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Guidelines for Line-Oriented Flight Training

Volume II

John K. Lauber and H. Clayton Foushee
Ames Research Center
Moffett Field, California

Proceedings of a NASA/Industry Workshop
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PREFACE

Line-Oriented Flight Training (LOFT) is an instructional technology still under development. In order to conduct a thorough review of the concept and the accumulated experience with it, the Federal Aviation Administration (FAA) and industry representatives requested that the National Aeronautics and Space Administration (NASA) organize and conduct a workshop to address various conceptual and practical issues related to LOFT. Since one of the important functions of the NASA aviation human factors program is to foster discussion and the exchange of experience, data, and views within the industry, NASA agreed to conduct such a workshop.

The NASA/Industry workshop convened a broadly representative group of airline management, pilots, flight engineers, and government personnel to review various approaches taken to LOFT by air carriers and their experiences with it. In view of the fact that LOFT under Advisory Circular 120-35 has not met with universal acceptance among airlines, it was essential to include representatives from those airlines as well, so that all of the significant issues would be fully and fairly addressed.

Preliminary remarks were made by a representative of the FAA, the chairmen of the training committees of the Air Transport Association, Air Line Pilots Association, and Allied Pilots Association, and by the Vice President, Air Safety and Engineering, of the Flight Engineer's International Association. The NASA presentation that followed focused upon issues that had been identified on the basis of discussions with various people and observations made during field trips to airline training centers by the editors of this report. The remainder of the first day was devoted to a series of presentations and general discussion by the carriers who are currently conducting LOFT according to AC 120-35 or who have developed and conducted alternative approaches and/or evaluation studies of the concept.

Following a general discussion of issues raised by the preceding presentations, assignments and instructions were given to the four working groups whose individual reports provide the foundation for the guidelines presented in Volume I. All of Day 2 and the early part of Day 3 were spent in individual working group meetings and in the preparation of the draft working group reports. On the third day, a plenary session was held during which the working groups presented their individual reports. Questions and discussion followed each report, and after a general discussion and closing remarks the workshop was adjourned.

The present volume is intended as a companion volume to the Guidelines for Line-Oriented Flight Training (Volume I). It contains the proceedings of the workshop including transcripts of the various presentations and discussions, as well as the draft working group reports.

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SECTION 1

INTRODUCTORY REMARKS BY NASA AND INDUSTRY REPRESENTATIVES

INTRODUCTORY REMARKS BY NASA AND INDUSTRY REPRESENTATIVES

DR. JOHN LAUBER (Workshop Moderator): It looks like most of us are here, so I would like to begin by welcoming all of you to what I believe will be a very interesting and, hopefully, productive three days. In order to get started I would like to have Al Chambers say a few words of welcome on behalf of the Center. Al is the Chief of the Man-Vehicle Systems Resesarch Division.

DR. ALAN CHAMBERS: It is a pleasure to have you here. I think a number of you have been to workshops that we have held before, but to those of you who have not, you will certainly find out what the workshops are like and what we expect from you.

These workshops form a very essential part of our total research program, and I hope that during the next few days you will have an opportunity to find out more about some of our other activities. John may give you that opportunity, but if he doesn't, please do not hesitate to contact me or some of our other personnel.

DR. LAUBER: At this time, I would like to introduce representatives of the many organizations who are attending the workshop so that each may make a brief statement about their interests and concerns. It seems most appropriate to begin with Charlie Huettner of the Federal Aviation Administration. Charlie is the Assistant Chief of the Air Transportation Division. He is going to make some comments on behalf of the FAA and what they would like this workshop to produce.

CHARLES HUETTNER (Federal Aviation Administration): Today is January 13, 1981, and I think we should all take note of this date because today you are embarking on an adventure into the flight training techniques of the future. We think that it is important to assemble this group at this time. This is a very important time for us.

The FAA is keenly interested in the results of this particular workshop. To assist this effort, I thought it might be beneficial for me to describe the FAA involvement in flight training over the last few years, to discuss the background and plans for the regulatory effort underway at FAA, and to offer a few comments about the workshop and what we feel the objectives of this effort should be.

FAA involvement in LOFT began June 10th, 1975 when we received a letter from Tom Nunn of Northwest Orient Airlines petitioning for an exemption from FAR 121.409 to permit a new

type of training in that airline. Our review and subsequent disposition of this petition resulted, on February 5th, 1976, in Exemption No. 2209 which allowed a test program for this type of flight training which at the time, had no name.

Finally, on July 13th, 1977, after examining the success of the Northwest program in operations review No. 5, we proposed a regulatory change which would permit any airline to utilize this type of training as part of their recurrent training program. In the spring of 1978, a meeting of industry, FAA training personnel, instructors, and FAA inspectors was held in an attempt to make a decision about the guidelines for LOFT. This resulted in Advisory Circular 120-35, which was published on May 24, 1978, and I am sure most of you are aware of the guidance FAA has provided since that time. On May 25, 1978, FAR Part 121 was amended to allow LOFT to be part of any airline's training program. We considered it to be a significant step in training ways of dealing with crew coordination problems--problems which we found so prevalent in the accident statistics we had reviewed.

Unfortunately, there has been a slow response from industry in accepting the voluntary program. Much of this may have been due to the restrictions which the FAA placed upon the program. However, on August 25th, 1980, the Federal Aviation Administrator, Langhorne Bond, announced before Congress that FAA would undertake a regulatory program to require LOFT as part of all FAR 121 simulator-training programs. The Administrator's statement placed priority on the program which had already been established in the Air Transportation Division.

On August 24th, 1979, the Air Transportation Division issued a letter to the FAA regions and to various segments of the industry soliciting comments about how to advance training in a progressive way so that in the 1980's and 1990's we could maximize the use of advanced simulators and meet the challenges raised by previous accidents. Almost one year to the day that the Administrator announced that we were proceeding with the program on a priority basis. Since that time, we have established a regulatory program, and we view this workshop organized by NASA as a critical first step in this area. Our goal in the regulatory program is to work with the industry as best we can in the months ahead to develop a draft Notice of Proposed Rule-Making (NPRM) sometime this summer.

The goals of the regulatory program, as we envision them at the present time, are about five-fold. First, it will include mandatory LOFT. Second, we hope to examine the possibility of restructuring training frequency in order to facilitate coordinated crew training. As you are well aware, we now have Captains returning for training twice a year and the rest of the crew returning once a year. Thus we are going to investigate

issues related to the optimum time frame for the conduct of training. Third, we believe that there is still a neccesity for a proficiency check of some type at some period of time. We do not, however, envision the inclusion of any type of check as part of a LOFT program. This is a separate issue. The FAA feels very strongly that LOFT should be a training program only, but in our regulatory program we will be examining training and checking as part of the regulatory development. Fourth, we feel that it is important to build some flexibility into the regulation in order to better accommodate future training objectives. As you are aware, the current Appendices E and F rigidly define the type of training and the amount of time which must be devoted, such that there is no room for new concerns. Thus, we are looking at ways to build in flexibility. Finally, we are going to try to include types of training that cannot be accomplished in the aircraft. Historically, these are maneuvers and procedures that have been utilized in training and things that can only be accomplished in difficult types of weather conditions. We are also going to explore how to incorporate environmental systems and human factors training as part of the recurrent training process.

With these goals in mind and the context of the FAA position, we are here to examine the role of LOFT. As we see it, the challenge is to develop LOFT guidelines. With respect to these guidelines, there are at least five things to keep in mind. One, they should be practical. We do not want to get caught in a situation where we provided a program that no one could see fit to use. Two, we want to make full use of the advanced simulators that are now available. Three, we want to include environmental, aircraft, and human factors problems which have been identified in the aircraft accidents over the past few years. Four, we want to challenge the flight crew. We do not want the LOFT program to develop into a situation where crews routinely do the same things in training. We want a program which challenges the crews to think, act, and use their judgement. And fifth, we feel that the program should meet the challenge of improving safety in the years ahead.

In the working group discussions over the next two days, we do not want you to feel constrained by past FAA requirements for LOFT. We consider the entire concept from top to bottom to be under review, and we are looking very carefully at the outcome of this workshop. We thank NASA for assembling this group and consider the objectives of this effort to be a significant activity in the improvement of aviation safety. We thank you for the opportunity to address you all.

WALTER ESTRIDGE (Chairman, Air Transport Association Training Committee): It is indeed an honor to be present with this group, dedicated to a program which could start a new era of safety in airline operations. I am convinced that we are

actually on the threshold of putting together one of the most significant advancements in training and operations.

It seems that either by design or by coincidence, a combination of circumstances has convened to allow us now to go forward. Simulator technology, including greater computer capacity and iteration rates, better visual systems, more realistic motion systems, and control loading systems have combined to give us the training vehicle long awaited. We are now at a point which will allow us to start meaningful training of flight crews in resource management through LOFT. We have known for a long time that such training was needed, but could not organize a program that would meet the need. We have known through the 5Ø's, 6Ø's, and 7Ø's that it was the "human element," all too often, which contributed most heavily to catastrophic air carrier accidents. There were, of course, accidents caused by mechanical failure and other elements over which no one had control, but sadly enough the greater percentage were caused by human failure.

In retrospect, after each accident we all seemed to recognize, after the fact, where the breakdown had occurred. All too often, we heard: "Lack of crew coordination" or "check list was never run" or "he just didn't see it," or "he failed to utilize his crew." So now, through experience and the record, we have convinced ourselves to do something about it. That "something" is called "Resource Management Training."

Resource management, to me, means giving the most professional attention in preparation, planning, operation, control, and review of the whole man-machine interface. I believe that resource management starts early on in the selection and training process to place the right people, properly qualified, into the machine. But on a day to day basis, for the flight crew member, it could start early in the day-- by being properly prepared and ready to assume the responsibilities of the daily assignment. it could start with a freshly laundered shirt, a neatly pressed uniform, and a flight kit filled with up-to-date manuals and equipment! In other words, we must teach our crews to manage the <u>whole</u> system--including proper flight planning, weather analysis, and crew briefing. It can well depend upon whether the rest of the crew is greeted in a cordial manner, and whether a good exchange of information takes place, setting the stage for a good flight deck and cabin atmosphere. I have always been convinced that a hostile atmosphere in an airplane or even an atmosphere of uneasiness, because of one dominating crew member intimidating to the rest, is an accident looking for a place to happen. There are many elements involved in total resource management, but I believe that LOFT programs can become the backbone of resource management training.

So, another important factor of those converging circumstances has been identified. We have already agreed that the technology has arrived and that is one part. We also agree that we now have identified the man-machine interface problem called resource management. Now the third part of our triangle has arrived. We have all just heard FAA's Mr. Charlie Huettner describe what I would like to call "enabling legislation." And, that is the third part of our puzzle. I believe that what we are seeing now is quite historic. This is an excellent combination: technology, resource management, and enabling legislation which will allow a complete restructure of regulations to include LOFT in our programs. With this combination, I believe we can accomplish the best training and safest operation of air carrier aircraft that the world has ever known.

The Air Transport Association Training Committee has worked together very well, under the leadership of men like Captain Al Frink of Pan American or Captain Barney Barnwell of Continental, to arrive at formulas and programs which would put us all ahead through more effective regulations allowing total simulation. Many improvements have been made over the years, but I think we are now about to take another quantum leap which may well set the stage for many years of safer turbo-jet operation. LOFT can help us do just that.

During this conference, you may hear some of us discuss such "alphabet soup" as FAR Part 61, 63, 121, Appendices A, E, F, and something called Appendix H, Advisory Circular 121.14C, and Advisory Circular 12Ø-35 which addresses LOFT. Now to those members of the ATA Training Committee who are here such as Captain Tom Nunn of Northwest and others, these are documents and subjects which they are quite familiar with. We discuss all of them regularly at ATA and in our day to day operations, but I know that not all of you have had an opportunity to become familiar with all of these documents. In short, these are enabling documents that we have used in past years to conduct airline flight training and checking programs. From time to time, we have seen some good changes made. It seems to me that what we now need to do, and Charlie Huettner put it extremely well I think, is put all of these variables together in a box and look at them all carefully. It is now time to include LOFT in these documents in a way which will enable carriers to combine it with their other training. Incidentally, while we are talking about regulations and numbers, recently I was asked, "What is LOFT?" The questioner said, "I have heard that there is big LOFT and little LOFT!" Now I do not know exactly how we

ever arrived at these terms, but it is significant that there is a difference. We must not get big LOFT mixed with little LOFT!

These terms are familiar to those of us who have lived with them for the past year or so, but I recognize that they have no meaning to anyone else than those of us sitting around the table at ATA. I can say now, however, that we need to put big LOFT and little LOFT in the box also. While we are at it, we must also include Appendix H and take a long look at what will happen to flight simulation as a result. We must also include Part 61 for pilots and Part 63 for flight engineers.

May I suggest, as we proceed with this conference, that we not only discuss LOFT but let us look at how it will affect other programs, such as original licensing as well as recurrency. It is clear to us that an application of LOFT which may work for U. S. Air certainly will not work for Pan American. We all have different segment lengths and content must be designed to meet the needs of each particular carrier.

We must also stress the necessity of providing flexibility in the enabling document which FAA is to draft. We must be most careful to provide the options necessary before we finalize our recommendations.

There are more variables to consider. We have been reminded constantly, in the training world, that we need real-world, real-time training. In LOFT, we must emphasize that it is this type of training --real-world training that is required. If we are to be successful, we must have crew acceptance. It must be training and not checking if we are to succeed. If flight crew members are not convinced that this is the best training that they have ever received, then we will have failed. The crew member must see LOFT as a better way of training in real-time and in a non-threatening atmosphere that he recognized as natural, allowing him to develop his cockpit management skills.

The ATA Training Committee has also committed itself to other activities. We have submitted, for instance, a complete package to FAA for FAR Part 61 and 121, Appendices A, E, and F. These documents have been well received by FAA, but little or no activity has taken place. We understand, however, that the FAA has been unable to react to our proposal because of time constraints and the need to write and implement the total simulation FAR Rule 121, Appendix H, and Advisory Circular 121.14C. These documents were of paramount importance, inasmuch as all the carriers were suffering from the extremely high cost of training operations and fuel costs. Since the simulation technology was here, we needed to go ahead with total simulation.

This committee work, however, is still under consideration and I am confident that it is a part of the contents of the "box of variables" that I mentioned earlier. The committee also submitted proposed changes to FAA for the FAA LOFT Advisory Circular 120-35. These suggested changes would make the Advisory Circular usable to all carriers who desire to use it, giving those options and flexibilities needed for their operation. This proposal is also under consideration by FAA, and I suppose it will be an overall part of the suggestions to be considered by FAA.

Another input just received from Boeing, is a document which proposes some training manuever deletions and improvements for future training programs. This package will be looked at by training committee members and combined with our proposed changes. These maneuvers are some of the presently required maneuvers of FAR 121, Appendices E and F. I am confident that the rationale expressed in this proposal from Boeing will substantiate the need for change.

May I conclude by re-stating that there are many variables to be considered during this conference. We should not feel constrained in any way from introducing our thoughts and points of view. I believe that we should consider all of the documents and experiences that we are familiar with, the papers and views presented here, and combine them to catalog guidelines for a better and more workable LOFT document. This document will then be recognized by industry which is already aware of the need for resource management training. May I challenge you all to a productive workshop. Thank you for your attention.

DR. LAUBER: Walt, I'm going to ask: What is little LOFT? I admit some ignorance.

CAPTAIN ESTRIDGE: Well, let's see, how many people know what little LOFT is? I see a few hands going up. Little LOFT is LOFT associated with Appendix H training. That is, the four hours of LOFT which follows transition, or total simulation. This LOFT program is strictly a set of training exercises to prepare crew members for line-flying. Appendix H requires four hours of LOFT prior to the initial operating experience phase in the airplane. Big LOFT is recurrent training; little LOFT is the phase which follows transition.

DR. LAUBER: As you said, there is a difference.

CAPTAIN ESTRIDGE: There is a specific difference in these two forms of LOFT and we want to keep them separated.

D. F. THIELKE (Vice-President of Air Safety and Engineering of the Flight Engineers' International Association): The FEIA is

an organization that has really not been involved in many of the previous meetings that have been referred to this morning. We do appreciate the opportunity to participate in this workshop as an organization. From what I have read, what I know about LOFT, I believe that as an organization, we are concerned with almost every aspect of flight training and the application of the LOFT concept.

One of the major reasons for our concern is that it is apparent that a flight engineer is one individual who is very heavily task-loaded during a LOFT exercise involving three crew members. Now, resource management development is the main thrust, I believe, of LOFT. The method of task-loading and human factors measurement during the application of LOFT is one of our concerns. How is it done? How do we assess the workload? How does the individual applying LOFT evaluate the performance of a crew member? These are areas requiring elaboration. One of our main concerns is how do you propose to measure workload? How are you going to apply this workload factor with LOFT? How is FAA planning to use LOFT as a tool for evaluation as far as the determination of workload? These are our main concerns. Thank you.

CAPTAIN R. E. "DICK" NORMAN (Chairman, Air Line Pilots Association Pilot Training Committee): Thank you, John, and good morning gentlemen, if I have not already said this to you personally. There are so many familiar faces, and it is a real honor to be here with you people and see the enthusiasm that is expressed especially by Walt Estridge.

I will certainly agree with him and the presentation that he gave; the feeling that he has expressed, because I think all of us together have the same thoughts. Earlier, my committee was introduced; they are, Captain Roland Liddell, First Officer Ken Warras, and our aviation staff representative from Washington, Mr. Bill Edmunds. So now we are well prepared to sit down and discuss some of the problems that will confront us here in the industry.

Dr. Earl Wiener, who I know well from the University of Miami has presented a paper that some of you may or may not have read, "Flight Deck Automation: Promises and Problems." This is an excellent paper, and if you have an opportunity to read it, I think you should. Enclosed in that paper are a lot of the considerations that we have in the LOFT program, especially in the human factors area. I think it is excellent, Earl. I wanted to tell you that, and make this announcement for the people who are here.

I have put a few thoughts together that I would like to bring out; it will take just a few moments to read.

LOFT can have a significant impact on aviation safety through improved training and validation of operational procedures. LOFT should present to aircrews scenarios of typical daily operations on their airline with reasonable and realistic difficulties and emergencies introduced to provide training and evaluation of proper flight deck management techniques. The result of such a program should be an appreciation and realization of operational shortcomings on the part of line crews and an evaluation of the adequacy of cockpit procedures and instrumentation, as well as overall crew training effectiveness on the part of the air carrier.

LOFT scenarios can be developed from a number of sources, but NTSB accident reports and information will provide a realistic and appropriate starting point. A properly conducted LOFT program can provide great insight into the internal workings of an airline's operations and training program:

1) If similar mistakes seem to be recurring among pilots, it may indicate a potentially serious problem with improper or incorrect procedures, conflicting or incorrect manuals, or other operational problems.

2) It will point out areas in aircrew training programs which are weak or which need emphasis.

3) It can point out problems with instrument locations, information being presented to pilots, or other difficulties with the physical layout of a particular cockpit.

4) Air carriers can test and prove flight deck management procedures.

LOFT must never be used as a check method. It is more properly a validation of training programs and operational procedures. If an individual or crew needs additional training after a LOFT session, they should be afforded that opportunity immediately with no stigma or recriminations.

A LOFT session should not be interrupted except in extreme and unusual circumstances. Part of LOFT's great benefit is derived from an individual or crew being able to quickly observe for themselves the results, either positive or negative, of operational decisions being made under less than ideal circumstances. After completion of such a session, a thorough critique should be made of all aspects of it. This critique should include the use of such aids as voice and video recorders, as well as written notes.

Gentlemen, that is our presentation on this program. I think all of us have the same ideas. When advanced simulation began, I remember distinctly the many meetings I had with Joe Ferrarese and Dick Skully, also, later with Ken Hunt, Dick Collie, and Charlie Huettner. It has now advanced to the point of acceptance. The discussions which we have had with Trieve Tanner, John, and the rest of the people at the beginning of this session are so important to the LOFT program.

I am certain that the outcome of these three days of meetings will be most productive. I want to thank each of you for your participation, especially Charlie Billings and John Lauber for bringing us together. Thanks again.

CAPTAIN JIM MICHAELS (Chairman, Allied Pilots Association Training Committee): We are on the threshold of a new era in the training of professional air crew members, and we of the Allied Pilots Association appreciate the opportunity to participate in this important beginning. The nation's airlines are devoting more money and attention to training than ever before, and those of us who are involved have the opportunity to shape the future for years to come.

The APA has devoted considerable attention to LOFT. It has been the subject of discussions in committee meetings with American Airlines, as well as with line pilots. We are very interested in the course that LOFT takes and the methods and ways in which it is implemented and used. We feel that it must be a non-jeopardy training program to be fully-effective and to achieve the level of success we believe is possible. But most important, we feel that LOFT provides us with a vehicle to develop a crewman into a professional airline Captain. Developmental training, simulating as near as possible real world situations, can be invaluable. We have always been able to teach a pilot the mechanical skills involved in flying an airplane, and we have always been able to evaluate how well he applies these mechanical skills. But, we have never had a program that could develop and evaluate judgement. We believe that LOFT is the vehicle we can use to accomplish that end. It is a program that will give a man an opportunity to make mistakes and to gain experience from those mistakes. We have seen too many of those tragedies, that Captain Estridge mentioned, where the price of experience was unacceptably high.

We are interested in all facets of LOFT, the mechanics of implementation and use, but the main thrust should be the development of experience without the tragedy that often follows. I want to add my thanks to Dr. John Lauber and all the people here at NASA for putting this workshop together and allowing us to participate.

DR. LAUBER: Thank you. I am extremely encouraged by each of the preceeding statements. I think that there is a remarkable amount of expertise here with regard to the issues and what we can hope to accomplish during the next few days.

SECTION 2

CURRENT APPROACHES TO LINE-ORIENTED FLIGHT TRAINING

ISSUES RELATED TO LINE-ORIENTED FLIGHT TRAINING

John K. Lauber

In the next 20 minutes or so, I would like to summarize and list the major issues and specific topics for discussion that we want to see addressed and resolved at this workshop. I will begin by briefly reviewing how NASA became interested in the concept of LOFT and discuss some relevant research which was conducted in our Human Factors in Aviation Safety program. Then, I will give you an overview of some of the observations made by Clay Foushee and myself during a series of field trips to various training centers. The intent of this presentation is simply to set the stage for the industry presentations you'll be hearing later, and to give you a framework for the issues to be resolved during the individual working group meetings.

Let me just briefly, then, review for you how we became involved in LOFT. I think most of you are familiar with the study that Pat Ruffell Smith and several of us conducted several years ago (ref. #1). As you may recall, Pat was interested in studying the human factors of aircraft operations, and had some ideas about making use of a training simulator along with some carefully structured, detailed, line trip scenarios to expose crews to a specific set of operational problems similar to what they might encounter during scheduled line operations. This provided us with an excellent, controlled and repeatable way to observe line crews in a highly realistic simulation of their working environment so that we could gain a better understanding of operationally significant human factors problems and issues.

This study was very central to our involvement in the LOFT issue. Although none of us were specifically concerned with training at the time the study was conducted, it soon became quite apparent that there were some significant training issues coming from it. In the course of having run one or two crews through these full-mission simulation scenarios, we noted some potential training implications, and also received comments from the volunteer crews and from the airline people who were working with us on the program to the effect that these were, "...damn good training sessions." Pat summarized some of these observations in his final report:

> "The kind of scenarios and techniques used in the experiments demonstrated to Center and training personnel how easy it is for errors to be made in a high workload situation...This has implications for training."

Pat's observation with regard to errors is a particularly relevant one for this discussion. It is one of the common themes that we see every time we start digging into LOFT and start asking flight crew members their impressions of LOFT or full-mission simulation. I think one of the major benefits to be derived from this approach to training stems from the fact that you are putting people in a highly realistic environment and they find, perhaps for the first time, how easy it is to make sometimes serious mistakes, even in fairly simple situations.

In another place in his report, Pat said that,

> "...special training in resource management and captaincy [should] be developed and validated. Such training should include the use of full mission simulation of scenarios that are representative of actual situations. Special emphasis shoud be given to those situations where rapid decisions and safe solutions for operating problems are required."

Again, I think that Pat managed to capture an essential feature of LOFT--that it is a full mission simulation of situations which are representative of line operations with special emphasis upon situations which involve decision-making, management, and leadership.

Some of the miscellaneous comments made by our volunteer crew members illustrate these points very well. One captain came out of the simulator and said, "That was the best damn training I ever had." That took us by surprise, because, to us, he was a subject in a human factors experiment. We had not focused upon the training issue, and yet this individual apparently came out feeling that he had just received a great deal of training.

Another individual reported that he always had the philosophy that in an emergency situation, he as the captain should immediately take over control of the airplane--he's the superman who is going to save the airplane and all of the people. However, his experience in the simulator clearly taught him that that is not necessarily the best course of action, and that there are some situations where it is best to turn over physical control of the airplane to the copilot so that the captain can properly attend to more pressing matters. Again, this individual expressed the notion that he had learned a valuable lesson, which was not what we had originally intended to do in the Ruffell Smith study.

We conducted the simulator study in 1975 and early 1976. In October, 1976, the ATA's Flight Operations Committee held a meeting in Chicago at which I was invited to present a report on some of our human factors research, including Pat's study. Jerry Fredrickson from Northwest was there, and during the course of the meeting, he asked if we were aware of what Tom Nunn was doing with what they called Coordinated Crew Training. We very quickly established contact with Tom, and soon exchanged views, ideas, and data. That exchange was very helpful to us to help us understand how full mission simulation might apply to training, and also to help us sort out future research interests.

One source of data from the Northwest program was a questionnaire given to flight crews who had gone through the program. There were some interesting comments made that are illuminating in the context of this discussion and that further helped us to understand some of the training implications of full mission simulation. One question we asked on the questionnaire was, "What did you learn from LOFT?" One individual said that he had, "...learned how easy it is to compound ignorance with damned foolishness." I thought that was an interesting observation. Another individual said, "We came in on a wing and a prayer, but it was mostly our own damn fault." This comment is typical of many which indicated that crew members recognized that their own errors further compounded their problems and that most of the difficulties were, in fact, of their own making.

About a year after the ATA meeting, Dick Collie organized a seminar for all the principal operations inspectors, and others, from each of the FAA regions. Dick asked me to make a presentation about the Ruffell Smith study and the data we had received from the Northwest program. We had a good two-day exchange of views and ideas , and I find it interesting that my most vivid memory of that meeting was the sometimes-heated discussion among the participants on one of the key issues that all of us will be trying to resolve at this workshop--the issue of training versus checking.

There were other developments following that seminar, but probably the most significant for this discussion was the cockpit resource management workshop which was held in June, 1979. Resource management problems appeared to be associated with a large proportion of the errors observed in the Ruffell Smith experiment, and a considerable amount of discussion was held on the topic of LOFT as a possible method for training resource management skills (ref. #2).

That brings us to the present. Clay Foushee and I, in

anticipation of this workshop, spent some time going out to the carriers, and talking to many people on the telephone when we couldn't visit, to try to get an overview of your experience with LOFT, and to identify the major issues that you people feel should be addressed during this workshop. What I'd like to do now is to go through some of those issues that we have identified as a result of our research, discussions, field trips, and observations in the simulator.

I have summarized the major issues in the outline below. As you can see, there are four major areas of concern, and, if you've looked ahead at the agenda, you probably noticed that we have assigned a working group to each of these areas. Please bear in mind that this is not necessarily the final, definitive list of issues, but rather, represents a starting place for your discussions in the working groups.

Some Issues for Discussion and Resolution

A. Scenario Design and Development Issues

1. Origin, routing, and destination
2. Abnormal and emergency conditions
3. Pacing
4. Quiet periods
5. Generalized scenarios vs detailed scripts
6. Scenario revisions and quality control
7. Scenario length and frequency
8. Categories of candidate problems

a. Operational problems

Cabin/passenger
ATC
Fueling, weight, and balance

b. Environmental problems

Weather, winds, temperatures
Runways wet, icy, closed

c. Equipment problems

Simple vs. complex problems
Airborne equipment problems
Ground equipment problems

d. Crew problems

Cabin crew
Flight crew--incapacitation

B. Real-Time LOFT Operations

1. Realism
2. Pre-flight activities, briefings
3. Trip paperwork
4. Communications
5. Role of instructor
6. Use of simulator capabilities and features
7. Working around simulator limitations
8. Crew composition and scheduling
9. Inadvertent departures from scenarios
   --because of pilot/crew decisions
   --because of simulator problems

C. Performance Assessment, Debriefing

1. Role of instructor in LOFT debriefing
2. Items for discussion
3. Self-critique vs. instructor critique
4. Training vs. checking--a critical issue
5. "Satisfactory completion"--inescapable
6. Use of video, performance data printouts

D. Instructor Qualifications and Training

1. Number of instructors
2. Line qualifications
3. Seat/position qualifications
4. Instructor training and standardization for LOFT

E. Other Issues

1. Other uses of LOFT

   Initial, transition, and upgrade training
   Procedures development and evaluation
   Equipment evaluation

Design and Development of LOFT Scenarios

As shown above, one of the major topics for discussion at this workshop is the question of the design and development of LOFT scenarios. Some of these issues have already been alluded to, however, I'd like to briefly mention some of the major areas of concern here.

Origination, routing and destination- How do you go about selecting departure stations, destinations, and the routing in

between? What are the factors to be considered when you begin to design a practical LOFT scenario? When you approach this issue this afternoon, remember that the objective of this workshop is to produce some practical guidelines that can be applied to meet the specific and unique requirements of individual carriers.

Abnormal and emergency conditions- How do you go about selecting problem situations to build into the LOFT scenarios? What kind of problems are best suited for LOFT? I have noted two basic kinds of problems being used in present LOFT scenarios: "simple" and "complex." "Simple" problems are those problems which appear once, are taken care of by the crew, and have no further impact on the remainder of the scenario. A good example of a "simple" problem is a hung start, or a potential hot start. Once the crew has recognized the problem and taken care of it, they can forget it for the rest of the trip.

"Complex" problems, however, are of lasting consequence. We observed a good example of a complex problem during our visits to various training centers-- a #1 a.c. bus failure on the B-727. The crew properly recognized and diagnosed the problem, and took care of the immediate items, and then continued the trip. However, upon reaching their destination, they proceeded to get themselves into a great mess because they had forgotten (and did not bother to check the book) that one of the things you lose when you lose the #1 a.c. bus is the flap position indicators. Consequently, when they started to configure the aircraft for the approach, they incorrectly decided that they had a problem with the primary flap extension system, and used the alternate flap extension system, all the while waiting for the flaps indicator to show them how much flap they had down. They finally concluded that the flaps were down, all the way down, when the captain noted that it seemed to be taking a great deal of power to stay in the sky. Well, they eventually got things sorted out, but they sure went through a lot of unnecessary steps to get there.

Again, the major question here is how to select the kinds and numbers of simple and complex problems for inclusion in a LOFT scenario. One thing to keep in mind is that if you include too many hot starts, hung starts, and similar problems on the ground, you can degrade the perceived realism of the scenario. I think it is important to keep these kinds of problems at a minimum.

