46	12- 8-77	Source reports for AB	FAA AAF-32	Complete
47	11-22-77	Source reports for two AB's	FAA AAT-300	Complete
48	12- 8-77	Problems of clearance misunderstanding	FAA ADA-1	Complete
49		Use of airport advisory frequencies	FAA AAF-32	Verbal rpt

Number	Date	Topic	Requested by	Status
50	3-24-78	Potential conflicts in Denver area	FAA AGC-	Complete
51	3- 3-78	Light conditions in ASRS reports	NTSB	Verbal rpt
52	12- 9-77	Analysis of system errors	FAA AAT-1	Deferred
53	3-17-78	Wind indicators at airports	FAA ARD-400	Complete
54	4-21-78	Human error in air transport opns	NTSB	Complete
55	3-24-78	Tucson Rapson/Davis-Monthan AFB	USAF	Complete
56	5- 1-78	Potential conflicts: TCA and TRSA	FAA AVP-210	Complete
57	5-16-78	Slippery runways	FAA ASF-10	Complete
58	5- 5-78	Carbon/graphite composites	FAA ASF-10	Complete
59	5-17-78	Runway incidents (VICON study)	FAA ARD-52	Complete
60	6- 5-78	TCA/TRSA reports (follow-up)	AOPA	Complete
61	7- 7-78	Effects of automation in aircraft systems	NASA LMS(rc)	Complete
62	7-18-78	NMAC between military and civil aircraft	USDA/FS-AFM	Complete
63	7-18-78	Radio frequency problems	FAA ARD-62	Complete
64	8-14-78	Takeoffs on taxiways at DFW	AAL APA/E&SS	Complete
65	10-27-78	Portland/Hillsboro, OR interface	FAA ANW-1	Complete
66	11- -78	Portland/Hillsboro, OR update	FAA ANW-1	Complete
67	11- -78	Seattle/Renton, WA interface study	FAA ANW-1	Complete
68	12- 8-78	Portland/Hillsboro, OR special study	FAA ANW-1	Complete
69	11-29-78	Practice approaches at airports	FAA AAT-300	Complete
70	11-29-78	Visual separation reports	FAA AAT-300	Complete
71	11-29-78	Transfer of communications reports	FAA AAT-300	Complete
72	12- 8-78	NMAC reported to ASRS; analysis	FAA AAT-300	Complete
73	10-18-78	Reports involving San Diego	FAA/ASRS	Complete
74	11-30-78	Reports involving 13 locations in PA	FAA ZOB	Complete
75	11- 9-78	Reports involving Mansfield, OH	Citizen	Complete

Number	Date	Topic	Requested by	Status
76	11- 9-78	Parachute-skydiving occurrences	FAA ASF	Complete
77	11-20-78	14 issues at 12 California airports	LA Times	Complete
78	10-20-78	Alert bulletins involving DTW	Detroit News	Complete
79	11-22-78	Alert bulletins involving PDX	KGW-TV	Complete
80	11-16-78	Alert bulletins involving SAC and SMF	SAC Union	Complete
81	11-24-78	Recent reports involving SAN	FAA AWE	Complete
82	6- -78	All alert bulletins	Flt Line Times	Complete
83	11- 2-78	ATC coordination at Spokane, WA	ASRS for ANW	Complete
84	10-25-78	Selected data on potential conflicts	AOPA	Complete
85	10-30-78	GA occurrences (SPIFR study)	NASA LaRC	Complete
86	10- -78	Occurrences involving automation	NASA ARC(LM)	Complete
87	12- 1-78	Potential conflict scenarios (CTDI)	NASA ARC(LM)	Complete
88	12-22-78	Further data on potential conflicts	FAA AVP-210	Complete
89	12-27-78	Data on occurrences at BOS	FAA ANE	Complete
90	10-25-78	Data on role reversal in flight crew	ATA	Complete
91	12-28-78	Flight check problems	NASA ASRS	Postponed
92	12-21-78	Data link-superseded by SR-107	FAA SRDS	Superseded
93	1-15-79	Controlled flight into terrain	FAA ASF-1	Complete
94	1-29-79	Detail regarding AB 78-49	USAF Kirtland	Complete
95	11-30-78	Potential conflicts and NMAC	FAA AT-300	Complete
96	1-12-79	NMAC in term. and enroute airspace	NBAA	Complete
97	2-26-79	Altimeter reading errors	ALPA	Complete
98	1-10-79	NMAC data in TCA and TRSA	Navy	Complete
99	1-??-79	Incidents at RNO, VIS, ONT	Gannett News	Complete
100	3-30-79	Altitude deviations: update	FAA OSEM	Complete
101	3-29-79	English language problems	FAA (Geier)	Complete
102	2-21-79	Military vs military pilot reports	FAA ASF-1	Complete
103	2-28-79	Strobe light usage	SWALPA	Complete

Number	Date	Topic	Requested by	Status
104	4-19-79	Operational problems at FL airports	Miami Herald	Complete
105	4- 4-79	Potential conflicts in Sacramento	Congress	Complete
106	4- 1-79	All near midair collision data	FAA AAT-300	Complete
107	5- 2-79	Data Link Information Transfer	FAA ARD-200	Pt I Pt II
108	6-15-79	Visual Aspects of Rwy Environment	NASA LMS	Complete
109	7- 2-79	Operations at Las Vegas, NV	LVS Review-Jnl	Complete
110	7-12-79	Alt. deviations update (SR 25)	FAA AEM-20	Complete
111	7-25-79	Altimetry errors – update	FAA ASF-200	Complete
112	7-19-79	Boston ATC sectorization	PATCO	Verbal rpt
113	7-25-79	In-flight incapacitation	FAA AAM-1	Verbal rpt
114	10-12-79	Evacuation chute deployments	Boeing-Brende	Complete
115	10-12-79	FOD problems at CRAC airports	ATA-Gatlin	Complete
116	10- 1-79	Arpt Facilities and Snow Removal Problems	FAA AGL (Duckworth)	Complete
117	5-24-79	CA Arpts Update (see SR —)	LA Times-Frank	Complete
118	9-21-79	Airways Facilities Problems	FAA ANE (Morrell)	Complete
119	8-27-79	System Error Reports	FAA ASW (Wolfe)	Complete
120	8-27-79	Arpt/Navaid Problems	FAA ANW (Backman)	Complete
121	10-17-79	Downwind landings	FAA AFO-223	Complete
122	11-27-79	Fatigue-related problems	TSC DTS-521 (Hallock)	Complete
123	10-23-79	Use of flaps in turbojet acft	Boeing Aircraft Co.	Complete
124	10-31-79	Parachute jumping	FAA AAT-220 (Burns)	Complete
125	11- 6-79	Runway Incursions at ATL	ALPA	Complete
126	10-24-79	Clear air turbulence	FOIA/Atty-Freed	Complete
127	10- 2-79	Slippery runway problems	AWE-160 (Armstrong)	Complete
128	11- 6-79	Problems in Washington ARTCC	ADA-1 (Taylor)	Complete
129	10-26-79	Problems at Burbank Airport	Congress (Burton)	Complete
130	10-24-79	Problems at Islip Airport	Congress (Burton)	Complete
131	9-15-79	Crossing situations	FAA ACE (Winnett)	Complete
132	11- 6-79	NMACs at SJC since DB II	ALPA-Deeds	Complete
133	11- 6-79	Reports from Mexico City Airport	WAL-LeBel	Complete
134	11- 9-79	Lighter-than-air activity	FOIA-Amsbaugh	Complete
135	11-20-79	Tucson and Davis-Monthan problems	FAA (DMA RAPCON)	Complete

Number	Date	Topic	Requested by	Status
136.	11-27-79	San Diego NMAC since 9-25-78	Newsweek (code DI)	Complete
137	12-11-79	Reports of problems at CMH and OSU	FOIA-Edwards	Complete
138	12-19-79	General aviation problems (SPIFR)F.U.	NASA LaRC/1470	Complete
139	1- 2-80	Lt. callouts on ASR approaches	FAA AEM-4 (Cayot)	Complete
140	1- 3-80	SFO Noise Abatement Procedures	ALPA (Deeds)	Complete
141	1-10-80	Flight engineer problems	UAL-EXOMD	Complete
142	1-31-80	Civil-civil NMAC in SAC area	USAF (Parisi)	Complete
143	2- 1-80	NMAC scenarios	NASA LM (Palmer)	Complete
144	2- 4-80	False warnings and alerts	NASA LM (Wiener)	Complete
145	2- 5-80	Warning and alerting systems, etc.	FAA ARD-312 (Tinsley)	Complete
146	2-12-80	Opa Locka Airport reports	FAA ASF-300	Complete
147	3- 3-80	Effects of jet blast on light aircraft	AOPA (Lawton)	Complete
148	2-19-80	All ASRS NMAC in Bay area and SAN	FOIA-KGO Radio	Complete
149	3-12-80	Alert bulletins on airworthiness	FAA-Beard	Complete
150	2-11-80	All ASRS reports re: Opa Locka, FL	FAA ASF-300	Complete
151	2-20-80	ASRS reports of fatigue factors	NASA (Reynard)	Complete
152	3-24-80	Visual approaches at LAX	PATCO	Complete
153	3-24-80	NMAC 1979 air carrier statistics	Lib. of Congress	Complete
154	3-18-80	NMAC data for 1978-79	FAA AVP-1	Complete
155	3-28-80	NMAC summary data for 1979	FAA ASF-200 (Jones)	Complete
156	3-31-80	Keyword listings in ASRS	FAA AAT-430	Complete
157	3-31-80	GPWS occurrences	NTSB (Schonberger)	Complete
158	3-31-80	Encounters with towers/ power lines	FAA (Becker)	Complete
159	4- 4-80	Helicopter scenarios for CAWS research	PLRA (Simpson)	Complete
160	3-31-80	Reports regarding MEX	ALPA (Edmunds)	Complete
161	4-11-80	Acft involved in alt. devs. (see SR 145)	FAA ASF (Tinsley)	Complete
162	4-11-80	NMAC: date, loc., type of aircraft	Congress (Whitaker)	Complete

Number	Date	Topic	Requested by	Status
163	4-14-80	Helicopter-fixed wing interactions	ASRS (Billings)	Complete
164	4-15-80	Most common errors in A.T. operations	STI (Jewell)	Complete
165	4-10-80	Op. problems in south FL (see SR 104)	Miami Herald	Complete
166	4-18-80	NMAC Stats for 1978–79–80	CBS-WBBM (Chi)	Complete
167	6- 9-80	Geographic trend in rwy incursions	TSC (O'Brien)	Complete
168	5-22-80	NMAC reports involving SJC	AOPA (Deeds)	Complete
169	5-22-80	ILS,Loc,G/S errors caused externally	R.L. Newman	Complete
170	5-22-80	Emergency use of cockpit windows	Pan Am (Reiner)	Complete
171	6-10-80	Reports of fatigue and desynchronosis	NASA (Chambers)	Complete
172	7- 8-80	Reports re: Connellsville, PA Airport	FOIA (Czop)	Complete
173	7-23-80	Reports re: Crew complement	FAA (ASF-1)	Complete
174	7-23-80	NMAC reports involving SAC area	FAA (ASF-300)	Complete
175	7-23-80	Reports re: Opa Locka, FL (update)	FAA (ASF-300)	Complete
176	8- 5-80	NMAC Stats re: TTN and PHL	FAA (Eidman)	Complete
177	8- 8-80	Intersecting rwy occurrences	APA (Holley)	Complete
178	8-11-80	ATC equipment problems at FAT	FOIA (KFSN)	Complete
179	8- 7-80	Reports re: Complacency	NASA (Wiener)	Complete
180	9-22-80	Reports re: flight check activity	NASA (Billings)	Complete
181	8-14-80	Wake turb. re: arpt rates and ATC stds	BCA (Sweden)	Complete
182	8-15-80	Reports re: acft ident. markings	NBAA (Fanning)	Complete
183	8-20-80	Runway incursions at LAX	APA (Morris)	Complete
184	9- 9-80	NMAC reports involving SJC	FAA (ASF-300)	Complete
185	9-12-80	Reports re: ATC TCSS at DFW	FOIA (Jacoby-Atty)	Complete
186	9-12-80	NMAC Stats by mo/yr/acft type and opn	ALPA (Mason)	Complete
187	8-15-80	Helicopter pilot workload and environment	FAA (ACT-340)	Complete

Number	Date	Topic	Requested by	Status
188	9-22-80	Stats and Reports of Mil/Civ NMACs	USAF (Gaspar)	Complete
189	9-30-80	Stats of report volume/type/ source	FAA (ASF-300)	Complete
190	10- 6-80	Reports re: South FL (Update SR 165)	Miami Herald	Complete
191	10-20-80	Reports re: Rotary Wing Operations	USC (Davis)	Complete
192	10-20-80	Opposite Direction TFC/ Apch and Depart	FAA (ASF-300)	Complete
193	10-21-80	Stats re: Pilot Reports (Update SR 189)	FAA (ASF-300)	Complete
194	10-21-80	Cockpit Commo Patterns/ FLC Performance	NASA (Foushee)	Complete
195	10-22-80	Emergency A/G Commo/ Info Transfer	BCL (Porter)	Complete
196	11- 6-80	NMACs in Terminal Areas/ Visual Apchs	ATCA (Gale)	Complete
197	11-17-80	Reports re: Mexican Airspace/Opns	ALPA (Deeds)	Complete
198	12- 2-80	Jet acft entry into inadvertent stall	Boeing (Lautman)	Complete
199	12-15-80	Reports re: HNL and DEN since 5/78	Speas (Reese)	Complete
200	12-12-80	Reports re: Alaska since 5/78	Sharpe/Vermillion	Complete
201	12-19-80	Overflights due to crew asleep	FAA (ASF-300)	Complete
202	1-19-81	Reports re: Gainesville, FL (GNV)	FOIA (2 requests)	Complete
203	1-19-81	Wing-tip or distortion incidents	FOIA (Tiffany)	Complete
204	1-22-81	Reports re: NMACs in SAC Ca. area	FAA (ASF-300)	Complete
205	1-22-81	Reports re: Apchs to Spokane	NTSB (Schleede)	Complete
206	1-22-81	Reports re: OPF – update SR 190	FAA (ASF-300)	Complete
207	2- 4-81	Reports re: visual approaches	ALPA (Krupinski)	Complete
208	2- 6-81	DEN NMACs, PCs, and Profile Descents	NASA (Palmer)	Complete
209	2-10-81	Reports re: DEN since 5/78	FAA (DEN ARTCC)	Complete
210	2-10-81	1979 and 1980 Reports – Fatigue and NMAC	ALPA (Edmunds)	Complete
211	3- 2-81	Reports re: loss of control in flight	FAA (ASF-300)	Complete

