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NASA Aviation Safety Reporting System: Fourth Quarterly Report

January 15, 1977 - April 14, 1977

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SUMMARY

During the fourth quarter of ASRS operations, 1325 reports were received. A decline in reports concerning small aircraft was noted; more reports involved transport aircraft, professional pilots, instrument meteorological conditions, and weather problems. A study of 136 reports of operational problems in terminal radar service areas was made. Pilot, controller, and system factors were found to be associated with these occurrences. Information transfer difficulties were prominent. Misunderstandings by pilots, and in some cases by controllers, of the policies and limitations of terminal radar programs were observed.

INTRODUCTION

This is the fourth in a series of reports describing the activities of the NASA Aviation Safety Reporting System (ASRS). It covers the period from January 15, 1977 through April 14, 1977, the System's fourth quarter of operation under a Memorandum of Agreement signed on August 15, 1975 by the National Aeronautics and Space Administration and the Federal Aviation Administration.

This report summarizes certain data for the first year of operation of ASRS, but focuses on activities during the fourth quarter. It presents the results of the fourth quarter's work, describes certain studies conducted using ASRS data, and discusses the results of one such study. Appendix A presents examples of alert bulletins disseminated by the ASRS and responses to those bulletins. Many of the bulletins illustrate types of data discussed in the report. Appendix B contains a sample of de-identified ASRS reports that are illustrative of the problems reported to ASRS.

With the exception of certain quarterly and annual statistics, the data in this report cover the period from January 15, 1977, through March 31, 1977. This adjustment has been made in order to convert the System's data processing and reporting activities to a calendar quarter basis. The fifth quarterly report will cover the period from April 1, 1977 through June 30, 1977.

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FOURTH QUARTER REPORT: SUBMISSION CHARACTERISTICS

Report Volume

During the fourth quarter of ASRS operations, 1325 reports were received. This is an increase over the 1249[1] reports received during the third quarter but a decrease compared with the first and second quarters of operation. The mean weekly receipt of reports during the year was 106 with a standard deviation of 32. Total volume through March 31, 1977 was 5268 reports.

Sources of Reports

Air traffic controllers submitted 53% of the reports during the fourth quarter; they had submitted 51% of the reports received during the previous 6 months. Pilots and other aircrew members submitted 46% during both periods.

Callback Actions

Attempts to contact reporters for follow-up were made in 17% of the cases, as in the previous quarter. In 10% of the cases, telephone contact was established; letters were used to contact 4% who could not be reached by telephone.

FAA Queries of Incident Identification File

During the fourth quarter, 596 FAA queries were received. This suggests increasing use of the query mechanism to determine whether reports have been submitted to ASRS regarding occurrences for which enforcement action is being considered (table 1). Occurrences on file were again less than 10% of total queries. This proportion has remained relatively constant through the first

TABLE 1.– INCIDENT IDENTIFICATION FILE INQUIRIES

Types of action	Period			Year
	4/15/76-10/14/76	10/15/76-1/14/77	1/15/77-4/14/77	4/15/76-4/14/77
ASRS report volume	2961	1249	1325	5535
Inquiries received	664	513	596	1773
Occurrences in file	61	56	50	167
Positive inquiries, percent of inquiries received	9.2	10.9	8.4	9.4
Positive inquiries, percent of report volume	2.1	4.5	3.8	3.0

[1]Third quarter report volume was incorrectly stated as 1429, rather than 1249 reports, in NASA TM X-3546, page 2.

year of ASRS operation. It is interesting to speculate whether this figure of 10% bears any relationship to the proportion of occurrences in the aviation system which are reported to the System. A study is planned to examine this question.

FOURTH QUARTER REPORTS: CHARACTERISTICS OF OCCURRENCES

Types of Operations

The types of operations in which occurrences were reported are summarized in table 2. As might be expected during the winter months, air carrier operations, corporate and personal business flying, and military operations contributed a greater proportion of reports; the proportion of utility, pleasure, and training flights decreased. A rather sharp decline in air taxi and charter operations (8.6 to 5.8%) was noted.

Flight Plans, Weather

As in the past, over three-fourths of ASRS reports concerned aircraft on instrument flight plans (table 3). Flight conditions at the time of occurrences are shown in table 4. The decrease in visual meteorological conditions seen during the fourth quarter is undoubtedly due to winter weather, manifestations of which were also observed in reporters' comments regarding weather pertinent to their occurrences (table 5). Reports of significant weather factors increased by over 9% during the quarter.

TABLE 2.– TYPES OF OPERATIONS IN OCCURRENCE REPORTS

User category	Period 7/15/76-1/14/77	Period 1/15/77-3/31/77
	Percent of reports received	
Scheduled air carrier[a]	36.1	41.0
Supplemental air carrier	1.7	0.5
Air taxi	5.7	3.5
Charter operations	2.9	2.3
Utility flying	2.2	0.7
Agricultural operations	0.7	0.9
Corporate aviation	8.1	7.8
Personal business flying	7.2	8.1
Pleasure flying	8.5	7.8
Training, all types	10.2	9.8
Armed forces	14.1	14.7
Government, other, and unknown	2.6	2.8

[a]This category was incorrectly reported in the previous quarterly report and caused figures for the other categories to be incorrectly summarized.

TABLE 3.– FLIGHT PLANS FILED

Type of flight plan	Period 7/15/76-10/14/76	Period 10/15/76-1/14/77	Period 1/15/77-3/31/77
		Percent of reports received	
Instrument flight rules (IFR)	65	78	76
Visual flight rules (VFR)	15	19	12
DVFR or SVFR	1	0	0
No flight plan	19	3	12

TABLE 4.– FLIGHT CONDITIONS

Flight conditions	Period 7/15/65-1/14/77	Period 1/15/77-3/31/77
	Percent of reports received	
Visual meteorological conditions (VMC)	78	70
Instrument meteorological conditions (IMC) and mixed IMC/VMC	21	29
Unknown	1	1

TABLE 5.– WEATHER FACTORS IN ASRS REPORTS

Weather factor	Period 7/15/76-1/14/77 (Percent of reports received)	Period 1/15/77-3/31/77 (Percent of reports received)
Restricted visibility	20	18
Precipitation	6	8
Thunderstorm	3	1
Turbulence	2	5
Crosswind	2	2
Haze, fog	1	2
Ice	1	3
Snow	0	1
Ceiling	1	2
Other	2	4
Weather not a factor	63	54

TABLE 6.– AIRCRAFT TYPES IN ASRS REPORTS

Type of aircraft	Period 7/15/76-1/14/77 (Percent of reports received)	Period 1/15/77-3/31/77 (Percent of reports received)
Small aircraft, <12,500 lb	50	40
Medium transport, 12,500–100,000 lb; Heavy transport, 100,000–300,000 lb; Wide-body transport, >300,000 lb	41	53
Military aircraft, all types	7	6
Other aircraft	2	1

Other Characteristics of Reports

A decline in the number and proportion of reports involving small aircraft (<12,500 lb) was noted during the fourth quarter (table 6). This decrease was compensated for by a 12% increase in reports involving transport aircraft. Coupled with this, there was a significant increase in reports involving pilots who reported high flying time, both total and during the last 90 days (table 7).

Another phenomenon of some interest was noted during the fourth quarter. Reports of near midair collisions (estimated miss distance less than 500 ft) comprised 23% of total reports, compared with 25% during the two previous quarters. (The difference is not significant.) Reports in which evasive action was taken or in which there was no time for evasive action, however, declined significantly, from 27% of total reports to less than 15% of reports. It is interesting to note the coincidence of this sharp decline with an increase in the proportion of reports coming from pilots whose recent and total experience is high. One may speculate that pilots with more experience are better able to judge whether evasive action is required. An attempt will be made to determine whether this association is real or apparent.

In summary, the January-March data indicate an increase in report volume over the previous quarter, coupled with relative increases in reports involving

TABLE 7.– FLIGHT EXPERIENCE OF REPORTING PILOTS

Reported hours	Period 7/15/76-1/14/77 (Percent of pilots reporting)	Period 1/15/77-3/31/77 (Percent of pilots reporting)
a. Total flight time		
0–3000 hr	41.5	27.1
>3000 hr	58.5	72.9
b. Recent flight time (90 days)		
0–75 hr	37.3	29.3
>75 hr	62.7	70.7

transport aircraft, professional or at any rate high-time pilots, weather factors, and night and high-altitude operations. All of these are indicative of a probable decline in general aviation small aircraft traffic, probably associated with winter weather. An interesting decline in the proportion of potential conflicts requiring evasive action was noted; this finding is presently unexplained.

Problems Discussed in ASRS Reports

In previous reports (refs. 1, 2, and 3) the use of problem codes to categorize ASRS reports was described; while these codes are only rough descriptors, they are useful as a means of focusing attention on certain categories of problems. The current quarter's data are compared with reports from the two previous categories in table 8.

Examination of the problem codes for the fourth quarter showed increases in the FLC, ACF, and PUB categories. Statistical evaluation indicates that only the increase in reports relating to publications and procedures is significant ($p < 0.05$).

TABLE 8.– DISTRIBUTION OF ASRS REPORTS BY PROBLEM CODE

Problem code	Period 7/15/76-1/14/77	Period 1/15/77-3/31/77
	Percent of reports received	
ATC (air traffic control function)	43.5	40.3
FLC (flight crew function)	22.1	27.2
NAV (air or surface navigation or communications equipment or facility)	8.9	9.1
ACF (aircraft structure or subsystem	2.6	3.9 (n.s.)
APT (airport and subsystems)	5.8	5.2
PUB (publications and procedures)	1.8	3.1 ($0.02 < p < 0.05$)
NMA (potential conflict between aircraft, not assignable to ATC or FLC categories	12.8	10.0
ACC (aircraft accident)	0.7	0.4
OTH (all other classes of problems)	1.7	0.8

ASRS ALERT BULLETINS

Quarterly and cumulative Alert Bulletin statistics are shown in table 9. The number of alert bulletins submitted during the fourth quarter was 93, somewhat above that of previous quarters. During the first year of operation, 312 alert bulletins were submitted, about 5.6% of total report volume. The disposition of alert bulletins is shown in table 10 for the fourth quarter and for the year.

TABLE 9.– ASRS ALERT BULLETINS: PROBLEMS BY CATEGORIES

Category	Quarter: First	Second	Third	Fourth	Year
	Percent of Alert Bulletins Submitted				
Hardware:					
Navigation	10	7	6	13	9
Communication	8	5	8	9	8
Aircraft	3	0	2	3	2
Other	1	0	2	2	1
Software:					
Regualtions and procedures	18	21	26	18	21
Navigation charts	8	12	3	5	7
Computer software	4	2	3	2	3
OAM/FOM	1	0	2	2	1
Liveware:					
Communication problems	11	12	3	7	8
Management problems	6	3	2	7	4
Other	5	3	2	7	4
Environment:					
Airport problems	16	33	29	22	25
Surface hazards	5	0	6	2	3
Airborne hazards	4	0	3	4	3

TABLE 10.– RESPONSES TO ASRS ALERT BULLETINS

Type of action	Current quarter 1/1/77-3/31/77	Year 4/15/76-3/31/77
Alert Bulletins submitted	93	312
Submitted for information only	1	4
No response received to date	25	42
Responses received as of June 15, 1977	67	266
Content of responses received to date:		
Information insufficient to permit investigation of problem	1	12
Information in bulletin incorrect or incomplete	0	6
After study, no system problem found; no action required	16	62
Alert bulletin under investigation	2	20
Investigation complete; action on the problem not within FAA purview	0	2
Action to resolve the problem was in progress when bulletin was received	16	43
Action has been or will be initiated to resolve problem	11	67
Action has been taken and is complete	21	54

STUDIES OF THE ASRS DATABASE

During the fourth quarter of operations, several requests were received for studies of the ASRS database. To the extent possible, these requests were complied with. These studies were concerned with a variety of specific topics; one analytic study of possible general interest is presented in this report.

It should be pointed out again that because the ASRS is a voluntary system, it is not possible to draw any conclusions concerning the incidence or prevalence of any problems in the national aviation system from ASRS reports. Reports submitted to ASRS represent simply the reporter's perception of a particular event, occurrence, or situation.

What can be gained from such reports is an indication of how certain factors in the aviation system are perceived by the persons within that system, and often how those persons respond to such factors. It is not possible, for instance, to determine from these data how prevalent a particular airport marking problem may be; it is quite possible, however, to determine from a small number of reports that a particular marking configuration is misunderstood, not seen under specific circumstances, or confused for something else.

The primary purpose of the ASRS is to assist in understanding some of the reasons for particular occurrences, rather than to place blame for such occurrences. It is in this frame of reference that the following study was performed.

OPERATIONAL PROBLEMS IN TERMINAL RADAR SERVICE AREAS: A REVIEW OF ASRS DATA

Summary

A large fraction of ASRS reports describe occurrences in terminal airspace. Of 136 reports that related to TCA and TRSA operating environments, 70% involved potential conflicts among aircraft. These reports were studied to determine what human and system factors were associated with operational problems in TCA's and TRSA's.

Half of the reports involved primarily non-participating aircraft. One-third involved ATC and controller problems. The remainder involved equipment and airspace design problems.

Pilot problems were often associated with information transfer problems: misunderstood clearances, lack of understanding of TRSA procedures, lack of knowledge of airspace boundaries, or ATC equipment and system limitations.

Controller problems were more often related to deficiencies in coordination or to incorrect actions. High workloads, unfamiliarity, and misunderstandings on the part of both controllers and pilots were contributory factors.

Airspace design appeared to be associated with pilot behavior in a number of instances, particularly in areas where such design is constrained by a variety of other environmental factors.

Equipment factors were most often related to the inability of ATC radar to provide consistent information on non-transponder equipped aircraft. ARTS failures were also associated with problems, especially when the failures were subtle ones.

ATC procedures and policies were associated with two types of problems. One relates to control of VFR aircraft at altitudes below ATC minimum vectoring altitudes. Under certain circumstances, pilots of such aircraft cannot maintain terrain and obstruction clearance off published routes and still adhere to ATC instructions. Another more insidious problem relates to misunderstanding by pilots, and in some cases by controllers, of the policies, the underlying rationale, and the limitations of terminal radar programs and services. Examples are provided of problems in each of these areas.

Introduction

Early scans of ASRS database entries indicated that a substantial proportion (over 50%) of reports concerned occurrences in terminal airspace. In the first 2300 reports entered in the database, 360 (16%) reported occurrences in Terminal Control Areas (TCA's) or Terminal Radar Service Areas (TRSA's). Examination of these reports showed that many of them did not relate specifically to the TRSA operating environment. Of 136 reports that did relate to the operating environment, however, 95 (70%) involved potential conflicts among aircraft. Fifty (37%) of the reports were concerned with near midair collisions. Because of this, it was decided to conduct a systematic study of the 136 reported occurrences in TCA's and TRSA's, with the intent of determining what human and system factors were associated with problems in this operating environment.

Background

Terminal control Areas and Terminal Radar Service Areas were devised by the Federal Aviation Administration (FAA) in order to provide safer, more efficient traffic flow into and out of high volume terminal areas. Using ARTS-III radar and computational equipment, controllers are able to provide traffic sequencing and separation to all (TCA) or all participating (TRSA) traffic within a defined block of airspace, and thus to assist pilots approaching, transiting, or departing from hub and certain satellite airports. The services available are the same in the two classes of airspace; the main conceptual difference is that use of such services is mandatory in TCA's and voluntary in TRSA's.

The concept of mandatory traffic control in terminal control areas has been subject to criticism, primarily from segments of general aviation, since its beginning in the Atlanta area in 1972. These criticisms have centered on the considerable volume of designated airspace in which pilots must submit to ATC control regardless of weather or traffic conditions at the time. More recently, with the introduction of terminal radar service areas, additional criticisms of awkward and time-consuming air traffic control procedures have been heard from the same segment of the community, as well as from some air carrier pilots trying to minimize flying time and fuel consumption.

On the other hand, the concept of mandatory control in terminal areas has received strong support from pilots of heavy air transport aircraft and from the controllers responsible for terminal radar operations. Air carrier pilots argue, with justification, that the procedures required in large turbojet aircraft simply do not permit even a multi-person crew to adhere to the "see and avoid" concept of air traffic separation, especially in view of the high cockpit workloads imposed by mandatory noise abatement procedures and complex flight patterns in terminal areas. Controllers, faced with heavy concentrations of terminal area traffic during certain hours, also argue with justification that it is simply not possible to cope with large volumes of high-speed traffic in the face of numbers of slow-speed, uncontrolled aircraft in the same airspace. It was believed that examination of ASRS reports might assist in placing these arguments in perspective.

Definitions

TERMINAL RADAR SERVICE AREA: Airspace surrounding designated airports wherein ATC provides radar vectoring, sequencing, and separation on a full-time basis for all IFR and participating VFR aircraft. Service provided in a TRSA is called stage III service . . . Pilot participation is urged but is not mandatory.

TERMINAL CONTROL AREA: Controlled airspace extending upward from the surface or higher to specified altitudes, within which all aircraft are subject to operating rules and pilot and equipment requirements specified in FAR part 91. The radar service provided in TCA's is stage III service, as in TRSA's.

POTENTIAL CONFLICT: As used in this study, any perceived problem related to the risk of airborne collision, from "less than standard separation" to "near midair collision, too close for evasive action."

NEAR MIDAIR COLLISION: As used in this study, a potential conflict in which the estimated miss distance was 500 ft or less, or in which evasive action was required to prevent an imminent midair collision, or in which there was no time for evasive action.

Pertinent portions of the Airman's Information Manual, part 1, and of FAA Handbook 7110.65, Air Traffic Control, are extracted in appendix C of this report.

Approach

Three hundred fifty-six reports coded as having occurred in or adjacent to a TRSA or TCA were examined to determine whether they were in any way related specifically to rules, procedures, and practices of the TRSA operating environment. This determination was made based on the operating rules for Terminal Radar Programs shown in appendix C. One hundred thirty-six reports met this criterion and were selected for further study. Each of these reports was evaluated in detail; pertinent data were extracted and tabulated. Primary enabling factors (ref. 3) were categorized,

TABLE 11.– TYPES OF REPORTS IN SAMPLE

Type of report[a]	No. of reports
Potential conflict between aircraft	95
Operational problem not involving a potential conflict	24
Nonparticipant operation within TCA or TRSA airspace	10
Reports not involving an occurrence	4
Airspace environment problems	2
Miscellaneous occurrence	1
	136

[a]Some reports fell into more than one category; the dominant theme of the report was used in this classification.

TABLE 12.– POTENTIAL CONFLICTS BETWEEN AIRCRAFT

Conflict category	Type of aircraft TCA	TRSA
Near midair collision	22	28
Less than standard separation	21[a]	24

[a]TCA not in use in one case.

TABLE 13.– REPORTED LOCATIONS OF OCCURRENCES

TCA's Location	No. of reports	TRSA's Location	No. of reports
NYC	17	BAL	7
DEN	9	PHX	5
PHL	5	TUS	4
DFW	5	SDF	3
DTW	5	MKE	3
PIT	4	SAN	2
STL	4	DSM	2
MKC	3	GSO	2
CLE	3	SAT	2
MSP	3	OKC	2
LAX	3	FWA	2
LAS	3	SYR	2
SFO	2	Others (each in different locations)	28
ORD	2		
Others (each in different locations)	4		
	72		64

partitioned by report source, and tabulated. Each of the major categories was then examined in further detail in order to discern human and system factors associated with the selected occurrences.

The types of occurrences in the 136 reports varied widely. Table 11 categorizes the reports by type of occurrence or by situation described.

Potential conflicts between aircraft, the largest category, can be further categorized as shown in table 12.

Operational problems not involving a potential conflict were further categorized by the part of the system in which they occurred. Operational problems involving flight crew were cited in 14 reports; problems involving ATC personnel were cited in 10 reports.

The locations of occurrences were tabulated; they are shown in table 13. Occurrences were reported from 18 of 21 TCA's and from 40 of 75 TRSA's. Specific local factors in certain locations are discussed below.

Since this study was initiated and since the computer search was performed in March, 1977, incoming ASRS reports have been studied to determine whether types of problems other than those cited here were being reported. None has been observed, though in some cases further illustrative material has been supplied.

Some examples quoted in the discussion are from later reports, but all tabular data describe only the original sample.

Results and Discussion

Classification of Occurrences– Table 14 shows a general classification of the primary enabling factors believed to be represented in 136 reports. The classification is somewhat arbitrary but provides a focal point for further discussion of the data. Aircraft and pilot factors were primary in 48% of the reports. Controller and ATC factors were believed to be primary in 38% of the reports. The remainder were concerned primarily with equipment and airspace configuration problems. Each of these factors is considered below.

In the 6-month period during which these reports were received, air traffic controllers submitted 51% of all (2961) ASRS reports. Controllers were the source of 43% of the 136 reports considered in this study, a significantly lower fraction ($p < 0.05$). The difference may suggest that

TABLE 14.– CATEGORIES OF PROBLEMS

Factor	TCA	TRSA	Total
A. Aircraft and pilot factors			
1. Entered TCA without clearance	20		
2. Entered TRSA as nonparticipant		26	
3. Canceled IFR in TRSA, refused III		3	
4. Did not adhere to clearance	7		
5. Misunderstood instructions/rules	2	4	
6. Other pilot factor	1	1	
Subtotal	30	34	64 (48%)
B. ATC and controller factors			
1. Handling problem	11	9	
2. Proficiency/training/supervision	2	3	
3. Interfacility coordination	4	2	
4. ATC procedures and policies	6	3	
5. Failed to point out/unable to detect traffic	5	8	
Subtotal	28	25	53 (38%)
C. Equipment factors			
1. Airborne equipment failure/malfunction	4	1	
2. Ground equipment failure/malfunction	3	2	
Subtotal	7	3	10 (7%)
D. Airspace/environmental factors			
1. Boundary/configuration problem	7	2	
Subtotal	7	2	9 (7%)
TOTAL	72	64	136 (100%)

TABLE 15.– PROBLEMS BY TYPE OF REPORTER

Problem	Percent of reports submitted by: Pilots	Controllers
A. Pilot factors		
1. Entered TCA without clearance	14	16
2. Entered TRSA as nonparticipant	15	24
3. Canceled IFR, refused stage III	3	2
4. Did not adhere to clearance	3	9
5. Misunderstood instructions/rules	6	2
6. Other pilot factor	1	2
Substotal	42	55
B. ATC and controller factors		
1. Handling problem	12	19
2. Proficiency/training/supervision	3	5
3. Interfacility coordination	4	5
4. ATC procedures and policies	9	3
5. Failed to point out/unable to detect traffic	15	2
Subtotal	43	34
C. Equipment factors		
1. Airborne equipment	3	5
2. Ground equipment	3	5
Subtotal	6	10
D. Airspace factors		
1. Boundary problems	10	2

flying personnel are more likely to perceive problems in TCA and TRSA operations than are ATC personnel. The factors shown in table 15 were partitioned by reporter category in an effort to examine this point. The results are shown in table 15.

With few exceptions, the data for each of the primary factors do not differ significantly from the overall distribution of reports. There are exceptions, however. Pilots were much more likely to report problems which in their view resulted from a failure to point out conflicting traffic. It should be noted that in some cases traffic may not have been pointed out because targets were not visible on radar. Pilots were also more likely to report occurrences that could be considered indicative of ATC policy or procedural problems. Finally, pilots were more likely to describe problems related to TCA and TRSA boundaries.

Controller reports of pilots' nonadherence to clearances, and pilot reports of misunderstanding of instructions, may be in effect one class of occurrences perceived differently by the two categories of reporters. If the two classes are combined, the distribution by reporter category is almost exactly the same as the overall ASRS report distribution.

Aircraft and pilot factors in occurrences– The most common factors in this sample of reports were entering TCA's without clearances and entering TRSA's as nonparticipants. These factors, together with non-adherence to clearances in TCA's and refusing stage III radar service in TRSA's, were primary factors in 62 occurrences, or in 46% of the sample. These reports were re-examined in an effort to ascertain reasons for the cited behavior. It should be recognized (see appendix C) that participation in radar services in TRSA's is voluntary, whereas it is required in TCA's. The number of potential conflicts in both types of environment suggests that nonparticipation in stage III operations may involve some degree of risk; it is important, therefore, to look for reasons for these occurrences across both subsets of the data.

