

## LINE-ORIENTED FLIGHT TRAINING

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I'd like to talk about some ideas on Line-Oriented Flight Training (LOFT):

- Why we at Eastern chose that program as a training tool;
- How we've developed our program;
- What it has done for us so far at Eastern Air Lines, and;
- What uses we plan for it in the future.

The environment in which we operate continues to become more demanding of management skills on the part of the pilot conducting the flight. This is directly related to the complexity of an operation intended to attain absolute safety while conducting all weather flight. We recognize the need to shift from training in manipulative skills to something closer to management skills.

Line-Oriented Flight Training (LOFT) is not a new idea. We used a similar format at Eastern in the late 1950's on our DC-8 and Boeing 720 series aircraft. At that time, the simulators available had no motion, nor visual capabilities. As a result, we were unable, until recently, to develop a training environment that would simulate the real world with acceptable fidelity. We needed to illustrate the value of standard operating procedures as they affect the line pilot in everyday operation. The advent of simulators with motion, plus the visual system ability to reproduce a realistic airport scene, provided us with the tools we needed to construct a worthwhile line-oriented flight training program.

Our first effort to implement LOFT was a scenario we developed in 1975, wherein the crew took a three-leg, four-hour flight that satisfied all requirements of Appendix F, except for steep turns and approaches to stall. By the end of the four-hour period, the crew had seen a major fault in every system on the aircraft. They conducted at least two ILS approaches and two non-precision instrument approaches per pilot. Most, if not all, of the emergency procedures had been reviewed.

To accommodate all this activity, the legs between the city pairs used in the scenario were shortened electronically. Shortly after this time, Eastern applied for, but was not granted, permission to operate under an exemption from Appendix F. Appendix F lists the requirements for the demonstration of competency as outlined by the Federal Aviation Administrator. In fairness to the Administrator, I must point out that this regulation is intended to accommodate all operators under Part 121, including those carriers who may not have the most modern training devices.

Since ours was a special case, we felt that strict compliance with the regulation would not provide the flexibility needed to shift emphasis from training in "manipulative skills" to training in management skills. We were unable to obtain the exemption and LOFT was put aside for a time.

Our current format was developed after guidelines for exemption were published, and we found that we were not required to conform to Appendix F at all - except that we must maintain our landing certification to Category II or Category IIIa minimums. This was no real deterrent since our visual systems are capable of visibility reductions, to whatever degree is required. If individual performance indicated a need for remedial training in normal VFR approach and landings, this could be completed as an add-on to the LOFT session. Right now we have two programs in operation, both approved by the Federal Aviation Agency (FAA). One is for the Boeing 727 aircraft, the other for the Douglas DC-9. LOFT programs for the Lockheed L-1011 and the A300 are being developed now. We expect to have these programs approved by the end of 1979.

Our present program consists of six scenarios per aircraft type. Each scenario contains three legs. The scenarios are designed to fit within the four-hour time frame ordinarily used for a training period.

When we develop our programs, we emphasize strict realism. All the legs are flown in real time. The problems presented for the crews to solve are those which can, and in some cases, have happened in real aircraft. The visual systems can construct the airport environment with considerable fidelity. The picture the pilot sees on approach to a runway in our simulator is amazingly close to what he would see in the real world. These visual breakthroughs add immeasurably to the flight crew's acceptance of LOFT, and therefore, enhance our program's value materially.

When we began to create scenarios, we needed to consider some key items:

1. What route segments and airports should we use which would give the best indication of the Captain's management skill? The approach briefing, individual task assignments, crew coordination and the command presence were some of the items we considered. For example, Pittsburgh, Pennsylvania, gives us a chance to work on Category II. It also affords us the opportunity to use an inner marker for decision height rather than a radio altimeter.

The VOR approach to Runways 5 or 36 in Charlotte, North Carolina, compels the flight crew to make an approach to what is commonly known as a "black hole" type airport - which is to say, there are no perimeter lights to rely on for attitude judgment. The only things you see when you break out are the runway lights and those lights adjacent to the terminal. So, we chose Charlotte to illustrate that particular problem at night.

Operations in and out of Atlanta, Georgia, gave us a chance to operate in a complex air traffic control environment, and another try at Category II approaches as well.