Number	Date	Topic	Requested by	Status
212	3- 2-81	Position deviations and ATC phraseology	FAA (AAT-330)	Complete
213	3- 5-81	Reports re: sailplanes/hang gliders	Amsbaugh	Complere
214	3- 5-81	Single pilot IFR in high density opns	Winn	Complete
215	3- 5-81	NMAC reports at 10 SFO Bay Area Arpts	KRON-TV (McLean)	Complete
216	3- 6-81	NMAC stats re: ACRs CY 77 to 80	FAA (Broderick)	Complete
217	3-13-81	NMAC stats since 7/76 re: categories	USAF (Scott/SACC)	Complete
218	3-13-81	Altitude deviations/casual factor stats	CAA (UK/Thorning)	Complete
219	3-13-81	Air carrier opns w/wx as a sig. factor	ATA (Abbott)	Complete
220	3-23-81	NMACs on parallel apchs 4000 ft and below	FAA (AAT-320)	Complete
221	3-25-81	Stats/reports re: trng, dual, CFIs	AOPA (Sheehan)	Complete
222	4- 1-81	Reports re: txwy lghtg and mrkg	FAA (ACT-410)	Complete
223	4- 6-81	Twin turboprop cockpit fumes	FAA (ASF-100)	Complete
224	4-17-81	NMACs CY 1980-LAX-MIA-ATL-ORD-NYC	FAA (ASF-1)	Complete
225	4-21-81	Helideck incidents	Dome Petro Ltd.	Complete
226	4-29-81	Crew complement	JKL-Pres Task	Complete
227	5- 1-81	Pilot and crew incap	Boeing Co.	Complete
228	5- 1-81	Sky diving activities	FAA (ASF-300)	Complete
229	4-28-81	NMACs/S Calif Airports	Dalmo Victor	Complete
*230	4-17-81	NMAC tally [weekly]	FAA (ASF-1)	Complete
231	4-28-81	Distraction/2nd Officer Report Sets	ALPA	Complete
232	5- 5-81	High-alt upset/EWR/LGA/HPN/TEB	B. F. Goodrich	Complete
*233	4- 2-81	NMAC/DB1&2 4/81 and 12/80 [1st ea mo]	NASA/WDR	Continuing
234	5-12-81	All RPTD 8103	FAA	Complete
235	5- 8-81	NMAC data for various arpts	Dalmo Victor	Complete
236	5-18-81	ACR acft fueling problems	KLM	Complete
237	5-29-81	FTIME-AGING	Nat'l Inst/Aging	Complete
238	5-27-81	Flt attendant/adverse wx problems	Crew Systems	Complete

Number	Date	Topic	Requested by	Status
239	6-17-81	Occurrences at DeKalb-Peachtree Arpt	Gold Kist Inc.	Complete
240	6-17-81	Loss of acft control (wet runways)	FAA Tech Cntr	Complete
241	6-17-81	ACR pilot incapacitation occurrences	Flt Safety Found	Complete
242	6-17-81	Headsets vs cockpit speaks (Commprob)	Ozark Air Lines	Complete
243	6-17-81	Alt excur in cruise phase FL290	IATA	Complete
244	6-17-81	Evasive action – PC	NASA Ames (Frank)	Complete
245	6-30-81	Bird strikes/water ingestion	FAA (ACT-320)	Complete
246	7- 7-81	Wake turb with parallel rwys	British Emb. (WDR)	Complete
247	7- 8-81	Interpersonal relationships	ALPA (Jobanek)	Complete
248	6-23-81	Rpts re TAOS or ARTESIA NDB	Brent Silver	Complete
249	7- 9-81	Engine out taxi	NWOrient (Cavill)	Complete
250	7-15-81	Explosive decompression/jet aircraft	Dome Petroleum	Complete
251	7-16-81	Cockpit noise/intracockpit comm	NTSB (TE-10)	Complete
252	7-31-81	Mode-C transponder failure	Mitre Corp.	Complete
253		NMACS-profile dsnts/DEN	NASA Ames (Palmer)	Complete
254	7-29-81	Pilot judgment-SMA and SMT	OSU (Rings)	Complete
255	8- 4-81	Pilot scuba diving/flying	Spokane GADO, FAA	Complete
256	8- 4-81	NMACs/SJC (update)	ALPA, Deeds	Complete
257	8- 3-81	Improp proced/equip fail/INS	Flt Safety Found	Complete
258	8-11-81	NMACs CY77 involving ACRs	FAA Tech Center	Complete
*259	8-13-81	Rpt tally of RPTN, RPTR, OPOR [weekly]	FAA (ASF-300)	Complete
260	8-17-81	Acft lndg/rwys temp closed	FAA (ASF-300)	Complete
261	8-12-81	NMACs/MO CY80/81 (L.A. Basin Arpts)	FAA (AWE-503)	Complete
262	8-13-81	NMACs DB-2 various locs and sits	Naval Safety Cntr	Complete
263	8-21-81	Alt dev: turb/erroneous Mode-C	U. Gas Pipeline	Complete
264	8-21-81	Seaplanes in lakes/rivers	Jones Air, Inc.	Complete
265	8-26-81	Penetration of NTZ/rwy operations	FAA (Kossiaras)	Complete
266	8-26-81	Data re: Bay Area and other arpts	S.J. Mercury News	Complete

Number	Date	Topic	Requested by	Status
267	9- 9-81	Mult engine failures/T-jet engines	FAA (Kossiaras)	Complete
268	9- 8-81	DB-2 rpts involving conflict alert	FAA (Kossiaras)	Complete
269	9-11-81	Rpts re: acft command bases	Airlift Command	Complete
270	9-22-81	Support Task Force w/ASRS Info	E. Gene Lyman	Complete
271	10- 8-81	Correlation-FAA Op Error w/ASRS data	E. Gene Lyman	Complete
272	10-12-81	Alert and Warning Systems/ Dates	Lockheed (Cokely)	Complete
273	10- 6-81	LOFT/other training scenarios	UA (McClone)	Complete
274	10- 9-81	Info on accellerate/stop problems	APA (Gumber)	Complete
275	10-19-81	CTLR-submitted rpts 9/79 and 9/80	FSF (Lyman)	Complete
276	10-19-81	Breakdown, PLT/CTR/ OTH-8-9/80-81	NTSB (Thomas)	Complete
277	10-19-81	All Atlanta region post-strike rpts	Atlanta Journal	Complete
278	10-14-81	Time study of position anomalies	NASA Ames (Foushee)	Complete
279	10-26-81	ATC problems at MSY, LA	McGlinchey, et al.	Complete
280	10-26-81	Tire failures in large ACR acft	Hogan	Complete
281	10-20-81	Blackout on T/O in 2-engine jet ACRs	Boeing Airplane	Complete
282	10-26-81	All rpts for 9/80-81	FAA (Kossiaras)	Complete
283	11- 3-81	All rpts supporting AB 81:24	FAA (Kossiaras)	Complete
284	11- 5-81	NMACs: 8-10/80-81-GA/ACR involvement	Meyers	Complete
285	11-12-81	Rwy excursions on lndg or T/O w/ACRs	ALPA (Edmunds)	Complete
286	11- 4-81	NMAC data	NASA (Reynard)	Complete
287	11-13-81	Rpts involving missed apchs or GARs	Crew Systems	Complete
288	11-17-81	NMAC and other data	Wash. GAO (Henry)	Complete
289	11-18-81	NMAC comparison data pre/post strike	CBS, Chicago	Complete
290	11-30-81	Rpts and ABs re Cannon Falls Gate @ MSP	Minneapolis Star	Complete
291	12- 1-81	Conflicts involving ultralight acft	Buschkoetter	Complete
292	12- 7-81	Pressurization probs in Corp turbojets	Esmark, Bolt	Complete

Number	Date	Topic	Requested by	Status
293	12-15-81	Navy acft NMACs near NAS Fallon, NV	Navy Safety Cntr	Complete
294	12- 4-81	Partial panel IFR in GA flying/problems	AOPA (Sheehan)	Complete
295	12-10-81	8008/8010-8108/8110 RPTN, ATC	FSF (Lyman)	Complete
296	12-18-81	Synchronous garble	FAA (ASF-300)	Complete
297	12-15-81	On-Board Weight and Balance Acft System	Sundstrand	Complete
298	12-28-81	ATC problem code/op error rpts	FSF (George)	Complete
299	1- 4-82	Before/after strike data comparisons	Pittsburgh Press	Complete
300	1- 4-82	Comparison of 10/80-81 occurrences	Jack Anderson	Complete
301	1- 4-82	Rptd occurrences involving maintenance	FAA (ASF-300)	Complete
302	1-13-82	DCA related occurrences	NASA (Reynard)	Complete
*303	12-15-81	All rpts by database update [every other Wednesday]	FAA (ASF-300)	Continuing
304	1-13-82	Noise in cockpit/noise abatement	NASA Langley (WDR)	Complete
305	1-18-82	ACR performance probs due to icing	NASA (Reynard)	Complete
306	1-19-82	All rpts having to do with DCA	NTSB (Hastings)	Complete
307	1-19-82	Rwy remaining decisions/ desirability of distance remaining markers at rwys	NTSB (Hastings)	Complete
308	1-20-82	Rpt count/classification – Hay letter	ASRS (Cheaney)	Complete
309	1-18-82	Misreading instruments/ warning resps	FAA, NW (Meyer)	Complete
310	1-25-82	All BOS rpts + all BOS re rwy probs	NASA (WDR)	Complete
311	1-27-82	NMAC near MCAS El Toro	USMC (Hardy)	Complete
312	1-28-82	NMAC data for VAR operations in U.S.	Aspen (GAP)	Complete
313	2- 4-82	NMACs at several NAS locations	U.S. Navy (Moore)	Complete
314	2-12-82	Transport acft in apch-landing phase	ALPA (Edmunds)	Complete
315	2-12-82	Icing/transport acft – air/ground	FAA (ASF-300)	Complete

Number	Date	Topic	Requested by	Status
316	2-12-82	Ground de-icing of acft	FAA (ASF-300)	Complete
*317	2-23-82	Update re ZDV airspace [6 months]	Chief ZDC (Kiss)	Complete
*318	2-22-82	Update post-strike data/WDR statement [3 months]	NASA (WDR)	Complete
319	3- 1-82	NAV Instr. Problems	ALPA (Edmunds)	Complete
320	3-12-82	Weather problems – GA flying	U of Berlin (Niedek)	Complete
321	3-15-82	All rpts re: wake turbulence	CAA (Frazer)	Complete
322	3- 9-82	Pilot course deviations/IFR apch	USAF (Fleming)	Complete
*323	3-22-82	U.S. Coast Guard reports [3 months]	U.S. Coast Guard	Complete
324	3-25-82	Alt dev involving alt alert system	USAF (Bonner)	Complete
325	3-31-82	No. rpts in DB2 re ultralight acft	FAA (Jones)	Complete
326	3-27-82	2-eng MLG pitchup, rolloff, or roll	ALPA (Martinson)	Complete
327	3-31-82	DCA mishaps/2-eng MLG crew stat probs	NTSB (Stoklosa)	Complete
328	3-29-82	3- to 2-man crew transitions and to dual qualification	ALPA (Selph)	Complete
329	3-31-82	NMACs within 30 mi of Williams AFB	USAF (Gaspar)	Complete
330	4- 2-82	All SNA reports	Loyola Law School	Complete
331	4- 2-82	Side windows in simulators	NASA (Haines)	Complete
332	2-15-82	GA/MIL NMACs/Luke AFB/ ABs for area	Major Droke	Complete
333	4- 8-82	Inappropriate pilot resp. to warnings	Harris (Student)	Complete
334	4-12-82	Water/snow/ice on rwys; MAP problems	APA (Blyth)	Complete
335	4-13-82	Acft perf on slippery rwys and inflt opns under icing/snow	NASA HQ (Tobiason)	Complete
336	4-19-82	Wet rwys (see SRs 334 and 335)	NTSB (Thomas)	Complete
337	4-19-82	727s where all engines failed	Grayson (Attorney)	Complete
338	4-23-82	Military acft stalking civil acft	BBC (Fink)	Complete
339	4-26-82	Callback comments re ATC post/strike	FAA, S Region	Complete

Number	Date	Topic	Requested by	Status
340	4-28-82	NMACs in vicinity of Lindbergh Field	SAN TRACON	Complete
341	5- 3-82	ATC involved-ZLA and Edwards AFB RAPCON	Marinis	Complete
342	4-26-82	Post-strike/Ctlr submitted/ ex-sup error	NASA (Reynard)	Complete
343	5- 4-82	Low vsblty apchs w/CAT II or CAT III	ALPA (Edumnds)	Complete
344	5- 4-82	All rpts involving "ACARS"	UA Trng Cntr	Complete
345	5-11-82	All rpts involving LA Center	Marinis	Complete
346	5-11-82	Air/grnd rdo msgs fail due mike	FAA, NW (ANM-505)	Complete
347	4-28-82	Info on non-standard rdo comm	Lewis and Jones, Ltd.	Complete
348	5-14-82	All rpts pertinent to AB 82:12	Mgr MSY arpt	Complete
349	5-11-82	Rpts involving clear air turbulence	Interstate Air	Complete
350	5-19-82	ASRS info on flight crew fatigue	APA (Paty)	Complete
351	5-28-82	Rpts re 8001 re airspace or ATC at SBD, RIV, PDZ, ONT	Norton AFB (Holman)	Complete
352	5-25-82	Airspace being added to ZAB	ZAB (Lansbery)	Complete
353	6- 4-82	Probs in instructional flying/ rapid decompression (GA)	FAA GA News	Complete
354	6- 1-82	Rpts re Vancouver-Seattle area	Cathay Pacific	Complete
355	5-20-82	BUF-IAG, Windsor-Sault Ste Marie Rpts	Transport Canada	Complete
356	4-26-82	VFR in IMC – GA Aircraft	U of Berlin	Complete
357	6-11-82	Specified rpts re fatigue/ automation	NASA (WDR)	Complete
358	6- 7-82	1981/82 rpts re PHX and DEN airports	KOOL Radio	Complete
359	6- 4-82	Hang gliders and ultralights	Glider Rider	Complete
360	6-10-82	Inadvertent thrust reversal in flight	Boeing Airplane	Complete
361	6-10-82	No. of rwy incursion repts	Eastern Air Lines	Complete
362	6-22-82	All NMACs occurring 8205	FAA (Hoch)	Complete
363	6-24-82	TOC/index system used by NOS in instrument apch charts	Aero Chart Div.	Complete

