1) information
2) questioning
3) listening
4) feedback

j) Pilot judgement/decision making

1) demonstrate how judgement leads to decisions
2) blockages to effective decisions
3) introduce a model for effective decision making

k) Summary experience (role playing)

Uses actual air carrier accidents and incidents to create problem-solving dilemmas that participants must act out and critique through the use of videotape playback

All of the topic areas are taught using an experiential training method that requires each crew member to actively participate in each phase of the training

Part two Practice and feedback

The second part of ICE training is conducted as line-oriented flight training In this phase each crew member flies a one and a half hour, real time, full mission simulator session that is designed to introduce a human factors problem that the crew will have to cope with, just as they would on a typical line trip The LOFT is videotaped and used to provide feedback to the crew members during the debriefing

Videotape feedback is particularly effective because the experience of viewing oneself from a third-person perspective creates a level of awareness not possible with other techniques This perspective appears to be a strong motivator for attitude and behaviour change It is virtually impossible to deny the presence of an ineffective managerial or interpersonal style if you see it for yourself

Part three Reinforcement

Each calendar year, Alaska Airlines will develop a three-hour block of classroom training that will reinforce one or more of the ICE concepts In addition, each calendar year we will develop new LOFT scenarios that will further develop the crew members ICE skills

Each part of the ICE programme will be evaluated by Dr Helmreich using proven measurement instruments that he has developed while conducting the NASA CRM evaluation study The results of this study will be used to continually upgrade and improve ICE training This method of evaluation will also indicate ICE training ensure that information transfer has occurred and measure any change in crew member attitude and behaviour

Alaska Airlines believes that ICE training will result in a significantly safer flight operation cause crews to operate with an even higher standard of excellence and reduce operating costs through greater standardization and improved performance

American Airlines

2.3.3 The following briefly presents an evaluation undertaken by American Airlines of its CRM programmes and the reasons for the evaluation

For almost a year the American Airlines Flight Academy has been actively evaluating and improving its Cockpit Resource Management programmes First I will mention something about the history of this effort, then something about the progress we are making in the development of a new, career-long CRM training system

There were four distinct reasons for turning our attention towards upgrading our CRM training First our own analysis of recent industry accidents and incidents convinced us that we could ensure safer flights by training crew members to make better use of all their potential resources This includes the use of the pilot himself as a resource, the use of his fellow crew members, and finally, the use of all the external resources and systems at his disposal

The second reason for focusing attention on CRM was the results of our "Operation Microscope' It is the policy of the American Airlines Flight Department to do intensive evaluations of our own flight operations at regular intervals using specially trained check airmen Last fall within a two-month period we completed approximately 2 100 line checks observing the cockpit performance of nearly 5 000 crew members Using the data collected in this effort a series of recommendations and action steps were developed to maximize pilot and flight operations performance Among these were several suggestions having to do with crew briefings communication terminology, leadership, and the interface between the flight crews and other American Airlines personnel

The third reason had to do with the feedback we were receiving from our own training surveys as well as those from the Allied Pilots Association As the LOFT concept took root a lack of co ordination developed between what was being taught in the simulator and the CRM material presented in the classroom It became clear that these two experiences had to be integrated in order to obtain optimum cockpit performance

Lastly, some of our emphasis on CRM course improvement came about as the result of the FAA Administrator's "Impact 88" programme. As part of that effort, an FAA consultant, Dr J Berlin, commenced the development of a new type CRM programme using the AA Flight Academy as the first 'test bed'. The initial results of this effort were so encouraging that we asked Dr Berlin to continue his work, this time in the role of Consultant to American Airlines. Since June 1 1988 he has headed up the development of a CRM programme unique to the needs of our operation. Before the development of specific training modules began Dr Berlin completed a needs analysis by interviewing training and flight managers, by interviewing flight crews of all types of equipment and seat positions and by observing cockpit performance during more than 100 flights. As a result of the needs analysis three themes emerged which, in addition to the usual CRM subject matter, became the focus for the development of new training modules.

The first theme concerns American Airlines' extraordinary use of procedures. It became clear both from comparing operations manuals and from actual cockpit observations, that we have one of the most, if not the most, procedure-oriented flight departments in the industry. In addition, reliable evidence indicates that extremely high adherence to these procedures exists.

While this emphasis upon procedures is entirely laudable there is growing concern among both the flight crews and management that the ability to creatively solve problems for which there are no standard procedures requires additional development. Although evidence does not support this, the concern is great enough for us to have decided to develop some special training modules which reinforce creative problem-solving without decreasing adherence to our procedures.

The second theme concerns the number and qualifications of new crew members. Because of the rapid expansion of our company, almost 1 000 pilots have been hired and trained during each of the past three years. Although American Airlines tends to get the "cream of the crop" it is extremely important that our captains contribute to the development of these new pilots, especially because they often move into the right seat very soon after coming on the line. Many of the pilots who voiced these concerns are themselves new captains and it is to their credit that they express the need for help in becoming effective coaches and teachers to the lesser experienced group. Perhaps the most exciting module thus far developed for the CRM programme is the "helping relationship" module given in the captain upgrade course. The response to the module has been unanimously favourable.

The third theme deals with our pilots' changing perceptions of themselves as managers on one hand, and highly skilled professionals on the other. While we continue to emphasize the importance of the pilot in making operational decisions, the so-called marketing decisions have largely been removed from the pilot's domain. Even though this is the correct thing to do from a corporate viewpoint it does leave many pilots feeling less trusted and admired as a member of the operations team.

There is another experience affecting our crew members. It is the perception among pilots that automation has lowered the requirement for their highly developed motor skills thereby making them feel less needed and important. Because of this and other factors they perceive that their general status both within the company, as well as in society in general, is decreasing. Here too we are attempting to face this issue openly and helpfully in our developing CRM programme. Already we have completed one training module dealing with this subject, and another is in the testing phase.

These themes which may or may not be specific to American Airlines, are being integrated into the other training experiences which include sessions devoted to leadership, management, communication, assertiveness, and the proper use of authority in the cockpit environment.

Perhaps the most innovative aspect of our new CRM programme is the concept of "career-long" training. All of us in aviation recognize the problem of degradation of skills over time. This is why we bring pilots back for proficiency checks and training as often as we do. Strangely enough this has been less recognized when even more complex behaviours such as attitudinal change and personality development of flight crews were the goals of training. Early in the planning for the new CRM programme, we decided to confront this issue head on, and the emerging CRM instructional system will include simulator, frontal teaching and group laboratory experiences at least once a year for the entire career of the American Airlines pilot. In addition because we are integrating the CRM programme into the regular and ongoing flight training as much as possible, we are able to accomplish this on a surprisingly cost-effective basis.

