The Future of the Civil Aviation System

Recent events, including terrorist attacks, airframe failures and labor-management strife, combine to make civil aviation one of the country's most pressing priorities, says a group of aviation leaders.

[The following recommendations resulted from a symposium of national aviation leaders convened January 11-13, 1989 at the University of Pittsburgh, U.S. The group consisted of representatives from national associations and airlines, government agencies, the U.S. Congress, the aerospace industry, and research and educational institutions.]

Civil aviation has developed essentially in the last half century, and has altered the nature of world travel and commerce in that short period more than all other factors in the prior millenium. It emerged in our time through leaps in technology driven by creative leadership that was in large part rooted in the United States. It remains a vitally important economic stake for this nation.

Yet the civil aviation scene now is troubling: air traffic is increasingly congested, and there are incipient anxieties about prospective air space gridlock and safety; technologies of avionics airframes, and traffic control seem to be moving ahead without integrated planning of total projected needs; airport capacity and connecting ground networks have surpassed saturation in some areas; commercial airline markets are a shifting flux of routes and prices; there is a growing shortage of skilled crews and technicians; and labor relations are in crisis.

These problems are manageable, provided they are addressed vigorously and coherently. Civil aviation is truly a complete economic system of interrelated elements and external connections that is insufficiently perceived and examined as a system — one that is in need of and amenable to a broad systems-analytical approach, such as proven successful in other large economic sectors. Thus, much of the energy and resources expended in developing the capital assets of civil aviation are focused on sub-optimal elements of air traffic, aeronautical research and development, training and education, airport design, regulatory controls, and market forces — but do not include a system-wide perspective on reciprocal relations among these elements.

Operationally, the civil aviation system is a highly interdependent set of dynamic functional elements that must continually adapt to a random variation of external factors, especially weather and shifting demand patterns. To sustain reasonable service at reasonable cost, this extraordinarily complex system must be robust enough to accommodate change on time scales far shorter than those required to assemble the capital assets that constitute the system.

In the United States all these elements of civil aviation are under the limited oversight of the U.S. Federal Aviation Administration (FAA), which itself is a relatively young organization staffed with people who come from various professional specialties and require new skills of many kinds.

A case can be made that the FAA and its leaders could benefit from direct access to expert advice and analysis. Further, airlines, aircraft and component manufacturers, air crews, managers, local political authorities who build airports, and national officials who make relevant rules and laws, could all benefit by better information and perspective about the scope and future of civil aviation. The result would be greater safety and efficiency, enhanced economic impact, and a better-functioning competitive market — without more regulatory bureaucracy.

The Future of the Civil Aviation System

All of us are concerned with the future of this enormously important economic resource; civil aviation in the United States is a vital and growing industry that is still the developmental prototype and the principal hub for aviation commerce worldwide. We are deeply aware of the challenges to civil aviation in terms of personnel, air traffic control, technology, connecting transportation networks, market mechanisms, and safety, and we perceive opportunities for improvement.

There follow our observations and recommendations for action. These represent our consensus as participants in the symposium; this means general agreement among us, but not necessarily conformity by everyone on every point.

The recommendations are directed at policy, operations and professional management of the civil aviation system and conclude with proposals for establishing two sources of expert advice: an advisory council reporting to the administrator of the FAA under the secretary of transportation, and an independent research organization dedicated to analyzing transportation problems.

The civil aviation system in the United States, while in clear need of remedial action, is a functioning system of great stamina and flexibility, serving as an exemplar for the rest of the world. However, the system could be improved by a number of measures taken and policies adopted.

There is urgent need for a national aviation policy covering all aspects of civil aviation. In the perspective of the national aviation policy, the administrator of the FAA, with the guidance of the secretary of transportation, should analyze in depth the civil aviation system in regard to airport congestion, airline competition, environmental concerns, and the trade-off between commercial and operational, and the larger public interests, in order to foresee emerging problems and develop the necessary responses.

There should be an examination of the requirements for further airport construction and the policy issues involved. This does not presume that there are inherent needs for airport construction; rather, study would determine if there are objective requirements and if so, how to meet them.

Related to airport requirements are the possibilities for joint use of military and civilian air facilities. The U.S. Department of Transportation and U.S. Department of Defense should pursue and implement joint use where feasible and beneficial. However, there must be a distinction between the use of air space and the use of facilities, because of air operational needs.

Environmental factors, especially noise, are strong public concerns. The interests of the traveling public and the interests of the local population often are in conflict. Government and industry should continue efforts to find new solutions to the contradictions between environmental and esthetic concerns, and efficiency and safety.

The entrance of other airlines, new and existing, into competition with the present large carriers is restricted and difficult. Barriers to competition are too high. For example, some agreements between airport authorities and airlines restrict entry of smaller competitors. The U.S. Department of Justice is responsible for anti-trust policy and enforcement. It should take the lead by maintaining a watching brief on the situation, by analyzing the cases, and taking legal actions, if necessary, to ensure competition and entry to the market. We support the concept of deregulation, but recognize that to be successful it requires competition and enforcement of measures and legal actions to sustain competition. Whatever problems have arisen with deregulation, it is an improvement.

We must find means to reduce the gap between capacity and demand when and where it occurs. The neglect of airports and the failure to automate air traffic sufficiently has produced a crisis at some major airports at peak periods, and threatens to do so at other airports. The trend for the future indicates that matters will only worsen if left unattended.

In dealing with overcrowding of terminals, gates, runways and other facilities, “pricing” (whether through gate fees, peak pricing or other such devices) should be examined as a means of relieving the overcrowding. If pricing is used to relieve overcrowding and spread the loads, the funds collected should be dedicated to measures and construction that will relieve the overcrowding responsible for these additional charges.

The civil aviation system must provide for expanding facilities for both commercial and general aviation. Airports and the system must be able to accommodate fast, heavy airplanes and small, slower aircraft. Ground transportation and ground facilities for both reliever airports and major hub airports are critically important and must be addressed by governments and industry.