Number	Date	Topic	Requested by	Status
364	6-24-82	Phonetic similar. of identifiers	DOD (Falatco)	Complete
365	6-24-82	Probs. during acrobatic flt-GA/MIL	M. Monroney Aero	Complete
366	6-28-82	DBII NMACS W/I 25nm of PHX and TUS	AZ Task Force	Complete
367	6-29-82	Fatigue; commuter involved accidents	NASA (Lauber)	Complete
368	7- 7-82	High speed turnoff at MCI	ALPA (Martinson)	Complete
369	7- 7-82	Wx related/dispatch info a factor	APA (Hopper)	Complete
370	7-14-82	Rpts re wind shear (DB-2)	ALPA (Martinson)	Complete
371	7-13-82	SJC and SNA – 1979 to present	NTSB (Llorente)	Complete
372	7-15-82	Wx related incidents at MSY	ALPA (Martinson)	Complete
373	7-26-82	MSY/MSY where wx was a factor	NTSB (Borson)	Complete
374	7-28-82	Airline Mgnmnt Policy (AFX, EFX)	Perrow	Complete
375	7-27-82	Use of Capt's Emergency Authority	CMR (Quilty)	Complete
376	7-27-82	Vert sep of acft GE FL290	ACT-220 (Busch)	Complete
377	7-29-82	NMACs in MOAs and other SUA	Wms. AFB (Breedlove)	Complete
378	7-26-82	DB summaries for WDR's Japan briefings	NASA (WDR)	Complete
379	7-29-82	Complex, multiple NMACs at ATL	NASA (Palmer)	Complete
380	8-18-82	Update on rpts involving ULT acft	FAA (ASF-300)	Complete
381	8-20-82	Average NMAC/mo – 1979/80/81	Jim Pope	Complete
382	9- 1-82	Total NMACs (yr and period breakdown)	FAA, Brown	Complete
383	9- 7-82	Rpts involving wind shear alert	FAA (ASF-300)	Complete
384	9- 8-82	Rpts involving wind shear (see SR-370)	ATA, Abbott	Complete
385	9- 8-82	IFR charts probs-cluttered/ confusing	APA, Lafay	Complete
386	8-27-82	Corporate aviation operations	AvInvesti. (Lyman)	Complete
387	9- 8-82	NMACs involving >12,500 lb, prop driven acft	RAA, Collary	Complete
388	9-13-82	Oxygen mask donning problems and depressurization	FAA (ASF-300)	Complete

Number	Date	Topic	Requested by	Status
389	9- 9-82	No. of NMACS in El Toro MCAS vicinity	FAA, Norris	Complete
390	9- 9-82	No. of NMACS in Sacramento vicinity	FAA, Norris	Complete
391	9- 9-82	No. of NMACS in San Diego vicinity	FAA, Norris	Complete
392	9-16-82	Reverse thrust moving away from gate	NASA (WDR)	Complete
393	9-16-82	Spatial disorientation	NASA (CEB)	Complete
394	9-20-82	Probs with apch charts/ procedures	NTSB (Stoklosa)	Complete
395	9-21-82	Human errors w/charts, maps, pubs	FAA (Diehl)	Complete
396	9-22-82	Update to current of SR-256 (SJC)	ALPA (Deeds)	Complete
397	9-21-82	No. of NMACs in San Antonio region	FAA (Smith)	Complete
398	9-14-82	NMACs Civil/Military/ASRS Data Systems	FAA (Brown)	Complete
399	9-24-82	Distribution of primary NMACs by RPTD PRTR	FAA (Hodges)	Complete
400	9-30-82	Live animals carried on freighters	NWO (Speltz)	Complete
401	10- 1-82	ACR crew distracted – result deviations and lack of vigilance using autopilot	ALPA, TWA	Complete
402	10- 5-82	NMACs in vicinity of San Bernardino (Norton AFB)	FAA (Norris)	Complete
403	9-27-82	SJC vcnty NMAC 8110 to present	SJSU (Lee)	Complete
404	10-12-82	DFW or DAL reports since 8110	WFAA TV (VanSant)	Complete
405	10-13-82	Pilot briefing process of FSSs	FAA (Norris)	Complete
406	9-27-82	Power back taxi incidents	NWO (Cavill)	Complete
407	9-30-82	Fuel contamination/ramp and taxi ops	Tenckhoff	Complete
408	10-12-82	Reports involving icing	Austin	Complete
409	10-18-82	Summary – all ctlr rpts since strike	ASRS (Cheaney)	Superseded by SR 413
410	11- 1-82	ACR rpts for study of attribution	NASA (Foushee)	Complete
411	11- 2-82	Conflicts in vcnty of Woodside VORTIC	Navy (Haug)	Complete
412	10-29-82	MIL acft involved in rptd incidents	Sys Res (Hottman)	Complete

Number	Date	Topic	Requested by	Status
413	10-20-82	Investigation categories (5) of followup study of ATC	NTSB (Stoklosa)	Complete
414	11- 8-82	Acft stall warning devices in transport acft	FAA (ASF-300)	Complete
415	11- 8-82	Arpt probs – No. each category/ST/Locid	FAA (ASF-300)	Complete
416	11- 8-82	Stalls in CY 1980–1981	Safe Flt (Blancato)	Complete
417	11-10-82	Typical incidents at joint-use facilities	Co Arpt Comm (Shuch)	Complete
418	11-10-82	Joint use at NUQ, RIV, NKX	NASA (Nunamaker)	Complete
419	11-18-82	ACRs-flt crew disorientation and visual illusions (black hole effect)	Air Lingus (Delany)	Complete
420	12- 9-82	Post-strike referencing ATC training	FAA (Norris)	Complete
421	12- 8-82	No. of OCC behavior factor coded rpts	NASA (CEB)	Complete
422	12- 1-82	Abnormal maneuvers during TOF/climb where surface contamination was present	Boeing (Lautman)	Complete
423	12-13-82	Acft subsystems presented misleading info during IAP or during TOF/climb	FAA (Ross)	Complete
424	12-20-82	Primary rpts on conflicts vcnty SAN	Peat . . . (Lindberg)	Complete
425	12-14-82	HF probs in piloting rotary-wing acft	NASA (Hemingway)	Complete
426	1- 4-83	Loss of braking on wet rwys	Wells	Complete
427	1- 6-83	No. of 81/82 rpts and prim occ by month	FAA (Hodges)	Complete
428	1- 6-83	Rpts re: DFW, DAL, ADS, RBD	Dallas Times	Complete
429	1-13-83	ATC procedural probes – recent 6 months	FAA (McIntyre)	Complete
430	1-13-83	Probs involve twr-like terrain obstruc	FAA (ASF-300)	Complete
431	1-14-83	NMACs involving MIL in MOAs or on MTRs	FAA (ASF-300)	Complete
432	1-17-83	Single eng, WH, GA–fuel contamination	VISTAS (Jennings)	Complete
433	1-21-83	Status differential btwn capt and F/O	U of Miami (Weiner)	Complete
434	1-24-83	Beech Twin/F-4 MAC off Atlantic Coast	FAA (Hodges)	Complete

Number	Date	Topic	Requested by	Status
435	1-26-83	Ambient noise, cockpit visibility, rdo comm	FAA (ASF-300)	Complete
436	1-31-83	Stuck microphones	FAA (Brown)	Complete
437	1-28-83	Aerodynamic stall incidents	NASA (REC)	Complete
438	1-28-83	GA/MIL conflicts w/i 60NM Bishop, CA	Nellis AFB (Braatz)	Complete
439	2- 2-83	Callback remarks re: post-strike ATC perf	FAA (ASF-300)	Complete
440	2- 2-83	Location SJC or SJC Twr cntling fclty	SJ City Hall (Nissen)	Complete
441	1-17-83	Apch charts or procedures ABs/responses	NTSB (Stoklosa)	Complete
442	2-10-83	Pilot judgment – 6 categories	ALPA (Edmunds)	Complete
443	2-14-83	FMN Tower incidents since Jan. 1982	FAA (McIntyre)	Complete
444	2-14-83	NMACs by Operator Class – NC, SC, VA	WPTF (Srpan)	Complete
445	2-14-83	Cockpit callouts on apch	U of Miami (Weiner)	Complete
446	2-24-83	Sidestep maneuver during an apch	USAF (Pettijohn)	Complete
447	2-24-83	Volcanic ash or dust	ALPA (Edmunds)	Complete
448	3- 1-83	Fatigue in GA flying	Vruels Research	Complete
449	3- 3-83	SID/STAR pcdrs significant problem	FAA (Watterson)	Complete
450	3- 1-83	Rotorcraft NMACs	FAA (Billman)	Complete
451	3-10-83	Hazard conditions at 16 terminals	NTSB (Borson)	Complete
452	3-14-83	Rpts to date re: 2 eng, WDB acft	NASA (JKL)	Complete
453	3-14-83	Post QR-12 rpts re: altimeter problems	FAA (ASF-300)	Complete
454	3-11-83	Rpts involving flight crew functions	AA (Mansfield)	Complete
455	3-11-83	Misunderstood alts via air/grnd radio	FAA (Harrison)	Complete
456	3-14-83	Rwy excursions 25/7 and txwy "A" at LAS	ALPA (Martinson)	Complete
457	3-16-83	No. of rpts re: various behavioral keyws	FAA (Tinsley)	Complete
458	3-30-83	26th QR stat profiles, rptr/prim dist, NMACS	FAA (Hodges)	Continuing
459	3-31-83	All rpts referencing auto-flight	ALPA (Edmunds)	Complete

Number	Date	Topic	Requested by	Status
460	4- 8-83	S/O recognition of recovery from incident	ALPA (Arthur)	Complete
461	3-28-83	Statistics re make/model identification	ASRS/AC (Nelson)	Complete
462	3-31-83	PHX area primaries since 8102	FAA (Davis)	Complete
463	4-12-83	Rpts used in CFTT study, plus update	Wilson	Complete
464	4-15-83	1980–82 NMACS by op class, FAA region, state	Engen	Complete
465	5- 2-83	Hang-gliders or ultralights	ALPA (Edmunds)	Complete
466	5- 2-83	Intxn TOF or lndg	ALPA (Edmunds)	Complete
467	5- 1-83	Report/reporter statistics for Athens speech	NASA (WDR)	Complete
468	4-29-83	DCA and DCA Tracon airspace since 8201	Hubbard	Complete
469	4-29-83	Op errors in Center airspace, recent 6 mos	FAA (Throne)	Complete
470	5- 3-83	Primaries where Stickshaker activated	NASA (Tobiason)	Complete
471	5- 3-83	Primaries involving windshear	Nat'l Acad of Sci	Complete
472	5- 2-83	CY82/83 Civ/Mil conflicts near Phoenix MOAs	FAA (Fandrick)	Complete
473	5-10-83	Rpts for cockpit resource mgmnt scenarios	Cavanagh	In progress
474	5-13-83	All PCs W/I 30 NM radius of NUQ	Moffett (Willard)	Complete
475	6- 1-83	ATC probs or arpt/acft probs near SWF	Zane	Complete
476	6- 1-83	Congestion on Unicom freq at uncntld arpts	Goshen (Kurtz)	Complete
477	6- 2-83	NMACs in PHX area	Spear	Complete
478	6-16-83	Update LOFT rpts re: automated cockpit	AA, Mansfield	In progress

APPENDIX H

SUMMARY OF CALLBACK CONTENTS BY ISSUE

Number

1 – *July 1979*
- – Description of ASRS staff and methods; purpose of CALLBACK
- – Announcement of AC No. 00-46B (change in immunity provisions)
- – Brief discussion of Alert Bulletins

2 – *August 1979*
- – Brief articles on Airport Perimeter Security, availability of ASRS reports, crossing altitude phraseology
- – Description of ASRS report processing procedure (including flow diagram)

3 – *September 1979*
- – Discussion of report confidentiality, anonymity, and ASRS security
- – Brief article on propping with no cockpit occupant
- – Article on incorrect clearance readback
- – Reports from observers (non-pilot/controller)
- – Medical problems (anoxia, hypoglycemia, oxygen use)
- – Monitoring incorrect frequencies

4 – *October 1979*
- – Hang glider hazards to other air traffic
- – ASRS procedures – proof of reporting, Alert Bulletins
- – Weather avoidance – 180 degree turns; loss of control in clouds, turbulence
- – Clearance misinterpretation – radio phraseology

5 – *November 1979*
- – Discussion of ASRS report types – statistics
- – Controller trainees – supervision
- – Altimeter setting errors

6 – *December 1979*
- – Winter – cold weather flying
- – Non-radio aircraft – taxi, runway confusion, conflicts
- – Taxiing – improper use of brakes
- – Error admission, lessons learned
- – Military aircraft out of proper area – conflicts
- – Distraction during flight crew meal

7 – *January 1980*
- – Altitude/heading rule – possible conflicts
- – ASRS procedures, Alert Bulletins, response, reactions
- – Further altimeter mis-settings (1 inch errors)
- – Clearance misunderstanding – phraseology

Number

8 – *February 1980*
- Flight check activity – clearance interpretation, readback, climb through occupied altitude
- FAR violations, poor flying judgment
- Reader comments – ASRS staff notes
- Clearance misinterpretations – confusion of words and numbers

9 – *March 1980*
- Return phone calls to reporters ("Callback")
- Reader comment
- "FAA General Aviation News" – recommendation for safety information
- Animals on runways, approach and runway lighting
- Radio procedures, acknowledging transmissions
- Traffic advisories, avoidance vectors
- Landing at wrong airport

10 – *April 1980*
- Flightcrew mistakes, remorse
- Gear up landings, distraction

11 – *May 1980*
- Landings – wrong runway, conflicts
- Radio procedure – phones unplugged
- Communication problems
- Airport name confusion – landing wrong airport
- Clearance acknowledgment – inattention – blocked transmissions

12 – *June 1980*
- ASRS report – need for clarity
- Alert Bulletins
- ASRS reports – confidentiality, security
- PIREPS
- Altitude deviations

13 – *July 1980*
- Reader comments, telephone callbacks
- "FAA World" – ASRS description
- Interpersonal relationships – pilots/pilots, pilots/controllers
- Flight instruction – radio procedure for students

13 – *August 1980* (No. 13 re-used inadvertently)
- Position reports – flight plan handling, readbacks
- Report synopses, analyst comments
- Distraction during flight crew meals
- Box score (ASRS statistics)
- Immunity procedures – ASRS security

Number

15 – *September 1980*
- "FAA General Aviation News" – See and Avoid, TCA, TRSA, conflict
- Blocked transmissions
- Other safety publications – conflicts, schedule pressure, bird strike
- Report extracts – miscellaneous comments
- Airspeed restriction rules
- Controller "deals"

16 – *October 1980*
- TRSA – Stage III service
- Transponder operating procedure.
- Word/number misunderstandings – altitude/heading, etc.
- Reader comments – various safety issues

