

GroundEffects

Reporting Maintenance and Groundcrew Error Reduction Efforts

"The Airlines, as part of their surveillance and analysis program, should investigate maintenance errors. It is a fundamental responsibility of the airline"

Mr. Dal Mortensen
Former Director of QA - United Airlines

January/February 1998

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DuPont Aims for "Zero Incidents" at its World-wide Business Operations

by Jim Brock

Editor's Note: When it comes to safety, the aviation industry and DuPont have a lot in common. Both involve high-risk operations; both are in the public eye; and both give the highest priority to eliminating incidents. Here is an inside look at DuPont's approach to ensuring safety at its many operations around the globe — an approach that has made it one of the world's safest companies. As a maintenance professional, you'll find much of interest in this discussion of the safety philosophy and strategies that are driving DuPont's relentless pursuit of zero incidents.

At DuPont Company headquarters in Wilmington, Del., the term "zero incidents" is anything but a blue-sky concept.

"Far from it," says Mike Deak, who heads up corporate safety and health activities for the world's largest chemical manufacturer.

"We're very, very serious about our
(Zero Incidents pg 3)

Maintenance And Ramp Safety Society

As announced in the last issue of *GroundEffects*, the Maintenance and Ramp Safety Society (MARSS), has been formed as a non-profit society to promote human factors issues impacting maintenance and ramp crews. MARSS, through its predecessor organization, has already begun promoting this important work through the "Dirty Dozen" Posters, the "Annual Maintenance Errors and Their Prevention" Conferences, and a soon-to-be-released video.

GroundEffects is now the official newsletter and website for MARSS. After this issue, the newsletter will become quarterly starting with the June 1998 issue. For our subscribers, your subscription will be adjusted so you will receive the correct number of issues. All subscriptions will now be handled by MARSS. We are happy to combine forces with MARSS to promote awareness of issues affecting the mechanic and ramp worker.

The new and improved website will be www.marss.org

Will No Good Deed Go Unpunished?

By Johnathan Hill

Suppose you, as a Director of Maintenance, had developed a wonderful research project, based upon the maintenance records of your FAA-licensed employer, that shows a pattern of activity indicating a serious human factors problem in your operation. Wonderful. You've done your boss a real favor. You've spotted a problem and you can now devise a fix. There is, however, this nagging feeling in the pit of your stomach. Is this newly developed information, drawn together by a consultant you hired at no small expense, going to be the basis of an equally expensive enforcement action from the FAA? Have you, with this study, given your PMI just what he needed to slap you with a big fine, or worse yet, shut you down? Self-critical analysis -has always been an important management tool; however; are you wise to create these self-critical studies when you are a licensee of the FAA?

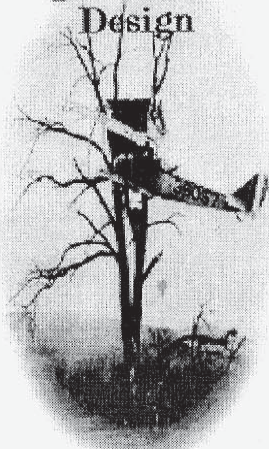
The answer to this question is a resounding "probably"! While you are probably exposing your employer to an enforcement action, and you are wise to undertake the studies! As an FAA licensee, you are subject to re-
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Maintenance Error Investigations Need a Push

by: Wayne Glover

GroundEffects Newsletter received a copy of a soon-to-be-released report, "Learning from our Mistakes: A Review of Maintenance Error Investigation and Analysis Systems," prepared by Galaxy Scientific Corporation for the FAA. This report summarizes the existing maintenance error analysis tools and challenges the industry with some interesting insights. The most intriguing insights in this report are: defensive log book write-ups, a startling maintenance error rate estimation, and, most importantly, a recommended change to FAR 121.373.

The discussion of defensive logbook write-ups may generate the hottest debate because it presents the possibility of technicians covering-up maintenance mistakes. However, this is mentioned almost in passing and the report should not be defined by this suggestion. Defensive logbook write-ups, if and when they do occur, are symptomatic of a larger problem and not the problem.