The CRM programme starts in the very first week of training for the new AA pilot. During what we call the Basic Indoctrination course, a half-day is devoted to teaching the principles of CRM. Within the next few months a new training module dealing with the successful integration of the flight engineer as a working crew member will be added to the programme. [illegible] upgrades. [illegible] currently

designed and tested CRM training course which in addition to reviewing general CRM concepts will focus upon the specific responsibilities problems and contributions common to that crew position Our Flight Academy is currently using advanced simulator LOFT training in initial, transition, and upgrade training programmes As part of the over-all CRM effort our flight managers are evaluating a recurrent LOFT training programme as recommended by the FAA If this proves feasible the recurrent CRM classroom day will be taught in conjunction with the LOFT training, with videotapes of the LOFT training used as a central focus of the classroom activities To this end the purchase of sophisticated video equipment has been approved Every year the CRM teaching team will be collecting case histories of CRM incidents on the line They will then translate these into LOFT scenarios and related training modules for use in the next year s training

Much of the success of this entire programme rests upon the attitudes of the Flight Training Academy personnel Therefore we have already begun CRM orientation training for the staff When this is completed all managers, check airmen and simulator and ground instructors will have been trained in what will be for some an entirely new learning area The first of these sessions have been met with enthusiasm by almost all participants

Unfortunately, we have encountered some obstacles in developing a programme such as this For each new captain who is upgraded two first officers must be trained This makes it difficult to schedule real-life crew experiences in both the simulator and the classroom In addition captains are required to undergo recurrent training at six- month intervals, while first officers receive their recurrent training once a year That too, presents some terribly difficult hurdles when constructing a programme such as ours A Special Federal Air Regulation is being developed which hopefully, will alleviate some of these problems Indeed it would be welcomed Nonetheless we continue to search for new methods to maximize our crew concept training within the scope of the current regulations and remain committed to developing the finest CRM programme in the industry

Delta Airlines

2.3.4 This operator's efforts are leading to the introduction of a full programme in 1989 In the following you should note that the term "facilitator" is used for what in this digest has been referred to as "co-ordinator"

In 1987 we undertook a review of our flight operations From this we embarked on a large-scale, in-house inspection to determine if any specific operational factors were apparent While no significant revelations occurred one table fact became readily apparent across the spectrum of the investigation There was a need to train pilots in the area of cockpit resource management (CRM)

Historically our airline has been known for its congenial close-knit pilot group and due to this congeniality the assumption had been made at the onset of CRM that we were not in need of such training In addition the cost effectiveness of such training was questioned However as a result of the before-mentioned inspection process the solicitation by many pilots for such training and the overwhelming agreement of the inspection team that CRM training would be beneficial at our airline our management consented to the research and development of a CRM programme To do this a CRM Steering Committee was formed

The Committee was to be chaired by a line pilot who had been a part of the inspection team in the area of human factors He picked as Vice-Chairman another pilot who had been a part of the same team and who had done extensive research into other CRM efforts Through this process, they became very familiar with CRM and formed the Steering Committee It was decided to use line pilots predominantly but to also include representatives from all aspects of the flight operation As a result people were selected from the following areas ALPA Chief Pilots Flight Training Ground Training, In-Flight Service (Flight Attendants), retired pilots and a cross-section of line pilots from all positions and a variety of bases This Committee was formed in November of 1987

The Steering Committee held its first meeting in November 1987 The first thing they established was a list of objectives which would guide the Committee in their endeavours Here is a list of those objectives

a) enhance safety through optimized team performance

b) develop and enhance crew decision-making skills

c) increase job satisfaction through increased decision-making efficiency customer satisfaction and personal growth

d) develop improved communication skills

e) enhance group interaction skills

f) provide for individual development

g) provide for crew/team development

h) modify the cockpit "shell" to optimize crew performance

i) encourage modification of organizational support where necessary, and

j) create a mechanism to remedy problem behaviours

Given these objectives the first task of the Committee was to research CRM what it is, its purpose and how it is implemented To aid them they used the NASA Publication 2455, regarded as the "bible" of CRM In addition much information was gathered on existing CRM programmes at other airlines and commercial vendors Learning from this research that there is a small group of academic experts in the field of CRM efforts were made to personally contact each of them to seek aid and advice concerning the subject These men included Dr C Foushee with NASA, Dr R Hackman at Harvard University, Dr R Helmreich at the University of Texas, Dr E Weiner at the University of Miami and Dr J Lauber with the NTSB Having researched in depth these resources, the next question became apparent Do we buy an existing CRM programme or develop one in-house?

Weighing these alternatives and considering advice from the experts, the Committee decided that our airline would be best served by a tailor-made next-generation programme To this end it was determined that we should enlist the services of some of the experts on a consultation basis to ensure our programme was up to date and of high quality Consequently, Drs Hackman and Helmreich were employed for this purpose In addition, by virtue of his NASA affiliation Dr Foushee would also be available to provide us with NASA-backed research Working with these experts, the Committee was ready to get specific about the structure and contents of our programme

In January after laborious discussions over structure it was determined that our optimum programme would include a two-day workshop seminar followed by a LOFT period with video feedback (low impact — 1½ hours) Six months later the pilot would return for a one-day workshop followed by another LOFT with video (2½ hours — medium impact) In the following year the pilot would receive a full mission LOFT (2½ hours — high impact) This was "blue-sky" to us i e the very best however we needed to be able to mesh this training with our existing recurrent training requirements There still exists some concern over simulator resources and the logistics of scheduling Beyond this though, the structure had been determined [illegible] time for the Committee to get specific about the content of the [illegible] and LOFTs

[illegible] the Committee [illegible] a set of modules to [illegible] the three days [illegible] shops By this time, we had established the importance of orienting the training toward a "team" concept Therefore we broke the three days into three general categories of targets for training awareness personal skills and team skills Within these broad areas, we will teach the modules that we have ascertained will be appropriate for CRM training

The modules to be taught are Traditions/Bonding/Culture, Accident Analysis I and II Communications Leadership/Followership Stress Management Problem Solving/Decision Making Work-load Management/ Automation and Conflict Management The development of these modules will be accomplished by the Committee with supervisory advice from Drs Hackman, Helmreich and Foushee Committee members were assigned in pairs to each module At this point (March 1988) we have established learning objectives for each module In April we will have an outline of the module followed in May by a rough draft In June we will finalize the workshop content (all modules) With seminars complete we will turn our attention to LOFT

Our airline has been using LOFT since the early 1980s, so it is not a new concept to us However, the profiles utilized in the past will be of little value to use for the CRM training Therefore profiles for each LOFT session for each individual aircraft will have to be developed At this time, we have not begun this task It is scheduled for July Also in July, we will begin studying the massive logistics problem which faces us

For a large airline the scheduling logistics of CRM are formidable In the past we have not trained adhering to a strict crew complement occasionally a captain would train or check with another captain rather than with a first officer However one aspect of the previously mentioned inspection pointed out the need for crew complement training Consequently our flight training department is in the process of a change to this type of training for 1989 Therefore, it appears that our training structure should overlay nicely with normal recurrent criteria As mentioned before, we will evaluate the logistical needs in July The next big step is to train the people who will teach the workshops and LOFT sessions i e the facilitators