17 – *November 1980*
- Altimeter errors – review and update of 1 inch problem
- ATIS misunderstandings, errors, automation
- Reader comment
- ASRS database discussion, research, search requests, Alert Bulletins
- Takeoff – gross weight computations, errors

18 – *December 1980*
- Airline flight crew bulletins, "FAA General Aviation News," emergency frequency
- TRSA – negative Stage III
- TCA – noncompliance – LTSS
- Reckless flying – unprofessional attitude
- Recognition of flight crew error – lessons learned

19 – *January 1981*
- Emergency handling – runaway yaw damper
- Value of incident reporting – information exchange – reports not involving immunity seeking – conflicts, loss of separation
- Altitude deviations – clearance interpretation, readback, conflicts
- Conflicts – incorrect position reporting, clearance interpretations

20 – *February 1981*
- ASRS procedures, immunity, etc.
- Unprofessional behavior – car on runway
- Inadvertent penetration of weather by VFR pilot – controller intervention
- Clearance misinterpretation – phraseology
- Refusal to follow control instructions

21 – *March 1981*
- Control malfunction – emergency – controller perception
- Checklist use – fuel conservation procedures
- ATC – combined problems, training
- Altitude deviation – balloon – FAR

Number

22 – *April 1981*
- – VFR pilot misjudgment of weather
- – Conflict – evasive action
- – Unauthorized runway crossing – clearance readbacks, phraseology
- – ASRS phone callbacks, multiple reports
- – Aviation history excerpt

23 – *May 1981*
- – Altitude deviations
- – Cockpit distraction
- – Taxiway signs and markings
- – Aircraft maintenance logs
- – Radio procedure
- – History excerpt
- – Altimeter setting

24 – *June 1981*
- – Cockpit distraction by passengers
- – Traffic conflict – radio-controlled aircraft in TCA
- – Human factors – causative chain in safety incidents – transponder mis-set
- – Observer report of conflict – negative Stage III
- – Distraction – poor cockpit discipline – conflict

25 – *July 1981*
- – ASRS output contents – Alert Bulletins, quarterly and other reports
- – Flight control failure – commendable emergency handling
- – Controlled flight into terrain – warning systems – GPWS, MSAW

26 – *August 1981*
- – Landings without clearance
- – Transponder operation – mistaken use of highjack code
- – Example of commendable ATC/flight performance, communications, etc.

27 – *September 1981*
- – Crew concept – problem handling with captain away from cockpit
- – Bird strike
- – Discussion of ASRS report distribution – pilot/controller/other
- – Reader response – value of CALLBACK and ASRS report material
- – GPWS incidents
- – Unprofessional conduct – pilot loss of temper
- – Balloons – inadvertent flight in cloud

28 – *October 1981*
- – Party line – monitoring of common frequency
- – Radio discipline – frequency congestion – mididentification
- – Check list of ASRS reports available on request

Number

29 – *November 1981*
- Flight Safety Foundation award to CALLBACK for safety lessons
- Traffic advisories – avoidance vectors – see and avoid
- Conflicts in higher altitudes
- Conflicts – see and avoid – PCA violations

30 – *December 1981*
- Multiples – matching reports of same occurrence from different participants
- Conflicts – evasive action – radio procedure
- Erroneous passenger weight – takeoff problem
- TACAN – DME overloading – proper procedure
- Refusal to comply with ATC instructions
- Pilot disorientation – save by controller vigilance, response

31 – *January 1982*
- ASRS reports – decline in controller reports – safety value in sharing experience through incident reporting
- Problems with careless passengers
- Use of common frequency at uncontrolled airports
- Unprofessional conduct – flight too close to other aircraft
- Radio procedure – clipped, blocked transmissions

32 – *February 1982*
- Approach to wrong runway
- Problems determining pilot in command
- Discussion of ASRS – reported incident types
- Conflict – possible altimeter discrepancies
- Follow up on previous CALLBACK articles
- Illegal low flying
- Necessity to review FAR, AIM, etc.

33 – *March 1982*
- Landing without clearance
- Check Lists – fuel load
- Altimeter setting and reading errors
- Commuter pilot workload

34 – *April 1982*
- Incorrect altimeter setting – 1 in. = 1000 ft again
- "Cruise" clearances
- Distraction during flightcrew meal
- Double engine failure – forced landing on ice
- NMAC – high wing vs low wing
- Emergency entry stripes – jet aircraft doors
- Compound errors – tuning wrong nav. frequency, incorrect position

Number

35 – *May 1982*
- Review of CALLBACK No. 1 – ASRS details
- Traffic pattern misbehavior – GA
- Landings at wrong airports
- Distracting conversation in cockpit – sterile cockpit rule

36 – *June 1982*
- Radio communication at uncontrolled airports
- Landing at wrong (military) airport
- Two NMACs in short time. Unusual light conditions, good controller call
- Widebody aircraft on narrow runway. Possible conflict
- ASRS refresher course continued

37 – *July 1982*
- Electrical fire – lost comm – premature engine shutdown
- Spilled liquids in cockpit
- Radar separation (mouse trapped)
- The Parties to ASRS (FAA, NASA, Community, Battelle)
- 1 in. = 1000 ft once more
- Availability of Report Forms

38 – *August 1982*
- Mil/air carrier conflict – 3 rpts
- GA problems with surface winds
- Accidents that didn't happen – value of incident reporting
- Self analysis of incidents
- Good Grief No. 10

39 – *September 1982*
- Comradeship – Brotherhood of the Air – Imagination
- Traffic pattern conduct – courtesy
- Wind shear – two accounts
- False position reporting – vision obstructed for flight instructors
- Readers' comments – Good Grief No. 11

40 – *October 1982*
- Military/civilian conflicts
- TCA penetration
- Taxi mishap – GA/distraction
- Professional attitude – lessons learned; no excuses
- Watching for shadows
- Good manners and safety

41 – *November 1982*
- Excessive radio conversation; short turn-around time errors
- "Fish" stories: conflicts, need to ask for evasion vectors
- Altimeter setting prematurely
- 1 in. = 1000 ft (continuing series)
- Landing gear pressure switch test (Good Grief No. 12)

Number

41 – Concluded
- Abrupt avoidance maneuver
- Explanation of CAVOK

42 – *December 1982*
- Landings – wrong airport
- 10,000 ft – a critical altitude
- Aircraft parked with engine still running
- Automatic pilot operation – possible stall
- New pilot – observations on FSS and traffic procedures

43 – *January 1983*
- Failure to recognize VOR passage
- Sleeve caught on power lever; blocked reverser action
- Duplicate reports of same incident
- Instrument Flight Plan by non-IFR rated pilots
- Sterile cockpit – single pilot
- Low flight over sporting events, congested areas
- Forgetfulness – examples

44 – *February 1983*
- Accurate position reporting
- Good Grief No. 13 – listening to music while flying
- Altitude deviations – various reasons
- Multiple errors (three strikes)
- Miscellaneous comments – value of reporting to ASRS

45 – *March 1983*
- Importance of numbers in flying
- Early IFR cancellation
- Runway light intensity adjustment
- VFR heading/altitude rule
- Reading CALLBACK
- CG calculations – incorrect aircraft loading
- List of ASRS publications – 26, 27, 28

46 – *April 1983*
- Loss of flight instruments
- Let-down assistance from other aircraft
- Visual Approach – radar service terminated
- Good Grief No. 14
- Traffic pattern conflict – military special/lightplane student
- Troubles with new automated equipment in aircraft
- Distraction examples

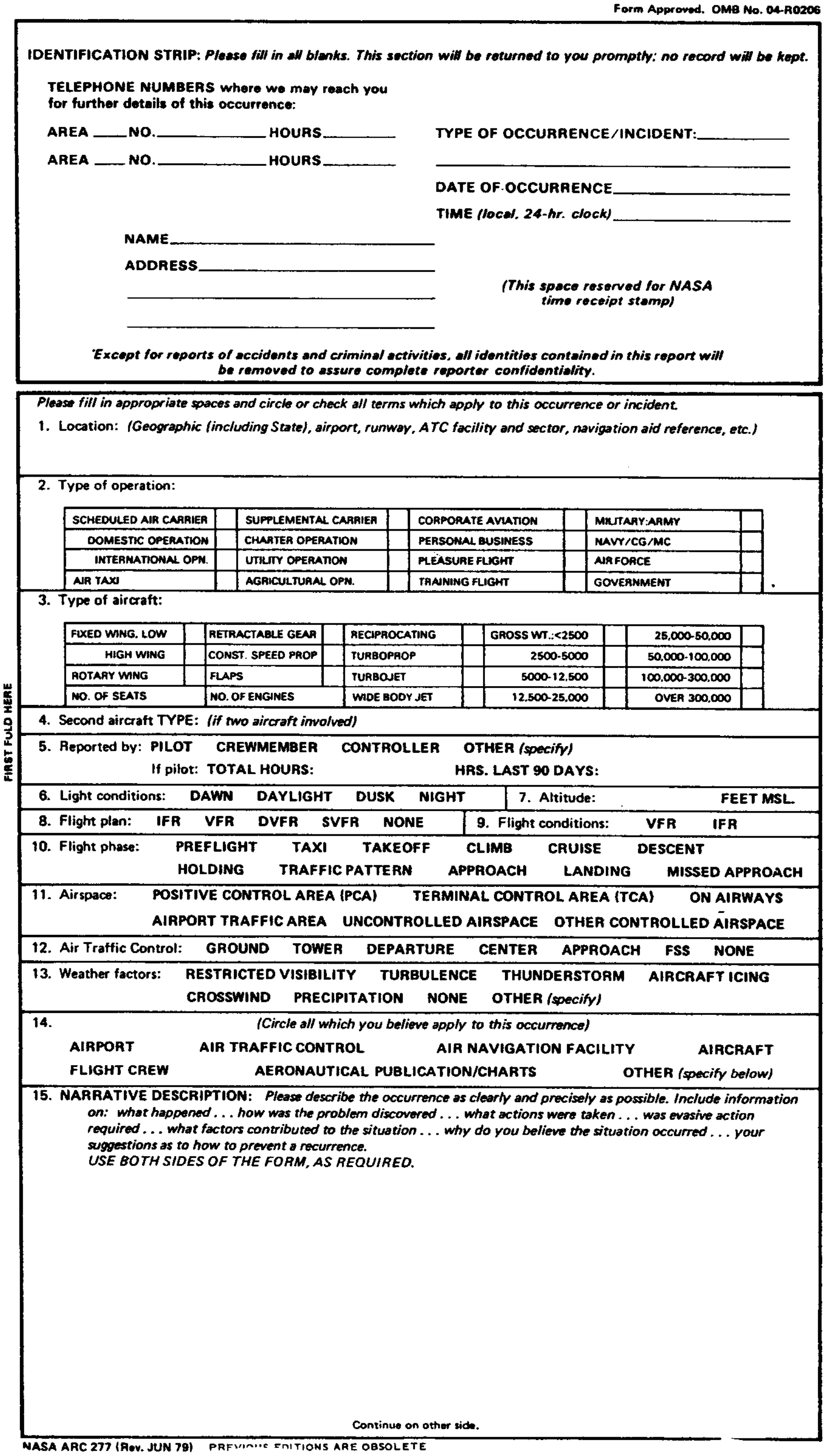
Number

47 – *May 1983*
- Holding pattern problems
- Controller aid to pilots
- Incorrect altimeter settings
- Garbled ATIS
- Addition to publication list

48 – *June 1983*
- M.E.s on list; human factors
- PMS troubles
- ASRS staff resumes

APPENDIX I

ASRS PROMOTIONAL MATERIAL AND FORMS



Form Approved. OMB No. 04-R0206

IDENTIFICATION STRIP: *Please fill in all blanks. This section will be returned to you promptly; no record will be kept.*

TELEPHONE NUMBERS where we may reach you
for further details of this occurrence:

AREA ____ NO. ________ HOURS ______
AREA ____ NO. ________ HOURS ______

TYPE OF OCCURRENCE/INCIDENT: ________

DATE OF OCCURRENCE ________
TIME *(local, 24-hr. clock)* ________

NAME ________
ADDRESS ________

(This space reserved for NASA time receipt stamp)

**Except for reports of accidents and criminal activities, all identities contained in this report will be removed to assure complete reporter confidentiality.*

Please fill in appropriate spaces and circle or check all terms which apply to this occurrence or incident.

1\. Location: *(Geographic (including State), airport, runway, ATC facility and sector, navigation aid reference, etc.)*

2\. Type of operation:

SCHEDULED AIR CARRIER	☐	SUPPLEMENTAL CARRIER	☐	CORPORATE AVIATION	☐	MILITARY:ARMY	☐
DOMESTIC OPERATION	☐	CHARTER OPERATION	☐	PERSONAL BUSINESS	☐	NAVY/CG/MC	☐
INTERNATIONAL OPN.	☐	UTILITY OPERATION	☐	PLEASURE FLIGHT	☐	AIR FORCE	☐
AIR TAXI	☐	AGRICULTURAL OPN.	☐	TRAINING FLIGHT	☐	GOVERNMENT	☐

3\. Type of aircraft:

FIXED WING, LOW	☐	RETRACTABLE GEAR	☐	RECIPROCATING	☐	GROSS WT.:<2500	☐	25,000-50,000	☐
HIGH WING	☐	CONST. SPEED PROP	☐	TURBOPROP	☐	2500-5000	☐	50,000-100,000	☐
ROTARY WING	☐	FLAPS	☐	TURBOJET	☐	5000-12,500	☐	100,000-300,000	☐
NO. OF SEATS		NO. OF ENGINES		WIDE BODY JET	☐	12,500-25,000	☐	OVER 300,000	☐

FIRST FOLD HERE

4\. Second aircraft TYPE: *(if two aircraft involved)*

5\. Reported by: PILOT CREWMEMBER CONTROLLER OTHER *(specify)*
If pilot: TOTAL HOURS: HRS. LAST 90 DAYS:

6\. Light conditions: DAWN DAYLIGHT DUSK NIGHT

7\. Altitude: FEET MSL

8\. Flight plan: IFR VFR DVFR SVFR NONE

9\. Flight conditions: VFR IFR

10\. Flight phase: PREFLIGHT TAXI TAKEOFF CLIMB CRUISE DESCENT HOLDING TRAFFIC PATTERN APPROACH LANDING MISSED APPROACH

11\. Airspace: POSITIVE CONTROL AREA (PCA) TERMINAL CONTROL AREA (TCA) ON AIRWAYS AIRPORT TRAFFIC AREA UNCONTROLLED AIRSPACE OTHER CONTROLLED AIRSPACE