Table 16 shows a breakout of identifiable enabling factors in these 62 occurrences. It must be noted that the degree of certainty with which a possible enabling factor may be ascribed to an occurrence varies with the detail available in the report; this, in turn, often is a function of who submitted it. Also, though it may be possible to say with some confidence that an occurrence was

TABLE 16.– POSSIBLE REASONS FOR TCA/TRSA OCCURRENCES INVOLVING PILOT FACTORS

Stated or hypothesized reason	Number of reports
Action appears to have been deliberate:	
Reason unknown	19
Unanticipated delay in clearance	3
Subtotal	22 (35%)
Action appears to have been inadvertent:	
Lack of knowledge of system	11
Lack of knowledge of position	3
Lack of comprehension of English	3
Equipment problems	1
Reason unknown	3
Subtotal	21 (34%)
Unknown on basis of available data	18 (20%)
Other reason	1 (2%)
TOTAL	62 (100%)

deliberate, it is usually not possible to say why the action was taken, since the reporter in these cases is often not the person who took the action.

It is believed that 22, or one-third, of these actions were deliberate. In a few TCA reports, it is clear that the reporter simply continued on his course in expectation of an imminent clearance which was not given him until he was well inside the area:

> I attempted to call Cleveland Approach Control as published on charts as I was VFR at 5500 ft. I tried reporting my position at 20 n. mi. from CLE VOR; my transponder was on, squawking mode C 1200. My attempts to contact approach were negated in the heavy traffic. At 15 n. mi. contact was made as I continued on course (060 to Lost Nation) but the controller's hurried response made his requests unintelligible. I was unable to get him to "say again" until approximately 10 n. mi. at which point I was asked to contact 125.35 (an unpublished frequency). This frequency too was jammed and contact could not be made until approximately 5–6 n. mi. at which point I was given a transponder code, and radar contact was made while I was 4–5 n. mi. south of Hopkins, still at 5500 MSL. I was immediately vectored to a heading of 090 to avoid the airport and soon chastised for failure to be in touch with Cleveland while in the TCA. Due to his work load I did not take time to explain . . . that their failure to communicate put me in this predicament.
>
> Looking back, I probably should have altered my course to avoid the TCA, but how can a pilot predict how long it will take . . . to get a clearance?

In a few cases, it is clear that a pilot (usually *not* the reporter) was deliberately circumventing the rules of the system:

> Shortly after turning to the SID heading of 340° we passed directly over the second aircraft. An engine failure shortly after takeoff could have resulted in a collision. The second aircraft was apparently violating the TCA. The Tower did not advise of the aircraft and I presume they were not aware of it. The other aircraft appeared to be flying at about 50 ft above the water, presumably in a deliberate attempt to operate unobserved in the TCA . . .

In 8 of 26 instances in the "TRSA nonparticipant" category the pilot apparently did not wish to utilize radar services, as is his right:

> At about 0124 I was working the north arrival sector at Baltimore Approach Control. Visibility was reported 5 miles with haze, sky partially obscured. I had under my control two air carriers, one of which was acft A. I cleared acft A for an ILS rwy 15R approach; no vectoring was required as he was over a transition fix. As acft A approached the outer marker, I was issuing traffic information to him on a target of his 2 o'clock position at 10 miles. It appeared the targets would merge so I continued issuing the traffic every few seconds. Acft A's pilot stated he had the target when they were less than 1 mile apart and would level off at 3800 ft until clear of traffic. I continued to monitor the target . . . and was able to identify it through Martin Tower . . . I had worked this same aircraft earlier in the shift, southwestbound to Dulles and gave him radar handoff to Dulles Approach. The pilot appeared knowledgeable at the time and I do not know why he did not request radar traffic services on his return trip. I believe this situation occurred because of restricted visibility with haze at night. Also, the practice of the pilot in flying across the approach path at approximately 3000 ft is not, I believe, a wise choice.

In three other cases, pilots of air carrier aircraft entered a TRSA on an IFR flight plan, then canceled IFR and refused further radar services. While they also were within their rights, it should be noted that this can cause serious problems for controllers when it occurs without advance warning:

> Acft A called for landing and was given a heading to put him in a position for a left downwind for runway 01 and was given a descent clearance to 6000 ft when 20 north of SDF. He reported he wanted to proceed VFR and he took it upon himself to descend. I gave him a heading because he was heading down the departure path for runway 01. At this point he was 10 miles north and he advised he was VFR and going to go east of the airport. He was out of 4000 ft and I told him he was about to enter into Bowman's control zone and he was given additional information and departures off the runway. I told him to contact the southeast controller which he ignored. He went to local frequency and continued his descent into the Bowman traffic pattern.

> Greensboro weather scattered clouds 2-1/2 miles visibility. Flight being vectored out of the way of other traffic. Acft requested to be turned toward airport. I told him he was on a heading for it. He asked what number he was for approach. I could not approve the approach. He canceled IFR, refused stage III. I told him Winston-Salem was IFR and asked how he was going to operate. He replied, "VFR, going to Tower." On his first call to Tower, he requested SVFR into the control

zone. He was advised to return to Approach Control for clearance into the control zone. He then reported inside the control zone and was cleared to land . . .

In another case (two such instances have been reported by controllers) an air carrier pilot cancelled IFR and refused further radar services while descending within the boundaries of a TCA. These cases, and others involving TRSA's, have given rise to questions as to how familiar air carrier pilots are with the locations, limits, and operating rules governing these types of airspace:

> Aircraft was on vectors to an ILS rwy 27R at Philadelphia. Apparently, for no reason, the airplane turned westbound and descended below the floor of the TCA. When queried as to his intentions, the pilot stated that he had cancelled IFR and was proceeding visually to the airport. Fortunately he was far enough behind other traffic so that no immediate evasive action was required.

Another problem of nonparticipation in stage III (TRSA) procedures relates to organizations or agencies (located either at hub or nearby satellite airports) that habitually refuse stage III services. This appears to be a particular problem at certain locations:

> Acft A on a training flight from Tucson, Arizona, came within 1/4 mile at the same altitude with acft B departing Davis-Monthan AFB. A government agency has a fleet of aircraft based at DMA. These aircraft do not use stage III service which is available in the Tucson area. Acft A made a low approach at Tucson, rwy 11L, was given a left turn heading 030 to return on a 'stereo' recovery. As acft A was making his turn I saw a target depart DMA and make a right downwind departure. Since this departure was negative stage III, D-M Tower was not required to call the departure to us. Midway between the two airports, the incident occurred. This problem has occurred many times . . .

A serious problem, both in TRSA's and elsewhere, is light aircraft that fly across ILS approach paths at or near the outer marker at or near final approach fix altitude:

> Airline acft over Gilbert locator approaching rwy 5R at Cleveland, altitude 3200 ft, was advised of light acft at 3500, 2–3 o'clock westbound. Weather 5000 broken, 5 miles haze. At 2800 ft traffic was sighted at same altitude at 12:30–1:00 o'clock at 1/2 mile on collision course. Airline pilot executed evasive turn and missed light aircraft by 1000 ft laterally and 100 ft vertically. Airline acft climbed to 3000 ft and was vectored for another approach and subsequent landing . . . the light aircraft was operating in this area without clearance or approval. In my opinion its pilot was not aware he was crossing an approach path to a busy terminal.

> Aircraft B crossing Newark runway 22 ILS final approach course at approximately 2500 ft. We were not advised about this aircraft. If we had been IFR it could have been a bad scene – or even in limited visibility. The weather was CAVU.

Most such aircraft are simply trying to avoid the airport served by the instrument approach, and such approaches are not depicted on VFR charts. The problem is a serious one for air carrier pilots, who are usually attempting to slow to approach speed, perform final checklist items, and establish a stabilized approach at this position. The use of delayed flap procedures and consequent higher body angles increases the difficulty of spotting light aircraft during final approaches.

Uncertainty as to an aircraft's position relative to the DME arc which defines the boundaries of a TCA or TRSA is occasionally cited as the reason for intrusion into terminal airspace. Many general aviation aircraft are not equipped with distance measuring equipment (DME), by which these blocks of airspace are delineated. Landmarks which can serve the same purpose may be difficult to locate:

> The reporter was examining some drainage ditches south of the Houston Intercontinental Airport at about 800 ft AGL. He was well aware of the TCA's 8 DME radius, surface to 7000 ft, and felt he was well outside the confines of the area. For this reason he did not contact the controlling agency. After completion of the inspection, returning home, he believed he would be close to the airport traffic area so he called the Tower to inform them of his position. They asked for his name and address and informed him he had violated the TCA without a clearance. He states that it is very difficult to judge distances at low altitude and that without DME on board it is difficult in such an area as this to evaluate where the exact borders of the TCA are.

A special problem at certain locations in the southwestern part of the United States is posed by pilots whose comprehension of English is extremely limited. These pilots are sometimes not prepared for the complexities of TRSA operations in a language with which they are unfamiliar:

> Subject: Pilot's inability to comprehend English. Acft A called Tower 15 mi south of airport. In accordance with stage III procedures he was told to contact Tucson Approach Control. I observed acft A entering downwind southwest of Tower with no radio contact. He entered downwind approximately 1/2 mile ahead of acft B in the pattern for 11R. Additional traffic was acft C on a right base for 11L. Acft B had to widen his pattern and extend his downwind to avoid acft A. Then acft A turned northeast and paralleled acft C on base for 11L. Acft A was inside acft C preventing him from turning final. I then instructed acft C to make a left 270° turn back onto final behind acft A. Both aircraft flew through the final approach to 11L. Radio contact with acft A was then established 1 mile north of the airport. He was instructed to make a left turn to follow acft C for 11L and did so with no further problems. Two aircraft had to maneuver to avoid him.

It has been shown that in 50 cases in this sample, a common factor was the presence in a TCA or TRSA of an aircraft which for one reason or another was not receiving stage III radar services. The implications of and the reasons for this may be quite different in the two classes of airspace, however.

Terminal control areas are prominently identified on both VFR and IFR charts; separate TCA charts are published and easily available. Rules regarding operation in such areas are codified in Federal Air Regulations and summarized in the Airman's Information Manual. Use of ATC services within TCA's is mandatory for all aircraft. It seems reasonable to believe, therefore, that most pilots are aware to some degree of the restrictions that apply to such areas. Uncontrolled aircraft in such airspace should be rare.

Terminal radar service areas, on the other hand, are not identified on VFR or IFR charts. While they are shown in part 4 of the AIM and their existence has in the past been noted in part 3 under radar services, some of this information for satellite airports has been deleted in the August 16, 1977 edition of AIM part 3. A general section on stage III services is contained in AIM part 1 (see appendix C), but without access to AIM parts 3 and 4, it is difficult for pilots to know whether a given terminal area does or does not provide stage III services.

Further, TRSA's may contain three types of traffic under visual meteorological conditions:

1. IFR aircraft (participants)
2. VFR aircraft (participants)
3. VFR aircraft (nonparticipants)

The information available to ATC about the third category may vary from none (primary target, dimly visible, not communicating) to a good deal (mode C transponder-equipped, intentions known). In this respect, TRSA airspace is exactly like all other low-altitude airspace with radar coverage except TCA's: under VMC, the three categories of aircraft can exist anywhere in terminal or enroute airspace, and radar advisories may be provided to VFR aircraft on request, workload permitting. The only unique feature of the TRSA, then, is that separation from other *known* traffic is provided to participating aircraft. The number of participants may also be greater by virtue of the services offered. But the number of nonparticipants may also be large; as in other controlled airspace, such nonparticipants may or may not be known to ATC.

Controller factors– Problems in air traffic control were believed to be primary factors in 38% of the occurrences examined in this study (table 14. Human factors in this category included handling problems, proficiency, training and supervision problems and interfacility coordination problems; together these were cited as primary in 31 reports (about one-fourth of the sample).

The 31 human factors reports were reexamined in an effort to discern exactly what occurred, and why. Table 17 summarizes the categories of behavior in these occurrences. Table 18 is a summary of possible reasons for the behavior described in the 31 reports. It will be shown that certain of these possible reasons were cited in many other reports as well.

There are many similarities between the elements in table 18 for controllers and those shown in tables 14 and 16 for pilots. High flight crew workloads, particularly during the early phases of departures and the latter phase of high-rate descents, can make maintenance of an adequate visual scan of the environment extremely difficult. Such factors appeared to contribute to some of the problems cited here:

> Ontario weather 12000 scattered, 20000 scattered, 5 miles, smoke, haze. Climbing out on the Prado 6 departure, had a near midair with a VFR (squawking 1400) light twin at 11,000 going eastbound. Communication was with Los Angeles Center at the time and controller said he didn't see it and apologized, as other aircraft was on 1400 code. Near midair was less than 200 ft; evasive action was required. Notes: (1) Prado departure is through one of the heaviest routes of air traffic in the USA. Local VFR, inbound and outbound VFR and IFR traffic into LAX, LGB, SMO, and many others plus military traffic at March AFB. (2) In the 5 minutes after takeoff, besides flying the airplane, this departure required three

TABLE 17.– CONTROLLER FACTORS IN TCA/TRSA OCCURRENCES

Factor	Number of reports	
Information handling:		
Did not note information	2	
Noted information incorrectly	1	
Forgot information	1	
Failure of coordination (information transfer)	9	
Subtotal		13
Actions		
Did not take action	4	
Took incorrect action	9	
Took action late	2	
Failed to ensure separation	3	
Subtotal		18
TOTAL		31

TABLE 18.– POSSIBLE REASONS FOR CONTROLLER FACTORS IN TCA/TRSA OCCURRENCES

Possible reason	Number of reports	
Human factors: controller		
High workload	3	
Inexperience/lack of familiarity	3	
Misunderstanding of stage III service	2	
Forgot pertinent information	2	
Visual misidentification of aircraft	1	
Misunderstood pilot's problem	1	
Subtotal		12
Human factors: coordination		
Transfer of converging traffic	2	
Refused coordination	1	
After coordination, took no action	1	
Subtotal		4
Equipment factors		4
Environmental factors		
Thunderstorms	1	
Pop-up, no time for action	1	
Subtotal		2
Unknown		9
TOTAL		31

radio frequency changes, four changes in heading, and three altitude restrictions; in the meantime, several callouts of conflicting traffic to watch for. Let's simplify these departure procedures!

Similarly, the controller may be placed in a situation of extremely high workload, sometimes with little opportunity to prepare for it. The existence of such situations is recognized both implicitly and explicitly (par. 22a, FAA 7110.65, in appendix C):

> Acft B on ILS 24R, acft A being vectored from south; parallel simultaneous ILS approaches in progress. Acft B should have been level at 2500, acft B at 3500 or above and turned onto the ILS prior to Century intersection to start parallel with 1000 ft vertical separation. Acft A was turned onto 25L from the southeast alongside acft B who was on 24R. Both acft were at 3500. Acft A was 3 miles from acft B not established on the localizer and on a converging course. I issued an immediate left turn to 180° and called traffic. By the time the courses diverged, the two aircraft were about 2 miles apart. Both were inside Century at the turn. The situation could have been alleviated if acft B had been at 2500 and if A was turned on properly. But the person making the turn on was extremely busy and under considerable pressure . . .

Inexperience or lack of familiarity with the environment of equipment can compound problems by increasing an already high workload to the point of saturation. Again, this is seen in both pilots and controllers, and the result is precisely the same in both groups: the person "falls behind"; the ability to visualize the situation in real time and to think ahead of it is temporarily lost:

> At 1707 acft A called me approximately 25 miles northwest of Fort Wayne, VFR, out of 9500 ft descending, with the ATIS information. I initially gave him a descent at his discretion to 3000 ft and instructed him to plan on runway 31. At 1708 acft A requested an IFR clearance to VFR conditions through a cloud layer. I cleared acft A to the Fort Wayne VOR via radar vectors to runway 31. I then asked acft A to report leaving 4500 ft. At 1710 I instructed acft A to maintain 4000 ft and asked his altitude. He reported leaving 8000 ft. The pilot was outside my airspace when I cleared him to descend; I was just becoming familiar with airspace allocations and our new radar environment.

Misunderstanding of the intent, nature, and limitations of stage III service appears to exist in both pilots and controllers. In both groups, such misunderstanding threatens the effectiveness of the service and imposes on the other member of the pilot-controller team the almost impossible task of guessing what the other is going to do next:

> LGA Tower cleared my aircraft to the George Washington bridge following LGA rwy 22 departure, to maintain 1400 ft. Acft B southbound down the river contacted the TCA on the same frequency and was directed to the GW bridge at 1400 ft. Neither aircraft was informed of the other; both were on the same side of the river, and both were presumably in radar contact under the same controller. When I complained about the controller's actions, he replied that the other aircraft was VFR. Acft B was just outside the TCA, entering; I was just inside, departing. Only alertness on the part of both pilots prevented a midair collision . . .

Coordination – the transfer of information – between controllers, and between controller and pilot, is an essential element of terminal radar programs. When such coordination breaks down, whether because of an equipment problem, workload considerations, or a lack of comprehension by one of what the other is saying, the system cannot work correctly:

> Acft A was given left traffic for runway 11L by Tucson Approach Control on stage III radar service. When aircraft called Tucson Tower, the controller told acft A to report abeam the tower on left downwind. Acft A reported abeam the tower but he was in right traffic. Acft A crossed the runways to make right traffic and conflicted with acft B in right traffic. Acft A was changed to rwy 11R. Acft entered short final for rwy 11L with acft C in position and tower controller had to reinstruct acft A to land 11R. Pilot seemed to have difficulty understanding English and what he was instructed to do.

Traffic that is not visible or only dimly visible may not be noticed in the midst of other, more luminous radar targets. "Pop-ups," or primary targets that are visualized only intermittently, were involved in several of the potential conflicts in this sample of reports. In at least one case, the aircraft was equipped with a transponder and encoding altimeter but this equipment was activated only after a conflict occurred:

> Acft A appeared on radar over the outer marker, northbound, primary target. Acft B departed on runway 22. Controller called "pop-up" traffic to acft B. Pilot of acft B sighted the aircraft at approximately the same time. Acft B advised it was close and about head-on at the same altitude. It was a single engine. After both aircraft passed, the unknown traffic turned on his transponder and squawked VFR 1200, mode C. The unknown traffic never contacted approach control . . .

While many of these reports described radar service provided to and point-outs of nontransponder equipped aircraft, there is little doubt that availability – and use – of a transponder, and encoding altimeter if present, appreciably enhances the ability of controllers to provide radar services in terminal areas. This is the case most especially when a pilot transgresses a TCA boundary, or when he chooses to traverse a TRSA as a nonparticipant; in these cases transponder positional and altitude information from the non-participating aircraft provides the controller with invaluable information which he cannot otherwise obtain:

> Acft A, an air carrier, heading 210, was descending from 8000 to 3000 in the approach quadrant 13 miles east of STL for landing runway 30L. I observed a non-identified VFR transponder with mode C indicating 6800 ft approximately 3 to 4 miles in front of acft A. Not knowing whether or not it was a false reply, I started to issue traffic when I noticed the target was picked up by TCA. I immediately advised A of this and noticed he was descending through 7300 to maintain 7000. Not sure that A could level at 7000 I then issued a turn to 180°. The TCA controller instructed acft B to descend to a lower altitude on a northwest heading. Once assured of separation, the operation returned to normal. The VFR aircraft eventually landed at STL and was instructed to call the facility. The pilot advised he had diverted from the east and after receiving ATIS, realized he had penetrated the STL TCA.
>
> Once again, mode C was the initial life-saver. Had the VFR aircraft not had mode C, traffic would still have been issued to A (in most cases, traffic permitting), but no altitude restriction or turn would have been issued because it would have been thought the VFR aircraft was clear of the TCA. Therefore, A would probably have descended into the VFR aircraft. As our first priority under 'Additional Services,' traffic information is issued to all air carriers and other aircraft, time permitting. VFR aircraft squawk 1200 and when in the TCA, a discrete code if under radar control. Aircraft not under control are required to remain outside the TCA . . . This is not always the case. VFR traffic around STL is extremely heavy. Many of these aircraft do not have transponders and some do not even show up on radar . . . Transponder-equipped aircraft, especially those with mode C, make it a great deal easier for controller to see and avoid VFR aircraft, especially if they are violating the TCA. Though the altitudes may not be verified, advisories or control instructions to controlled aircraft can be issued.

Environmental factors: airspace– Many environmental factors are beyond the control of pilots and controllers; they must simply be worked around. An example is thunderstorms; they make provision of radar services appreciably more difficult and were a pertinent factor in several reports in this sample. Some environmental factors, however, can be manipulated; among these is the configuration of airspace allocated for terminal area control.

Airspace configuration determines to a considerable extent the behavior of pilots using the space. The allocation, design and construction of terminal airspace areas may be comparatively simple – when only one airport is being served, when terrain is comparatively flat, and when no large areas of water exist to inhibit the flight of single-engine aircraft – or it may be extremely difficult. Regardless of these factors, however, the design process has a great deal to do with how effectively, and even whether, VFR pilots will utilize and cooperate with the ATC system serving the airspace.

The New York TCA is an excellent if extreme example of the problems that face the airspace designer. It is believed that a substantial fraction of the occurrences reported in this airspace were motivated in part by these problems (fig. 1).

The complexity of the space called the New York Metroplex is caused by many factors, among them the presence of three large and busy air carrier airports and several very busy general aviation fields, the relatively narrow geographic confines of the metropolitan area, and water bounding the area on the east. Virtually all of the low-altitude airspace within the TCA is used to provide even minimally adequate approach and departure corridors for the three carrier airports. Unfortunately, these factors in combination have produced a situation in which there is virtually no overland airspace provided for VFR general aviation aircraft traversing the area from south to northeast or vice versa. The situation is particularly acute for light aircraft enroute to or from satellite general aviation airports on Long Island. When weather conditions permit, these aircraft may utilize a shallow corridor just off-shore, but the use of this airspace poses potential hazards if J. F. Kennedy airport jet traffic is landing on runway 4 (fig. 2):

> . . . The TCA south of JFK . . . is referred to by controllers as area B . . . this area was structured, I am told, so that the General Aviation community can get to and leave Long Island area airports, below the TCA, over land. On the date of this report, I observed 27 such aircraft using this method of transiting the TCA east and west along the south shore of Long Island. Two problems exist, however. First, when traffic is landing on runways 4 at JFK, light aircraft may find themselves less than 1000 ft below a heavy jet inbound to the runways (the outer markers are just in from the shoreline). If the glide slope goes out and we are using non-precision approaches, the margin could be even less. The first problem is a potential conflict if the carrier descends rapidly and the light airplane is a little high . . . the second problem is wake turbulence. Eighty percent of our traffic is heavy jets . . . I suggest that the aircraft using this space be instructed to call Kennedy Tower transiting this area so we can advise them of whether 4L/R are in use . . . this would take the surprise out of the operation . . .