Pacing and quiet periods- This is an important element of scenario design. Once you've selected the kinds of problems you want to include in a scenario, how do you decide when to insert them? Should the activity always be rapidly paced, or should there be some quiet periods in the scenario? When we did the

Ruffell Smith study, we included a fairly long period after departure where there was very little happening. These were very realistic scenarios from that point of view--a complex, and somewhat harried departure, followed by a long, uneventful climb to cruise altitude. How important is this? Are you sacrificing valuable training time by including such periods in a scenario, or does the enhanced realism increase the effectiveness of the scenario? Some balance has to be struck--what it it? How do you make these choices?

Generalized scenarios vs. detailed scripts- Another issue has to do with the level of detail at which you specify scenarios. This has some very important implications for the instructors when they conduct a LOFT scenario-- it can impact their workload, and also has implications for standardization and control. Clay and I saw examples of both kinds. Very loosely organized and structured scenarios place the burden upon the instructor as to what is to be included, and when. Another approach is to use highly detailed scenarios. One example we have seen consists of several pages of script in which all problems, expected actions, communications, radio frequencies, and other necessary details are listed. All of these events are specified along a time line so that the instructor simply has to follow the script, segment by segment from push-back to the destination gate. One thing to keep in mind when you consider this issue is how do you handle diversions and, more importantly, unexpected crew actions? To prepare a detailed scenario requires careful analysis to make sure that you anticipate the most probable crew actions. We'll discuss this problem again when we get to the issue of real time LOFT operations.

Scenario revisions and quality control- I think we should attempt to come up with some guidelines for the long-term quality control of LOFT scenarios. What procedures should be followed to ensure that scenarios are kept up to date? Are there special considerations regarding the revision of LOFT scenarios?

Scenario length and frequency- A good case can be made that LOFT should not completely replace so-called Appendix F training both in the short- and long-term. For example, currently AC 121-35 requires three hours and 2Ø minutes of LOFT, with the remainder of the standard four hour period reserved for other maneuvers, problems, etc. Is this a good distribution of time? Is there a better mix? What are the factors to be considered in deciding this distribution?

Similar questions apply to the long term. Is it best to use LOFT every time you bring someone back for training, or should you alternate the use of LOFT and Appendix F training? Steep

turns, approaches to stalls and other maneuvers are not (hopefully) conducted during line operations. Does occasional exposure to these kinds of maneuvers in the simulator have an important effect on pilot skill and confidence? If so, how frequently should this be done?

Categories of candidate problems- I've identified four major categories of problems which can be included in LOFT scenarios.

Operational problems- Cabin and passenger problems can provide a rich source of distractions for flight crews. For example, you're on final approach and you get a frantic call from the cabin reporting a brawl in the first class cabin-- what do you do now, Captain? ATC provides probably the richest source of operational problems--there is an almost endless variety of ATC handling problems that can be built into LOFT scenarios. Another good source of purely operational problems can be the trip paperwork--fueling, weight and balance, etc. Errors can be deliberately built into these, just as they occasionally and inadvertently happen on the line.

Environmental problems- This class of problems is obvious--anything having to do with the weather and its effects is fair game here.

Equipment problems- We have already discussed some examples of hardware problems--failures of various aircraft systems and components. Remember that ground equipment can fail too, for example, navigational aids can fail, ground power units can fail, etc. All of these could be incorporated in a LOFT scenario. What guidelines can we develop to assist the scenario designer in selecting these various problems?

Crew problems- There are also problems having to do with the cabin and flight deck crew. Communication and coordination problems can be used, as can crew incapacitation.

Real-Time LOFT Operations

Another working group will be dealing with issues having to do with real-time LOFT operations. Once the scenario is put together, how do you properly run it in real-time? What are the important factors to be considered?

Realism, pre-flight activities, briefings, and trip paperwork- Clay and I were both impressed with the notion that realism is a very important part of LOFT. It seems to us that

what you are trying to do with LOFT is create an illusion--the illusion of being in the real world operating environment. You want your pilots to deal with the problems they will encounter in the LOFT scenario in the same way they would if they were on a line trip. In order to do that, you have to create an illusion, and to do so requires strict attention to small details. Communications, trip papers, and other small details make an important contribution to the realism of a LOFT scenario. The briefing is another important element here--making the briefing as much as possible like the routine pre-flight activities, including the dispatch process, helps to create and sustain the idea that the crew is conducting a line operation. Clay and I noted some wide variations in how the dispatch process is treated in LOFT operations.

Communications- I don't believe that anyone is actually providing background communications, although we did so in the Ruffell Smith study. We found that it made a significant contribution to the perceived realism. Even though the real-time controller's voice was clearly different from that on the background tapes (which we made by recording communications on similar trip segments), we still heard an occasional crew member say, "Was that for us?". They seemed to be so engrossed in the scenario that the differences between voices were not noticed. How important is this for LOFT training?

Role of the instructor- What is the role of the instructor in real-time LOFT operations? This is another key area that has a significant impact on the perceived realism of a scenario. Occasionally Clay and I observed an instructor who just couldn't resist the temptation to get involved, to point out a mistake, or to provide a suggestion. Every time this happens, the crew is reminded that they are in a simulator; they are in a make-believe world, not the real world. Again, I think this has a significant impact upon the effectiveness of LOFT, and for this reason, we must develop some guidelines describing the role of the instructor.

Simulator capabilities and limitations- How can you properly use the capabilities of your simulator in constructing and operating LOFT scenarios? On the other side of the coin, how can you work around the limitations of the simulator? In the Ruffell Smith study, we took advantage of a "limitation" in the motion platform (e.g., a pronounced kick in the seat when the "motion enable" button was pushed) to simulate the start of push-back with a not-so-smooth tug driver. At Northwest, Tom Nunn's people have programmed the visual system so that they can taxi anywhere on the airport, even into the gate. These details contribute greatly to the realism of the situation, and, I believe, enhance the training effectiveness of LOFT scenarios.

Crew composition and scheduling- This is an issue which has come up frequently. The question here is whether or not you must have a regular line crew member in all three seats, or whether it might be possible to substitute someone else in an emergency. This question has important logistical and economic implications, as well as raising serious questions about training effectiveness given certain crew compositions. What guidelines can we suggest which will allow sufficient flexibility, yet not adversely impact training effectiveness?

Inadvertent departures from scenarios- Regardless of how thoroughly you have planned and designed a scenario, at some point, somebody is going to make a decision you did not anticipate. It's going to happen--how should the instructor handle it? Furthermore, occasionally, the simulator is going to break. If it breaks completely, obviously you have lost some time, and maybe all of the session. If it is only a partial failure, however, these can sometimes be overcome in real time. What guidelines can we develop to handle these situations?

Performance Assessment and Debriefing

There are several issues that have to do with the question of performance assessment, feedback and debreifing. Although LOFT is a training session and not a checking session, we still must contend with the issue of "satifcactory completion." The following issues will be addressed by working group 3.

Role of instructor in LOFT debriefing- Instructors like to be actively involved in a training session. Furthermore, they like to come into a situation as an expert with special knowledge that they want to impart to the trainees. This is one role for the instructor, but there is another role, too, and that is to serve as the manager of the training session. In this capacity, one of the principal functions of the instructor is to observe the trainees, but not to interact with them in real-time. Active participation comes during the debriefing session, when the instructor helps to provide feedback to the crew. We need to develop guidelines for the instructor. What are the significant items which should be addressed during the debriefing? What are the items that an instructor should be looking for during the course of the LOFT scenario, and how should these be built into the debriefing session?

Self-critique vs. instructor critique- Another issue we need to address is the role of self-critique in the debriefing session. Several carriers use an approach in which the first thing that happens during the debriefing session is that the captain debriefs the crew. The crew does its own self-critique first. We noticed in the Ruffell Smith study and in the data from the Northwest questionnaires that crew members seemed

frequently to come out of a LOFT session with a fair amount of insight into what they had done wrong and what could have been done differently to have avoided some of the problems that they ran into. I think this self-critique can be very important, and we need to give guidance to the instructor as to how to facilitate this process.

Training vs. checking- This is a critical issue. If you put crew members into LOFT sessions where they feel that the intent is only to administer a check, I believe you lose a lot of the potential training value of the session. Yet, at the same time, it is an inescapable fact that someone has to make a decision that the crew has performed acceptably well. The Advisory Circular specifies that the training program must be satisfactorily completed. How can the instructor make this determination? What are the guidelines? At what point should the instructor decide that additional training is required? How can the instructor determine that a lesson has been learned?

Use of video recording and performance data- I'd like to see this working group give some thought to the potential application of video or performance data recording to assist in the debriefing and performance assessment process. It is conceivable that the use of a segment of a video tape in whch some specific aspect of performance during a LOFT scenario is recorded could be very helpful in showing the crew what happened and who did what to whom during the scenario. The same is true with recorded performance data. In the Ruffell Smith study, we printed out aircraft flight data at frequent intervals and then used these data to cue the crew during the debriefing. The pilots found it interesting to go back and look at their own performance, and it seemed to help them recall specific situations which they encountered during the scenario.

Instructor Training and Qualifications

The fourth major topic for discussion during this workshop is the question of instructor qualifications and training for LOFT operations. I indicated earlier that the role played by an instructor is different in LOFT, and it is possible that some special training and qualifications are required as well. This working group will deal with the following issues and questions.

Number of instructors- One significant issue which has been raised is the question of the number of instructors required to conduct LOFT. Are two instructors required (for a three crew aircraft), or can one do the job? What are the circumstances under which one might be sufficient? Are there special steps that should be taken if one instructor is used?

Line qualifications- Line-oriented flight training means

just that--it is a simulated line operation. That means that the people who conduct the program must have intimate knowledge of line operations. Does this require that LOFT instructors be fully line-qualified? Is it necessary for them to fly in line operations occasionally? Will observation of line operations from the jumpseat suffice to qualify an instructor for LOFT operations? In the event that one instructor is used in a three-crew aircraft, must that instructor be fully qualified in all positions? If not, is any special training required?

Instructor training and standardization for LOFT- Are there instructor training requirements unique to LOFT? How should such a training program be designed? Is there any kind of recurrent training required for LOFT instructors? What kind of quality control or standardization program is necessary to ensure that all instructors are conducting LOFT in the proper manner?

Finally, as I've indicated on the outline, there are some general issues that I would like each of you to address during your working group sessions. All of the discussion above has been in the context of LOFT in recurrent training programs. There may be other uses to which LOFT or full-mission simulation can be put. For example, we at NASA use these techniques to conduct human factors research. Other potential uses include areas like the development and evaluation of operating procedures, and the evaluation of new systems. Although we don't want to spend too much time on these other applications during this workshop, I encourage you to consider some of these and to make suggestions, comments, or raise questions, where it seems appropriate to do so.

That completes what I have to say at this point. As I said, the intent was to give you some background, to identify some of the major issues, and to give you a framework which you can use during the remainder of this workshop. What we will do now is hear from those carriers who have been using LOFT, or who have evaluated the concept, to learn what the experience to date has been. Following these industry presentations, we will split into the four working groups and spend the remainder of the workshop addressing the issues identified above.

LINE-ORIENTED FLIGHT TRAINING--NORTHWEST AIRLINES

Captain H. T. Nunn

In the world of aviation an apparent contradiction exists. While every flight would seem to harbor the possibility of a new experience, it does not take long to find someone else who can tell a similar story. During the Kitty Hawk 75th anniversary celebration someone postulated that the reason for the short flight of the Wright Brothers was an encounter with unforecasted low level wind shear. Whether true or not, the moral of that statement still stands. Very few experiences are new.

Historically, pilots have recognized the value of lessons learned through experience and have actively sought to share their experiences with others. Through formal reports, classroom presentation and informal conversation (otherwise known as hangar flying), aviators have attempted to share the benefits of "lessons learned through experience." Through the years, flight training has been designed to provide for safe flight by giving pilots an opportunity to develop necessary flying skills and gain information through exposure to potential hazards. Before the existence of flight simulators, when actual aircraft flying was required, the task was somewhat difficult. Safety provisions on training flights were mandatory. Obviously a check pilot had to occupy a pilot seat. Certain maneuvers could not be practiced to a realistic conclusion. Complex real world incidents could not be entirely duplicated. Verbal or written communication remained the only vehicle by which to share experiences.

With the advent of flight simulators, the capability to realistically duplicate inflight problems became possible. However, progress in this direction was slow. Maneuvers, originally designed to satisfy the safety requirements of actual aircraft flight training, were simply transferred to the simulator. In order to design significant improvements in flight crew training, regulatory change would be required.

In mid-1974, the flight training staff at Northwest Airlines began internal conversations exploring avenues of a possible correction for this problem. Later that year we initiated preliminary conversations with the FAA regarding necessary regulatory change for flight simulator training programs. We were seeking approval to create simulator training programs closely related to the actual line environment with total crew participation in real world incident experiences. The FAA responded in a most positive fashion. On June 10, 1975, Northwest Airlines made a formal application for an exemption from certain regulations which stereotyped simulator flight

training. On February 5, 1976, we were granted that exemption by the FAA with an implementation date for the program of July 1, 1976. This allowed approximately five months for Northwest Airlines to develop a program around the concept outlined in the original request.

We selected six of our most experienced instructors; one Captain and one Second Officer from each of three aircraft types. Taking a page from Lockheed's book, we created an area known as "the skunk works." We cloistered the six instructors for a period of three months to ensure their full attention to this project. Their first duty was to redefine and refine the program objectives. Methods and approaches were discussed. One guideline given to these gentlemen was to throw away the rule book and approach the exemption program using their extensive line experience as the primary influence. As a supplement, active participation by our line pilots was encouraged through both written and oral communication.

After initial scenarios were completed, instructor personnel flew the scenarios in our simulators. Further refinement took place at that time. Then line pilot volunteers entered the program and for the first time, sampled the scenarios. After final refinement, the FAA sent local ACI's to fly the finished products. We met our implementation date of July 1, 1976, and from that date forward, instructor and pilot feedback, as well as comments from the FAA, gave us the indicator we had all been waiting for--in fact we did have a most significant improvement to simulator flight training.

The regulation change and accompanying advisory circular are now history. Many airlines have chosen to develop LOFT programs and have experienced success. Today, however, there is not total agreement on all of the principles or the conduct of LOFT. Therefore, the need for this conference. I would like to present, in rather direct fashion, what we at Northwest Airlines Flight Training regard as our position on LOFT relative to certain points in the outline for this conference.

Definition and Characteristics of LOFT

LOFT is a line environment flight training program with total crew participation in real world incident experiences with a major thrust toward resource management. Recognition and proper use of available resources, on the part of each crew member, is a new subject for simulator training. Judicious care is required to keep that primary goal untarnished.

LOFT is <u>not</u> full-mission simulation. LOFT <u>utilizes</u> full-mission simulation to create a real-world environment but full mission-simulation has many uses beyond original LOFT concepts.

Full-mission simulation may be used as a vehicle for check-rides, navigation training, specific emergency procedures training, experimental evaluations and other purposes. The primary thrust of LOFT is not specific procedure training and is certainly not intended for flight checking. A proper distinction between any type of full-mission simulation and LOFT must be maintained.

LOFT is learning through involvement in simulated real world incident experiences. It is in a sense "case book" education as opposed to "batting practice." No one could properly argue that manual flying skills are not important; they certainly are. But practically the total thrust of past simulator training has been dedicated to precision batting practice. A proper division of time needs to be given both areas without inordinate emphasis on either one.

In LOFT case-book type education, lessons are learned through personal involvement. The old cliche, "experience is the best teacher," has definitely proven true. Comments from our crews indicate more has been learned and retained longer through LOFT involvement.

Real-world problems must be provided. This is a basic departure from aircraft systems-oriented failures. A hardware failure may certainly be involved but it is not necessarily the "Star." Accident reports indicate many incidents result not from a single catastrophic event, but rather culminate from an interconnected series of not so apparent elements. The proverbial primrose path can be created from any number of diverse sources. To set up the problem situation, the LOFT case book should use reasonable real-world events to the extent possible.

Crew interaction is an essential feature of LOFT. Past training practices tended to isolate crew members requiring them to operate as a "one man band." Contrary-wise, LOFT stresses the importance of operating the aircraft utilizing the coordinated efforts of all crew members. Complex operational procedures mandate effective crew interaction. By confronting the crew with situations requiring a high degree of coordination in order to reach a successful conclusion, LOFT forces them to utilize interactive skills or observe the consequences. As one of our pilots commented, "it is interesting to see a coordinated crew lose its coordination." A lesson was learned!

System interaction in real-time is also an integral concept of LOFT. Use of total system elements requires a high degree of simulator sophistication and instructor expertise. The higher the degree of realism, consistent with cost, the better. ATC, aircraft sound, company radio or data link, maintenance control,

flight attendant problems, etc., all contribute as elements of the primrose path. Placed in the context of real-time, the crew must exercise management skills and utilize available resources. These skills cannot be effectively honed in a sterile atmosphere.

LOFT, properly practiced, should emphasize the importance of positive flight management. Events outside the control of the crew are pre-programmed in the LOFT scenario and will occur regardless of crew action. Due to this fact, inappropriate action or indecision may quickly compound a simple problem into a much more serious one. On the other hand, properly managed, no compounding will result.

One absolutely essential concept for LOFT is protection of the training environment. The training environment is essential so that pilots feel free of checking constraints and stereotypes. We are human and subject to error. In LOFT, mistakes will be made. According to Dr. Lauber, "to some extent, the success and efficacy of the LOFT session depends upon the number of errors made; up to a point, the more the better." Recognizing and observing our own errors brings insight into our own performance. To those who are hung up on the concept of checking and cannot be satisfied without it, LOFT does have an element of checking--"self checking!" We do learn from our own mistakes and "lessons learned" is our goal. The response data from our exemption program graphically illustrates that people learn vividly from their own mistakes. The key question for an instructor is not what errors were made but do the pilots recognize and understand why the errors were made? How aware are they of critical events and do they have insight into their own performance?

Construction and Conduct of Scenarios

The obvious key to successful scenarios is the personnel assigned to the development project. Our approach mandates that only pilots with current line experience be involved in LOFT preparation and development. With proper guidelines and adequate time for preparation, our flight instructors have produced outstanding results. Following are some of the guidelines provided our instructors:

1. Problems must be realistic or actual events.

2. There is no requirement for any particular maneuver or approach; so as to practice flexibility according to real world parameters.

3. An early problem can set the stage for a later major event (e.g., early engine flameout with

restart capability; later that same engine could develop a fire).

4. Remember the real world; flying can be boring. Do not "overfill." Leave time for a lull. This is necessary both for the illusion of realism and training effect.

5. All simulator or system elements may be manipulated to achieve the desired result or to cover simulator deficiencies (e.g., dispatch release, minimum equipment list, weather, ATC, cabin problems, etc.).

6. It is very important that scenarios not be overly complex. The objective is to make the scenario sufficiently difficult so the crews will find them challenging, but not so difficult as to be impossible.

7. Provide a standard instructor briefing. Remember the briefing establishes an atmosphere and can mean success or failure for LOFT learning. A good briefing can set the stage for a successful debriefing.

8. Remember, there is not always a solution for every problem. Use an actual event or create realistic problems for which there is no procedure or solution (e.g., a stuck landing gear causing a gear-up landing; this type of element should not be used routinely in every scenario).

9. Stretch your creativity to produce realism. Coordinate with simulator maintenance on possibilities (e.g., we used the motion platform bump when initialized to simulate push back). Now through programming, the simulator will produce fully simulated push back motion including visual. Such attention to seemingly small details will greatly enhance the overall impression of realism.

10. Follow all material as presented in Advisory Circular 120-35.

Debriefing and Assessment Standards

The debriefing session, following a LOFT flight, should be a continuation of the learning experience. With the training atmosphere still preserved, the debriefing provides each crew

member with a forum to verbalize their self-evaluation. This validates the depth of learning from the events just experienced. It is of paramount importance, therefore, that the instructor permit the participants to exhaust their evaluation before proceeding with the instructor-noted items. In a perfect situation, the instructor should be left with zero items not already mentioned. Otherwise, the instructor should cover unmentioned items with tact and a positive attitude.

During the LOFT flight, instructors should note observations of the following key items for the debriefing session:

1. Resource Management
2. Crew Coordination
3. Crew Management
4. Timely Decision Making
5. Use of Specific Procedures
6. Problem Solving Process

After all debriefing items have been covered, the crew should be excused. If any crew members have exhibited the need for further training, they should be called aside privately and the matter discussed. Perhaps this single event calls for the greatest tact on the part of the instructor. The crew members' performance did not constitute a failure, nor place their job in jeopardy. The "train to proficiency" atmosphere must be preserved for positive training to result.

In October, 1976, Mr. Webster B. Todd, Jr., then Chairman of the NTSB, spoke before the Flight Safety Foundation. In that speech, Mr. Todd, speaking in the context of Appendix F Check/Training, stated that it is:

> "A process based on checkitis--a process based almost on the presumption of incompetence of the pilot. Every six months, either the air carrier inspector or the instructor pilot that is checking that airman is looking at him from a proficiency basis .... he is totally programmed from the time he gets in that simulator until the time he gets out of it. He enters that simulator, whether he likes to admit it or not, whether the company likes to admit it or not, whether the FAA likes to admit it or not, he enters that simulator with a feeling in the back of his head that somebody is trying to take his certificate away from him--to remove his livelihood. I submit that that can only lead to a basically negative training program."

We certainly concur with Mr. Todd. Regardless of the name it was given, past simulator flight training was almost totally oriented around a checking atmosphere.

In truth, LOFT represents significant progress over past simulator flight training. The broad base of pilot acceptance and enthusiasm is evidence of positive results. The very foundation of this program is maintaining the "train to proficiency" posture. In this framework we look forward to future progress and improvement.

Discussion

CAPTAIN FRINK: Tom, first I want to express on my own behalf, and I am sure on behalf of a lot of people here in the training business of the airline industry, a tremendous feeling of indebtedness to you and your pioneering efforts in this area and the wonderful work that you have done. You have set a tremendous example for all of us, and we are going to do our best to emulate that example.

I would like to ask you a couple of questions about how you have come along. One of them, did you, or do you have the same total amount of simulator hours in training now as you had prior to instituting LOFT?

CAPTAIN NUNN: Yes, Al, we do. This causes us a certain amount of concern because LOFT is not a total training concept. It can't be. I think we alluded to the batting practice versus the casebook training type of education. We need a balance between the two, and with the time we have now allotted, if we spend the full four hours every year for first officers and flight engineer/second officers in LOFT, where are they going to get their batting practice? We have not gone far enough with LOFT for this to be a critical problem, but I foresee one in the future. I think we need to address that as a very serious issue here-- the establishment of a balance between true training and batting practice, but we really have not had the latter either. It has been proficiency checking. I do not care whether we call it proficiency training, or proficiency check, or training in lieu of a check. It makes no difference--in reality, it has still been proficiency checking. We need true training, not an appendix of maneuvers, but many of the things that have been suggested: "the black-hole approach, the slippery runway conditions under cross-wind, etc." We really need these in training. Likewise, I think we need LOFT and a balance between the two, but we have not come up with a solution yet.

CAPTAIN FRINK: I assume that all of your crews, regardless of whether this is a short-range or long-range operation, are

involved in LOFT. In other words, are you just as apt to have your 747 crews in LOFT as your short-range people?

CAPTAIN NUNN: That will be true, yes. There was a period of time when we had to give LOFT up because of a very dramatic vertical movement in our crew structure. We had a down-turn and then an up-turn where they were going through transition, upgrade, downgrade, requalification, and so forth. That precluded the use of LOFT. However, in a static situation, that would be our standard practice.

CAPTAIN FRINK: How often have you determined that additional training is necessary after one of the LOFT sessions?

CAPTAIN NUNN: I don't have the figures, but it would probably be less than two or three percent of the cases.

CAPTAIN FRINK: Has there been a reaction to that on the part of your pilots? When you give them additional training you have not, in effect, been giving them "true training." Haven't you, in effect, been checking them?

CAPTAIN NUNN: Our pilot reaction has been very positive. The additional training was welcomed. It was perceived as being useful and was conducted in such a way that we prevented what I consider to be a key issue. That issue is the prevention, at any cost, of the embarrassment of an individual crew member. We dare not embarrass professionals, and our pilots and flight engineers are professionals.

CAPTAIN FRINK: I know, that because you bring your captains in twice a year and the first officers and engineers in once a year, you obviously cannot give a LOFT session in all instances.

CAPTAIN NUNN: That is correct.

CAPTAIN FRINK: Do you find resentment on the part of those who come in for recurrent training and find they are not getting LOFT?

CAPTAIN NUNN: Yes. They feel as though, in a sense, they have been cheated.

CAPTAIN FRINK: Can you give us an idea of what this program might have cost you? Do you have a requirement for full crew? If you have scheduled a full crew and not achieved it for the session, do you bring pilots in on extra time? Have you any idea, or have you attempted to put a cost figure on LOFT?

CAPTAIN NUNN: Al, if I answer that question, I had better not go home.

CAPTAIN FRINK: Okay, I think I will listen for awhile, thanks Tom.

CAPTAIN MICHAELS: I am curious about the amount of acceptance among your line crews of the LOFT program. Was there any significant negative response?

CAPTAIN NUNN: Let me give you an example of what happened at the very outset. We invited ALPA to come in and participate at the beginning of LOFT development. Can I regress for a minute, then I will answer your question?

I do not want this conference to go too far without addressing the question of where the acronym LOFT came from. We called it Coordinated Crew Training (CCT). We had a meeting in Minneapolis at Northwest with Dr. Lauber and several industry representatives. Eastern Airlines had Ed Warden there, and there were many others including the FAA from Washington. Dick Collie was heading up the session, and he did not like CCT. Some of our crews called it "Combat Crew Training." We were trying to develop an acronym and Dick Collie said, "You know, the government likes four-letter acronyms--we can't live with a three-letter acronym." We were scratching our heads, and everyone was trying to come up with something and he kept saying, "Well, it's line-oriented, and it's not checking, it's flight--by golly, we're going to call it line-oriented flight training--what do you think?" It was Dick Collie of the FAA who gave it a title.

But, back to your question. We invited ALPA to come in, and there was a young man from the Training Committee in Seattle who came to me and said, "I want you to know something. I'm opposed to this. We had the same thing in SAC (Strategic Air Command-USAF)." He was referring to SAC's full-mission simulation. He said that it consisted of one emergency piled on top of another and another until the crew broke, that it was negative training, and, "We're opposed to it." He said, "I'm going to do everything I can to kill it." I invited him to participate in one of the scenarios. He said, "You want me to do that, and give me ammunition?" I said, "I want to give you all the ammunition you need if it's wrong, so come on in and participate." He did. At the two-hour break, he came out of the simulator muttering to himself, "My gosh, you know what I did?" He was shaking his head. He went back in, and when he came out at the end of the four hours, sweat was coming all the way down his shirt, from under his armpits, and the brow was wet, as most people's are. He could not quit talking about the mistakes he had made. The first officer was the same way. That young man went away not as an opponent of LOFT, but as a proponent. In fact, he almost took on an evangelistic zeal and saying, "I have

never learned so much. I came in with a negative attitude, and I went away with lessons learned." I think that is perhaps the most dramatic response that we have had, but it is typical. Of all the pilots who have gone through the program, only one or two have been rather lukewarm.

CAPTAIN MICHAELS: One other question Tom. Have you had the program long enough for all of your crews to have had a second experience with it?

CAPTAIN NUNN: A large number, but not necessarily all, and the response has still been the same.

CAPTAIN ATKATZ: Have you been able to document a change in the performance of crew members from one experience to another in terms of resource management?

CAPTAIN NUNN: I don't know that you could say that we had a study that documents it. How can you prove that any training has prevented an incident or an accident? I cannot say that we have.

CAPTAIN ATKATZ: I am not saying that it prevented an incident or an accident. I am saying that in terms of their performance from one LOFT session to the next LOFT session, how did they perform the first one as compared to the second one?

CAPTAIN NUNN: All right. Again, we do not have data formally recorded that can prove it, but we have feedback from instructors which definitely indicates improvement in crew coordination and resource management among those who have undergone their second or third session--we have some who have gone through three LOFT sessions--rather dramatic improvement.

CAPTAIN TRAUB: Tom, you did not say anything about crew composition with LOFT. Do you always have a captain, first officer, and second officer?

CAPTAIN NUNN: Since we operate three-man crew airplanes, yes, and they are line crew members. We feel we cannot introduce instructors in the event someone does not show up. If the instructor knows that a problem is coming, how can he be a member of a problem solving team? He knows what the problem is, and he knows the solution, so he is going to be play acting. He might be a disturbing element even if he did not know what was coming. It violates the validity of the scenario, so to speak. Now if he is an instructor who is not familiar with the scenario and is qualified in a crew member position, I see no reason why they could not take a participant's role.

CAPTAIN ATKATZ: Do you fill in, in any way, if somebody does not show up in some situation?

CAPTAIN NUNN: We will try if we have time to go to crew schedules and get someone off reserve for that particular crew position. If we cannot, then we revert to a standard Appendix F check or training session, as appropriate.

MR. THIELKE: One question is, what do you do in the case of "no-shows" because of the weather, or something such as that? The second question is that you said you do not record the data formally. Do you plan to record data regarding an individual's performance from one LOFT session to the next?

CAPTAIN NUNN: We do not plan to record it on an individual basis. However, we have a debriefing form for our instructors where we do record crew performance on specific procedures. One thing we do want to know--you touched on this earlier--is where is the task loading too heavy, or where do procedures need refinement? We are looking for overall operational improvement using information obtained from LOFT sessions, but with regard to evaluating individual performance, we do not give grades or keep such information as part of their record. Satisfactory completion is noted as part of their record and that is it.

MR. THIELKE: Is that at the end of their program?

CAPTAIN NUNN: Yes, it is.

CAPTAIN SMITH: Have you used the LOFT approach in your initial first officer or captain upgrade programs, and if so, what has been the result of that?

CAPTAIN NUNN: We have not. We have used LOFT only in the context of recurrent training. We have used "capital" LOFT, as Walt said earlier. We have not yet developed lower case or "little" LOFT.

CAPTAIN KARABELLA: I have one more question concerning LOFT that some people have brought up previously and that regards progress or getting ahead. I think most everyone has a certain, what has been alluded to as, two or three percent of problem people, who from one six-month interval to the next do not progress. They go on. In what you have been doing so far, do you have any indication that progress has been made in this two or three percent?

CAPTAIN NUNN: Yes. We all have that two or three percent. LOFT did not create the problem. The proficiency problem existed before they came into LOFT, but what LOFT has done in the evaluation process is to give us a broader view of that crew member's capabilities. We have been able to focus and define in

a much sharper fashion where his problem is. Maybe it was in crew management, or maybe it was in manual flying skills. Maybe he did not even understand command responsibility or authority, or crew management. It has been defined by LOFT. We focused on it, gave him additional training appropriate to his deficiency, and they have not been repeaters. We have not had one single repeater come in after he has had additional training after LOFT.

MR. WARRAS: I have just one comment, Tom, as a follow-up. In the early days of LOFT, I can recall sitting in on a period with a captain, a 727 captain, who did not use his resources properly. His management of the crew was below average. He had a strong copilot during that period, and the copilot took charge during the whole LOFT period, and they came to successful conclusion of the operation. However, after that particular period, the captain remained for additional training. I happened to fly with him in his second LOFT period a year later, and he was a completely changed individual. He was well-versed in aircraft systems and procedures, and so on. He came back that second period, and he really knew what he was doing. He took charge, he took command, and he utilized all his resources.

DR. LAUBER: Thank you very much, Tom.