There is a lack of clarity in intergovernmental relations as they concern airports, ground transportation, and oversight of airline service. For example, the federal government has no direct responsibility for the construction of new airports, even though they are linchpins in the national network of interstate commerce. Therefore, assessments are needed by independent experts, special conferences, or recognized organizations specializing in research on intergovernmental relations. Unwarranted federal interference in state and local areas of responsibility, and in private enterprise, should be avoided. Balance is needed in the patterns and kinds of relations among and between the governmental units concerned, as well as with the private sector. For example, architecture and design of airports should be left to the local authorities directly concerned with the design and construction, in terms of local needs and conditions, but in the perspective of national requirements. The FAA should take the lead in involving all players, private and governmental, in working together on the diverse problems of civil aviation scattered among different governments components.

The capability for long-range planning should be improved. The process of long-range, systemic planning should begin in the FAA itself, but it will have to include other agencies, departments, and the private sector. The Department of State, for example, must be involved in matters of international civil aviation. The FAA should take the lead and coordinate all planning.

The FAA is largely an operational agency; therefore its own planning function requires discrete funding and independent standing in the agency. There should be a planning unit at the level of the administrator. A program of partnership should be started with "think-tanks," universities, and independent research firms.

Human Resources

Stronger ties and links should be developed between the FAA and the nation's universities that have strength in education, training, research and programs in professional areas with relevance to civil aviation. New separate educational institutions such as the military academies should not be created. Training for pilots and controllers, for example, can be done at institutions already existing for that purpose. Therefore, there should be a partnership between the federal government and academia to interest and educate college students in aviation studies using the Reserve Officers Training Corps (ROTC) concept (officer candidate studies leading to a commission at college graduation) with FAA oversight, including the possibility of a representative on campus, careful selection of students, full scholarships, and commitment to serve the agency on graduation.

Where aviation programs are in autonomous or separate units of universities or educational institutions, an important goal ought to be setting of standards, and accreditation as a means to that end. Support is needed from accrediting organizations and associations, such as the Council on Aviation Accreditation, with approval of the Council on Postsecondary Accreditation.

Civil aviation involves closely related professions that have managerial and technological aspects; the challenge of human resource development and planning is the integration of these, bringing the specialized professions into common understanding and mutual appreciation.

To recruit, retain, and develop the human resources needed by the FAA:

- The U.S. Congress must accept that there is a compelling need to distinguish the FAA within the total civil service system that is supervised by the Office of Personnel Management;

- Compensation levels should be made competitive at both entry and mid-level management, and for FAA pilots, controllers and other specialized groups; and,

- Training and education in the FAA should be continually realigned with changing roles and required skills, and foster ongoing managerial and professional development.

Management

There is a prime need to achieve a balance between autonomy and collaboration in the relationship of the FAA to the Department of Transportation. The significance of the civil aviation system calls for markedly elevating the stature of the FAA administrator within the senior levels of the federal government, including access to the president as needed, and more independent budget authority, such as for grants to universities and contracts with research firms and institutes. Nonetheless, civil aviation is part of the whole transportation network under the purview of the secretary of transportation. This calls for closer collaboration, with a clear oversight role for the secretary of transportation, especially on issues related to system-wide analysis and planning.

The FAA administrator should have increased flexibility in the exercise of his responsibility, akin to the administrator of the National Aeronautics and Space Administration (NASA) and other senior administrators in the federal government. The length of the term of the administrator should be reviewed in order to attain the goal of continuity and long-range planning.

The Airport and Airway Trust Fund should be moved "off-budget" and made immune from the provisions of the Gramm-Rudman-Hollings Act that requires spending cuts if federal budget projections exceed established limits. Further:

- It must be dedicated exclusively to aviation uses; and,

- It may be used directly on aviation projects or as leverage for bonding to encourage additional funding from local and state governments and perhaps from private firms.

Procurement practices and procedures of the FAA must be improved and streamlined. This would not require new legislation. Furthermore, authority for procurement should be officially delegated from the secretary of transportation to the administrator of FAA, including the delegation of accountability. The goals of the Packard Commission (which aim toward more effective procurement processes) should be applied where relevant; these specific measures should be taken:

- A time limit should be put on the competitive process;
- Only one "best, final" offer should be allowed;
- Only one review body is needed; there is wasteful duplication when both DOT and FAA review several times;
- Performance criteria should be employed; input specifications are not needed except as general or primary guidelines;
- More flexibility is needed in the use of sole source procurement; and,
- Monitoring of contractors should be improved through the reassignment of personnel and hiring additional personnel if needed.

Expert Advice and Research

We recommend the creation of an advisory council reporting to the administrator of the FAA under the secretary of transportation. The advisory council should be small and focus its attention on the encouragement and utilization of policy and technological research, with initial priority on civil aviation within the transportation matrix.

We recommend the creation of an external, independent research unit dedicated solely to transportation and civil aviation questions. The fabric of research in economics, technology, human resources, and policy formation and implementation can be considerably strengthened by a coordinated effort involving this new dedicated unit, along with existing Federally Funded Research and Development Corporations (FFRDCs), universities, and the resources available in the private sector.♦

Education — The Corporate Possibilities

By becoming involved with local learning institutions, corporate aviation can make a significant contribution toward implementing a new and positive sense of purpose in the education system

by

Allen Mears
Director, Special Projects
Flight Safety Foundation

Flight Safety Foundation has aligned itself with individuals and organizations that are attempting to improve the quality of aviation education and training in the United States and elsewhere. These efforts are directed to improving educational standards within the aviation community, from college through ab initio and recurrent pilot and technician training. While these efforts are worthwhile and are proving successful, the Foundation believes much more attention is needed. Aviation industry, at the corporate level, needs to aggressively involve itself with the educational processes within their communities, starting with primary education.