"Facilitator" is the term widely used across the CRM front to refer to the person (or persons) who guide the learning process in both the workshop and the LOFT The term is used because the process is truly self learning The leaders simply facilitate this process by keeping the group on [illegible] and functional Our [illegible] for training [illegible] in September 1988 [illegible] training [illegible] line pilots [illegible] volunteer and [illegible] judged [illegible]

and mentally capable of such a task We anticipate the need for two facilitators in every workshop Of course, leading up to this point, there has been a number of administrative tasks, small but important, to get us this far

Over the course of the last four months we have developed several administrative adjuncts to this programme development First in November 1987, we created a video to be shown in 1988 recurrent training which briefly described CRM and the fact that we would have CRM training in place in 1989 In addition to this, we established a plan to disseminate information over the year 1988 in an effort to promote the training To aid us in understanding where we should concentrate our efforts in training, we are setting up an information-gathering device by way of our line check and simulator check airmen Another part of gathering information was accomplished by way of a pilot survey distributed in March of 1988 The purpose of this survey was to provide data on pilots' attitudes to help in tailoring the programme content, and to allow us to compare our pre-training position to our post-training feelings when the same survey will be distributed in 1990 Hopefully, at that point we will see the justification of our labours

Though statistical justification may be hard to obtain the experts widely agree that training in the area of cockpit resource management is targeting the primary causal factor in aviation accidents and incidents "pilot error" Obviously, we on this Steering Committee agree with this theory The main point we want to emphasize is that although we are attempting to change the attitudes of the individual, it is the "team" as a whole which needs to be strengthened Therefore, our concentrated effort over 1988 as we prepare our CRM training programme will be to deeply embed this philosophy through the entire spectrum of our programme

KLM — Royal Dutch Airlines

2 3 5 This airline has long been in the forefront of LOFT and CRM training in Europe Its Human Factors Awareness Course for aircrew constituted one of the earliest airline human factors courses KLM provided a brief and a long version of its programme The brief version follows

Management considerations

From the start of the use of flight simulators instead of link trainers KLM has been convinced that this not only meant simulation of the aircraft as such, but also simulation of the circumstances of a flight In other words, almost right from the beginning, in fact, well before the name was invented, KLM has adopted LOFT for its type recurrent training About seven years ago LOFT was also introduced during type qualification training

Benefits

It goes without saying that in respect of benefits from LOFT and CRM no hard figures are available However, we think KLM's performance reflects a high quality, which is undoubtedly a result of LOFT and CRM

Methods

LOFT and CRM are incorporated in type recurrent and type qualification training in such a way that the instructor will as little as possible interfere during the simulator session During the (thorough) debriefing especially, the aspect of crew management is reviewed for the two-man crew aircraft with the help of a video recording of the session Furthermore, a special crew management course/workshop is scheduled for each pilot, in principle before his upgrading to captain

Selection of flight crew training staff

Selection is carried out according to the following guidelines

- knowledge
- skill
- personality
- ability to mix with people
- flexibility
- instructional capability
- motivation
- experience on type

Most of these items are self-explanatory As far as the last one is concerned captains with previous experience as instructors may be selected again after six months' experience on a new type, in all other cases a twelve-month period of line experience is preferably required

Qantas Airways

2 3 6 In its reply this operator with an accident-free record, stated

Background

The importance of effective cockpit resource management has always been stressed in programmes for promotion of second officer to first officer and from first officer to command. During the 1970s, a period of very slow promotion and very low levels of recruiting, the approach taken to this subject was generally to analyse reported accidents, decide whether the potential existed for a similar accident in Qantas and give the necessary training or instruction to crews. The company's accident-free record and the high levels of experience of all cockpit crew members (in 1980 a minimum of ten years for second officers, the third pilot), suggested that these measures were sufficient.

Extensive recruiting of minimum experience pilots in the early 1980s along with sudden rapid promotion within the company, considerably diluted the experience levels in Qantas. This was a source of some concern within the company and, it is believed, was an important factor in producing increasing numbers of economic incidents which, although they raised no immediate safety worries were costly and, upon analysis amounted to a breakdown in efficient cockpit resource management.

The commercial pressures of the time also created another source of concern within the flight training organization. During times of slow promotion, the supply of candidates for command in Qantas far exceeded the demand and those who were not natural leaders and could not quickly acquire and demonstrate the necessary leadership skills were simply not promoted to command.

The rapid expansion of the early 1980s however forced the company into the situation where it had to accept something less than inherent perfection in management skills and it became apparent that more extensive management training for captains was an urgent necessity.

As management awareness of CRM issues became more extensive, further deficiencies amongst our crew members, notably subordinate crew members, became apparent. There was clearly a need for training of our captains in participative management but also there was a need for training of other crew members in communication skills, monitoring and what we in Qantas, term "managing upwards".

Action

The Director of Flight Operations appointed a Flight Training Supervisory Captain to investigate ways of introducing CRM training in the company. After familiarization with industry progress in the field of CRM a Steering Committee was formed consisting of pilots and flight engineers representing both the company management and the pilots' and flight engineers' industrial associations.

The Steering Committee mapped out a programme for the introduction of formalized CRM training which involves a two-day live-in course for all technical air crew. The course is currently being produced and is expected to commence in July, 1988.

CRM training in Qantas

With experience of CRM courses run by other international operators and also Australian domestic airlines, the Steering Committee decided that CRM training in Qantas needed to be specifically tailored to our own operations. There appeared to be an "ethnic" quality to be approached to CRM training which seemed to require the tailoring of a course not only to suit the country involved but also the particular airline.

The Steering Committee further concluded that the CRM problem was to a great extent, one of basic management principles applied to the air crew team environment. Accordingly, a leading Australian management consultancy company was engaged to assist in the construc-tion of the CRM course.

It is expected that it will take approximately one year to roster all technical air crew for the course. As soon as a substantial number have received training it is intended to introduce an annual LOFT exercise which we believe, will considerably reinforce the training given in the two-day course.

An approach has been made to the Australian Department of Transport and Communications for a concession against Air Navigation Orders allowing the company to delete one route check from the current requirement of two for air crew members who have received CRM training and are undergoing continuing CRM training in the form of the short refresher course and the annual LOFT.

Conclusion

We believe that the introduction of a CRM programme, as discussed will equip our crews to deal with the problems of aircraft management at a time of unprecedented rapid promotion in Qantas when the experience of our crews is significantly below that which we in Qantas are used to

2.4 LINE-ORIENTED FLIGHT TRAINING (LOFT)

Introduction

2.4.1 LOFT refers to aircrew training which involves a full mission simulation of situations which are representative of line operations, with special emphasis on situations which involve communications, management and leadership. In short, LOFT means realistic, "real-time", full mission training. Most of the information in this chapter has been gleaned from NASA Conference Publication 2184, *Guidelines for Line-Oriented Flight Training, Volume II*.

2.4.2 The assessed value of LOFT is such that several States' aviation administrations permit its use instead of the usual semi-annual proficiency checks provided that certain specified conditions are met.