PANEL DISCUSSION OF THE FRONTIER AIRLINES LOFT PROGRAM

Captain Roy Williams

CAPTAIN ROY WILLIAMS: I certainly cannot add very much to what has been said. I really do not even know how Frontier heard about LOFT, but we did and when the Advisory Circular came out, we went to Northwest Airlines and rode through a few of their scenarios. We adopted their format, at least at that time. With regard to the LOFT program itself, it has been very successful. Our biggest problem has been scheduling. We use LOFT in lieu of a PT (proficiency training), and we always schedule a line first officer and a captain, but sometimes, getting those two together is difficult. However, if the copilot is in for a PC (proficiency check) or a PT and the captain is scheduled for a PT, we will run a LOFT session. That procedure has been approved by our local FAA inspector. Thus, there is the possibility, although it has not happened so far, that a first officer could go two or three years and never have a PC, in theory, and would never be examined on the required Appendix F maneuvers.

Another problem is convincing our crews that the program is intended for training and not checking purposes. Our local FAA says, "Oh, no, no; it's a check-ride as far as we are concerned." We have been arguing the point back and forth. However, at any time, if you bring a crew in, tell them that LOFT is for training purposes only, and then later inform them that their performance has been unsatisfactory; you have thrown the entire program out the window. In a small airline like Frontier, all they have to do is go back to the crew room and thirty minutes later no one is going to accept the program.

We think LOFT is good, and use the program quite a bit. We feel our system is unique in that we write 30 or 40 minute legs into our scenarios, and that works out beautifully. We can pick any trip we want and design the scenario for three hours and twenty minutes which leaves us forty minutes left-- something we feel is important. In that period, we can cover anything that an instructor feels may be a problem. This system creates no embarrassment, and we can return him to the line. We feel that is very important. At this point, I will answer any specific questions.

CAPTAIN HARDY: If you detect a deficiency in one particular crew member, would you train him to proficiency in that 40 minute period or would you bring him back later?

CAPTAIN WILLIAMS: We would try to train him in that 40 minutes.

CAPTAIN HARDY: You would not bring him back later?

CAPTAIN WILLIAMS: Well, it depends on what the problem is. Last week we had one LOFT session where the first officer was unsatisfactory in terms of the conduct of the checklist and other procedural things. In that case, we brought him back into another LOFT session the following day after telling him what his particular problem was. All he had to do was go home, study it a while, and he was fine.

We have found LOFT to be very effective. We use problems that have been identified in line operations, both mechanical types of things as well as decision-making problems.

CAPTAIN TRAUB: Earlier you said the scenarios were 30 or 40 minutes in length. Do you put several of these together?

CAPTAIN WILLIAMS: Oh, I meant the stage length.

CAPTAIN TRAUB: Oh, I see, and you put that whole program together?

CAPTAIN WILLIAMS: Well, we take an actual trip: Denver to Great Falls, through Casper, and on to Billings is a good example. We use the exact trip, the exact times, turnaround times--everything is identical to the actual trip. When the crew arrives, they receive a flight release, a computerized flight plan, and we print weather information for the scenario. It is no different than if he went to the crew room, got his papers, and took the trip. They are exact trips. That is one thing about being a small airline--we cannot really write a scenario that most pilots have not actually flown on the line. That helps a lot.

CAPTAIN STEGER: Did you say your FAA considers LOFT a check ride?

CAPTAIN WILLIAMS: Yes, it is a check, but our FAA considers any time a pilot goes into the simulator with a check airman to be a checking environment, even if it is a practice session.

CAPTAIN STEGER: How do you resolve that? How do you get the pilots to accept, to have the proper attitude toward LOFT with that attitude from the FAA?

CAPTAIN WILLIAMS: Well, we battle a lot-- (laughter) we do not actually tell our pilots that they are being checked. We tell them that LOFT is LOFT, and that there really is no failure, provided they do not completely fall out of their tree--you know, fly the trip upside down or something. Fortunately, the FAA has stayed away from us, for some reason, on LOFT. They do

emphasize the fact that they want people grounded, more or less, just as if they failed a PC or a PT.

MR. HUETTNER: I'm not going to touch any of that, but I do have one question. You mentioned that you were small and that word gets around quickly. How do keep the crews that have been through the scenarios from informing those that have not, so that it can truly be a LOFT-type training program?

CAPTAIN WILLIAMS: Well, at the moment we have six scenarios. We have only 600 pilots and only about 400 of those are jet-pilots. We do not use the LOFT program for the Convair 580--we do not have a simulator with a visual system for that airplane.

Another aspect is scheduling. We have been using LOFT since early 1979. With captains and first officers scheduled together and the captain being on a PT and not a PC, we still have not gotten through the entire pilot list. To my knowledge, no one has ever repeated the same LOFT scenario. If they discuss scenarios, the chances are that they will not get the same scenario even if they just went to crew room and informed about the whole thing. The odds of another crew doing the same thing are very small within a short time frame.

CAPTAIN ATKATZ: I want to ask Tom a question in reference to his difficulties with the FAA. Have you had any and if so, how have you resolved them?

CAPTAIN NUNN: We have only had difficulties with one or two particular ACI's (Air Carrier Inspectors) who sat in on a LOFT session and said, "That man failed." I take the ACI to the back room and talk to him in a very direct fashion. We pull material out from the approved training program, and we discuss it. He concurs that the man will continue training or that he misunderstood the program, and we have resolved the problem there without it getting to the pilot. It has never affected a pilot, so we have had no problem, really.

CAPTAIN ATKATZ: Well, what is the attitude of the individual?

CAPTAIN NUNN: As far as our principal is concerned, there is a depth of understanding of LOFT. We receive excellent support in that relationship from the FAA.

CAPTAIN WILLIAMS: I would like to make a point in regard to the issue of the scenario contents becoming well-known. As I said, we have six scenarios, and that is a lot of material. We try to keep them confidential, but even if the content got out, no one can possibly know when the faults or systems problems will be introduced. But, if they want to go out and share them, fine. In one sense, that is our goal. When we can get crews talking

about what they did in training, that's just absolutely super, but they are still going to have to solve the problem when they get into the simulator, even if they know what is coming.

We had a guy sneak out a copy of a scenario, and he studied it the night before. He still came out sweating under the armpits. He still made mistakes, some rather dramatic mistakes, and he still learned from the experience. We have found that to be absolutely no problem.

DR. LAUBER: Any more questions for Roy?

UNKNOWN SPEAKER: Again, to respond to Charlie (Huettner), maybe for smaller airlines and possibly as a change in the Advisory Circular; we could start with three scenarios and add one each year. That would allow on-going change in the program. At least it is something for the discussion groups to consider.

DR. LAUBER: You will indeed have that opportunity when we give the working groups their instructions later this afternoon.

CAPTAIN WILLIAMS: John, I would like to say that we change our scenarios every year.

UKNOWN SPEAKER: All five of them?

CAPTAIN WILLIAMS: All six of them, right. We pick different routes--we may use some of the problems again, but we do change the scenarios, and our approval is based upon that. That is another reason that why the pilots do not get too familiar with them.

CAPTAIN WINTENBURG: I would just like to know, what was your cost factor--not in actual dollars, but compared to what we heard about Northwest's experience?

CAPTAIN WILLIAMS: In developing the LOFT program itself? Well, actually it was dirt cheap because we went to Northwest and sort of copied their program-- (laughter)--right down to the way we wrote our scenarios. In fact, the one they are missing, I have. (laughter)

MR. HUETTNER: I just want to say that as far as the FAA and monitoring of programs are concerned, we look at this as an entirely new program, and we are going to totally rethink the process of recurrent training--something I tried to say at the beginning. As we go through the regulatory effort, there will be a whole new set of guidelines and instructions to our field people in order to help standardize their approach to the monitoring of programs in the field. We expect something similar to the misunderstanding which occurred with the advanced

simulator regulation. We will bring all the principal inspectors together to discuss these types of things once we have decided how it is going to be. I would like everyone here to at least feel unshackled with respect to the development of this program. We will do our utmost to standardize our people in the years ahead.

CAPTAIN WILLIAMS: Let me say one thing. I do not want it to get back to our POI (Principal Operating Inspector) that I was running him down. The FAA has never sat in on a LOFT program and caused one of our pilots to be grounded. The only thing I was referring to was that it would be nice to be able to tell our pilots that this is not a check environment. This is strictly training, and we are not going to fail you, so to speak. What the FAA is really concerned about--and you can't really blame them--is proficiency, but we have a moral obligation. This program is no different than a line-check in a real airplane. If I give a line-check and a pilot is obviously not doing his job, I am going to remove him from the trip. That is what they are concerned with (so are we). But, it certainly helps if you can tell your pilots when they come in for a LOFT that you are not going to fail them--that it's not going to be a black mark on their record. We have to be careful, FAA wants our assurance that we are not going to let an unqualified man fly the line. That is all I was trying to say.

CAPTAIN FRINK: We are going to cover this whole area, the semantics of evaluation, checking versus training, and so forth; in our working group. We are very anxious to get all of this cleared up, so we will be coping with the semantics of this.

DR. LAUBER: Good. Roy, thank you very much.

UNITED AIRLINES LOFT TRAINING

Captain Dale Cavanagh
Captain Bill Traub

Today we from United would like to describe for you the use we make of line-oriented training and some of the background which has led us where we are today. At the outset let me make it clear that when we speak of LOFT we are in most cases talking of line-oriented training in a broader, generic sense and not as a specific program approved under FAR 121.409 and AC 120-35. I will be describing a LOFT concept which we use in recurrent flight training while Captain Bill Traub will discuss the use of LOFT in transition training.

One of the criticisms most frequently heard concerning airline training and checking has been its lack of line orientation. The maneuvers required under FAR 121, Appendix F, too often bear little resemblance to the normal day-to-day requirements of line flying. The environment in which the checks are conducted because of the need to accomplish the many maneuvers dictated under Appendix F too often bear little resemblance to the cockpit environment on a line trip. In addition, in many cases the composition of the crew has had little resemblance to that found on a line flight. In our view both of those criticisms have been valid.

There has been little which we could do about the manuevers required to be performed during proficiency checks and recurrent training, but in the area of crew composition we have had the latitude to structure the crew to be as close to that found on a line flight as possible. Nearly 20 years ago, United determined that in order to properly evaluate the performance of a Captain, First Officer or Second Officer, it could best be accomplished if he were working with the support of a qualified cockpit crew. Accordingly, a company policy was established which required that all pilot checks and recurrent training must be conducted with a full crew occupying the seats they occupy on the line. In order to maintain this crew concept, it has been necessary for us to schedule First Officers and Second Officers into our DEN training facility twice as often as is required under FAR in order to provide a fully-qualified crew during the Captain's visit to DEN for proficiency checks and recurrent training.

We are not able to provide a regular line crew for FAA type-rating checks, but the ACI's with whom we worked agree that both the safety pilot occupying the right seat and a Flight Operations Instructor occupying the Engineer's station during a rating check should be permitted to provide normal SOP items without specific command.

As a result of the crew concept application during proficiency checks, recurrent training and rating, pilots involved in such checking or training have operated with the support of a full crew, unlike a number of other airlines around the world where performances are sometimes demonstrated in a solo environment.

A number of years ago we were intrigued by the LOFT concept when it was first introduced by Northwest Airlines. We secured an invitation to observe some of their training in Minneapolis. A Flight Manager, a Training Manager and a representative from ALPA all observed Northwest's operation of LOFT and were uniformly impressed--so impressed, in fact, that we immediately investigated the possibility of implementing a similar program in Denver.

The program approved for Northwest included two instructors, one for the Flight Engineer and one for the pilots. In addition, the instructors were line-qualified or at least rated on the aircraft. However, the instructors whom we had used for many years in proficiency training were not qualified in the same manner and consequently could not meet the requirements of the FAA guides which by this time had been laid down. Some of our Flight Simulator Instructors were line pilots who had been medically grounded, others were pilots for other airlines, and a large number were retired military pilots. None of the instructors were line- current and because of medical groundings a number could not be rated on the aircraft. However, we had established a qualification program for the instructors which, in our view, had adequately prepared them for the job they filled. Each Flight Simulator Instructor completed the full transition training required for each pilot in command and upon completion of the training, passed the same qualification check as is administered by the FAA for type rating.

In addition, each Flight Simulator Instructor is given additional training to qualify them as a flight engineer on the aircraft so that they have a familiarity and an acquaintance with the operating duties and procedures of the pilots and flight engineer. Recurrent proficiency training is required on a monthly basis and line observation trips are also required on a monthly basis. Annual proficiency checks are also required.

With that as a training background and with the benefit of the years of experience they had had in administering proficiency training programs for United, we felt they were fully qualified to provide the required instruction as envisioned with LOFT and were also qualified to do this with a single instructor. Consequently, for reasons of instructor qualification and the additional expense which would be imposed with furnishing two instructors during LOFT training, United

elected not to pursue LOFT under the earlier exemption nor subsequently under the FAR when it was promulgated and published. However, we continued to look longingly at LOFT, wondering how, under our system, we might adopt at least some part of the concept.

In the early summer of 1978 we approached our FAA Principal Operations Inspector with a proposal to restructure the four hours we used in recurrent proficiency training. For many years, roughly 2-1/2 hours of the four had been used to accomplish the Appendix F maneuvers for both the Captain and First Officer participating in recurrent training and the remaining 1-1/2 hours were used for review of emergency and abnormal procedures. We proposed to our POI that we use that 1-1/2 hour for a LOFT flight. He was agreeable to our suggestion. Consequently, in September of 1978 we launched a LOFT portion in recurrent proficiency training.

That first year the flight originated in SEA and was planned to terminate at SFO; however, because SEA-SFO would require more than the time available, the scenario was structured in order to provide a diversion into PDX. When the crew reported for training during the briefing, they were provided with a flight plan, a weight manifest and a weather briefing message which approximated the material they would have in hand prior to departure on a similar line flight. The instructor was directed to provide all the normal ground communication contacts such as clearance for engine start, pushback, taxi clearance, ATIS, clearance delivery, and the after-takeoff departure control, center, etc. The instructor was also told to make no instructional comments during the flight, to provide only the assistance by radio that would be normally available to a crew, but to keep notes so that in subsequent debriefing unanswered questions, suggestions, comments and the like could be reviewed with the crew.

The number of emergencies and abnormal procedures which could be undertaken with some degree of realism had to be carefully considered. While we originally left the selection of problems, their timing, and the numbers to be given to the discretion of the instructors, we did have to step in after several weeks and suggest a more standardized approach. Eventually, as a general guide, we suggested that somewhere between 6 to 1Ø problems of varying magnitude as being a normal number. Obviously on a typical line flight one doesn't expect that number of problems. However, crews recognizing this as a training exercise, would be less than happy with a great deal of time spent in climb, cruise and descent with everything operating normally.

To digress for a moment, we have had various comments in these areas. Probably one of the most repeated criticisms has

been the aspect of too much time being spent in a training situation with nothing going on. I was very comfortable with the pacing and number of problems we had in our scenarios until John Lauber and Clay Foushee visited last November. In talking about their observations afterward, I asked about the number of problems which were introduced. I think it was Clay who said that one instructor he had seen had only introduced one problem, and I sucked my breath in involuntarily, thinking I had a problem. But, he went on to say that the problem this instructor had introduced was one which occupied the crew for the balance of the flight. They could not retract their landing gear after takeoff. They could not return to the point of origin because of the weather, and they were forced to go to Los Angeles with the gear down and with all the things that went with that particular problem--hydraulics, etc. The more I thought about it, I began to feel that that is a good approach to follow.

The LOFT concept has been well received by virtually all the pilots and managers who have been exposed to it and it has been accepted as a regular way to doing business on recurrent proficiency training.

After about 12 months, during which period most line crews had been exposed to the SEA-SFO route with a landing at PDX, we changed the route and for the following year picked up LAX to SFO.

We also introduced an occasional incapacitation as one of the problems which might confront the crew. Shortly thereafter we elected to include incapacitation as a standard part of each PT for the following 12 months. The incapacitation was not intended or designed to be subtle, though there would certainly be nothing wrong with that approach. However, by including it on each PT, all crews were soon aware that an incapacitation would occur so it was hardly a surprise. There was an element of uncertainty, though, because the crew didn't know which crew member would be taken out of the loop, nor did they know when during the flight the incapacitation would occur.

We feel this incapacitation has been a worthwhile educational exercise. It is certainly the first opportunity many crews have had to operate shorthanded. We have received a number of interesting comments and made a number of interesting observations. For instance, we have found that the Flight Engineer is generally considered to be the most difficult crew member to replace on the wide-bodies. More difficulty is experienced by the Captain and First Officer when they are operating without the Flight Engineer on a DC-10 or 747. Conversely, we have found that the Captain is more difficult to replace when incapacitated on either a DC-8 or 727.

Last summer we directed a request to our POI, asking for his approval to expand our application of LOFT to the entire four hours of recurrent training. Our justification for proposing a plan which did not fully comply with AC was the wording in it which says the AC describes one method of operation which can be approved by FAA, the implication being that there could be other methods. In November our request was rejected, though a loophole was provided which suggested that FAA might consider one instructor if we used a simulator capable of automatically managing the entire scenario, including all malfunctions, thus relieving the instructor from any manual input. At this point we have not made a decision as to any future action along the lines suggested, though we know that our simulator capabilities would preclude automatic management of the scenario in all except the very latest equipment.

I have given you a brief description of the application of LOFT in our recurrent pilot training over the past 2-1/2 years. I would now like to introduce, Captain Bill Traub, who is Flight Operations Manager for Boeing aircraft training, and who will take over as Director of Flight Operations Training on February 1.

Bill Traub

Dale has covered our use of LOFT in the recurrent training program at United Airlines. We, at United, enthusiastically endorse the LOFT concept and accordingly have expanded its use into several other facets of training and checking. We have chosen to continue using the acronym LOFT, even though this added use is considerably different than LOFT as described in the original Advisory Circular. I will cover:

- First, why we have expanded on the LOFT concept,
- then, how we are now using the LOFT concept in our simulator syllabus development under Appendix E training.
- I'll also explain our use of "pure" LOFT periods in training;
- and, finally our use of the LOFT concept on type-rating checks for Captains.

Why have we have expanded the LOFT concept to Appendix E training programs? It's our desire at United Airlines to be as operationally oriented as possible in training, so that each task the trainee accomplishes has a real meaning in complementing his line skills, in addition to fulfilling the obligations of FAR 121 training regulations. In the past we probably concentrated too much on individual maneuvers in order

of relative difficulty. This approach also led to a conditioned environment that was considerably different than line operations and did not explore the airplane gross weight and performance capabilities to the extent used in line operations. Along with this, our syllabuses listed the maneuvers to be accomplished, important briefing items that needed emphasis and irregular and emergency procedures randomly selected to fulfill training requirements. Our instructors then had to try to put some realism into their briefings and simulator training. By using the LOFT concept we can structure every period like a typical line flight and still accomplish our training objectives.

Now let me explain how we are using LOFT in our simulator syllabus development in Appendix E training. In order to develop good planning skills our pilots need to have a syllabus that logically and sequentially outlines what they are going to accomplish in that training session. Therefore, every simulator period is structured first like a line flight. In simulator training we provide our pilot trainees with actual line documents for each simulator period: they have a flight plan forecast, a weather briefing message covering enroute weather and NOTAMS, and a weight manifest with airplane type and weight operating data. These are the same papers that are automatically generated on the line and so they are provided in the same format for each simulator session. By providing line documents for training, we are familiarizing our pilot trainees with the essential information in the correct format for safely and accurately conducting their flights.

Ground operations receive high priorities in a LOFT concept syllabus. Weather parameters are included to develop the flight crew's awareness that they must integrate weather contingencies into their normal procedures, including such items as slush on taxiways, freezing rain, and tailwind takeoffs. Communication details are included, starting with the closing of all cabin and cargo compartment doors, discussion with ground crews, salute, ATC clearance, and VHF comm switching for taxi, takeoff, enroute, through gate arrival at termination. Simulator positioning can be on a parallel taxiway when the visual is turned on so realistic taxiing and sequencing of checklists can be experienced.

Real-time orientation is a key in LOFT. When a training mission is formulated, it is assumed that flight progress will be in the same time frame as a line-operated flight. Fast slewing the simulator to another geographical fix or cutting short an irregular procedure can become confusing and can dilute training effectiveness. Realism, in our opinion, is a critical factor in allowing our crewmembers the opportunity they need to formulate plans and exercise judgment.

Maneuver-sequencing realism is another byproduct of a well-planned LOFT sortie. If we truly concentrate on a line environment, we shouldn't get a wheel well fire on final approach after an hour of training.

Another key element in our LOFT training syllabus is the development of the crew concept. One of our primary objectives in simulator and airplane operations is the interrelationship of each flight crewmember to fully realize the synergistic aspects of a well-run team. Individual crew training, such as a second officer working on an unrelated irregularity, to fulfill his training while the pilots are shooting a CAT II approach, does not foster crew coordination. On the other hand, a hydraulic irregularity with the full crew involved, does enhance performance by establishing duty assignments, aircraft control responsibility, coordination, and the time planning necessary to arrive at the landing airport safely.

A well-planned simulator syllabus under LOFT will acquaint the flight crew with varying parameters of environment and configuration. We are all aware of airplane performance variations as we fly from a cold winter takeoff at DEN to a balmy LAX landing. This is really only a start as we vary gross weights for takeoff and landing, vary flap settings for takeoff and landing, employ the reduced EPR program, encounter turbulence, and a variety of headwinds, tailwinds, and crosswinds. A rejected takeoff at V1 with maximum weight for the runway, is an excellent training manuever in developing the Captain's confidence that the performance charts really work or in detecting that his braking technique is faulty.

The actual conduct of the LOFT syllabus involves less coaching and interruption in crew training by the instructor. Effective exercise of judgment and command ability are keys in Captain training. It is difficult for Captains to assume and maintain control, or to develop the skills, if he is constantly interrupted or the training session is put together in pieces and offered to him one at a time by the instructor.

We coordinate irregular and emergency procedures required for pilot or Second Officer training to involve the whole flight crew as much as possible and in a realistic sequence. As an example, a leading-edge flap problem after takeoff can involve the whole crew, and should as they cope with aircraft control, navigation, communications, and crew coordination to correct or deal with the irregularity.

Each period of the simulator syllabus is arranged to require as much interaction between the pilots and Second Officer as possible. This fosters our crew concept and keeps each crewmember's attention focused on the total airplane environment. An example, combining some higher altitude

problems such as a loss of all generators where each crewmember has inputs, then encounter associated dutch roll problems with the loss of electrical yaw dampers. This involves checklist completion concurrent with maintaining aircraft control and possibly descent to a lower altitude. You can see that this type of sequence requires crewmember coordination and each member's input.

When we finally put this syllabus together into a period-by-period mission profile plan, we must keep all the factors previously mentioned in mind to compel each trainee to exert himself to his greatest capability. We can continue to challenge him by changing performance parameters, weather environmental factors and compounding of abnormals. In the latter stages of training we can introduce the Minimum Equipment List (MEL) items. This allows us to operate with some components inoperative, with certain attendant associated restrictions which the crew must observe throughout the flight.

I have a complete B-727 transition training syllabus available for your inspection with every period structured as a typical line flight following a LOFT type concept. Some periods follow the LOFT concept only through the initial departure. In the latter stages of the syllabus we have a complete LOFT scenario for the entire period.

Use of "Pure" LOFT Periods in Training.

In each of our transition training programs we have introduced "pure" LOFT scenarios. What I mean by a "pure" scenario is a training session that is operated from start to completion as a typical line flight. In several of the training programs we conduct one of these "pure" LOFT scenarios prior to the check flight and one after the check. In the B-747 and DC-1Ø where we are (or soon will be) conducting Appendix H type training, we conduct pure LOFT after the simulator rating check in compliance with the Appendix.

Use of the LOFT Concept on Type-Rating Checks.

At United we have had some difficulty with some ACI's conducting very poorly-planned and very unrealistic type-rating checks. In an effort to correct this problem, we proposed using the LOFT concept to develop a scenario in real time that would accomplish the type-rating. Our POI and ACI's agreed with this plan. In this case we did change the acronym a little bit, we called this a Line-Oriented Check. This concept has enhanced the checking continuity for trainees and gains all the advanced planning benefits associated with training LOFT sorties. It has introduced a more realistic profile to accomplish the majority of the rating requirements. Rating items like stalls, steep turns and no flap landings are then accomplished at the end of

the LOFT or LOC to fulfill the remaining FAR requirements. Rating candidates receive all planning items and the route they will fly about 24 hours in advance of their check. This allows them adequate time to review the route, SID's, STAR's, and profile descents where published. Along with the route they receive a weather briefing message, flight plan forecast, dispatch relase message, and a planned weight manifest so they can be mentally prepared for the conditions that could confront them on the check. Since it is conducted in the real-time environment, they do not feel as rushed. The enroute cruise time gives them added time to collect their thoughts in preparation for the descent, approach and landing.

Summary

Our experience with the LOFT concept in training and checking has been very positive with wide acceptance by trainees, instructors, Flight Standards, and FAA Air Carrier Inspectors. The FAA personnel who work with United Airlines have been excited about the LOFT concept syllabus that starts early in training and reaches its peak on a line-oriented check.

New programs always have a few problems that must be solved. LOFT has a few that need to be refined in our opinion. Some instructors feel that there is too much non-productive time in cruise that could be corrected with a 300K tailwind. We wish to protect the real-time aspects and will approve of a 100K tailwind. The diversity of operating areas, approach aids and terminal aids connected with line-type scenarios has added many more approach plates for trainees to become familiar with. However, operation in real time seems to allow well-disciplined and organized folks the time needed to review and brief for each approach.

I am excited, as our company is, about the LOFT concept in training. I have covered some highlights of the programs we are now using, or are in the process of developing, and in each case, the only limitations are priorities for simulator time and our own vision.

We know that by concentrating on line orientation that our flight crewmembers are better prepared for line operations because they have operated more closely as a crew under real-time line conditions in the appropriate environment. Their planning strengths are enhanced by more documentation before mission execution, thereby allowing Captains to develop their command and judgment earlier in the training process. Certainly, the bottom line in this whole process is each graduate's confidence that they can proficiently function in their new status. We believe we have done this by exposing them to wide, yet realistic variations in their flight environment and broader use of the airplane's envelope.

CAPTAIN BEACH: On the initial aircraft checkout--your LOFT format for initial checkout--you mentioned that you have all the flight type paperwork available for every training period. Do you have dispatch release, the routes they are to fly and all that?

CAPTAIN TRAUB: Yes.

CAPTAIN BEACH: For each trip? How many trips do you have for your pilots?

CAPTAIN TRAUB: It varies between aircraft types.

CAPTAIN BEACH: Say, the 727?

CAPTAIN TRAUB: In the 727, we currently have eight periods.

CAPTAIN BEACH: Does that include the LOFT and the check?

CAPTAIN TRAUB: It includes the LOFT and the check.

CAPTAIN HARDY: In the LOFT check, as you call it, for a type rating; you mentioned that the candidate will be getting information 24 hours in advance. What type of information do you give him 24 hours ahead of his check? Do you furnish the scenario to the individual getting the check, or just what type of information do you provide?

CAPTAIN TRAUB: For safety reasons, a "semi-retired" reservist on assignment as a line pilot is generally given a flight assignment 24 hours in advance. So, we give him the departure station and where he is going, obviously. We do not give them a copy of the scenario, but we do give them a copy of the weight manifest, the weather briefing, and the dispatch release. Obviously, they would not have the weather 24 hours in advance, but in this case, we do give them that.

CAPTAIN BEACH: These scenarios for type rating--are they prepared by United or by the ACI's, or how were they specifically structured?

CAPTAIN TRAUB: The scenarios that we developed for the type-rating were prepared by United Airlines in cooperation with the FAA. The FAA test flew all the scenarios along with us. Our POI asked that we have four different scenarios available, but they choose them. The FAA picks the scenario given on that particular check ride.

CAPTAIN ESTRIDGE: Can you comment on the average rating ride time due to changes in LOFT and completing the Appendix A requirement?

CAPTAIN TRAUB: Walt, the time has been about the same as running a straight Appendix A type rating ride. We actually block the simulator for three hours. I guess that I would estimate that our average time on the rating ride is around two and a half hours.

CAPTAIN FRINK: You have said that in your recurrent training program you have an hour and a half or so remaining after you complete the required Appendix F maneuvers. Do you do Appendix F required maneuvers for both pilots during that session?

CAPTAIN TRAUB: I'll let Dale answer that.

CAPTAIN CAVANAGH: We have always given the first officer, as part of a PT, the maneuvers that are required under Appendix F, and it takes about the same length of time to do as a proficiency check--roughly two and a half hours for captains and first officers. With the introduction of LOFT, we are still doing the same maneuvers that we had done before. Anything done during a LOFT segment, however, we obviously take credit for. If we had a normal takeoff, then we don't need to do another takeoff. If we had an engine failure or an engine-out approach, then we take credit for that as well. We have tried to keep our LOFT within the basic hour and a half that we had previously used for emergencies and irregularities in order to give us adequate time to cover the balance of Appendix F maneuvers.

CAPTAIN BEACH: One more question. I was curious about whether you had any difficulties with the ACI's for United trying to go into business for themselves once they had the typewritten script.

CAPTAIN TRAUB: Not so far. We have provided suggested irregularity and emergency procedures at various segments in the profile similar to what John showed on the graph (NASA LOFT presentation). We do draw profiles similar to what John showed, and so far, they stick to the script. It works quite well.

CAPTAIN CAVANAGH: I would like to comment on the advance notice that we give to crew members. In some of our early conversations with ACI's and the POI, the suggestion had been made that we should have more than one script and that there ought to be a last minute selection by the check airman or ACI as to what route they were going to operate on so there could not be any advance preparation. I suggested--and they accepted--that as unrealistic. You do not go out to fly an airplane from A to B without knowing until 15 minutes beforehand

where you are going. You know at least a couple of hours ahead, and very commonly, if you are on reserve, you may know as much as 24 hours ahead. We think that it is completely realistic to tell them where they are going and give them an opportunity to review charts or anything they think is appropriate to the flight that they are going to operate the next day. We think that it is an essential ingredient of LOFT, where you are going to operate over several different routes, for them to have some advance opportunity to know where they are going so they can prepare just as they would do on the line.

CAPTAIN SMITH: Do the ACI's conduct your rating scenarios or does the check airman?

CAPTAIN TRAUB: The ACI's.

CAPTAIN SMITH: What is your objective in using a LOFT scenario--a conceptual approach--for a rating ride versus the prescriptive approach (which has usually been associated with the latter)? Why not use a regular rating ride as has been done in the past? What are the advantages? How is that ACI capable of using the conceptual approach (LOFT), in your opinion?

CAPTAIN CAVANAGH: Those are good points that you made. I think one of the things it does is point toward the need for training of the FAA and ACI's in how to conduct a check along those lines. We have had good cooperation from the leading ACI's in monitoring the performance of their individual inspectors so that they are basically following the scenario that has been agreed upon--that it will follow the route that has been prescribed. They are not given much latitude to branch out. I think the advantage, from the crew's standpoint, is that it gives them a better idea, before they get into the simulator, what route they will proceed on. If the first 30 to 45 minutes have gone with some degree of ease, and they know basically where they are going, it builds the confidence necessary to handle the balance of the maneuvers that are going to be required. I think they can approach the whole thing a bit more comfortably. You have a better basis on which to start. It probably gives us a better way to handle the individual eccentricities, if you will, of the ACI conducting the check--not that airline check airmen don't have eccentricities.