On September 12, 1989, the Foundation conducted an education workshop for the Corporate Advisory Committee members and guests. Speaking to the group were the following: John Fitzpartrick, vice president for Academic affairs, College of Aeronautics, Flushing N.Y.; William Motzel, Ph.D., vice president for special projects, Embry-Riddle Aeronautical University, Daytona Beach, Fla.; Edgar Morgan, executive director, NBAA Education and Safety Foundation, Washington, D.C.; and Douglas Schwartz, assistant director, flight standards, FlightSafety International, Houston, Texas.

The workshop investigated changes in education that occurred during the last generation and the effect those changes are having on the quality of our pilots and technicians, including the amount of remedial training needed at the college level (due to inadequate education at the pre-college level), and the most effective manner in which aviation personnel need to be trained in the future.

Corporate advisors were unanimous in their concern and desire to engage the problem of education. The Foundation is concerned with the educational process as it affects all industries, aviation included. The aviation industry must be part of the solution and Foundation members need to lead the industry in that direction.

The Foundation must continue to focus attention on the problem, continue private initiatives already in place, but more importantly, it can offer simple and relatively inexpensive ways for members to make a difference. Members, and the rest of the aviation industry, must become partners with education at the primary, secondary and collegiate level. This involvement can capitalize on aviation's reputation as a "high-tech and still glamorous" profession in order to motivate students and educators. Aviation can be a learning tool to excite students about the concept of a formal education, while providing a rewarding environment in which to learn math, science and social skills needed to successfully compete as an adult.

Whether your firm manufactures aircraft or components, operates wide-body transports or a small corporate aircraft, insures aircraft or holds the mortgage, has offices throughout the world or just one, members can get involved and make a contribution. Here are a few suggestions:

- Call your local elementary, junior and high schools and ask to participate in their advisory councils. Ask if a member of your company can speak to the students on a regular basis, either in assembly or in class and share information about the industry. If you have an employee who has the appropriate skill and eduction, suggest that the

(continued on page 7)

Materials Description

As part of an effort to promote a better understanding of aviation and the role of air transportation in today's world, the U.S. Federal Aviation Administration offers a selection of educational publications for teachers and school administrators. These publications are designed to provide instructional materials consisting of accurate, timely information to enrich and enhance general studies programs with the concepts relating to aviation, and to inform students about opportunities for careers in aviation.

The publications are distributed free of charge. To order multiple copies contact your regional FAA aviation education officer.

Elementary Level

Aerospace Curriculum Guide. This curriculum guide is designed for teachers of grades K-3 who have little or no experience in the area of aviation and space. The purpose of this guide is to provide an array of aviation and space activities which may be used by teachers as a motivator for students interest in learning.

Aviation Science Activities for Elementary Grades. Pamphlet containing science demonstration pertaining to physical properties of air. Experiments use simple equipment.

Demonstration Aids for Aviation Education. Set of science teaching strategies for independent or classroom work. The activities are based in four categories such as aerospace communications, aerospace and environment, nonpowered flight, and space exploration.

How We Made the First Flight. In Orville Wright's own words, a description of his and Wilbur's first flight.

Nuestro Primer Vuelo. Spanish version of *How We Made the First Flight.*

Teachers Guide for Aviation Education. For teachers Grades 2-6

August Martin Activities Book. Learning activities based on a biography of the world's first black airline pilot.

A Trip to the Airport. Contains English-Spanish bilingual materials. Bilingual text plus supplemental teaching materials.

Middle and Secondary Level

A Model Aerospace Curriculum. Description of the aerospace program of New York's August Martin High School.

Aviation Curriculum Guide for Middle School and Secondary Levels. Guides for language arts, science, math and social studies.

Safety in the Air. Six lessons of flight and the air traffic control system.

College and University Education

Careers in Airway Science. Brochure describes career paths in aviation science and list of schools participating in the Airway Science Degree Program.

All Education Levels

Teacher's Guide to Aviation Education Resources. List of free or low-cost classroom teaching materials, career information, audiovisuals, publications, and periodicals.

The Main Parts of an Airplane. A two-part worksheet identifying the main parts of an airplane and the instrument panel.

Public Awareness

Women in Aviation and Space. Personality profiles of 18 women who have succeeded in nontraditional careers.

Guide to FAA Publications. List of FAA publications and ordering information.

Federal Aviation Administration. Provides an overview of the Federal Aviation Administration.

Aviation Education Resource Centers. Brochure describes in detail the resource center program and lists FAA designated centers.

International Science and Engineering Fair Abstracts. Brochure explains the International Science and Engineering Fair Program in detail and features the abstracts of FAA's science fair winners.

FAA Film/Video Catalog. 16-page film/video catalog describes 49 16mm motion pictures and VHS video cassettes available for audience viewing in the areas of airports, careers, general interest, medical, pilot techniques, and safety; also tells how to order them. Gives 14 tips on making the showing most effective. Some popular films include: "AFSS: A Look at Where We're Going"; "Cleared for Takeoff"; "Controlled Impact Demonstration (CID)"; and "Flight 52".

Aviation Career Information

The following publications provide information that will be useful in making career decisions. The career publications are divided into major job categories. Each publication contains general information, opportunities for advancement and training, outlook for the future, and much more.

Government. Includes information on air traffic controllers, aviation safety inspectors, airspace systems inspection pilots, accident investigators, electronic technicians, engineers, and meteorologists.

Pilots and Flight Engineers. Includes information on flight instruction, corporate pilot, air taxi/charter pilot, commercial airplane/helicopter pilot, patrol pilot, agricultural pilot, test pilot, airline pilot, and flight engineer.

Aviation Maintenance. Includes information on airframe & powerplant technicians and avionics technicians.

Airport. Includes information on airport manager/director, airport service person, safety employees (firefighters), terminal concessionaires, fixed base operators (FBO) and lineperson (ramp service person).