We chose Miami, Florida, because of the variety of approaches available in generally VFR weather. Previous experience in upgrade training from Second Officer (Flight Engineer) to First Officer (Co-Pilot) has indicated a need for training in approach and landing based on visual perception rather than electronic guidance.

2. What aircraft systems and procedures should we examine and where should we put them in the scenario to ensure the highest degree of realism? For instance, current emphasis is being placed on the use of maximum braking in the event of a rejected takeoff. This is the result of industry experience which indicates that:
  - A. The rejected takeoff is more likely to be the result of some malfunction, such as a blown tire, or a fire warning indication, rather than a failure of the most critical power plant; and,
  - B. Admonitions to the flight crews to go "easy on the brakes" - "consider costs" - "don't try to make that first turn-off," have resulted in the use of less-than-maximum braking when needed.

In the scenario, we can consider including the rejected take off, to physically demonstrate maximum brake pedal deflection, and the effectiveness of ground spoilers and reverse thrust in reducing roll-out distance, and by using an airport layout in the visual scene, such as Washington National, the results of non-standard operating procedures on a rejected takeoff can be dramatically displayed.

3. Finally, how should we tailor these scenarios to fit the four-hour time frame?

First, we decided what approaches we would "shoot" into what airports. Then we took city pairs and linked them together to form the legs of the scenarios. We decided, on each leg of each "flight," what problems we would present for the crews to solve and also, how many problems, and where they should occur. After we roughed out our plans, we went to our dispatch department, and drew from the computer actual flight plans that are stored there, selecting those city pairs we had chosen. Once we had those plans in hand, we began to fit the segments together to form the four-hour training period needed to satisfy our requirements.

As soon as all six scenarios were composed and all of the legs were laid out, we test-flew them in the simulator to be certain that they fit within the four-hour time frame. We allowed adequate time between legs for short breaks for the crew. When all of the scenarios were put together, we invited three different groups to fly the scenarios, and we solicited comments from each group.

First, our simulator flight instructors were scheduled to fly the scenarios. In each case, they were asked to consider:

- Whether the flight plan was realistic and could be related to a typical EAL flight segment.

- Was the routine excessively demanding? and,
- Could the expected response by the crew be indicative of a lack of management skills?

Next, the Training Committee from ALPA reviewed the scenarios and flew one. Since all members of the committee are regular line pilots, we felt that their input as potential users would be significant.

We then invited a group of Air Carrier Inspectors from the FAA to try a scenario or two and give their opinions. We felt that FAA participation at the early stage of program development was important. Since they would be the approving authority, we could use their input to help identify any possible problems which might delay program approval. Once we had collected all of the ideas, comments, and suggestions, we put a final polish on the total package and passed it to the FAA for its official approval.

The training period begins with the full crew attending for the examination of the flight departure papers. At Eastern Air Lines, all of those flight departure papers are stored; that is, dispatch releases, flight plans, fuel requirements, weather sequences, and forecasts are all in the computer and are recalled as each crew requires them prior to departure. Since we strive for considerable realism in the LOFT program, we also have the flight departure papers for the program stored in the computer, accessible to us in training. They are recalled by the instructor prior to briefing his crew, before the training sequence.

As in normal operations, the crew examines the papers for minimum equipment items, fuel requirements, notices to airmen, and so forth. They also check the appropriate weather sequences and forecasts, determine fuel requirements, and perform any other preparations that a Captain may require.

When the Captain decides that sufficient time has been spent on briefing, the crew proceeds to the simulator. While in the simulator, the Instructor/Check Airman links normal communications among start crew, ground control, tower, departure control, and so forth. He does not, under any circumstance, interfere with normal operation or functioning of the crew.

Once under way, the crew must solve all problems according to their own best judgment. We took great care to avoid overloading the scenario. Had we cluttered it with unrealistic situations, we might have induced mismanagement. But, any of the crew's mistakes or errors in judgment, or ignorance of procedures, will remain until corrected, or until the "aircraft" is on the ground. The training requirement is for four hours, and all the legs need not be completed.

A word about scripting is appropriate at this time. All sequences are tightly scripted, and deviations and additions are not permitted, except that items may be deleted if there is not enough time in the four-hour period left to perform them. As a timing aid to the instructor who is conducting the scenario, we designed the last leg with an adjustable time frame. The script is so written that the instructor has the option of selecting that point at which the problem will be presented which best utilizes the training time remaining.