2.4.3 LOFT can have a significant impact on aviation safety through improved training and validation of operational procedures. LOFT presents to aircrews scenarios of typical daily operations in their airline with reasonable and realistic difficulties and emergencies introduced to provide training and evaluation of proper flight deck management techniques. The result is an appreciation by the air carrier of operational shortcomings on the part of line crews and an evaluation of the adequacy of flight deck procedures and instrumentation as well as over-all crew training effectiveness.

2.4.4 LOFT scenarios may be developed from many sources, but accident reports provide a realistic and appropriate starting point. A properly conducted LOFT programme can provide great insight into the internal workings of an airline's operations and training programme for the following reasons:

a) If similar mistakes seem to be recurring among pilots, it may indicate a potentially serious problem as a result of incorrect procedures, conflicting or incorrect manuals, or other operational aspects.

b) It may reveal areas in aircrew training programmes which are weak or which need emphasis.

c) It may reveal problems with instrument locations, information being presented to pilots, or other difficulties with the physical layout of a particular flight deck.

d) Air carriers can use it to test and verify flight deck operational procedures.

2.4.5 LOFT should not be used as a method of checking the performance of individuals. Instead it is a validation of training programmes and operational procedures. An individual or crew needing additional training after a LOFT session should be afforded that opportunity immediately with no stigma or recrimination.

2.4.6 A LOFT session should not be interrupted except in extreme and unusual circumstances. Repositioning the simulator and repeating problems is inconsistent with the principles of LOFT. Part of the benefit of LOFT is derived from an individual or crew being able to quickly appreciate the results, either positive or negative, of operational decisions. After completion of such a session, a thorough debriefing should be made of all aspects. This may be accomplished by an initial self-debriefing by the crew followed by the LOFT co-ordinator's (check pilot's, instructor's) debriefing. This critique should include the use of such aids as voice and video recorders, as well as written notes.

Development of scenario designs

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

2.4.8 Full-mission simulation may be used for purposes other than LOFT. Many of the following guidelines for scenario development may 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.

2.4.9 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.

2.4.10 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 weather, operational and equipment problems etc. Simulator visual systems, 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 charts Similarly, current manuals and other operational documentation must be available to preserve realism

2 4 11 Other factors to be considered are alternate airports fuel and air traffic control The specifics of location choice will depend on the operator's needs For example, if a situation is to be constructed around an air traffic control problem one must choose a route where that problem is likely to occur

2 4 12 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 The simultaneous presentation of multiple problems should not result from scenario design, although it may occur as a result of inappropriate crew action LOFT scenarios should not be designed to "bury or overload the crew An accident should never be inevitable, although it is an outcome that may occur

2 4 13 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 co-ordinator (check pilot, instructor) should be in a position 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 failure of the landing gear to extend resulting in a gear-up landing

2 4 14 The pacing and tempo of a scenario must be appropriate to certain factors such as 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

2 4 15 Scripts should be designed in as much detail as possible in order to simulate the real world A lack of detail requires the LOFT co-ordinator to improvise, which takes considerable time away from observation and evaluation of the crew Such improvisation may also fail to accomplish the specific objectives of the scenario

2 4 16 Communications under the control of the LOFT co-ordinator should be specified verbatim The pacing and timing should be built in Problem timing and input should be specified Whenever a problem is injected, all anticipated crew actions should also be included in the scenario 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 co-ordinator may not add to or modify a scripted situation, but if the crew is observed to be so overloaded that further learning is impossible, reasonable judgement should be exercised to prevent further compounding of the crew's situation

2 4 17 In the area of scenario revision and quality control after development, the scenario must be tested Revisions will almost always be required Even after further testing and, when required, approval by the aviation authorities, use of a scenario may reveal details that require further revision based on input from LOFT co ordinators and line flight crews

2 4 18 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

2 4 19 Procedures and practices in the flight operations manuals or flight crew operating manuals that are known to be frequently misunderstood should be considered for inclusion in a LOFT scenario For this purpose, also consider accident and maintenance reports as well as incidents taken from information exchanges and confidential reporting systems such as the NASA Aviation Safety Reporting System

2 4 20 Under operational problems, include pre flight dispatch release, hazardous cargo, fuelling options NOTAMs, etc

2 4 21 Minimum equipment list (MEL) items as well as cabin/passenger problems, ATC problems, and mass and balance problems are all good sources for LOFT scenarios

2 4 22 Under environmental problems include weather, wind, temperature runways that are wet icy or closed and runway and touchdown zone lighting problems as appropriate

2 4 23 In the equipment problems category include as appropriate, airborne equipment problems and ground equipment problems such as support equipment and ground-based radio aids

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

2.4.25 Also consider other uses of full-mission simulation It offers promise for several applications in training and other areas of interest to operators The design of such simulations will depend on the specific objectives to be attained Examples of the areas in which full-mission simulation can be of value are initial training of new pilots, upgrade and transition training some check-rides and evaluation of new procedures

Performance evaluation and assessment

2.4.26 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 There is no such thing as a "no jeopardy" training exercise, since operators are charged with the responsibility of continuing training for those who require it It is, however, essential that an atmosphere be created which allows the crew members to enter the training with a feeling of freedom, openness and enthusiasm Reserve or defensiveness because of concern for "failure" must not inhibit participation

2.4.27 To a considerable extent, conflict can be minimized by the manner in which the co- ordinator sets the scene during the pre-flight briefing, when it should be emphasized that

a) it is a purely a learning experience,

b) it is a training concept designed to emphasize crew command co-ordination, communication, and full management of the available resources,

c) the co-ordinator will not interfere regardless of developments,

d) apparent mistakes may be made but the crew should carry on since there is no one book solution to a LOFT exercise,

e) there will be an opportunity for a full self-analysis during the debriefing and

f) the co-ordinator will take notes during the exercise and will assist in the debriefing

2.4.28 The role of co-ordinator is not that of an instructor in the traditional sense For example realism considerations dictate that the co-ordinator will not intervene or intrude in any way into the LOFT scenario Thus, for purposes of the debriefing, it is crucial that the co-ordinator serve primarily as a moderator

2.4.29 In the experience of operators who use LOFT to good advantage, crews tend to debrief themselves Self-criticism and self-examination are normally much more effective than a critique led by the co-ordinator In fact, crews are often much harder on themselves than the co-ordinator would ever consider being The co-ordinator should do everything possible to foster such self-analysis

2.4.30 When serving as moderator the co-ordinator can guide the discussion to points that need attention Questions about certain procedures, mistakes, and so forth, should be asked whenever possible, and unless absolutely necessary, "lectures" about what is right and what is wrong should be avoided A suggested format for the debriefing should include

a) a positive general statement opening the discussion,

b) a short review of the scenario, including the human factors and training objectives,

c) a discussion by crew members of the operation as a whole and in part,

d) coverage of all aspects of the flight not permitting any one feature to dominate the debriefing,

e) reference to possible alternatives and better ways of accomplishing the objectives, and

f) further development of the discussion through the use of questions to each crew member, such as, 'what if you had done "

2.4.31 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 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 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 operators and their instructors