CAPTAIN SMITH: A further comment--if I understand your approach to LOFT in a checking situation, you are utilizing LOFT in a way other than what we have had previously described as our objective in this workshop. You are using LOFT in a checking environment, and it was my understanding that LOFT was a training concept, period. When you put a pilot in a checking situation, I fail to understand how you can expect that crew, that pilot, to exercise judgement on his part other than to try

and attempt to arrive at the decisions he expects the ACI wants to see. It is not spontaneous judgement, they are trying to do what the ACI wants them to do. Are we not talking about two uses of LOFT?

DR. LAUBER: I think I will respond to that. Yes, indeed we are. The area we are discussing right now is certainly another application of LOFT, but I do not even want to call it LOFT because LOFT, by definition, means training. It is another application of full-mission simulation in a checking situation. That very definitely falls into another category, or the "other applications. . ." category. It is an simulation approach which happens to share something in common with LOFT. However, your point is a good one, and we want to make sure to keep it in mind.

CAPTAIN SMITH: Are we going to concern ourselves, in this workshop, with that implementation of LOFT, or are we going to consider, in our discussions, only the utilization of LOFT as a training and developmental device?

DR. LAUBER: Well, once again, I am going to be very literal with regard to what you just said. The focus of this workshop is on LOFT, line-oriented flight training. We are dealing with a training operation, not the checking situation. We do, however, have to remember that we will deal with other uses of LOFT, but now, we are getting into a rather gray area. We are dealing with other uses of full-mission simulation. I do not see that as the focus of this workshop, but I also do not see how we can possibly ignore some of the issues involved in the checking application as well. We should not avoid them, although it certainly is not the focus. We will have an opportunity for further discussion of these issues later. It seems to me, upon reflection, that one of the most important things that we need to achieve is some consensus on the nomenclature for LOFT or line- oriented flight training, or line-oriented checking, or whatever. We must seek to avoid the potential confusion or misunderstanding of these concepts. Rather than do it now, I think the appropriate way to handle this is for you all to consider it in the working group meetings. If you have suggestions with regard to terminology, this workshop is the place to make them.

EASTERN AIR LINES LOFT PROGRAM

Captain Berton E. Beach

I'd like to thank NASA for inviting Captain Hardy and myself from Miami up here to a warmer climate and tell you how glad we are to be involved in the program. I've been, I suppose, preaching LOFT after talking with Captain Nunn some five or six years ago -- and am totally committed to the idea that line-oriented flight training is probably the best vehicle that's ever come down the pike for flight training.

There is, in each of the kits that you've been given, a paper that we presented about a year and a half ago at a NASA workshop on resource management. And if I may, I would depart from the text and use the outline that John Lauber has provided which covers some of the issues for discussion. A detailed look at how LOFT was designed and implemented on Eastern Airlines is contained in the paper of which you have a copy of examine at your convenience.

We've been in the LOFT business since about 1978. The first program we began was the Boeing-727, because that's obviously our initial training airplane for everyone who comes on the property. It's also the aircraft of which we have the most. The next airplane that was involved in line-oriented flight training was the Douglas DC-9. Currently, the Lockheed L-1011 and Airbus A-300 programs are approaching approval. I believe that by around February or so we'll have the L-1011 program in place, and the A-300 one shortly thereafter.

Beginning with scenario design and development issues, Eastern Airlines committed itself to the full four-hour LOFT training format without the additional time for specific maneuvers. We felt when we put the program together, looking at the way the scenarios in our opinion should have been developed, the full four hours is the best time frame to use.

Scenario design and development issues, origin, routing and destination- We asked ourselves when we first began developing the scenarios where we wanted to go, and why? We took a look at the various airports on our system that had specific things we wanted to look at. For example, Pittsburgh gave us a chance to do Category II work with an inner marker instead of a radio altimeter Decision Height. Charlotte gave us a chance to do non-precision approaches into a "black hole". Atlanta gave us CAT II possibilities with a very complex ATC environment to work in, as did Miami. And those were the four stations we chose. We continue to use those four stations to this day.

The FAA did require us, since we are a Category II and Category III airline, and since LOFT can be used for proficiency check or second in command check, and for second officer training, to provide crew training for Category II in each LOFT because each First Officer must demonstrate first officer duties in Category II at least annually. So we had that single constraint in developing our scenarios. We had to have each scenario include CAT II, and they do.

Abnormals and emergency conditions, pacing, quiet periods- When we began to develop the scenario, our operating word was realism. We were committed to construct the scenario or scenarios, as close to what actually happened in the airplane as was possible to do. We did not elect to use ground speed times two in the simulator. We ran everything and do now run everything in real time. Our criterion has been if it would happen on the airplane, it can happen in the simulator; if it does not happen in the airplane, we will not require it in the simulator.

Time in cruise, has been labeled by some as non-productive. We don't feel that is the case. Any departure in our opinion from real-time, real-world, degrades the training. We felt that as in the real-world, there are times when you can sit back and relax. We feel that quiet time is important in the scenario.

Generally, our scenario scripts are detailed scripts, written verbatim for the instructor to follow. There are a couple reasons for that. We feel that the instructor's principal duty in the simulator during LOFT training is to observe and to evaluate. It was a decision of the people who wrote the scenarios that there were certain things that we wanted to see. For this kind of training, we didn't want the instructor to go into business for himself. There were certain things we wanted to see and certain reactions we wanted to take a look at, certain evaluations we wanted to make. Therefore, we elected to tightly script the scenarios.

Scenario length- As mentioned, we chose to go four full hours. We feel that for our purposes that is the best time frame to use. We have three legs, the first of which averages about two hours, primarily because that's the leg during which we look at Category II approaches.

Category II requires us to make an ILS approach down to the lowest minimums, to miss out of one and land out of another, and we do that. The second leg is normally flown by the co-pilot; and we generally look at a non-precision approach there. The third leg is time adjustable. The abnormality that we have scheduled there can be given to him anywhere, which means if you only have 30 minutes left in the LOFT program, you give that

particular abnormality, let's say, at the gate. If you have an hour and 30 minutes left, you can give it anywhere you like, after takeoff, en route, on descent at the next point.

Operational problems- Cabin and passenger problems are a little difficult to illustrate in the simulator, although we have had diversions because of a cabin problem--heart attack of a passenger, that type of thing. But it's a little difficult to program a cabin emergency whereupon you open the cockpit door all you see is a room full of computers. It kind of destroys the illusion. So we don't do that.

Environmental problems- Weather, winds, temperatures, wet runways, and that type of thing are included in this category. When we put the program together, there were a number of things we wanted to look at. We decided there should be at least one major system problem on every leg. Usually you don't get into anti-icing, de-icing problems unless it's wintertime, so we chose winter. Our simulators are not Phase 3; they don't have daylight visual capability, so we chose night. I went to the weather department and selected a very nasty day, December 12, 1973, where there was a severe low pressure area around Atlanta with an honest-to-God Category II with freezing rain and snow and all the other good kind of things you like to look at. We took that specific day, and all of our LOFT training on Eastern Airlines on the B-727 and DC-9 is constructed around that day.

Equipment problems- Simple versus complex, airborne and ground equipment: we thought, as I said earlier, that there should be at least enough of a challenge in the LOFT program to stretch the minds of the people involved in training. It shouldn't be something that's a walk through. There should be some genuine deep, meaningful training where you get down deep inside the student's head and dredge out all that stuff he used to know about the airplane but forgot.

In every LOFT scenario there is at least one major fault; one major problem that the student can get himself in deep trouble with if he handles it badly.

Crew problems- Cabin and flight crew: we have done nothing with this category because I think it's a little difficult in the simulator. At least we haven't found anything that really works well for us.

Crew incapacitation- We do two kinds, subtle and dramatic. Subtle incapacitation is generally done around pattern altitude or approach altitude, two to four thousand feet, where the man flying the airplane fails to respond to whatever his next task is and the other man must recognize it and take over. Dramatic incapacitation is written to affect the Captain, and he leaves the seat. The First Officers like that a lot because it's the

first chance they have to fly the airplane alone and the Captain can't tell them what to do.

We make it a point not to interfere with the crew operation. As I said before, realism is the operative word we use. It is an airline flight. The instructor does not participate in anything except as a communicator and as the evaluator. In a three-crew aircraft, we have two instructors; the line Captain who is our Check Airman functions as ATC and observes and evaluates the front-end crew; the second officer instructor functions as the company radio, and he does the evaluation on the second officer.

With respect to real-time LOFT operations, I can't stress enough how much we feel that you must stick as close to the real world as you possibly can. Pre-flight planning and activities must reflect reality. On Eastern Airlines our dispatch papers, weather sequences, flight plans and the like are computer-stored and are available in Operations for the crew as they check in. They are also available to our crews in training as they check in for LOFT. MEL items are included. We are very concerned that the paperwork the man sees during LOFT training is the same thing that he sees on the airline in operation, because we feel it sets the tone for the training he is about to receive. We feel that the crew operates best in an environment with which they are familiar, so we do everything we can possibly do to be sure that the environment duplicates what they would have at the airport when they check in for a regular line trip.

The instructors act as the communicators and, ideally, they would be invisible in the simulator. In fact, the next simulator we are designing with the manufacturer's help will have the instructor's station as far removed from what is going on up front as possible to give the instructors the opportunity to disappear into the background when we do LOFT training.

The role of the instructor- The principal role in line-oriented flight training is as an evaluator. And you can semantically play with that word any way you like.

LOFT as checking- Before I arrived here and learned there was little and big LOFT, to me a check meant that you had to perform a specific maneuver within definite prescribed parameters, pass or fail. Check means to me an evaluation, I don't care how you cut it. So our instructors really are evaluators in this sense of the word.

Simulator capabilities and limitations- We have everything from a brand new AST simulator which very closely approaches Phase 2 with a wrap-around visual and landing credit approval, down to one of the last steam-powered reciprocating simulators left in captivity. And up until not too long ago, we still used

that older machine to conduct LOFT. We don't do it anymore, because it's just not maintainable -- the navaids don't come up to speed; every now and then it just shudders and falls off the jacks; and we decided for obvious reasons that's not the way you want to train in line-oriented mode.

Crew composition and scheduling- I feel the best evaluation of a flight crew is with the whole flight crew in attendance. I feel, as has been mentioned here, that if you put an instructor or a check airman in the other seat, you don't really get the picture of what the crew is doing.

Scheduling a complete line crew is a problem since we operate about seven different domiciles but we do training, LOFT training, in three of those. Of about 4300 pilots we have had about 1200 go through LOFT training so far. We would have a great deal more than that if we had a little bit better scheduling flexibility. But we feel it's important enough to have the full crew in attendance so that they will perform as they would expect to perform on the line, that we have decided not to go with the instructor in the empty seat. We will fall back to some other training mode rather than to continue LOFT with the instructor filling the empty seat.

In reference to inadvertent departures from the scenarios, I'll bore you with an anecdote, if I may. The first DC-9 LOFT program that was given after we had the program approved by our local principal was given by me. In the flight departure papers one of the MEL items was that the autopilot was inoperative. The crew was being dispatched from Charlotte to Atlanta. The Atlanta weather was measured 100 feet overcast, zero visibility, RVR, nine left was 1200'. When we put the scenario together, it was anticipated that the crew would obviously not accept the airplane because you can't fly a CAT. II approach without an autopilot. The crew accepted the airplane without question. So now what do you do? What you do is let him go with it, which is what you must do in any case. Whatever happens, unless it's a simulator glitch, you live with his decision and so does he. So we trooped out to the airplane (simulator), launched from Charlotte to Atlanta, and at a place named Toccoa at around 17,000 feet prior to being released to approach control, the Captain used an expletive (I would use the word but there are ladies present) which indicated to me that he all of a sudden remembered that he wasn't supposed to be there. He said, "Oh, blank, we don't have an autopilot". Now the crew had three choices, divert to Knoxville, or Chattanooga, or Birmingham, or wherever they wanted to go; lie about the failed autopilot and hand-fly the CAT. II approach into Atlanta, which some of us might have done; or he could go back to Charlotte and expose himself to the wrath of Borman, which he chose to do.

Now, here you are. We had spent a great deal of time constructing the scenario in exquisite detail and the Captain blew our whole plan. The next question is, what do I do on the next leg back to Charlotte? As it happened, he gave the airplane to the copilot to fly, so I cranked that in as Leg Two, and I applied the problems that I had already decided to use on Leg Two, and so we proceeded to "fly" back to Charlotte.

When he got out of the airplane (simulator), the Captain said, "What am I supposed to do"? I said, "What would you do in the real-world? First of all, you'd call Frank and apologize. Second, you find out what the weather is, refuel, and go on back to Atlanta", which is what we did. And thereby ends the anecdote. However, I think the chances are slim that he will ever again just give a cursory examination to a set of flight departure papers--which is part of the LOFT exercise.

Departure from the scenario due to a simulator malfunction is something that we have to live with in the age of electronics. Ignore it if it's a minor glitch, or stop LOFT and revert to another kind of training if the simulator is irreparable for the line-oriented mode of training. We don't have major problems very often, but it is something that we have had to deal with, and when we do have a major problem you just about destroy the reality of the scenario.

Performance assessment- The role of the instructor in LOFT debriefing. As someone mentioned earlier, the debriefing will generally be commenced by the crew themselves as they exit the simulator. Most of the time, you'll find the crew talking about what they did as they come down the stairs walking to the briefing room. Most of the time the Captain, First and Second Officers do their own debriefing. The instructors should take notes about those things which they want to highlight in debriefing. The role of the instructor, generally, in debriefing is one of summation, what went wrong, and why, if you can figure that out.

Training vs. checking- Training versus checking is obviously something that's a very sensitive area today. LOFT for checking, I think, is not a very good idea. Full-mission simulation for checking, perhaps so. And I think I will just leave it for that. Let's leave it for discussion in the group.

Satisfactory completion- On our airline, the instructor who conducts the scenario decides whether the people are satisfactory at the end of the scenario or not. If he decides that the crew in total, or an individual in that crew, needs extra training, we give him extra training to the extent that the instructor recommends. In the statistics I have here in front of me for last year (198Ø), we ran about 224 scenarios; there were five people brought back for additional training. We

do not permit--and it's the instructor's dedication to the program--we do not permit someone to go back to the line who we feel is not up to our standards, not the FAA minimum standard but our standard. I daresay that our standards are very high.

Use of video or performance data printouts- We do have in two of our simulators a hard-copy printout available of any portion of the flight. In line-oriented flight training we rarely use that capability. We don't like interruptions in the flow of the scenario to address a problem that happened in that scenario. We believe that it destroys the feeling of line flying and therefore degrades the training effectiveness.

Number of instructors- All of our instructors are line-pilots, all of our check-airmen are line-pilots. The people who instruct in LOFT are those who are on permanent staff in the training department. We do have temporary people who fill in from time to time when the training loads are heavy, and some of those who have an appreciation for what we are trying to do are LOFT qualified, but the majority of our temporary instructors are not.

Instructor training and standardization- Put ten airmen in a room and give them a problem, you'll probably come up with ten different solutions. Standardization is a very serious problem, particularly in something as subjective as line-oriented flight training. We have managers of standardization on every aircraft type, and they observe our instructors periodically to maintain standardization. All of our LOFT programs are precisely scripted which is of considerable help in standardizing our LOFT program. To further develop a standard program, on those simulators which have the capability to automate lesson plans, we will soon begin to write simulator programs which will take advantage of that capability. This will do two things for us. It will ensure that the script is carried out the way it was written. It will also relieve the instructor from the necessity of doing the programming himself, and therefore, give him the opportunity to observe and evaluate which is really why he is there.

Initial, transition, and upgrade training- We have designed a couple of programs which aid us in reducing aircraft time by using the small LOFT format to practice dress rehearsal for the aircraft portion of the type rating. We have by using the LOFT format--full mission simulation, if you like--reduced the average flight training time for a Captain who was upgrading from First Officer on a Boeing 727 from about 3-1/2 hours to less than an hour and a half. We are doing the same thing on the DC-9, A-300, and L-1011.

We have just finished running six experimental students through our nine-simulator period/zero-aircraft training

program. They will also be given airplane training because the program is not approved just yet. That particular program is written entirely in full-mission simulation. The program is nine periods long. The eighth period is a FAA-conducted type-rating for the Captain; the ninth period is the LOFT which is part of the on-line training. We emphasize the day that a man walks in the door that he is flying the airplane. We start out just as we used to do in the airplane with clearances out to the training area. If he must do steep turns and approaches to stalls, we do them in the old training area just off-shore in Miami. We still do that in the simulator. We go over to Dade-Collier airport which is our training airport and shoot approaches just as we used to do in the real airplane. The whole idea is to get the man away from thinking that he is in the simulator and get him to thinking about the airplane. We are using LOFT to develop procedures which are currently in use. Incapacitation is one. We were concerned about the fact that we have no written procedure for crew incapacitation. Our experience with LOFT has shown that there are many answers to what the crew will do for a given situation involving incapacitation of one crew member. We have not had a crew with an incapacitated member have any difficulty in safely landing the aircraft. Consequently, we have decided not to formulate a written policy on crew incapacitation.

Equipment evaluation: about a year or so ago we started going out to the various manufacturers to look for a radar simulator. I think that's the only thing that is missing in LOFT. It's within the current state of the art, now with digital radar systems radar simulation is possible. If we only had the money, we'd have one right now. So you can use line-oriented flight training as one of the best devices in the world to check out new equipment.

In summation, I still feel that for any training purpose you can define line-oriented flight training as the best vehicle.

Discussion

CAPTAIN CAVANAGH: If instructors disappear, as you described, in future simulators, how do you propose to have him critique or participate with the crew?

CAPTAIN BEACH: Well, "disappear" is probably not the word I should have used. There is LOFT for recurrent training and LOFT/full-mission simulation for initial qualification. In initial qualification training, I would deal with you in the same way that I would deal with you in the airplane--I would talk over your shoulder. In recurrent training, where we run "pure" LOFT, to use your term, the instructor should not be

anywhere where the student can turn around and say, "Did that really happen or was that a simulator problem?" There are two kinds of programs to look at. In "pure" LOFT, the instructor should be as unobtrusive as possible. In initial or upgrade training, where you are actually trying to teach something, he can be there. That is not really the problem. The problem is to make him invisible in recurrent training.

CAPTAIN CAVANAGH: I guess my question still is, he cannot physically get very far away because he has got to know what is going on.

CAPTAIN BEACH: That's very true.

CAPTAIN CAVANAGH: Okay, that's all I wanted to know.

CAPTAIN NUNN: Bert, you mentioned your two instructors--the captain and the second officer/flight engineer instructor. Of course, the captain instructor is up front to observe what they are doing, and the second officer instructor is to observe what the second officer is doing. My question is, could you elaborate a bit on what your experience has been in the debriefing session as to what one instructor will give to his counterpart? Will the captain instructor critique the second officer at all or vice-versa?

CAPTAIN BEACH: Yes, there isn't any line of demarcation between observations, no matter by whom. It is all grist for the debriefing mill. If the second officer instructor has seen something at the front end that the captain and first officer have done, and the captain instructor did not; he is free to put that on the debriefing table for discussion. It is just like any other type of crew interaction--you have overlapping areas of responsibility, thus there are overlapping areas of observation. There is no distinction made in the debriefing about who is responsible for what portion.

CAPTAIN CAVANAGH: Secondary to that, do you consider this to be an important element of what we are here to discuss--whether one or two instructors are necessary in a three-man crew?

CAPTAIN BEACH: Yes, probably. Again, this a personal feeling based on working with the program with two instructors. Obviously, on the DC-9, there is only one. If it is a two-crew airplane, there is no one else to watch. There is so much happening in an airplane even as small as a Boeing (727) and certainly in one the size of a 747. I do not believe one instructor can really make all of the pertinent observations that need to be made. I feel that two instructors should be there--that's my opinion.

CAPTAIN CAVANAGH: When you register a dissenting opinion, I'll stop there.

DR. LAUBER: Bert, did you want to say something about the videotape that you brought?

CAPTAIN BEACH: Oh yes, not too long ago, we put together an hour and a half videotape that we intend to use for training LOFT instructors. It has a crew being briefed, portions of the flight, and the debriefing. We brought two copies, and they are available for the working groups or for whatever use they can be put to.

DR. LAUBER: Bert, I have a question, and it has to do with the difference between your approach to LOFT for the two-crew versus the three-crew airplanes. Other than the obvious differences between types, are there other considerations involved?

CAPTAIN BEACH: No. The only difference is the way the airplane is operated.

CAPTAIN FRINK: I hate to keep harping on the same old subject again, but in the course of running all training in real-time as you do, versus what we old-fashioned people do where you use repositioning and repeating problem areas over and over until the crew learns how to handle whatever the problem is--I assume that we are not the only people who have airmen who occasionally have problems like that--it would appear that there must be built into your program quite a bit of additional time that must be set aside in order to handle problems or people like that. Everyone going through a transition program cannot possibly go from one maneuver to the next or from a situation that has a maneuver in it and just redefine and go on to the next one, continuing in the development of his knowledge of the flight characteristics or problems of flying that particular airplane. How do you handle that and stay in a LOFT atmosphere, or do you attempt to do that?

CAPTAIN BEACH: I assume you are not talking about recurrent (training) now?

CAPTAIN FRINK: No, I am not talking about recurrent. I am talking about what you and Dale (Cavanagh) mentioned--trying to do all your training, not in a "capital" L-O-F-T, but in a full-mission simulation.

CAPTAIN BEACH: You are dead right when you say there should be slack left in the program to teach, to iron out those wrinkles that cannot be done in just one shot, and we did not. When I wrote the program, I made a tactical error. I asked to combine the simulator and airplane training programs, and I asked for

nine periods. What I should have asked for was eleven so that when my boss cut me down to nine, which I guess he is always a little prone to do, I would have had a little more flexibility than I do now. But, we do have enough time--Captain Hardy wrote the program so I am stealing his thunder. I told him to be certain that we had enough time in the event that there was a problem to be handled. We wanted to address that problem and still stay within the nine-period framework. When we looked at all the requirements under Appendix E that we had to accomplish in nine simulator periods, we found that there is enough time to iron out the wrinkles that do develop. If the instructor feels that it is necessary, he can "suspend" reality long enough to iron out the wrinkles that do develop. That is to say, if a guy can't get it from 500 feet to the end of the runway, we can use "snapshot" recall, suspend the LOFT for a moment, iron that wrinkle out, and then press on with the program. We do that from time to time.

CAPTAIN FRINK: Can you tell me the difference in time between your former simulator program and your full-time simulation program and the use of nine periods?

CAPTAIN BEACH: Six four-hour periods which we lengthened to nine, but that does away with the airplane entirely--or it will I should say. I am describing the program we would use for zero airplane time.

CAPTAIN TRAUB: What is your crew complement in this zero airplane program?

CAPTAIN BEACH: Two kinds, depending on what our training mix happens to be. Right now that is concentrated on the captain and first officer. You can do two first officers. You can do two captains. You can also do a captain, first, and second.

CAPTAIN TRAUB: Do you have any preference?

CAPTAIN BEACH: If I had my preference, we would do three crew members, all three together.

CAPTAIN TRAUB: Captain and all crew members?

CAPTAIN BEACH: We would, for the crew complement training. I would prefer that, but the economics of scheduling and training loads do not always permit it.

CAPTAIN MICHAELS: I would appreciate it if we could have a response from other carriers who have LOFT programs also (on this question). First of all, do you introduce any misleading elements into your scenarios?

CAPTAIN BEACH: No.

CAPTAIN MICHAELS: For example, do you try to induce a man to make a decision-- to land in a crosswind in selecting a longer runway?

CAPTAIN BEACH: No. There are no "got-yas" in my program and deliberately not. As a personal point, I do not feel that type of training is valid and not in a training simulator. But, if it can happen in the real-world, it should happen in the simulator. If it does not happen in the real-world, I can see no reason to try to trick someone into doing something that he would not ordinarily do.

CAPTAIN MICHAELS: That's good, but for example, say you have an engine failure in the initial stages of the climb with a fire, and the procedure is to shut the engine down. During the follow-up procedure, the engineer hits the wrong engine off switch, and now you have got . . .

CAPTAIN BEACH: Now you have got a double engine flame-out.

CAPTAIN MICHAELS: That is a barrel of alligators for the captain to handle, and he should not have to--it was not in the scenario, and he should not be jeopardized. How do you handle a situation like that? Do you plug it up?

CAPTAIN BEACH: No. The whole philosophy of our program is that if you mess it up then you have to get yourself out of that mess. If your crew member puts the wrong hand on the wrong knob at the wrong time in the real-world, you would live with it, and you do in our program as well. We do not interfere. That's about the time the captain leaves stripes this wide on the guy's back during the debriefing. That is what it is for.

CAPTAIN MICHAELS: How do the others handle it?

CAPTAIN CAVANAGH: Same thing. If you start from the context of no failure, that it is a training situation, you learn from it. The captain may not have learned anything other than he wishes the second officer had not done it, but the second officer may have learned a lot. It is beneficial to everyone to recognize, for whatever reason, they did something they should not have done.

CAPTAIN MICHAELS: How about the first question? Do you introduce anything misleading?

CAPTAIN CAVANAGH: We do not do anything with the intent of misleading. Sometimes, with the best of intentions, it happens, but I do not deliberately try to trick them.

CAPTAIN FRINK: I think if I sense the basis of your question correctly, you are concerned about a captain failing or being criticized for a situation which was not his fault. I do not know of anyone involved in this operation who would hold a captain responsible for that specific problem. However, the captain, first officer, and second officer are going to be responsible for what happens after that, as far as their command ability, organization, and resource management are concerned, and quite properly so. But, the engineer is the one who will be criticized; certainly not the captain.

CAPTAIN MICHAELS: But, he still lives with it to the runway, or he "dies" with it.

CAPTAIN FRINK: Even if he "dies" from it, it is not the captain's fault, it is the engineer's fault.

CAPTAIN MICHAELS: He just picked a lousy engineer.

CAPTAIN FRINK: It's just the end of the exercise.

CAPTAIN WHITEHEAD: In answer to you, Jim, we brief on this aspect before we enter the simulator. At Delta, we do not compound any problems or try to present problems that they would not be able to anticipate on the line. We do advise them that if they use an improper procedure and compound their problem, they will have to deal with it in the rest of the operation.

CAPTAIN WILLIAMS: We do not try to trick them at all. Of course, in our case and depending on the altitude, if the copilot shuts off the wrong engine, it's all over--because we only fly two-engine airplanes.

MR. WARRAS: I guess that if the focus remains on pure training with no jeopardy involved, my concerns are inconsequential, however, if evaluation jeopardy creeps in somewhere down the line; I think it would be grossly unfair for a captain to be criticized and have his "ticket" in jeopardy.

CAPTAIN BEACH: There are a couple of safeguards that I think will prevent that from happening. In the first place, you cannot get into the simulator without being evaluated. I don't care what you are there for, someone will comment, to himself perhaps, on how well you did. But, the concept is training--whatever happens to you, you are supposed to learn from it. Otherwise, there is no reason for you to be there. If the scenarios are designed properly by people who know what they are doing, you will learn a very valuable experience. There is always the possibility that you will need a little remedial training as a result of not being up to a particular standard.

But, it is stated in the very beginning, often in great depth, that LOFT is a no-jeopardy operation which is specifically designed to permit the crew to demonstrate their best solution to the problem without having to worry about what they think the instructor wants to see.

CAPTAIN ERICKSON: What do you mean, no jeopardy?

CAPTAIN BEACH: That means do not put your ticket on the table, I don't need it. The old system where you put it on the table and if you don't mess it up, I will give it back to you, is not what this idea is all about.

CAPTAIN JENSEN: There is one more aspect of this. If, for instance, the second officer does something fairly catastrophic like you have just mentioned, it does not necessarily mean that the captain is going to suffer from it. As a matter of fact, he might come out a lot better. He might handle something that even ends in their supposed death, and he might do a tremendous job of it. Normally, in the LOFT sessions that I have been associated with, you can tell how he is doing and how the other man's actions have affected him.

CAPTAIN LIDELL: You mentioned that you keep them over for a little brush up. The question that I would like answered by those involved in LOFT is, do you put it on a pilot's record when he is kept over for extra training?

CAPTAIN BEACH: Every time you are in the simulator, it is recorded that you were there.

CAPTAIN LIDELL: It could be interpreted by someone that he was kept over for additional training.

CAPTAIN CAVANAGH: When a man goes through transition training, and it is projected to take a total of six periods and he takes ten periods; it is in the record. There is no free ride.

CAPTAIN NORMAN: I think that the critique that is used with this type of training should be left up to each individual airline as it fits into their own style of training. Regulatory actions should not be involved in this area. Generally speaking, you certainly have my support and that of the pilot group, but each individual airline should handle their own problems of this nature.

DR. LAUBER: I would like to add just one comment about the point Jim Michaels made which started this discussion. In regard to the example about someone inadvertantly shutting down the wrong engine and the implications of having to suffer the consequences of someone else's actions; often, that kind of

situation is a reflection of the atmosphere in the cockpit at the time it occurred. We have observed this pattern in the full-mission simulation work that we have done. Frequently, we find that the captain or first officer had not paid sufficient attention to the workload on the flight engineer. It is often a reflection of the captain's management style. I have seen flight crews, before they take a critical action like shutting down an engine, say, "Okay, we're shutting down number one--do you want to check me on that?" These situations very often reflect the lack of that type of coordination. I also feel that the concentration on these types of factors in the debriefing can represent a very valuable learning experience. Even though one person might have directly committed the error, more often than not, everyone has contributed to it.

TEXAS INTERNATIONAL AIRLINES LOFT PROGRAM

Captain Jack Sommerville

As a preface, we do have a different program than those that have been described here today. Initially, we had a similar program which we called "Recurrent, Day One," where we provided them with two hours of ground training, discussing manual changes and so forth. We then briefed the crews for an hour, and took them into the simulator for four hours, where they underwent what we are now calling LOFT--a no jeopardy exercise. Since that time, we have evolved a somewhat different program which I will try to describe to you.

As you know, the program must be acceptable under FAR 121.409, which sets forth the guidelines for LOFT-type training programs. The training time set forth is four hours, three hours and twenty minutes of which must be conducted in a LOFT-type situation. The remaining time may be utilized for whatever other work may be necessary. This four hour period does not include the briefing and debriefing time. Incidentally, we have also used the forty minute period before the LOFT segment.

A complete crew is required--captain and a qualified first officer--for our DC-9 aircraft. The captain may sit in the right seat if he is still qualified as a first officer. We have found this to be problematic in some cases, so we do not place some of the old veterans, who have been flying nothing but captain all their lives, in the first officer's seat.

The scenario should be completely representative of the actual line operation and involve abnormal and emergency procedures. All of our instructors or check airmen are line-qualified pilots. By the way, if we do not have a complete crew available for our LOFT-type PC (proficiency check), they receive training in lieu of that under the FAR.