Aircraft Manufacturing Operations. Includes information on scientists, engineers, technicians and production workers.

Airline. Includes information on flight dispatcher, meteorologist, schedule coordinator, station manager/agent, teletypist, reservations sales agent, ticket agent, ground attendant, air freight/cargo agent, passenger service agent, and ramp service persons. Note: This publication does not contain information on pilots and flight engineers.

Air Traffic Control Specialists. Publication describes in detail the job of an air traffic controller. It also includes an employment application form.

Aviation Safety Inspector. Publication describes in detain the jobs of an operations inspector, maintenance inspectors, avionics inspectors, and manufacturing inspectors. It also includes an employment application form.♦

Education (continued from page 4)

school let you set up an aviation-oriented course. This can be a course designed around your firm's special abilities or it can be one already prepared. (See "Materials Description" for types and sources of course data.)

- Call the local colleges, vocational-technical schools and universities and ask to participate in their advisory councils, and offer to speak to the students. Colleges and universities may not be expected to start an aviation curriculum but they may have, or be interested in starting, an aviation club. As a member of the local business community, you can suggest changes that will foster a higher standard for the existing curricula.

- Establish a cooperative training program with high schools and colleges, that allows students to attend school and work in an aviation environment.

- Suggest to your local school boards that they start a course or curriculum in aviation.

- Open your firm to school tours and field trips.

- If asked for comment on revisions to FAR Parts 65 (Certification: Airmen Other Than Flight Crew Members) and 147 (Aviation Maintenance Technician Schools), make those recommendations your believe will ultimately result in an improvement in the overall education process.

- Tell the rest of your company what you are doing. Suggest to regional offices that they do likewise. If you are in a regional office, ask for support from top management.

Competition has developed the world's aviation and aerospace industries, and to a great extent, formed the foundation of the United States' high-tech strength. The lessening of any nation's competitive energy due to a deterioration in the educational process calls for a restructuring of this process to make fundamental positive changes to the way youth are educated.

Flight Safety Foundation believes that the aviation industry is able to make a significant contribution toward implementing a new and positive sense of purpose to the education system. One of the preferred ways of affecting change is at the individual corporate level by simply becoming involved with local education, from elementary schools to universities.♦

Reports Received at FSF Jerry Lederer Aviation Safety Library

Reports:

Moving America: New Directions, New Opportunities. Volume 1: Building the National Transportation Policy. — Washington D.C.: U.S. Department of Transportation, 1989. *35p.*

Key Words
1. Transportation and state — United States.
2. Transportation — Planning — United States.

Contents: America Needs a Transportation Policy — Blueprint for Building the National Transportation Policy — Forces Influencing Transportation, 1990-2020 — Snapshot: The Markets Served by Transportation: The Intercity Passenger market, the Intercity Freight Market, the International Market, the Urban/Suburban Market, The Rural Market, Innovation and Human Factors — Sparking the Policy Debate — List of National Transportation Contracts.

Aviation Safety: FAA's Safety Inspection Management System Lacks Adequate Oversight. Report to Congressional Requesters. — Washington, D.C.: General Accounting Office, November 1989. U.S. General Accounting Office Report GAO/RCED-90-36,*14p.*

Key Words
1. Air pilots — Licenses — United States.
2. Air pilots — Certification — United States.
3. Airplanes — Inspection — United States.
4. Airplanes — Maintenance and repair — Inspection — United States.

Recent airline accidents involving problems with pilot training and the aging airfleet have focused attention on the FAA's safety inspection program. FAA has developed both a safety inspection program to help ensure that flying is safe and the computer-based WPMS to assist in keeping that safety inspection program on track. GAO found that FAA has not provided adequate supervision, as required by government standards for internal controls, to ensure that their policies are being followed by local staff who implement those policies. Furthermore, FAA cannot guarantee the reliability of the information contained in its annual report to the Congress because of inaccurate and unreliable data in the Work Program Management Subsystem. [GAO summary]

Aviation Ground Operation Safety Handbook, 4th Edition. — Chicago: National Safety Council, 1988. *162p., ill.*

Key Words
1. Airports — Safety measures — Handbooks, manuals, etc.
2. Aeronautics — Safety measures — Handbooks, manuals, etc.
3. Airplanes — Ground handling — Safety measures.

Contents: Introduction — Airport buildings and fixed facilities — Safeguarding passengers in terminals — Ramp operations at passenger terminals — Mobile ground service equipment — Hangar and shop operations — Air cargo operations — Fire prevention and protection — Hazardous materials and processes — Personal protective equipment and guarding — Accident investigations, reports and records — Safety program organizations — Planning for emergencies — Index.

Aviation Safety: Information on FAA's Age 60 Rule for Pilots. Fact Sheet for the Chairman, Select Committee on Aging, House of Representatives — Washington, D.C.: U.S. General Accounting Office, November 1989. U.S. General Accounting Office Report GAO/RCED-90-45FS, *22p.*

Key Words
1. Air pilots — Licenses — United States
2. Air pilots — Certification — United States.
3. Air pilots — Legal status, laws, etc. — United States.
4 Air pilots — Health and hygiene — United States
5. Aging.

The Age 60 Rule applies only to pilots flying large commercial planes, not to commercial pilots of small commuter aircraft. This report provides information on (1) the history of the Age 60 rule, (2) exemption requests; (3) the number of "special issuance" medical certificates granted to air transport pilots; and (4) studies on the Age 60 Rule. GAO found that FAA has not changed its policy on the Age 60 Rule since its adoption 30 years ago. Opposition has resulted in legal challenges, studies on the medical validity of the Rule, and 67 petitions from pilots for exemption, none of which FAA has granted to date. In defending its policy, FAA states that the regulation is consistent with its mandate to promote the highest level of safety. FAA plans to fund a study of the relationship between age and accident rates in FY 1991.