When the simulator period ends, the Instructor/Check Airman leads the crew's debriefing session.

In the year and a half since Eastern Air Lines began the LOFT program, we have come to see it as the training vehicle of the future. We believe that LOFT can provide more realistic initial training because, from the first day of training, we can emphasize the kinds of skills needed to operate a particular aircraft in today's complex environment. We believe that LOFT develops considerable judgment skills and provides excellent experience in structuring priorities. It also illustrates the consequences of poor resource management, ignorance of proper procedures, and lack of command presence.

Training conducted in simulation, very closely matching the environment in which the crew normally operates, gives a crew the best opportunity to see normal and abnormal situations and their solutions. For example: in the simulator, a Category II approach to a runway closely approximates what the pilot will see in the real world. But in a trainer aircraft, as soon as you "pop the hood," the pilot finds himself in an entirely visual environment. For this reason, we feel that LOFT provides considerably more realism.

In addition to its value as a training vehicle, a line oriented training program is an excellent evaluation exercise. The simulator's ability to accurately reproduce the line pilot's normal working environment, plus the instructor's briefing prior to the start of the period, emphasizes to the crew that they are expected to perform in the simulator exactly as they would perform in the real world. This permits us to see a more accurate picture of how the crew functions in such areas as decision-making, cockpit discipline, the Captain's command presence, crew coordination, and other resource management skills. The crew is also briefed that the LOFT program is not constructed as a pass or fail check ride; it is, rather, an evaluation of their skills to uncover in what areas, if any, they may need additional training. We feel that it is important to remove any threat of embarrassment or punitive action. By so doing, we diminish the tendency of the crew to respond in the way that they think that the instructor wishes them to respond, and apply instead their own best solution. We believe that this environment produces a very clear picture of the capabilities of the crew being evaluated.

We have found LOFT to be excellent for remedial training. We have taken crews off the line who have had a problem of one kind or another, put them in a LOFT training format to duplicate the problem or circumstances they experienced, and let them pinpoint the moment when things go wrong. We can show them what they did, find out why they did it, and demonstrate the better way to do it next time.

As a result of our success with this approach in remedial training, we are now experimenting with the construction of modules to be stored in the computer. Each one will be fabricated to illustrate a particular problem or abnormality that, if mishandled, could have serious consequences.

When we get a crew requiring remedial work, for whatever reason, we hope to retrieve these modules from the computer, examine them, and extract those which, when linked, will result in a LOFT scenario for that particular crew to exercise in. Eventually, we hope to have enough modules to cover the majority of difficulties we see on the line. In this fashion, we will tailor a training program, almost exactly, to fit the kind of training required.

We also intend to use LOFT to evaluate our current operational procedures for both normal and abnormal situations, and to help us determine needs for, and the effectiveness of, new procedures. For instance, at Eastern Air Lines, we have no written procedure to cover crew incapacitation, both subtle and dramatic. By observing the crews as they handle these situations, we will decide whether or not we should have in writing some procedures for crew incapacitation, and if so, what they should be.

We intend to further use LOFT to spot any trends indicating weak spots in our training program.

When all of our simulators are approved for the landing maneuver, LOFT will make it possible to complete all phases of training in the simulator. We want training programs that will assure competency in the area of manipulative and management skills prior to assignment to scheduled operations. The line operating experience will serve to validate the effectiveness of the training program.

To sum up: Line-Oriented Flight Training, as it has been developed at Eastern Air Lines, represents the best training vehicle we have seen thus far. We believe it matches all our training needs more than anything yet devised.

We shall, of course, use LOFT programs in training, and for the annual and semi-annual proficiency checks. Soon we will build it into initial training. We see it as a marvelous device for remedial training as well, and for reviewing the effectiveness of operational procedures. As a tool for developing new procedures, we have found it to be unequalled. We are confident that LOFT will lead us to zero aircraft time.

## DISCUSSION

MR. RANDALL, NASA: I agree with you, the CGI systems are really classy, but I've never seen a generation of terminal weather with those things. Is it done electronically or optically?

CAPT. BEACH: No, it's electronic.