2 4 32 During debriefing, both total crew performance and individual performances should be openly discussed and assessed by the co-ordinator Critical assessment of an individual must be mentioned in the presence of the full crew, but remedial details should be handled separately Tact is required to maintain the proper training atmosphere

2 4 33 LOFT is, first and foremost a learning experience The success and acceptance of a LOFT programme depends in great measure on its planning and preparation Scenarios must emphasize realism Co-ordinators should be carefully selected and trained in the art of briefing, conducting the programme and debriefing

2 4 34 Additional training for crew members, when indicated, must be handled in a low-key non-threatening manner If these factors are carefully handled, the evaluation/assessment chore will not necessarily detract from the pure training atmosphere, and will result in full acceptance

Co-ordination training and qualifications

2 4 35 Each co-ordinator should have completed a specific training course on LOFT training Generally, co-ordinators are selected from line pilots or check pilots flying the type of aircraft on which the LOFT training is given

2 4 36 Some airlines are successfully using former pilots who have extensive airline experience but who are no longer current In this case they should receive the ground and simulator part of the type-rating training course for the applicable type of aircraft They should also be familiar with the current line operational procedure and should regularly ride the jump seat on typical line segments to observe operating procedures

2 4 37 Where LOFT training involves a crew of three, the airline should have the flexibility of conducting the LOFT training with one co-ordinator appropriately trained for all crew positions

2 4 38 The role of the co-ordinator The role of the co-ordinator should be confined to the following

a) pre-flight briefing,

b) accurate conduct of a prescribed scenario in a realistic manner,

c) monitoring, recording, and assessing crew performance for the debriefing, and

d) performance of an objective debriefing, encouraging the use of self-critique to its maximum advantage

2 4 39 Specialized training for co-ordinators Instructors and check pilots selected to conduct LOFT exercises should receive training in the concepts and conduct of LOFT Such training would include but not be limited to

a) the conduct of the crew briefing and complete familiarity with all pre-flight procedures including flight plans, weather reports, minimum equipment lists aircraft performance data, aircraft loading procedures, etc ,

b) observation and understanding of resource management, including the crew concept and crew co-ordination,

c) the pacing and selection of items in the LOFT scenario and the introduction of abnormal and emergency procedures or situations,

d) an in-depth understanding of observational communication, command and leadership skills as well as related psychological aspects

e) development of the individual's own skills in interacting appropriately with the flight crew during the briefing the LOFT exercise and the debriefing, and

f) 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 and performance, knowledge of and compliance with aviation regulations and ATC procedures sensitivity leadership, assertiveness, smoothness and flying skill work standards and crew co-ordination

2 4 40 Standardization of LOFT Standardization of LOFT will be achieved if co-ordinators are given a complete training programme at the outset, followed by periodic monitoring Additionally, a feedback and critique programme using flight crew members is essential if such a programme is to work Co-ordinator standardization is improved if LOFT co-ordinators monitor each other Standardization can be more easily achieved if the LOFT co-ordinator group is small and works almost exclusively on the LOFT programme LOFT should not be conducted by anyone other than a properly qualified co-ordinator, but the co-ordinator can perform other functions within a

training department if necessary Regular co-ordinator standardization meetings should be scheduled During these sessions, LOFT scenarios can be assessed and re-evaluated for improvement

2 4 4 1 Other uses of full-mission simulation The following is a list of other uses

a) transition training or initial training

b) developing familiarity with special airports,

c) format for check flights,

d) remedial training,

e) wind shear problems

f) accident and incident investigations

g) introduction to communications, clearances, checklist duties and route flying of new pilots

h) evaluation of cockpit controls and flight instruments, and the assessment of human factors in the cockpit

i) first officer training, such as VFR approach and departure techniques, traffic patterns and so on

j) fuel management and assessment,

k) developing techniques and procedures

l) developing take-off and landing skills,

m) accident and incident scenario reviews,

n) engine-out ferry training and qualifications,

o) pre-mission reviews for special operations, and

p) special handling training, such as high altitude stalls

Appendix 1 to Chapter 2

October 5 1988

Note to All Training Captains
All Check Flight Engineer Officers
All Flight Engineer Instructors
All Operations Training Instructors

From Senior Training Captain — Standards

Subject The conduct of LOFT

It seems to have been only yesterday, but it has been a year since we first started annual training Airmen will start returning for their annual training in October Our work-load will increase noticeably and you will find yourself doing LOFT/PT periods where you may not have been for some time The purpose of this letter is to discuss with you some thoughts and ideas as this annual training phase is about to begin

It is becoming more and more obvious that flight safety is directly related not only to the technical and procedural aspects of what we do but to the way we interact with others, in getting what we do safely accomplished [Over the last decade, an increasing amount of evidence has accumulated suggesting that between 60 and 80 per cent of air carrier incidents and accidents have been caused, at least in part, by a failure of the flight crew to make use of readily available resources][1]

With this in mind let's review what LOFT is — what it is all about Simply put, LOFT is Line-Oriented Flight Training It is a simulator training period But it is more than that It is an opportunity for the crew and the instructor to evaluate how well the crew performed from a FORM (Flight Operations Resource Management) perspective

LOFT is an opportunity for airmen to take a look at themselves through the eyes of others The tools used are a video camera, fellow crewmembers and a facilitator The objective is to review how well each individual performed the various flight manoeuvers from a human factors point of view How well were resources managed and utilized? Did the crew work together to solve the problems, or were one or more crewmembers excluded? Could the result have been better with team participation? It is a chance for self-evaluation But even more importantly, it is an opportunity for the crew to critique how well they did as a unit Could one member of the crew have done something else or more to enhance the crew s performance? If so how could it have been made to happen? Could the atmosphere have been better - or could that person have been more assertive?

Each crew will be different — and therefore made up of different personalities and styles How these different styles interact and perform together is the meat of FORM/LOFT training

While it is true that we should know what FORM/LOFT is we should also know what it is not Quite clearly it is not the same as a new manoeuver which must be practised all by itself It is not an end unto itself Much like a salad dressing, which you would not consider eating all by itself Resource Management should not be looked at all by itself, but rather as an integral part of the whole flight operations effort In the past we have looked at technical proficiency plus policy and procedural adherence Now we look at Resource Management too

Our responsibilities, as conductors of LOFT, are many-faceted Probably one of the most important things we can do is believe in the benefits of Resource Management, for only then can we effectively support the concept Secondly, it is important for us to realize that we are an integral part of the FORM process [For a CRM programme to produce more than short-term insight, it must be reinforced and integrated into a recurrent training programme][2] Regardless of how good our FORM Seminars are one dose is not going to be enough It is up to us to integrate and reinforce at every opportunity

A properly conducted LOFT period starts with the briefing The trainees should be briefed in general terms about what LOFT is (the NASA Line/LOFT Worksheet is a good guide) The crew should be informed that LOFT is an opportunity for them to practise and evaluate what they have learned from the FORM seminar and recurrent training Our attitude here should not be one of "ask a lot of questions and I'll give you a high score on inquiry We and the trainee need to evaluate real behavior not something that's put on for just two hours of LOFT