12\. Air Traffic Control: GROUND TOWER DEPARTURE CENTER APPROACH FSS NONE

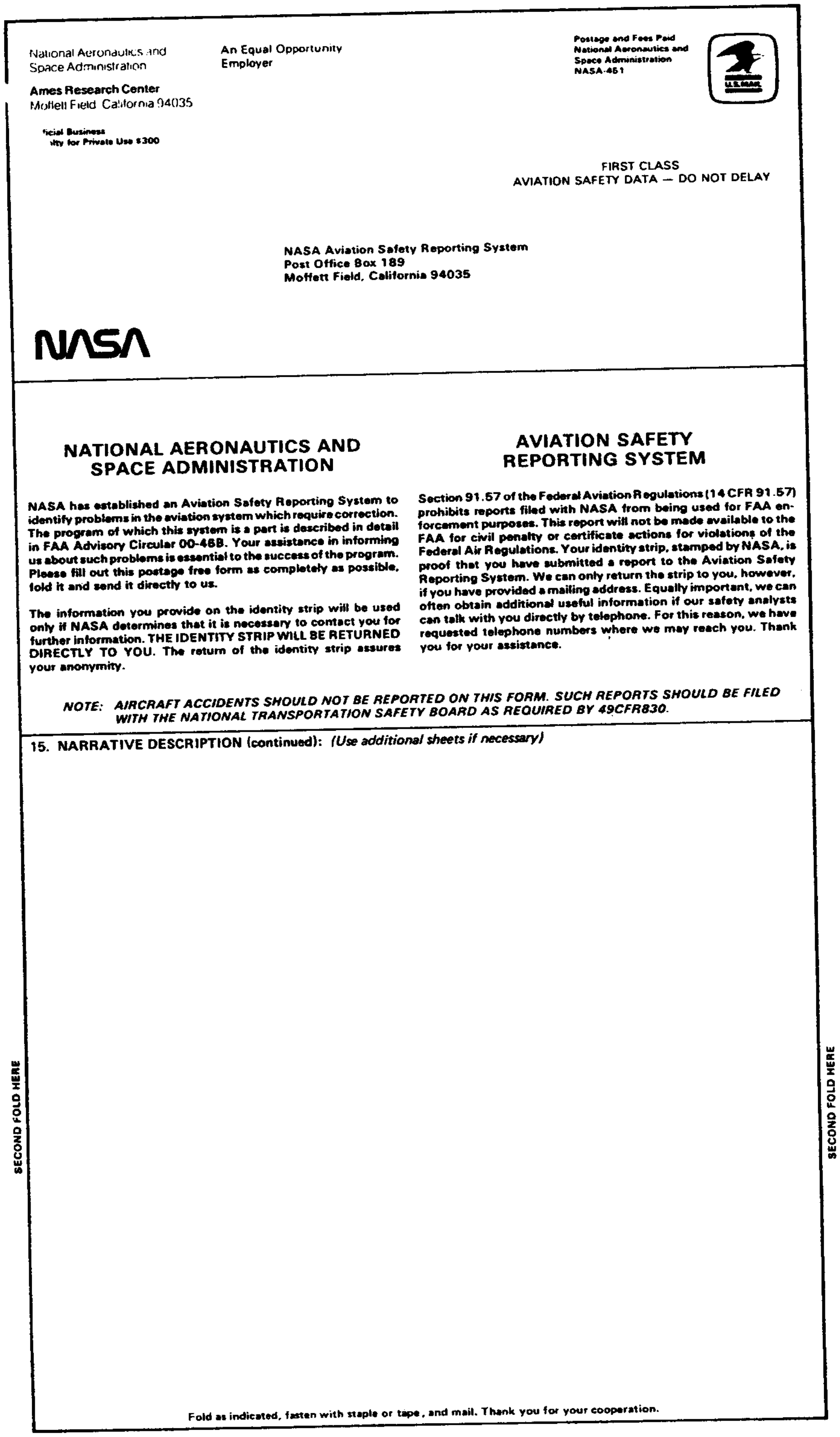
13\. Weather factors: RESTRICTED VISIBILITY TURBULENCE THUNDERSTORM AIRCRAFT ICING CROSSWIND PRECIPITATION NONE OTHER *(specify)*

14\. *(Circle all which you believe apply to this occurrence)*
AIRPORT AIR TRAFFIC CONTROL AIR NAVIGATION FACILITY AIRCRAFT
FLIGHT CREW AERONAUTICAL PUBLICATION/CHARTS OTHER *(specify below)*

15\. **NARRATIVE DESCRIPTION:** *Please describe the occurrence as clearly and precisely as possible. Include information on: what happened . . . how was the problem discovered . . . what actions were taken . . . was evasive action required . . . what factors contributed to the situation . . . why do you believe the situation occurred . . . your suggestions as to how to prevent a recurrence.*
USE BOTH SIDES OF THE FORM, AS REQUIRED.

Continue on other side.

NASA ARC 277 (Rev. JUN 79) PREVIOUS EDITIONS ARE OBSOLETE



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Post Office Box 189
Moffett Field, California 94035

NASA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA has established an Aviation Safety Reporting System to identify problems in the aviation system which require correction. The program of which this system is a part is described in detail in FAA Advisory Circular 00-46B. Your assistance in informing us about such problems is essential to the success of the program. Please fill out this postage free form as completely as possible, fold it and send it directly to us.

The information you provide on the identity strip will be used only if NASA determines that it is necessary to contact you for further information. THE IDENTITY STRIP WILL BE RETURNED DIRECTLY TO YOU. The return of the identity strip assures your anonymity.

AVIATION SAFETY REPORTING SYSTEM

Section 91.57 of the Federal Aviation Regulations (14 CFR 91.57) prohibits reports filed with NASA from being used for FAA enforcement purposes. This report will not be made available to the FAA for civil penalty or certificate actions for violations of the Federal Air Regulations. Your identity strip, stamped by NASA, is proof that you have submitted a report to the Aviation Safety Reporting System. We can only return the strip to you, however, if you have provided a mailing address. Equally important, we can often obtain additional useful information if our safety analysts can talk with you directly by telephone. For this reason, we have requested telephone numbers where we may reach you. Thank you for your assistance.

NOTE: AIRCRAFT ACCIDENTS SHOULD NOT BE REPORTED ON THIS FORM. SUCH REPORTS SHOULD BE FILED WITH THE NATIONAL TRANSPORTATION SAFETY BOARD AS REQUIRED BY 49CFR830.

15. NARRATIVE DESCRIPTION (continued): *(Use additional sheets if necessary)*

SECOND FOLD HERE

SECOND FOLD HERE

Fold as indicated, fasten with staple or tape, and mail. Thank you for your cooperation.

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035

NASA

Reply to Attn of: LMS:239-3

TO: Reporters to the Aviation Safety Reporting System

FROM: The ASRS Staff

SUBJECT: Your Recent Report to ASRS

Thank you for your recent safety report. It has been carefully evaluated by our analysts and has been entered in the ASRS database. Your contribution will be available to assist in ongoing safety studies. All identifying material was removed from your report and we are returning your identification strip with this letter. It is most important that you retain the strip as proof that you have submitted a report to ASRS; we have retained no information regarding your identity.

The Aviation Safety Reporting System and the rules applicable to reports submitted to the program are described in FAA Advisory Circular 00-46B. This publication, along with a reporting form, was sent to all active airmen in July, 1979 and is available in all FAA field offices. The FAA may investigate possible violations which it learns about from a source other than ASRS. Your submission of a report gives you certain rights in such an instance, which are described in the Advisory Circular. You may rest assured, however, that the FAA may not request, and NASA will not furnish, any identified information that could be used in an enforcement action against you.

Your cooperation in support of aviation safety is appreciated.

Sincerely,

William Reynard
bp

William Reynard, Chief
Aviation Safety Reporting System

CALLBACK

Aviation Safety Reporting System

NUMBER 38 AUGUST 1982

JACKPOT

Last month CALLBACK mentioned that rare and welcome windfall, receipt of reports from all participants in an incident, and promised to share the story with our customers. One dot (•) = air carrier Captain; two dots (••) = military pilot; three dots (•••) = Center controller.

• . . . *Traffic was called by Center at 10 to 11 o'clock, approximately 5 miles. The traffic was sighted almost immediately — a military fighter in a near vertical climb. Our route of flight was a descent passing Flight Level 220, to maintain 14,000 feet in a gradual right turn to intercept the localizer and proceed inbound. We diverted further right — 30° angle of bank — while continuing our descent, to avoid the fighter. He, meanwhile, had reached a peak in his vertical climb and had begun a descending right hand turn back toward us. We, in turn, made a reversal turn to the left to maneuver ourselves behind and below the fighter. Its flight path . . . climb, peak, and descending turn . . . was a converging course despite our maneuvering to get out of his way. At the nearest point of closure the fighter came within less than half a mile of our aircraft, at FL 190, passing over and in front of us . . .*

•• . . . *preparing to return to base. Enroute we proceeded to practice confidence maneuvers, commencing at 13,000 and terminating at approximately 16,000 feet. The procedure is to commence at 300 knots, 45-60° climb, military power by 200 knots, and push over for recovery . . . Technique of power application, pitch angle, etc. does make a difference in total altitude gained during a maneuver. We noted a large air carrier transport in a right, and then a left, bank on our 4th or 5th maneuver . . . We appeared clear for the VFR rules we were under; he appeared to be a thousand or so above and a couple of thousand displaced. We then heard over Guard frequency that the military aircraft squawking 1200 was in PCA. This didn't make any sense to us, as we had been below FL 180 prior and with a good pad of 2000 feet during our practice. Speaking with Center afterward, we were told that we were at FL 189, with the air carrier descending and at FL 192. I don't have any means of proving yea or nay on our altitude at that time; I was watching other instruments as well . . . The air carrier Captain returned my call and indicated, as he had with Center, that he was going to file a NASA report, and that we should also.*

•••. . . *I had a large air carrier transport on descent to land from the North. I observed a 1200 code in his 12 o'clock position about 15 miles at 16,200 feet. On the next update the 1200 code was at FL 189. I thought at first it was a bad readout. The next update was back at 16,000, then next it was up around FL 190. The target was within about a mile or so of the air carrier, so I gave the air carrier traffic on the target. He replied that it was in sight, coming right up at him. I asked if it was a fighter and the air carrier said it was. I got on UHF 243 and broadcast for aircraft operating in the area that it was violating Positive Control Airspace and had traffic in its vicinity, same altitude . . .*

Our thanks to the alert and perceptive controller, to the inadvertently erring fighter pilot, and to the conscientious Captain for giving us these three perspectives on the event. As we said; isn't it nice they all had ASRS Report Forms!

IT'S AN ILL WIND . . .

The wind bloweth where it listeth, and thou hearest the sound thereof, but canst not tell whence it cometh, and whither it goeth. St John (3:8)

Not knowing whence and whither it cometh and goeth can bring thee an unpleasant (and expensive) lesson. Two ASRS pilot reporters from the same rugged and mountainous area:

• *Landing in turbulence at mountain strip. Had a cross wind — change of wind direction. Had too much airspeed but not enough to make a go around. Ran out of airspeed — experience — runway length — at the same time.*

On callback the pilot told our analyst that the landing was made at a mine strip on the side of a mountain, subject to variable winds. The original lineup for approach was into the wind, but when everything settled down it was found that the actual landing was made with a tail wind. Airplane slewed off the runway . . . Oops! Now our reporter has the experience . . .

• *After landing at the cabin I parked my airplane and went down . . . There was no wind so I didn't tie my plane down. While away the wind picked up within five minutes and turned my plane upside down. To prevent this occurrence one should always tie his plane down even if he is going to leave it only five or ten minutes. Very little damage was done . . . A lot of lost time could have been saved by just taking a minute to tie the airplane down.*

Well — probably, and we certainly recommend doing so, but we did tie down once on a deserted strip while we went fishing only to find, on our return, that a small tornado had passed that way, flipping our airplane onto its back — with severe damage. In fact, the only undamaged part was the propellor which, in an effort to leave things tidy, we had positioned parallel to the ground. The tie down lines were still attached to the wing and to the stakes, but the latter had been neatly pulled from the ground. Experience is great . . . But sometimes costly. Those two came, obviously, from GA pilots. Before we leave this general subject we'd like to share a note just received from an air carrier pilot:

While waiting for weather improvement in the runup block, in one of the worst thunderstorm, tornado watch, heavy rain, hail, wind conditions that any of us in our cockpit could remember, we heard the following conversation between the tower and an aircraft on approach:

"Tower, Airline 123, outer marker."

"Airline 123, cleared to land; wind 270 at 21, gusts to 29, heavy rain, hail, severe turbulence below 300 feet, RVR 2000 feet."

"Ah, Roger, Airline 123 is cleared to land — and ah, let us know if it gets any worse!!!"

••••••••••••••••••• BOX SCORE •••••••••••••••••••

REPORTS RECEIVED TO DATE	31,924
REPORTS LAST MONTH	287
FROM CONTROLLERS	33
FROM PILOTS	216
FROM OTHERS	38

AN INFORMAL MONTHLY BULLETIN FROM THE OFFICE OF THE NASA AVIATION SAFETY REPORTING SYSTEM, P.O. BOX 189, MOFFETT FIELD, CALIFORNIA 94035

ACCIDENTS THAT DIDN'T HAPPEN

In a recent discussion of program achievements, NASA's ASRS Chief made a couple of interesting points. ". . . Program participants have expressed the notion that the act of having to organize and express the relevant facts and issues associated with a given event or situation has proved to be an extremely valuable learning experience for the reporter . . . The event analysis and performance critique that takes place at both ends of the reporting process is clearly a significant, but unmeasurable, benefit of the ASRS program."

Continuing, our leader said, "The most obvious, as well as the most undocumentable, category of ASRS achievements is the element of accidents avoided and deaths prevented; it is impossible to document a non-event. However, given the array of research, Alert Bulletins, publications and assistance offered and utilized as a result of ASRS operations, it seems reasonable to assert that the presence and product of the ASRS has prevented accidents and saved lives."

Concerning the first point above, a number of reporters have told us that the necessity to write a clear explanation of an event has, in itself, served as a form of discipline and self-evaluation of underlying causes. The thought that our efforts may have aided some flightcrews to bring their aircraft and passengers home unharmed allows our staff members to feel that our work is useful. In a recent ASRS report a pilot contributes some interesting thoughts:

- *In years past hangar flying was a part of the aviation scene. The exchange of info, problems, goofs, and incidents encountered was a very important educational or alerting factor benefitting all pilots. That situation or opportunity does not exist at the present time due to several factors such as tight schedules and other facts of life. The CALLBACK publication is doing a great job of replacing the free exchange of the type of info normally acquired in the hangar flying of previous years; CALLBACK should be sent to all pilots.*

Maybe we should turn that recommendation into an Alert Bulletin. Fact is, CALLBACK does reach a great many pilots — and controllers, too. It is available for the asking to any pilots or controllers not already on our mailing list. Another comment along this line comes from a Captain whose crew had missed an altitude assignment. They misunderstood their clearance, read back the incorrect assumption — and here we go again: altitude bust . . . Contributing was the controller's failure to correct. Everybody hearing what they expected. . .