The hypothetical example used in the report is the dilemma a technician might face when finding a missing O-ring. This O-ring was likely incorrectly installed by a fellow technician and our technician has a choice on how to write up his repair. Correctly, his write-up should be "replaced missing o-ring." However, this would implicate a fellow, albeit likely un-identifiable, technician. Thus, this technician may choose to enter the log book write-up as "replaced o-ring". Perhaps the technician does not see a difference. After all, the end result is the same: the aircraft is now safe. However, the report notes that this critical missing word eliminates the possibility of learning from this error through an airline investigation. The airline will not investigate a replaced o-ring; however, a missed o-ring would be a likely candidate for an investigation. A chance has been lost to improve the safety of the system.

Concerning the frequency of maintenance errors, the author estimated that: "... the number of aircraft dispatched with a maintenance (*Investigations page 5*)

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Zero Incidents

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goal of zero injuries and occupational illnesses," he says emphatically. "With so many units in the company already operating at that level, we believe that a zero target for our entire worldwide operation is achievable and will soon be within our grasp."

Deak, whose formal title is Corporate Director of Process Safety Management and Employee Safety and Health, has good reason for his optimism. He can point to an impressive record of performance during 1997 by the company's 97,000 employees who work at more than 250 reporting units around the globe. "As we close out the year, more than 160 of these sites are right on target. That means zero incidents at more than 66 percent of our plants, laboratories, administrative offices and field marketing operations around the world. As of November 1997, eight of the top 15 safest DuPont plants were located outside the United States. Of those 15, three were located in Mexico."

What's more, the company's total recordable frequency rate is expected to hit a record low this year. Total recordable frequency rate reflects the number of Lost Workday Cases (LWCs), Restricted Workday Cases (RWCs) and Medical Treatment Cases (MTCs) per 200,000 hours worked in the year. "Our recordables for 1997 should be at a 0.39 level, the best performance ever," Deak predicts. "That's a significant drop from our 0.9 level back in 1994 and shows how close we are to our goal. In addition, our lost workday performance of 0.026 is challenging our best-ever year."

Contract workers employed at DuPont sites share in this commendable level of performance. "On the average, we have 40,000 contract personnel on our sites at any given time, and their recordable rate of 0.94 and lost workday case rate of 0.19

are safety records for DuPont," says Deak. In recognition of its success in this area, DuPont has received the 1997 Business Roundtable's Excellence Award for Exemplary Contractor Safety. "This is the third time in this decade that DuPont has been honored with this major industry safety award," Deak points out.

With this high level of safety performance, it's easy to see why DuPont is setting its sights on zero incidents for the entire corporation. "Zero is our only acceptable goal at this point," says Deak, "and we're very serious about it. We're confident that we'll achieve the goal and that, once we've reached it, we'll be able to sustain that high level of safety."

Zero Goal "Speaks Volumes"

Like Deak, senior management at DuPont is also confident that the zero goal will be both achievable and sustainable. "It's a level of excellence that our corporate executives are focused on achieving," says Deak, "and it speaks volumes about our concern for our employees and the public in general, as well as for our business success. The zero goal not only tells our employees that we're dedicated to safety, it also sends a clear message to society, to the news media and to regulatory agencies that we do indeed care about our employees, our neighbors and their communities."

"Just as with air transportation, society is today very much aware of the hazards associated with our business, and a goal of zero incidents is truly the only safety target that the public will accept from us," he adds.

There are other similarities between the aircraft and chemical industries. "For example, maintenance professionals can appreciate the many parallels that exist in maintaining a chemical process and readying an aircraft for safe flight,"

says Jim Brock, DuPont's industry development manager for the aerospace industry. "Both operations require servicing of highly complicated systems involving engines, compressors, valves, thermocouples and other critical components and assemblies. And, both require employees and contractors to work safely around high temperatures, high pressures and flammable and toxic liquids."

With these parallels in mind, and with the extreme importance placed on safety in both industries, "it makes sense to share our knowledge and techniques of incident prevention," continues Brock. "The approach that we're using in our drive to zero incidents is built around five core elements that may also be of value in aircraft maintenance operations."