We should make the flight as realistic as possible It should not resemble a 'normal' training period with one problem or emergency after another [LOFT is by definition a group performance training exercise that is undeniably relevant to any crewmember's job In a properly designed LOFT scenario successful crew performance will require the co-ordinated efforts of all crewmembers][3] So let's stick with the script If the scenario does not accomplish what it is supposed to, make a suggestion on how to improve it

It is important to note that LOFT has equal importance with the PT portion of the training period There are those who feel that it is even more important Their argument stems from the fact that every single air transport airplane that has crashed in recent history has been flown by a crew who has successfully completed PT and a PC within the preceding six to twelve months

Our conduct of the debriefing (critique) is critical to the effectiveness of the LOFT training On one hand we don't need or want to watch the entire videotape, but on the other, we must resist the temptation to not use any of it Our job is to help (facilitate) the trainees critique their performance We should have paid close attention to their performance during the period and made notes of what we feel are examples of good or bad communication, assertion, critique etc (In particular, we should be aware of the impact the crew's use of Resource Management had on the conduct of the flight) We should use the NASA Line/LOFT worksheet as a guide Rewind and then replay those portions of the video where your notes indicate Since reinforcement of FORM is the most critical phase of the learning process, let's remember that it will work if we do

It is vital that the airmen see for themselves, by looking at their own performance, how important Resource Management is for efficient and safe flight operations Remember, if we just tell them about FORM, they will forget If we show them FORM, they may remember But if we involve them in the principles of Resource Management, they will understand it And that s the first step in the process called FORM

It is also important that we be able to correctly identify what is happening within the crew from a statistical point of view It is from our observations that NASA will determine if our cockpit culture is changing We are a very important part of the validation effort Let's do our best!

General information regarding annual training which may be of interest to you follows

1 Trainees will receive two days of ground school with a FORM refresher included (you may wish to review this material yourself)

2 Trainees who are incomplete or unsatisfactory due to proficiency on the PT or PC will be required to return in six months (this return will not change their anniversary date)

3 If we use three hours of the PT/LOFT period for PT and only one hour for LOFT we are being unfair to the entire training process Here's why First, we cheat the airman of valuable training Second we are a part of the validation process Part of our job is to find out if annual training, as it is presently constructed, works We should do all we can within the framework as it exists to provide the airmen with the training they need However be aware that we skew the data we need to validate or invalidate annual training if we make up our own programmes

4 LOFT will now precede PT Most of us feel it's the best way and now the FAA goes along with us

5 Airmen may request voluntary training six months after their Annual Training package The procedure has not changed The request must be in writing and once assigned, attendance is mandatory

6 Please leave the video camera running after the LOFT period until the airmen actually get out of their seats This will allow any post-mission critique to be captured for later review

7 We have included the Charlie Plum video "Building Prison Walls' in the FORM seminar Anyone who would like a copy of this video, please contact Dave Jenkins or Bernie Lyons Cost is yet to be determined but will be less than $10 00 we think

David H Jenkins

cc System Director Flight Training
Director Flight Training — Resource Management/LOFT
Director Flight Training — A300, A310 A320
Director Flight Training — B727 B707, B737 B747
Director Flight Engineer Training

Appendix 2 to Chapter 2

Note to All Training Captains
All Check Flight Engineer Officers
All Flight Engineer Instructors

From Director Resource MGT/LOFT

Subject LOFT scenario revisions

October starts the second year of annual training For the last six months very little LOFT/PT/PC has been conducted Since that time there have been ATC changes which affected our LOFT scenarios We have corrected our LOFT scenarios to reflect those changes and have modified the structure slightly The changes are listed below

1 The PT/LOFT simulator period has been reversed LOFT will follow the briefing and precede the proficiency training as we had originally requested LOFT periods will be conducted as before with video feedback in the debriefing The PC is the second day

2 The scenarios between IAD and JFK have been modified to reflect your input along with ATC changes We have also changed the weather from a summer to a winter operation in this sector The FRA/LHR scenario will remain the same with ATC corrections It will be further modified during the next few months

3 Additional problems have been added to the problem menues to give us an opportunity to exercise new dilemmas We can always use some of your ideas to expand this list even more Our goal is to provide the maximum potential for human factors exchange between crew members while keeping the blue side up

4 We ask you to provide each airman with a "LOFT Survey Form" that you will pick up with the PT/PC worksheet in the records room This will give the airman a chance to voice comments in a completely confidential manner This form will be processed by the University of Texas in Austin under a NASA validation programme It will help us determine the effectiveness of LOFT Ask the airmen to deposit the completed surveys in the "LOFT Survey Box" located in the service center

We can't stress enough how important each of your observations are during the LOFT part of the period The debrief supported by the video feedback provides each crew member with an opportunity for self-critique as an individual airman and more importantly as a team member Please adhere as closely as possible to the scenarios you select and note the time of those interpersonal exchanges during the LOFT period for debrief in conjunction with the video feedback Your realistic presentation of this simulated activity is a key to the success of the LOFT programme

We would like to think that the material we have presented is error-free In reality we know better, given our limited clerical capabilities We need your help to proof this material Please return any portion of the new (and old) material that needs correction Utilize the hard copy for your correction It will be easier to find on the computer disk The quicker we correct these errors the easier it will be to convince our airmen that there is no "gotcha" in the paperwork We will attempt to correct the material as soon as possible

The "LOFT Co-ordinators' on each aircraft will be responsible for the paperwork supply that is required for the airmens' LOFT Make sure that a reasonable supply is available in each briefing room The B-727 will need both the U S and the European scenarios for the 235 and the 2D4 simulators We will make the initial distribution

As the users of this material, you have the best perspective of how to make the LOFT more realistic We solicit your ideas and expect you to critique this material as if it were a line trip If it doesn't work as designed we need to fix it You are the main source of that feedback Please let us hear from you Thanks!

Bernie Lyons

cc System Director Flight Training
Director Flight Training A-300/310
B-727/737/747
Director Flight Engineering Training

PAN AM LOFT PROBLEM MENU (A-310)
(revised 9-26-88)

Problems and/or situations

1 Engine potential hot start

2 Engine stall
EGT exceeds 644 degrees
Engine shut-down

3 Engine oil low pressure
Engine shut-down

4 Green hydraulic system failed

5 Bravo Whiskey Direct

"*Clipper 594 New York, contact your company immediately on frequency* " (Company frequency)

(When contacted)

"*Clipper 594, flight control, we have just been notified by Security of a Bravo Whiskey Direct for your flight Security has confirmed the threat to be valid We advise you to land immediately at (Planned destination airport)*"

Provide assistance as requested

Provide priority ATC handling

Any runway available for landing

6 Passenger threat

Flight attendant reports that a passenger has barricaded himself in an aft lavatory, he claims to have a gasoline bomb device (or hand grenade) which he continually threatens to detonate, he is demanding that the flight divert to (Nicaragua, Beirut, Tehran, etc as appropriate)