- *As an avid reader of and believer in CALLBACK I had always thought, "It can't happen to me!" WRONG!!*

The candor and responsible attitude of these reporters is appreciated. It would interest us greatly to hear from pilots and controllers who feel that some ASRS lesson has, indeed, saved some lives or prevented an accident. Agreed, we can't document a non-event, but reprinting your experiences can help others avoid the same hazard. Confidentiality still holds, naturally, so give us the scoop if we have helped to save your bacon; perhaps between us we can help somebody else.

WHY DID I DO IT?

Those who commence reading from the upper left will have noted the discussion in the adjacent column about the value to an individual of analyzing, criticizing, and then setting down in writing the reasons why an event took place. A report from a relatively inexperienced pilot illustrates:

- *I taxied from the military base Aero Club line to the run-up area. Another aircraft of the same type (but locally based) had led the way for me as I was not familiar with the airport. The two aircraft sat there doing our run-ups. I was finished before the other aircraft. Suddenly I felt a violent rocking motion. The instructor in the other aircraft had gotten out of his plane and was pulling up and down on my wing tip. He then walked to the tail of my aircraft and removed my rudder gust lock. The gust lock is of the "home-made" wood type with a Velcro fastener. During my walk-around pre-flight I had noted the gust lock but forgot to remove it. Nose wheel steering on this plane worked fine during my taxi. While checking free movement of controls I had noted slight stiffness in the rudder pedals. I did turn around, did notice some motion, and continued the checklist. This incident probably developed because (1) I was pressed for time, (2) I was upset by the unusual procedures at this base (pilot must visit WX office and air ops officer in order to get clearance — phone calls not permitted), and (3) I was getting sloppy.*

We'll bet a lifetime subscription to CALLBACK that the wing rocking by the vigilant instructor drove home the lesson that control locks must be removed; of equal importance, our reporter's self examination revealed to him the real causes of this almost mishap: (1) GETHOMEITIS, (2) DISTRACTION, (3) COMPLACENCY. Most of the reports reaching ASRS involve one or more of those factors. Admitting them to yourself will go a long way toward eliminating unsafe occurrences.

GOOD GRIEF — #10

- *Arriving from Southwest with vectors from Approach Control at 8,000 feet. Approximately 10 miles Southwest of the airport a deadheading crew member in the jump seat sighted, through a break in the clouds, a powered glider-type aircraft at our one o'clock position — estimated less than one mile, at our altitude. Momentary sighting due to cloud density. Called traffic to Approach Control — they did not paint it on radar. Weather was estimated 6,000 broken with tops about 10 to 11,000. My estimate — 80% coverage with towering cumulus. Ideal soaring weather!*

Reporter: Captain of wide-body jet. Location: smack over one of our largest metropolitan areas, with TCA top of 7,000. Hazards (among others): to vehicle and its pilot; to wide-body and its passengers and crew (and to other aircraft in neighborhood); to persons and property on ground. Calls to mind a vivid line from a popular ballad of some years back: "Young man, quoth Abdul, has life grown so dull/that you wish to end it so soon?" As the Captain said, it was ideal soaring weather, and no doubt quite beautiful among those spectacular cloud canyons, but . . . As we said, "Good Grief!"

REPORTING TO ASRS IS VALUABLE TO OTHERS — AND TO YOU, TOO

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ttn of: LMS:239-3

MEMORANDUM to Reporters to the Aviation Safety Reporting System

From: William Reynard

Subject: Your recent ASRS Report

Thank you for submitting a report regarding aviation safety hazards you have observed. The situations or conditions you described in your report have been analyzed and considered to be of sufficient importance to warrant the issuance of an ASRS alert bulletin. Our deidentification system does not allow us to retain your name and address, and we are returning your identification strip to you. If you are interested in receiving information about the disposition of this problem, however, we would be pleased to have you return the strip at the bottom of this letter in about 90 days, when we will have received a response to our alert bulletin.

Please retain your identification strip; it serves as proof that you submitted a report to the Aviation Safety Reporting System. We are also sending another report form for your future use. Your assistance in this cooperative effort to improve aviation safety is appreciated.

Sincerely yours,

William Reynard, Chief
Aviation Safety Reporting System

Enclosures:
Identification Strip
NASA ARC Form 277

Name ______________________________ AB# ____________________

Address ____________________________ DATE ____________________

____

____

NASA
Aviation Safety
Reporting System

a voluntary, confidential program

Aviation Safety Reporting System Report Form

The National Aviation System is both efficient and complex. It has an outstanding safety record, but situations and conditions can develop that pose a threat to safety. Pilots, controllers, and others using and working in the system have the best opportunity to recognize and report these problems before someone has an accident.

To provide this capability, the FAA asked NASA to design and run an Aviation Safety Reporting System (ASRS) in support of the FAA Aviation Safety Reporting Program.

The ASRS acts as an early warning system. Safety reports describing problems are submitted by pilots, controllers, and others in the system. Safety information is extracted and sent to those who can do something about the problem—hopefully in time to prevent an accident.

By being the central point for collecting safety reports, ASRS can also detect trends which alert the aviation community to hidden problems. For this reason, each ASRS safety report is considered not only for the information it contains alone, but also for what it contains when compared to all others.

Attached to this pamphlet is a preaddressed, postage paid reporting form. When you encounter a situation that you believe threatens aviation safety, you are urged to complete the form and send it to NASA.

The form is structured to identify specific data regarding the situation. Additional space is provided for you to describe other details.

The report form also provides space for your name, address, and phone number. NASA has found in previous safety analysis projects that valuable information may be found during a conversation between a safety analyst and the person involved in an incident. By talking to you NASA may discover subtle factors that led to the problem.

NASA will return the identification portion of the form to you as quickly as possible—hopefully in the mail within two days. This will let you know that the report was received and that the problem you identified is receiving attention.

ASRS Operation

The operation of ASRS is straightforward. As each safety report is received, it is promptly given to an expert safety analyst. He examines the report and decides whether or not he needs to call you for more information.

If the analyst does call, you can be assured he is an expert in the subject you described in your report. NASA has employed experts in all phases of aviation, including air traffic control, general aviation operations, and airline operations.

When the analyst has obtained the information he believes necessary, he removes the identification portion of the report and mails it back to you. He also removes all other information that could be used later to trace the report back to you or to any other person. NASA calls this step "de-identification".

The analyst then codes the de-identified information and enters it into the ASRS computer. If the problem you encountered poses an immediate threat to aviation safety, pertinent de-identified information is promptly relayed to the FAA so they can take appropriate action to correct the problem.

The ASRS computer is designed to continuously examine the coded information from your report and all others. This allows NASA and the aviation community to discover subtle changes and uncover hidden problems. Also, the effectiveness of corrective actions can be evaluated.

NASA will routinely provide the results of its study of the coded ASRS information to all segments of the aviation community. Additionally, you will see the results of these studies reported from time-to-time in aviation magazines and publications.

Safeguards

The ASRS is a voluntary reporting program. NASA has designed it so that you can report in confidence without being concerned that the information you have provided will be used against you or anyone else. There are only two exceptions to this: (1) criminal activities like hijacking, sabotage, or smuggling; or (2) actual aircraft accidents. NASA has to pass those reports to the proper government officials with all identifying information.

The FAA has taken a number of steps to make the ASRS a meaningful safety reporting system. The three steps of most concern to you relate to what enforcement action FAA might take if there is a possible violation of the Federal Air Regulations (FAR).

First, FAA will never request and NASA will never report if alleged violations of FARs are revealed in a safety report. Second, FAA will never ask NASA the identity of an individual submitting a safety report. And third, for unintentional FAR violations, FAA will not take disciplinary action when a timely safety report has been sent to ASRS.

The FAA will continue to enforce the FAR for intentional acts that threaten safety whether or not an ASRS safety report has been submitted. However, the FAA would have to learn of these acts through means other than the ASRS.

The FAA has sent Advisory Circular No. 00-46A to all certificated airmen. The AC sets forth the policy about ASRS and enforcement action. It should be read if you have questions about the enforcement policy.

In the event of possible enforcement action by FAA, there are two safeguards available to show that you have reported to ASRS. The first is the identity slip that NASA returned to you. It will be date stamped by NASA.

The second is a separate computer file kept by NASA that notes only the date, time, location, and type of incident of each safety report received. An entry will be kept in this file for 45 days after the incident. If FAA believes enforcement action may be appropriate, it asks NASA to check the "45-Day File" to see if a safety report has been submitted. If it has or if FAA does not ask NASA within 45 days of the incident, enforcement action will not be taken except for those intentional acts that threaten safety.

As a final safeguard, NASA has organized a committee of aviation safety experts to advise NASA on the design and operation of ASRS. Within the committee there is a security group that examines ASRS periodically to assure that individual confidentiality is being protected. Members of the security group are associated with AOPA, ALPA, and PATCO. Whether or not you are associated with one of these organizations, your personal interest is their concern.

The Aviation Safety Reporting System is your way to further aviation safety. You use and work in the National Aviation System routinely. You are the first to observe potential threats to safety. A few moments of your time may well save lives.

Don't put yourself in the position of having to say—IF I HAD ONLY REPORTED—

REPORT!

**before
it's
too
late**

REPORT!

before
it's
too
late

NASA
Aviation Safety Reporting System

a voluntary confidential program

APPENDIX J

ANALYSIS OF ASRS COSTS

INTRODUCTION

This appendix summarizes the results of an analysis of the costs BCL incurred during the first 60 months of its conduct of ASRS project operations (April 1976 through March 1981). BCL functioned in the role of contractor to NASA with responsibility for a major share of the activities involved in the design and implementation of ASRS and for essentially all the operational activities carried out after implementation. Throughout both of these phases, NASA provided program direction as well as some operational services, but the costs of these NASA functions were handled separately and are not included in this analysis.

The analytical approach in this study was to (1) identify BCL's functional activities, (2) measure the specific outputs resulting from each activity, and (3) allocate the incurred costs to these functions and outputs. All results arising from this three-step approach are summarized in table J-1.

FUNCTIONAL ACTIVITIES

The table shows BCL's functions which are divided into the two main categories: those associated with the formative period of the program during which ASRS was designed and the design implemented, and those associated with the operation of ASRS. The former, consisting of 14 identifiable function elements, began in April 1976 and was finished, for practical purposes, in May 1978. The latter has really extended throughout the full period but BCL's role in producing operational output (ABs, Program Reports, Technical Reports, and *Callback* bulletins) was not emphasized until after the implementation phase was complete. The operational functions are further subdivided into five program areas and these are broken down into functional elements. The functional elements are described in greater detail in chapters 3, 4, and 5 of this report.

OUTPUTS

The term "output" denotes the tangible and/or measurable products generated during the 60 months by the various functions. An example is the 42 alert bulletins emanating from functional activity 2.2.3. Outputs, however, are not limited to products or accomplishments external to the project. For example, the number of incoming reports analyzed, processed, and entered into the database for future use is considered to be a program output.

The nature of each of the specific outputs counted in table J-1 is readily inferrable from the label applied to the corresponding function. For example, with respect to the 1.1 functions the outputs are defined as:

TABLE J-1.– ASRS FUNCTIONS, OUTPUTS, AND CORRESPONDING COSTS

Program service functions	Output units	Cost-dollars			Cost per unit of output
		Direct	Distributed	Total	
1.0 Design and implement ASRS					
1.1 Design/implementation activities					
1.1.1 Establish operational facilities	1	9,800	3,120	12,920	12,920
1.1.2 Prepare acceptance test plan	1	5,600	1,780	7,380	7,380
1.1.3 Train report analysts	3	15,900	5,060	20,960	6,986
1.1.4 Prepare SOP manual	1	12,200	3,880	16,080	16,080
1.1.5 Conduct ASRS test and evaluation	1	10,000	3,180	13,180	13,180
1.1.6 Select computer terminal	1	2,600	830	3,430	3,430
1.1.7 Acquire computer terminal	1	5,700	1,815	7,515	7,515
1.1.8 Develop database format	1	50,800	16,160	66,960	66,960
1.1.9 Develop software specification	1	23,400	7,445	30,845	30,845
1.1.10 Develop and test software	1	129,830	41,300	171,130	171,130
1.1.11 Conduct major design review	1	16,000	5,090	21,090	21,090
1.1.12 Implement design review results	1	15,500	4,930	20,430	20,430
1.1.13 Analyze program cost effectiveness	1	5,700	1,815	7,515	7,515
1.1.14 Conduct data processing methods study	1	1,200	380	1,580	1,580
Total	NA	304,230	96,785	401,015	NA
2.0 Operation of ASRS					
2.1 Create ASRS database					
2.1.1 Log in incoming reports	9,791	5,000	1,590	6,590	.67
2.1.2 Review incoming reports	24,536	208,500	66,325	274,825	11.20
2.1.3 Conduct report followups	3,505	122,500	38,970	161,470	46.07
2.1.4 Deidentify reports	24,860	57,100	18,160	75,260	3.03
2.1.5 Analyze reports	23,814	598,550	190,405	788,955	33.13
2.1.6 Process reports for entry	23,814	367,550	116,905	484,455	20.34
2.1.7 Enter reports into database	23,814	211,470	67,270	278,740	11.70
2.1.8 Log out I.D. strips	9,791	3,000	955	3,955	.40
2.1.9 Destroy original incoming reports	20,632	8,900	2,830	11,730	.57
2.1.10 Maintain database	12,098	433,300	137,840	571,140	47.21
Total	NA	2,015,870	641,250	2,657,120	NA
2.2 Alert Bulletins					
2.2.1 Consult on/generate ABRs	914	45,700	14,540	60,240	65.91
2.2.2 Maintain AB status file	895	5,200	1,655	6,855	7.66
2.2.3 Issue ABs with NASA approval	42	1,000	320	1,320	31.43
Total	NA	51,900	16,515	68,415	NA
2.3 Quick response information					
2.3.1 Process special requests	185	212,450	67,585	280,035	1,514
Total	NA	212,450	67,585	280,035	NA
2.4 Major technical studies					
2.4.1 Conduct research planning including workshops	2	55,600	17,685	73,285	24,428
2.4.2 Support NASA database use	—	5,900	1,875	7,775	—
2.4.3 Conduct major analyses	32	835,250	265,705	1,100,955	34,405
2.4.4 Prepare routine/special reports	21	106,950	34,020	140,970	6,713
2.4.5 Prepare quarterly reports for NASA printing	4	10,800	3,435	14,235	3,559
2.4.6 Print/distribute major technical reports	2	5,900	1,875	7,775	3,888
2.4.7 Distribute reports for review	6	3,800	1,210	5,010	835
2.4.8 Maintain reports distribution lists	1	1,300	415	1,715	1,715
Total	NA	1,025,500	326,220	1,351,720	NA
2.5 Educational activities					
2.5.1 Deliver technical papers	10	17,900	5,695	23,595	2,360
2.5.2 Generate educational publications	7	15,400	4,900	20,300	2,900
2.5.3 Participate in meetings w/aviation community	14	20,500	6,520	27,020	1,930
2.5.4 Prepare administrative reports for RTAC meetings	3	7,100	2,260	9,360	3,120
2.5.5 Generate CALLBACK	21	37,300	11,865	49,165	2,341
2.5.6 Publish CALLBACK	21	19,000	6,045	25,045	1,193
2.5.7 Maintain CALLBACK distribution list	1	22,200	7,060	29,260	29,260
Total	NA	139,400	44,345	183,745	NA
Total cost of operation	NA	3,445,120	1,095,915	4,541,035	NA
Total cost of program	NA	3,749,350	1,192,700	4,942,050	NA

Function	Output
1.1.1 Establish operational facilities	One facility established
1.1.2 Prepare acceptance test plan	One test plan prepared
1.1.3 Train report analysts	Three analysts trained
1.1.4 Prepare SOP manual	One SOP manual prepared
Etc.	Etc.