It is also a classic example of an airspace configuration that tends to force a substantial volume of general aviation traffic into a constrained corridor of airspace. Numerous such *de facto* corridors exist, for a variety of reasons. Another in the New York area is the "Hudson River corridor," extending from the surface to 1099 ft. (Its upper bound is imposed, among other things, by the La Guardia runway 13 ILS glide path.) While this corridor is higher, it is only as wide as the river

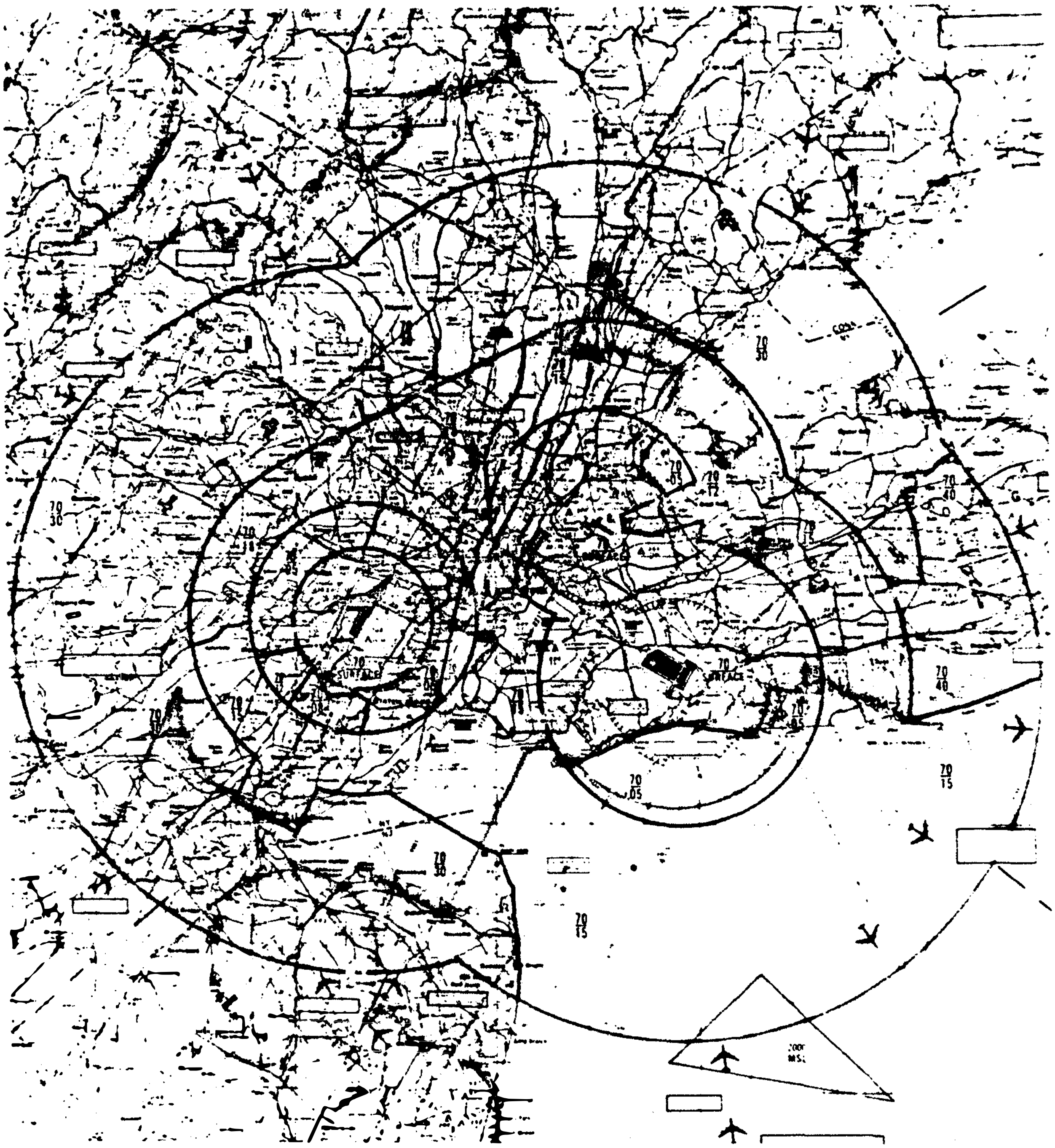

Figure 1.– New York Terminal Control Area.

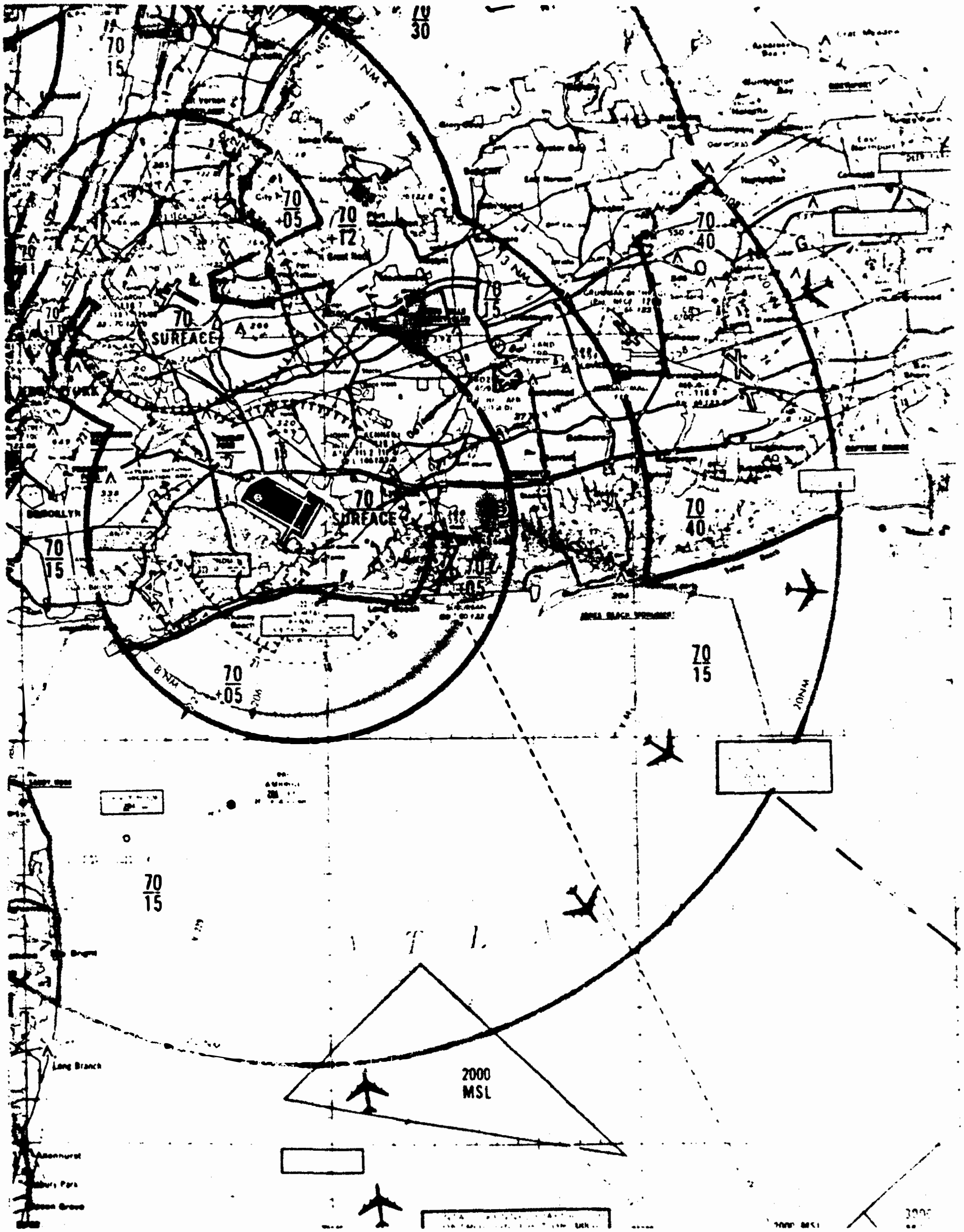

Figure 2.– New York TCA: Southeast portion showing approach to Long Island.

and offers few reasonable spots for a forced landing. Aircraft tend to use only the upper few hundred feet of the corridor:

> Acft A eastbound over Hudson River at 1200 ft in radar contact with TCA controller and in the TCA on routine flight into Manhattan. Passenger raised hand to point at aircraft B approaching from our 9 o'clock position. Range at my first sighting perhaps 75 yards, same altitude. Immediately initiated right descending turn and noticed that at the same time acft B dropped its right wing and turned behind me. It is difficult to say for sure but I feel that without evasive action a collision would have been likely. LGA TCA controller advised no radio or radar contact with other aircraft . . . Hudson River corridor is heavily traveled by all manner of aircraft with little apparent regard for proximity to TCA limits.

Another problem in configuring terminal airspace is the proximity of hub and satellite airports. This problem exists in New York, further complicating the task of FAA airspace planners. The "Flushing cut," an indentation in the TCA to well within the La Guardia airport control zone, was provided to permit general aviation traffic to utilize Flushing without becoming involved with the TCA, but there are still problems due simply to the physical proximity of the two airports, the overlying TCA, and the high traffic density in the area (fig. 2):

> During my approach to Flushing Airport from the south, I was vectored to the Throgs Neck bridge and was told to make a left 180° turn to enter left traffic for the active runway. Radar service was terminated. While I am not certain whether there was a misunderstanding or just incorrect instructions by the controller, the fact remains that a right-hand traffic pattern was appropriate. I consulted my charts and noticed that a left-hand traffic pattern would put me back into the TCA. After considering this, I returned to the other side of the airport and landed out of right-hand traffic. I feel that the extremely close proximity of this airport to La Guardia, one of the busiest in the country, is in and of itself quite dangerous and requires extra precautions, specifically on the part of ATC.

A similar problem exists at Linden, New Jersey. The airport is uncontrolled, provides aeronautical advisory service on 122.80 MHz (Unicom), and underlies a portion of the New York TCA whose floor makes it difficult to overfly the field to ascertain wind and traffic conditions. Frequency congestion on 122.80 is such that it is often difficult to obtain such information by radio. The approaching pilot is thus faced with the dilemma of either penetrating the TCA and being required to forego at least a listening watch on Unicom frequency or waiting outside the traffic area for considerable periods of time trying to get information before entering the pattern (fig. 3).

While New York poses a difficult combination of problems, especially for general aviation aircraft, it is only one example of such areas. Problems associated with airspace configuration tend to fall into one of four classes. The class of corridor problems has been mentioned. The other classes relate to upper boundaries of terminal airspace, lateral boundaries of such airspace, and the proximity of satellite airports. Each will be discussed briefly here.

Other "corridors" – either formally established, as in Los Angeles, or *de facto* because of VFR flight patterns – exist in the vicinity of TCA's at San Francisco, Dallas-Ft. Worth, and Chicago. Two examples most often cited in ASRS reports are the area beneath the TCA shelf east of San

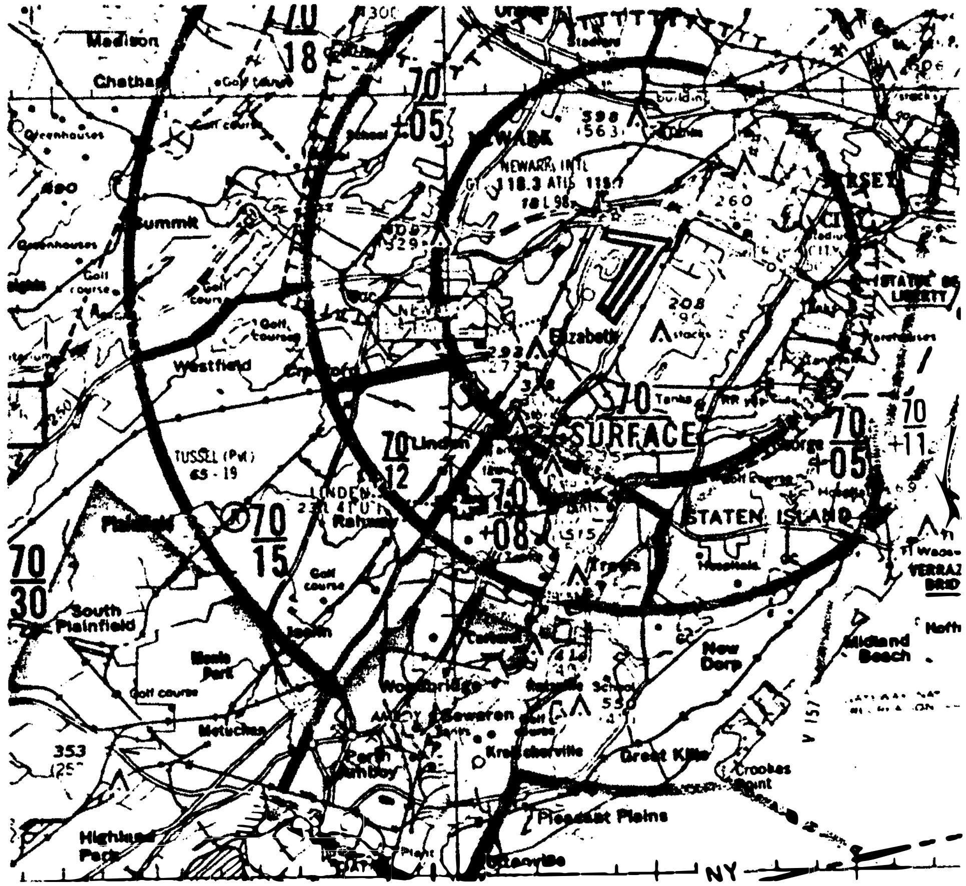

Figure 3.– New York TCA: Southwest detail showing Linden Airport.

Francisco Bay, and the area beneath the TCA shelf east and north of Dallas-Ft. Worth. The former area is a problem because of the very considerable concentration of general aviation traffic in the Bay area and the hills directly east of the TCA (fig. 4). The latter is a problem because of the very large amount of air traffic flying between Love Field and points north and west (fig. 5). This traffic, a mix of reciprocating, turboprop, and turbojet traffic, is further constrained at certain times during the year by thunderstorm activity, a frequent occurrence in the Dallas area. In the Chicago area, the presence of high towers in the uncontrolled airspace beneath a TCA shelf leaves little maneuvering room for pilots attempting to minimize the distance of their flight (fig. 6). In several of these areas at night, the large concentrations of lights on the surface in these metropolitan areas makes it extremely difficult to visualize the lights of other aircraft. During the day, industrial smog and haze impairs visibility. In some areas, aircraft not equipped with DME may have difficulty remaining outside the TCA lateral boundaries by reference to surface landmarks.

The problem of proximity of satellite airports has been mentioned in connection with Flushing Airport. Another satellite airport whose proximity to a hub field has caused problems is Bowman Field, Louisville, Kentucky. This field has active VFR traffic and a considerable number of students. Its traffic patterns are close to certain approaches to Standiford Field, Louisville's air

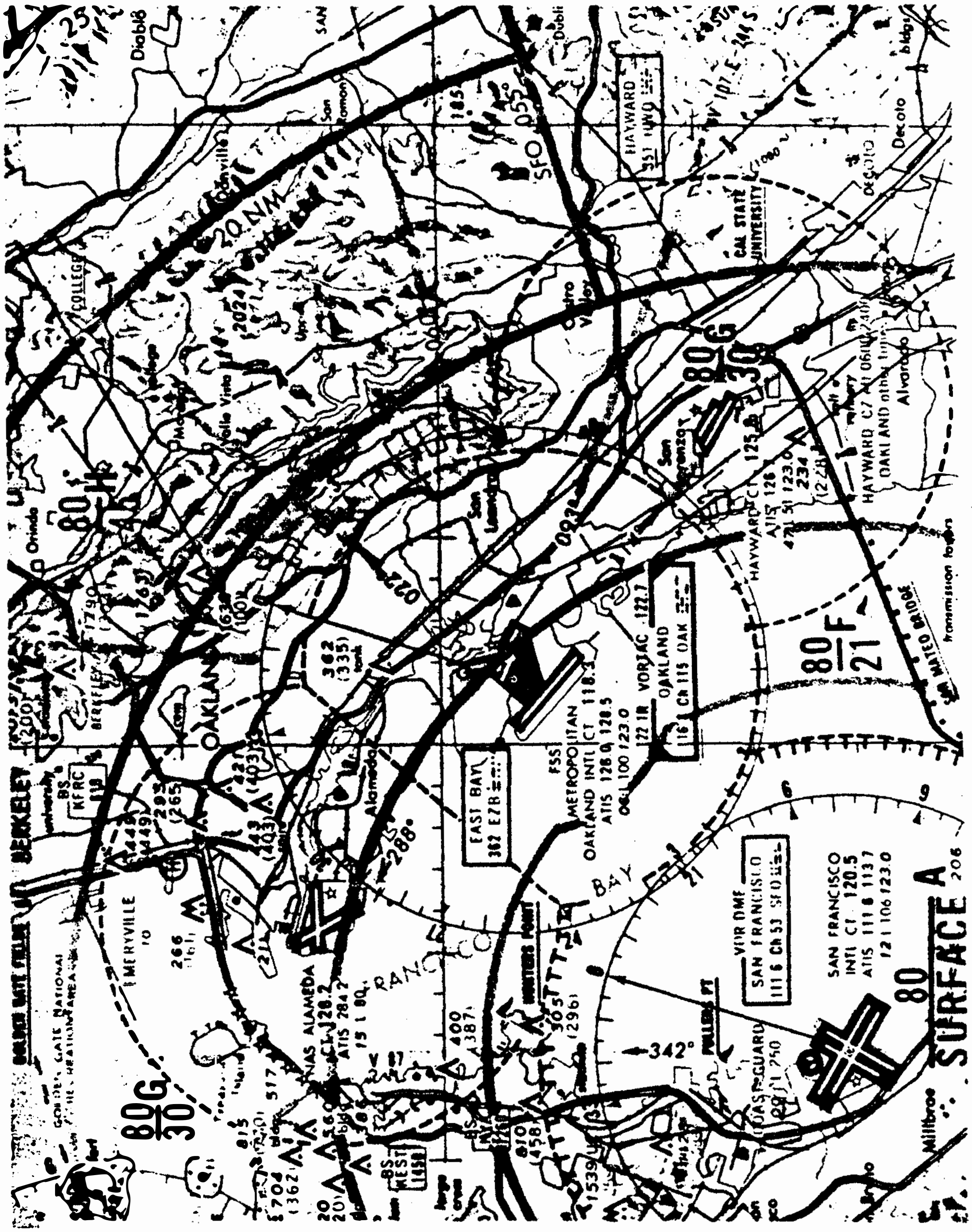

Figure 4.– San Francisco TCA detail showing eastern boundaries.

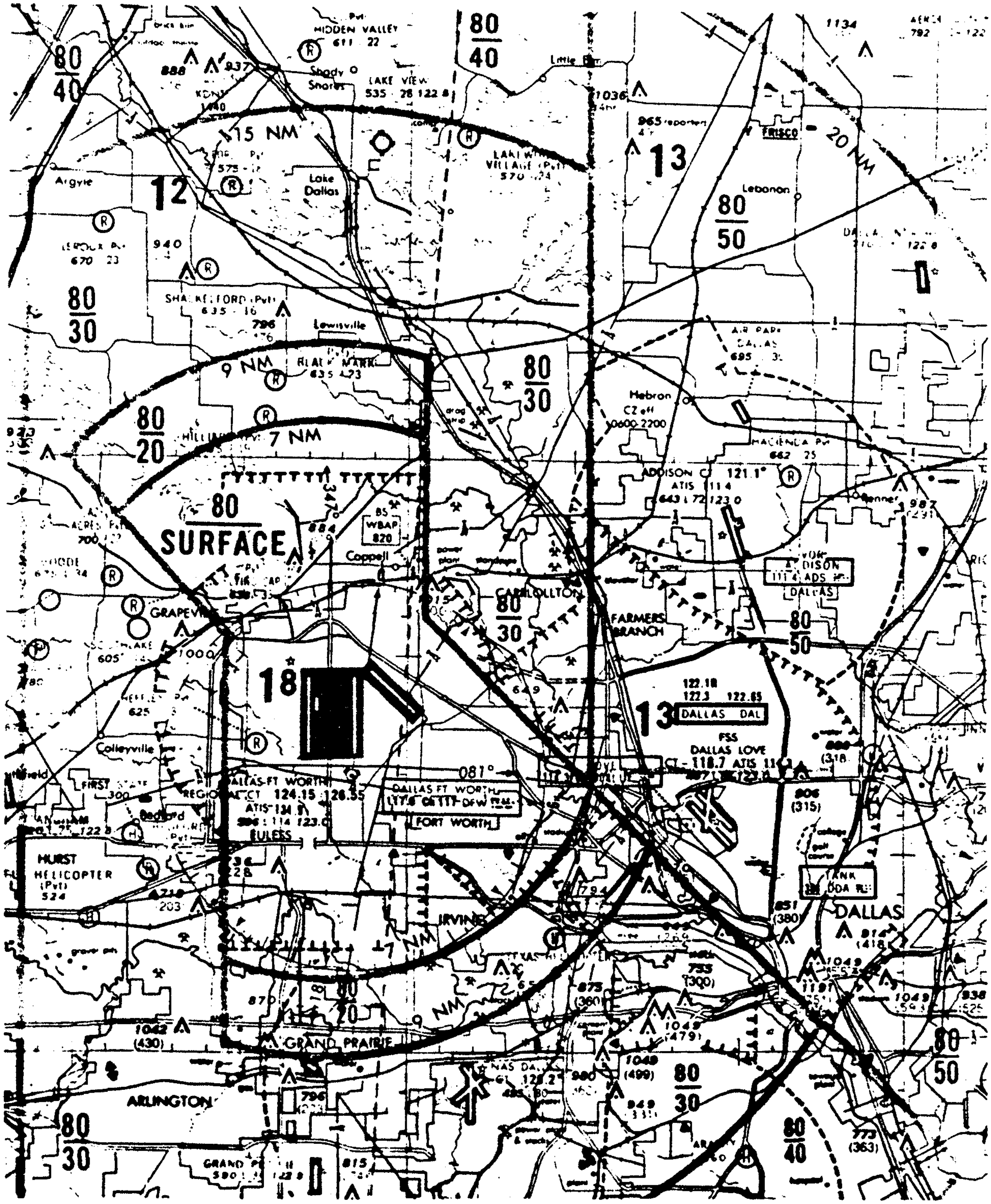

Figure 5.– Dallas-Ft. Worth TCA showing relationship of Love Field to boundary.

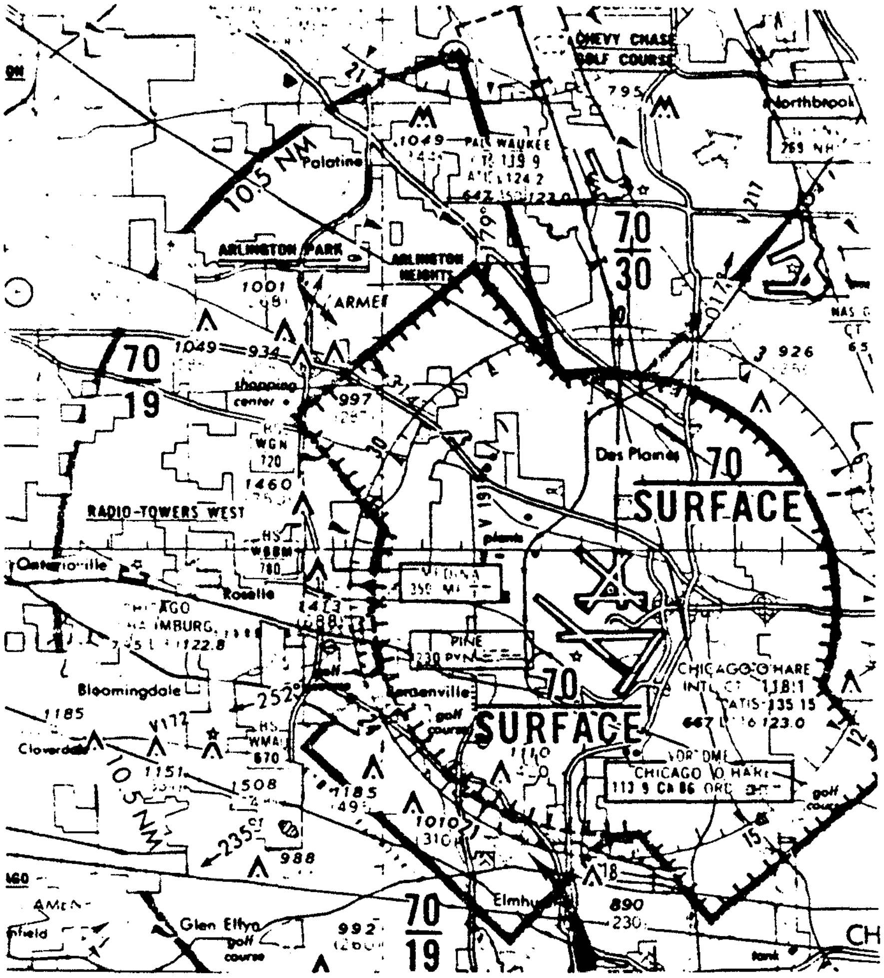

Figure 6.– Chicago TCA detail showing high towers beneath west shelf.

carrier hub. Louisville has a stage III TRSA; participation is not mandatory. Both general aviation and nonparticipating air carrier aircraft have been involved in occurrences in the immediate vicinity of Bowman Field:

> Airline aircraft on final approach into Louisville Airport reported that he missed a light aircraft by only 20 ft. Position was about 3 miles on final approach. Controller pointed aircraft out but pilots of airliner did not see in time to initiate evasive action. Why this incident occurred: (1) Possible lack of training in pilots to identify themselves while flying in controlled airspace and in particular when in the path of aircraft making instrument approaches; (2) Airports with overlapping traffic patterns without compatible runway use programs . . .