7 Communication failure

Crew loses all communications with air traffic control on normal VHF frequencies, also unable to establish contact on 121 5 or receive on VOR frequencies maintain loss of communications as long as possible, attempted communications with approach control are successful instructions are for the flight to '*continue last assigned clearance*", give holding instructions if requested

(*Note — Reason for loss of all radios is massive explosion in the air traffic control building*)

8 Passenger incapacitation (or intoxication)

Flight attendant reports that certain individual has suffered massive seizure of unknown type (or is extremely unruly and is purposely obstructing cabin crew duties)

9 Brake explosion/green system hydraulic failure

Brakes hot indication (any wheel) followed shortly thereafter by a green system hydraulic failure, flight attendant reports loud noise below floor, possible damage in the wheel well

10 Suspicious object

Flight attendant finds device in lavatory area which resembles a bomb, device looks like two sticks of dynamite with ticking object attached with tape

LOFT profile codes

LFT = Normal route between airports
LRR = Abnormal route between airports
LTB = Turnback or diversion

PAN AM LOFT SCENARIO (9-26-88)

CLIPPER 594 "HEAVY" IAD-JFK (A-310)

Problems 1, 5, 6, 7 (See problem menu)

1)	SIM setup		Dulles runway 01R (#), Gate #3, taxi weight 233 900 lb, fuel 22 500 lb, take-off CG 29 2%, ceiling 1 000 ft, cloud tops 3 000 ft, visibility 10 000 RVR, OAT 30F (-2C), altimeter 29 59 Hg (1 002 mb), wind 020/8, QXI/OCI #1 Green-to-blue hydraulic PTU INOP QXI/OCI #2 Left inner fuel tank pump 1 INOP Insert Problem 1
2)	Dep ATIS	134 85	"This is Washington Dulles departure information ZULU Ceiling measured 900 overcast, visibility 2 miles in light snow, temperature 30, dew point 28, wind 020 at 8, altimeter 29 59 Departures expect runway 01 right Inform clearance or ground control on initial contact that you have received information ZULU "
3)	Clearance delivery	127 35	'Clipper 594 "Heavy', cleared to JFK capital two departure as filed, maintain 4 000 ft, expect 17 000 ft ten minutes after take-off Departure control frequency is 125 05, squawk 0523, contact Dulles ramp control on 129 55 prior to taxi "
4)	Routing		Radar vectors direct Baltimore, V-44, V-229 MORTN, V-44 CAMRN, direct JFK
5)	Ground support		Clearance to pressurize hydraulics, remove external electric (as appropriate) Clearance to start engines when requested Remove external connections when directed "Standby for hand signals on your left '
6)	Ramp control	129 55	Receive pushback request "Clipper 594 "Heavy , cleared to push back, face east " Receive taxi request "Clipper 594 ' Heavy", taxi eastbound to taxiway Echo-1, turn right and taxi south, then contact Dulles ground control frequency 121 9 "
7)	Ground control	121 9	"Clipper 594 "Heavy", continue taxi and hold short of runway 01 right "
8)	Atlanta flight support	130 9	Receive blocks departure message
9)	PANOPS	129 7	Receive off blocks time and gallons of fuel added
10)	Load control	129 7	"Clipper 594 "Heavy', load control Your zero fuel weight is 210 6 with a CG of 27 2, your take-off weight is 233 1 with a CG of 29 2 Passenger load is 12 first class, 21 clipper and 103 coach Stabilizer setting is 0 1 up
11)	Ground control	121 9	(Approaching runway 01R) ' Clipper 594 ' Heavy' contact Dulles tower, frequency 120 1 "
12)	Tower	120 1	Clipper 594 ' Heavy', wind 020/8, fly runway heading cleared for take-off
13)	Tower	120 1	"Clipper 594 "Heavy", contact departure control frequency 125 05
14)	Departure control	125 05	"Clipper 594 "Heavy", radar contact, continue heading 080, vectors to Baltimore, climb to and maintain 6 000 ft receiving Baltimore cleared direct "

15) Departure control	125.05	(Approximately 20 miles west of Baltimore VOR) Clipper 594 Heavy continue climb, maintain 17 000 ft, contact Washington Centre on 133.9
16) Washington Centre	133.9	Clipper 594 Heavy radar contact, maintain 17 000 ft and cleared via flight plan route
17) Atlanta flight support	131.25	Receive airborne message
18) Washington Centre	133.9	(Approximately 41 miles west of Sea Isle) Clipper 594 Heavy contact Washington Centre on 127.7
19) Washington Centre	127.7	Clipper 594 Heavy, radar contact, maintain 17 000 ft.
20) ARVL ATIS	115.4	This is Kennedy International Airport information WHISKEY. Sky condition 800 overcast, visibility 1 and 1/4 mile in snow. Temperature 29, dew point 27, wind 310 at 3 knots, altimeter 29.75. Arrivals expect VOR/DME approach runway 22L. Notice to airmen ILS 22L out of service. Departures expect runway 22R. Inform New York approach control on initial contact that you have received Kennedy arrival information WHISKEY.
21) Washington Centre	127.7	(Overhead Atlantic City) Clipper 594 Heavy, descend and maintain 10 000 ft, Kennedy altimeter 29.75 Hg (1 007.5 mb).
22) Washington Centre	127.7	(5 miles northeast of Atlantic City) Clipper 594 'Heavy' contact New York Centre on 128.3
23) New York Centre	128.3	Clipper 594 'Heavy' radar contact, maintain 10 000 ft, cleared CAMRN one arrival JFK
24) SIM setup		JFK runway 22L (#) ceiling 800 ft, cloud tops 6 000 ft, visibility 8 000, RVR, temperature 29F (-6C), altimeter 29.75 Hg (1 007.5 mb), wind 210/04
25) Problem		(10 miles northeast of Atlantic City) Insert Problem 5 or 6 or 7
26) PANOPS	131.37	(Receive in-range message) Clipper 594 Heavy, you can expect gate number 3, enter via taxiway KILO. Provide assistance as requested
27) New York Centre	128.3	(5 miles southwest of CAMRN) Clipper 594 Heavy, contact New York approach control on frequency 127.4
28) New York approach control	127.4	'Clipper 594 'Heavy, radar contact, fly heading 040 and descend to 3 000 ft. Vectors for the VOR final approach course, runway 22 left.' (on final vector) Clipper 594 Heavy, cleared for the approach, contact Kennedy tower on frequency 119.1
29) Kennedy tower	119.1	Clipper 594 Heavy, wind 210 at 4 knots, cleared to land on runway 22 left.
30) Kennedy tower	119.1	(During rollout) Clipper 594 Heavy, turn right first available taxiway, hold short of runway 22 right, remain this frequency.
31) PANOPS	131.37	Provide assistance as requested
32) Kennedy tower	119.1	(Approaching runway 04 left) Clipper 594 Heavy, cross runway 22 right, I'll call you on the inner, and I'll contact ground control on frequency 121.9
33) Kennedy ground	121.9	Clipper 594 Heavy, proceed the inner to your gate.
34) Atlanta flight support	131.25	Receive block time message