Regulations/Advisories:

AC 23.1309-1. Equipment, Systems, and Installations in Part 23 Airplanes — Washington, D.C.: Federal Aviation Administration, September 19, 1989. *6p.*

Provides an acceptable means, but not the only means for showing compliance with the requirements of Part 23.1309 through amendment 23-33 of the Federal Aviation Regulations, for equipment, systems, and installations in Part 23 airplanes. This material is neither mandatory nor regulatory in nature and does not constitute a regulation.

AC 120-50. Guidelines for Operational Approval of Windshear Training Programs. — Washington, DC.: Federal Aviation Administration, October 10, 1989.

Provides guidance for approval of low-altitude windshear training for Federal Aviation Regulations Parts 121 and 135 certificate holders. This AC is issued for guidance purposed to outline a method of compliance with the FAR. An applicant for a training program may elect to follow an alternate method, provided that the alternate method is found acceptable by the FAA.

Reference Updates:

International Flight Information Manual. Volume 37, April 1989, *Amendment No. 3,* January 1990. — Washington, D.C.: U.S. Federal Aviation Administration

Updates IFIM. Manual contains foreign entry requirements, a directory of aerodromes of entry, and pertinent regulations and restrictions.

World Airline Accident Summary. Supplement 76, — London: Civil Aviation Authority, 1989.

Accidents during the period 1 January 1989 to 30 September 1989 are included.

World Helicopter Accident Summary. Supplement 34 — London: Civil Aviation Authority, 1989.

Accidents during the period 1 January 1989 to 30 September 1989 are included.

Aviation Statistics

How Close Are Commercial Air Carriers To (Probably) Perfect Safety?

Leonard Wojcik, Director of Research, FSF

Risk accompanies every commercial air carrier flight, despite the rarity of accidents and continued, steady improvements in safety over the years. The presence of risk seems to guarantee that an accident will eventually happen, if only we wait long enough, since the small accident probabilities associated with all individual flights eventually aggregate to a high probability over many flights. But, is it theoretically possible to manage risk to the point that, even with some risk for each flight, an accident is unlikely to ever occur in the future, no matter how much flying is done?

The answer, perhaps surprisingly, is yes. It is indeed theoretically possible for every flight to have some accident risk, but for the probability of an accident ever occurring to be less than 50 percent no matter how much flying is done. The condition that would permit this to occur is a sufficiently rapid rate of improvement in risk per flight or per hour of flying. In fact, rate of percentage increase of inverse accident risk is an "absolute" measure of aviation safety, since we can compare the actual rate of increase to what would be required to make it unlikely for an accident to ever occur again.

Figure one plots the inverse of accident risk per flight hour — it shows the average number of flight hours (in millions) between accidents with passenger fatalities for worldwide scheduled commercial air transport operations over the 20-year period between 1969 and 1988, excluding operations of USSR airlines. Note that the number of flight hours between fatal accidents has nearly tripled during this period, a testament to the industry's commitment to safety improvements.

Figure two shows how the number of flight hours between fatal accidents has varied with total flight hours accumulated since the beginning of 1969. Thus, this graph shows how the safety record has improved as operational experience has been gained. Between 1969 and 1988, the number of flight hours between accidents has improved at a rate of about 0.38 percent per million hours flown. Now, we ask the question: by what factor must the rate of safety improvement increase to make it unlikely for an accident with a passenger fatality to ever occur in the future?

The answer, obtained by mathematical analysis, is approximately 400. If the entire industry, including aircraft engineers, pilots, managers, aircraft maintenance technicians, flight attendants, air traffic controllers, and so on, could increase the rate of safety improvement by a factor of about four hundred, it would be unlikely for an accident with a passenger fatality to ever occur again, despite the presence of risk on every flight. This would require accelerating the whole process of learning from ordinary operational experience and applying the knowledge to improve safety.

While a 400-fold increase in safety improvement rate may be beyond present capabilities, the challenge for aviation professionals is to identify and master the means for learning from operational experience, through techniques such as Digital Flight Data Recorder (DFDR) monitoring and review of hazardous incidents, and by constantly being alert for potential accident situations and communicating this information to others.

Graphic Unavailable

Accident/Incident Briefs

Close Encounter Of the Wrong Kind

Boeing 727: Minor damage. No injuries.

The air carrier aircraft was preparing to depart from Stapleton International Airport, Denver, Colo., U.S., for a flight leaving shortly after 0800 hours. On board were 114 passengers and seven crew members.

The captain received pushback clearance and had released the brakes at the request of the tug operator. The wingwalker, who had been standing underneath the left wing, walked over to his station outboard of the left wing when he heard the tug being shifted. The tug operator said he put the tug transmission into reverse and pulled the airplane forward between one and six inches to bring the nosewheel off the chocks. When he moved the aircraft, the left main landing gear collapsed.

The left wing tip hit the ground at the feet of the wingwalker.

The airline's ramp operations manual states that to prevent ground collisions, wingwalkers should position themselves at each wing tip and the tail to provide guidance to the tug operator during pushback operations. The company has since changed the operations manual to require that no person be underneath the airplane while it is in motion.

Vision Problems During Approach

Final report. Boeing 727: Substantial damage. No injuries.

The aircraft was approaching Calgary International Airport, Alberta, Canada, on a scheduled flight from Los Angeles, Calif., U.S. There were 140 passengers and a crew of seven aboard.

The reported weather at 2300 hours, just prior to the arrival, included a 200-foot ceiling with visibility three-quarters of a mile in fog, and a runway visual range (RVR) of 3,500 feet. When the aircraft was 35 miles south of the airport, arrival control gave the crew a special weather report that stated, "indefinite ceiling, 300 obscured, one mile in fog, visibility north and east one-half mile, RVR setting five, runway 16, 3,500 feet." The aircraft was given vectors for an ILS approach to runway 16.