Other cases at other locations have involved a military aircraft that cut across a TRSA departure path on an emergency descent to its home field, and another military aircraft that was unable to make good a SID crossing restriction due to high ambient temperature; it entered an adjoining TRSA.

ASRS reports have described potential conflicts during VFR overflights of the Cleveland, Chicago, New York, Los Angeles, and Dallas-Ft. Worth TCA's. In order to avoid the communication and vectoring workload associated with transit through a TCA, or because of difficulty in obtaining clearance through the area, many pilots flying under visual flight rules choose to overfly the upper boundary of the TCA. Unfortunately, turbojet aircraft usually enter and depart the TCA through this airspace; the routes in use are often not known to the overflying pilot. Climb and descent rates of the larger aircraft may exceed 3000 ft/min (50 ft/sec) at a speed of 250 knots; near midair collisions have resulted:

> Airliner was slowing to 160 knots per ATC. Instructions were: "Stop turn at 300°, slow to 160 knots ... traffic at 12 o'clock less than a mile, altitude unknown." Traffic was immediately observed head-on, same altitude (10,700 MSL). Airliner ducked under with a right turn. Estimated miss distance 1300–1500 ft. Controller was very busy working heavy traffic to two parallel runways. His not required call-out was timely; we thanked him for the 'save.'

> Airline acft A was on vectors, heading 360° assigned by O'Hare Approach Control and descending through 7200 to 4000 ft when the copilot noticed a light aircraft B at our 2 o'clock position westbound coming from over the lake at our altitude, very close. Both aircraft banked to avoid striking. Estimate miss at approximately 100 yards. We were not given traffic information by approach and asked them if they could paint the other traffic after the miss. They were unable ...

(It is pointed out by reporters that VFR overflights often represent attempts to avoid prolonged overwater flights or protracted diversions. This is especially true at Boston, New York, Miami, Los Angeles, and San Francisco. Although extending the TCA's upward to the floor of the continental control area may prevent some conflicts above the present TCA's, as suggested by several reporters, it will do nothing to accommodate the needs of the general aviation pilot.)

One special boundary problem, a TCA bounded by two TRSA's, has been described to ASRS. It was pointed out that the configuration of the Dulles-Washington-Baltimore complex, and the charts that describe the airspace, tend to favor pilots communicating with Washington approach control, during which time they may traverse the Dulles or Baltimore TRSA's as nonparticipants. A report, alert bulletin, and its response regarding this problem are presented:

> Aircraft within Dulles airspace receive stage III with 15 miles of Dulles airport and advisories to 25 miles. This provides separation between known aircraft ... aircraft flying within Dulles airspace unknown to IAD controllers are in fact known to Washington Approach Control. The Washington TCA VFR sectional map depicts Washington frequencies in Dulles airspace. Pilots requesting service prior to entry into the DCA TCA are thus encouraged to call Washington instead of Dulles. This results in two aircraft with less than standard separation ...

Text of Alert Bulletin:

Airspace controlled by Dulles Intl. Airport and Baltimore-Washington Intl. Airport ATC Facilities: Confusion and a potential conflict situation have been reported involving VFR traffic transiting IAD and BWI airspace enroute to Washington National Airport. Even though aircraft in the IAD and BWI airspace can voluntarily receive stage III service and advisories, many pilots elect to communicate only with DCA controllers in anticipation of their entry into or while exiting the DCA TCA. It is suggested (by the reporter) that this condition of pilots in one controller's airspace talking to controllers working other airspace is inadvertently encouraged by the VFR terminal Area Chart's instructions to contact DCA frequencies while in IAD and BWI airspace.

Text of Response:

The Washington VFR Terminal Area Chart has been amended to improve the reported situation. Information boxes for pilots to contact Washington Approach Control on appropriate frequencies have been relocated. Additional boxes have been added on the Baltimore and Dulles areas which read: "VFR TRAFFIC TRANSITING ----- TRSA ARE REQUESTED TO CONTACT ----- APPROACH CONTROL ON (FREQUENCY)." These changes will provide more accurate information for pilots' use.

(Note: This is not an isolated problem. AIM part 4 graphics for Los Angeles do not identify the adjoining Burbank TRSA, which could lead pilots into a similar trap. The use of effective coordination and handoff procedures can minimize the seriousness of the problem, but presentation of appropriate information on VFR charts would be at least equally effective. TRSA's are not depicted on these charts at present, and their presentation in AIM part 4 does not follow a standard format.)

Table 19 summarizes 14 reports in this series: 9 in which a terminal area boundary problem was thought to be a primary factor, and 5 in which a boundary problem was a pertinent secondary factor.

TABLE 19.– TERMINAL AREA BOUNDARY PROBLEMS

Airspace	Location	Boundary	Nature of problem
TRSA	SDF	Lateral	Proximity of SDF and LOU
TRSA	PHX	Lateral	Proximity of Luke Dpt pattern
TCA	DFW	Lateral	Proximity of Love Field (1)
TCA	CLE	Upper	VFR overflight, A/C descending
TCA	LGA	Lateral	Proximity of LGA and Flushing Apts
TRSA	SAN	Lateral	Proximity of NAS North Island
TCA	DFW	Shelf	Conflict across boundary
TCA	EWR	Floor	Proximity of Linden Airport
TCA	HOU	Lateral	Landmarks
TCA	LGA	Floor	Tfc over Hudson River
TCA	LGA	Floor	Tfc over Hudson River
TCA	ORD	Upper	VFR overflight, A/C descending
TCA	DCA	Lateral	Interface problem: see text
TCA	DFW	Lateral	Proximity of Love Field (2)

Equipment factors– Four types of equipment factors were cited in these reports. Ground-based radar and computer-enhanced (ARTS) equipment were cited as contributing factors in a number of occurrences. The absence of and malfunctions of airborne transponders were also described. A few reports mentioned other airborne avionics failures. Table 20 summarizes these citations.

Inability to make or maintain contact with primary targets accounted for over one-third of the equipment citations. There are many possible reasons for such an inability on the part of a controller. As mentioned previously, the target may be there but may go unnoticed for a time. The radar gain may be set at a low level to minimize ground clutter which minimizes primary targets as well. Thermal inversions and other atmospheric phenomena can appreciably degrade the performance of even a well-tuned radar unit:

> . . . Primary radar at the facility was poor with temperature inversion and clutter and some cancellation problems. AFS was working on the radar at the time to improve the presentation . . .

TABLE 20.-- EQUIPMENT PROBLEMS

Equipment problem	Number of reports	
A. Ground equipment: radar		
1. Radar inoperative	2	
2. Unable to make/maintain contact	11	
3. Environmental problem	1	
4. Targets lost in central blind spot	1	
Subtotal		15
B. Ground equipment: ARTS System		
1. ARTS inoperative: primary radar only	3	
2. ARTS malfunction, not specified	2	
3. ARTS tag drop, false target, target swap, etc.	5	
Subtotal		10
C. Airborne equipment: transponder		
1. Transponder inoperative	2	
2. Mode C inaccurate	1	
Subtotal		3
D. Other airborne equipment		
1. Communications, radios	2	
2. VOR navigation receiver inoperative	1	
Subtotal		3
TOTAL		31

Certain light aircraft, and some military aircraft, present only a very small reflective surface, especially when head-on to the transmitted radar beam. Regardless of which of these factors may have been responsible, 10 of the 11 reports involved near midair collisions in which the other aircraft was in contact with ATC. It can be assumed that transponder-enhanced targets would have been painted more clearly by the radar and thus detected more easily by the controller.

ARTS computer problems were cited in 10 cases. A total failure or serious malfunction, placing reliance on broadband radar, was mentioned as a contributory factor in 5 occurrences. In the other 5 cases, tag drops, false targets, and target swapping were described. These subtle failures are more difficult for a busy controller to detect, and thus are more likely to lure the controller into making an error:

> The first aircraft, acft A, was vectored to ILS 27R at PHL with an acft B in trail. When acft A was approximately at the outer marker, I asked the Tower if they could circle acft A to rwy 17, as acft B was 3 miles in trail. Tower advised rwy 17 was closed. I then asked if they could take the two acft with present separation. They said "okay, we'll put one on 27L and one on 27R." They then asked if the acft had each other in sight and I said "no." At this time I turned acft B over to the Tower. Several moments later (perhaps 2 minutes) the ARTS tag dropped from acft A and I could not see a primary target on the acft. Acft B was on about a 2-mile final with an ARTS tag. I called the Tower and asked if they had either acft in sight and they replied "no." At this time I told the Tower to give acft B a missed approach . . .

While the air traffic control system has backup modes of operation designed to compensate for each of these types of failures, the very reliability of the radar and computer equipment tends to place the controller at a disadvantage when a failure occurs, especially a subtle failure. Controllers, like pilots, learn after a time to rely on the continued correct functioning of devices that usually function correctly. This places them at a disadvantage for a short time if the equipment fails. Perhaps more important, their level of alertness respecting subtle failures is lowered after a long period without them. Man does not function well as a monitor when he must look for events with a low probability of occurrence. In the absence of information to verify the existence of a false target, the controller may be unable to check the validity of the information he is processing. It is in this situation that the queries of a suspicious pilot may be invaluable, for such queries will usually lead the controller to question what his data sources are telling him:

> Acft A called Denver Approach for TCA clearance and landing at Denver. He was assigned a descent beacon code and acquired an ARTS tag 35 miles northwest of the airport. He was given radar contact and cleared direct to the Denver VOR. The beacon and ARTS tag was good and steady. At 25 miles northwest of the airport the aircraft was assigned a heading of 090° to go around the BJC airport area. The pilot questioned the heading and stated it would take him away from the airport. The aircraft was told to ident and verify heading and was given its position. The tagged target idented and checked well on beacon readout. After further checking, however, the aircraft was really 25 northeast of Denver with discrete beacon readout. The false target was tagged with a good readout.

Airborne equipment problems included two cases of radio trouble, one incorrect position due to a faulty navigation receiver (the pilot intruded into a TCA without clearance), and an incorrect encoding altimeter readout which led to a conflict between two aircraft, both under control of ATC.

ATC procedures and policies– Two areas which relate to ATC procedures and policies were identified in these data. The first has also been the subject of Alert Bulletins which are extracted below. It is the responsibility of the VFR pilot to "maintain appropriate terrain and obstruction clearance" at all times. At the same time, a VFR pilot participating in a terminal radar service program "must maintain an altitude when assigned by ATC." Assignment of radar headings, routes or altitudes is based on the provision that a pilot operating under visual flight rules is expected to advise ATC if compliance will cause him to violate any Federal Air Regulations. Further, VFR aircraft may be vectored regardless of altitude. It is the responsibility of the pilot to comply with the provisions of any applicable Federal Air Regulations. (Extracted from AIM and ATC Handbook; see appendix C for context.)

Three reports in this series, and others previously cited in alert bulletins, indicate that pilots continue to receive clearances at or to altitudes below minimum vectoring altitudes off published routes. It has been pointed out previously that at night, or under conditions of reduced visibility during the day, pilots may not be able both to maintain an assigned altitude or heading and to maintain appropriate terrain and obstruction clearance. This problem has been reported with respect to the Las Vegas and Denver TCA's and the Tucson TRSA; unrestricted clearances at or to below minimum safe altitude or minimum vectoring altitude have been received from other approach control facilities. It is believed, as acknowledged by FAA in the response quoted below, that this is a system problem which may need correction at a national level:

> Text of Alert Bulletin:
>
> Las Vegas TCA: Pilot on night flight into LAS on VFR flight plan, no moon, called for clearance into the TCA from over Boulder City at 5000 ft. He was cleared direct to LAS airport to descend to 3500 ft at pilot's discretion. After clearing mountains he descended to 3500 ft, was then given turn to 340. He became concerned about terrain clearance because of obstruction lights ahead, requested MSA three times, was then told 4800 ft. After landing, he was informed VFR traffic is responsible for terrain clearance regardless of radar vectors in a TCA. He states that when radar vectors take a pilot off a published route at night, it may not be possible to know the minimum safe altitude and adhere to AIM part 1 admonition to maintain appropriate terrain and obstruction clearance, since radar vectoring altitudes may differ from information available to pilots. This is the second report of this potential area of misunderstanding with respect to Las Vegas TCA. In both reports, vectors and assigned altitude of 3500 ft took pilots into areas where terrain clearance was not assured.
>
> Text of Response:
>
> We have investigated procedures at Las Vegas in response to the Aviation Safety Report. The following actions have been taken by the Western Region Air Traffic Division:

1. Las Vegas Tower shall not assign an altitude to a VFR aircraft that is below the minimum safe altitude as defined in FAR 91.79.

2. Las Vegas Tower shall not assign a VFR nighttime departure an altitude that is below the appropriate minimum vectoring altitude.

Las Vegas Tower will issue a facility directive containing these instructions.

In a subsequent communication, FAA advised this matter is under further review for possible national application of revised procedures for the handling of VFR traffic in terminal control areas.

A second, more subtle problem relates to the policies that govern the control of aircraft within terminal radar service areas (including terminal control areas).

The statements in appendix C make it quite plain that the provision of radar traffic information is an additional service, to be provided when workload permits. The provision of radar vectoring and radar or visual separation of participating aircraft in stage III service, however, appears to be mandatory, although under visual meteorological conditions, pilots are also responsible for seeing and avoiding other traffic.

Pilots who request radar traffic information service, either explicitly or by voluntary or mandatory participation in terminal radar programs, appear to believe that as a minimum, they will receive at least radar safety advisories on a continuing basis. They do not appear to understand that "an awareness of situations involving unsafe proximity to uncontrolled aircraft cannot be mandated . . ." Still less do they understand that radar traffic information may be provided, then discontinued without notice. Pilots of aircraft operating under instrument flight rules in particular do not understand why point-outs of potentially conflicting VFR aircraft are not routinely given them.

Notwithstanding the "workload permitting" nature of traffic advisory service, participating pilots, especially in a stage III environment, expect that separation and traffic advisories will be provided. They do not know, of course, whether a potentially conflicting aircraft is a participant, or even whether it is visible to the controller handling their flight.

Table 21 lists 19 cases in this series in which an advisory ("point-out") was not issued. In 17 cases, less than standard separation was reported; separation was 500 ft or less in 13 cases. In 5 cases, the other aircraft was said not to have been observed on radar or to have been seen only after the conflict. In two cases, the controller stated he was unable to provide a point-out because of workload; in at least 4 cases, both aircraft were under ATC control.

It is clear from these data that in several cases, the aircraft not pointed out was a primary target which was not seen by the controller. In other cases, it is likely that the controller's other duties precluded a point-out. In many other reports in this series, of course, a timely point-out was issued to one or both pilots. Some of these point-outs were said to have prevented almost certain collisions and prompted expressions of deep gratitude by the reporting pilots.

TABLE 21.– FAILURE TO POINT OUT/UNABLE TO DETECT TRAFFIC

Reporter	Area	Aircraft A	Aircraft B	Outcome	Comments
P	TCA	AC IFR	GA VFR	NMAC–NT	B no radio contact
P	TRSA	AC IFR	GA VFR	LTSS	B no radar contact
P	TRSA	AC IFR	GA VFR	NMAC–EA	B no radar contact
P	TRSA	AC IFR	?	NMAC–EA	
P	TRSA	GA IFR	GA VFR	LTSS	Both working ATC
P	TCA	AC IFR	GA VFR	NMAC–EA	B at TCA boundary
P	TRSA	AC IFR	GA VFR	NMAC–EA	
P	TCA	GA VFR	?	NMAC–EA	Both working ATC
P	TCA	? IFR	GA VFR	500 ft sep	B seen after call
P	TCA	GA IFR	GA ?	?	Both working ATC
P	nr. TCA	GA IFR	GA VFR	LTSS–EA	
P	TRSA	GA VFR	?	NMAC–NT	Non-participating, mode C
P	TCA	GA IFR	GA VFR	LTSS	Both working ATC
P	TRSA	AC IFR	GA VFR	NMAC–EA	
P	TCA	GA IFR	GA VFR	LTSS	Too busy for point-out
P	TCA	GA IFR	GA VFR	NMAC–NT	Too busy for point-out
P	TRSA	AC IFR	GA VFR	NMAC–?	B overtook A
P	TRSA	? IFR	?	NMAC–?	Controller apologized
C	TRSA	AC IFR	GA VFR	NMAC–?	Not seen on radar

Code:

P:	pilot	C:	controller
AC:	air carrier	GA:	general aviation
IFR:	instrument flight rules	VFR:	visual flight rules
NMAC:	near midair collision	LTSS:	less than standard separation
EA:	evasive action	NT:	no time for evasive action

Herein lies the insidiousness of this problem. Pilots know they are in a radar environment and that the primary purpose of the radar is to facilitate separation of aircraft. If VFR, they are urged to participate in the radar-based system. They are encouraged to request traffic advisory service. Yet they have no way to determine at any particular moment the extent to which they can expect to receive the services for which they asked from the system in which they are participating.

Unfortunately, most pilots are unaware of the coordination tasks often required of the air traffic controller. If the frequency they are guarding is relatively quiet, they assume the controller's workload is light enough to permit him to provide them with traffic advisories. While many pilots are now aware that primary targets are more difficult to track than beacon returns, few are aware of the multiplicity of variables that influences the performance of radar, or the performance of the controller working their flight.

On the other hand, the tasks required of the pilot in terminal airspace may also impose a high workload, especially under circumstances of marginal visibility. Point-outs of possibly conflicting traffic can be most helpful in moderating that workload, as is evident from many comments in these reports.

Pilots flying under instrument flight rules (16 of the 19 cases in table 21) find it particularly hard to understand that not all of the traffic around them is necessarily known or observed traffic.

They do not appear to understand the caveats stated in the AIM 1 section on Radar Safety Advisories.

However clear the policies regarding radar services are to those who enunciated them, there appears to be a serious problem of misunderstanding in this area. Pilots, like all other humans, function most effectively in a relatively stable, certain environment, or at any rate in one whose uncertainty is known to them (the known uncertainty of weather forecasts is an example). Reliance to any degree on a service whose elements and extent vary unpredictably causes uncertainty and anxiety which are reflected in many of the critical comments in these reports.

It also appears that at least some controllers are uncertain as to the basic policies regarding terminal radar services. An example is provided of a situation in which the controller appeared to misunderstand the philosophy underlying the service. Others will be found elsewhere in this section:

> I was flying on a VFR flight plan from Norwood, Mass to Reading, Pa, cruising at 6500 ft with Boston radar advisory service. I was turned over to La Guardia radar advisory service near New Haven, Ct and they approved my continuing flight through the NY TCA over Westchester and the Tappan Zee bridge. La Guardia was in communication with another airplane, also (the one I nearly collided with). I was told on approximately three occasions from about 7 miles east of the bridge to the bridge area that I had traffic at 9 o'clock. Both I and the other aircraft were asked to ident. When over the center of the Tappan Zee bridge at 6500 ft I heard the other pilot tell the controller that he was over the center of the Tappan Zee bridge at 6500 ft. I then told LGA that I was also over the bridge at 6500 ft. La Guardia had us both ident separately. La Guardia then told us that we were both in about the same place and asked if we couldn't see each other. I replied that I could not see my traffic, then told the controller that I was going to make a very gradual right turn up the Hudson in an attempt to get away from the other aircraft. I got no reply. I looked out my right window and proceeded. Halfway through the turn my plane bounced, indicating to me that I had either hit wake turbulence or the other airplane. I told La Guardia of this and requested permission to descend for a landing to gather my composure. I do not recall whether I got a reply or not. I landed and found no damage to the aircraft, and then finished my flight to Reading.

General Discussion

Reports submitted to the NASA Aviation Safety Reporting System have limitations as a source of data for studies of this kind. Since the System is voluntary, one cannot evaluate whether these reports are a representative sample of occurrences in terminal airspace. One cannot, therefore, state whether potential conflicts are or are not common in such airspace. ASRS reports may be considered representative of a reporter's perception of an occurrence, but the accuracy of that perception cannot be judged because the System has no means to verify the facts of an occurrence by independent investigation.

What, then, is the value of such reports? Can the data contained in them be used to advance aviation safety? The study reported here represents a first attempt to construct a model for the use of such reports for this purpose, notwithstanding the limitations set forth above. Since it is the first such study, a short discussion of these questions is in order.

It will be argued that at best, ASRS reports, containing the perceptions of but a single person, are an imperfect picture of the real world. This is quite true, but it is also true that these perceptions are what motivate the decisions made by these persons. If their perceptions are incorrect, the decisions made and actions taken by these controllers and pilots are also apt to be incorrect. Thus, in certain respects, perceptions of those working in the aviation system are as important as the reality, and when such perceptions are wrong, the reasons for them should be explored.

In this study, little use has been made of numerical data except to determine whether a particular phenomenon should be studied. The study thereafter must deal with stated or hypothesized factors associated with a particular phenomenon. A potential strength of the Aviation Safety Reporting System is that it relies only on the data actually present, yet permits the study of fairly considerable bodies of data related to a particular question.

In this study, as in earlier ones, it is clear that information transfer in the aviation system is an extremely important factor in how well the system operates. Lack of knowledge of the procedures and limitations of radar service, problems in communications, lack of information as to the altitude and position of nonparticipating aircraft, lack of information regarding instrument approach paths at hub airports, limited comprehension of English, and failures of coordination among ATC facilities, all represent problems of information transfer, whether from manuals or charts or from one person to another.

Another major factor which appeared to be associated with problems in this study was that of airspace configuration. The shape, design and use of airspace appear to influence pilot and even controller behavior in many of the occurrences selected for this study. Once again, the availability of information concerning these factors may have been a part of the problem in several instances.

The final factor demonstrated in this study, that of misunderstanding of policies, rules or procedures, is again a function of information transfer within the aviation system. It seems clear that in at least some cases, pilots simply did not understand what was expected of them and that in many other cases, they did not understand why the system is operated as it is. Such misunderstandings demonstrate, if nothing else, the validity of the earlier comments regarding the importance of perceptions as a determinant of behavior.

Conclusions

It is concluded that a systematic investigation of information transfer problems in terminal radar service areas and terminal control areas would be productive and would be likely to point out areas in which procedural or system modifications would enhance aviation safety.

It is concluded that existing methods of dissemination of information regarding TRSA and TCA airspace boundaries and procedures are not optimal and that a study of available methods for dissemination of such information may be useful. In particular, information concerning TRSA's and their boundaries is not readily available to pilots.

It is concluded that a better understanding of the rationale, policies and recommended procedures for the use of terminal radar services by both general aviation and air carrier pilots would enhance the safety and effectiveness of the system. In particular, a better understanding of why the system works as it does, and especially of its limitations, would be of benefit. Air traffic controllers also need to be fully aware of the rationale, as well as the methods, of terminal radar programs, and of the needs of all classes of pilots who may utilize airspace designated for these programs.

DISCUSSION AND ACKNOWLEDGMENTS

Aviation Safety Reporting System intake throughout its first year remained comparatively constant at just over 105 reports per week. The system has been utilized steadily during this year; the quality of many reports has been outstanding. Many problems, some minor, some serious, have been brought to light in a frank dialogue between the users of the National Aviation System and those responsible for managing that system. The ASRS staff wishes to express its gratitude to all of the pilots, controllers and others who have given generously of their time and expertise through the submission of reports. We shall do our utmost during the coming year to be worthy of the continued support of the aviation community. We also wish to acknowledge with appreciation the assistance of Miss Jan Bennett, of the FAA Office of Aviation Safety, whose name was inadvertently omitted from the acknowledgments in our third Quarterly Report.