Five Core Elements of DuPont's Approach to Safety

Here, as summarized by Mike Deak, are five core elements that DuPont is using in its successful pursuit of zero incidents:

1. A Solid Commitment from Top Management

Visible and unconditional support from business leadership is vital to the success of any safety activity. At DuPont, safety is promoted widely as a core value of the corporation, and the safety and health of employees is made an integral part of every business strategy. The company also understands and acknowledges the positive impact that a good safety record can have on customers, stockholders and the public at large. DuPont managers are expected to "role model" the corporate safety position and to encourage and support safety activities at every opportunity. For example, during plant visits, DuPont's senior managers make safety an integral part of their discussions with employees.

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2. Responsibility and Accountability of All Employees

At DuPont, safety is considered a personal responsibility and requires the involvement of everyone in the organization. "We emphasize the individual's duty not only to observe safety rules and regulations, but also to make sure they do the right thing in the right way...every time," says Deak. Like the aviation industry, DuPont has a structured operating discipline for assuring the safety of its operations, including checklists and procedures similar to those used in releasing an aircraft for flight. If contract employees or outside firms are involved in any part of a DuPont operation, they are made aware of company safety policies and procedures and are held to the same high level of personal responsibility and accountability as DuPont employees.

3. A Clearly Communicated

Expectation of Zero Incidents

DuPont's corporate management is convinced that its goal of zero incidents worldwide is realistic and attainable, and has communicated this expectation widely, both inside and outside the company. A formal statement of the zero goal is contained in the company's Safety, Health and Environmental (SHE) Commitment, a corporate policy document that applies to both DuPont and contractor employees working on the company's sites. There is no confusion or misinterpretation of the goal within the company, and all employees and contract personnel are aware of it and of their important role in achieving the zero goal.

4. Auditing and Measuring for Continuous Improvement

"We consider auditing as the

window that lets us examine our safety systems, shows us where we are and helps us understand what we have to do to improve our performance," says Deak. At DuPont, both leading and trailing indicators are used to measure progress and to make sure that effort is being placed in the proper areas. "Leading indicators are especially useful in dealing proactively with safety issues before incidents occur," adds Deak. "Being proactive is especially important when your goal is zero incidents."

The average DuPont plant, with 370 workers, has operated for eight years without a lost workday injury and with fewer than two recordable injuries per year.

In 1996, the 97,000 DuPont employees at all our operations worldwide had only 50 Lost Workday Cases (LWCs). That is an incidence rate of only 0.05 cases per 100 employees. Using an LWC cost index of \$32,000 per case (based on National Safety Council data), the total cost impact would be \$1.6 million.

By comparison, the U.S. air transportation industry LWC rate per 100 workers was 6.8. If DuPont had that rate for the size of its work force, it would have experienced approximately 6,600 LWCs, costing more than \$211 million! By being 136 times safer than the U.S. air transportation industry, DuPont avoided \$209 million in nonproductive costs. Now, that is good business!

5. Felt Leadership by All Employees

When employees become personally dedicated and involved in the safety effort, their impact on the success of systems and processes can be truly amazing. That's the premise behind DuPont's unique concept of "felt leadership," which encourages employees to take

responsibility for each other's safety, to share experiences and to coach one another in safe work habits. "It's a peer-to-peer concept of safety in the workplace," says Deak, "a step beyond taking responsibility for one's own personal welfare. It's learning and sharing from our successes, and from our failures, too," he adds. As a safety strategy, felt leadership on the part of all employees is growing at DuPont, and Deak believes that it will be one of the keys to success in achieving the goal of zero incidents.

Learning from DuPont's Experience

There is little doubt that DuPont is very serious about achieving its goal of zero injuries and occupational illnesses around the world. In Deak's words, "We intend to pursue our zero goal relentlessly and with a passion until we're 100 percent incident-free in every business."

What key learnings can the aviation industry take from DuPont's "zero based" approach to incident avoidance and from its five core elements for reaching that goal? Deak's advice to safety-conscious maintenance professionals is summarized as follows: "Believe that zero incidents is both

achievable and sustainable in your area of operations. It is the only truly acceptable goal in industries such as ours, where high-risk operations and a high public profile go hand in hand. If aircraft can be designed for zero failures, why not take that same approach to preventing injuries? (Zero Incidents page 5)

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"Understand your successes and failures. Learn from them, and communicate those learnings throughout your operations. Above all, recognize and celebrate outstanding performance.