In accordance with the guidelines, we have incorporated a line-oriented flight training program which allows the crew to work as a team to solve all problems, abnormal or emergency, within the crew concept. I should emphasize that the term LOFT does not really fit our type of program. Perhaps we should call it L-O-C-R for line-oriented check ride. The program utilized by Texas International takes place every six months for the pilot as a proficiency check. There are advantages and disadvantages to this program. One disadvantage is that since it is designed as a check-ride, the scenarios must be structured so that the average pilot will complete the check-ride without complication. This system is different from a proficiency check where you can stop at a problem area and train to proficiency before proceeding with the check. Within the LOFT context, you

cannot stop once the scenario has begun. I consider this a disadvantage since the pilot is checked once every six months and expected to perform with perfection. I think this problem could be alleviated by utilizing time in the simulator prior to the check--give the crew two, maybe four, hours of time the day before the check-ride--allowing them an opportunity of flying the airplane to get their procedures polished, feel more comfortable, and possibly prevent "checkitis."

As I said earlier, another disadvantage of the LOFT concept in our type of program is that in designing the scenario, it is difficult to be fair and keep the program interesting for all concerned. You must tailor the scenario to the average pilot's ability. This means that, on occasion, you will find the above average pilot being bored due to the fact that they are not being challenged. On the other hand, you might find a below average pilot having a great deal of difficulty completing the program satisfactorily. The instructor does not have the option of changing the scenario while checking.

There are advantages to the LOFT program. Assuming that the scenario is well-planned, this type of training is much more interesting, more realistic, and a better demonstration of competence, while at the same time providing more insight into cockpit duties, responsibilities, and the importance of crew coordination. There is also the advantage, since this is a check-ride as far as the requirements are concerned, you are not required to administer a line-check in the airplane.

In our LOFT scenarios, we provide experience in very real problem areas including gross weight problems, takeoffs at high temperatures, power failures using specific engine-out procedures. For example, you can structure a segment around an airport with unique engine-out procedures-- a situation requiring prior planning. In the high altitude segment, you can provide experience in drift-down procedures that have been practiced. Other segments can provide practice and review of such areas as short runway operations, wet runway rules, cross-wind conditions, and so forth.

The problem inputs are designed to involve both crew members. Our flight crew operating manual is designed with the duties and responsibilities of each crew member specifically designated, and this should be demonstrated by the crew. The selection of "abnormals" is one of the most difficult aspects of scenario design. The problem must be realistic and workable and should be inserted at appropriate times so that analysis and action may be accomplished. We try to design scenarios so that while completing the required procedures, hopefully both pilots will learn and receive a refresher about the duties, responsibilities, and actions required in a given situation.

All communication frequencies, identifiers, and so forth are provided to the instructor in conjunction with those appropriate for the specific phase of flight. All the necessary paperwork is provided to the flight crew just as it would be on an actual line flight. Normally, I will fly the actual route-segment before designing a scenario for that route and collect all the required paperwork and other information. Changes are made when necessary to provide the desired emphasis. For instance, the weather may be modified and fuel loads may be changed, so the dispatch releases and weight and balance papers are altered accordingly. We find this to be easier in making the scenarios realistic.

Line-pilots are asked to comment on all scenarios after they have flown them for their inputs and constructive comments. However, any revisions must be approved by the FAA.

As I said earlier, the briefing is begun one hour prior to the scheduled simulator period. Someone commented earlier that on some airlines you receive a 24 hour advance notice of the route you are going to fly if you are on reserve. At Texas International you are lucky if you get 30 minutes-- well, maybe and hour and 30 minutes. The briefing is initiated by giving the crew the necessary papers for the first leg of flight. The instructor informs the crew of the ground rules for the session--the do's and don't's. All communications must be accomplished by use of radios or by requesting communication with maintenance, dispatch, or an agent, etc. The instructor pilot is required to stay functionally out of the cockpit in order to maintain as much realism as possible. The crew is informed that the simulator will not be frozen and that all equipment and aircraft functions are available unless notified otherwise.

The instructor may not deviate in any way from a scenario unless absolutely necessary. However, if a simulator malfunction should cause an undue hardship, the instructor will make himself available to answer questions. The instructor utilizes the control panel to insert any special effects which are available such as visual traffic, turbulence, lighting, or any other effects to increase the sense of realism. Should the crew request a deviation from the flight plan, it is left up to the instructor to decide whether the deviation would be acceptable and allow the objectives of the scenario to be accomplished. For example, if the crew requests to land at airport X and this is unacceptable, the instructor pilot as ATC may say, "Unable due to power failure at airport X." Any realistic reason may be utilized by the instructor. On certain segments, simulator position may be altered if that option is designed into the scenario, but in these cases we make sure that the crew is aware of the change. However, in some cases, this

does detract from the realism of the scenario so we try to avoid this procedure as much as possible.

For the purpose of the debriefing and performance evaluation, instructors are encouraged to make detailed notes throughout the course of the session. The first order of business in the debriefing is to allow each crew member to debrief the other. The captain, in particular, is encouraged to debrief the first officer. Upon completion of the crew's discussion, the instructor commences a thorough debriefing based on his notes. All aspects of the flight, from initial preparation, weather review, cockpit pre-flight, check lists, start, taxi, and so forth are all covered. Compliments on good procedures are very important and allow a better acceptance of comments regarding poor procedure. The lessons learned are very apparent in the debriefing. Allowing the crew members to express their opinions usually results in detailed discussion and a continuation of the learning process. Special emphasis should be placed on cockpit situations which have been devoid of teamwork. A lack of teamwork usually shows up in terms of increased workload and confusion in completing or correcting a problem.

On some occasions, one or both crew members will show up for the session unprepared. If this is true, it always shows up during the session. It is left up to the discretion of the instructor as to how far they will be allowed to deviate, but basic guidelines are provided to instructors, and the crew must perform in a safe, reasonable, and efficient manner. The quality of our check-pilots allows me to give them a free hand in this area. In the event of a "bust," the individual is required to train to proficiency, and is then required to perform a full proficiency check observed by a check-pilot and the FAA.

On the training and qualifications of LOFT instructors, I realize that during the next few days we will undoubtedly consider definite guidelines for instructor qualifications, but at Texas International, the basic qualification is that an instructor be a line-qualified pilot. Each instructor is briefed on what and what not to do, the accepted procedures, and ideas based on a cockpit resource management seminar we held last year. We do not have formal training program centered around more sophisticated training and observational techniques.

We do not use LOFT for any other purpose than to replace the standard proficiency check. I would like to address some of the earlier comments that have been made at this workshop. I feel that the real key to a LOFT- type training program is making it acceptable to flight crews, and I suppose you are wondering now how we made LOFT as a check-ride acceptable to our crews, but they are accepting it. We also have a wonderful

relationship with the FAA in Houston. They watch and observe what we do, but they also help us in any way they can.

There was another comment made earlier about how you make sure that someone does not repeat a scenario that they have already done. We make sure that they do not by recording on the pilot's training record that he has been given LOFT No. XX on a given date. Every six months, we design two more scenarios, and we have four up-to-date scenarios at any given time. Incidentally, I do not feel that having pilots spread the word about a given scenario is all bad. It can be an advantage. One of our scenarios incorporates the incapacitation of the captain. I gave one crew this scenario and the first officer was unprepared for it. He was a good pilot, but he just laid back on this particular check-ride. At 2,000 ft., the captain was incapacitated, and the copilot just sat over there looking at the radio to see if it was tuned--looking everywhere except at what the airplane was doing. When he finally realized where he was--at 200 ft.-- he could not recover. The next day, everyone on the line knew about it. We did not "bust" him for that one particular thing. He was unprepared, but the point is, the rest of the pilots knew about it, and started talking, "Well, what about incapacitation?" I think that was a real advantage.

Discussion

CAPTAIN CAVANAGH: Jack, from our understanding, a captain still takes a PC and the other six-month period he takes your LOFT type program? Is it in lieu of recurrent training?

CAPTAIN SOMMERVILLE: It is in lieu of a proficiency check. It is a check-ride. The LOFT we give in one six-month period is a check-ride, and the next six-month period, he will get a proficiency check.

CAPTAIN CAVANAGH: How about first officers?

CAPTAIN SOMMERVILLE: First officers are scheduled each time. The first officers are getting one LOFT and one PC a year.

DR. LAUBER: I have a significant concern as a result of something you said, Jack. I think maybe now is the time to agree on some critical terminology with regard to LOFT and check-rides because we are getting into a situation of talking about them interchangeably. From what we have seen in these presentations, they are not the same, and we must keep the distinctions in mind. Can we adopt the terminology that if we are talking about a line- oriented check-ride or the use of the full-mission simulation approach to check-rides, that it is a line-oriented check-ride. We should not refer to it as LOFT because it is not. When we are talking about a training

application of full-mission simulation, whether it is recurrent, upgrade, initial, or whatever, as long as it is a training application; we refer to it as LOFT. Is that a fair way of dealing with this issue?

CAPTAIN ESTRIDGE: I agree, John. I am still a little confused, Jack. Is the line-oriented check-ride in compliance with FAR 121, Appendix F, or AC 120-35?

CAPTAIN SOMMERVILLE: We have the approval of FAA in Houston to use this as a check-ride in lieu of a proficiency check by using our procedures.

CAPTAIN ESTRIDGE: Then it has to be FAR 121, Appendix F.

CAPTAIN SOMMERVILLE: They consider it to cover that, yes sir.

CAPTAIN NUNN: Jack, I would like to carefully clarify this check-ride usage. Is it approved by your local FAA under AC 120-35? If it is, I do not know how they did it, because that is definitely a training exercise, not a checking exercise. In fact, the Advisory Circular (120-35) refers to it as a training exercise. It must be satisfactorily completed, but it is not a check-ride.

CAPTAIN SOMMERVILLE: I cannot give you a number. I would have to call Mr. McCabe (TXI FAA POI) in Houston to find out, and I will do that.

MR. DAN BEAUDETTE: Can you do two line-oriented checks a year for a captain--must the other one be a full-mission simulation?

CAPTAIN SOMMERVILLE: It must be a full basic.

MR. BEAUDETTE: Okay, most likely it is not a proficiency check, and the FAA office has not approved it. I am not sure how they would have gotten it to this point because it is not a substantial Appendix F check-ride.

CAPTAIN SOMMERVILLE: I think that the way to get around this is check it out and get an answer from the Houston FAA. You can give training in lieu of a PC and all the things you do in a PC--you only must accomplish everything on the list.

CAPTAIN ESTRIDGE: My question is related to the statement you made about the line-check. How do you get credit for a line-check?

CAPTAIN SOMMERVILLE: When you give a PC, you are required to give a line-check. When you give training in lieu of, or LOFT under the rules set forth down at the Houston office, we do not have to give the line-check.

CAPTAIN NORMAN: This question is directed toward Dale (Cavanagh). How is your LOFT program approved in the current situation?

CAPTAIN CAVANAGH: We are complying with the FAR in that we do all the maneuvers required under Appendix F as recurrent training in lieu of a PC. We spend the four hours that are required under FAR 121, and we devote time to a line segment or LOFT.

CAPTAIN NORMAN: That is not under the Advisory Circular, is it?

CAPTAIN CAVANAGH: That's right. It is generic "small letter" LOFT. It is not LOFT, Advisory Circular. I think there are distinctions to be made to the use of the term LOFT.

DR. LAUBER: All of this underscores the necessity for you as a group to come to terms with the question of terminology and nomenclature.

MR. WARRAS: This may also be a question of terminology, Jack, but you mentioned that if a pilot comes unprepared for a LOFT, I assume you meant unprepared for a line-oriented check-ride.

CAPTAIN SOMMERVILLE: That is correct.

CAPTAIN BEACH: What do you mean, he is not prepared, period?

CAPTAIN SOMMERVILLE: For example, if a pilot comes for a LOFT or LOCR, or whatever you want to call it, and the other crew member does not show up; that pilot must be given a PC or training in lieu of, instead of a LOFT. If he takes training in lieu of, it is still the same as if he took LOFT, as least as far as paperwork goes. He still does not need to have a line-check. If he takes a proficiency check, then he must have a line-check. When I say unprepared, I mean that he is prepared to take the LOFT, but now he is going to take training in lieu of, or a PC. They are told in advance that there is always the possibility that LOFT may not go and to be prepared for a PC.

DR. JOHNSON: Jack, earlier you said that you had some better than average pilots, but your LOFT is geared to the average pilot, and you wished that you could adjust for that. What would you do for the less than average pilot?

CAPTAIN SOMMERVILLE: He has to be trained, if he cannot get through it. We are working somewhere on the curve, and we would not design a separate check-ride for him.

DR. JOHNSON: Would you adjust it to his level?

CAPTAIN SOMMERVILLE: No, once the scenario is designed, it is for the average pilot. You may find in some cases that he gets extra help from the other crew member. If it gets to the point where the individual cannot function safely--that is the number one priority for this whole thing--he is going to have to have more training.

DR. JOHNSON: So you would adjust it in that sense.

CAPTAIN SOMMERVILLE: Well actually it amounts to a "bust." The FAA does not dictate the conditions, and it is left to our discretion.

CAPTAIN ESTRIDGE: I think I can clear up a point. If training in lieu of is done under FAR 121, Appendix F, if training in lieu of is substituted, there are no line landings required. But, you do a PC, then there are line landings required. You must not be talking about the annual line-check required for an airman under FAR 121-F.

CAPTAIN SOMMERVILLE: That is right. An annual line-check is still required, but that coincides with the proficiency check that he has.

CAPTAIN ESTRIDGE: Okay, that's the point--it's solved.

DELTA AIR LINES LOFT TRAINING

Captain Jay Whitehead

It is a pleasure for me to be able to participate in this LOFT workshop with you. I would like to share with you today some of Delta's experience with LOFT. I want to point out where we have experienced some difficulty and where we have concerns regarding the effectiveness of LOFT as a complete training vehicle.

Delta instituted its LOFT training in August of 1978, shortly after Advisory Circular 120-35 was issued. The LOFT program was developed as part of the DC-9 training program which has served as a prototype for much of Delta's other aircraft training programs. We had been using many of the LOFT principles in our initial DC-9 training program prior to adopting formal LOFT scenarios. Each training period began as a normal flight from departure to destination. The scenario was loosely scripted with abnormals and emergencies programmed as required for each stage of training. Flight plans, weather, weight data, and related flight papers were issued to the crew during the briefing prior to their training session. Once the simulator arrived at the destination, we would generally abandon the line operating atmosphere and practice Appendix E maneuvers for the balance of the training session.

The LOFT scenarios were developed under the Advisory Circular as an expansion of the initial training profiles which we had been using previously. The nature of Delta's DC-9 line operation affords us many flight sequences which are readily adaptable to simulation using LOFT principles. Delta's hub-and-spoke system utilizes the DC-9 to operate to close-in airports and back to the hub with passengers to feed the longer route structures. We have been able to duplicate these short-leg segments in our LOFT scenarios.

Our concept of LOFT differs little from the ideology presented in the Advisory Circular. We are very conscious of the fact that the Appendix F type of checking and training exercise is artificial in its application. Pilots have been able to adjust their routines to be efficient in this situation which is not much more than a rapid series of disassociated maneuvers. In the real-life environment, the clock cannot be stopped so that a problem can be examined in detail; nor do problems mysteriously disappear when their training value is no longer significant. It is not like a hurdle race where you surmount the obstacle immediately confronting you, and once by it, consider it no longer.

LOFT has given us the ability to present the real-life environment where crews must deal with the problems presented and live with the results for the duration of the flight. Sometimes the problem resolution is complete, but usually the situation presents lingering effects which reflect cumulatively on the total operation. LOFT offers line-crews an opportunity to exercise their problem solving skills as well as demonstrate their everyday flying capability. Crews are able to develop insights into the crew coordination and resource management requirements of situations which tax their capabilities to the utmost. The normal line operation does not usually offer pressures which demand maximum effort by all crewmembers in concert to resolve a problem. However, when this time does arise, the crew should have previously practiced their coordination and management skills. The LOFT program affords an opportunity to use these management tools in situations which are critical and often stressful.

LOFT has a side benefit as well. It has provided a unique opportunity to observe the application of our procedures in the line environment. Our instructors can observe the appropriateness of our procedures in normal, abnormal, and emergency situations. These procedures may be seen to their normal conclusion. Prior to LOFT, procedures were often expedited or sometimes halted prematurely when a problem ceased to have training value. We were forced to race the clock in order to complete all the required maneuvers. We have also discovered areas where our own training program can be improved as a result of observations of crew performance during LOFT periods.

One of the most important ingredients determining the success of LOFT is the presentation of the concept to the crew being trained. Most crews are uncomfortable with the training/checking situation to begin with. The crew must be made aware of the objectives of LOFT. They need to become comfortable with the new concept and not feel this is just another bag of training tricks with a new label. The crew needs to know that we will be simulating the normal line environment as closely as possible. They must know that we expect them to operate exactly as they would on a line trip. Each crewmember should feel that he is not being manipulated by the training environment, but performing crew duties as he would every day.

We have found that the crews have a difficult time understanding that the instructor will not take an active role instructing during LOFT. During their first LOFT exposure, it often takes one or two legs for the crew to understand this notion. At this point they will stop looking to the instructor for guidance and begin conducting the flight as if it were real. This realization by the crew is necessary for the accomplishment

of LOFT and the earlier it occurs in the period, the better the training value. Ideally, this understanding should be reached in the briefing phase prior to getting into the simulator.

We emphasize during the briefing that there are no specific performance criteria that we are using to judge the crew's performance during the LOFT period. We stress that LOFT must be completed satisfactorily, but downplay the pass-fail concept. We encourage each crewmember to exercise his judgment to cope with a situation or developing problem. We recommend performance which falls within the scope of our pilot operating procedures. However, if another method may resolve the problem more adequately, judgment may indicate the use of an alternate course of action. Regardless of the procedure used, the crew must live with the result until the conclusion of that flight.

Each crewmember must feel that he is controlling his situation and is free to use his judgement as warranted. The objective must be to manage the conduct of the flight using all the resources available while coordinating his activities with other crewmembers. The crew must not feel that they are second guessing the instructor for the "approved solution" in the conduct of the flight.

We have just completed and received approval for six scenarios for our B-727 LOFT program. The construction criteria used were similar to the DC-9. Our DC-8 and L-1011 scenarios are in the development stages now.

If we were to rank our criteria for scenario construction, the first consideration would have to be leg-length. We want the LOFT scenarios to be representative of the typical operation of the aircraft. Basically, the DC-9 and B-727 fly shorter leg distances with more legs flown in each trip sequence. We have chosen to fly four legs in each of the LOFT scenarios for the DC-9 and the B-727. The Captain and First Officer each fly two legs to maximize the training. The arrival and departure stations have been chosen so that the timing of each scenario falls within the 3:20 and 4 hour time period specified by the Advisory Circular. Since we qualify our First Officers to Category I minimums, we utilize the balance of the period flying the certification approaches.

Once we determine the probable city-pairs based on leg-length, we next look into the navigation facilities which are available to us. We are limited in developing scenarios by the storage capability of our simulator computers. Our computers for the older simulators have a storage capacity of approximately 500 navigation facilities. Our newest B-727 AST simulator has storage for 1000 facilities. We must be very careful in selecting departure and destination stations. All

the navigation facilities we need to use enroute must be available to us in the computer storage system. In addition, navigation aids must be available at both the destination and departure airports. Quite often, after we research the enroute facilities for adequacy, we find we are limited in the types of approaches that we can program at the destination airport.

We have 18 airport models prepared for our CGI display system. These are complete in detail with respect to approach light systems, runway configuration, as well as taxiway configurations. Even prominent landmarks in the vicinity of the airport are displayed in the event we program the weather and visibility to be able to see them. Unfortunately, most of these models are located at points so far distant from each other that we are unable to fly between them within the time prescribed for LOFT. In order to program the CGI for the cities we want to use for LOFT, we must sacrifice some of the realism. We have to take one of the models which is similar in configuration to the airport we want to use and insert it into the CGI system. We then activate the runway needed and associated lighting for that runway. We lose some of the realism due to the fact that runway turnoffs, taxiways, terminal buildings and ramps are associated with the model airport and not the airport we are operating to. Taxi instructions are given by the tower to the crews to position the aircraft. It can be a problem for a crew if they anticipate a right turn-off and the taxiway turn-offs are only to the left. They wonder if they have landed at the correct airport. We will be developing a model airport which we call Anytown, USA, to fit this situation. This model should allow us to display the runway system with the capability of selecting parallel taxiways on either side of the runway, whichever is appropriate for the airport we are operating to.

We strive for realism in our scenarios and formulate them to present an operating environment as closely aligned to the line operation as possible. We attempt to maintain a workload which is manageable but one which offers little opportunity for relaxation. You can imagine there is very little idle time when accomplishing four legs during a three hour and twenty minute period of time.

Communications are developed normally and at times can cause difficulties for a crew especially on a leg as short as some that we have developed. For the two man crew, communications becomes a more significant factor in their workload. We do present situations where the crew loses contact with ATC. They must return to the previous frequency to reestablish contact, or refer to charts to gain radio contact. Some of the abnormal conditions which we present result in the loss of radio contact for periods of time. All of the crew's contacts outside the aircraft are made using the radios and

interphone systems in the case of Maintenance or Aircraft Service personnel.

Cabin crew and flight crew interaction is minimized in our scenarios. Contacts are made so that the flight crew becomes aware of the fact that they must consider the cabin condition even though they are operating a simulator. Contacts result usually from unusual situations in the cabin; for example, cabin smoke, passenger or flight attendant illness, turbulence, etc.

Particular care should be taken in selecting abnormal and emergency situations. It is very easy to sit down and dream up a scenario using one of these abnormals and one of those emergencies along with an irregular ATC clearance. Before you know it, you have placed the crew in a situation which becomes totally unmanageable, and the value of LOFT has been destroyed. The scenario will appear very simple when described on paper; however, the performance in the simulator becomes very complex, very quickly. We test flew each scenario several times prior to finalization to verify that the manageability of the workload and pacing of events was adequate. When we were satisfied with a scenario, we invited the FAA to fly it and obtained their approval. We did this for each of the scenarios which have been approved for our LOFT programs.

In a few instances, we have placed one of the crewmembers in a situation where he is not able to keep up with the demands of the situation. This is intentional, but is not intended to cause the total overload of an individual. We do this to demonstrate to the crew that this can occur very quickly and allowances must be made to account for this by an extra turn in a holding pattern, extending the downwind leg, or delaying a takeoff. A good crew manager will recognize this immediately, but a poor manager needs to be shown how the operation can be downgraded if allowances are not made for the completion of the work.

We have been responsive to the inputs made by line-pilots in the development of our LOFT programs. Many of the situations we offer in our LOFT scenarios have been adaptations of similar real-life events. We continually evaluate the daily maintenance reports to determine trends or unusual discrepancies which might be incorporated in our scenarios.

We also monitor industry safety reports and incident reports. Significant safety related situations have been included in our scenarios where we have felt the exposure would be beneficial to our pilots.

We present problems to the crews in LOFT which are plausible and not unrealistic. The success of the LOFT concept

depends to a great extent on its acceptability by the crewmembers experiencing this training. If we were to load up the scenarios with events which were unlikely to occur in real-life, the program would eventually lose its credibility and become useless as a training vehicle. Each scenario must be valued by the line-pilot as an opportunity to broaden and enhance his professional capabilities.

Since the inception of our LOFT training in August, 1978, we have conducted 150 LOFT periods in our DC-9 program. We would have liked to have scheduled more, but our scheduling demands were such that we could not pair crewmembers together more often. Captains must be receiving training in lieu of a check and First Officers may be scheduled for either a check or training in lieu. Of the 150 First Officers receiving LOFT, most were receiving training in lieu of a check. Only 19 First Officers who received LOFT were fulfilling the proficiency check requirements. This is primarily due to the fact that First Officers usually transition to other aircraft prior to their accumulating 24 months experience on the DC-9.

As we initiate our LOFT program on the B-727, we can see that adding an additional crewmember will complicate the scheduling process. We have not been able to fully assess the impact yet. We do feel that if we were able to have the flexibility of making substitutions with training personnel, we would be able to conduct LOFT more frequently. This would also enable us to salvage a LOFT mission in the event of a last minute cancellation by one of the required crewmembers.

Our briefings for the LOFT period begin with a discussion of the LOFT concept and the objectives of the training. This is a very important step. The stage must be set properly in order for the crew to derive the most benefit from the training. As I indicated earlier, once the crew understands the concept and the methods which will be used in conducting the training, they will be able to immerse themselves in the rigors of flying the simulator. Until they understand the situation, they will not totally involve themselves in the training. They will revert back to previous experiences where they were given sets of isolated problems. After years of Appendix F training, the crews have grown dependent on this type of presentation.

We stress the real-world atmosphere during the briefings. We emphasize that the crew should operate just as they would on an actual line trip. Any problems which arise should be resolved using standard procedures. The crew must live with the result of a malfunction throughout the flight until maintenance can provide a fix after landing.

At this point, we add a disclaimer to the real-life presentation. We explain to the crew that we are not able to duplicate all the airports in their entirety with the CGI system. We explain that the runway and lighting systems should be accurate; however, the taxiways and ramps are not always positioned accurately. We suggest asking for progressive taxi instructions where necessary for ground maneuvering.

We present the crew with the flight papers which we have duplicated from the actual line operation. We brief them on the sequence of legs they will fly and give them a timetable to go by so they may pace themselves and plan their time as they would on the line for specific departure times. We provide a summary of the overall weather conditions in which they will operate along their series of legs. This is in addition to the specific airport observations.

We provide ample time for the crew to analyze the information we have provided. Realizing a conscientious crewmember would have completed a substantial amount of preflight organization and planning prior to a line flight, we must allow an opportunity to do this in LOFT rather than throw the crew into the situation cold.

Usually the simulator programming is prepared for the first leg prior to the crew's entry. This is accomplished by the instructors while the crew is reviewing the flight papers and accomplishing its preflight planning. A preflight inspection of the aircraft is performed through a slide presentation. This preflight is monitored by the check airman/instructor for the DC-9 First Officer or the check engineer for the B-727 Second Officer.

While in the simulator the instructors serve as coordinators, communicators, controllers, mechanics, and generally perform any role in response to requests by the flight crew. The only role they do not actively play is instructor. The instructor may not make any suggestions or give any assistance to the crew about the operation of the flight. Of course, the instructor is continually performing as an evaluator of the crew's performance.

Each scenario has a script for the instructor to follow during the LOFT period. There are no deviations or alterations allowed in the execution of the training. This is ensured by strictly following the script. The pilot instructor provides communications from ATC, the dispatcher, and meteorology; while the Flight Engineer Instructor provides communications from mechanics, ramp service, and cabin attendants. In the case of

the DC-9, the pilot instructor provides all communications with the crew.

The script should be adequate to prevent deviations from the scenario. We usually provide instructions in the script to describe a course of action in the event the crew has a multiple choice of actions. The most logical course of action is planned and we provide instructions for contingencies. If a situation arises causing a deviation which we had not considered, we must rely on the instructor's ingenuity to put the flight back on the right track. We have found that our flight control dispatchers can be especially helpful in prodding the crew back to the planned scenario. The instructor can get the crew's attention by using the SELCAL and then communicating as the dispatcher when the crew responds. In addition, temporary weather adjustment enroute and in terminal areas often are sufficient to cause the crew to return to the scenario.

When the LOFT scenario has been completed, we utilize the remaining time to recertify the First Officer for Category I minimums. While this recertification is in progress, the check engineer will split the engineer's panel off from the rest of the simulator so that it will not affect the performance of the simulator for the pilots. Then the check engineer may conduct additional system reviews in areas not specifically covered by the LOFT scenario. Remedial training may be given if this is necessary.

LOFT is new to our flight engineers. They have expressed some reservations about the adequacy of LOFT to provide the necessary in depth system review which flight engineers had been getting during requalification checks. Their concern is mostly associated with the long-term effect. Will flight engineer system knowledge and operational proficiency decline if LOFT is given consecutively for two or three years? Should we have a mix of LOFT and requalification checks?

The LOFT debriefing offers an opportunity to provide the real instruction of the program. The instructor is now free to make his comments on the conduct of the flight after possibly biting his tongue for the previous four hours. The instructor is aware of the objectives to be accomplished for each scenario including the subtleties involved with carrying out the objectives. The scripts we use amplify this information for the instructor. The instructor must advise the crew of these objectives and then review their performance in fulfilling the objectives.

The debriefing for LOFT is usually longer than the briefing phase. It is animated quite a bit more than the debriefings of proficiency checks. I feel this is due to the fact that the

individuals feel more involved in the training with LOFT. They will participate in the debriefing more actively. Most times they can debrief their own performances very well. The lessons they have learned will be remembered for a long period of time. Unlike the proficiency check, the crews cannot come back with the thought that it wouldn't have happened on the line. Since they are allowed to use their own devices and resources to accomplish the objectives, they cannot easily rationalize away an error. These are the best lessons.

The instructor must be well trained in order to conduct LOFT successfully. The instructor wears many hats while participating in the program. His performance directly affects the degree of receptiveness of the crew. He must use a great amount of finesse in operating the simulator so that it will not detract from the realism. He must be intimately familiar with the line-operating environment either by flying the line periodically or making frequent line-observation flights.

We give a comprehensive training program for our new instructors. We outline various instructional techniques, observation skills, and evaluation criteria. Each month we conduct an instructors' recurrent training course which each instructor must attend annually. This recurrent program reviews the information presented to new instructors as well as presents recent topical information.

Our B-727 instructors are qualifying now to be able to conduct LOFT. Each receives a comprehensive briefing on the LOFT concept and a review of the LOFT scenarios. Prior to their conducting LOFT unassisted, each instructor is observed and coached by a supervisor while conducting LOFT with a line-crew. One or two LOFT periods may be required to check out an instructor in LOFT.

We use LOFT to supplement our other training programs. The DC-9 initial training program has a LOFT profile incorporated in it for First Officers. Most of the DC-9 initial First Officers have upgraded from flying Flight Engineer. This is usually their first experience as a pilot for the airline. We have included LOFT to increase their familiarity with line operations.

We know that our training program is somewhat segmented in its presentation. We train for proficiency in each maneuver separately with the overall objective of having the trainee totally proficient at the end of the training program. The new First Officer has not had many opportunities to put a whole flight together in real-time. Our LOFT exercise schedules four legs to be flown real-time. The emphasis of this training is to familiarize the trainee with the normal operation from takeoff

to landing. It provides the trainee an opportunity to plan his flight and pace himself in the normal environment. The instructor makes inputs as necessary to aid the trainee in completing the flights. Special emphasis is put on descent planning, descent profiles, and meeting crossing restrictions. We program instrument conditions for approaches, but present visual conditions soon enough to allow the trainee to align the aircraft with the runway visually. We usually program crosswinds to allow practice of crosswind landing techniques.

We had two motives in mind when we incorporated this LOFT program. The primary motive was to decrease the amount of real aircraft training required for proficiency. The secondary motive was to provide the airline a pilot who was more line-oriented. We were successful on both counts. We have reduced our aircraft training flights by half for our new First Officers. Line-check-airmen report that our new First Officers require less guidance and are generally more capable during their initial operating experience flights.

We have used LOFT to supplement our fuel conservation program. Each LOFT scenario includes a tabulation of fuel use for each of the legs flown. Each time a leg is flown, the instructor lists the fuel burned plus any remarks explaining excessive consumption. We observe the fuel conservation techniques of each crew and compare their fuel use with previous flights. If we need to suggest improvements to the crew in debriefing, we have a data bank to compare their performance with. The comparison can be an eye-opener for the crew which shows little regard for conservation.