The captain flew the aircraft manually, and the flight crew reported that the localizer and glideslope indicators were centered throughout the approach. The first officer made the mandatory altitude callouts down to decision height, reporting when the approach lights were visible at 100 feet above decision height and when the landing environment was sighted at decision height. As the approach continued over the approach lights, the first officer called out radar altimeter heights at 50-foot increments above the runway elevation.

As the aircraft crossed over the end of the high-intensity approach lights, the captain later stated that he did not see the runway lights for one or two seconds. Then he found he could see only three or four lights on the left side of the runway, and that he could not see clearly. He made no comment about this to the other crew members at the time and continued the approach to the landing flare, when the first officer told the captain that the aircraft was veering off the left side of the runway.

A go-around was initiated, but the aircraft touched down heavily before climbing away. The crew noticed no system abnormalities other than the second officer recalling later that a leading edge device in-transit light remained illuminated after the flaps were retracted.

The captain also flew the second approach manually, and again the localizer and glideslope needles were centered throughout the approach, according to the flight crew. The approach lights were again sighted 100 feet above decision height and, once more, the captain had difficulty visually acquiring the runway environment as the aircraft crossed over the approach lights. The first officer did not lose visual contact with the runway, and the captain did not comment on the difficulty he was experiencing.

As the captain was about to flare the aircraft for landing, the first officer felt that the aircraft was not going to land safely on the runway and offered to take over the landing. He realigned the aircraft with the runway and completed the landing. The second officer made no comment during either landing attempt regarding the attitude or position of the aircraft. The captain taxied the aircraft to the terminal with no further incident. After shutdown, the crew was informed that the right wingtip of the aircraft was damaged.

The Canadian Aviation Safety Board, in its subsequent report, stated that the captain was wearing half-eye reading glasses for both approach and landing attempts, and that the improper use of the glasses may have contributed to his vision difficulties.

The captain did not inform the flight crew of his difficulty in acquiring the runway environment nor did he immediately initiate a go-around when he experienced the difficulty. There was no discussion among the flight crew as to why the first landing approach was unsuccessful before a second attempt was commenced.

The Board noted that the lack of communication among the pilots permitted the development of a hazardous situation that could have been avoided. In its report, the Board said that the accident underlines the need for crew coordination and the value of cockpit resource management (CRM) training for flight crews.

Distraction and Busted Altitudes

BAC One Eleven: No damage. No injuries.

The twin-jet airliner was climbing out of the U.K. airport with the copilot flying the aircraft. The flight was cleared to 8,000 feet, but while the captain was involved with manual operation of the air conditioning, the aircraft climbed through its assigned altitude. The captain noticed the error at about 9,000 feet and the climb was stopped.

After the crew advised ATC, the aircraft was cleared to continue its trip at 10,000 feet and the rest of the flight went without incident. After arrival at the destination, the captain was advised by ATC that an ATC occurrence report would be filed. The crew was reminded by company management on the importance of altitude awareness, especially on aircraft without altitude alert equipment. The aircraft involved had not yet been fitted with the warning mechanism.

Air Taxi/
Commuter

Crash into Sea

Mitsubishi MU-2 Marquise: Aircraft destroyed. Fatal injuries to two.

The aircraft departed an Italian airport carrying a load of small packages and bank documents. There were two crew members aboard.

The aircraft subsequently disappeared from radar screens and a search was initiated by rescue helicopters. Parts of wreckage, including a fuel tank with the aircraft's registration number on it, a lifejacket and a seat were sighted off the eastern coast of Sardinia. Special equipment later located a large section of the fuselage on the sea bottom approximately 2,000 feet below the surface.

Things That Go Clunk Before the Flight

Piper PA-31: Substantial damage. No injuries.

After landing at the U.K. airport, the pilot gave the ground handling personnel his departure time in Universal time instead of local time. As a result, there were no ground personnel on hand when the pilot arrived back at the aircraft for departure.

During the preflight checks, the pilot noticed a fire extinguisher close to the aircraft on the right hand side but considered it no hazard. After he boarded his passengers, the pilot called for clearance to start engines, in hopes that this would result in the dispatch of ground personnel.

However, by the time the pilot was ready to taxi, there still were no ground handlers present, so he got underway without assistance.

Shortly after releasing the brakes, the pilot began a right turn — and the right propeller struck the fire extinguisher which the pilot later stated was not visible from his position. There were no personnel injuries but the aircraft sustained substantial damage to the right propeller and to the tail.

Corporate Executive

Storm Diversion Ends in River

Learjet: Aircraft destroyed. Fatal injuries to one.

The pilot was attempting a mid-morning landing at an airport in Argentina. However, he was unable to land because of a thunderstorm over the airport. The aircraft circled the airport for more than a half hour, while the pilot waited for conditions to improve sufficiently for an approach and landing.

At 1045 hours the aircraft crashed into a river during a rainstorm. The aircraft floated a short time before it turned over and sank. One passenger was killed in the accident and five others, including two crew members, survived.

Crashing the Gate

Piper PA-34 Seneca: Substantial damage. No injuries.

The light twin was approaching to land at an airport in India. The final approach was low and the right main gear of the aircraft collided with an airport gate.

The pilot completed the landing and the occupants exited the aircraft with no further incident. The right main landing gear locking mechanism was damaged and the aircraft had to be transported to a maintenance base by road.

Other General Aviation

Finish of a Fortress

Boeing B-17G Flying Fortress: Aircraft destroyed. Two serious injuries, three minor injuries.

The aircraft was being operated by a film company at an airfield in the United Kingdom. The aircraft commander and the copilot had flown together frequently for 10 years and had accomplished numerous film flights.

The four-engine aircraft taxied out and lined up for takeoff on the left side of the runway. Another B-17 lined up to the right and rear of it. As the pilot of the lead B-17 applied power at the beginning of the takeoff roll, everything seemed normal.