MR. RANDALL: Could you describe how it looks?

CAPT. BEACH: The best description I can give you as to how it looks is — I'll go back to the example I used to begin with. In Category II, for instance, the only thing that you do not see in the visual system, if you're looking at fog at the airport, is the halo around the lights — we have done everything but that. The discrimination of the runway texture, the numbers, the slight blurring of the centerline, all of that, touchdown zone lights, their intensity. If you're not careful you think you're in a real airplane, that's how good it is. The only thing we don't have in the visual system now is the occulting of buildings. As you taxi up to the terminal, for instance, at Washington National Airport in Washington, D.C., you can see through the buildings. It is only a slight infidelity, but it is not too dandy and we're working on it.

MR. RANDALL: Do you have the phenomenon of broken clouds — now you see it, now you don't?

CAPT. BEACH: Yes, that mode is called scud. I'm not sure what the random occulting is, but there is a random, patchy fog that we can use. As a matter of fact, we use it for a missed-approach maneuver, now you see it, now you don't, you've got to go.

UNIDENTIFIED: How do you handle an unsatisfactory or less-than-capable crewmember?

CAPT. BEACH: What is done depends entirely on what the check captain feels is required. Since there is no pass or fail, we take the instructor's recommendation as to what kind of training is required to bring the man up to our standards, how much and in what direction. We rely completely upon the instructor to give us that input. If Capt. Jones needs a 4-hour training period with emphasis on nonprecision approaches, that's what he gets. Then another evaluation.

MR. MANSFIELD, American Airlines: I understand what you're going to do in the next step, but up to this point in time do you use LOFT at all in the standard transition program, and if so, how?

CAPT. BEACH: On July 1 we are beginning to use LOFT concepts to reduce aircraft time. We're doing what really amounts to a dress rehearsal for the type rating ride. It will be done in our AST simulator, and I have

constructed a small mini-scenario to be used by the training captain as a dress rehearsal. That's the beginning. Ideally what I want to do, and I think we will when we have the development-type simulator, is use line-oriented flight training in initial training. The first simulator period or two will be devoted to systems and procedures, after which it begins to be a line trip. That's next.

CAPT. SESSA, Allegheny Airlines: After, say, a pilot receives 4 hours of emphasis on nonprecision approaches, how is the reevaluation conducted? Is it under a LOFT basis, or on a normal proficiency check?

CAPT. BEACH: On the normal proficiency check, because we require for a LOFT program a line crew. Which is to say, if the line crew is not present, we can't do LOFT. For one thing, the exemption, I think, prohibits us from putting check people in to be used as additional crew members. So because the crew he went through the LOFT program with is gone, plus the fact that we want to focus on his individual problem, we take him aside and plug him into the ordinary program.

MR. COEN, FAA: Lest we scare some of these other people off, the rule was changed about 9 months ago to allow for LOFT training, under Subpart N and 121. So now you have the three options of 409 training, Appendix E and other proficiency checks for the LOFT training, and it spells out the regulations.

CAPT. BEACH: I'm not entirely sure that I have seen that particular modification across my desk, but I'm glad to hear it.

MR. COEN: Anybody who wants to can go into LOFT; we don't want to scare you off.

CAPT. HOLDSTOCK, British Airways: We have gone down this road, and, like you, I do appreciate the value. However, for the period the flight is actually going on there is no training. We call it training, but we're not, we're checking, we're evaluating. The training comes at the end with the debriefing. However, there are times when a mistake has taken place during the flight, and the one thing you need to do for the individual is to right it, then and there. You don't want to send him home with the thought that he did something stupid or was incapable of flying the procedure — you want to put it right. Do you have any facility in this training?

CAPT. BEACH: We have done perhaps the other side of the same coin you're talking about. We specifically do not interrupt the flow of the flight as it proceeds. For example, the DC-9 aircraft electrical fire and smoke is one of the more frightening things about that airplane. If you find a crew that simply cannot handle it, we sit back and let the thing crash. The idea being we want the man to dig as deep a hole as he can dig. But once he has crashed, if that's what turns out to be the case, once the aircraft is back on the ground again, then by debriefing immediately thereafter we can begin to show him what he did wrong. But we don't



interfere with things as they are happening. We used to do that on what we called the 4-hour training period in lieu of a proficiency check. Launch the aircraft, present a problem, put the simulation on freeze, and let's talk about what you've seen — why did this happen or why did that happen. We crammed a wealth of information into that 4-hour training period, and you could see it leak out of the man as he walked away from the simulator.

