FIFTH SYMPOSIUM ON AVIATION PSYCHOLOGY

TRAINING FOR ADVANCED COCKPIT TECHNOLOGY AIRCRAFT

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INTRODUCTION AND MOTIVATION

Advanced cockpit technology (ADVTECH) aircraft represent a major advance in the long evolutionary development of transport aircraft.

Shortly after these aircraft were introduced, the Aviation Safety Reporting System (ASRS) was asked by NASA and others in the aviation community to determine pilot opinion of the overall safety of new generation aircraft in the real world of day-to-day line operations.

One of the first steps the ASRS took to respond to this request was to survey a group of 48 pilots who flew ADVTECH aircraft in regular service and who had reported incidents. They were selected using a stratified, random sampling procedure. The survey was conducted by means of comprehensive "structured callbacks" (telephone interviews).

The pilots interviewed clearly identified training and, on some airlines, operating procedures as problem areas. Their view supported a general industry consensus that training practices had not kept up with advancing cockpit technology (Norman and Orlady, 1988). A follow-up study to examine ADVTECH training issues was undertaken.

While training and procedures are obviously interrelated (they provide the interface between the aircraft and the pilots who fly it), we restricted the follow-up study to training issues. There were several reasons. First, training and training concepts are relatively independent of variations in operating procedures. Second, if specific problem areas in training can be verified, improvements can be made with relative ease. Third, this subject was particularly amenable to exploration with the data-gathering tools available to the ASRS. Finally, because the adequacy of training directly affects cockpit workload (particularly during high workload periods), a training study could be expected to shed much-needed additional light on the difficult and controversial subject of cockpit workload in ADVTECH aircraft.

OBJECTIVES AND SCOPE

In the summer of 1988, we undertook a broad investigation of flight crew training issues relating to ADVTECH aircraft. Our objectives were to:

(1) Determine line pilots' views of the initial and recurrent training they received to fly ADVTECH aircraft

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(2) Determine the strengths and weaknesses of current training and the sensitivity of this training to widely varying needs

(3) Identify the most effective methods for instructing flight crews of advanced cockpit aircraft with the eventual hope of identifying model training curricula.

Because of space and time limitations this paper is restricted to a small portion of the above. We will discuss preliminary findings on only two issues:

(1) Training for crew coordination and communication with ADVTECH aircraft

(2) Maintenance of basic flying skills in ADVTECH aircraft.

These subjects were selected for this Symposium because they are important and of general interest. Our discussion will include some of the differences between Captains and First Officers on these issues.

APPROACH

One of the great strengths of the ASRS is its ability to contact the pilots who report to it during the very short period it holds reporter identification slips.

Between October of 1988 and February of 1989, approximately 100 pilots who were flying ADVTECH aircraft and had reported incidents with them to the ASRS were called and asked to participate in the survey. They were under absolutely no obligation to do so. These respondents were selected from the much larger base of ADVTECH pilots who submitted reports to the ASRS during that period. They were selected to get a reasonable (albeit not perfect) distribution between captains and copilots, among current ADVTECH transports, and among a variety of airlines ranging from established trunk and international carriers to newly-established commuter airlines. In other words, this was a stratified, random sample.

Description of Data

Our survey covered five types of ADVTECH aircraft which were flown by pilots of 12 airlines. The aircraft were grouped as follows: A300-600; B737-300/400/500; B757/767; MD-80; and MD-88. Selected pilot population variables are shown in Exhibit 1.

Exhibit 1. RESPONDENT DEMOGRAPHICS

	CAPTAINS	FIRST OFFICERS
FLIGHT HOURS		
Average	13000	6777
Range	4500-25000	2500-12500
YEARS WITH PRESENT AIRLINE		
Average	17.7	6.9
Range	1.5-35.0	0.5-17.5
HOURS IN TYPE		
Average	1025	720
Range	50-3500	50-2500
FIRST TIME IN PRESENT COCKPIT POSITION	27%	19%
TRANSITIONED FROM 3-MAN CREW	52%	63%

Method

We made initial calls to selected ADVTECH pilots to ask them to participate in this study and to make an appointment for the longer interview. There were no refusals. This procedure also enabled us to send these pilots a list of the general subjects we wished to discuss prior to inter-

viewing them. We did this because we wanted their considered opinions, not their "snap judgments." Virtually all of the pilots later stated this had been helpful.

In addition to basic demographic data, the questions we asked were based on nearly 30 training issues previously identified by ADVTECH pilots in our earlier study or developed from a *Working Paper on Training for Advanced Technology Aircraft* (Orlady, 1988).

The telephone interviews took approximately one hour and were all conducted by experienced airline pilots. We needed interviewers with this background and expertise because they were required to quickly establish a rapport with the interviewees and because of the technical nature and the often open-ended form of many of the questions. These pilot interviewers were given special callback training on interviewing techniques, with particular emphasis on the importance of controlling interviewer bias.

Responses were placed in a relational database. Further analysis of the results of the callbacks is continuing and will consist of the development of appropriate descriptive statistics for the respondents, as well as comparisons between pilot groups representing different cockpit responsibilities, different training and flight experience, and different flight environments.

FINDINGS AND DISCUSSION

It is important to remember that even without the complication of advanced cockpit technology aircraft, airline pilot training is a complex subject. Its complexity is increased by many factors. These factors include a broad range of aircraft, some very basic differences in airline operations and operating philosophy, and the varying training resources of airlines that range from established trunks and international carriers to newly-formed airlines. Further complicating this picture are differing training needs of pilots with a wide range of skills and experience, and the need to operate in an ATC system which is not always sensitive to the performance characteristics of these aircraft.