However, after about 300 feet of roll, a slight swing to the left developed. The aircraft commander, who was flying the aircraft, corrected the swing by partially retarding the power on engines 3 and 4 and by use of the rudder. Following that, full power was reapplied to all engines.

The aircraft began another swing, this time to the right. The pilot throttled back on engines 1 and 2 and applied corrective rudder. These actions were not immediately effective, and the aircraft did not resume a straight course until it was on the grass to the right of the runway.

Knowing that the aircraft was capable of operating from grass runways, the pilot decided to continue the takeoff. However, after travelling between 1,200 and 1,500 feet, the aircraft swung farther to the right. The aircraft was travelling between 90 and 95 mph by this time.

At that point, the pilot realized that the aircraft's path was obstructed by a tree and a pile of gravel. The left wingtip struck the tree and the number 4 propeller struck the gravel. The aircraft yawed to the right, crossed a hollow in the ground and came to rest in a cornfield.

The fuselage broke in two sections aft of the bomb bay, and a ground fire began immediately. The pilot was not injured, and he assisted some of the passengers to evacuate through the break in the fuselage. All occupants were able to escape the aircraft. Despite the prompt arrival of fire apparatus, the aircraft was destroyed by fire.

The pilot was unable to explain the cause of the accident, although he suggested that the number 1 engine's turbocompressor may have been cutting in and out. He considered that the right wheel brake may not have been completely free. One eyewitness, an engineer who was familiar with the aircraft type, reported that he saw smoke emanating from the area of the number 3 engine at the start of the takeoff roll. He offered the opinion that this engine may have overboosted and then suffered a power loss, thus causing the sequential swings to the left and the right.

Secure All Loose Articles

Steen Skybolt: Aircraft destroyed. Fatal injuries to one, serious injuries to one.

One of the owners of the sport aircraft based at a U.K. airport agreed to take another pilot, a member of the local aero club, for a flight that would include aerobatics and spin-recovery demonstrations. The second pilot had flown in the aircraft on several occasions and had aerobatic experience, but had not flown the aircraft solo.

To prepare for the aerobatic flight, both pilots wore flying suits with zippered pockets, and both wore fabric flying helmets with attached goggles. Neither wore spectacles or sunglasses. The first pilot had emptied his pockets of all potential loose objects and left them behind. When flown solo, this aircraft is normally flown from the rear cockpit. In this instance, the first pilot occupied the front cockpit and the other pilot was in the rear.

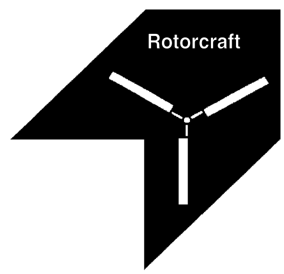
The aircraft took off and several spins and recoveries were carried out, generally from a height of about 4,000 feet. The second pilot recalled doing a roll and a loop before before pulling into a stall turn. During the recovery from the last maneuver, the aircraft rotated, as if it were entering a spin, before rolling into the opposite direction. Suspecting that something had gone wrong, she handed control over to the first pilot. The first pilot then shouted that she should “get off the controls” and repeated it at least twice. She recalled that she did not understand this because she had released the controls when first requested to do so.

The aircraft descended steeply and then seemed to level off just before making firm contact with the ground. The second pilot was aware of flames, mostly from the front, and as the aircraft came to rest there was an explosion. She released her harness and evacuated the aircraft with her flight suit on fire. She smothered the flames by rolling on the ground. The first pilot had been knocked unconscious and remained in the aircraft which was consumed by a fierce fire. Later examination revealed no medical condition that could have contributed to the accident, but medical opinion suggested that the first pilot could have survived had he been wearing a protective helmet. While awaiting the arrival of an ambulance, the second pilot was reported by witnesses to have stated that the rudder had jammed.

Later examination revealed that the aircraft had impacted on flat ground in a wings-level and slightly nose-down attitude. Ground track evidence indicated that the aircraft first contacted the ground with a considerable amount of yaw to the right. It was ascertained that prior to impact, the aircraft had been intact and that all control surfaces were attached and properly connected.

The rudder cables in this aircraft are cable-operated. The rear pilot’s rudder pedals are located on either side of the front pilot’s seat, and in this aircraft were directly below the arm rests. The rudder controls are designed so that it is unlikely that a loose object could cause a jam, except in the vicinity of the pedals themselves. The cockpits are not separated by close-fitting bulkheads, so it is possible for any loose objects to move about freely in flight.

During detailed examination of the accident site, the remains of a pair of spectacles or sunglasses along with an AA-size battery were found among the wreckage. The position they were found indicated to investigators that they must have been aboard during the flight but, since none of the aircraft equipment required such a battery, it was not possible to determine how the items came to be an board.



Horn Blows Before Power Goes

Robinson R-22: Aircraft destroyed. No injuries.

The student was practicing traffic patterns and landings at an airfield in the United Kingdom. After one landing he brought the aircraft to a hover before making another pattern. He checked the engine instruments and found that the readings were all normal.

After taking off, and in the later stage of transition from hover to forward flight, the main rotor low rpm warning horn sounded. The pilot opened the throttle and lowered the collective a little and the warning signal stopped. However, a few moments later as the pilot attempted to re-establish the climb from a height of about 100 feet above the ground, the horn sounded again. This time the helicopter began to descend.

The pilot opened the throttle further but that failed to silence the horn or to stop the descent. He lowered the collective and transmitted a distress message. The aircraft struck the ground in a level attitude and moved for a short distance before somersaulting and coming to rest on its right side. The pilot, the only occupant, was not injured and managed to evacuate the helicopter through the broken windshield.

Later examination of the aircraft revealed that the carburetor heat control was in the full hot position.

Which Instrument Can be Trusted?

MBB Bolkow BO 105: Substantial Damage. Minor injuries to one.