The managers and staff of the ASRS solicit, and will be responsive to, comments and criticisms from readers of these reports. Such comments should be directed to:

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Ames Research Center
National Aeronautics and Space Administration
Moffett Field, California 94035, September 22, 1977

REFERENCES

1. NASA ASRS Quarterly Report No. 76-1. Washington, D.C., NASA TM X-3445, September, 1976.

2. NASA ASRS Second Quarterly Report. Washington, D.C., NASA TM X-3494, December, 1976.

3. NASA ASRS Third Quarterly Report. Washington, D.C., NASA TM X-3546, May, 1977.

APPENDIX A

EXAMPLES OF ALERT BULLETINS AND RESPONSES

INDEX

Previous ASRS Quarterly Reports contained examples of Alert Bulletins generated on the basis of reports submitted to the ASRS. Because the Alert Bulletin procedure is a vital element of the ASRS concept, and because many Alert Bulletins and the responses to them produce information of benefit to the aviation community, an additional sampling of Alert Bulletins and responses by the FAA and other aviation interests is provided in this appendix to the Fourth Quarterly Report. The bulletins have been categorized to assist the reader in locating those bulletins of particular interest to him; the classification is shown in the index to this appendix.

AIR NAVIGATION

This general category includes examples of possible problems associated with (1) procedures following communications between pilots and ATC personnel (refs. 1,2); (2) profile descent charts and communications (ref. 3); (3) instrument approach chart depictions of missed approach procedures (ref. 4); (4) in-flight filing of IFR flight plans (ref. 5); and (5) the possible confusion surrounding airway intersections with similar sounding names (ref. 6).

1. Text of AB: Various locations: Misunderstandings appear to exist on the part of both controllers and pilots as to the timeliness of actions initiating altitude changes after issuance by ATC. Reports of potential conflicts have been received wherein the issue seems to be the length of time following an ATC instruction to climb or descend before the pilot actually initiates the change in altitude. Unlike change of direction instructions issued by ATC, which are generally acknowledged with immediate compliance, an element of flexibility exists with regard to responses to altitude change instructions. One reporter suggests that the following addition to ATP 7110.65 paragraph 233, would assist in resolving the problem: "All altitude changes shall be commenced promptly unless the controller specifically states that the change is at the pilot's discretion."

Text of Response: AIM Part 11, page 1-49, paragraph 6 (Adherence to Clearances) contains five examples indicating pilot responsibilities in complying with various descent clearances. Additionally, paragraph 7 of the same section states: "when ATC has not used the term 'at pilot's discretion' nor imposed any climb/descent restrictions, pilots should initiate climb or descent promptly on acknowledgment of the clearance." These requirements appear to be quite explicit and would seem to eliminate the possibility of any misunderstanding.

Insertion of the suggested statement in 7110.65, 233, would serve no useful purpose since that document prescribes ATC procedures for use by personnel providing air traffic control services and does not purport to delineate procedures to be used by pilots.

However, in view of the possibility of misunderstanding, identified in the NASA Aviation Safety Report, we plan to call both pilots' and controllers' attention to the procedures in AIM Part 1 via a letter to the users and an ATS Bulletin article.

2. Text of AB: Various locations: Recent reports received from controllers contain expressions of concern regarding the possible existence of a misconception, particularly among general aviation pilots, relating to what altitude the pilot may descend to when the clearance reads

"... cleared for approach to XXX." Several reporters note that pilots may believe that with this clearance they can descend to the procedure turn altitude for that approach once they are established anywhere inside the approach chart's circled area (usually 10 plus or minus miles from the airport). This information suggests the need for pilots to review the provisions of FARs 91.116 and 91.119, as well as those sections of AIM Part 1 dealing with ATC clearances and instrument approach procedures.

Text of Response: We concur with the recommendation that pilots review FARs 91.116 and 91.119 as well as the AIM if they have any question in regard to what altitude they may descend to once they have been "cleared for approach."

Air traffic control procedures are quite specific (Handbook 7110.65-794) for the controller. He may issue an approach clearance to an aircraft without specifying a maintain altitude only when an aircraft is established on a published route or segment of the approach procedure. However, as this safety report speaks of pilot confusion when an altitude to maintain is not specified in an approach clearance, we will, through our Accident Prevention Specialists and Counselors, undertake a pilot education effort.

At future pilot meetings and seminars, we will discuss the appropriate FARs and the AIM, Part 1, procedures relating to clearances and approach procedures, most specifically, AIM, 1-67 through AIM, 1-76.

3. Text of AB: Various locations (presently Denver, CO, and Atlanda, GA): Profile descent experiment. Numerous reports have been received that criticize various aspects of the profile descent program as described in AC 90-73 and applicable instrument charts. The most frequent criticism relates to the profile descent charts. Both the original issue and the 2-24 revision for DEN show not only the profile descent restrictions, but also the MEA's for each segment. Several reports indicate that some pilots have descended through crossing restrictions because of confusion caused by the depiction of the MEA's. The 2-24 NOAA ATL charts do not show the MEA's, only the profile restrictions. Can this be done on the DEN charts also? Chart clutter is another complaint received from a number of reporters.

The other major criticism is of excessive communications from ATC during profile descents at DEN, in which additional altitude, airspeed, and vector changes are given while the crew is trying as much as possible to maintain the profile. It is pointed out that precise adherence to these profiles imposes a substantially increased workload on flight crew, especially in view of multiple airspeed reductions above 10,000 ft, and that additional restrictions further increase this workload.

Text of Response: Profile Descent routings are not designated as federal airways and are constructed with descent gradients and obstruction clearance taken into consideration. On the June 16 charts all MEAs will be identified so as to eliminate any confusion.

The June publication of Profile Descent charts was developed using new charting criteria. These criteria have reduced chart clutter, proliferation, and an extensive amount of pilot/controller communications.

We attribute the excessive amount of communications that now exist to the fact that this is a new program. As experience and confidence in the procedures increase, a substantial reduction in communications should occur. We have, however, reminded our regional offices to monitor this particular aspect of Profile Descent procedures.

4. Text of AB: Jackson, MS, Allen C. Thompson Field: Missed approach procedures for runway 15R LOC BC and VOR runway 15R approaches on NOAA charts show a curved dotted arrow and contain instructions: "Climbing left turn to 2000 on R-129 JAN VORTAC within 15 NM." The instructions do not specify which direction to go on the R-129, however, and no clearance limit is specified. Jeppeson plates, however, specify that direction of travel on the radial is OUTBOUND from JAN and indicate this. It appears from ASRS reports that NOAA chart is open to misinterpretation with respect to this procedure.

Text of Response: Flight Standards National Field Office has been directed by memorandum dated March 23, 1977, to incorporate a clearance limit in the missed approach for all instrument approach procedures where they are not presently included. Exceptions may be made only when such a clearance limit would result in a very complicated missed approach procedure, in which case the direction of flight along a radial or bearing would be identified as "outbound" or "inbound" as appropriate.

The above mentioned procedures for Jackson, MS are presently being processed to amend the missed approach instructions. Changes will be incorporated in other affected procedures as they become due for routine amendments.

5. Text of AB: Portland, OR Approach Control and Flight Service Station: Report alleged that pilots in VFR flight wishing to file an IFR flight plan cannot do so by virtue of a letter of agreement between the Portland ATCT and Portland FSS. That letter allegedly stipulates that any IFR flight plan filed in-flight in Portland's airspace must be filed through approach control. The reporter notes that approach control has neither a separate frequency, personnel, nor pertinent weather data on the proposed route of flight – items normally available with a FSS flight plan filing. Additionally, Portland Approach Control has no way of including an alternate airport, estimated time enroute or other information ATC might need in event of radio failure.

Text of Response: No Letter of Agreement exists between the Portland FSS and Portland ATCT covering flight plan handling. Our investigation revealed that certain specialists felt there was a "working arrangement" on how to handle air files. The two facility chiefs have resolved this issue with their personnel – flight plans are accepted as published in the Airman's Information Manual (AIM), Part 1, pages 1-52 through 1-56.

It is true that we do not provide a separate frequency or additional personnel for the taking of flight plans at Portland Approach Control. Also, it is true that Service A weather is not available from the approach control facility. We have no plans to include any of the above at our approach control facilities.

Finally, terminal facilities and centers do not require a complete flight plan before issuing a clearance. The AIM, Part 1, page 1-53; Subject, "Flight Plan – IFR," paragraph 1.a., first sentence, may not be clear to the public. In fact, "complete" flight plan information is seldom required or desired from pilots who file flight plans by radio with towers or centers.

An "abbreviated IFR Flight Plan" is an authorization by ATC which requires the pilot to submit only that information needed for the purpose of IFR flight. It includes only a small portion of the usual IFR flight plan information.

The following definition of "Abbreviated IFR Flight Plan" is being submitted for inclusion in the Pilot/Controller Glossary.

> ABBREVIATED IFR FLIGHT PLAN – An authorization by ATC requiring pilots to submit only that information needed for the purpose of ATC. It includes only a small portion of the usual IFR flight plan information. In certain instances, this may be only aircraft identification, location, and pilot request. Other information may be requested if needed by ATC for separation/control purposes. It is frequently used by aircraft which are airborne, desire an instrument approach, or by aircraft on the ground which desire a climb to VFR on top (See VFR ON TOP) (Refer to AIM, Part 1).

We intend to review the present AIM "Flight Plan" text to determine its currency, to reduce the size of text where possible and clarify the matter of "Abbreviated IFR Flight plan."

6. Text of AB: Victor 103-218, Northwest of Akron (OH) VORTAC: A potential for misunderstanding ATC instructions exists relating to SHEFF and CHAFE intersections. The names of the two intersections sound very similar, both are on V-103,218, both are referenced from the Cleveland VORTAC, and both serve a heavy traffic area. A recent pilot report noted this difficulty in distinguishing between Sheff and Chafe intersections during radio communications with ATC.

Text of Response: The CHAFE intersection will be changed to CHUGG intersection effective June 16, 1977.

AIRPORTS: FACILITIES AND MAINTENANCE

FAA personnel and the management staffs of the respective airports have been very responsive to both the short-term and long-range considerations associated with issues raised by ASRS Alert Bulletins. Their attitude of cooperation is exhibited in the following examples of airport-related problems and their solutions. Bulletins 7, 8, and 9 deal with aircraft ground operations. Both ground and approach to landing operations are effected by the unmarked fence discussed in Bulletin 10. Finally, the importance of something as basic as clean windows is noted in Bulletin 11.

7. Text of AB: Various locations: Standard Operating Procedures after landing: Numerous reports from pilots and controllers on conflicts between taxiing aircraft indicate serious misunderstandings among pilots as to how far beyond runway margins a pilot may taxi prior to receiving a taxi clearance from Ground Control. Reports indicate also that there is considerable variability

among airlines and among airports with regard to controller expectations as to flight crew procedures for taxiing. The resultant conflicts have in some cases had quite serious accident potential. Several reports suggest that both regulations and recommended operating procedures be standardized and clarified for all concerned. Although this has been a particularly serious problem at Atlanta-Hartsfield, many reports have been received from other locations as well.

Text of Response: Although the Airman's Information Manual (AIM), Part 1, pages 44 and 45, discusses after landing taxi requirements, we believe it is possible and desirable to improve upon the existing language. Accordingly, a complete review and upgrade of this section of the AIM is underway. Controller handbooks will be amended as necessary . . . (Response goes on to discuss corrective measures at Atlanta.)

8. Text of AB: Anchorage International Airport, AK: Report alleges that the overflow parking area for jet transport aircraft, adjacent to the north taxiway, presents a serious problem for smaller aircraft in the general aviation parking area. When heavy aircraft start up and begin taxiing, jet blast across the general aviation ramp threatens aircraft parked on that ramp.

Text of Response: The subject alert bulletin alleges that overflow jet transport aircraft are being parked adjacent to the north taxiway which creates a jet blast problem for general aviation aircraft using the north taxiway or general aviation parking area.

Discussion with the airport management discloses that the parking spots on the extreme north edge of the heavy aircraft parking ramp are no longer being utilized. Not only was the jet blast a problem, but the aircraft wings overhanging the service road and taxiway present traffic conflicts.

This summer the west parking apron will be reconstructed. During this period the north apron will be utilized by the contractor as a staging area for equipment and materials.

9. Text of AB: West Palm Beach (FL) Airport – taxiway "F" north of runway 27R onto taxiway "C" eastbound: Several pilot reports point out the difficulty experienced by large, particularly "stretched," aircraft attempting the tight turn onto taxiway "C" from taxiway "F" without leaving the narrow paved surface and possibly getting stuck in the sand. Pilots state that even with extreme care the turn from "F" to "C" is difficult; the turn is particularly difficult during darkness due to the fact that the taxiway lights at this point are set back about 12 ft from the paved surface, thereby making it very hard to discern where the pavement ends and sand begins. All reporters suggest widening the pavement in the turn area and providing better taxiway light placement.

Text of Response: The airport's management is aware of this problem and proposes to widen the fillet where taxiway "F" intersects taxiway "C," relocate taxiway lighting to proper distance from taxiway edge, and repaint taxiway markings in the upcoming ADAP 04 project. In the interim taxiway "F" is closed until further notice and a NOTAM has been issued to this effect.

10. Text of AB: Oklahoma City, OK, Downtown Airpark: A recent pilot report indicates that an unmarked, 4-ft high, barbed-wire fence is located within 2 ft of the run-up area for runway 16 at

this airport. The same fence also runs nearly perpendicular to the final approach path for runway 16. The fence is not marked in any manner, and its presence is not noted in Part II of the A.I.M. The reporter suggests that the persons responsible for this privately owned airport paint the fence with reflective, light-colored paint and provide both the run-up and approach path sides of the fence posts with reflective markers; in addition, it was suggested that Part II of the AIM provide some precautionary note regarding the proximity of this fence to the run-up and runway areas.

Text of Response: Oklahoma City Airports District Office advises that the AIM is being updated to reflect precautionary information. ADO has written the owner of this private airport outlining the problems and suggesting corrective marking.

11. Text of AB: Louisville, KY, Standiford Field: The cab windows in the SDF Control Tower are reported to be critically in need of cleaning. Citing the combination of dirt, water spots, and sunglare one report notes that at certain "low sun" hours final approach and pattern traffic is extremely difficult to control by means of visual contact. It is alleged that the automatic window-washers have never performed properly.

Text of Response: The problems were caused by extremely cold weather and a janitorial contract problem. Both have been resolved. The automatic window washer has required a lot of maintenance, but the stated problem was inside, not outside; the washer is now operational.

AIRPORTS: LIGHTING AND APPROACH AIDS

Airport lighting and approach aids continue to be the subject of many ASRS reports. Since the initiation of the ASRS program, reports dealing with this subject have been a consistent, and productive, source of information on possible problems in the aviation system. Bulletin 12 deals with the effects of illusion on approaches into the St. Thomas, V.I. airport. Approaches to Denver's runways 35 under instrument meteorological conditions are discussed in Bulletin 13. The continuing importance of NDB's is highlighted in Bulletins 14 and 15. Variable localizer signals, and the FAA's ongoing efforts to improve the situation, are described in Bulletin 16. Bulletin 17 involves the radiation of simultaneous ILS signals for approaches onto intersecting runways. ATIS announcements regarding parallel runway operations are the subject of Bulletin 18. The last example in this category addresses a local problem with approach light intensities (19).

12. Text of AB: St. Thomas, V.I., Charlotte Amalie Airport runway 9: Numerous reports have been received regarding the runway marking at STT. The runway is 4658 X 200 ft. Its extra width and shortness combine to give pilots the illusion that it is even shorter. The illusion is strengthened by the hill beyond the runway. VASI is less effective because it is further lateral in the pilot's visual field, and the distance markers, well off to the side of the runway, are too small to be helpful. The only useful marking is the TDZ marker, and once past it, pilots have little to help them in estimating distance to go.

Pilots plead for immediate modification of runway markings by painting a 25-ft wide white stripe on each edge of runway to provide a more standard apparent width, provision of large distance-to-go markers on or immediately adjacent to both sides of runway, and if possible improvement in positioning of VASI.

Text of Response: The Southern Region advises that the following actions have been taken.

A. In order to reduce the illusionary effect of a short runway created by the 200-ft width of the present runway, white edge markings have recently been painted 150 ft apart down the length of the runway.

B. Installation of a new, two-bar VASI has been completed.

C. New runway distance markers have been installed and are much more visible than the previous ones.

13. Text of AB: Denver, CO, Stapleton International Airport: Several reports have described difficulties with approaches to runways 35 under instrument meteorological conditions. The difficulties involve mistuning ILS and shooting approaches to wrong runway.

It appears that two factors are involved. One is the relative positions of the two runways; runway 35L comes into view first under limited visibility conditions. Little can be done about this except to increase pilot awareness.

The other factor is that Englewood Intersection and Gandi OM are used for ILS approaches to both runways. It has been suggested that if Englewood and Gandi were renamed for the 35R ILS approach, pilots would hear, read, and be required to report at a uniquely named fix; they would therefore be less likely to use the wrong approach plate, which would contain unique names for the fixes. Additionally, ATC would be able to monitor which runway ILS the pilot was actually using, as a check on pilots.

Text of Response: We have coordinated the subject Alert Bulletin with personnel in the Rocky Mountain Region and have been unable to confirm that this report represents a major problem. ATC personnel at Denver advise that pilots seem to have a preference for using Runway 35L when cleared for approaches to Runway 35R but they are not aware of a problem in mistuning the ILS. If this is a pilot problem, we do not concur with the suggestion for using different names for the common outer marker serving both ILS systems.

Air Traffic Service has recently issued a letter to user organizations amplifying the need for precise adherence to ATC clearances and the importance of selecting the proper frequency when tuning in navigation facilities. They have also stressed these issues internally by GENOT. In addition, the Denver Tower has advised that they will include the ILS frequency whenever an approach clearance is issued for Runway 35L or Runway 35R.

The problem identified in the Alert Bulletin appears to be an isolated one. Actions taken by ATC, as outlined above, are responsive to this report and should preclude the possibility of selecting the wrong ILS frequency at Stapleton Airport.

14. Text of AB: Lebanon, NH, Lebanon Regional Airport: Navigation facilities are discussed in recent ASRS reports. Power output of White River NDB (IVV 379) is cited as being too low for consistent reception within 10 n. mi. of facility, despite normal beacon monitor readings. This is a more serious problem at present time because LEB VOR is out of service. Terrain compounds problems due to unreliable reception of IVV.

Text of Response: An on-site inspection of the ground system at the Lebanon NDB on March 30, 1977, revealed that the power company ground, transmitter rack ground, and antenna ground radial system were at different potentials. This condition was corrected immediately and we anticipate that system performance will improve.

15. Text of AB: Iliamna, AK, and Big Mountain, AK, Nondirectional Beacons: Several reports have been received from professional pilots describing present problems in using ILI NDB, and the future problems which will result when BMX is shut down (airspace proposal 76-AL-10-INR). All reports describe difficulty in getting ADF bearings on ILI beyond 10–15 miles. They note that ILI and BMX are the only radio navigation facilities for their respective airports and the only facilities available for low-altitude VFR navigation assistance. ILI FSS has no VHF DF equipment, thus no back-up is available for marginal weather. Several pilots request that ILI NDB be relocated off one end of runway 17-35 for more effective approaches (present cat. A minima are 400-1, but NDB is 2.2 miles from airport). All request a substantial increase in ILI's radiated power, especially since Big Mountain airport will be unusable in marginal weather if BMX is decommissioned.

Text of Response: We are aware of the problems with the Iliamna NDB. The Alaskan Region plans to replace the existing equipment by October 1977. Installation of the new transmitter and associated antenna should greatly improve the operational service volume of the Iliamna NDB. Facility relocation is being considered, but with land acquisition uncertainties, the exact location cannot be determined at this time. We will select the best possible location available.

16. Text of AB: Longview, TX; Gregg County Airport: Localizer signals on the ILS approach (109.5 MHz) to runway 13 are reported by pilots to be extremely variable. In one instance the pilot experienced large variations on either side of the center line from 2 to 3 miles outside the OM down to DH; when he discussed this lack of reliability of the signals with ATC personnel, they confirmed that other pilots had complained of the same problem.

Text of Response: In late February 1977, a screen was constructed immediately behind the localizer array. As a result of this screen the localizer course was significantly improved from the outer limit of coverage to the middle marker. After this construction, the facility was returned to service on March 4, 1977.

17. Text of AB: New York, NY, JF Kennedy Airport: A recent report involves aircraft cleared for approach to runway 31R, then switched to runway 31L. ILS frequency 110.9 tuned; identifier for ILS runway 22L received. Pilot was told both ILS transmitters were radiating simultaneously. He suggests a lockout device to protect against this possibility in future.

Text of Response: At Kennedy Airport there are seven ILS systems for which three frequencies have been assigned on an interchangeable basis. These frequencies are assigned as follows:

109.5MHz to 4R-22R-ILS
110.9MHz to 4L-31L-22L ILS
111.5MHz to 31R-13L ILS

Three ILS systems are on the air at all times except for intentional shutdowns or system failures.

Runways 4R/L and 22L/R are equipped with a lockout device whereby only one ILS can be on the air for the direction of landing, that is, 4R/L or 22L/R.

In the case cited it appears that the ILS for runway 22L was indeed on the air and the information given the pilot that the runway 31L ILS was radiating was incorrect.

To preclude recurrence of this incident, this facility has coordinated with the Chief, Kennedy Tower to assure that when ILS approaches are being conducted to the Kennedy runway 31R, the runway 31L ILS shall be on the air. Since the runway 22L/31L ILS's have lockout devices that react to each other, a repetition of this incident should not occur.

18. Text of AB: Reports describe ATIS identification of a specific landing runway at parallel runway installations, followed by controller clearance to the other parallel runway, after which pilots land on runway named in ATIS. Controllers suggest an alerting phraseology such as "Landing runways 17L and 17R, dual runway operations in use" as a corrective measure.

Text of Response: The procedures for ATIS are contained in Handbook 7210,3C-1350 and permit the phraseology as suggested by the controllers in the safety report. The handbook clearly specifies "runway/s" and Example #2 also identifies approaches in use to *two* runways. We know that most locations do specify multiple runways when more than one is used. However, we are publicizing the matter in our Supervisors Digest as a reminder.

19. Text of AB: Herndon Airport, Orlando, Florida: With the nightly shutdown of Herndon's control tower at 2300 (local time), the approach lights to runway 7 are set to high intensity; the Orlando FSS is unable to control the intensity of the lights. Recent pilot reports complain about the brightness of these lights, particularly following an IFR flight and breaking out under a low overcast. A report suggests light systems that are controllable either by Orlando FSS or from the aircraft if lights are left on high setting because of lights on highway south of airport.

Text of Response: The Airway facilities Division, FAA Southern Region, has coordinated with the Air Traffic Division to ensure the correct operation of approach lights to runway 7 at Herndon Airport. When the control tower is unattended, the approach lights will be set to medium intensity step number 3. A memorandum establishing this procedure has been brought to the attention of each air traffic controller at Herndon Airport. Because of the expense of installing additional controls at the Orlando flight service station, no further action will be taken unless the approach light intensity continues to be a problem during unattended tower operation.

Bulletins 20 and 21 address issues arising with the use of advanced radar beacon equipment. Coordination and communications problems are the subjects of Bulletins 22 and 23. Bulletin 24 relates to the cost versus benefit dilemma as it relates to an ATC function.

20. Text of AB: Omaha Radar System, Minneapolis ARTCC: Extensively documented reports of problems associated with this particular radar system have been received. Numerous examples exist of weak, lost, and split beacons and of false targets, target swapping, "ring around," and azimuth shifting. Several reports allege that the problems have existed for 5 years and have not been diminished or corrected despite repeated UCR's, USR's, and formal requests for assistance. According to recent reports the problems associated with the radar system are becoming more acute due to the rerouting of aircraft from J60 to J144 to accommodate Denver's new high profile descent program. The reconfiguration of these traffic routes because of the Denver program causes more aircraft to transit the area served by the radar system in question. Controllers allege that radar separation cannot be provided within a 25 mile radius of the "main bang" at Omaha. This condition creates the necessity for setting up aircraft separation prior to their entry into the problem area, and then hoping that the separation will continue to exist until the traffic is once again in a workable radar area.

Text of Response: The problems outlined in the subject NASA Aviation Safety Report have been under investigation for several months. Several changes have been made; several changes are forecast.

Changes in the Minneapolis Center traffic flow, to accommodate Denver Center's sector realignment for profile descent, have caused a substantial increase in traffic operating in the proximity of the Omaha radar system antenna site.

Recently the following actions were taken to alleviate unsatisfactory beacon target returns, false targets, ring around, and azimuth shifting:

a. The STC power setting was reduced.
b. The beacon omni power was raised to 1,000 W.
c. The number of "hits" to declare a target was raised from six to seven.