As we prepare our advanced simulation training program under Advisory Circular 121-14C, LOFT again will be used as an integral part of the package. We have plans to administer this LOFT in a similar fashion to what we have done on the DC-9 for our First Officer initial training. We are planning the four-hour LOFT program with one normal leg, one leg containing abnormal and emergency flight operations, and additional legs to demonstrate the performance characteristics of the aircraft with varying configurations and operating techniques. We intend to utilize the instructor actively during this training, and one the two required legs have been completed, we plan to take advantage of some of the simulator gadgetry to make comparisons of various performance characteristics and demonstrate the effects of varying configurations.

We have discussed developing a leadership and command LOFT program. This would serve to supplement our training for new Captains. The scenario would consist of situations where a new Captain would be called upon to exercise his new leadership

functions and demonstrate his management capability in selected representative situations.

In summary, after using LOFT for approximately two years, we have become believers in the program. We are becoming more actively involved and soon we will have LOFT programs operational for all of our aircraft. LOFT is not a panacea to solve all of our training needs. It does fill the gap perfectly between the artificial Appendix F checking and the real world situation.

Discussion

CAPTAIN TRAUB: You mentioned the training value of overloading crews. My question is, how do you go about doing that and still maintain a realistic situation in the scenario?

CAPTAIN WHITEHEAD: Well, I think that this overloading occurs--and we do not do it intentionally--in the flight engineer's seat. That is the center of coordination activities in the airplane with the gathering of paperwork, analysis of problems, etc. Occasionally, even in the line situation, the flight engineer will become overloaded, and the captain needs to consider this in the operation of the flight and handle it accordingly. We have built this factor into our scenarios, and it is not very difficult to do. It is easy for the flight engineer to become time-pressed. We have put it there so that the crew, especially captains, realize various workload demands, both in normal and abnormal situations.

MR. WARRAS: You spoke of crew managers. Are you referring to instructors?

CAPTAIN WHITEHEAD: No, I am talking about the captain as the crew manager. We would like the captain to be able to see how task demands affect his crew. In some cases, he may need to make an extra turn, or extend the downwind leg so that the work can be accomplished. A lot of errors that have resulted in incidents are due to the fact that crew tasks were not accomplished. We want them to be able to see this and be able to deal with it when it does occur on the line.

MR. THIELKE: You said that the instructor must be well-trained in order to conduct LOFT successfully. I think all of us in the room would agree with that. You said that an instructor must be intimately familiar with the line operating environment either by flying the line or by making frequent line observation flights. Do you feel that line observation provides an instructor with an intimate knowledge of line flying?

CAPTAIN WHITEHEAD: I was referring to an instructor who may not

be medically qualified to fly the line any longer, but we can still use him in the LOFT environment. Where he was once familiar with line operation, he is no longer directly associated with it, and we encourage these people to go out and observe at regular intervals so they will have an accurate picture of the line situation.

CAPTAIN NUNN: Jay, I simply want to concur with what you said about instructors and their qualifications. In fact, just to go one step further, our instructors are actually changing their roles, becoming actors. If we are not careful, in view of the fact our union representatives are here, the Screen Actor's Guild is going to be after us. Maybe ALPA, APA, and FEIA had better watch out.

CAPTAIN WHITEHEAD: This is very true. The instructors are becoming actors. Our scenarios are written just like a movie script would be written.

CAPTAIN NORMAN: Jay, what is Delta's plan for zero-flight time.

CAPTAIN WHITEHEAD: I alluded to it briefly in my comments regarding 121-14C. We are planning to use LOFT according to the Appendix. I am not sure how Appendix H applies specifically, but as far as the Advisory Circular on LOFT, we are planning to use it as a vehicle to supplement the normal training environment, the Appendix E type training situation with repetitions and so forth. On our other aircraft--I am not thoroughly familiar with the others, I am on the DC-9--begin with a series of training maneuvers and exercises in a LOFT-type concept. It is not LOFT, but a LOFT- type concept, and then get into specific maneuvers. I see us maintaining the same type posture--giving pilots a good workout in LOFT prior to the line-check.

CAPTAIN NORMAN: I have not had a chance to review your simulator installation. What do you have? Are you using a six-axis simulator now? Do you have up-to-date models?

CAPTAIN WHITEHEAD: The DC-8 is not, and the DC-9 is not. We have one AST 727 which is a six-axis system and the L-1011 is a six-axis simulator. We will be getting another 1011 and another 727 shortly after we move to our new installation. We have a mix of both types of simulation.

CAPTAIN ATKATZ: With reference to the Actor's Guild, have you had difficulty with instructors passing their screen tests?

CAPTAIN WHITEHEAD: No, we have a very comprehensive training program for instructors, which is, of course, associated with the selection process. We start with ground school of four days

duration and then general principles involved in being an instructor. We talk about concepts and theory, and then we work on the specifics of the training situations. We then send them to the simulator to view the application of the concepts that we have talked about for the last three or four days. This is all before they get involved with their particular airplane--this is just the role of being an instructor. Once they have completed this phase, they go through their aircraft training as an instructor, learning the aircraft, the simulator operation, what they need to instruct, the profiles and syllabus requirements. Associated with that is a briefing on LOFT. Of course, before they actually do each portion, whether it be a check-ride, or training in lieu, or initial training, or LOFT; they are observed and get on-the-job training. They are approved by supervisory personnel before they are turned loose.

CAPTAIN KARABELLA: Are all of your instructors line-pilots?

CAPTAIN WHITEHEAD: There are a few who are not--they are mostly line-pilots. In a couple of instances, we have people who administer training who have not been line-pilots. We do utilize personnel who have been line-qualified, but are no longer medically qualified, but as a general rule, most of our instructors are line-qualified. We usually rotate two, three, or four times a year in order to maintain our line-qualifications.

CAPTAIN KARABELLA: You said you rotate to maintain the qualifications. Are any of these people dual-qualified?

CAPTAIN WHITEHEAD: Yes, but they do not serve in that dual-qualification function as instructors, however.

AMERICAN AIRLINES LOFT EVALUATION PROGRAM

Captain Don Jensen

CAPTAIN JENSEN: This presentation deals with an evaluation we ran of recurrent training LOFT. Some time ago Captain Estridge requested that a review of recurrent training LOFT be made by American Airlines. Captain Bob Smith and myself were lucky enough to be assigned to conduct this evaluation. It was really an enjoyable experience.

Today, I would like to provide a brief overview of how we went about developing the test program and a very brief outline of a three-leg scenario we developed for the evaluation. We will look at the test guidelines that we set up at American to conduct this evaluation. The remainder of the presentation will briefly deal with the questionnaires that we sent to each one of the crewmembers that experienced the LOFT test and what their conclusions were, then finish with a bit of our conclusions on the program.

In developing our test program we contacted some of the other carriers that had developed some expertise in this area. Right here I would like to say that we would like to give a great deal of thanks to Captain Nunn and his group at Northwest. I was fortunate enough to be able to visit Northwest. They were far more than gracious in providing information than I could have hoped.

Bob Smith traveled to Bert Beach's group down at Eastern, and he also, talked to Ray Jones at Delta and saw some of their LOFT presentations. From this information, the information we got from NASA, and the Ruffell Smith report, we constructed one three-leg LOFT scenario for the 727 to use to conduct this test. When we had it developed, we tested it with a couple of volunteer crews. The first thing we found was that we made the legs way too long. We reconstructed it and designed the legs to be no more than an hour. Some were somewhat shorter, none of them shorter than 45 minutes.

We then went to Jess Williams, our POI, and got approval to conduct the test in our recurrent training program, with the understanding that we would accomplish on the second day of our recurrent training, all the Appendix F requirements that we did not cover in LOFT on the first day. We were able to do this because we bring all of our people in for a two-day recurrent training program.

We ran 25 crews through the test program. After the program was completed by each crew, and they returned to their

base, we waited about ten days then mailed questionnaires to each crewmember's home. We were asking them to evaluate the experience that they had just gone through and give us any helpful hints that they could.

The crew was briefed that they were reporting for a flight from Dallas, Fort Worth to Oklahoma City, and from Oklahoma City to Chicago for a layover in Chicago. In actuality, the flight went from Dallas, Fort Worth to Oklahoma City, from Oklahoma City to Tulsa, and from Tulsa to Kansas City. On leg one, winter weather was the major item. We started out with a couple of start problems on the first leg. The first couple of crews that went through it talked us out of that because, all we accomplished with these particular problems on the first leg was to remove part of the realism of the LOFT concept which our initial 20-minute concept brief helped create. The winter weather conditions including icing conditions on the ground and in the air were a fairly good load.

The only major aircraft problem that we ended up with on the first leg of the scenario was a lever latch relay problem on the 727, which the crew needed to solve. Although it did not seem to us like much of a problem, it is a fairly involved thing when they had to contend with these procedures on arrival.

The other item on the leg was a CAT II destination. When the crew got to the airplane, the log book had an autopilot writeup which was signed off, by the time the crew contacted maintenance they found maintenance had not been informed of this and time was short. Maintenance attempted to talk the crew into taking it, not a very good maintenance procedure, admittedly. We were anticipating the crew would refuse to take the airplane in that situation, and that presented no problems.

Leg 2 of the test was a two-generator dispatch. We set up for this on roll-out in Oklahoma City on the first leg by instituting a generator problem, which maintenance checked and got permission to dispatch in a two-generator operation.

We included some more takeoff limit reviews. During taxi-out the weather went below landing minimums which should require a takeoff alternate and gave some opportunity for crew planning. Shortly after lift-off, the crew experienced an engine fire warning on an engine that had an operating generator. This gave them their major problem on this leg. Basically, as soon they shut down the engine, they were confronted with an aircraft that had one generator operating and two engines. It gave them obstacle clearance considerations and a number of things to talk about. First they had to decide where to go. Obviously, we were not going to Chicago any more. Tulsa became the obvious choice with Oklahoma City below landing limits. When contacted,

the only advice given by the tower at OKC was that they were presently below landing limits. We did not have anybody try to land below limits, although that was a possibility for them.

The other item that was built into this leg was arrival runway selection. We presented a northwest wind in Tulsa and they were making arrivals on Runway 26. However, if the crew requested they were able to get Runway 35. The winds were not out of limits for the aircraft on Runway 35. We presented that as probably a better solution than the nonprecision approach to 26. However, either one was presented as a viable solution. It did give a lot of chance for discussion on runway selection and planning on conditions for your approach.

There were things like landing weight considerations and a great deal of crew planning. This leg probably more than any other pointed out to the crew that if the Captain flew this leg and tried to make all the decisions, he had a really hard time. If he gave the aircraft to the copilot and worked with the engineer on the problems, his workload was a lot less. That did not happen very often, but most of the crews agreed that they would have rather done that had they thought of it. I think they gained a lot from that particular area.

The third leg is a two-part leg and the hardest one we tried. A case might have been made for compounding on this, but we wanted to see what the crews would think of a leg like this. Again, we were in winter weather conditions, but the weather was not nearly as bad. Icing or deicing equipment was still needed. There was a slow speed abort on takeoff for a minor electrical problem which was easily fixed, and then a clearance for departure again.

The climbout was relatively uneventful. As a matter of fact, the climbout was completely uneventful at the start of our test, but we did add a couple of minor things that were easily solved to give the crew something to do on the climb without giving them a high workload. We were trying to get them to forget about why they were climbing all the way to altitude with nothing happening, because some of them were pre-planning the next event. We gave them quite a bit of center conversation and things like this that did not require any particular action from the crew, but kept them occupied on the climbout. Then slightly before we got to the cruising altitude, an explosive depressurization problem was instituted. We preceded it momentarily by a wheel-well fire indication, which we immediately extinguished ourselves, and then as they were in the descent a slow "A" system hydraulic loss was incorporated into the problem. This was a duplication of a wheel failure in the well. A similar problem occured on both American and another carrier that operates the 727's.

Now, the second part of this third leg of the scenario happened after the crew had made their descent and had pretty well taken care of their explosive depressurization. They were some distance from Tulsa and were somewhere in the Butler, Missouri area. The Captain was handed a card which stated that within three minutes of the time he read this, he was going to be feeling so ill that he would have to leave his station. This gave us an opportunity to give the copilot a leg. We set LOFT up so that the Captain was under no constraints to give the copilot a leg. They were asked to run this exactly like they would on the line. In this case, of course, the Captain was out of the picture so his copilot was now in command. They had to decide where they were going, some of that decision possibly being made before the Captain became ill. It just depended on how quickly a solution was reached. The weather situations normally were such that Kansas City was the best alternative. Tulsa was also there, but all went into Kansas City. Some tried other places but the weather was not forecast suitable in those places. They arrived at a non-"AA" station, doing their own altimeter-setting procedures. This leg completed the test scenario.

Now, I would like to run over a little bit of what we did on the 25 crew tests, exactly how we set them up and what we tried to accomplish. The tests were run during the months of December and January, 1979-80. Crew selection was made at random by computer. We determined that the 1540 simulator period in the 727 usually resulted in a crew concept R-1 or recurrent training period, so that is the period we decided to use for this LOFT training exercise. Most of the time the simulator had a fully-qualified line-crew in all positions scheduled. In a couple of cases when that did not happen, we just did not run a test; and on three occasions, we were able to find a line-qualified crew member (not an instructor) that volunteered to sit in. As a matter of fact, Jim Michaels, our training committee chairman with APA and in attendance at this workshop, was gracious enough to come and fly copilot on one of these with no advance briefing on what he would experience.

The LOFT test was given on the first day of the two-day recurrent training program. And by agreement, all Appendix F requirements not given in LOFT were given to the crew on their second day of the training program.

A little bit about the questionnaire before I talk about each individual question. It was sent to each crew member, and out of the 75 crewmembers that experienced LOFT, 67 of these individuals responded to this questionnaire, so we thought we got a good response. All but two of the questions were rated on one to nine scales, with one being a negative response and nine

being the most positive. We felt that if we got an average answer of seven or above, we were getting an overwhelming endorsement of LOFT.

There were several reasons why the answers might have been affected a little. First, we had several probationary flight engineers who participated in this evaluation. They had to pass their probationary check the second day. Several of these gentlemen required another period before they got their probationary checks. I am sure that affected their responses a little. Second, because there was no Appendix F "relief on this evaluation, the second day of training was very busy. Third, on 8 of the 25 periods in which this evaluation was conducted, we had FAA observers along.

The first question was, "LOFT is more realistic than present simulator training". On this question, 85% of the Captains, 87% of the First Officers, and 90% of the Flight Engineers responded with a mark of 7 or above. The average answer for Captain was 7.8, for F/O was 7.67, and for F/E was 7.95.

The next question asked them whether "LOFT should help develop crew concept." Seventy-three percent of the Captains answered at a level of seven or above; 87 percent of the First Officers and 82 percent of the F/E's. It seemed that they were even more overwhelmingly endorsing the crew-concept than the Captains were in this particular response. But all of them met the criteria of what we decided was a highly favorable response.

The next question, "Would the Captain receive good training from LOFT"? Again, the Captain was asked that, and the First Officer and the Flight Engineer were each given the opportunity to respond to whether they thought the Captain received good training. The Flight Engineers really think the the Captain got it. But all of them reached our plateau. The same question was asked about the First Officer. The Captain's response to this just missed the 7 average. About 76% of the Captains responded at a level of 7 or above to this question.

Did Flight Engineers receive good training from LOFT? Eighty-two percent of the Captains really thought they did, at a level of seven or above. The only thing I can say about the Flight Engineer's response in that particular case with the probationary check crewmen, was that we did identify a problem. That was a kind of sticky situation for us. We briefed them well ahead of time that they did not need to be concerned about LOFT interfering with their check. When a man gets another day before he does his check-ride it probably colors his opinion, somewhat.

The next question; were the problems that we presented on this LOFT scenario realistic. The response we got was that 77 percent of the Captains answered seven or above; 78 percent of the First Officers, and 68 percent of the Flight Engineers. The first two or three Flight Engineers had a pressurization problem on their LOFT sequence. In our present simulators we just were not able to simulate that problem very well, so since it was not realistic we removed it. I feel that affected the answers from these gentlemen.

The next two questions had a slightly different format, with five being the most ideal answer. We just wanted to know whether they thought the scenario that they had experienced was too easy or too hard. Ninety-five percent of the Captains answered within the four, five, or six range; 78 percent of the First Officers; and 77 percent of the Flight Engineers gave us what we considered were good grades. We did not want to get far from the mid-range on these questions.

Did we have too few or too many emergencies incorporated in this recurrent LOFT program? From the answers that they gave us, Captains slightly below five, they almost rated it on the easy side. No one graded it higher than six in difficulty.

The next question, "Was LOFT a step in the right direction"? Now we go back to seven as our plateau. Everybody we felt gave an overwhelming endorsement of LOFT being a step in the right direction.

Conclusions from the LOFT evaluation: we feel that crew acceptance was very good, to say the very least. I could tell you hundreds of stories on the second item, "Crew planning and communication was enhanced". In my part as an observer, I learned more than the crews did from this. That is saying alot, because they learned a lot from this. I think their planning and communication were really enhanced.

Just one anecdote on that. For instance, on the departure out of Oklahoma City when we got down to one generator and both packs off. The engineers always did well on accomplishing their tasks. They did very well on taking care of the MEL item on the two-generator dispatch. But not always did the Captain try to find out what would be the impact of the action. When the engineer accomplished these tasks and the Captain did not try to find out the impact, often the engineer did not initiate an effort to let the Captain know. For instance, we were flying out now with no packs on, obviously we could turn them on, but this is a high workload situation for the engineer, and many times when he was very busy he would forget. We would get up to 11,ØØØ feet without any packs on and get an altitude warning horn. It made a real good point of discussion. Again, it was

not a serious problem, but it made the Captain realize that he should talk to the engineer. The checklist was complete what did that mean? If he had given the plane to the copilot and had, in fact, given this individual the task of flying the airplane the way they wanted it flown, and then worked with the engineer, he would have had a little more time. Again, we did not press them that they had done it wrong either way but this was discussed and the crews really seemed to respond to this very well.

LOFT is an excellent self-analysis tool. We had one Captain who could fly very well but really did not respond very well as a Captain. By the second leg, this individual had been able to see, from things he was experiencing, that he needed to take a much more active part. The man made his own correction without anybody having to say anything to him about it. It was very impressive to me to see what a great change the man made.

Crew acceptance of standard operating procedures was enhanced in several cases. And, in one case, the lever-latch relay problem, we made some minor adjustments to the operating manual to make it a little more self-explanatory.

LOFT definitely develops resource management skills. How the crew worked together and how they used what they had available, really was brought out in this evaluation.

Now, just a little about where we are now. We have developed six scenarios for the Boeing 727. These are two-leg recurrent-type scenarios. At American, we would like a little bit of time at the end of the LOFT period to be able to concentrate on a few other hands-on items. They have not been approved yet, because it requires a three-leg scenario at the present time. All the simulation and navaids have been updated for the narrow-body aircraft at American. We have all the navaids required for the LOFT programs that we have developed in the simulators. We have updated some of the communication capabilities in our older simulators. We have through the ATA requested some regulatory changes to the present LOFT governing rules. Scenario approval and instructor training is still to be accomplished in our program. We are in a holding mode right now.

From my own experiences, LOFT, that is recurrent training LOFT, is very fine training. It could be used for a check-ride, but we would lose the value of recurrent training LOFT. The crewmember has to be able to feel that he is in training, in a learning situation, that he is experiencing this rather than being checked on it. And if he is able to do that, he is going to go out there and really get something out of it. He is going to operate it the way he thinks he should. The problems a

crewmember experiences are the most valuable part of this training. The crewmember really learns from these problems particularly those that are self-induced.

The debrief is very important. He cannot be made to think that you have got a "pat" solution and that's the only one. He has got to know that you are interested in his solution and you really want to explore the idea with him. We worked very hard. At times we didn't achieve total crew briefing; many times we did. Sometimes the crew was hesitant to start talking, we would set them up by asking questions, run through the overview of the leg, etc., and then ask them how they thought the session went. Somehow we would get the crew into the debrief.

Discussion

CAPTAIN CAVANAGH: Don, in reference to incapacitation, how do you induce it? We have occasionally found a problem if the captain or first officer was too good an actor, that the others became concerned that it was real. You have to establish a, "Don't worry guys, I'm taking myself out of it, but I'm not really sick," atmosphere. Otherwise they want to get out of the simulator, rush him to the hospital and shut the whole thing down.

CAPTAIN JENSEN: We did have that happen once, and the first flight attendant (the other instructor) and I jumped up and let them know that we had everything under control. They got the message, and that is how we handled it without talking to the crew. This young engineer told us in debriefing, "I can't believe you guys, we had a guy dying in there, and you were going on with the period like nothing had happened." (Laughter) However, in our brief experience with this, most captains are such crummy actors that you couldn't possibly mistake it for the real thing. (Laughter)

CAPTAIN ERICKSON: I just wanted to ask you what your final time breakdown was. How much time have you applied for LOFT, and the other "hands-on" things you were referring to?

CAPTAIN JENSEN: I was referring to the normal type of training. Maybe we would like to review a few things, but not necessarily because they have done something wrong in the LOFT exercise. In most cases, they have already learned the lesson, and it is hard to go back and teach them something that they have already discovered they should or should not do. However, we decided at American that we would like to have some time for procedures training--maybe fly a Category II approach, but there are various opinions on that. We discovered this need especially in the case of engineers. They go through a program in which the engineer gets to practice all of the basic operations of the systems and to review all of the procedures, abnormals and this

type of thing. On the second day, he gets a proficiency check. Another engineer going through LOFT is a little hesitant to take that proficiency check if he has to be compared against the one who got to practice all of that stuff. We cannot schedule everyone for the crew concept training (LOFT). We are going to have some people receiving regular recurrent training, getting procedures practice, and others receiving LOFT. On the second day, they all get their check. If we had extra time, we would like to use it for things that the LOFT exercise did not address. Perhaps he would like a little practice just to get up to speed.

CAPTAIN CAVANAGH: Do you have one or two instructors during the (LOFT) evaluation, and what are your future thoughts?

CAPTAIN JENSEN: We had two instructors in the simulator. I feel that the instructor running the session--this is a personal feeling--should be a line-qualified person. Bob Smith and I ran this evaluation. I ran about half, and he ran half. We did some with flight engineer check-airmen and some with our flight engineer simulator instructors--either way it worked fine, but you just need that line experience in there to operate it. We picked a captain check-airmen simply because the problems are normally set up and given by the captain. I would really feel short-handed, though, with only one instructor in the simulator.

CAPTAIN DISCH: I just wanted to clarify your proposed time-breakdown. Is it the three hours, twenty minutes for LOFT, and forty minutes left over for other things, that you are applying for?

CAPTAIN JENSEN: No, we are applying for relief from the three hours, twenty minutes provision (Advisory Circular 120-35). We would like to have two representative segments. We found that after a while, although it is nice to have some lags (quiet periods in the LOFT scenario) in there, we had quite a few lags they way we had it designed. Because of that we had to put in things like 150 knot tailwinds in order to get everything done. It was also really boring and the guys did not like all of the quiet periods. That is why we wanted shorter legs. We did not like to electronically reposition the simulator. We feel that a couple of representative legs are adequate.

CAPTAIN DISCH: So then, you essentially applied for no-time, just two legs and a passover?

CAPTAIN JENSEN: I would say that is accurate. Would you Walt?

CAPTAIN ESTRIDGE: Yes, the ATA recommendation is that some of the LOFT Advisory Circular would be changed to allow each carrier to utilize segments representative of their needs. We would also like to leave adequate time to practice the things

Don was talking about--for the second officer/engineer to get some systems work. The combination of time should be flexible so that it can suit each carrier's specific needs.

CAPTAIN WHITEHEAD: Scenario leg-development is a significant concern of ours, especially for aircraft like the L-1011 and DC-8 which fly longer legs. We would like the ability to shorten these segments electronically and still preserve as much realism as possible. Since we cannot interject specific maneuver-type training under the LOFT Advisory Circular, we chose to go with four legs. If we are going to continue with this philosophy in the strict LOFT atmosphere, then we would like to observe as many legs as possible. The ability to shorten a leg would be beneficial to us if we are going to continue with the three hour, twenty minute system. However, if we could affect revisions in the Advisory Circular to allow for two representative legs and then additional training pursuant to the company's needs and the further training the regulatory agency requires, this would be most beneficial to us.

CAPTAIN JENSEN: One possibility is to plan for a very long leg, like in the Ruffell Smith study, and then cause a diversion for one reason or another, shortening the leg. We have plans to do that unless it proves unacceptable. We planned a segment from OKC to ORD, they got all the paperwork, etc. for that route, but caused them to divert to TUL, a very short leg.

CAPTAIN BEACH: Jay (Whitehead), as part of what Don (Jensen) was saying, you mentioned that on a long-haul airplane like your L-1011, you program a shorter leg. There is no reason why you cannot take a long-haul airplane and never get out of the local area if you choose to write it that way. You can develop a very effective training exercise with only 350 miles in it.

CAPTAIN WHITEHEAD: But, after a while your crews realize it, "Well, I know we are not going to Europe today, we'll go over and get coffee." "Since we are in the simulator, we're going to deviate."

CAPTAIN CAVANAGH: I would like to comment on that aspect too. The 747s in our system do not fly between SFO and LAX except that it is entirely possible that you could have weather problems in one place and the airplane has to be repositioned, or it needs to go to maintenance. There are reasons to do that, as ferry flights or whatever. I think you can create believable, acceptable, short-haul operations for a long-haul airplane.

CAPTAIN NUNN: In addition to that, if you look at the Advisory Circular carefully, it says that on long-haul operations you can shorten the cruise segment by going to position A from position B, and so on. That came up on one of our scenarios from Seattle

to Tokyo, and the airplane went from Seattle to Tokyo. After reaching cruise altitude, everything came to a halt, and they were slewed (repositioned) to a point 100 miles from touchdown. Everything was recalculated, the fuel burn, etc., and all of the paperwork was there. Our crews felt that it was no problem. They felt that was realistic for a 747 scenario. You do not have to stay in the local area, but I agree with Bert (Beach) that that is very effective too. We had another, Seattle or Portland to Honolulu--they never got to Honolulu--they went back to Seattle or Portland. They preferred that. But, you can do either, at least enough to do away with the expectation of always having a diversion.

CAPTAIN JENSEN: I agree with that. After a while we get used to diversions if that is all we do. Sooner or later we have to get away from that. We have not planned anything for our "wide-bodies" so far, so I don't know.

CAPTAIN MICHAELS: We have participated in the LOFT sessions, and I feel the benefits of making an approach into a strange airport, the navaids, the unfamiliarity of the area, and so forth; far outweigh the detrimental effects of repositioning the simulator. I do not think that you lose as much realism that way as you do by staying in the local area all the time.

MR. HUETTNER: I just wanted to reference what Tom (Nunn) was saying about the provision in the Advisory Circular, it appears in paragraph 13, "For operators who normally operate lengthy route segments, the simulator may be repositioned during the LOFT period while in the cruise configuration and cruise altitude." We have no problem with that concept, so long as it is done in a realistic nature.

CAPTAIN RISCHAR: There are a lot of people with a lot of programs here, and it is obvious that developing the training programs, scenarios, etc. requires a lot of effort. Is it possible to get copies of scenarios and other materials from some of the individuals here?

CAPTAIN BEACH: One of our principal operating inspectors (FAA) said that if any one of our scenarios got out, we would have to write all six over again, but we can certainly help you out.

GENERAL DISCUSSION

"Remarks"
Captain A. A. Frink

Gentlemen, I think it is time to raise a yellow flag of caution. Statements made here today appear to be leading us headlong into something we are, or may not be, ready for. One statement came from the FAA, Charlie Huettner, to the effect that rulemaking is planned to make LOFT mandatory. Following that there has been a veritable deluge of laudatory reports from those airlines that have used LOFT in their training programs. That all points to a possible rush into AC 120-35 type LOFT as a command performance for all airlines. This is something many of us have found impractical and unacceptable under current limitations.

First, I want to be careful to point out that we at Pan American join with others in agreeing that Line-Oriented Flight Training, in principle, has filled a long existing void in airline crew training; that of command and resource management in the total crew resolution of realistic line-type problems. This is a major advance in training concepts.

But one might believe from listening to the reports today that LOFT is a substitute for the traditional training we have been doing for years. It is not. It is, in part at least, additive. We must face that fact and evaluate it.

We must also be careful of what we apply the term LOFT to. Nearly all of us, including Pan Am, are using some form of crew concept, total task training in our programs. There are many versions of this and perhaps we should apply another name. I suggest RECTAL as an appropriate acronym, Route Environment Crew Training at Location. But whatever we call it; it is not LOFT unless it is a substitute for recurrent training in lieu of check. LOFT is a route around Appendix F. Even when used this way, however, it is not now and will not be a full substitute for traditional exercises.

Professional baseball teams do not go to Florida or Arizona in the spring and start playing exhibition games. They have batting practice, infield practice, and running practice. Then they play games, but they still work on the fundamentals. Pilots must do the same. We can not abandon the work on basics; the engine -out maneuvers, the non-precision approaches, the missed approaches, the icy runways, the aborted takeoffs. That's the pilot's batting practice, and it must continue. Teamwork, LOFT, in real-time is an add-on. And it is expensive.

Experts must spend many months developing effective scenarios. These must be changed and updated frequently to remain effective. Special instructor training and experience is needed if that crucial role is to be handled well. Scheduling is a major problem because only full-line crews are permissible. Will we all be required to bring all first officers and second officers in for training twice a year now to match the captains' twice-a-year program? Or will we be permitted to drop the captain to once a year? Will we actually cancel expensive simulator time if a crew member is a no-show? The very definition of "real-time" operation of the simulator means a reduction in the efficient use of the instant replay capabilities of simulation. Flying a full leg with quiet periods or long uncomplicated climbs or descents can't help but stretch out the exercises required to refresh the expertise of the flight crews; and, quite possibly, they will resent the waste of their valuable training time. How much time will be left after the LOFT training to handle the specific problems of the individual or the seasonal special problem of the moment -- wind-shear, aborted takeoff, black-hole approach? These either require additional training or neglect, and I do not believe we are ready to neglect them or that we would be allowed to if we were.

It should be pointed out that even those airlines who have adopted LOFT have used it only on a limited basis, on only part of their fleets, and have heavily used the alternative of Appendix F training. Full acceptance of LOFT has not arrived.

Much more study must be done. Alternatives to LOFT must be permissible. Flexibility in application is a practical necessity. The varying needs of all types of carriers must be considered and unnecessary or unproductive burdens avoided.

Let us at this symposium seek ways to improve and expand on the excellent work that has been done by a few, but let us also face the fact that many responsible and conscientious airlines have been prevented by the restrictive features of the current Advisory Circular from implementation of the LOFT program.

We are a long way from mandatory LOFT. The caution flag is up!

Discussion

CAPTAIN CAVANAGH: I would like to endorse a good bit of what Al (Frink) had to say. I also think, for various reasons, that it may not be practical to make LOFT mandatory as a recurrent training tool, particularly if it is tightly defined as to what the crew complement should be, what it should contain, and so forth. I think there must be an allowance, at least at this

stage of development, for innovation and change that may fit a particular carrier's circumstances, the qualifications of its instructors, etc.; to permit them to adopt it, to adapt it to their needs with minimum cost, yet maintaining the expectation of maximum benefit. I do not think that we should consider LOFT as additional training. I want to make it clear, though, that we are considering it in lieu of some portion of current required training rather than additional training.