The weather for the flight was generally fair with low clouds between 500 and 1,000 feet with occasional showers and accompanying lower visibility and cloud bases. The helicopter took off at 0825 hours from the Scottish airport and followed a familiar low-level route in VMC conditions.

About four miles short of the destination, the pilot noticed a rain shower ahead with clouds extending toward the surface of the small pass through which his route passed. He decided against flying through the rain shower and began a left turn. Realizing that he did not have enough airspace in which to complete the turn, the pilot began a climb with the intention of achieving a safe height in the IMC conditions.

The airspeed slowed to below 40 knots but the pilot later stated that he made an appropriate correction and maintained about 80 percent torque climb power. At this point the pilot became uneasy about the readings of his artificial horizon indicator. This instrument had a history of sometimes presenting attitudes that disagreed with those indicated on the lefthand standby instrument. The pilot transferred his attention to the standby instrument which was located at the far left side of the instrument panel.

The climb continued to about 2,000 feet when the pilot sensed that the aircraft had begun to descend on its own. He was unable to arrest the descent and then became uneasy about the indications of the left artificial horizon which was indicating wings level and slightly nose up although the compass was indicating a left turn. By this time the pilot figured he had become disoriented so he transferred his attention outside the cockpit in hopes of acquiring a visual reference from the ground as the aircraft descended. He saw that the helicopter was descending toward trees and flared the aircraft and applied full collective pitch. Shortly afterwards, the aircraft entered the trees in a gentle right-hand turn.

The helicopter fell through the trees down a slope and came to rest on its left side facing the direction from which it had come. The pilot, who was uninjured, and engineer, who had some back pain, exited the aircraft after shutting down the engines. They extinguished a small exhaust fire and were able to recover a portable telephone which they used to summon rescuers. The aircraft sustained substantial damage to the fuselage, the main rotor blades were destroyed, and the tail rotor drive was sheared through.

Both artificial horizon instruments were recovered and torn down for inspection. The right hand instrument was found to be unserviceable; one of the balance weights of the erection mechanism had jammed causing a progressive right roll indication. Investigators considered it possible that the fault was intermittent; the jammed erecting balance weight could have become free periodically during startup and shutdown cycles. Thus, it would have presented correct indications on those occasions. The lefthand instrument was found to be serviceable.

No Power on Demand

Reims Cessna F150: Aircraft totalled. No injuries.

The pilot and one passenger were on a local flight from Newtownards, Northern Ireland, during a mid-morning in April. The temperature was seven degrees Centigrade and the wind was from 220 degrees at 10 knots.

The aircraft had been flying at 500 feet heading southward over Strangford Lough until abeam Killy Leagh, when the pilot decided to descend to 300 feet. He selected carburetor heat to prevent engine icing during the descent and circled a small group of islands. The engine power setting resulted in 2,300 rpm.

Abeam the southern end of the islands a short time later, the pilot applied full power and climbed back to a height of 500 feet. However, when the aircraft reached the new altitude, the engine power suddenly decreased and the rpm dropped to 1,200.

The pilot made a Mayday call and carried out the forced landing procedures. The field he selected was straight ahead, but at 150 feet above the ground, the pilot noticed that it was steeper than he first thought and was saturated with water. The only alternate landing site was a small peninsula on the southern shore which he would have to land across because he was too low and far away to utilize the longer landing distance offered coming in towards the land. The pilot selected the peninsula route. On touchdown, he decided that the distance remaining was not enough for a normal stop, so he pushed the control column forward to purposely break the nose gear and stop the aircraft quicker. However, the propeller dug into the ground and the aircraft somersaulted. It came to rest on its back.

There was no fire and the occupants, who were wearing shoulder harnesses, evacuated without injury.

The pilot had stated, during his distress message prior to the forced landing, that his engine had stopped because of fuel starvation, but investigators found fuel in the carburetor.

Call for Nominations for The Joe Chase Award

A call for nominations is being made for the Joe Chase Award, administered by the Professional Aviation Maintenance Association (PAMA) and presented in conjunction with Flight Safety Foundation events. This year's award will be presented during the Foundation's Corporate Aviation Safety Seminar in Montreal, Canada, April 18-20, 1990.

Joe Chase, known in aviation circles as the champion of the forgotten man — the aviation technician — originated publication of the *FSF Aviation Mechanics Bulletin*. He used the *Bulletin* and other means to raise the status of the aviation maintenance technician. Chase recognized that technicians play a vital role in aviation safety and strove to communicate this belief throughout the industry.

Foundation readers are encouraged to participate in the Joe Chase Award program and to **submit nominations by February 1, 1990 to PAMA Headquarters**, 500 NW Plaza, Suite 401, St. Ann, MO 63074. Phone (314) 739-2580; FAX (314) 739-2039.

Eligibility Requirements

One or more of the following is needed for the candidate to qualify for the award:

1. Candidate should show dedication to learn and continuously educate himself or herself and communicate what is learned to others in the aviation field.
2. Candidate must show dedication to the improvement of communications between employer and employee in the aviation industry.
3. Candidate must show dedication to the communications methods which advance the knowledge of the aircraft technician.
4. Candidate must show dedication to the improvement of the role of the aviation technician.

This dedication to the improvement of communications and increased learning must be conducted beyond the normal work requirements.

Nominee Information

Name ______________________________

Address ______________________________ City ______________

State ________ Zip ____________ Telephone (Home) ____________ (Office) ____________

Employer ______________________________

Employer's Address ______________________________ City ______________

State ________ Zip ____________ Telephone ______________________

Nominee's position ______________________________

FAA License # ______________ FAA Certificate # ______________

PAMA National # (if applicable) ______________________________

Nomination submitted by ______________________________

Address ______________________________ City ______________

State ________ Zip ____________ Telephone (Home) ____________ (Office) ____________

Signature ______________________ Date ______________________

• Please use a separate sheet of paper to list nominee's achievements.