Extensive testing within the last 2 months indicates that the problem has been reduced to the point that the Omaha radar system is the best system in Minneapolis Center in terms of false beacon returns. A sample test of the various Minneapolis radar systems rendered 561 false returns out of a total 73,330 beacon targets (0.76%) for the Omaha system. This was the lowest percentage of any system in the center. Additionally, input from the facility indicates the aforementioned "hardware fixes" have substantially reduced the "ring around."

At present, Minneapolis Center is testing a software modification. This modification would further reduce or eliminate the troubles encountered with the Omaha radar system.

In no case do we operate in a mode where we hope separation will exist. It is the controller's responsibility to ensure separation and if he cannot provide radar separation, he will use nonradar separation. We provide air traffic service in many areas where there is no radar coverage and safety is not jeopardized.

Another long-range radar site is being considered to augment Minneapolis' Omaha system. Since Lease Service funds to provide data lines are not available at this time, we would have to submit this item through the budget process.

21. Text of AB: Cleveland, OH, Cleveland Hopkins TRACON: Controller reports indicate that despite numerous local and regional actions the attempts to improve the performance of primary and secondary radar and associated equipment commissioned with new TRACON in July 1976, false beacons, limited data blocks, and data switching persist unabated. Average rates of up to 80 such problems per hour are described. Reports suggest that misleading data occurring this frequently have led controllers to serious distrust of even good data with considerably increased potential for errors in handling traffic at this busy terminal. UCR's 316,126, 316,121, and 315,683 refer. It is stated that no lasting improvement has occurred with any of the actions taken.

Text of Response: The Great Lakes Region has taken several actions which improved the radar beacon equipment operation at the Cleveland Hopkins TRACON. The latest action was accomplished on April 5, 1977. This action decreased the number of false beacon replies from approximately 0.85% to 0.25%. The Air Traffic Tower Chief was advised on April 14 regarding this improvement. A follow-up check (April 25) on the current operation indicated that system performance is satisfactory. The region will continue to monitor the system performance and take necessary action should the performance be found unsatisfactory.

22. Text of AB: New York, NY: NYCIFRR: Three reports have been received in the past month of aircraft handoffs to Sates arrival sector, none with advance notice, none on a standard routing. One aircraft was 150-ACY V44 LEGGS-DRIFT-DPK 209 SELFF-BDR, 7000. A second was GSB V44 SATES-HPN, 7000. A third was CRE/V44 SATES-HPN, 13,000. No FDEP information was received by NYCIFRR, no ARTS data in CIFRR computer. In one case, the aircraft arrived at Leggs with traffic holding at SATES at 7000. Reports suggest that such traffic, cleared on non-standard routes during peak traffic hours and arriving without advance notice, constitutes a hazard.

Text of Response: The route V44 V229 through the CIFRR airspace was designed primarily to service single-engine aircraft enroute New England and Washington terminals at altitudes of 6000 and 7000 ft.

The CIFRR may suspend this operation with 15 minutes advance notice to the New York Center. Additionally, with prior coordination multi-engine aircraft may, at the discretion of the CIFRR Supervisor, utilize this route at higher altitudes. Advance notice should be received via FDEP, and ARTS data should be in the CIFRR computer prior to the flight being transferred to the CIFRR. If this was not accomplished, it would appear that the flights were not entered into FDEP properly by the New York Center.

In any case, under mandatory radar handoff procedures, the Center must retain aircraft within their delegated airspace until a radar handoff is accomplished.

Supervisors have been briefed to be alert for malfunctions in FDEP strip printing, and to advise the data system staff to follow-up any identified problem with New York Center.

23. Text of AB: Puerto Rico, San Juan ARTCC: Pilot reports describe problems in communicating with ZSU on both 134.3 and 121.5 in vicinity of Mayaguez, due apparently to ZSU's inability to use El Yunque site and remote transceiver at Las Mesas simultaneously. They are concerned that traffic departing or experiencing an emergency in the area of Mayaguez may not be able to communicate effectively with ATC. Mayaguez Tower does not have 121.5; problem is most severe when tower is not in operation.

Text of Response: The lack of emergency frequencies (121.5 HMz/243.0 HMz) in the Mayaguez area was recognized as a potential problem area, and an FY-77 F&E project was generated to provide the service. Action will be taken to provide the emergency frequencies as soon as the equipment is available and DCS link channels can be obtained.

24. Text of AB: New York, NY, NYCIFRR: JFK sector departure controllers are responsible for handling light aircraft transiting JFK area NE and SW bound, including aircraft enroute to Long Island. Departure controllers state they frequently need destination airport weather and JFK altimeter settings but must leave position to obtain it. Digital altimeter readouts are available at all arrival positions but not at departure position.

Text of Response: The problem as stated can be answered best in two parts, because the issuance of destination airport weather and the issuance of JFK altimeter are really two different issues.

When the digital altimeter displays were installed at the Common IFR Room, facility management decided, after a careful study of cost versus benefit, that altimeter displays were not to be installed at the departure sectors. Part of the reasoning used was the fact that the departure controller is very rarely required to issue an altimeter setting. Also, when this does become necessary, the handoff or data controller can obtain the appropriate altimeter setting via interphone from one of the arrival sectors or towers. The best estimate available for the number of times this would occur at the JFK departure sector is less than six per shift on the busiest days. The only altimeter settings that are regularly displayed, in the facility are for Kennedy, La Guardia, and Newark Airports, so if the controller needs a setting for one of the more distant satellite airports, such as Islip, it is necessary to obtain it by interphone from the tower.

The weather information that is displayed in the Common IFR Room is from JFK, La Guardia, Morristown, Teterboro, and Newark Airports only. This is done via electrowriters to the Kennedy, La Guardia, and Newark arrival sectors. Anytime any sector controls an aircraft destined for any other satellite airport, it is necessary for the sector to call the tower and obtain the most current weather at that airport. In the case of the aircraft that transit the JFK departure sector destined for airports on Long Island, usually the aircraft are handed off from the La Guardia arrival sector. The La Guardia arrival sector does not have interphone capability to the appropriate airports so must rely on JFK sectors to issue the destination weather.

Common IFR Room management is committed to preparing a facility directive that will thoroughly explain and set policy for the handling of these operations, and define responsibility for issuance of altimeter settings and weather.

HAZARDS TO FLIGHT

Bulletin 25 covers an issue of concern to both controllers and pilots – simultaneous landings on intersecting runways. A topic of particular interest to air carrier pilots is discussed in Bulletin 26; departure procedures expressed in terms of a minimum rate of climb in feet per nautical mile was treated rather extensively by the reporter. While the response to Bulletin 26 included in this report represents only the answer from the FAA, it should be noted that responses to the Alert Bulletin were also received from other aviation industry organizations that had been provided with copies of the Bulletin as a matter of courtesy. Bulletins 27 and 28 represent an awareness of, and the response to, purely regional and local problems.

25. Text of AB: Daytona Beach, FL, Daytona Beach Regional Airport Air Traffic Control Tower: An air carrier report describes a recent landing at DAB on runway 06L in which, on short final, he was asked to hold short of 34 due to student pilot training flights utilizing that runway. He points out that this eliminates 1600 ft of a 7500 ft runway, that it poses a potentially serious hazard if carrier aircraft has to go around. A runway parallel to the jet runway is available.

Text of Response: The procedure which allows simultaneous landings on intersecting runways is a safe procedure when applied properly. We intend to continue the use of the procedure where operational benefits are realized to the user or the system. Supervisors will monitor the application of these procedures to ensure they are applied properly. The pilot always retains the option to refuse a landing if he believes the procedure is not acceptable.

26. Text of AB: A potentially hazardous situation has been brought to the attention of the ASRS. Although confirmed by various other reports, the nature of the situation is best stated and analyzed in the following narrative summary, quoted with the permission of the pilot-reporter:

"The problem occurs when a minimum rate of climb in feet per nautical mile is specified on a departure procedure. Feet per nautical mile climb gradients are not specified in air carrier aircraft operating manuals, nor is any other type of rate-of-climb information. Only FAR climb limitation information is specified. This information frequently does not provide adequate coverage up to the elevations commonly used in SID departures and only extends out to about 6.0 n. mi. Also, such information is impossible to use when attempting to determine whether an airplane can make a specified climb gradient. The purpose of the TOGW Limited by Obstacle Clearance table is to determine a maximum takeoff gross weight for a given runway length with an obstruction fairly close-in to the runway. Computer printout performance data appearing in route manuals which pilots use instead of the TOGW charts is derived from these same operating manual charts. The data in most cases covers only straight out departures and there is no attempt to associate SID or IFR departure procedure climb gradients with maximum takeoff gross weights. It is now up to, the flightcrew's experience and "gut feeling" as to what the rate of climb will be. In most cases climb gradients specified on SID and IFR departure procedures pose no problem during normal operations. But, in some cases the climb gradients cannot be complied with during high gross weight/high density altitude operations. For example, the Taipei, Formosa chart which specifies a 420 foot per nautical mile climb gradient. On a hot day it is doubtful that a grossed out 747 could maintain the necessary rate of climb to accomplish this SID with all engines operating. Consider what the situation would be if an ingine failure occured after takeoff."

The reporter provides the following suggestions as possible methods to correct the situation:

"Require the airplane manufacturing companies to provide climb gradient information in feet per nautical mile, on a simple to use chart which can be related directly to the ft/n. mi. climb gradient information on the SID or IFR departure procedure. The climb chart should contain necessary information such as airport elevation, temperature, and airplane gross weight.

"Two such charts should be provided, one for all engines operating, and one for an engine out. If the airplane cannot accomplish a terrain limited departure procedure with an engine out, the crew should be provided with an alternate departure procedure in the event an engine fails. Or, perhaps the departure procedure should not be attempted on four engines, depending on whether the climb restrictions are based on terrain, ATC, or noise abatement.

"The aircraft operating manual 4 engine profile should extend to at least 5000 ft, maybe higher (based on a world analysis of SIDs and IFR departure procedures). The profile should be based on the ATA noise abatement profile unless another universally approved profile can be found (V_2 + 10 to 3000 ft AFE, then an acceleration through the flap retraction schedule at approximately 500 fpm, then acceleration to the 250 knot climb speed or climb schedule speed). The second chart should be based on the engine out profile. The profile in the engine out case will be a little harder to derive for universal approval and probably would be tailored to an operators SOP. However, the result should be the same. At the end of the runway, the pilot should be able to quickly determine if a new SID is acceptable.

"The SID or IFR departure procedure should contain a box which specifies the minimum vertical speed value in feet per minute which is required to make good the climb gradient. It should be referred to during the departure to assure conformance to the minimum climb gradient as the airplane accelerates through the flap retraction schedule."

Text of Response: These comments are in responses to the subject NASA Alert Bulletin concerning the availability of obstacle clearance data in operating manuals. Obstacle clearance information for FAR Part 25 aircraft is presented in FAA-approved Airplane Flight Manuals. These data are presented as obstacle height versus downrange distance for each gross climb gradient available, and fulfill the requirements of FAR 25.1587.

The pilot-reporter states that obstacle clearance information is not available from air carrier operating manuals. However, manufacturers do make these data available and they may be included in operating manuals if the air carrier so chooses.

Further development of this data requirement must be initiated by the air carrier.

27. Text of AB: Western Washington and Oregon: A controller-pilot reports that research reported about 2 years ago indicated that the worst icing conditions over west slope of the Cascades are in a sloping band about 1000–2000 ft thick, base 1500 ft or so above the general slope of the terrain. He also notes that normal ATC procedures for descending westbound traffic from relatively high MEA's over the Cascades to the successive MVA's for landing at Seattle will take low altitude aircraft through the worst of the icing band in typical winter storms. He asks whether wider dissemination of such information, and possibly revised vector descent patterns might not enhance pilot and controller awareness of the hazard and assist especially general aviation traffic in avoiding the areas of greatest risk.

Text of Response: We are familiar with the band of icing conditions on the west slope of the Cascades. The Flight Standards Accident Prevention Specialists hold many meetings each year to discuss hazards to flight such as this one. Last year there were 65 such meetings with over 4000 pilots in attendance. The problem of icing in this area cannot be stressed enough. The Accident Prevention Specialist is going to prepare a separate Letter to Airmen on this subject towards the end of summer. It will be disseminated to pilots.

The ice band is not static, but rather changes in size and location depending on the temperature. It would not be practical to revise procedures to completely remain clear of this area. Our Towers, Flight Service Stations, and the Air Route Traffic Control Center are aware of icing problems in the Northwest Region. They normally receive pilot reports on icing conditions and are able to pass this information on to other pilots.

28. Text of AB: Albany, NY runway 10 Final Approach Course: Report cites lack of VASI plus high, unlighted terrain, including tall trees, creates a hazardous situation during night operations to runway 10 at Albany. Problem is further compounded by the fact that runway 10 is of minimum length for jet aircraft operations.

Text of Response: The reopening of runway 1-19 this fall reduced the use of runway 10 currently to approximately 1% of total airport movements.

VASI on runway 10 is regarded as a very low priority item at Albany. Trees have been cut in the approach area for runway 10. There is an obstruction light on a pole on the ridge to the west of the threshold. This is the controlling obstruction. An airport inspection was conducted about February 25. No hazardous or unusual conditions noted.

MILITARY-CIVIL COORDINATION

Two general categories of issues typify the subject of military-civil coordination. First, the exchange of information regarding the existence of modified or new military procedures and current flight operations to the appropriate civilian facilities, is addressed in Bulletins 29 and 30.

The second, potential conflict situations during actual flight operations, is covered in Bulletins 31 and 32.

29. Text of AB: Various locations: Lack of timely notification to FAA Flight Service Station (FSS) and ATC facilities concerning planned military low altitude training route (TR) operations is reported to be creating potential conflict situations. Citing specific examples of notification being received by FSS personnel after the operations had already taken place or while the routes were being flown, a recent report from an FSS specialist pointed out several hazards resulting from failures to comply with the notification provisions of DOD Flight Information Publication AP/1B. Of particular concern was the possibility of civilian pilots being lured into complacency after voluntarily requesting information on TR operations and being informed that the applicable TR's were not active, when in fact the FSS had not received timely notification of TR operations which might already be in progress or about to begin. The FSS report also questioned that level of safety resulting from the provisions of DOD Publication AP/1B, section II, paragraph M-*Communications*, subparagraph 2, which states: "If contact with FSS cannot be established, route may be flown as filed."

Text of Response: Headquarters Tactical Air Command (TAC) is the primary USAF major command that uses low altitude training routes at speeds above 250 knots. The DOD makes every effort to provide a safe environment and obtain the required training to be proficient in low level navigation. All possible USAF flights file IFR flight plans to and from the training route entry and exit points, respectively. Normally the composite (IFR/VFR/IFR) flight plans are put into the ATC system for IFR clearance and dissemination to the appropriate FSS. When the ARTCC automated system cannot handle the IFR/VFR/IFR flight plan, manual dissemination is required which is time consuming and frequently precludes notification of the FSS of impending use of a training route. When the USAF is made aware of these circumstances, procedures are established to call the appropriate FSS directly. The USAF has no control over the FSS use of the flight plan information and is not aware if departure times and/or entry and exit times are passed on to the FSS by ARTCC. That information should be available from the FAA. Aircrews are instructed to initiate a radio call to the FSS after completion of the IFR leg to the entry point. However, often release from the ARTCC is at low altitude and not within the communication coverage of the FSS. That is the reason flights are authorized to continue onto the published TR without radio contact. Based on IFR flight plans, ATC clearance and actual departure times, however, TR usage information is available in the air traffic system.

30. Text of AB: Rickenbacker AFB, OH: Recent ASRS report suggests that a breakdown in coordination has occurred between the appropriate FAA air traffic control facilities and the Air Force regarding additions, deletions, or modifications to military standard instrument departures for this facility. Although the lack of coordination regarding Rickenbacker SIDs has been corrected as it relates to the specific recent incident, the issue of a lack of established procedures to ensure advance communication of future SID changes may represent a problem.

Text of Response: Contacted a representative at USAF Headquarters and learned that Rickenbacker AFB had published a military SID and did not coordinate the effective date with the FAA approach control at Columbus. This information was confirmed with a staff specialist in the Great Lakes Region.

The representative of USAF Headquarters and the Great Lakes Region believe that the existing USAF procedures, as updated, are sufficient to preclude a similar problem in the future. Additionally, the revised SID Order, which is now being finalized, will clarify FAA responsibilities in the handling/coordination of military SIDs.

31. Text of AB: Omaha, Nebraska: Several reports from pilots and controllers reveal the existence of an apparent critical situation in the vicinity of Millard Airport, as well as those sectors serving traffic operating west in and out of Eppley Airfield. High-speed, low-level, military aircraft operating off runway 12/30 from Offutt AFB are reported to have created conflict situations with various types of civilian operations, specifically training aircraft out of Millard and air carrier traffic approaching Eppley from the southwest. Reporters contend that even though the AFB authorities had agreed to keep training operations high in order to reduce potential conflicts and conserve fuel costs, T-38 aircraft have been observed and recorded operating at 3000 ft with airspeeds up to 350 knots.

Text of Response: In an effort to minimize T-38s' initial IFR departure flight at 3000 ft MSL, the Offutt RAPCON has recently initiated a special coordination procedure which facilitates cancellation of the 3000-ft tunnel altitude in a timely manner; just before takeoff roll. This enables the aircraft on a coordinated basis to climb immediately to higher altitudes, above local VFR aircraft operating in proximity to Offutt's airport traffic area.

We have concluded from our investigation that, (1) T-38 aircraft are being controlled in a safe and positive manner, (2) T-38 aircraft are being operated within their speed limitations, as waivered.

32. Text of AB: 25 miles west of Prescott (AZ) VORTAC in the vicinity of Victor 12: Several controller reports document repeated excursions by military aircraft outside the north boundaries of the Gladden 1A MOA; these operations generally involved penetration of the V-12 airspace. The reported boundary violations occurred at various altitudes and in several instances resulted in potential collision conditions between the military aircraft and civilian aircraft traveling on V-12.

Text of Response: The Southwest Region is aware of this problem and has already called it to the attention of military authorities at Luke AFB. The military has assured the region that positive action is being taken to curtail excursion from the military operation areas.

Report no.	Topic	Page

COMMUNICATIONS AND MISUNDERSTANDINGS

Misunderstandings based on communication problems continue to be associated with occurrences reported to the Aviation Safety Reporting System. Three examples, ranging from a simple problem to a rather complex one, are cited in the following reports.

1. Submitted by air traffic controller:

On this date I was assigned to the local position combined with ground control position and monitoring an air traffic control trainee specialist. The trainee had been recently certified on the ground control position. About 11:25 A.M., a single-engine aircraft called for taxi instructions from the National Guard ramp. The trainee issued taxi instructions to rwy 15. In the meantime, a flight of four fighter aircraft was approaching the area for an overhead 360 approach to rwy 21. The priority traffic problem at that time was sequencing another light aircraft entering a left downwind for rwy 15. That problem being solved, the fighter flight was cleared to land. As the lead aircraft in the flight was touching down, he broadcast to "stay to the right side, aircraft on the rwy." "Number 3 go-around." Simultaneously, I made a transmission "for 3 and 4 go-around," but I couldn't see the aircraft number 1 in the flight mentioned. Subsequently I did see the light aircraft taxiing at approximately midfield on the southeast side of rwy 21 and 3. The third and fourth fighters in the flight went around. Instructions were then issued to the light aircraft to taxi straight ahead turn southeast on rwy 15, after some confusion as to who the aircraft actually was. Numbers three and four in the fighter flight then landed safely on rwy 21. Numbers 1 and 2 landed safely but rolled out passing the light aircraft on the rwy.

Factors that led to the incident: (1) ground and local control positions were being worked combined; (2) a trainee was being monitored on the combined positions; (3) taxi instructions issued to the light aircraft were incomplete or at the very least confusing ("Taxi to rwy 15, hold short of rwy 15"); (4) pilot of light aircraft not familiar with airport rwy or taxiway layout (the pilot taxiied on a rwy without clearance); and (5) the aircraft color blended exceptionally well with terrain (aircraft was white and green, bottom of aircraft green blended with grass, top of wing blended with rwy).

2. Submitted by air traffic controller:

At 2129Z I relieved another controller on sector 15 interphone and radar. He briefed me on the traffic situation. The briefing concerned an airliner landing Stapleton International, who had just been given an amended clearance to FL230, and a departure climbing to FL220 deviating around thunderstorms through the arrival gate. Thunderstorms were developing in the arrival and departure gates.

After working with some traffic in the southeast sector, I looked back at aircraft B and aircraft A and observed them to be head-on. So I called traffic to aircraft B as "Aircraft B traffic twelve o'clock 10 miles descending to FL230." At this time I observed aircraft A's Mode C readout indicated the aircraft was out of FL210 and the interim altitude was FL230 as was indicated on the strip and as I was briefed. I requested aircraft A's altitude which was reported by the pilot as leaving

FL20.7. I then requested Aircraft B's altitude which was reported as leaving FL210. I then told aircraft A to expedite through FL200. I requested aircraft B's altitude again which he reported as leaving FL21.5. I believe that I then noticed aircraft A was more than 1000 ft below aircraft B and had been for 2 or 3 miles when I called traffic as twelve o'clock and 3 miles. The pilot's answer was "in sight." I believe that I never had less than standard separation even though both aircraft were head-on, one descending and one climbing.

After listening to the voice recording, I determined why aircraft A did not stop at FL230. The controller I relieved did clear aircraft A to FL230 after a profile descent clearance was given earlier. However, when the controller released his mike switch after giving the amended clearance, the pilot of aircraft A was also on the frequency in the middle of a sentence and was overriding the controller's transmission. The pilot never heard the amended clearance and so acknowledgment was never received from the pilot by the controller.

3. Submitted by air traffic controller:

The corporate jet received a clearance to 15,000 from Binghamton, NY and then proceeded to dial 17,000 in his window and began a climb to that altitude. On initial contact the jet advised he was climbing 17,000. I issued a clearance to the aircraft to "Maintain 15,000." There was no reply. I started a track on the aircraft and observed he was on the wrong transponder code. I then issued the following clearance (from tape replay). "(Aircraft identification), Maintain 15,000, squawk 2703 and acknowledge please." The jet acknowledged only for the transponder code change. I was convinced, however, that he had received the altitude assignment and proceeded to operate on that basis. While issuing the clearance to the jet I was unusually busy with computer entries. His configuration was such that "point-outs" were necessary to both a high and low altitude sector and also a handoff to another high altitude sector. The point-outs had to be followed up with a verbal confirmation that they were in fact received. An interim altitude, 15,000, was also placed into the computer. (I was pushing a lot of buttons.)

Traffic for the jet was an air carrier proceeding over Hancock Victor 273 Syracuse. To facilitate eventual descent clearance into Syracuse the airline was turned 20° left. This turn, fortunately, provided the difference between a serious incident and what did occur. The airliner was issued traffic (required by merging targets procedure) as "one o'clock and 4 miles climbing to 15,000." The corporate jet readout was 14,600. Airliner did not see traffic. The next altitude refresh was 15,000 and that was followed by an update of 15,300. The corporate jet was advised "Altitude assignment is 15,000." The aircraft replied "We are climbing to 17,000." The two aircraft were laterally separated at this point and the light jet was continued to FL250. The airliner, hearing this dialogue, reported seeing the other aircraft high and off to the right.

It would seem that both co-pilot and controller in this situation misinterpreted information and I would guess that a good part of this stems from the fact that both were preoccupied with many other tasks.

It is my impression that since the advent of the current radar displays and automatic procedures there has been a deterioration in a controller's "listening" skills because of an increased reliance on the visual aspect of the job. More concretely, a change in Air Traffic Handbook, paragraph 526, requires that traffic be issued only to scheduled air carriers under merging target procedures. If traffic had also been issued to the corporate jet, the aircraft may have been alerted to the fact that something was amiss.

COORDINATION PROBLEMS

An interesting problem occurring at the junction of the airspace of three Air Route Traffic Control Centers was recently reported by two controllers, both of whom described the problem in similar terms. The report of one is reproduced here.