"Expect your employees to work safely and be accountable for their actions. Work with them to create a safe working environment and encourage their involvement in shaping safety processes.

"Treat contract employees with the same care and concern as your own people. Insist on the same level of safety performance as you do from your own employees.

"Realize that safety success is fragile and that it takes a lot of hard work to achieve and sustain good performance. Despite our many years of success, safety is far from automatic at DuPont. We work very hard at it every day of the year.

"Finally, be aware that there are business as well as humanitarian rewards from a successful safety program. Safety can and does impact the bottom line of an operation, whether it's a chemical plant or an airline company. At DuPont, for example, we have realized 14 consecutive quarters of record earnings as our injury/illness rate has dropped 50 percent over that time period."

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Investigations

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error on board in the U.S. is roughly 48,800 per year." This estimation is based on established In-Flight Shutdown maintenance-error data extrapolated for the number of U.S. flights. The complete explanation may be seen on the MARSS website. Although this number is an estimation based on available data and subject to discussion, the magnitude of this number, and the credible source, suggest the number of maintenance errors is higher than most would have imagined.

The report takes pains to note that this number is deceptively large in that there are approximately 80,000 U.S. technicians. Thus, each technician would have to work approximately two years between mistakes. Looking at past issues of GroundEffects, I can only wish my record were as good. However, the criticality of maintenance errors warrants efforts to reduce this number with thorough maintenance errors investigations. Mr. Dal Mortensen, former Director of QA for United Airlines and former head of the ATA Maintenance Human Factors Committee, agrees with the need for more investigations. Although stopping short of suggesting any change to specific FARs, Mr. Mortensen did say "the airlines, as part of their surveillance and analysis program should investigate maintenance errors. It is a fundamental responsibility of the airline."

However, airlines have been extremely reluctant to conduct human error investigations, likely due to cost considerations or lack of faith in resultant improvements. In the short run, perhaps the costs should concern them: using the estimated 48,800 maintenance errors for Part 121 and 135 operators, and approximately 20 to 30 operators, each airline would be required to perform 1,500 to 2,500 investigations each year. However, even ten years

after the Aloha incident, the seminal event launching maintenance human factors, no airline comes anywhere near that number. In fact, at the 11th Human Factors in Maintenance Conference in 1997, the author, presenting a paper for a colleague, asked if any airline present conducted maintenance error investigations as frequently as they do for mechanical failures. Not a single airline representative could make that claim. Why, since these mechanical reliability programs have been very successful in reducing mechanical problems, are we so reluctant to apply these principals to human error event investigation? Specifically, why do airlines perform mechanical reliability investigations but not human error investigations? The answer is simple: regulations.

Thus the key report recommendation: reinterpret FAR 121.373 to mandate thorough maintenance error investigations. The report stresses that more regulations are not needed. The FAA must simply acknowledge that the current airline maintenance surveillance program is not adequate unless it requires maintenance error investigations. Although the specter of more enforcement will certainly not please many, I believe it is necessary to spur these investigations. For proof of the effectiveness of regulation, look at the wide spread use of CRM and the much more limited use of MRM. The difference: CRM is mandated; MRM is not. This suggests that to promote investigations, a change to the FARs is needed. The industry has had ten years to make improvements in their human error investigation system with little impact.

I acknowledge that, in the short run, costs are certainly an important issue. However, taking the long view, at least two companies, Dupont Safety Systems and Behavior Science Technology, have methodologies with supporting data showing safety can save money. (Investigations page 7)

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inspection at any time. If you are a Part 121, 135 or 145 operator, the FARs specifically give the FAA very broad powers and require you to let the Administrator or her representative have access to your records at any time. However, it is often not that simple or direct when the FAA's request is for studies such as our example.

The FAA Chief Counsel Office provides little guidance on the relationship between the FAA's reinspection rights and FAA requests for voluntary production of company documents or providing company personnel for interviews. Perhaps it is an area that FAA has not addressed or it reflects the tension between the need of the regulator to have access to the records of the regulated and needs of the regulated to study their operations to insure the safe operation of their companies. Clearly, for managers of these regulated companies to do the job required by the FAA, the creation and use of our hypothetical self-critical report should be encouraged. My own experience is that the FAA's response to such a study depends on the relationship you have with your PMI. If your operation is not under scrutiny for any political or substantive reasons, and if the working relationship with the PMI allows the exchange of information and ideas, you should create and use such self-critical reports. Unfortunately, I have seen such reports subpoenaed to support an FAA enforcement case. What better evidence than your own work to prove the FAA's point! It is hard to contest that which you have created.