Because our space is limited, we will be able to discuss only two of the specific training issues we examined. We will then conclude with some general observations. The first of the specific issues is intracockpit communication and crew coordination in ADVTECH aircraft, the second is maintenance of basic flying skills.

Intracockpit Communication and Crew Coordination

As was suggested in our previous study, a substantial proportion of the pilots we interviewed believe that good crew coordination and good intracockpit communication are even more important in ADVTECH aircraft than in their predecessor airplanes.

Their importance is also recognized in industry training practices. For example, approximately 70 percent of the pilots surveyed received their transition training utilizing a full "crew concept" during simulator training. Nearly one-half of the remaining 30 percent, who instead were trained by cockpit position (i.e., captains with captains and copilots with copilots), believed this was not a good practice.

One of the major innovations in airline flight crew training over the past decade, has been the development of formalized Cockpit Resource Management (CRM) training which stresses crew coordination and intracockpit communication. Companies for 85 percent of the

pilots had formalized CRM training programs. In an almost unanimous response, 97 percent of the total pilots interviewed believed that "there is a real need for such programs."

The comments given in Exhibit 2 illustrate the variety of reasons for the support of the line pilots for CRM training despite some criticism of their airlines' current programs, and other qualifications.

Exhibit 2. COMMENTS ON QUESTION P3b.

"As a professional pilot, do you think there is a real need for a CRM program?"

CAPTAINS' COMMENTS

('YES' Responses)

"However, one year the programs are good, the next year no good."

"Pilots are mechanical- not people-oriented (i.e., people managing). Our program still doesn't recognize this."

"It's needed for some individuals."

"Timid crew members are sometimes afraid to voice their opinions."

"Have less personality conflicts than in the past. Capt. regards the rest of the crew as human beings and accepts inputs from the rest of crew."

('NO' Response)

"Has diluted Capt. authority. Not necessary!"

FIRST OFFICERS' COMMENTS

('YES' Responses)

"Everyone's opinions are considered."

"Puts things into perspective and recognizes F/O intelligent input."

"Don't feel free to volunteer input with certain types of captains (personality)."

"Not enough feedback to company on line operations being used in training."

"Have noticed changes in crews recently, but I'm not flying with the old timers."

('NO Response')

"Not as presently given."

Maintenance of Basic Flight Skills

While there is nothing new about the problem of maintaining basic flying skills, there is considerable evidence that this difficulty has been exacerbated with ADVTECH operations (Orlady, 1988). Prior to the introduction of ADVTECH aircraft, the problem was largely confined to long-range flight operations with their limited number of takeoffs and landings. However, when highly-automated ADVTECH aircraft were introduced, the policies and procedures of many companies stressed the maximum use of their automatics. This policy, which has been somewhat facetiously called the "we bought it, you use it" philosophy created a very real maintenance of skills problem for the pilots flying these aircraft. Several airlines have modified their policies considerably since our first ADVTECH study.

One captain we interviewed had an interesting comment regarding this problem. He explained that the maintenance of manual skills had indeed been a problem until his airline had moderated its policy regarding maximum use of the automatics. He said it is still a problem for low-time pilots, but in this case the problem is in the initial development of skills—not in the maintenance of skills that have already been developed. He said further, "It's not their fault, but many of the new copilots have never had a chance to learn these skills and they don't have enough opportunity to practice." Exhibit 3 presents typical

comments made by captains and first officers when asked if the maintenance of skills was a problem for the low-time pilot.

Exhibit 3. COMMENTS TO QUESTION T22b.

"Do you think that the attainment and retention of manual flying skills is a particular problem for low-time pilots?"

CAPTAINS' COMMENTS

('NO' Responses)

"Most fly manual too much when they should use auto."

"Has to do with personal discipline—not low time."

('YES' Responses)

"They get so enthralled with all the magic they forget how to flip switches back to raw data."

"You can't develop additional skills without flying. When you need to hand fly, you need your highest skills. The only way to attain and maintain them is to fly manually."

"Yes, but also for everybody else."

FIRST OFFICERS' COMMENTS

('NO' Response)

"Because most of us fly a lot manually and company encourages this."

('YES' Response)

"Have to force yourself to fly manually. Some captains are more comfortable if you are on auto. Some captains are not good on PNF duties."

Before concluding with some general observations, we would like to reemphasize the point we made earlier in this preliminary discussion of our findings. Even without the additional complication of advanced cockpit technology, airline pilot training is a very complex business. There are a great many variables and some of them are critical. With few exceptions, one can make industry-wide generalizations only at considerable peril.

SUMMARY

- Pilots like these airplanes.
- We saw nothing which caused us to conclude that the addition of sophisticated automated systems has reduced the level of basic airmanship skills required of an airline pilot.

- We saw nothing that suggests that automation reduces training needs.
- Despite glowing testimonials in its support, computer designed or computer assisted training is not yet an unqualified success.
- Major advances in information display, as exemplified in glass cockpits, have created some problems that may be related to training. Moving map displays are an exception. They are universally liked.

Our overall impression is that there have been definite improvements in the quality of ADVTECH pilot training since these airplanes were introduced. This is not surprising for there have always been "shakedown periods" in new training programs. The quality of individual programs still varies, and individual needs are not always recognized.

However, there seems little question that pilot attitudes toward ADVTECH training and operating policies have changed. The pilots we interviewed for this study believe that current operating policies and the training they received show greater sensitivity to line operating needs than did their peers, who were surveyed in our earlier study.

Still, there is room for improvement. Some training methods seem more effective than others. Some carriers appear more adept at training their crews for service in ADVTECH aircraft. We expect to publish the full findings of our study this summer. At that time we will furnish considerably more data and will identify those operating policies and training procedures that we believe have demonstrated their worth and should be more universally implemented.

REFERENCES

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