4. Submitted by air traffic controller:

I received a handoff from Kansas City Center on Aircraft B, FL390, westbound J110 to Los Angeles. A few seconds later I received another handoff from Kansas City Center on Aircraft A northwest bound FL390 from southeast of Lamar direct Lamar landing Denver. At the time the handoff was taken on Aircraft A, the conflict alert went off between the two aircraft which would come together south of LAA if no action was taken. Working the interphone, I called Kansas City Center and requested control to FL370 on one or the other aircraft. Kansas City released both aircraft to my control to 370. With this information I informed my radar man that we had control of either aircraft to FL370. Since aircraft A was landing at Denver the radar man cleared him to FL370. He did not get a reply from the aircraft or see any altitude change and since time was limited, he then cleared the other aircraft to 370. As aircraft B started to descend the conflict alert once again went off but this time with aircraft C southeast bound at FL370. Prior to this time Aircraft C had been in our airspace that had been handed off to Kansas City Center and was now in their airspace, in the same sector which gave us aircraft A and B. Seeing this, my radar man climbed aircraft B back to FL390 and turned him right to a heading of 360. He then turned aircraft A left to a heading of 270 to that these two aircraft would stay apart. Once aircraft B was clear of aircraft C he descended him again to FL370 so that he would go under aircraft A. I believe that aircraft A and B should not have been handed off in the state that they were in. An altitude change on either aircraft prior to the handoff would have worked out fine. Also, aircraft B should not have been released to FL370 by Kansas City with aircraft C right in front of him going the other way.

The airspace where this took place is a very bad spot because three Centers come together there (Denver, Albuquerque, Kansas City). Aircraft in this area become a problem day in and day out. I believe it would help if Denver Center got airspace about 30 miles south of what they have now into the Albuquerque area and about 40 miles east of what they have now into Kansas City Center in the area around LAA. Having that airspace would reduce the problems that now occur. We also have proper radar and radio coverage in this area.

While the second controller's report was virtually identical, he brought up another point which is of some interest.

5. Submitted by air traffic controller:

... After determining that aircraft B was definitely clear of aircraft C, I again instructed aircraft B to maintain FL370. Another aircraft was eastbound on J102 at FL370 over LAA. Reaching FL370 aircraft B was advised of the eastbound traffic. Thirty seconds later, aircraft B was asked if he was making the requested left turn to 4LS. He replied that he was. He was again advised of the traffic and he replied that he had the traffic in sight. I asked aircraft B his heading and he replied 330. I then cleared the other aircraft to turn left 40°. The aircraft passed 4 miles apart, 1 mile less than required. Aircraft B had turned 30° in 1 minute. I knew that air carrier aircraft turned slowly at high altitudes but I didn't know exactly how slowly. Perhaps if others had been surprised by such turn rates, it would help if controllers would be provided with more specific figures on high altitude air carrier turn rates.

Adequate briefings are an important part of coordination between controllers. The following occurrence demonstrates the problems that can arise.

6. Submitted by air traffic controller:

On the above mentioned date, I was working flight data in the TRACON when the team supervisor for arrival functions excitedly told me to get my headset and relieve another controller on arrival radar 1. I was unaware that this controller had just been involved in a systems error and near midair collision. Thinking him to be possibly ill, I plugged in with him to "get the picture." He pointed out aircraft A, 6 miles northeast heading 180 at 2300 ft. He said "A is going for a visual" and continued to point out two or three other aircraft. He was visibly upset so I assumed the position and asked aircraft A if he had the field in sight. He replied, "Affirmative" so I cleared him for a visual approach, sent him to the tower and continued to work my traffic. The following Tuesday, I was informed that while researching the systems error package, the Assistant Chief discovered that the weather was below visual approach minimums when A was cleared for a visual approach. The weather was M18OVCST while our minimum is 1900 ft ceiling.

Coordination among sectors was the cause of a recent potential conflict involving two corporate aircraft.

7. Submitted by corporate pilot:

My aircraft, A, was on IFR flight plan to Sidley Airport at 6000 ft MSL. At approximately 1645 hours, Memphis Center cleared aircraft A for the approach to SZY to descend and maintain 2800 ft until the SZY radio beacon. Aircraft A descended normally to 2800 ft; upon reaching SZY we turned outbound to a 330° bearing and began descent to initial approach altitude of 2100 ft MSL. At 2500 ft MSL aircraft A was below the overcast. We cancelled IFR and turned back to the airport. At 3 miles at straight in approach to runway 16, aircraft A made a call for a 3 mile straight in approach to runway 16, Sidley.

At this time aircraft B made a call that he was entering crosswind for runway 16 and had aircraft A in sight. Both aircraft landed uneventfully.

After landing, the pilot of aircraft B indicated that Center had cleared him for 3000 MSL for approach and he had also cancelled upon breaking out of the overcast. Aircraft B was approaching from the west and aircraft A from the east. Center (two different sectors) had apparently cleared both aircraft to approximately the same altitude (3000 and 2800, respectively) at approximately the same ETA over SZY RBN. Neither aircraft was aware of the other's presence. Had ceilings been lower and both aircraft been forced to execute the full approach, a potential conflict situation would have existed.

Frequency usage was associated with another problem, during the decombination of two sectors.

8. Submitted by air traffic controller:

We were in the process of decombining the arrival and departure positions. The aircraft involved in the incident was an A inbound to the Dayton Airport on the 24R localizer and aircraft B inbound to Piqua Airport on a converging course, northwest bound. Aircraft A was cleared to descend from 4000 to 3000 by the arrival controller, and the pilot acknowledged by saying, "all right." I, working with departure position, was controlling aircraft B at 6000 and he requested lower. I coordinated with arrival for the converging A traffic and was told I could descend to 4000. I then cleared B to descend to 4000.

A few minutes later Aircraft A reported seeing the traffic in front of him. I did not realize aircraft A was even on my frequency and advised him that the traffic was at 4000 and to contact approach control on the proper frequency. He said he was also level at 4000 and switched over to approach frequency. Both aircraft had already crossed courses.

The pilot of Aircraft A should have read back the clearance to 3000 and stated his call sign. The arrival controller should have made certain the pilot received the clearance by getting a proper acknowledgment.

It should also be noted that aircraft A was still on departure frequency when the positions were decombined. When the arrival controller turned off the departure frequency and began to use arrival frequencies, he was unable to contact aircraft A in two attempts to verify his altitude. I think when positions are combined, all aircraft should be on one frequency to the extent possible with regard to transmitter capabilities.

PROCEDURES AND PRACTICES

Procedures and practices of both pilots and air traffic controllers may become a problem under conditions of high workload. It is in such circumstances that judgment factors often become *important in determining whether a problem becomes an incident. The next several reports illustrate examples of these factors.*

9. Submitted by air traffic controller:

Air Carrier Aircraft A from Rochester to Minneapolis cruising at 10,000 ft. Aircraft B inbound to Minneapolis on J113 descending from FL330.

Time: 0162Z: Initial contact from Aircraft B descending to 240. I cleared him for high profile descent to cross 38 miles southeast of Minneapolis at 7000. We remained inbound on J113.

Time: 0133Z: Aircraft A called off RST climbing to 10,000 heading 320 vectors for Minneapolis.

Time: 0134Z: It was soon obvious that Aircraft B was overtaking Aircraft A so Aircraft B was recleared to 11,000 ft. B was on a high profile descent so he was too high to utilize speed control effectively. A was issued heading 345° while B was going directly to the airport headed about 320°. This was a delaying vector for A to allow B to overtake him.

Time: 0135Z: B was told to maintain 11,000 ft. A was level at 10,000.

Time: 0136Z: A told to cross 38 miles southeast of MSP at 7,000.

Time: 0136Z: A told to turn right heading 360. No acknowledgment. A told again to turn right heading 010 and reduce speed to 250 knots. At this time A was converging on B at about a 70° or 60° angle at 250 knots. B was in A's twelve o'clock position 5 miles.

Time: 0137Z: Aircraft A asked what was his traffic. At this time Mode C indicated B had not stopped at 11,000. I asked B his altitude; he said "11,000." Mode C now showed him level at 10,000. B was told to turn right heading 360 maintain 11,000 immediately. A then said he was going to 9500 ft. A was told to maintain 9000 immediately.

Time: 0138Z: B was level at 7000. The aircraft passed at the altitude within 1 mile or less. In a phone conversation later, the pilot of Aircraft B said they never reset the altitude alert going from 7000 to 11,000 ft and they must have been waiting for the gong. The pilot of aircraft A said they passed mighty close.

Although sea-level barometric pressures often do not vary enough from standard to make an appreciable difference in air traffic control, they can and did do so on several occasions during the past winter. Two reports involving failure to reset altimeters follow.

10. Submitted by corporate pilot:

The flight was cleared to climb to FL200 direct to VOR. During climb at approximately 15,000, the flight was recleared to an NDB. The NDB was tuned and signal received; the direction the ADF needle pointed didn't make sense. The station identification was rechecked and confirmed. About that time a rather loud report was heard indicating some sort of structural damage. Both I and my copilot did a quick check of warning lights and what we could see from the cockpit. Everything seemed to be in order so Center was asked for a vector because we couldn't comply with the direct routing. Clearance was changed and the flight proceeded according to the new clearance. We were in the process of leveling at 20,000 ft when Center came back and told us we were instructed to climb to 200. At first our reply was that we would level at 200 then I realized that with the confusion I had passed 18,000 without resetting the altimeter to 2992. Due to the low barometric pressure that day, we were several hundred feet too high. After resetting the altimeter the flight continued. The report heard turned out to be a broken bolt in the door lifting mechanism which had nothing to do with the integrity of the airplane. The problem with the NDB was simply distance from it.

The basic problem was too many things going on at once so resetting the altimeter at 18,000 ft was missed. Two things could have reduced the workload. The copilot could have been flying the airplane so the Captain who was making the decision would not have had to think about flying too. The problem with this is there are times when having the copilot fly can be more demanding than doing the flying. ATC could have given a simpler clearance (e.g., radar vector) that didn't require looking up information right away. The route change was not a problem until the facility to be used turned out to be out of range, and then the workload increased considerably.

11. Submitted by air carrier pilot:

We were about 200 miles from LGA and were given descent to FL190 with no expected crossing altitude later. The descent was at pilot's discretion. In the descent, turbulence changed from light to moderate so I was in no hurry to get to a lower altitude, as turbulence had increased as we descended. About FL220, we were given descent to 9000 on a DME fix from Milton VOR, which we could not receive satisfactorily. Clearance was then changed to a crossing restriction on the JFK VOR. At about 80 DME from JFK we were given clearance to 9000 ft, to cross the JFK 55 DME at or below 10,000 ft. We advised ATC that we didn't know if we could do it or not but we'd try. We received no definite statement in reply, so we began a rapid power-off speed brake descent to 9000 ft, still in moderate turbulence. There was some confusion involving a "How do you read this transmitter," a frequency change, and an off-course vector in the latter position of descent. We leveled off at 9000, and made the restriction. We immediately noticed the improper altimeter setting (29.92 instead of 29.15) and immediately climbed to 9000 ft. This had put us at an altitude of 8300 ft instead of 9000 ft. I do not believe ATC was aware of this deviation because there was no question or comment from them.

Causes: (1) Early descent with no expected crossing altitude. I do not believe this would have happened if we had an expected crossing altitude or an arrival when altitudes and speeds depicted. (2) Rapid descent in moderate turbulence was distracting in that the crew focused most of its attention on aircraft control, attitude, and speed. The aircraft was on autopilot and it seemed that all attention was focused on a rapid descent to crossing altitude. (3) Crew missed resetting altimeters at 18,000 ft. No excuses . . . I do feel that we had not been given the chance to properly prepare and plan for the clearance we were given. (4) Weather: If the east coast had not been under the influence of a deep low pressure area, the altitude deviation would have been much less. I have seen this problem occur before but it doesn't normally cause large altitude deviations. Perhaps complacency about resetting altimeters is a factor here. Turbulence greatly complicated matters in this case. Recommendations: Most of all, I believe that when descent clearance to below 18,000 is given, one of the altimeters should be set to local barometric setting. Present procedures do not provide for this. Granted there were several other contributing factors, this was not an isolated case and a procedure such as this should at least be studied. I do not suggest that ATC was at fault, but they were no help. Basically, I do not believe that crew coordination was a major factor in that there was no lack of communications or cooperation either before or after this incident. The remainder of the flight was uneventful all the way to touchdown at La Guardia except for almost continuous turbulence.

It is well known that pilot expectations are important in determining pilot behavior. A brief report makes this point clearly.

12. Submitted by air traffic controller:

Aircraft A, a single engine high performance airplane, VFR flight plan from over SBJ via JFK to RVH and then to destination. Aircraft A checked in with Newark and was assigned SBJ-JFK-RVH at 2500 ft. Aircraft was transferred to JFK TCA controller approximately 10 miles southwest of La Guardia VOR. Communications transfer took longer than usual and pilot wound up 2 miles southwest of La Guardia at 2500 ft mixed in with IFR and VFR traffic landing La Guardia runway 31. Aircraft was issued 3500 and a heading of 150 to get him away from La Guardia traffic. When questioned as to why pilot was over La Guardia instead of JFK as cleared, pilot asked for JFK VOR frequency and then replied that he had tuned the LGA VOR instead of Kennedy because that is the route he had requested. When he was issued the JFK VOR route, he stated he failed to change the VOR frequency to Kennedy.

Most pilots attempt to give their passengers the most interesting ride possible. On occasion, however, deviations from assigned routes may become a problem for Air Traffic Control. An example of such a pilot practice follows.

13. Submitted by air traffic controller:

An air carrier jet was flying LAX J189 SEA. At Crater Lake, OR, the aircraft made a drastic heading change (approximately 325 to 270) without advising the Controller. The heading change placed the aircraft at least 5 miles west of course on a heading that was rapidly increasing this distance. No other traffic was involved. This was the second such occurrence on this shift. I have witnessed many such deviations over Crater Lake, even when aircraft were on an assigned vector heading. Flight crews should obtain clearance to deviate from assigned route or heading.

Note: It happened again today: Same type aircraft northbound, assigned vector of 340, turned to 360 without requesting or advising he was going to deviate. When questioned about heading change pilot said, "We were taking a little scenic tour."

Problem is that these deviations occur very near a boundary between two sectors. Traffic from SFO to PDX/SEA is controlled by sector 15, and aircraft are often vectored in close proximity to sector 14/15 boundary. Deviation in the vicinity of Crater Lake can place a sector 15 aircraft within 3 miles of the boundary.

ASRS has received a number of reports from pilots complaining of the necessity for very high rate descents in a number of areas. On occasion, the requested descent exceeds the aircraft's capabilities. The following two reports demonstrate two quite different pilot reactions to receiving such clearances.

14. Submitted by air carrier pilot:

Flight 123, CMI-IAD: While descending into Dulles, center held us at 230 until approximately 15-20 n. mi. west of FRR and then cleared us to cross 10 east of FRR at 8000. The power was reduced and spoilers deployed. At approximately 6 n. mi. east of FRR Center asked us if we were going to make the crossing restriction. There was some exchange of conversation as to the late clearance and also our aircraft configuration. In trying to make the restriction the airspeed restriction of 250 knots below 10,000 was exceeded. We crossed 11 n. mi. east of FRR at 8000 but airspeed was in excess of 250 knots. The airspeed was reduced as soon as possible when pressurization and aircraft were stabilized in normal configuration. Rapid descent caused some passenger discomfort due to outrunning cabin pressure altitude.

A normal descent should have been started approximately 50 to 60 n. mi. west of Front Royal to cross 10 east at 8000. I do believe center has a normal crossing restriction of 40 n. mi. west of FRR at 230. Factors involved here were a late descent clearance, preoccupation with making the crossing restriction, and the conversation regarding the restriction. The cabin pressurization problem due to rapid descent was also distracting. In hindsight I believe trying to make the crossing restriction would have been the top priority over the airspeed restriction in a loss of communications situation, although this did not occur. Another factor was a rather strong tailwind which I don't believe the controller knew about. No evasive action was required.

15. Submitted by air carrier pilot:

We were level at FL270, having descended from 370 in accordance with previously issued clearance. At 17 DME west of HAR, eastbound, we received a clearance to "descend so as to cross HAR VOR at and maintain 17,000." It was not possible to descend this quickly. We advised Center and received an alternate clearance. This is a continuing problem with ATC in this sector on this airway.

Any clearance from ATC which is outside the normal performance capabilities of the aircraft is an exercise in futility. It requires a refusal by the pilot and a revised clearance from the controller. The increased workload on both increases the chance for error. It is also conducive to an attempt by the pilot to "Give it the old college try" who may discover too late to get a revised clearance that he cannot make the crossing restriction.

Recommendation: Controller should be thoroughly schooled in performance capabilities of all aircraft they control and all ATC clearances should be tailored to fit these performance capabilities.

The concept that pilots and controllers each provide redundancy for the other in the ATC situation is often mentioned in ASRS reports, although it is believed that the potential uses of this approach have not been explored systematically. One of the best examples of a case in which one of the two was operating on incorrect information and the problem was detected by the other is cited below. Another example is cited on page 32.

16. Submitted by air carrier pilot:

Approaching Fresno, weather 800 overcast 2 in fog, ATIS information indicated ILS 29R. We departed cruise altitude for 9000, 30 DME north of Fresno. Passing 12,000, the controller inquired if we wanted a back course localizer 11L as the wind was 180 at 5 knots. After checking the cabin and assuring the flight attendants were through with their service, and also confirming that the weather was above back course minimums, we accepted and applied full speed brakes to get down and on profile. Due to the quick changeover and limited time available, I requested the first officer to read me the transition to the backcourse. He did so ... I performed the necessary procedures, intercepted the backcourse and crossed Buckles at about 4500. The minimum altitude was then 1500 ft to Shaw. Prior to crossing Buckles, the controller and the first officer had a discussion about our heading. I was busy flying the back course and going from full speed brake to 2° flaps, so I didn't really understand the entire conversation about our heading. Passing through 1800 ft, the controller issued a turn to 180 and climb to 2000. We complied with this immediately and once level, I inquired why we were "pulled up" and given these instructions. The controller said we were 10 miles north of FAT VOR and on a heading of 115° we would soon be in the "high" country. He stated the 180 heading was to position us properly on the back course. We then quickly checked our VHF nav receivers, double checked identification and ADF/VOR function switches and from all indications we were about 8 miles south of the VOR. He argued that we were north of the VOR on his radar. We suggested that he could possibly have the wrong aircraft; he replied we were the only Code 0400 in the area. We again checked our receiver and centered the FPDI on the VOR. At this time we were 10 DME on the 177 degree radial. He said we were now passing abeam the VOR. We told him exactly where we were according to our equipment and that one of us was wrong. After a fairly long silence, he replied that he had checked with the tower's "BRITE display" and they confirmed that we were right and showed us just south of Chandler airport. We then got several vectors to position us for an ILS 29 approach which we completed without difficulty. After reaching the gate, I called the watch supervisor. All he could tell me was that they had recently changed the range and obviously it was 10 miles off. He had called maintenance and written the incident up. I advised him that I intended to report this to NASA and our own safety program as a lesson for all pilots to learn from.

The following report, which discusses controller terminology with respect to altitude restrictions, is another illustration of a potential problem that has been cited by ASRS and others throughout the past year.

17. Submitted by air carrier pilot:

Cleared by Washington Center to cross 25 miles northeast of GSO at 8000 while on a direct course to GSO on the 043 degree radial. At about the time I was crossing victor 266 Center cleared me to 6000 with no comments or crossing restrictions. As a point of interest I told the Center that I was going to make the 25-n. mi. restriction at 8000, however, I wanted to know if it had been his intent to cancel the 8000 restriction. The controller seemed chagrined at my question and assured me that the restriction did apply and his intention was not to cancel it. I then asked him about the "new" phraseology in which clearance to a new altitude without specifying previous restrictions cancels those restrictions. Again he was a little sheepish in his reply as he admitted that I was correct. Now I hope this report does not embarrass this gentleman as I feel that he is a victim of gobbledegook. It is begging for trouble to use phraseology which requires an exact interpretation by the pilot and by the controller. Center frequencies are not so busy that a controller can't say "Cancel previous restriction" or "Previous restrictions apply." This is a severe hazard and it should be stopped now. If it is not, and if everyone gets used to it, complacency will set in sometime in the future and someone is going to forget the proper interpretation. The results could be disastrous.

Two additional reports are cited that take issue with current ATC procedures. While both reports emanate from occurrences at Los Angeles International Airport, only the first is specific to that site. The second concerns a more general problem of runway usage.

18. Submitted by air carrier pilot:

This report is in regard to an ATC clearance procedure used frequently by Los Angeles Tower. Normally, departing jet aircraft receive a pre-taxi clearance to maintain FL230 via a SID departure such as Ocean 2 or Seal Beach 5, etc. Then, the non-standard happens, when with the takeoff clearance or sometimes on takeoff roll, LAX tower issues a "Maintain 2000 ft" restriction. It was stated this was required by IFR departing aircraft from Torrance Airport. This is particularly unsatisfactory and could be unsafe for departing jets for the following reasons: (1) Maintaining 2000 ft assigned compromises the SID lost communication procedure, putting the aircraft into FAR 91.127 regarding altitude. The SID lost communications says maintain heading 210 to 3000 ft before turning, then climb. Communications failure keeps the aircraft at 2000 on SID routing until entering MEA approaching SLI and for a full 10 minutes before unrestricted climb. This would cause a lot of complications in the Orange County, El Toro area. (2) It compromises our required aircraft anti-noise climb departure procedure . . .

19. Submitted by air carrier pilot:

Upon landing, observed commuter carrier aircraft taking off from same runway at same time. Separation of aircraft given as 8000 ft by tower. Weather overcast, bases approximately 500 ft, tops approximately 1500 ft.

Spoke to watch supervisor; I was told that he thought separation was adequate, with which I agree unless a missed approach is required for whatever reason. At that point my faster aircraft and the slower aircraft would be attempting to fly in essentially the same airspace at the same time. This airspace would probably have been in the cloud layer over the area.

At the current time it appears that approaches and departures are authorized without regard to possible conflicts due to missed approaches. The assumption is that all approaches will be completed. It is standard procedure to clear takeoffs and landings at Las Vegas from runways with conflicting headings. This also sets up a conflict should a missed approach be executed. In Reno, aircraft are cleared for approaches in airspace which would have to be used in the event of missed approach, before preceding aircraft are on the ground. These examples serve to illustrate that the missed approach is not planned for. We are playing games with the odds.

EQUIPMENT PROBLEMS

Previous reports and many articles in the Aviation Press have described the problems that occur due to inadvertent actuation of emergency locator transmitters. This report cites an example of such actuation and its effect on an IFR flight.

20. Submitted by corporate pilot:

This flight was on an IFR flight plan from St. Petersburg, FL to Raleigh-Durham, NC. I had just been transferred from Jacksonville Center control to Jacksonville approach control and had transmitted flight number and altitude to JAX approach with acknowledgment from approach. At altitude and location specified above, I first noticed considerable noise (resembling numerous ambulance sirens) coming from the number 2 comm receiver. At this point I surmised that someone's microphone below had become stuck. The sound continued so I switched to the other comm set. The same sound continued. It was at this time that I surmised that my ELT had gone off. I could not raise approach control due to all the horrible noise and both VOR NAV receivers were absolutely unusable. With the control switch for the ELT being outside the aircraft, it was impossible for me to disconnect or turn off the unit. I did finally manage to call JAX and by keeping the receiver as high as possible I was barely able to discern information from the Center. Conditions were undercast below and I informed the Center that I would proceed to IDU as planned assuming that I would be able to raise enroute controllers. The DME, transponder and ADF continued to function, but the ELT noise from the communications receivers was almost unbearable. The flight was completed and the ELT turned off after landing at RDU. Such a situation in high density traffic under extreme IFR conditions could prove disastrous due to lack of adequate communication and navigation equipment.

The malfunctioning unit was an early model which had badly corroded. A new unit was installed as a replacement. For safety reasons, I feel that ELTs should have control switches in the cockpit area to eliminate such situations as I have referred to above. It would be much safer to turn the unit off than to have an inadvertent actuation of the ELT in difficult traffic or weather conditions. Apparently this condition has happened to other unfortunate pilots as well.

Several reports during the past few months have described air carrier or corporate turbojet aircraft operating without transponder or without Mode C capability by advance arrangement with Air Traffic Control. Two examples of the problems which can occur in this configuration are cited below.