ALTERNATE WEATHER REPORTS (IF REQUESTED)

Newark	300 obscured Visibility 1/2 mile, snow fog Temperature 30 dew point 29 wind 350 at 5 knots altimeter 29 72
Philadelphia	400 obscured Visibility 1/2 mile, snow, fog Temperature 31, dew point 29 wind 010 at 4 knots, altimeter 29 70
Boston	Measured 800 overcast Visibility 3 miles, snow Temperature 15, dew point 11, wind 010 at 7 knots, altimeter 29 58
Bradley	Measured 400 overcast Visibility 3/4 mile, snow Temperature 20, dew point 17, wind 020 at 5 knots, altimeter 29 68
Baltimore	Estimated 400 overcast Visibility 1 mile, snow, fog Temperature 30, dew point 27 wind 020 at 7 knots, altimeter 29 59
Andrews AFB	Measured 400 overcast Visibility 1 mile, snow Temperature 31, dew point 27 wind 020 at 5 knots Altimeter 29 60

PAN AM LOFT SCENARIO (9-26-88)

CLIPPER 594 'HEAVY' IAD-JFK (A-310)

Problems 1, 2, 3, 4 (See problem menu)

1)	SIM setup		Dulles runway 01R (#) Gate #3 taxi weight 233 900 lb fuel 22 500 lb take-off CG 29 2% ceiling 1 000 ft, cloud tops 3 000 ft, visibility 10 000 RVR, OAT 30F (-2C), altimeter 29 59 Hg (1 002 mb), wind 020/8, QXI/OCI #1 Green-to blue hydraulic PTU INOP QXI/OCI #2 Left inner fuel tank pump 1 INOP Insert Problem 1
2)	Dep ATIS	134 85	This is Washington Dulles departure information ZULU Ceiling measured 900 overcast visibility 2 miles in light snow, temperature 30, dew point 28, wind 020 at 8 altimeter 29 59 Departures expect runway 01 right Inform clearance or ground control on initial contact that you have received information ZULU'
3)	Clearance delivery	127 35	Clipper 594 'Heavy' cleared to JFK capital two departure as filed maintain 4 000 ft expect 17 000 ft ten minutes after take-off Departure control frequency is 125 05, squawk 0523 contact Dulles ramp control on 129 55 prior to taxi
4)	Routing		Radar vectors direct Baltimore, V-44 V-229 MORIN, V-44 CAMRN direct JFK
5)	Ground support		Clearance to pressurize hydraulics, remove external electric (as appropriate) Clearance to start engines when requested Remove external connections when directed 'Standby for hand signals on your left'
6)	Ramp control	129 55	Receive pushback request Clipper 594 'Heavy' cleared to push back, face east ' Receive taxi request 'Clipper 594 'Heavy' taxi eastbound to taxiway Echo 1 turn right and taxi south, then contact Dulles ground control frequency 121 9"
7)	Gound control	121 9	"Clipper 594 "Heavy" continue taxi to runway 01 right '
8)	Atlanta flight support	130 9	Receive blocks departure message
9)	PANOPS	129 7	Receive off blocks time and gallons of fuel added
10)	Load control	129 7	Clipper 594 'Heavy , load control Your zero fuel weight is 210 6 with a CG of 27 2, your take-off weight is 233 1 with a CG of 29 2 Passenger load is 12 first class, 21 clipper and 103 coach Stabilizer setting is 0 1 up'
11)	Ground control	121 9	(Approaching runway 01R) 'Clipper 594 'Heavy , contact Dulles tower frequency 120 1 '
12)	Tower	120 1	Clipper 594 Heavy wind 020/8 fly runway heading cleared for take-off
13)	Tower	120 1	'Clipper 594 'Heavy' contact departure control frequency 125 05
14)	Departure control	125 05	Clipper 594 Heavy radar contact continue heading 080 vectors to Baltimore climb to and maintain 6 000 ft receiving Baltimore cleared direct

15)	Departure control	125 05	(Approximately 20 miles west of Baltimore VOR) Clipper 594 Heavy contact Washington Centre on 133 9 '
16)	Washington Centre	133 9	Clipper 594 Heavy radar contact maintain 17 000 ft and cleared flight plan route
17)	Atlanta flight support	131 25	Receive airborne message
18)	Washington Centre	133 9	(Approximately 41 miles west of Sea Isle) Clipper 594 'Heavy contact Washington Centre on 127 7
19)	Washington Centre	127 7	Clipper 594 Heavy , radar contact, maintain 17 000 ft '
20)	ARVL ATIS	115 4	This is Kennedy International Airport information WHISKEY Sky condition 800 overcast, visibility 1 and 1/4 mile in snow Temperature 29 dew point 27, wind 310 at 3 knots, altimeter 29 75 Arrivals expect VOR/DME approach runway 22L Notice to airmen ILS 22L out of service Departures expect runway 22R Inform New York approach control on initial contact that you have received Kennedy arrival information WHISKEY'
21)	SIM setup		JFK runway 22L (#), ceiling 800 ft, cloud tops 6 000 ft, visibility 8 000 RVR, temperature 29F (-6C), altimeter 29 75 Hg (1 007 5 mb), wind 210/04
22)	Washington Centre	127 7	(10 miles southwest of Atlantic City) Clipper 594 "Heavy , radar contact lost due to Centre computer failure We have a routing change for you when ready to copy ' "Clearance limit is the ZIGGI" intersection Proceed direct Atlantic City Depart Atlantic City on V-184 to "ZIGGI" intersection Expect possible hold at 'ZIGGI ' Slow to 250 kt, then descend to 8 000 ft The Atlantic City altimeter is 29 69 Read back "
23)	Washington Centre	127 7	(5 miles northeast of Atlantic City) "Clipper 594 Heavy , contact New York Centre on 128 3
24)	New York Centre	128 3	'Clipper 594 Heavy ' radar contact, maintain 8 000 ft cleared V-184 ZIGGI ' direct JFK
25)	Problem		(10 miles northeast of Atlantic City on V-184) Insert Problem 2 or 3 or 4
26)	New York Centre	128 3	(Approaching "ZIGGI" intersection) Clipper 594 'Heavy', contact New York approach control on frequency 127 4 "
27)	New York approach control	127 4	'Clipper 594 "Heavy", depart 'ZIGGI ' heading 040, vectors for the VOR final approach course runway 22 left Descend to 7 000 ft Kennedy altimeter is 29 75 Hg (1 007 5 mb) " Provide vectors for the approach
28)	PANOPS	131 37	(Receive in-range message) 'Clipper 594 "Heavy ' you can expect gate number 3 enter via taxiway KILO ' Provide assistance as requested
29)	New York approach control	127 4	(on final vector) 'Clipper 594 'Heavy', cleared for the approach, contact Kennedy tower on frequency 119 1 '
30)	Kennedy tower	119 1	Clipper 594 'Heavy ' wind 210/04 cleared to land on runway 22 left
31)	Kennedy tower	119 1	(During rollout) 'Clipper 594 Heavy turn right first available taxiway hold short of runway 22 right remain this frequency