The FARs are replete with specific references to the FAA's powers to get that study of which you are justifiably proud. § 119.59, a relatively new section of the FARs placed into the regulatory mix in June of 1996 as part of the FAA's safety review and "one level of

safety" initiative, requires the custodian of records to make records available to the Administrator at any time or place. Failure to make such records available is grounds for suspension of the license. It's important to note, however, that §119 does not give authority for taking enforcement or certificate action itself. Under the Transportation Act and the Administrative Procedures Act, your company must receive notice and have an opportunity to respond. Also, you may have certain appeal rights before such action can actually be taken by the FAA.

The FAA's power to inspect records is limited because their enforcement right requires official action under Part 13 of the FARs. The company and/or individuals may refuse to cooperate in an investigation, although that refusal itself may hasten the initiation of a formal action and the issuance of administrative subpoenas by the FAA under Part 13. The choice one faces is whether cooperation will lead to a worse result than non-cooperation. Ultimately, the government will get its hands on any documents it wishes to review if those documents are kept in the normal course of business and are relevant to the matter under investigation. Part 13 - "Investigation and Enforcement Procedure" - covers many subjects beyond the scope of this article. However, one needs a basic understanding of the enforcement structure so that management may judge the proper action when confronted with a request from your PMI for documents that will incriminate your company in a civil matter or certificate action. The FAA has reserved a variety of means to conduct investigations of those it licenses. They range from informal inquiries, to formal fact-finding investigations using an FAA employee with subpoena powers, to full evidentiary hearings with live testimony before an administrative law judge. These powers are

contained in 14 CFR §13.

Part 13.3 sets forth the extensive investigative powers of the FAA. The provision gives the Administrator the right to conduct investigations, hold hearings, issue subpoenas, require the production of relevant documents, records and property, and take evidence and depositions. That fairly well covers the waterfront! However, the key issue always remains: what documents or reports are relevant to the investigation?

Part 13.7 "Records, Documents and Reports" - states that "each document or record that is required to be maintained, exhibited or submitted" may be obtained by the Administrator or her representative and may be used in any civil penalty, certificate or other legal proceeding. The obvious judgment here is whether the requested documents are "required" to be maintained. Clearly, maintenance logs and personnel or training records are all required to be maintained. For instance, when faced with a request for the primary records of maintenance done on an aircraft, or training records of your mechanics, the FARs require that you provide these records to the FAA. This part is clear. The issue becomes cloudy, however, when the request is for reports generated from those required records. Certainly, without a formal order of investigation authorizing the Administrator subpoena power, you need not turn over the requested reports. Also, once an enforcement proceeding has begun, you can appeal the scope of a subpoena or argue that a specific study is not relevant to the inquiry.

If the FAA progresses to a Letter of Investigation (LOI), you must now decide whether to provide the study or other information in the hopes of discouraging the FAA from pursuing a civil penalty or certificate action. Assuming that the issue is still unresolved and that a formal complaint has been issued, the (*Reports next page*)

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power of the Administrator increases. My own experience in these matters has included an extensive and costly "Formal Fact Finding Investigation Under an Order of Investigation" beyond the normal enforcement actions. The FAA uses this unusual procedure when they do not receive cooperation from the licensee. The procedure allows the FAA to appoint an employee to take evidence, subpoena documents and take testimony under oath. Again, how much you want to cooperate with the FAA depends on how closely related the requested documents are to those that are required and whether they are relevant to the investigation at hand. In the case I referred to, some 35 mechanics and management were deposed and reams of documents were produced in order to attempt to prove a violation of the FARs. The FAA's attempts to prove a violation of the Act in that case were unsuccessful, but not for a want of trying!