COSTS INCURRED

The total cost incurred by BCL in carrying out the ASRS contracts – over the 60-month period – wa approximately $4,942,000. The purpose of the analysis summarized here is to relate these costs in a meaningful way to the different program functions and outputs. At the beginning of the program, the project cos accounting framework was set up in a fashion so as to facilitate such a "functional accounting." This framework served as a valuable input to the cost analysis. In addition, detailed debit summaries showing every individual charge by month were reviewed. Finally the disaggregation of costs in table J-2 was developed.

TABLE J-2.– COST CATEGORIES

Cost category	Cost	Percent
Labor related (a)	$3,564,700	72.1
PBI industries (b)	102,800	2.1
Office lease	105,500	2.1
Telephone	21,600	.5
Furniture	15,000	.3
ADT security system	1,300	—
Copying expenses	40,600	.8
SYCOR terminal lease (c)	18,400	.4
Other purchases	60,700	1.2
Travel expense	160,600	3.3
Special facility usage (d)	431,300	8.7
Cost of facility capital	41,900	.9
Report and Photo	5,600	.1
Stores withdrawals	2,000	.1
Equipment	16,600	.3
Other	65,000	1.3
Fees	288,400	5.8
Total	$4,942,000	100.0

(a) Direct labor expense and related overhead expenses both for Battelle and its subcontractors and consultants on the project.
(b) Magnetic tape transcribing services.
(c) Interactive terminal for use with computerized BASIS system.
(d) Largely computer related charges.

The final step, then, was to distribute these costs between and among the functions listed in table J-1. Where costs could be logically assigned against these functions (Program Services), the allocated costs can be thought of as direct. Where costs cannot be so assigned – inferring that they are too general or, as it were, benefit all functions – they can be thought of as indirect distributions (supporting services). Labor-related and materials costs are combined in the data shown in table J-1.

As shown in table J-2, over 72% of BCL's incurred cost was labor related. The design, implementation, and operation of ASRS required the formation of a sizable project team. This team included, at various times and on both full-time and part-time bases, nearly 100 BCL employees as well as numerous subcontractors and consultants. A listing of all participants is in Appendix A. By March 31, 1981, the team had expended a little over 134 thousand hours on the ASRS project. Over the 60-month period, this is the equivalent of 14 persons working full time.

UNIT OUTPUT COSTS

For each functional area shown in table J-1, the related number of units of output is shown. By dividing the cost by the associated units of output one obtains the unit cost of each output tabulated in the right-hand column of table J-1. These data provide a basis for analyzing how the funds made available were spent in support of program objectives. Rendering judgment about these unit costs is beyond the scope of this study; however, some observations and caveats can be stated.

1. The direct-cost split between development and operational activities after 60 months was 6% and 94%, respectively.

2. For the 23,814 reports entered into the database, the average unit cost of moving them from the review stage to the database was approximately $87. (One can arrive at this figure by summing the total costs of 2.1.2 through 2.1.7, and then dividing this sum by 23,814.) Thirty-eight percent of this is incurred in the analysis phase (2.1.5).

3. The unit cost per computer database analysis was approximately $1,514 (2.3.1).

4. The average unit cost of maintaining each report in the database was about $47.21 for the 52-month,[5] or approximately $0.91 per report per month.

5. The unit cost of each Alert Bulletin consulted on and/or recommended is about $65.91.

6. The ASRS staff conducted 32 major research studies during the 60 months which results in a unit cost per study of approximately $34,405.

7. If the sole purpose of the entire program was to provide the means for issuing Alert Bulletins (and it is not) the fully amortized cost against each such bulletin recommended would have been $5,407.

8. The unit costs of "processing" incoming reports could be misleading. The analysts on the project team who are the ones who perform most of the processing functions have been provided under contracts with small subcontractors. These organizations have very low overhead costs and had other individuals (e.g., BCL employees) been used in these functions instead of the contractors, the costs would have been higher.

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[5] The database did not become operational until the ninth month of the project so the time base for this calculation is 52 months.

APPENDIX K

ASRS STAFF AND ORGANIZATION

The managerial and operational organization of the ASRS program incorporates elements of the following institutions: Offices of the FAA and NASA administrators, cognizant parts of FAA and NASA Headquarters, the Advisory Committee for ASRS, cognizant parts of the NASA Ames Research Center, the operating contractor – BCL, and the aviation community. This appendix describes the relationships among those components and the organization and staffing of each.

RELATIONSHIPS AMONG PRINCIPAL COMPONENTS

Figure K-1 depicts the accountability, responsibility, and information flows among the main components of the ASRS program. The Memorandum of Agreement (MOA), enacted jointly by the FAA and NASA administrators, assigns the entire conduct of the ASRS program to NASA. The cognizant activity at NASA Headquarters is the Controls and Human Factors Program Office in the Office of Aeronautics and Space Technology which provides administration and policy direction to NASA Ames Research Center. At Ames, the program is managed by the ASRS Program Office. This activity, especially created for ASRS, is a component of the Man-Vehicle Systems Research Division under the Office of the Director of Life Sciences.

The MOA provides for NASA's creation of an advisory committee composed of representatives of the major parts of the aviation community including FAA and NASA Headquarters. The advisory committee is charged with oversight of the conduct of the program, policy guidance to NASA regarding the program, and performing and reporting evaluations of the program to the two administrators.

NASA Ames contracted with BCL to provide management, staff, and facilities for the actual operation of the ASRS in a suite of offices separate from but close to Ames. Battelle is responsible, under direction from Ames, for analyzing the incoming ASRS reports (which it receives from NASA), creating and maintaining the computerized database in which the information abstracted from the reports is stored, and producing all the forms of ASRS program output for release to the FAA and the aviation community via NASA.

The aviation community is considered here as being made up of all parts of the operating aviation industry. As a result of program orientation and promotion from the FAA, the advisory subcommittee, and Ames, the community has become aware of ASRS and its benefits and volunteers ASRS reports. The community, in its various parts, then makes use of the program output fed back to it.

The following subsections (tables K-1 and K-2) present more detailed information on the organization and staff of those components as they pertain to the ASRS.

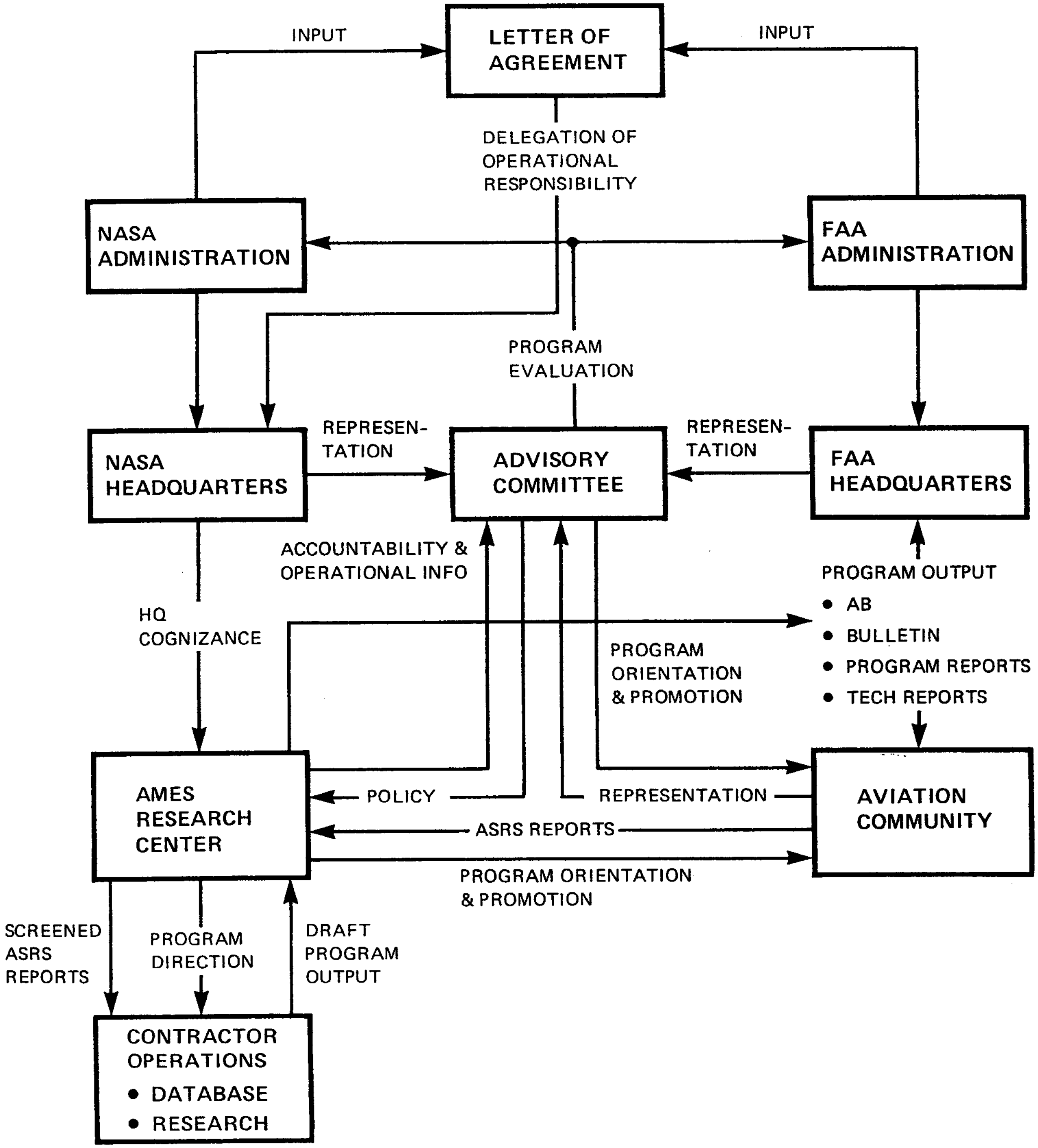

Figure K-1.– ASRS institutional relationships.

TABLE K-1.– U.S. GOVERNMENT PERSONNEL INVOLVED IN OR ASSOCIATED WITH THE ASRS PROGRAM (Titles shown are those during period of contact with ASRS)

James M. Beggs NASA Administrator	Final approval authority for ASRS renewal and renegotiation of Memo of Agreement, 1981–83
Charles E. Billings Chief, Aviation Safety Research Office, Ames Research Center, NASA	ASRS principal investigator and program manager, June 1975 to September 1980
Langhorne M. Bond FAA Administrator	Proposed rescission of "immunity," 1979; action led to negotiation of modified waiver of disciplinary action embodied in FAA Advisory Circular 00-46B
Alan B. Chambers Chief, Man-Vehicle Systems Research Division, Ames Research Center, NASA	Responsible for oversight of ASRS program, 1976–present; has provided active guidance to program since early development period
Raymond S. Colladay Chief, Aerospace Research Division, OAST, NASA	Responsible for NASA aeronautical human factors research, including ASRS, 1981–82. Thereafter, Deputy Associate Administrator for OAST
George Deutsch Chief, Aerospace Research Division, OAST, NASA	Responsible for NASA aeronautical human factors research, including ASRS, 1978–1981
James E. Dow Acting Administrator, FAA	Responsible for activation of FAA Aviation Safety Reporting Program, May 1975, and for "third party" concept involving NASA
James C. Fletcher NASA Administrator	Ultimately responsible for initial approval of ASRS concept, 1975
Charles R. Foster Associate Administrator for Flight Standards, FAA	Oversight of FAA responsibilities in Aviation Safety Reporting Program as Director of Flight Standards
William R. Fromme Director, Office of Aviation Safety, FAA	Management of FAA Office responsible for ASRP and funding for ASRS
Robert A. Frosch NASA Administrator	Ultimate oversight of ASRS during term of office; provided guidance during early development of ASRS
Leonard A. Harris Director, Aerospace Research Division, OAST, NASA	Responsible for NASA aeronautical human factors research, including ASRS, 1982–present

TABLE K-1.– CONTINUED

John Harrison Director, Office of Aviation Safety, FAA	Management of FAA Office responsible for ASRP and funding for ASRS
J. Lynn Helms FAA Administrator	Final authority for approval of ASRS continuance beyond 1982
Edward N. Huff Chief, Man-Machine Integration Branch, Ames Research Center, NASA	Provided guidance to researchers during development of ASRS concept and program
Jack L. Kerrebrock Associate Administrator for Aeronautics and Space Technology, NASA	Oversight of ASRS during period of transition from developmental to operational program
Harold P. Klein Director of Life Sciences, Ames Research Center, NASA	Approval authority for ASRS concept and program in 1975; continuing oversight of program since that time
Thomas Kossiaras Aviation Safety Programs Manager, Office of Aviation Safety, FAA	FAA liaison officer for ASRS since 1979
James J. Kramer Associate Administrator for Aeronautical and Space Technology, NASA	Supported ASRS program continuance during 1979 FAA review of program
John K. Lauber Research psychologist, Man-Machine Integration Branch, Ames Research Center, NASA	Coprincipal investigator for ASRS program, 1975–76, during concept development and initiation of research program
Bascom Lockett Deputy Assistant Administrator for Aviation Safety, FAA	Responsible for FAA ASRP during 1977–1978; provided continuing oversight and guidance during that period
Alan M. Lovelace Associate Administrator for OAST, then Deputy Administrator of NASA	Approved ASRS concept as Associate Administrator for OAST; provided continuing guidance during initial development of program
George M. Lowe Deputy Administrator, NASA	Signed initial Memo of Agreement with FAA in August 1975