We felt that you never learn better than when you embarrass yourself, if it comes to that. Those kinds of things that make a dramatic impression on you or those kinds of events where you could have killed yourself. So we felt rather than, and we specifically talked about that subject, rather than put it right at that time, we'll use the debriefing for that. If we feel that we have made the man overly humble, then we'll put him back in the machine again, and let him do it right, just to prove to himself that he can.

CAPT. FRINK, Pan Am: Can you tell me to what extent you are required to do additional specific remedial or brush-up-type training following the LOFT exercise? Also, how do you face the fact that in the normal course of a man's line flying, he does not come upon an engine cut on takeoff, he does not come upon a two-engine approach or three-engine missed approach. Yet throughout the years we have been using our periodic checks and our training in lieu of checks to give him practice in maneuvers that we feel they need. To give him a smattering of these, but not all of them, in a LOFT program has caused us to look very, very carefully at the concept of the LOFT because of the economic effect it would have. On the one hand, it would force us to double our training in order to accomplish the practice piece of this thing, yet on the other hand it would obviously take advantage of the crew concept aspect and the management aspect of LOFT itself. It would be very helpful to us if you could tell us exactly how much additional training it will require if we were to go to the LOFT concept for our training in lieu of check.

CAPT. BEACH: We haven't found a specific amount of time required. Maybe I can address your question by answering the last half of it first. Part of what you're talking about is those kinds of things, as I mentioned earlier, when we had the 4-hour training period, where he saw one each of everything that could possibly go wrong. Engine failure at V-1 in the case of the 727, an engine-failed approach, an engine-failed missed approach, double-engine failure, single-engine landings, electrical fire and smoke, abnormalities — all of that in 4 hours. As you just said, it doesn't happen all the time. But maybe he ought to see it once a year, at least, to refresh his memory on why things happen like that. That's what we used to do. But we felt, all of us who talked about it in concert, that that kind of thing lasts just about the length of time it takes him to walk out the door if you put that much into a program. We felt that we were teaching better management of the flight by selecting those kinds of things which, if improperly managed, could be catastrophic. For instance, one of the scenarios is an engine explosion that throws pieces through the center engine; as a result, you are on one engine about a 100 miles from Pittsburgh.

There it is, 100 miles away, you can see it, what do you do? Or you're looking at single engine drift down. We felt that the length of time that we exposed the people to that problem was far more beneficial than running them through three anti-icing exercises perhaps. But that anti-icing exercise is part of the scenario. So we covered the kinds of things that could get you in the deepest trouble, engine failure at VR, that kind of thing. We felt that we should cover really those things that would be beneficial to the crew rather than gyro failure or compass failure, which don't really provide a great base to build a training problem on. With our approach, although there's no pass or fail, we have had to take some people out of the program and retrain them or upgrade their training. There has been no specific amount of retraining that we have had to do — it depends on the individual. We have had people come through who can almost walk on water, and we have some who don't wash. Between those two is the ordinary pick and shovel aviator like myself who manages to stumble through it every time. So we felt that the program really hadn't caused us any extra training at all except for those few who really need it, and they would be the ones who would probably fail the PIC check or the semiannual check anyway. So there has been no training generated in excess of what we ordinarily do. I hope that answers your question.

MR. SMITH, ALPA: Has this had any effect on your instructors in terms of what they're required to know and to be able to transmit in terms of information? How do you feel this has affected standardization of procedures under emergency situations?

CAPT. BEACH: The effect on instructors has been considerable because when we first put the program together, it was incumbent upon us to be sure that the instructor conducting the program, which is really an evaluation, knows what he's doing.

It is, as probably you have gathered, quite subjective in scope. Whether the man is good, bad, or indifferent depends entirely on how the instructor feels. So we have, I won't say rigid, but rather comprehensive briefings among the instructors who are LOFT qualified and myself, about what the program is about. In our handout, the script we give to the instructors to use is a foreword that gives my ideas of what line-oriented flight training is and what the instructor's responsibilities are, and we discuss those when he comes in to talk to me before he's LOFT-qualified. It hinges very much on the instructor, and he's very much aware of the fact that that's his position, and we train him for that.