One tried and true method of protecting documents is to find a way to "shoe horn" them into the attorney client privilege. This exception generally requires that the document be prepared by, or directly for, an attorney contemplating litigation. Maintenance or personnel and training records do not ordinarily fall within such an exception. Additionally, maintenance studies are not conducted for counsel; they are conducted to evaluate maintenance issues. Thus, the attorney privilege would not likely apply. However, some Federal Courts have recognized in limited circumstances a "qualified privilege" for self-critical studies. In at least some courts, the privilege has been recognized if you show that 1) the information was found through a self-critical study, 2) the public has a strong interest in preserving the free flow of this type of safety information, 3) the study would not be done

if it were known that it would be subject to discovery, 4) and the information was prepared with the expectation that it was to be kept confidential. These cases may provide you with an argument to the FAA that as a matter of public policy, they should not pursue discovery of the report.

Fortunately, this issue of which reports must be provided is not one that I have experienced frequently in about 30 years of practice before the FAA on behalf of airlines and other regulated entities. It is a matter that usually arises in the course of an investigation that has its origins in a fact-specific investigation. As part of a request for documentation related to a Letter of Investigation or a subpoena, you are faced with a report that you may have even forgotten exists. Under the present state of the law it appears that should the FAA want to pursue the matter, ultimately you will have to turn over any report that is relevant to the issues they are investigating.

Given the obvious benefits that self-critical reports provide, I believe the FAA should limit its requests to documents required by the FARs. Allowing management to investigate human factors issues and generate self-critical reports of their investigations clearly advances aviation safety without impeding the FAA regulatory authority. If these reports were discoverable by the FAA, they might not be created and their safety benefit would be lost.

In summary, while there are actions you can take to test the resolve of the FAA to obtain certain documents, in 30 years of practice before the FAA on behalf of airlines and other regulated entities, I have rarely encountered this problem.

Mr. Hill is an experienced attorney with a Washington law firm. He has considerable experience with aviation legal issues including FAA enforcement actions.

Investigations

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The Dupont approach is discussed in the lead article on Page 1. The next issue will feature Behavioral Science Technology.

The Dupont Safety Systems method is one example of a program which delivers increased safety and reduced costs through human error investigation programs. The accompanying article from Dupont Safety Systems (Page 1) contains data which suggests that reviewing these low level events and actions can pay off in both increased safety (for passengers and employees) and reduced airline costs. For example, in 1995 DuPont's lost work days cost the company \$1.3M. For a similar sized airline with the average airline injury rate, the cost would be \$255M. These savings would pay for many investigations.

For the airlines, reluctance to human error investigations could be a cost or time issue, or lack of faith in such investigations producing quantifiable results. Either way, the challenge is to develop effective investigation systems that the airlines can use to effectively investigate these events to increase safety and reduce costs. If these systems can't be developed and implemented soon, perhaps it is time for more regulation.

Portions of the referenced report will be posted on the MARSS website (www.marss.org) for comment. The full report will be available soon - look to the website for information..

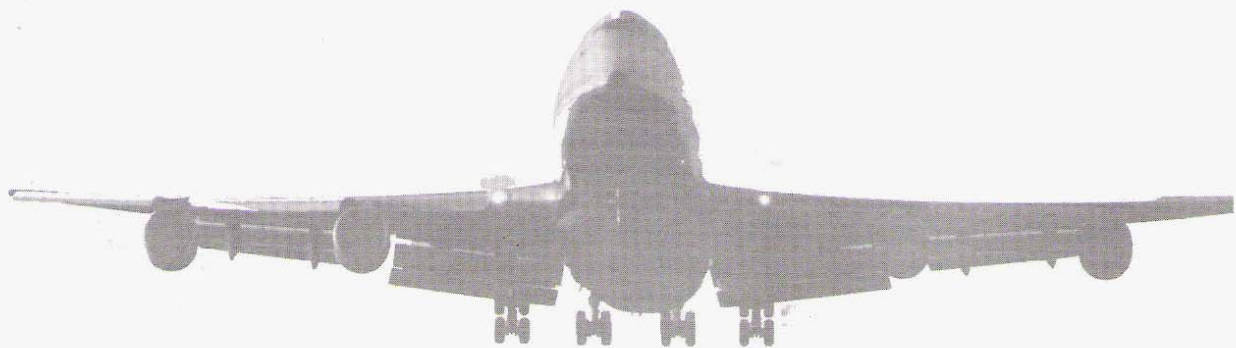
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