TABLE K-1.– CONTINUED

Walter Luffsey Associate Administrator for Aviation Standards, FAA	Ultimate responsibility for all FAA safety programs, including ASRS
E. Gene Lyman Director, Man-Vehicle Technology Division, OAST, NASA	Headquarters NASA program manager for aeronautical human factors; an active participant in ASRS concept and program development, 1975–78
Hans Mark Director, Ames Research Center, NASA; later Deputy Administrator of NASA	As Ames Center Director, approved initial ASRS development plan; provided active guidance to investigators throughout early development period
Duncan McIver Chief, Controls and Human Factors Program Office, OAST, NASA	Responsible for management of NASA aeronautical human factors research, including ASRS
John L. McLucas FAA Administrator	Provided active support of ASRS during period as Administrator of FAA
Melvin D. Montemerlo Manager, Human Factors Programs, OAST, NASA	NASA Headquarters Program Manager for aeronautical human factors research, including ASRS
Hermann Rediess Chief, Avionics, Controls and Human Factors Office, OAST, NASA	Responsible for management of NASA aeronautical human factors research, including ASRS
William D. Reynard Attorney-Advisor, later Chief, ASRS Program Office, Ames Research Center, NASA	Deputy ASRS program manager, 1976–80; program manager, technical monitor and principal investigator, 1980–present
Marion Roscoe Assistant Administrator for Aviation Safety, FAA	Provided active support of ASRS concept in 1975, while still with NTSB; thereafter, responsible for oversight of ASRP and ASRS within FAA
James Rudolph Associate Administrator for Aviation Standards, FAA	Initiated request to NASA for "third party" assistance in implementing a confidential, nonpunitive safety reporting program in 1975
Joseph C. Sharp Deputy Director of Life Sciences, Ames Research Center, NASA	Review authority for initial ASRS concept presentation, 1975; continuing oversight of program since that time

TABLE K-1.– CONCLUDED

C. A. Syvertson Director, Ames Research Center, NASA	As Ames Center Director, ultimately responsible for ASRS program management and oversight
Larry Youngren Program officer, Office of Aviation Safety, FAA	Manager of FAA Aviation Safety Reporting Program, 1975–76; thereafter, acted as FAA liaison officer with NASA during implementation of ASRS

TABLE K-2.– AVIATION SAFETY REPORTING SYSTEM ADVISORY SUBCOMMITTEE

Member	Represents
John H. Winant, Chairman (1975–present)	National Business Aircraft Association
Captain C. W. Blair* (1975–present)	Air Line Pilots Association
Thomas S. Falatko (1975–present)	Department of Defense
Lloyd E. Frisbee (1975–present)	Aerospace Industries Association
Captain Joseph Gumber (1979–present)	Allied Pilots Association
F. Russell Hoyt (1978–present)	American Association of Airport Executives
Thomas P. Kossiaras (1979–present)	Federal Aviation Administration
Ralph F. Nelson* (1975–present)	Aircraft Owners and Pilots Association
Gilbert F. Quinby (1975–present)	General Aviation Manufacturers Association
Captain F. L. Wallace (1975–present)	Air Transport Association-Operations
Dr. Melvin D. Montemerlo (1980–present)	Ex-officio representative of HQ, National Aeronautics and Space Administration
Dr. Charles E. Billings (1975–1980)	Ex-officio member, ASRS Program manager, Executive Secretary (1978–80)
William D. Reynard (1980–present)	Executive Secretary, Aviation Safety Reporting System Program Manager
Robert H. Holt* (1975–1981)	Professional Air Traffic Controllers Organization
Dr. Frank Munley (1975–1979)	Aviation Consumer Action Project
R. J. Masiello (1975–1977)	Air Transport Association-Maintenance
Larry Youngren (1975–1978)	Federal Aviation Administration
Captain James R. LeBel (1978–1980)	Air Transport Association-Training
Bascom Lockett (1978–1979)	Federal Aviation Administration
E. Gene Lyman (1975–1978)	Executive Secretary, HQ, National Aeronautics and Space Administration
Dr. Hermann Rediess (1978–1980)	Ex-officio representative of HQ, National Aeronautics and Space Administration

*Members of the ASRS Advisory Subcommittee Security Group

BATTELLE'S COLUMBUS LABORATORIES ORGANIZATION AND STAFF PERTINENT TO ASRS

Figure K-2 depicts the organization of BCL's ASRS project component. The main purpose of this chart is to show the on-site project staff organization and its working linkages with support groups at the BCL Columbus, Ohio location. The chart is top-truncated at the "General Management Supervisor" position. This supervisor is a BCL unit manager (Transportation System Section) who reports to the Laboratory Director through two management levels (Department Manager, Associate Director).

Figure K-2 is coded to coordinate with the entries in table K-3 showing the staff members occupying the positions.

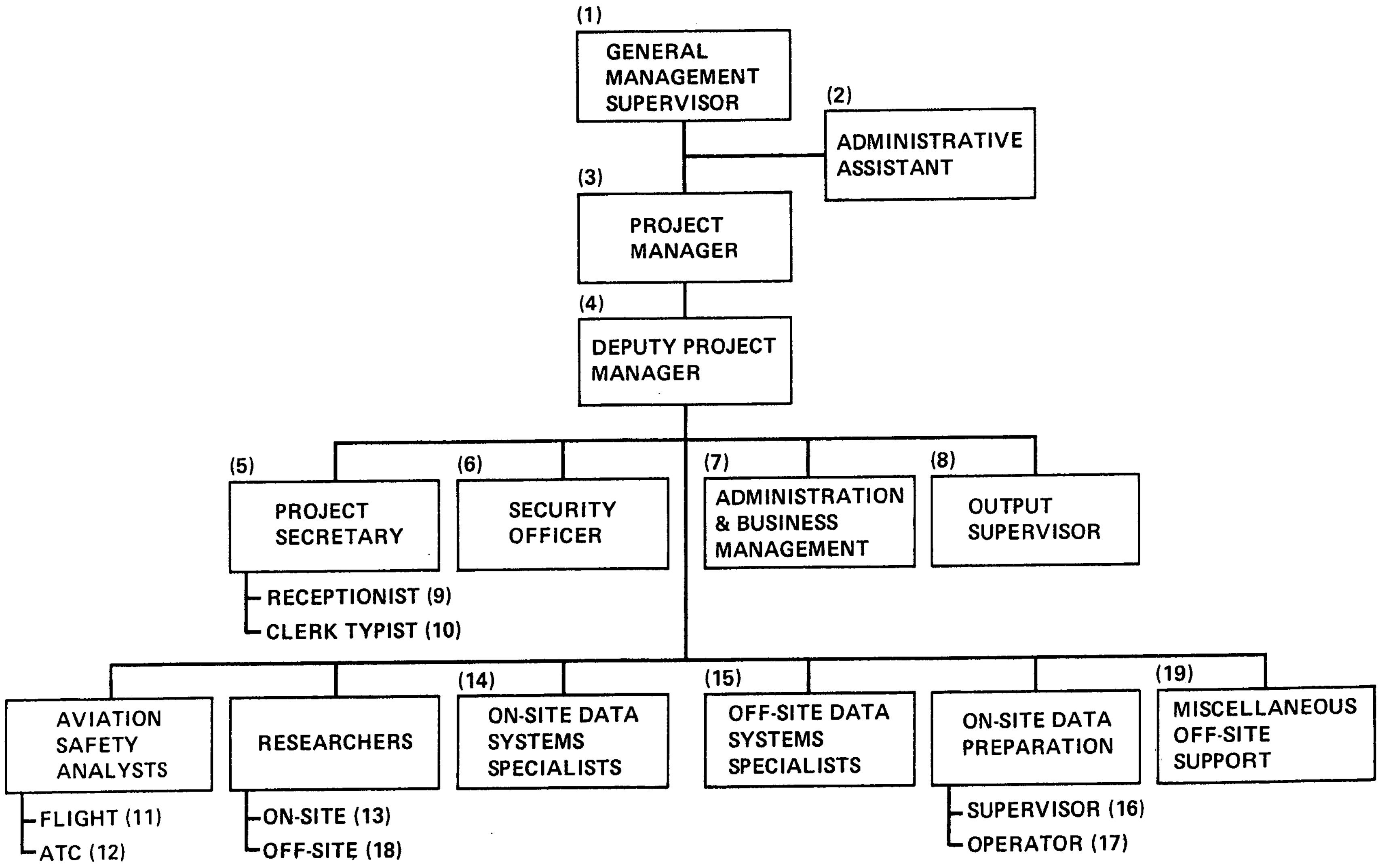

FIGURE IS CODED TO COORDINATE WITH THE ENTRIES IN TABLE K - 3 SHOWING THE STAFF MEMBERS OCCUPYING THE POSITIONS

Figure K-2.– Organization of BCL's ASRS project.

TABLE K-3.– STAFF ASSIGNED TO BCL'S ASRS PROJECT

Position		Individuals filling position			
Chart No.	Position title	Name	Affiliation	Location	Period
1	General Management Supervisor	J. P. Loomis	BCL	OH	4/76 to present
2	Administrative Assistant	N. L. McDaniel	BCL	OH	4/76 to 7/78
		F. N. Searfoss	BCL	OH	8/78 to present
3	Project Manager	R. A. Rogers	BCL	CA	4/76 to 11/77
		E. S. Cheaney	BCL	CA	12/77 to present
4	Deputy Project Manager	D. W. Hall	BCL	CA	9/78 to 5/80
		Rex Hardy	BCL	CA	9/81 to present
5	Project Secretary	D. J. Muenster	BCL	CA	4/76 to 12/76
		R. E. Howes	BCL	CA	1/77 to 4/80
		E. Turner	BCL	CA	4/80
		B. Root	BCL	CA	5/80
		N. Mandella	BCL	CA	6/80 to present
6	Administration and Business Management	J. Davies	BCL	CA	6/80 to present
7	Security Officer	A. Maus	ASA – TASS	CA	4/76 to 9/82
		J. Davies		CA	9/82 to present
8	Output Supervisor	Rex Hardy	BCL	CA	12/78 to present
9	Receptionist	F. L. Teeple	Kelly	CA	8/76 to 9/78
		R. E. Howes	BCL	CA	10/76 to 11/76
		C. M. LoPorto	Kelly	CA	12/76 to 5/77
		C. M. LoPorto	BCL	CA	6/77 to present
10	Clerk Typist	R. Sawyer	BCL	CA	6/79 to 9/79
		P. Bailey	BCL	CA	11/79 to 1/80 5/80 to 8/80
		K. Zaring	BCL	CA	11/80 to 9/82
		R. Howes	BCL	CA	9/80 to 6/81
11	Aviation Safety Analysts - Flight	F. J. Brown	BCL	CA	5/76 to 11/76
		J. C. Dietrich	BCL	CA	11/76 to 6/77
		R. L. Giordano	BCL	CA	7/77 to 9/77
		G. C. Chapman	ASA	CA	6/76 to 4/77
		W. Samuels	ASA	CA	5/76 to 8/77 8/79

TABLE K-3.– CONTINUED

Position		Individuals filling position			
Chart No.	Position title	Name	Affiliation	Location	Period
11	Aviation Safety Analysts - Flight	Thomas Cook	TASS	CA	6/80 to 8/81
		J. P. Thomas	ASA – TASS	CA	6/78 to present
		R. Somers	ASA – Self	CA	6/78 to present
12	Aviation Safety Analysts - ATC	A. Maus	ASA – TASS	CA	5/76 to 9/82
		J. McMeans	TASS	CA	11/78 to 9/81
		A. Severns	TASS	CA	10/78 to present (part-time)
		D. George	ASA – Self	CA	11/78 to present
13	Researchers On-Site	A. W. Hecht	BCL	CA	9/78 to 1/82
		W. P. Monan	BCL – Self	CA	9/78 to present
		S. Jago	BCL	CA	8/80 to 5/82
		R. Grayson	BCL	CA	1/79 to 11/81
		H. Orlady	BCL	CA	1/82 to present
		N. Hennigan	BCL	CA	2/82 to present
		D. Frank	BCL	CA	6/82 to present
		L. Rosenthal	BCL	CA	8/82 to present
		S. Chappell	BCL	CA	6/79 to 4/80
14	On-Site Data Systems Specialists	J. C. Perry	BCL	CA	5/76 to 5/78
15	Off-Site Data Systems Specialists	R. Garmise	BCL	OH	
		W. Welch	BCL	OH	Present
		S. Rischard	BCL	OH	Present
16	On-Site Data Preparation Supervisor	J. L. Davies	BCL	CA	1/79 to present
17	On-Site Data Preparation Operator	J. L. Davies	BCL	CA	1/79 to present
		N. Mandella	BCL	CA	6/80 to present
		K. Zaring	BCL	CA	11/80 to 9/82
		M. Paul	Ampra	CA	3/82 to present
		Various	Kelly	CA	6/79 to 10/80
18	Researchers Off-Site	R. Thomas	BCL	OH	
		G. Lyman	Consultant	OH	10/80 to 4/81
		T. Rockwell	Consultant	OH	11/80 to 6/81
		S. Weislogel	Consultant	OH	10/80 to 8/81
		H. Orlady	Consultant	IL	10/80 to 8/81
		R. Porter	BCL	OH	
		L. Rosenthal	BCL	OH	
		V. Drago	BCL	OH	Present

TABLE K-3.– CONCLUDED

Position		Individuals filling position			
Chart No.	Position title	Name	Affiliation	Location	Period
18	Researchers Off-Site	C. Chapman	BCL	OH	4/77 to 3/82
		R. Cote	BCL	OH	
		M. Hanley	BCL	OH	
19	Miscellaneous Off-Site Support	W. Griffith	BCL	OH	Present
		L. Sander	BCL	OH	Present
		C. Brooks	BCL	OH	Present
		G. Six	BCL	OH	Present
		V. Perry	BCL	OH	Present
		R. Pauley	BCL	OH	Present

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16. Abstract

This reference paper describes the design and development of the Aviation Safety Reporting System (ASRS). The ASRS is a voluntary, confidential, and non-punitive incident reporting program; it is the product of a 1975 agreement between the National Aeronautics and Space Administration and the Federal Aviation Administration. The system was implemented in 1976 and continues to function as both a research and operational resource in behalf of aviation safety.

This report consists of a history of the ASRS, a discussion of the process of acquiring voluntary safety reports, the development of the information processing system, database design, uses of incident data, ASRS products, and lessons learned. The report is supplemented by appendices outlining the ASRS organizational structure, database structure, program cost analysis, promotional efforts, and the products of data analysis and safety research.

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