21. Submitted by air carrier pilot:

I was serving as pilot in command on a scheduled air carrier operation. We received the airplane at ABC and flew it to GHI with an intermediate stop at DEF. When we boarded the aircraft it was observed that the Captain's corrected air data system (CADS) was placarded inoperative. With this situation the aircraft operating manual requires that the automatic altitude reporting feature of the transponder be turned off at 6000 ft. After consulting the appropriate MEL we determined that the flight could operate without the altitude reporting feature with ATC's approval. ATC was advised of our problem through clearance delivery at ABC. The flight departed and proceeded to DEF at FL250 without problem. At DEF the same method of informing ATC was used and another clearance was received to GHI at FL290. The flight from DEF to GHI differed from the previous leg in that two Centers were involved, whereas the first leg only involved one Center. It was assumed that the first Center would communicate the transponder problem to the second Center. When the first center handed us off to the second at FL290 the controller advised that flight above 12,500 ft was not authorized without prior approval. We informed that we knew this and that prior request for approval had been made. The flight continued to GHI without further incident. The problems which precipitated this occurrence seemed to me as follows: (1) Poor maintenance action. Correction of this condition had been deferred from the previous day and the aircraft had been flown a considerable number of hours through several maintenance stations. (2) A breakdown of communication between maintenance and dispatch. Dispatch was uninformed of this inoperative system until I advised them of it. This piece of equipment should have been included in the remark section of the dispatch release as should all inoperative components which impose an operational problem. This one was not. (3) A complete lack of airline procedure to handle this situation relative to ATC. What information is available to the cockpit crew member is either vague or obscure. (4) The lack of adequate information transferred from Center to Center. It is quite common to be handed off from one controller to another and the new controller not even be advised of such things as assigned headings, altitude change, inoperative equipment, and true airspeed change by the previous controller.

22. Submitted by ATC controller:

Aircraft departing had inoperative altitude readout on Mode C transponder. AB123 was a departure out of DFW during heavy rain storm. I was working him as a departure radar controller in the Ft. Worth Center. He asked for a southwest deviation due to weather. I asked AB123 his altitude and I thought he said 170. As he was out of 170 I approved the deviation and pointed him out to the AQN arrival sector. AQN arrival pointed out AB456 inbound to DFW leaving FL279. I watched AB456 descend and kept track of his altitude so I could be sure that AB123 was above him. When AB456 was leaving 16500 DFW departure asked the altitude of AB123. I automatically asked AB123 his altitude expecting it to be at least 190 (still no altitude readout). AB123 replied that he was leaving 13,000. I immediately stopped him at 14,000 and turned him right. AB456 stopped at 15,000 and also turned right. The above evasive action was taken and thereby averted a possible collision. I know that if the first aircraft's altitude readout had been working this situation would have never occurred. I think that if the Mode C altitude readout is not working it should be brought to the attention of all concerned any time it goes out.

The next report, from a general aviation pilot, illustrates one problem of winter operations in light aircraft.

23. Submitted by general aviation pilot:

I noticed my oil temperature gauge reading high. On my next check my temperature had reached the red area and the oil pressure had dropped below a safe level. I reduced rpm's from 2400 to 2000 to try to cool the engine. I made a 180° turn to the nearest airport and landed without incident. The oil quantity checked normal. I grounded the aircraft until checked by a mechanic (100 hour inspection was scheduled for the next week). This is a club aircraft which is maintained to a strict time and use schedule. There was no apparent reason for the occurrence, but I was very happy I had kept an eye on the oil gauges.

Mechanic's report during 100 hour inspection: Cold weather engine kit was still on the aircraft and lightweight oil was still in use. The weather had warmed considerably and the combination added up to low oil pressure and high oil temperature.

Finally, a report by an Air Carrier passenger who is also a general aviation pilot makes note of a potential cabin safety issue in air carrier aircraft.

24. Submitted by passenger:

The following is one occurrence, illustrative of a widespread situation with potentially serious implications for passengers and cabin attendants. During the period after pushback from the gate and before pre-takeoff safety announcement, the cabin attendants passed out stereo earphones. In the event of a need for emergency evacuation after this point in flight, these lengthy (approximately 40 inch) cords could entangle passengers trying to make a rapid emergency exit. The same could also be said for cabin attendants during the conduct of their emergency duties. Since the introduction of passenger stereo, I have observed this practice numerous times and on many different scheduled carriers. Even though the need for emergency evacuation is remote, it seems to me stereo headsets should not be passed out at least until cruise altitude is reached and should be collected before the start of final approach. There is plenty of cabin attendant time for this on the longer flights where headsets are passed out. Passengers could be told that it's in their best interest if they want to listen during the time headsets were not being provided under the above mentioned procedural change.

JUDGMENT FACTORS

Our previous quarterly report included a number of examples involving judgment under the heading "Why Pilots and Controllers Get Gray." Although the title is facetious, those previously reported examples and the ones that follow here, are representative of the sort of problems that are most difficult to deal with.

Three reports illustrate pilot judgment factors. While the motivation was very different in the three cases, all three represent, at best, questionable judgment.

25. Submitted by general aviation pilot:

I was circling the local college watching a ball game doing 720° steep turns. Altitudes varying between 1400 and 1100 ft MSL. I was rolling from one bank to the other. Nothing I was doing I felt hazardous to pilot or those on the ground. I was in the area for 20 minutes which is the reason I believe I annoyed a number of people, who called the control tower and those around. The weather was CAVU and the time was dusk. I believe the extended time in the area was the reason for the reporting of flying "low," doing "loops," "rolls," and other such violent maneuvers over a town. I am innocent of any such violations, although I admit flying below 1400 ft (100 ft AGL) for small periods of time, possibly steeper than 60° bank and turns, and aerobatic maneuvers over town and below 1500 AGL during steep banks.

26. Reported by flight student, total time of 305 hours:

This event occurred during a training flight which originated from Santa Monica Airport and included a stop-over at a nearby airport to pick up the school's assistant chief pilot. Shortly after takeoff and power adjustment I was instructed to put on a hood and continue the flight under simulated IFR conditions. I had just leveled off and was putting the aircraft into a slow flight configuration. At this time I heard the throbbing sound of another aircraft's engine. I looked at my instructor while attempting to look outside and found he was turned around talking to his employer; he had been this way a good part of the flight. At this time the individual in the back saw the aircraft we had nearly collided with and said to the instructor, "You'd better do something." The instructor pulled back on the elevator control, I let go of the controls and the collision was averted. We came within 35 ft of an aircraft close to our flight path. This incident could have been avoided if the instructor had been performing his duty; the most important in this case, where I was wearing a hood, was to look for other traffic and not worry about his employer in the backseat. The assistant chief pilot in the back should have kept his mouth closed and let his instructor do his job. It also would have been prudent if they hadn't included company business with my IFR training flight.

27. Submitted by a charter pilot:

While on final approach to runway 4 left I was given a go-around without a reason by the tower, which I complied with. On my second approach, on base leg, I was asked if I had a green light condition for my gear and I replied that it was coming down at that time. When I got on the ground and back to the gate, there was a message for me to call the tower. When I called the tower the chief asked me if I had forgotten to lower my gear. I told him that I had not forgotten but that I was dropping the gear late on purpose. The chief seemed satisfied with my explanation and asked me to inform them the next time I desired a delayed gear extension.

Reason for delayed extension: I work for a Part 135 scheduled service. We fly twin engine aircraft which have a quick extension system for the gear. We are paid from a Hobbs meter which stops counting when the gear is lowered. It is my procedure to lower the gear relatively late. On this particular flight I was empty so I held off lowering the gear a little longer. On the average, we make 16–20 landings in a day. If you save 2 to 3 minutes on each landing through late gear extension you make $8.00 to $10.00 more a day and $40.00 to $50.00 more a week that you would not have made by extending the gear further out.

Finally, three reports illustrate situations in which combinations of circumstances conspired to prevent the system from running smoothly.

28. Submitted by air traffic controller:

Military aircraft A enroute from Moffett, Southland five departure, Salinas transition, called Oakland Sector 10 over Salinas at 7000. Airline aircraft B landing Monterey runway 28 was descending to land on vectors to the runway head-on with aircraft A. No separation was lost but Center was not talking to airline aircraft and aircraft A was under Oakland Sector 23 control. Aircraft A was not handed off to Sector 10 by Sector 23. Sector 10 was not aware of aircraft A in the Sector until aircraft A called. Sector 23 was very busy with other traffic and through a misunderstanding between manual and radar controllers, aircraft A wasn't handed off. This was automation-oriented too, first through the standard practice of positioning handed off data blocks in the PHI position, and second in that the automatic handoff feature did not function in this instance. Assuming strip posting could have warned Sector 10 of aircraft A's time over Salinas so that Sector 10 could have planned the situation but this didn't occur. Somehow all the warning devices or "crutches" failed and when a handoff wasn't made a deviation occurred. The deviation is being investigated.

29. Submitted by air carrier pilot:

DEF Flight 456 arriving O'Hare from over CGT, V-7 SOXES, Radar vectors O'Hare landing 14 right. There was a north-south line of thunderstorms moving east over O'Hare. Our vector was northwest through the line with a left turn to runway 14 right ILS final for landing. Thunderstorm was overhead at time of landing. DEF was proceeding north between two well-defined cells on the airborne weather radar when given a vector northwest into the left cell. Frequency was *extremely* congested. DEF requested to deviate north to avoid cell. Refused due to traffic. DEF requested lower altitude to get below cell, refused. Numerous other aircraft requesting deviations to avoid weather. DEF was given a vector west at 8000 ft. DEF 456 answered transmission to descend to 5000 ft MSL and turn southwest. After we were heading southwest at approximately 6000 ft, radar asked our heading and altitude. They told us to maintain 6000 ft and immediately initiate a turn to the north. It seems the transmission had been for ABC number 456. Even after we were apprised that ABC 456 was on frequency there was still some confusion due to extreme congestion on the frequency. DEF 456 had turned into final traffic on 14 right. I was operating the radios on DEF 456 and had prefixed all replies with my company name. This was not the fault of the approach controller; there were far too many aircraft on the frequency for the thunderstorm weather conditions existing at the time. Flights should have been vectored around the cells and required to hold to prevent this congestion. It was beyond human capability for an individual to give and receive that number of transmissions in the time span available. This congestion creates a very hazardous situation.

30. Submitted by air traffic controller:

I was working Sector 7 radar and had been working about 5 minutes when Sector 15 said they were going into holding. We gave the next four aircraft to Sector 15 which would fill all their altitudes. Aircraft A was the first aircraft that I held at Smity intersection at FL240. The flight ahead of A was descending slowly and didn't look like the sector was going to descend the aircraft below 240 so I stopped A at FL250. Narrowband radar started to drop in and out several times. Aircraft B was the second aircraft enroute holding in Smity intersection descending to FL260. Aircraft C was the third aircraft enroute to holding at Smity descending to 270. Aircraft D was the fourth aircraft at 280. I had other aircraft enroute to Smity intersection with holding instructions at all altitudes up to FL310. I was trying to display the hold list in the top part of the radar scope but the narrowband radar kept dropping out so after the third time I gave up. It was about this time that Sector 15 requested the next two aircraft so my interphone controller initiated radar handoffs on aircraft A and aircraft B. I descended A to FL240 to report leaving 250. Aircraft A reported leaving 250 so I gave then to Sector 15 frequency. I descended aircraft B to 250 report leaving 260. Aircraft B reported leaving 260 so I descended aircraft C to 260 report leaving 270. Aircraft C reported leaving 270. I descended aircraft D to 270 report leaving 280. Aircraft C reported leaving 280 at about the time the team supervisor came over and said that Sector 15 didn't want a radar handoff until the aircraft was in the hold list. Aircraft B was still flashing at Sector 15. I tried to take the handoff back but Sector 15 had just taken the handoff. I told the supervisor that we weren't getting any altitude information. We had two flights coming on frequency and the one flight I re-routed to avoid the inbound route. The other set of parallel tracks at FL390 was flashing at me. We didn't have any strips because the computer was behind with two start-overs. Then we started to get two and three strips on the same aircraft.

A departure aircraft from adjacent sector began to flash at us. I told my intercom controller to re-route the aircraft around our sector. Then Sector 15 called and asked if we were still working aircraft C and my interphone said yes; Sector 15 said descend C to FL210 and given them to us. I looked over at the strips and aircraft C was the bottom strip at 260 so I descended him to FL210 to report leaving 250 and 240. Aircraft C reported leaving FL260 so I descended aircraft D to 260. Aircraft D reported leaving 270 then I got a radar handoff on 3 aircraft parallel at FL390. Aircraft C reported leaving 250 so I descended aircraft E to 250 and aircraft D reported leaving 260. Then aircraft B called and said you have us at FL250. I thought at first it was aircraft F that called us so I verified his clearance, then aircraft B called again. I looked for a strip and didn't have one. Then I remembered that he was in the holding pattern and had aircraft B ident. Aircraft C reported leaving FL240 so I gave them Sector 15 frequency. Realizing that I had descended aircraft F to 250 I requested his altitude and he said he was at FL250. I descended aircraft F to 240 immediately and gave him traffic as one o'clock and 15 miles going around the back side of the pattern. Since I had not terminated radar we had 7 to 8 miles between aircraft C and aircraft B and 9 to 10 miles between aircraft B and aircraft F. Since Sector 15 had taken the handoff on aircraft B when the aircraft was over Smity intersection the full data block went into Sector 15's hold list and off my scope and my interphone controller had taken the strip down when he took the strip down for Aircraft A.

First, the strip should not have been taken down until the aircraft had acknowledged the frequency change. Also, if the hold list was the same intensity as the full data block instead of being connected with the limited data block and at only one-half intensity, Sector 15 might have realized aircraft B was still in their hold list and at FL250. It might be better not to have a preset place for the hold list because every time the narrowband radar drops and comes back, it comes back to the preset position and not where you might want it or have had it.

APPENDIX C

EXTRACTS FROM AIRMAN'S INFORMATION MANUAL AND AIR TRAFFIC CONTROL HANDBOOK

AIRMAN'S INFORMATION MANUAL
Part 1, Chapter 3 (July 1977)

SERVICES AVAILABLE TO PILOTS

RADAR TRAFFIC INFORMATION SERVICE

1. A service provided by radar air traffic control facilities. Pilots receiving this service are advised of any radar target observed on the radar display which may be in such proximity to the position of their aircraft or its intended route of flight that it warrants their attention . . .

a. *Purpose of the Service*: The issuance of traffic information . . . is based on the principle of . . . advising a pilot that a particular radar target . . . warrants his attention . . . to alert the pilot so that he can be on the lookout for it . . .

FAA HANDBOOK 7110.65, AIR TRAFFIC CONTROL
(October 1, 1977)

SECTION 18. ADDITIONAL SERVICES

511. TRAFFIC INFORMATION: Unless an aircraft is operating within positive controlled airspace or omission is requested by the pilot, issue traffic information to aircraft on your frequency when in your judgment their proximity may diminish to less than applicable separation minima . . .

510. APPLICATION: Provide additional services to the extent possible contingent only upon your capability to fit it into the performance of higher priority duties . . .

(Par. 22. DUTY PRIORITY: Give first priority to separation of aircraft as required in this handbook and to the issuance of safety advisories. Give second priority to other services that are required but do not involve separation of aircraft. Give third priority to additional services to the extent possible.)

Note to par. 510: The primary purpose of the ATC System is to prevent a collision between aircraft operating in the system and to organize and expedite the flow of traffic. In addition to its primary function, the ATC system has the capability to provide (with certain limitations) additional services . . . Consistent with the aforementioned limitations, controllers shall provide additional service procedures to the extent permitted by higher duties and other circumstances. The provision of additional services is not optional on the part of the controller, but rather is required, when the work situation permits.

b. *Provision of the Service*: Many factors . . . could prevent the controller from providing this service . . . The controller possesses complete discretion for determining whether he is able to provide or continue to provide this service in a specific case. His reason against providing . . . the service is not subject to question nor need it be communicated to the pilot . . . Traffic information is routinely provided to all aircraft operating on IFR Flight Plans . . . Traffic information may be provided to flights not operating on IFR Flight Plans when requested . . .

Note: Participation by VFR pilots in formal programs implemented at certain terminal locations constitutes pilot request . . .

510 (cont'd) . . . and on the basis of the following:

a. Factors such as limitations of the radar, volume of traffic, frequency congestion and workload.

b. You have complete discretion for determining if you are able to provide or continue to provide a service in a particular case.

c. Your reason not to provide or continue to provide a service in a particular case is not subject to question by the pilot and need not be made known to him.

SAFETY ADVISORY

A safety advisory will be issued to pilots of aircraft being controlled by ATC if the controller is aware the aircraft is at an altitude which, in the controller's judgment, places the aircraft in unsafe proximity to terrain, obstructions or other aircraft.

2. *Aircraft Conflict Advisory*. The controller will immediately issue an advisory to the pilot of an aircraft under his control if he is aware of an aircraft that is not under his control at an altitude which, in the controller's judgment, places both aircraft in unsafe proximity to each other. With the alert the controller will offer the pilot an alternate course of action when feasible . . .

The provision of this service is contingent on the capability of the controller to have an awareness of unsafe situations . . . The issuance of a safety advisory cannot be mandated, but it can be expected on a reasonable, though inter-

609. SAFETY ADVISORY: Issue a safety advisory to an aircraft under your control if you are aware the aircraft is at an altitude which, in your judgement, places it in unsafe procimity to . . . other uncontrolled aircraft. Do not assume that because someone else has the control responsibility for the aircraft that the unsafe situation has been observed and the advisory issued – inform the appropriate controller about it . . . Inhibiting the computer-generated MASW/EMSAW alert does not relieve you of your responsibility to alert the pilot . . .

b. . . . With the advisory, offer the pilot an alternate course of action when feasible.

Note: The issuance of a safety advisory is contingent upon the capability of the controller to have an awareness of situations involving unsafe proximity to . . . uncontrolled aircraft. The issuance of a safety advisory cannot be mandated, but it can be expected on a reasonable, though intermittent, basis . . . In mittent basis . . . This procedure is intended for use in time-critical situations where aircraft safety is in question. Noncritical situations should be handled via the normal traffic advisory procedures.

summary, because of the many factors affecting the ability to observe a situation in which unsafe proximity to . . . uncontrolled aircraft may be developing, this paragraph does not impose a duty to see the development of such situations; it does require, however, that when such a situation is known to exist, the pilot be so advised.

TERMINAL RADAR PROGRAMS FOR VFR AIRCRAFT

1. STAGE I SERVICE

a. In addition to the use of radar for the control of IFR aircraft, Stage I facilities provide traffic information and limited vectoring to VFR aircraft on a workload permitting basis . . .

Section 19. STAGE I SERVICE

1240. APPLICATION: In addition to the radar services prescribed elsewhere in Chapter 4, apply the procedures . . . in 1011 when arriving VFR aircraft are handled by approach control and provide vectoring service in accordance with Ch. 4, section 4.

(1011. APPROACH CONTROL SERVICE FOR VFR ARRIVING AIRCRAFT: Where procedures have been established for arriving VFR aircraft to contact approach control for landing information, issue the following:

b. Traffic information on a workload permitting basis . . .)

(Chapter 4, Sect. 4, VECTORING:

680. APPLICATION: a. Vector aircraft for separation purposes, noise abatement . . . operational advantages to pilots or controllers, or when requested . . . Vector aircraft for separation from other aircraft only within airspace where you have control jurisdiction . . .

Note: VFR aircraft may be vectored regardless of altitude. It is the responsibility of the pilot to comply with the provisions of any applicable Federal Aviation Regulations.)

2. STAGE II SERVICE

a. The purpose of the service is to adjust the flow of arriving VFR and IFR aircraft into the traffic pattern in a safe and orderly manner

Section 20. STAGE II SERVICE

1250. APPLICATION: In addition to stage I, apply stage II procedures at those locations where a program has been established for and to provide radar traffic information to departing VFR aircraft. Pilot participation is urged but it is not mandatory . . .

d. Standard radar separation will be provided between IFR aircraft . . . Standard radar separation between VFR or between VFR and IFR aircraft will not be provided . . .

f. Pilots of aircraft transiting the area . . . will receive traffic information on a controller workload permitting basis . . .

this purpose. If an aircraft desires the service but cannot communicate on the appropriate frequencies, provide the service to the extent possible using an available frequency. Aircraft which do not desire the service provided may be fitted into the landing sequence by the tower after coordination with approach control. Such aircraft shall, to the extent possible, be given the same landing sequence they would have received had they been sequenced by radar vectors.

Note: This service is mandatory on the controllers unless the pilot declares that he does not want to participate . . .

1251. SERVICE AVAILABILITY: Inform aircraft on initial contact whenever this service cannot be provided because of radar outage . . .

1260. HOLDING: . . . You may hold VFR aircraft . . .

3. STAGE III SERVICE

. . . The service is advertised in parts 3 and 4 of the AIM . . .

a. . . . The purpose of this service is to provide separation between all participating VFR aircraft and all IFR aircraft operating within the . . . TRSA. Pilot participation is urged but it is not mandatory . . .

d. The TRSA is . . . a radar environment . . . however, this does not preclude application of nonradar separation . . .

Section 21. STAGE III SERVICE

1280. APPLICATION: In addition to Stage II, apply Stage III procedures within the designated Terminal Radar Service Area (TRSA) or Terminal Control Area (TCA).

1281. ISSUANCE OF EFC: When VFR aircraft are held either inside or outside of the TRSA/TCA, inform the pilot when to expect further clearance.

1282. SEPARATION: As appropriate, separate aircraft in accordance with chapters 3, 4, 5 and 6 minima. Any of the following may be applied within a TRSA/TCA.

Note: Assignment of radar headings, routes or altitudes is based on the provision that a pilot . . . VFR is expected to advise ATC if compliance will cause him to violate any FAR's.

e. Visual separation is used when prevailing conditions permit . . .

a. Visual separation, as specified in 796 and 1262.

f. Until visual separation is obtained, standard vertical or radar separation will be provided . . .

Note: Radar or vertical separation must be maintained until visual separation is gained.

b. 500 ft vertical separation between VFR aircraft and between a VFR and an IFR aircraft.

Note: 500 ft vertical separation shall not be applied below a heavy jet.

h. Within the TRSA, traffic information on observed but unidentified targets will, to the extent possible, be provided all IFR and participating VFR aircraft . . .

4. PILOT'S RESPONSIBILITY: THESE PROGRAMS ARE NOT TO BE INTERPRETED AS RELIEVING PILOTS OF THEIR RESPONSIBILITIES TO SEE AND AVOID OTHER TRAFFIC OPERATING IN BASIC VFR WEATHER CONDITIONS . . .

TERMINAL CONTROL AREA OPERATION

1. *Operating Rules*: . . . Regardless of weather conditions ATC authorization is required prior to operating within a TCA.

3. *ATC Clearances and Separation*: While operating within a TCA, pilots are provided the service and separation as in the stage III, Terminal Radar Programs for VFR aircraft . . . In the event of a radar outage, separation and sequencing of VFR aircraft will be suspended . . .

4. Assignment of radar headings and/or altitudes are based on the provision that a pilot operating in accordance with visual flight rules is expected to advise ATC if compliance with an assigned route, radar heading or altitude will cause the pilot to violate such rules.

1287. TCA METHODS:

a. Clear large turbine-powered aircraft operating to or from the primary airport at an altitude or via a route which will avoid airspace being used by VFR traffic underneath the TCA floor and within VFR corridors.

b. Vector aircraft to contain them in the TCA once they have entered it. If it is necessary to extend an aircraft's flight path outside the TCA for spacing, the pilot shall be informed when the aircraft leaves and reenters the TCA.

c. An aircraft executing a missed approach or in other extenuating circumstances . . . is excluded from meeting the requirements of (a) above . . .

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16. Abstract

During the fourth quarter of ASRS operations, 1325 reports were received. A decline in reports concerning small aircraft was noted; more reports involved transport aircraft, professional pilots, instrument meteorological conditions, and weather problems. A study of 136 reports of operational problems in terminal radar service areas was made. Pilot, controller, and system factors were found to be associated with these occurrences. Information transfer difficulties were prominent. Misunderstandings by pilots, and in some cases by controllers, of the policies and limitations of terminal radar programs were observed.

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