There is an important underlying theme in all of what we have heard today. That is, one the the major benefits of LOFT is resource management training, how you manage the airplane, the rest of the crew, and the ground resources that are available to you, as well as an awareness of what your resources are. It is our view at United that there is a requirement for formalized crew training about how you best utilize these resources and then to critique how they were used. That is where our Command, Leadership, and Resource Management Training Program, CLR, fits into the scheme of things. We intend it as a prelude, if you will, to the formal tailoring of our LOFT program so that crew members have some basis for reference on which to judge how well these things happen. We think that this factor is an important part of it.

Lastly, I would like to address a question that arose early, I think Bob Smith brought it up. LOFT can offer more than just in the area of recurrent training. We think there is a value in a line-orientation in transition training, and so on. I do not mean to suggest that the workshop should consider all of those areas, but to point out that the concept, at United, has not only been applied to recurrent training, but to transition training, and in the future, it may be applied to proficiency checks. It has been applied on a limited basis, in rating checks by the FAA with good results all the way around. This is also related to terminology. I suggest that the term LOFT has been used to mean many more things than the "pure" LOFT that you talk about. It might be appropriate to consider abandoning it as a term and picking new terminology or acronyms to describe what you are talking about, such as line-oriented recurrent training, line-oriented FAA check, transition training, etc. I was playing with some terms, and I am afraid that I cannot come up with anything as good as Al (Frink) did. But, for example, we could use LORT for line-oriented recurrent training, LOC for line-oriented check, and LOTT as in line-oriented transition training. I think we do need to establish some terminology so that in the groups, we will know what we are talking about.

CAPTAIN NORMAN: Gentlemen, regardless of what we call the program, I would like to say that the economic impact will be softened by the elimination of aircraft training time. We

should not lose the continuity that has been started here. I agree that there are some conflicts, but we need to get things moving in the right direction. Of course, there will be pitfalls, but all of us here are totally safety-minded, and we certainly want the best for pilot training.

CAPTAIN ESTRIDGE: I agree with you, Dick. However, there is a proposal before the ATA (Air Transport Association) now concerning a concept that Mr. Huettner alluded to this morning in his remarks. It has to do with a new concept in frequency (of training). It may not apply to your airline, but it might. Until a cost analysis is made, we will not know whether it affects us favorably or unfavorably. However, in the context of looking at the whole training framework, we are proposing that an annual--I'm going to use a new term--sabbatical be looked at as a total training package in order to eliminate the six-month check for captains. This would allow the captain, the first officer, and the flight engineer to be on the same frequency of training. This would allow the combination of time, traveling pay, incidental expenses, and lost motion that is now involved in the six-month check. With this system, an entire crew could come in together and undergo training together for four or five days. Please do not hold me to the number of days--it may be more or less. This period could include LOFT scenarios, Appendix F practice, flight engineer system reviews, accident and incident reviews, resource management training, special subjects concerning corporate concerns, and so forth. It seems to me, after the costs were evaluated, that for the same number of dollars we might be able to do one good annual training session for everyone, rather than spreading it out as it is now. There may be good reasons why it will not work for your airline. Your bid patterns, the type of trips that you fly, etc., may not work for your airline. It might penalize you to adopt this concept. However, I think that we should at least look at it, and then we should do a cost analysis. If it works for some of us, then such a course should be designed, and we should be given the regulatory authority to use it. By the same token, I do not think that we should lose the option of an Appendix F program if that better suits our needs. We must have the option of utilizing LOFT--I think we are all convinced that it will work. But, we should look at all methods before we draw the curtain and sign the paper.

CAPTAIN NUNN: I think what we are all saying, and I certainly would like to underscore that I support what Al Frink had to say about batting practice, is that you need to keep a proper balance between all of these elements. But, we are here for this three-day workshop to look at LOFT for recurrent training. We should not go too far astray or get too embroiled in this, and I hope that we can come to a consensus about what LOFT means with regard to this workshop. In line with that, I would like

to suggest that we use LOFT in its classic sense; line-oriented flight training under the recurrent FAR 121 regulation as it was spelled out through the exemption process and the Advisory Circular 12Ø-35. For all the other excellent applications that we have alluded to, lets apply the name full-mission simulation and tack on whatever it is used for. That is my suggestion, that we use LOFT in one and only one way. Then, at least, we have our definition, and we can proceed with some of the things that Walt (Estridge) was just mentioning.

DR. LAUBER: Okay, since the discussion has again come around to that issue, and since you have indicated that it is essential that we resolve this issue before we get too far; let's try and resolve it. Tom (Nunn), Al (Frink), and Walt (Estridge) have all helped identify the issue. Tom has made a very specific proposal, that the term LOFT be reserved for use in its classical sense; recurrent training in lieu of. He has suggested that we only use it in that sense, and that we use other terminology to indicate other applications of full-mission simulation. Is there any discussion of that?

CAPTAIN BEACH: I second that motion.

DR. LAUBER: We have come down to parliamentary procedure. I think the choice is an excellent one. The question has been raised about a change in terminology, and I think one is indicated, but it is not something we want to undertake right now. What we want to achieve now is a working definition for the purposes of this workshop. The focus of this workshop is and always was intended to be upon recurrent LOFT. Let's go with that as our working definition. In the long run, we might want to consider some other terms or applications. If FARs 121 and 61 are rewritten, maybe that is the place to do it.

DR. BILLINGS: Tom (Nunn), your suggestion was not intended to constrain our discussions in the working groups only to recurrent LOFT as defined in the Advisory Circular was it?

CAPTAIN NUNN: No, just the definition of the acronym. When we use LOFT, we are referring to the classic Advisory Circular 12Ø-35 LOFT program; to the recurrent training program. Otherwise, let's use the terminology, full-mission simulation.

DR. BILLINGS: I have no difficulty with that. I was concerned that we would also adopt the position that LOFT only exist within the constraints of the Advisory Circular. I think that is contrary to what Charlie Huettner suggested.

DR. LAUBER: Charlie (Billings), that is an important point, and I am glad you raised it. You should remember that one of the things Charlie Huettner raised is that for the purposes of this

workshop, we are not to feel constrained by the Advisory Circular or by the current training practices. We are trying to come to grips with the technical and training issues involved in the application of full-mission simulation to recurrent training LOFT. We are interested in developing guidelines and an improved application of technology to the whole training picture.

CAPTAIN FRINK: I hate to be on the negative side again, but we are discussing a training program that we have been using in lieu of a check, period, and how that is to be done. The subject of cost comes up again. Dick Norman very correctly stated that the cost connected with this will be retrieved through total simulation training. I do not know about others, but in the approval for the upgrade of my simulators, involving millions of dollars, it had nothing to do with recurrent training (alone). It also involves transition training, upgrade training, etc., and the cost of those programs balanced against the cost of the simulators. I believe, Charlie (Huettner) correct me if I am wrong, that is how it was decided to allow three and a half years for Phase II-A (the intermediate stage of simulator upgrade, while still allowing advanced training). It is going to take them about that long to recoup the money which had to be put into the new simulators, so we can use them for transition and upgrade programs. We do have our economics wrapped up in longer term programs. The economics of total simulation do not directly apply to the recurrent training thing. I am not deluded into thinking that my total simulation program is going to pay the cost of the additional training and expenses that are related to LOFT. I am going to find the money to do LOFT, but it has nothing to do with total simulation.

MR. HUETTNER: I would like to make a few comments since, obviously, some of these closing remarks are directed at the FAA. I will agree that the cost benefit, three and one half year program under Phase II-A, did consider the upgrade of simulators. However, we also had the objective to examine LOFT as part of the capabilities of these simulators. That is something that should be understood. What I was trying to say this morning is that we, the FAA and the industry, have a long way to go toward a regulation regarding training in simulators in the next few years. I was hoping that in this symposium, which we have discussed with NASA, we could devote the time to the discussion of a practical form of LOFT. There will be plenty of opportunity for the discussion of the problems of mandatory training programs, if we are going to do that, later. I simply want to express our view that we want a system which is as economical as possible. We want, for the purpose of this meeting, you to feel totally unconstrained by the requirements that we have had in the past. If you believe that we have been unreasonable in certain areas, we would like to hear from you

what areas you think we have been unreasonable in. I cannot say that we will adopt every recommendation of this group, but I can say that we are very much interested in the conclusions of this group of experts. With that, I hope that you will support the goal of this workshop--to produce a LOFT handbook that is practical and can be used by the entire spectrum of air carriers, which you represent.

CAPTAIN DISCH: Al (FRINK) apologized for being in the negative field, and it takes two negatives to be positive, so I would like to endorse what he said, particularly about caution flags and LOFT as a separate element or substitute for Appendix F-type training. There is certainly a need for both of these areas.

CAPTAIN HARDY: Al, would it be possible to outline the remarks you made earlier so that when we draw up the guidelines in the working groups, we do so with all of the airlines' views represented.

CAPTAIN FRINK: They were off the top of my head. I do want to say that I hope I did not hurt anyone's feelings or use incorrect terminology. The only real point that I wanted to make was that I did not hear a word of caution anywhere. Listening to the total approval I heard here, I thought we had better be careful before we rushed into something that we are all going to be forced into, and at least, give ourselves time to look at this thing and make sure we go about it correctly.

CAPTAIN BEACH: I would like to make several comments about some of the issues that Al was concerned about, and specifically regarding the cost of developing a recurrent LOFT program. Having developed two programs for two different types of airplanes, I think Eastern Airlines developed it more on the cheap side than anything else. Most of the work was done by three or four of us in our spare time. There's your program development.

With regard to instructor training, I really do not see that as much of a problem. Any time you train instructors, for whatever reason, you can include things which apply to the LOFT part of the package. We trained 27 new instructors in the Boeing 727 program alone last year because of movement upward. I have not found the training to be much more of a problem than for the standard program.

As for the simulator, I said earlier that we were using a steam-powered reciprocator until it fell apart three weeks ago. The training we were doing there was very valid. In my considered opinion, the great cost problem is not here, but further down the road in the total application area.

CAPTAIN SESSA: I would like to raise a couple of points. I think that we should all take heed of the caution flags. As an industry we really have not been doing a bad job. We ought to recognize that and not be so quick to run away from things that have been tried and true for a long time. I think flexibility is the most important factor here. No one can write a regulation that is good for everyone--what is good for one carrier will not be good for every carrier. Each airline has a lot to contribute to this exercise--years of experience in the training business. I would rather see this type of training evolve on a more natural basis, by United doing it their way and Pan American doing it their way. Each would make a contribution. Each in their own way would be doing what is best for their pilots. Out of this, could come a much more meaningful regulation than if we cast the die before we go into it. That is, if each airline were given the flexibility to use that training in lieu of section of the FARs for LOFT in their own way, we would have a better program.

DR. LAUBER: I share your concern. It was one of the concerns that all of us at NASA had with the current exercise. The danger, of course, is that we end up with a product which lacks flexibility and responsiveness to individual requirements. However, our feeling is that regardless of the issues involved, differences in application, equipment types, crew, routes, and so forth, I think that there are still some common features. It is the core of these common features that we are trying to identify as guidelines for the purpose of this workshop. I think that it is possible to formulate statements about principles for developing and designing scenarios, or principles involving instructor qualifications and training, that if stated in the appropriate way, will not preclude adapting them to individual needs or to the specific requirements of any given operation. If we wind up with something which is not flexible, we have not done the job properly. We have focused on the specifics and have not identified the core. It is going to be difficult, and we harbor no illusions about that. The job that the working groups have for the next day and a half is going to be a difficult one indeed.

Instructions to Working Groups

We want to generate a report on the basis of this workshop which will attempt to deal, in a reasonably definitive way, with the issues that we have all been discussing. In addition, we want to compile a report which accurately reflects the needs, requirements, and views of this assembled group. We also want to do this in a fairly short period of time. I know that some of you have heard me say that the smallest unit of time in the

government is a month, but I have set a goal for sending out a preliminary report to each participant within ten weeks from the end of this workshop. If we are going to meet this goal, the only way we can do it is with considerable input from each of the working groups. If we (NASA) have to generate all of the written material, there is no way we are going to meet that deadline. Furthermore, a lack of specificity by the working groups will open up the possibility that we will inadvertently introduce some inaccuracies in the views of this group when we draft this report.

Thus, we urge you to generate as much discussion of the issues as possible in written form. We have tried to facilitate this effort by providing secretarial support. In addition, each working group chairman has a NASA person working with him to help with logistics, to help focus the discussion, and to get the report written. We have devoted a full day and a half to the working group discussions. We have done this all in an attempt to maximize the probability that we are going to get some good, hard, useful data out of the working groups. From there, it is up to you.

SECTION 3

REPORTS OF THE WORKING GROUPS

GROUP 1. SCENARIO DESIGN AND DEVELOPMENT ISSUES

Chairman, Captain Peter Sherwin

LOFT is a recurrent training methodology that makes use of a full-crew and full-mission simulation to teach and assess resource management skills. As such, it is but one element in a comprehensive training program. It does not necessarily fulfill requirements for the training and manipulation of all skills.

Different air carriers, different operations within an air carrier, and different pilots within an operation will have different training needs. Legislation and regulations governing the use of LOFT must allow flexibility to permit the fulfillment of these different needs for training. If a minimum number of simulation training hours is specified, a carrier must be permitted to partition these hours among LOFT and the training of other skills in order to accomplish the objectives deemed most important by that particular carrier.

Full-mission simulation may be used for purposes other than LOFT. This report does not consider other uses in detail. Many of the guidelines for scenario development that appear in this report will also be appropriate for the design of other full-mission simulation tasks. The primary factor which must govern the use of full-mission simulation is the specific objective for which it is being used and the specific context in which it is being applied.

The use of full-mission simulation for recurrent training, or LOFT, should be guided by the skills necessary for the exercise of good cockpit resource management. Additional factors to be considered are those human behavioral attributes known from previous experience to constitute problems in aviation operations. These would include distraction, failure of information transfer, complacency, forgetting, etc.

All LOFT scenarios and flight segments should be designed on the basis of a detailed statement of specific objectives. These objectives must state what kind of situation is to be addressed and why.

The origin, routing, and destination of a particular scenario should be dictated by the specific objectives for that scenario or leg. Other factors to be considered are the desired weather, climate, etc. Simulator visual system, as well as other capabilities and limitations must be considered at a very early stage of scenario design. The simulator navigation area must be appropriate and must coincide with current Jeppeson charts. Much of the realism of LOFT is destroyed if the crew is unable to use current manuals and other materials.

Other factors to be considered are alternate airports, fuel, and air traffic control. The specifics of location choice will depend on a carrier's own needs. They must be consistent with the carrier's training objectives. For example, if a problem is to be constructed around an air traffic control situation, one must choose a route where that situation is most likely to occur.

Problems and anomalies should be chosen in terms of the specific objectives. Both simple problems, those that have no impact on the flight once they have been diagnosed and corrected; and complex problems, those that exert an influence on the remainder of the flight, may be used. Problems should not be compounded unless the crew causes further complications as the result of improper actions. The simultaneous presentation of multiple problems should not be the result of scenario design, although it may occur as a result of inappropriate crew action. One is not designing LOFT scenarios to "bury" the crew. An accident should never be inevitable, although it is an outcome that can occur, and it is not wasted if learning has taken place.

Sub-scenarios should be designed in order to anticipate crew actions as much as possible. It is wise to limit the crew's options to some extent. The LOFT coordinator (check airman, instructor) should have the ability to follow alternative branches to a reasonable conclusion in many cases. The use of problems that cannot be corrected is permissible if those problems are appropriate to the objectives of the scenario. An example would be a hung main landing gear, that cannot be extended, resulting in a gear-up landing.

The pacing and tempo of a scenario must be appropriate to, among other things, the location, the departure time, and the phase of flight. Most importantly, it must be appropriate to the specific objectives of that scenario. Designers should avoid totally filling a flight period. They should leave some time for lulls and periods of relative inactivity. The pacing of anomalies and other events must not detract either from the realism of the scenario or from the training potential of the situation.

Scripts should be designed in as much detail as possible. This is necessary because to create the illusion of the real-world requires a great deal of detail. A lack of detail leaves the LOFT coordinator on his own and requires him to improvise, which takes considerable time away from his ability to observe and evaluate the crew. Such improvisation may also fail to accomplish the specific objectives of the scenario.

Communications should be specified verbatim. The pacing and timing should be built in. Problem timing and input should be specified. Whenever a problem is injected, the expected crew actions should be detailed. The LOFT coordinator should be given alternatives in the event of a foreseeable but unexpected crew action. Alternatives should also be specified where appropriate to modify the timing of a scenario. For example, if the crew executes an unexpected missed approach, an alternative course of action for the next leg may be necessary in order to stay within simulator time constraints. The LOFT coordinator may not add to or modify a scripted situation, but if he observes that the crew is so overloaded that further learning is impossible, he may be permitted to exercise reasonable judgement to prevent further compounding of the crew's situation.

In the area of scenario revision and quality control after development, the scenario must be proof-tested--revisions will almost always be required. Even after further testing and approval by the FAA, use of a scenario may reveal details that require further revision based on input from LOFT coordinators and line flight crews.

All scenarios must be kept current with respect to navigation, communications, regulations, company procedures, and aircraft modifications. Accuracy of the scenarios with respect to hardware and software is essential to the credibility of LOFT.

LOFT scenario length should be appropriate to the training objectives of the air carrier or the specifics of its operation. (See paragraph 2).

Any issue raised by the flight operations manuals or airplane operating manuals that is known to be frequently misunderstood is a logical candidate for inclusion in a LOFT scenario. Other sources of problems include reports from the NASA Aviation Safety Reporting System, other flight incident reports, NTSB accident reports, and FAA Maintenance Difficulty Reports.

Under operational problems, we include preflight, dispatch release, hazardous cargo, fueling options, NOTAMS, etc.

MEL items, as well as cabin/passenger problems, ATC problems, and weight and balance problems are all good sources for LOFT scenarios.

Under environmental problems we include weather, wind, temperatures, runways that are wet, icy, or closed, and runway and touchdown zone lighting problems.

In the equipment problems category we have airborne equipment problems, and ground equipment problems such as support equipment and ground-based radio aids.

Under crew problems we include cabin crew problems, flight crew problems including incapacitation, either obvious or subtle.

We also considered other uses of full-mission simulation. It offers promise for several applications in training and other areas of interest to air carriers. The design of such simulations will depend on the specific objectives to be attained. Among the areas in which full-mission simulation can be of value are: initial training of new-hires, upgrade and transition training, Appendix A check-rides, evaluation of new procedures, and training for special missions. However, the acronym, LOFT, should not be applied to any other application than recurrent line-oriented flight training.

We would also like to propose a few other recommendations. Group 1 believes that a flight crew should not be exposed a second time to a LOFT scenario that they have previously flown. We also feel that sole reliance upon LOFT for recurrent training may make it difficult or impossible to meet all FAA training requirements such as CAT II or CAT III requalification, monitored approach training, etc. We would like to reemphasize the need for flexible guidelines that permit a carrier to structure its training in accordance with its own specific needs.

Discussion

CAPTAIN TRAUB: With regard to the specific objectives that you mentioned, do you mean that in a broad sense--to provide recurrent training, or are you focusing on an operational problem? Could you give us an example?

CAPTAIN SHERWIN: We are trying to say that if you ever start to construct a scenario, you want to look at the broad aspect of what you are trying to accomplish in that particular scenario. It should be designed to achieve those specific objectives.

DR. LAUBER: I notice that you made use of a term that I had not heard before. Maybe it is a concept that you developed during the course of your group deliberations, and that is LOFT coordinator. Do you have any comments?

CAPTAIN SHERWIN: Well, there was considerable discussion about whether to use the term instructor, or check-pilot, or observer. We felt that it was beyond the scope of our committee to say that it must be a check-airman, a line-check-airman, or an instructor. We chose coordinator as an all-inclusive term

rather than trying to tie something down that was not within our province.

CAPTAIN SESSA: For the record, Group 4 thinks that LOFT coordinator is an excellent term. We went through the same exercise about terminology and came up with the same term, coordinator.

GROUP 2: REAL TIME LOFT OPERATIONS

Chairman, Captain Dale Cavanagh

All LOFT scenarios should be constructed so as to provide the highest degree of realism that is economically, technically, and operationally feasible. The more realistic the situation, the faster the crew will adjust their thinking and provide reactions which would be typical of a line-flight orientation. The goal is to produce crew performance which would be typical of a crew on an actual line flight, given the same set of circumstances that were developed during the scenario.

The briefing which is provided to the crew before entering the simulator for LOFT, the trip papers, the communications throughout the flight, the role played by the instructor, and so on, are important factors, crucial to the establishment and maintenance of a high degree of realism. Crews should have all manuals and other required equipment for a normal line-flight.

In reference to the instructor briefing, it is essential that the crew have a full and complete appreciation of the rules under which LOFT is conducted. However, this briefing should be done before initiation of the crews' planning for the flight. Once flight planning and preparation have started, routes which follow should be as near to the normal pattern as is possible given the physical limitations imposed by the use of simulation.

Flight planning should be completed in a manner which duplicates as nearly as possible the comparable process prior to a line flight, though an actual appearance in operations is not necessary. The weather sequences, the weight manifest, and the flight plan should all be constructed and provided to the crew with definite training objectives in mind such as maximum weight takeoff, the winter operational considerations, etc.

Adequate time must be provided for the crew to perform a normal complete preflight setup. If it is customary for the flight engineer to enter the cockpit before the captain and first officer, the same sequence should be followed. However, if necessary and in the interests of saving time, it might be possible to modify the scenario to provide shorter ground times such as those sometimes found on through flights, in which case, all crew members might normally enter the cockpit together. It is desirable to provide a planned departure time toward which all preparations can be directed.

All communications must be in the manner normally found on a line-flight, that is, via radio from outside the "airplane," via interphone, between crew members, or in the case of cabin to cockpit, via the normal aircraft equipment provided for this

purpose. All external communications such as ATC, ground crew, etc., must be credible and realistic. If supplemental, background radio conversation is utilized, it must be complimentary with all aspects of the LOFT flight with respect to weather, segments, etc. Our group discussed the use of background communications at considerable length, and there was not a unanimous feeling that this kind of background is necessary or even desirable. There are problems associated with unplanned diversions, things that really cannot be foreseen, in which case you would probably have to turn off the background. It must fit the flight precisely, and may also be very expensive to maintain. Normal company communications must also be included such as weight manifest check, departure reports, etc.

The instructor's role is that of a communicator and observer during the session, but to some extent he is also an evaluator. He is not an instructor in the traditional sense of that word. He is the manager of the flight, using appropriate radio calls or responses to direct the flight along the desired path. However, he must be prepared to accept and manage alternative courses of action that the crew may wish to pursue. The instructor should remain as unobstrusive as possible, within the physical limitations of the simulator. He must not instruct, he must not intrude into the crew discussions. He must allow their decisions to be carried out regardless of the consequences. Where feasible, automatic scenario running may be used, not as a replacement for the instructor, but as a means of unloading him and in the interest of standardization.

The simulator must be capable of performing the mission scenario which has been designed. If a required component for a scenario is inoperative, that LOFT scenario cannot be flown. However, if the inoperative component is not required for the planned scenario, and if it does not significantly detract from the crew's perception of a realistic cockpit environment, that LOFT training is not precluded. If an equipment failure occurs in-flight in a manner which could be duplicated in the airplane, the scenario can proceed to completion of that segment as a similar line-flight might continue, even though the scenario for that flight might then require some modification.

The use of simulator capabilities to provide replay, to be frozen, to be repositioned, etc., which is not consistent with a continuous, real-time operation, should not be permitted except for some long-range flight where cruise patterns may be altered by repositioning.

Regardless of the physical separation between the instructor and the crew, the instructor should be provided with a means to monitor conversations between all cockpit crew members.

When a simulator lacks realistic taxi capabilities, sufficient taxi time should be provided to allow for the completion of duties normally occurring during that interval of the flight.

Regardless of the direction a flight was intended to follow, crews might elect to follow a course of action that was not contemplated when the scenario was developed. The instructor has the option of permitting the selected action and supporting it with appropriate clearances, weather, etc., or alternatively, to prevent the selected action by providing adverse weather, closed airports, inoperative aids, etc. The latter course should be used with care since it is often preferable for the crew to be allowed to proceed as they elect.

When simulator equipment failures occur, causing deviations from the scenario, it is permissible to continue provided the flight can operate in a credible manner which would be possible on an actual flight.

The crew should consist of a normal line captain, first officer, and flight engineer when the latter is part of that airplane's normal operating crew. However, if possible, another line-qualified person may be substituted whenever the regularly scheduled crew member is not available.

ATC clearances, operational situations created by the scenario, and so on, should be straightforward, with no attempt at trickery.

Evaluation and assessment after a LOFT flight must ultimately be the responsibility of a qualified instructor, regardless of the recording capabilities which may be available on the simulator. To amplify, we feel that there is no replacement for the judgements of a real human.

The schedule, when provided to the pilot assigning him to training, should include a summary of all pertinent equipment required, the rules to be followed such as the instructor's role, and as nearly as possible, the routes to be used, including departure and arrival stations.

Any contemplated regulation by the FAA regarding LOFT, should recognize that there is more than one approach to the problem. We do not feel that there is only one right way.

Discussion

CAPTAIN SESSA: Would you just go over the section on the automatic insertion of problems?

CAPTAIN CAVANAGH: We said that the evaluation and assessment

after a LOFT flight must ultimately be the responsibility of a qualified instructor, regardless of automated scoring or recording which may be available on the simulator used.

GROUP 3. PERFORMANCE EVALUATION AND ASSESSMENT

Chairman, Captain Al Frink

LOFT provides a unique new learning experience and an opportunity to look at aspects of performance other types of training have not provided. Areas such as crew coordination, resource management, leadership, and so forth, can be readily evaluated in such a format. While individual performance is of the utmost importance, crew performance deserves equal emphasis. Therefore, we feel that these areas should be carefully observed by the instructors as an area for discussion in the same way that individual performance is observed.

There is an apparent conflict inherent in the purpose versus the application of LOFT. To be effective, it must be accepted by the crew members, and administered by the instructors as pure training--learning through experience. To keep open minds, to benefit most from the experience, both in the doing and in the follow-on discussion, it is essential that it be entered into with a feeling of freedom, openness, and enthusiasm. Reserve or defensiveness because of concern for "failure" must not inhibit participation.

Yet, operators are responsive to safety concerns. They are charged with the responsibility of continuing training for those who require it. Thus, there is no such thing as a "no jeopardy" training exercise. Yet, it is essential to create that atmosphere.

To a considerable extent, this conflict can be offset by the manner in which the instructor sets the scene during the pre-flight briefing. He should emphasize:

- it is a pure learning experience;
- it is a new training concept designed to accent crew command, coordination, communication, and full resource management;
- he should emphasize the instructor's role, that he will not interfere regardless of developments;
- that apparent mistakes may be made, but the crew should carry on--there is no one book solution to a LOFT exercise;
- that there will be an opportunity for a full self-analysis during the debriefing;

- and that, he himself, will take notes and assist in the debriefing.

To a certain extent, the instructors may have to be trained in areas such as resource management themselves, so that they are more closely attuned to those issues. However, at present, these standards are difficult to set and will hopefully evolve as more and more experience is gained with LOFT and resource management training.

The instructor, because of the nature of LOFT, fulfills a very different role than in more traditional types of training. He is not an instructor in the traditional sense. For example, realism considerations dictate that the instructor not intervene or intrude in any way into the LOFT scenario. Thus, for purposes of the debriefing, it is crucial that the instructor serve primarily as a moderator.

Instructors must have time to observe performance adequately. They should make detailed notes of observations made during LOFT so that they can guide the debriefing appropriately. LOFT places rigid demands on the instructor, handling ATC, running the scenario, and so forth. Thus, we recommend a tightly-scripted LOFT, and if possible, to have two instructors for three- man crews (one for two-man crews) so that performance can be adequately monitored.

In the experience of companies who have utilized LOFT, it is often the case that crews tend to debrief themselves. Self-criticism and self-examination are almost always present in these situations and perhaps are much more effective than instructor criticism. In fact, crews are often much harder on themselves than the instructor would ever consider being. Thus, the instructor should do everything possible to foster this sort of self- analysis.

In his role as moderator, the instructor can guide the discussion to points that he has noted need attention. Questions about certain procedures, mistakes, and so forth, should be asked whenever possible, and unless absolutely necessary, the instructor should avoid "lectures" about what is right and what is wrong. Obviously, the instructor should avoid the embarrassment of crew members as much as possible. A suggested format for the debriefing would include:

- a positive general statement opening the discussion;

- crew members should then be encouraged to discuss the operation as a whole and in part;

- o in referring to his notes, the instructor must assure coverage of all aspects of the flight, not permitting one feature to dominate the debriefing;

- o the instructor should mention (as appropriate) possible alternatives, better ways of accomplishing the objectives;

- o he should use questions to each member to further develop discussions, such as, "what if you had done. . . ;"

- o at the appropriate time, the instructor should summarize the debriefing.

With respect to evaluation and assessment, everything should be done to assure crews participating in LOFT that their jobs are not in jeopardy every time they enter the simulator for a LOFT session. We feel that while "satisfactory completion" is an inescapable aspect of LOFT, at the same time it is hard to imagine "unsatisfactory training." In some cases, LOFT may underscore areas which need extra attention, but often, even serious mistakes made during LOFT are obvious and need no further attention. Even a session which results in a "crash" may be a "satisfactorily completed" LOFT if the learning provided by the experience cannot be improved upon. However, in some cases, mistakes may indicate deficiencies that need additional work. The way that this is conveyed to a crew member is of vital importance and represents a challenge to the companies and their instructors.

During debriefing, both total crew performance and individual performances should be openly discussed and assessed by the instructor. Critical assessment of an individual must be mentioned in the presence of the full crew, but remedial details should be handled privately. Tact is required to avoid the appearance of satisfactory/unsatisfactory concepts.

LOFT is, first and foremost, a learning experience. This committee feels that the success and acceptance of a LOFT program depends in great measure on the planning and preparation for the program. Scenarios must accent realism. Instructors should be carefully selected and trained in the art of briefing, conducting the program, and debriefing.

Additional training for crew members, when indicated, must be handled in a low-key, non-threatening manner. If these factors are carefully handled, our committee feels that the evaluation/assessment chore will not necessarily detract from the pure training atmosphere, and will result in full acceptance.

CAPTAIN CAVANAGH: The one area in which I am somewhat disturbed, Al, is the categoric reference to fact that there must be two instructors present. I do not frankly think that there has been enough research or enough work done at this stage to say categorically, two instructors must be present. I think that it is important that instructors be qualified and properly prepared to observe the performance of all crew members present. I will grant that if there are two present that it is perhaps easier than with one, but I do not think it would be appropriate at this point to say there must be two. Automatic management of scenarios, automatic introduction of malfunctions, and various schemes might be used to minimize instructor workload; and might permit one to do a better job than two instructors could do in a situation where some of these aids are not present. I would personally rather see a report and recommendations that ultimately recognized these as legitimate concerns and issues that should be resolved in some other way.