MR. SMITH: But in the standardization of the emergency procedures, has there been any problem in terms of the instructors' techniques to solve a problem?

CAPT. BEACH: No, there is no individual opinion in the line-oriented flight training as we constructed it. The emergencies are handled according to the standard procedures as spelled out in the airplane flight manual. That doesn't mean to say the captain can't use whatever solution

he feels best, but in debriefing he should be prepared to defend it. If you deviate from standard procedure, we expect you to say why. One benefit of the LOFT program we feel may be that if we find your procedure is better than the one we have written, we may change the one we have written. We haven't yet, though.

CAPT. FRINK: The training committee requested of the FAA, when they were considering this regulatory change, that they change the time distribution for LOFT to 3 hours for the scenarios and allow us 1 hour remaining to do specific maneuver practice that may be a seasonal thing. We might want wet runways, icy runways, we might want crosswinds, we might not want wind shear, something of this nature. But we felt a very great need to be able to have some time to concentrate once a year on specific needs that the operations has indicated are there. In your opinion, having used the LOFT to the extent that you have, would a 3-hour period be adequate to do the job that you're trying to do?

CAPT. BEACH: A 3-hour period again would depend on what kinds of things you want to see. Our operational requirements, and particularly the airplanes I'm involved with, are unlike yours. The situation that you are probably looking at, where maybe you get one landing a day, doesn't apply to us. So you would perhaps need that extra period to focus on the kinds of things you feel the crew may not ordinarily get to see. Because of the way we're operating and the kinds of airplanes and route structure we have, we elected to go the full 4 hours for line-oriented flight training and have three legs to develop the kinds of things we wanted to see. Can you do it in two? Yes, I think you can. You would have to sit down with the people who are going to construct the program and decide your priorities and then construct 3 hours based on what you feel is really important, which is what we really did for 4 hours.

MR. COEN: I would like to suggest that maybe we ought to have a training committee meeting. The 409 training presently in the book that a lot of the carriers have is nothing but a race through all of the maneuvers of Appendix E. Now, when you get into LOFT, it's Appendix E training in a logical sequence, in a realistic sense. And the grading or the pass-fail situation is no different for LOFT training than it is for 409 training, using all of Appendix E instead of line check. So there is really no great change in the additional training that would be required to bring a man up to a standard if he in fact was not. I don't know how many carriers are using it, but there are many. So there is no real great change here.

The other thing is that the LOFT training program, at the recommendation of the training committee, requires a minimum of 3 hours and 20 minutes and the other 40 minutes are there for such things as wind shear and what have you.

CAPT. BEACH: Every airline has its own flavor, I believe, based on the kinds of things that you feel you need for operational requirements. Ours may taste differently from yours. But I think if you adopt a

line-oriented flight training program that suits your needs it probably won't be different completely from my own, but will be every bit as good for the kind of training you need to do from your particular point of view.

DR. LAUBER: Thank you, Bert. I'd like to underscore a couple of things that Bert brought out and Capt. Holdstock brought up. One of the things that Tom Nunn did up at Northwest was to administer a questionnaire to people who had gone through his program to get some idea of what their ideas and impressions were about the program. Tom provided those data to us, and we analyzed them in an attempt to find out what people who had been through the program thought they learned about it. There are a couple of selected comments that we got back that I think really speak for themselves. These are direct quotations.

"Judgment in flying can be described as the ability to place relative importance on many variables while in different situations. LOFT allows the individual to exercise this judgment."

Another comment, "LOFT offers the chance to take a situation to its conclusion regardless of whether the procedure selected was good or bad. It forces them to carry through with a series of actions and forces them to think about it."

Another one, "It was a real eye-opener to see a crew lose its coordination. It brought out two things to me. One, there's a heavy load on the second officer during emergencies and two, the necessity for deliberation before taking action. You must think about the consequences of every action."

I think these are some indication of the insight that people get into their own behavior when they go through this. Two final ones.

One, "This program should make a few maverick loners realize how much we need coordination within the cockpit."

And the final one: this individual learned "How easy it was to compound ignorance with damned foolishness."