CAPTAIN FRINK: Dale, the committee discussed this at great length. The committee was unanimous in our resolve to find a way of presenting LOFT so that we could overcome the heart of the problem of acceptance of LOFT as pure training. We felt that the instructor's role was exceptionally important in this type of training versus other types of training that we do. He has a great deal of work to do. He has to do realistic communications, he has to monitor everything that goes on, to make sure that his work as conductor of the program is right on target; and to maintain the realism that is required. If you have a three-man crew with problems that are involving the engineer's panel, as well as the panels up front, and the need to monitor the specific actions of each crew member in addition to taking notes--we felt that note-taking was extremely important for the purposes of the debriefing--you have a situation involving a lot of work. After all these points were discussed, the committee recommended--nothing more--that if three people are part of a LOFT program, it would be better handled with two observing rather than one.

CAPTAIN CAVANAGH: I recognize that it is a debatable issue. I submit that we might all look at this in terms of the three versus two-man crew concept.

DR. LAUBER: I think that we will be getting back to this question once again when we get to the fourth working group report, instructor training and qualifications. That was one of the issues we put to them. I might say now that I hope during the course of the deliberations on that question, that the

conditions under which one instructor might be acceptable are discussed.

CAPTAIN FRINK: Our group did consider some other matters. We felt that the terminology questions still poses a problem here. Yesterday, we stated that the acronym LOFT should only be applied to recurrent training. However, as we tried to talk about the line environment in other aspects of training, we found we were always talking about LOFT. No matter how you try to get around it, all types of training that utilize line conditions are referred to as LOFT even though they come nowhere near meeting what we have under 12Ø-35, as capital L-O-F-T. Nevertheless, line-oriented flight training is a very common thing, and it applies to many versions of line-oriented training. We, therefore, felt that we would be better served if we made LOFT an umbrella term, and we are recommending that. Further, we should preface LOFT by the specific use that is being applied-- Recurrent LOFT, Transition LOFT, Upgrade LOFT, Remedial LOFT, etc. LOFT, itself, is in such general use that the term itself cannot be eliminated. It is going to be used in these other ways no matter how much we try to stop it. We cannot stop it by having it apply only to recurrent training.

GROUP 4. INSTRUCTOR TRAINING AND QUALIFICATIONS

Chairman, Captain Ron Sessa

We were charged with generating some guidelines for the training and qualifications of LOFT instructors, but before I get into that I think it would be appropriate to address the matter brought up by Dale Cavanagh. When you talk about the number of instructors, the one thing that we discussed early on in our group was that it largely depends on how you have been doing it in the past and whether you have been successful with one mode of operations; be it one instructor or two. By the same token, for those who have been flying airplanes with two crew members as opposed to three, the necessity to have three may not be as strong for them because their operational procedures and personnel have worked that way for years. Considerations like these should be taken into account, and we have tried to be very careful in writing these guidelines so as not to impose any particular airline's opinion of how training should be accomplished in another organization, which is already doing it differently but quite successfully.

Instructor qualifications- Each professional instructor or check airman used in LOFT training course should complete an FAA approved training course in the appropriate aircraft type. Instructors used in such courses need not be type-rated. If an instructor or check airman who is presently not line-qualified is used as a LOFT instructor, he or she should remain current in line-operational procedures by observing operating procedures from the jump seat on three typical line segments per 90 days on the appropriate aircraft type. For definitional purposes, "line qualification" means completion as a flight crew member of at least three typical line segments per 90 days on the appropriate aircraft type. If there is any confusion, "line-qualified" obviously pertains to check airmen.

An instructor utilized to conduct LOFT training should be given a course of training equivalent to that of a line crewman for that type aircraft, and it should include the requirements of FAA Advisory Circular 121-14C, paragraph 11(f), four hours of LOFT training, in lieu of actual aircraft training or line operating experience.

The working group strongly recommends that where LOFT training involves a three-man crew, the individual airline should have the flexibility of conducting the LOFT training with one instructor or check airman. If one instructor or check airman is utilized, he or she must be appropriately trained for all crew positions.

The role of the instructor in LOFT- There has been so much already said in the other group reports, but we see the role of the instructor confined to the following:

- o Preflight briefing;
- o Accurate conduct of a prescribed scenario in a realistic manner;
- o Monitor, record, and assess crew performance for the debriefing;
- o Perform an objective debriefing, utilizing self-critique to its maximum advantage.

Specialized training for LOFT instructors- Instructors and check airmen selected to conduct LOFT exercises should receive training in the concepts and conduct of LOFT. Such training would include but not be limited to:

- o The conduct of the crew briefing and complete familiarity with all preflight procedures, including flight plans, weather reports, minimum equipment lists, aircraft performance data, aircraft loading procedures, etc.
- o Observation and understanding of resource management, including the crew concept and crew coordination.
- o The pacing and selection of items in the LOFT scenario and the introduction of abnormal and emergency procedures or situations.
- o An in-depth understanding of observational, interpersonal, command and leadership skills.
- o Development of his own skills in interacting appropriately with the flight crew during the briefing, the LOFT exercise, and the debriefing.
- o Training in assessment skills with appropriate guidance in specific areas such as the exercise of command responsibilities, planning, organization, interpersonal communications, problem solving, decisiveness, judgement, knowledge of aircraft systems performance, procedures, knowledge of and compliance with FARs and ATC procedures, sensitivity, leadership, assertiveness, smoothness and flying skill, work standards, and crew coordination.

If we left anything out of the above list, I challenge you to find it.

The working group wishes to stress that the above are important items of consideration, and instructors should be aware of and understand these factors which contribute to overall resource management. It has been said again and again that resource management is so important and will fit into the LOFT concept very well. We generated the categories as a checklist of resource management concerns.

Standardization of LOFT instructors- Standardization of LOFT instructors will be achieved if they are given a complete training program at the outset followed by periodic monitoring by supervisory personnel. Additionally, a feedback and critique program using flight crew members is essential if such a program is to work. Instructor standardization will be equally enhanced if LOFT instructors are urged to cross-monitor other LOFT instructors. Standardization could be more easily achieved if the LOFT instructor group is small and work almost exclusively on the LOFT program if practical. We felt that LOFT should never be conducted by anyone other than a properly qualified LOFT instructor, but that the LOFT instructor could perform other functions within a training department if necessary. Regularly scheduled instructor standardization meetings should be scheduled. During these sessions, LOFT scenarios that are presently being used can be assessed and reevaluated for improvement.

Other uses of full-mission simulation- Following is a list of other uses:

- Transition training, or initial training.
- Developing familiarity with special airports listed in AC 121.445.
- As a format for check flights.
- Remedial training for problem pilots.
- Special training areas, such as command and leadership training.
- Wind shear problems.
- Accident and incident investigations.
- A new-hire's introduction to communications, clearances, checklist duties, and real-time simulated routes.

- To evaluate cockpit controls and flight instruments, and the assessment of human factors in the cockpit.

- First officer training, such as VFR approach and departure techniques, traffic patterns and so on.

- Fuel management and assessment.

- Developing techniques and procedures.

- The development of takeoff and landing skills.

- For accident and incident scenario reviews.

- Engine-out ferry training and qualifications.

- Pre-mission reviews for special operations.

- Special aerodynamic training, high altitude stalls, and other controlled problem training.

Discussion

MR THIELKE: Ron, I have a question with regard to the qualifications of instructors. I really do not believe that you can have an instructor assessing a crew who is not line-qualified and operational in that position. In other words, if you have a pilot check-airman evaluating a captain and first officer, monitoring and assessing their performance, I believe that person has to be line-qualified and fully operational. When I say operational, I mean being able to fly a bid trip.

CAPTAIN SESSA: We had considerable discussion on that point, and I think that you have to go back to what I said initially. Lets take United Air Lines as an example. They are presently conducting training utilizing a method contrary to what you said (utilizing non-line-qualified instructors), and we did not feel that we were in a position to say that that is wrong. That was the consensus of our group. By the same token, if your airline is not doing a certain thing, we would not say you ought to change it because there is a better way. A lot of these issues depend so heavily on how you have done something in the past. Have your pilots accepted the way you have been doing it? What are they used to? What are they comfortable with? And, has your method has been successful? The answers to all of those questions are fairly obvious. They have been succesful in the way they have been conducting training, as have others in the way they have conducted training. I think that that is the most important factor. What have you been doing and have you been successful at it?

MR. THIELKE: I guess my whole point is that we are convened here to talk about LOFT. If we are going to make it realistic line-oriented flight training, I feel that regardless of whether one airline does it one way and another a different way, the instructors should be line-qualified and operational. If you have a three-man crew you should have two instructors. Refer to your own laundry list which you said was all-encompassing. I believe one of your items was "smoothness and flying practice." You can have interpersonal skills, wind shear training, and the whole bit, but if you do not have the flying practice, I believe the evaluator cannot evaluate properly.

CAPTAIN SESSA: Back to your point about line qualifications. Maybe we did not articulate very well what the non-line-qualified instructor must go through to be qualified to give this type of training. In the first place, if you become an instructor, you are either a professional instructor, or you have a medical problem and cannot fly the line. In any event, he has been around a long time and is an experienced instructor and pilot with an appropriate background. We then send him through an entire training program, which is to say right up until the point that he is to get a type-rating for the aircraft. However, in this case, he cannot go to the airplane because he cannot hold a medical certificate. In lieu of that, we run him through four hours of LOFT or whatever it takes. In addition to that, he goes through initial and ground training and flying LOFT trips. You are flying the line trips that you are going to be teaching, but you are flying them in the simulator. We are using LOFT to make a LOFT instructor out of him. The bottom line is that he becomes a LOFT instructor only when a degree of proficiency and expertise has been reached. You must go out on the line. We talked about jumpseat riding on three typical line segments per 90 days. We had a hard time putting an actual amount of time on that, but we felt that that was a good place to start. I don't know if that changes your opinion or not, but I do want you to know that we did try to address that question in a manner that would produce an instructor that was qualified to give a LOFT session.

MR. THIELKE: No that does not change my opinion.

CAPTAIN MICHAELS: Ron, do I understand you to say that your group is recommending that grounded airline pilots be used in the capacity of LOFT instructors?

CAPTAIN SESSA: No we didn't recommend anything. We just said that in cases where they are utilized today, that there is no reason why they could not be utilized if given the proper training and qualifications.

CAPTAIN MICHAELS: I personally would feel more comfortable if this were outlined a little more specifically, and John (Lauber), I am directing this mainly toward you. I am going to make a statement, and then I would like to ask Ron a question.

Without the line background, the airline flying background, I would question the ability of an instructor to distinguish the relative importance of various occurrences in a flight. Things can happen that are relatively unimportant, while at other times they can be extremely important. I would also question the ability of an instructor without a line flying background, to evaluate the needs of a crew. He cannot have the same frame of reference. And, I would also question the credibility of that instructor with crews; credibility is based on line experience, and I think credibility is an important consideration because of the importance of the debriefing. The debriefing is the only thing that ties it all together. I feel that these are very important considerations. If you are going to say that line qualification is not necessarily a requirement, then I certainly think that you should say that line qualification at some time in the past is a very very important qualification. At least, that man will have some frame of reference to rely upon.

Now, the question. Was your group recommendation a consensus opinion? Was it a majority opinion, or was there any dissent among your group when you were considering instructor qualifications?

CAPTAIN SESSA: I'm not going to tell you. (Laughter) I think that your point about former line qualification and the background of the individual is one well taken and one that was addressed. I do not know if I can speak with any degree of expertise on the backgrounds of people who exist in the industry. Our airline has only two such individuals. One is medically retired from our airline, and the other is medically retired from Pan Am. I have no other information about what others do, so it would be hard for me to speak on that.

CAPTAIN CAVANAGH: I recognize that we are the only carrier present using a single professional instructor, and I appreciate the consideration that was given to us in all the discussion that has gone on. If you were not in that posture, I think that we would probably have finished a half a day sooner. I think that is apparent and that we all agree that the qualifications of the instructor are very important. I would also agree that if a man has had experience on your airline as a line pilot, and that he leaves the line tomorrow because he lost his ticket, in that case we have certainly overcome a large measure of qualification training that is otherwise essential. You say line qualification, what is line qualification? Ron cited an example of an instructor who had no line experience on his airline. We have four instructors who came to us 2Ø years ago

from Philippine Airlines. They were Americans who were line captains when the Philippines decided to nationalize their operation and take all foreign nationals out. Is that line qualification? I will not attempt to answer that, and I don't know if anyone else here would want to. Nonetheless, all I'm suggesting is that there are various ways to employ line qualification. I think it is certainly useful, but I do not think that it is essential. Once such people are trained, their thinking does have to be line-oriented. They have to react in a manner which you as a line-pilot accept and respect. We have some in our group who are very well respected, and I'm going to be very candid; we have a couple of others, who because of aging and deterioriation are probably less competent and less respected. However, even with line-qualified pilots, this can occur. I think it is important to say, "What have you done for me today."

CAPTAIN MICHAELS: How do you intend to handle this question, John?

DR. LAUBER: I'm not going to tell you. (Laughter) I am not sure yet Jim. What I am trying to do is sense where there is agreement, and I think there in some sense. I think there is a way to express what Dale is saying and what Ron is saying. For example, I think one area that everyone can agree upon is that if you are using an instructor in a LOFT operation who does not routinely fly the line, then some special training or special effort is required in order to bring that individual up to speed for LOFT operations. I do not think that there is any disagreement about that statement. We are going to look through these reports, take the materials that have been presented, and try to generate an accurate reflection of what the working groups have submitted as their recommendations. In addition to that, the proceedings of our general sessions will accurately reflect the questions and differences of opinion that might exist.

CAPTAIN MICHAELS: John, quite frankly, I am concerned that while all of us here will understand exactly what is being implied, someone taking the report and reading it may not. Without the benefit of these discussions, they may interpret "non-line-qualified" more literally, and that frightens me.

DR. LAUBER: Yes, I share your concern. We will take these working group reports and do a major job of rewriting them. When we send a draft out for review, you are all going to have to take a close look at what we have done with what was submitted in order to make sure that the people who are not in attendance here will get the same sense of what this group felt. It is going to be a challenge to put this material together in that way, but all I can say is that everyone will have an opportunity to review what we have done.

MR. EDMUNDS: In regard to your working group recommendation that individual airlines should have the flexibility to use an instructor or a check-airmen in a LOFT training session, I will agree with that basically. I do think it needs to be qualified somewhat. One of the recommendations that we came up with in our group was that a flight crew should not be exposed to a LOFT scenario that they have previously flown for a second time, and I think that the same thing applies to an instructor. If an instructor is substituting for a crew member, and he has already flown the scenario or even served as the instructor in it, that could influence the training effectiveness of that session.

CAPTAIN SESSA: Yes. We addressed that issue in our discussions about instructors or others occupying seats, but we were not really charged with that in our report so we did not formally make any recommendations about that issue.

CAPTAIN CAVANAGH: Bill, I don't think that there is an easy solution that would be acceptable to everyone, but I recognize the reservations you have expressed. We envisioned a situation where you have scheduled a LOFT with a full line-crew, and when the time comes, one of the crew members is ill. Now you are faced with a situation of cancelling the session or continuing with a fill-in crew member, or I guess you could revert to the standard "batting practice" type of training. I don't think that there is unanimous agreement, but we did develop a consensus within our group when we discussed crew composition. While perhaps not ideal, that was to put a line-qualified crewman in that spot. You cannot remove all of the problems, but if he is, at least, competent to fill that seat, can fill it and does fill it on the line, then it is better than cancelling the session and losing all the other benefits even though these benefits are not as great in a situation where you have to substitute someone else.

CAPTAIN SESSA: I agree with that position, and I feel that airlines should have that flexibility, but I believe it should be watched very carefully. If you get someone who is familiar with that scenario, the training value is diminished. However, if that is your only option, it might be better to substitute such a person.

CAPTAIN NUNN: I would like to comment on the use of non-line-qualified instructors. Dale was very kind to take the burden on his shoulders that United is the only carrier utilizing that method in training. While it is true that they are the only ones here representing that method, I can think of three other carriers that also fit United's profile. NASA has done an excellent job of selecting participants for this workshop and in the composition of the working groups so that all viewpoints could be adequately represented. I believe that the problems of

carriers who are not here are being considered fairly. I think we should all go on record giving NASA and the staff here our vote of gratitude for the very excellent job they have done in structuring this workshop. We have achieved the exchange of views in a very effective way. (Applause from the group)

DR. LAUBER: Thank you, Tom. We have had lots of help and guidance from many of the participants. I hope we have achieved what you have suggested, that is representing not only the views of those who are here, but all the others as well. We have tried to do that.

CAPTAIN BEACH: I would like to say something in support of what Jim Michaels said. Anyone who has been in the instructor business for very long understands the importance of credibility with the trainees to the effectiveness of the training. I would like to offer an opinion that anyone used as an instructor in line-oriented flight training should at least have been line-qualifed at one time. That does not preclude carriers from using medically-retired personnel as LOFT instructors provided that some kind of program keeps them current in line-type problems. I feel it is imperative that when a crew comes in for training, they know that the people from whom they are receiving it know what they are talking about.

DR. LAUBER: We have actually been having a rather general discussion about a number of issues, and I would like to continue in that vein. If there are any issues that people would like to discuss, things raised by the working groups or questions to NASA about how we are to proceed, lets get those out in the open.

CAPTAIN BEACH: Will we get a chance to see a copy of the assembled working group reports before we leave or will we have to wait for your review copy.

DR. LAUBER: We did not anticipate handing those out. I would prefer taking the material that the individual working groups have assembled and go through a round of editing before we send anything out.

CAPTAIN RISCHAR: I would like to address this to Group I, Pete Sherwin. I notice that you gentlemen lock up the time, to quote:

> Legislation and regulations governing the use of LOFT must allow flexibility to permit the fulfillment of these different needs for training. If a minimum number of simulator hours is specified, a carrier must be permitted to partition those hours among LOFT and other skills training. . .

I think that is great, but I am a little concerned with the LOFT programs that were designed under the previous Advisory Circular; the three-hour, twenty minute concept. I am afraid FAA will take that as the time frame since you did not make a recommendation in that regard.

CAPTAIN SHERWIN: That was not our intent. With respect to the partitioning of hours, we had some tough discussions in this area. I feel safe in saying that there was a consensus of opinion even though we had to jump up and down on a couple of guys. We felt that we did not want to specify hours because one particular carrier might wish to use a short LOFT segment and then go on to "batting practice," while another might wish to use the entire period for LOFT. We just did not feel that it was within the province of our committee to tie everyone's hands in that regard. We were trying to develop guidelines for how one is to use LOFT. The question of how much of your training to conduct in a LOFT format should be the individual carriers' preference.

CAPTAIN RISCHAR: Great, I agree with that, and I think that most everyone agrees. I am concerned with the attachment on your report (example LOFT scenario instructor's script) Might that not cause someone to possibly infer a specific recommendation as to format?

CAPTAIN SHERWIN: We really did not intend it that way. We envisioned the possibility that this document will be used by a carrier who had not previously had a LOFT program, and that organization might wonder what the instructor's format might look like. It is just intended as a useful example.

MR. HUETTNER: I would like to respond briefly to that. The FAA's intent is not to make the output of this workshop into regulations. We are simply looking for guidance in reviewing the issues. We are certainly not going to mandate three-hour, twenty minute LOFT sessions because one of the reports contained such a segment. Rest assured that that is not our intent in working in this forum.

CAPTAIN NORMAN: I just want to continue what we have been discussing for a few moments. We were very fortunate to have an ALPA representative in each of the four working groups, and I can say that none of the groups were hung up on specifics and exact ways of doing things. It is strictly a compilation of views which NASA is providing, and FAA is looking at it in that sense. FAA is asking for guidance and that is what we are giving. True, in order to be useful, you have to be concrete, but the legal spelling of it is not so necessary. Let's put to rest the fears that have been prevalent in much of this meeting.

CAPTAIN ATKATZ: We are all here to provide guidelines for a new concept which is to be perceived by flight crews as training. An important part of this concept is how this is to be perceived by flight crew members. Even though we are dealing with new concepts, we ought to look at new terminology because we can get locked into things which mean the same old things to crew members, such as training versus checking. I suggest that applying old terms to new concepts may defeat the entire purpose of what we are trying to accomplish. For instance, a pilot goes into to the simulator and a LOFT scenario unfolds before him. We are not training him, we are providing an experience which in the final analysis will provide him with training. I suggest we look at this and try to define it in ways which are as meaningful as its concepts.

DR. LAUBER: Arnie, you raise a very good point. There are several questions which I have in regard to the best way to resolve these terminology issues. I am not sure that NASA is the appropriate group to do this in. The reason that I say this is because of my impression of what drives our use of

terminology is what eventually appears in the written form of the Federal Aviation Regulations. I would recommend with regard to issues of terminology that we make recommendations through workshops like this, and also through other association committee activities to the FAA regarding appropriate terminology and language so that we can avoid problems like those encountered at this workshop.

One of the driving forces of this workshop was the question of future actions by the FAA in regard to LOFT. Charlie Huettner, would you like to say anything in regard to this exercise?

MR. HUETTNER: I would like to express excitement over what I have seen in the last couple of days. I think this has been a remarkable experience for me and for Dan Beaudette to interact with the very diverse group of people that are assembled here, and to see the openness, constructiveness, and the consensus that has developed here. I think NASA has provided us with an excellent opportunity to develop guidelines and to assist new carriers in developing LOFT training programs. I also think that it has offered us, the FAA, an opportunity to open a dialogue with the industry and to help us achieve our goal of trying to generate a new flight training regulation which I think all recognize that we need. Every person who has talked to us has said, "We have problems with Appendix F." Every person has said, "LOFT is a good thing." Every person has said, "We need some batting practice." Everyone seems to recognize that somewhere along the line pilots need to be evaluated. Our views are consistent with yours. I would like to make all of you part of the FAA team to write a regulation that is going to be positive, and anxiously awaited by you, not one which is feared and fought by you along the way. Let's keep the dialogue open.

For the next few months, we are going to be working on alternative courses of action. We are taking back the ideas we have found here, and we will also be developing some of our own. With this in mind, I would like to provide you with a challenge and an invitation to keep working on these ideas, both in regard to the L LOFT concept and in the whole recurrent training, proficiency checking area so that we can come up with good constructive ideas as to how we, FAA, can fulfill our responsibility to make sure crew members are trained properly so that the public interest is served. However, at the same time, we want to develop a program that has some flexibility so that airlines can, in fact, get to the business of fine tuning and making the program work for them. The invitation is to submit your ideas in the next couple of months so that we can consider them in the development of alternatives. As we get closer to the time to take action--at this time I cannot give you any

specific dates--we will be seeking out the major industry groups for face-to-face discussions of the ideas that we have developed, and so that they can present their views. In this way, I hope we can work together toward a new regulation. Please send any comments you have to Dan Beaudette.

I would like to thank Al Chambers, John Lauber, and all of the people from NASA who have put together this remarkable workshop. I really think that it has succeeded in meeting its objectives and far exceeded them in many areas. Thank you again--it was nice meeting you all.

DR. LAUBER: Thank you Charlie, I don't really have anything else to say. I too want to thank everyone for their participation. We have sponsored several of these workshops now, and I always get excited about them. It takes a lot of work to put one of these things together, drawing a diverse group with diverse views and seeing them work constructively toward a practical and useful product. It is a very rewarding experience for all of us at NASA who have been involved with it. Thank you all very much and we will see you at the next workshop.

APPENDIX A

NASA/INDUSTRY WORKSHOP ON LINE-ORIENTED FLIGHT TRAINING

January 13, 14, and 15, 1981

Ames Research Center
Moffett Field, California

Day 1

0830	Welcome and Overview
0845	FAA and Industry Comments
0900	Full-Mission Simulation and its Application to LOFT
0945	Coffeebreak
1000	Industry Presentations on LOFT (NW, FL, and UA)
1215	Lunch
1300	Industry Presentations on LOFT, continued (EA, TI)
1430	Coffeebreak
1445	Industry Presentations on LOFT, continued (DL, AA)
1615	Industry Comments and Discussion
1715	Working-Group Instructions
1730	Adjourn

Day 2

All Day: Working Group Meetings

Working Group I: Guidelines for LOFT Scenario Development
Working Group II: Guidelines for Conducting LOFT Scenarios
Working Group III: Guidelines for Performance Assessment and Debriefing
Working Group IV: Instructor Training and Qualification

Day 3

0830	Working-Group Meetings
1000	Plenary Session: Working Group Reports
1200	Adjourn

APPENDIX B

LOFT WORKSHOP: WORKING-GROUP ASSIGNMENTS

WORKING GROUP #1

TOPIC: LOFT SCENARIO DEVELOPMENT

CHAIRMAN: Peter Sherwin OZ
VICE CHAIRMAN: Charlie Billings NASA

MEMBERS:

Bill Edmunds ALPA
Wally Erickson TW
Charles Hunt FEIA/AA
Neil Johnson UA
Ed Karabella, Jr. FM
Tom Nunn NW
Bill Reichert PA
R.N. Smith APA

WORKING GROUP #2

TOPIC: LOFT REAL-TIME OPERATIONS

CHAIRMAN: Dale Cavanagh UA
VICE CHAIRMAN: Bob Randle NASA

MEMBERS:

Bert Beach EA
Wayne Disch TW
Kevin Gallagher FM
Jim Michaels APA
Ernie Rischar CO
Dick Norman ALPA/PA
Gerry Norton WC
Don Thielke FEIA/AA

WORKING GROUP #3

TOPIC: PERFORMANCE ASSESSMENT AND FEEDBACK

CHAIRMAN: Al Frink PA
VICE CHAIRMAN: Clay Foushee NASA

MEMBERS:

Arnold Atkatz AL
Dave Devine TI
Charles King FEIA/AA
Don Jensen AA
Ken Warras ALPA/NW
Jay Whitehead DL
Roy Williams FL
Kip Wintenburg CO

WORKING GROUP #4

TOPIC: INSTRUCTOR QUALIFICATIONS AND TRAINING

CHAIRMAN: Ron Sessa AL
VICE CHAIRMAN: Ren Curry NASA

MEMBERS:

Walt Estridge AA
Roger Fleming ATA
Jim Hardy EA
Roland Liddell ALPA/TW
Jim Sifford PI
Jack Somerville TI
Ed Steger WC
Bill Traub UA

APPENDIX C

INSTRUCTIONS FOR WORKING GROUPS

It is our intent to publish the proceedings of this workshop in the form of a handbook of guidelines for the conduct of LOFT. A proposed outline is attached. To be useful, this document must contain sufficient information to allow any company involved in pilot training to design, develop, and conduct LOFT programs that will meet the specific and unique requirements of that company. To accomplish this, the report must be written at a level of detail that will provide useful guidance and yet not preclude sufficient flexibility to allow a user to tailor a LOFT program to meet the unique requirements of his operation, equipment, routes, crews, instructional staff, simulation facilities, and other factors. Keep in mind that you and your colleagues at other carriers will be the ultimate consumers of this report.

Each working group has been assigned a specific topic area for discussion. Please focus your deliberations on the assigned area. However, we do not mean to preclude consideration or discussion of the other areas. It is expected that each group will reach some conclusions about each topic area, and we encourage you to include these in your reports. NASA will assume the responsibility for editing and integrating the final report, so don't worry about overlap or duplication.

In addition to the four major topics assigned to individual working groups, there are three chapters for which no specific responsibility has been assigned. Because these chapters, particularly Chapter II: Definition of the LOFT Concept and Chapter VII: Other Uses of LOFT, are more general than the others, we are asking all working groups to include, whenever possible, these areas in their deliberations.

We have allowed a full 1-1/2 days for individual working group meetings. We have also made typing services available. Both were done in the interest of promoting reasonably extensive, detailed working group reports. Obviously, it is not possible to write a complete draft report by committee in a day and a half. However, to ensure accurate reflection of the discussion and conclusions reached by each group, you are strongly encouraged to generate sufficient written detail so that we can generate a first draft of your chapter after the workshop. For example, it would be most helpful if your working group report could contain a complete outline of your chapter and a short paragraph for each chapter subheading.

Each working group will be given an opportunity to summarize their deliberations and conclusions on Thursday afternoon, followed by a general discussion.

After the workshop, NASA will prepare a draft report, which will then be distributed for review and comment prior to publication. We are committed to producing preliminary copies of this report for distribution to each of the participants within 1Ø weeks of the workshop. To achieve this, your cooperation in generating as much written detail as possible during the workshop is vital.

LOFT Workshop Participants

NAME	TITLE	CARRIER/ORG.
Capt A. Atkatz	Check Pilot	USAir
Capt B.E. Beach	Manager-Intermediate Jet Training	Eastern Air Lines
Mr. D. Beaudette	Chief, Training & Technical Stand. Br	Federal Aviation Administration
Capt D. Cavanagh	Director-Flight Standards & Procedures	United Air Lines
Capt D. Devine	Check Pilot	Texas International Air Lines
Capt W. Disch	Manager-Flight Instruction Standards	Trans-World Air Lines
Mr. W. Edmunds, Jr.	Human Performance Specialist	Air Line Pilots Association
Capt W. Erickson	Manager-Flight Training 707/727	Trans-World Air Lines
Capt W.W. Estridge	Director-Flight Training	American Air Lines
Mr. J.R. Fleming	Assistant V.P.-Operations	Air Transport Association
Capt A.A. Frink	Vice President-Flight Training	Pan-American World Airways
Capt K. Gallagher	B-727 Flight Instructor	Federal Express
Capt J.D. Hardy	Manager-B-727 Flight Training	Eastern Air Lines
Mr. C. Huettner	Ass't Chief, Air Transport Div.	Federal Aviation Administration
Mr. C. Hunt	Member, FEIA Training Committee	Flight Engineers Int'l. Assn.
Capt D. Jensen	Check Airman-B727	American Air Lines
Dr. N. Johnson	Flight Training Development Specialist	United Air Lines
Capt E. Karabella, Jr.	Manager-DC-10/B-727 Flight Training	Federal Express
Mr. J. Lewis	Member, FEIA Training Committee	Flight Engineers Int'l. Assn.
Capt R. Liddell	Pilot Training Committee	Air Line Pilots Association
Capt J. Michaels	Chairman, Training Committee	Allied Pilots Association
Capt R. Norman, Jr.	Chairman, Pilot Training Committee	Air Line Pilots Association
Capt G. Norton	Chief Pilot	Wien Air
Capt H.T. Nunn	Director-Flight Training	NorthWest Orient
Capt W. Reichert	Director-Flight Standards & Training	Pan-American World Airways
Capt E. Rischar	Instructor-Flight Standards & Training	Continental Air Lines
Capt R.M. Sessa	Vice President-Flying	USAir
Capt P. Sherwin	Director-Flight Standards & Training	Ozark Air Lines
Capt J. Sifford	Director-Flight Standards	Piedmont Air Lines
Capt R. Smith	APA Training Committee	Allied Pilots Association
Capt J. Somerville	Standardization Check Pilot	Texas International Air Lines
Capt E. Steger	Check Pilot	Wien Air
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Capt K. Wintenburg	Flight Instructor	Continental Air Lines

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16. Abstract

Line-Oriented Flight Training (LOFT) is a developing training technology which synthesizes high-fidelity aircraft simulation and high-fidelity line-operations simulation to provide realistic, dynamic pilot training in a simulated line environment. LOFT is an augmentation of existing pilot training which concentrates upon command, leadership, and resource management skills.

This volume (Volume II) is intended to serve as a companion to Volume I. Included here are papers by NASA and industry representatives describing the development of LOFT and the various approaches taken to it. Also included are selected segments of the discussion transcripts, and questions and answers from the January workshop.

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