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Aircraft Fire Protection

A FUTURE WITHOUT HALONS

Human Factors Research

RESPONDING TO EMERGENCIES

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FEATURES

ICAO UPDATE

COVER

As the article beginning on page 6 explains, the production of halons — a type of chemical used in aircraft fire protection systems — ceased many years ago. This could present a problem for the air transport industry, which has been slow to adopt alternative technologies and consequently remains heavily dependent on the use of halons for fire suppression.

Roy Ooms/Masterfile photo

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* Detail of a mural on display at the ICAO headquarters building, Montreal.

New ICAO business plan is part of a broad strategy initiative

ICAO has put the finishing touches on a business plan that clearly articulates its goals and places the accent on measurable performance.

ICAO SECRETARIAT

FOLLOWING an intensive and elaborate process, ICAO has completed a business plan that addresses the organization's current work programme (2005-07). A living document, the plan will be reviewed and updated periodically.

The newly developed business plan is not about finances per se, but rather the rational allocation of limited human and financial resources in an era of budgetary constraints. The document contains an action plan for meeting all of the organization's strategic objectives, and spells out the key activities and critical steps that need to be taken by the organization.

While the plan identifies areas where more emphasis is needed to reach clearly articulated goals, it also identifies elements that can be downgraded or set aside, if necessary, in order to focus more sharply on priorities. Among current top priorities are ICAO's activities related to enhancing safety, security, environmental protection — specifically, work focused on engine emissions — air transport system capacity and efficiency, and regional and sub-regional issues. Another of the organization's current strategic objectives is to strengthen law governing international civil aviation.

Included in the ICAO business plan is a set of performance indicators which the organization will use to assess how well it is advancing toward its objectives.

As ICAO Secretary General Taïeb Chérif informed delegates to the 35th Session of the ICAO Assembly in 2004, "Given the increasing demands for the services of the organization and the significantly reduced resources, the 2005-07 triennium will be a tremendous challenge to us." The organization, he stressed, will nevertheless deliver all of the critical services expected of it by implementing measures that would enhance performance despite constraints. Hence the need for a business plan, part of a broad strategy to enhance ICAO's performance.

"At the core of our strategy is a shift in perception," Dr. Chérif explained. "It is to transform a perceived crisis into an opportunity. It is to streamline the way we do business, to continuously re-examine the work programme of the organization in order to prioritize activities and remain as responsive to your needs as we have always been, and perhaps more so."

updated annually in the context of budgetary realities. All efforts were made with the current plan to accommodate the existing 2005-07 programme budget, but subsequent business plans are expected to reverse this sequence, with development of a programme budget based on the business plan, the first step in the budgetary cycle.

With respect to one top priority, aviation safety, the current business plan calls for more emphasis on certain activities, among them the development and implementation of a formal safety management process within ICAO itself (a process that includes remedial actions to correct safety deficiencies) as well as support for the adoption of safety management systems

Jim Jorgenson

ICAO's new business plan is ultimately about ensuring that the organization utilizes its resources appropriately, in light of its mission statement and changing priorities.

In developing the business plan, all line managers and supporting staff throughout the organization were consulted about their roles and activities. Now that the plan has been finalized, it will be

across all safety-related disciplines in all States. Emphasis is also placed on the Universal Safety Oversight Audit Programme (USOAP), implementation of

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Slow transition to halon alternatives in new aircraft raises concern

Although production of halons has long ceased, the airline industry is still heavily dependent on their use in aircraft fire protection systems. This reliance could be problematic considering that stockpiles of halons will expire before newer aircraft reach their retirement date.

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DANIEL VERDONIK • BELLA MARANION
(UNITED STATES)

MODERN aircraft fire protection has historically relied on chemicals known as halons, but these substances have been recognized since the 1980s as being particularly destructive to the stratospheric ozone layer. The end of global halon production, uncertainties in the availability and quality of stockpiles, and the lag in adopting available substitutes raise the concern that civil aviation is unprepared for a future without halons.

According to a recent report prepared for the U.S. Environmental Protection Agency (EPA) by ICF Consulting, transition in the United States to the next-generation halon alternatives for aircraft fire protection systems is impeded by technical, regulatory and procedural issues.* The authors of the report conclude, moreover, that this situation is likely mirrored in most member States of ICAO and may pose a significant problem for airlines worldwide. Addressing the potential impacts of the transition away from halons will be most successful through the coordinated action of ICAO member States.

Need for ozone protection

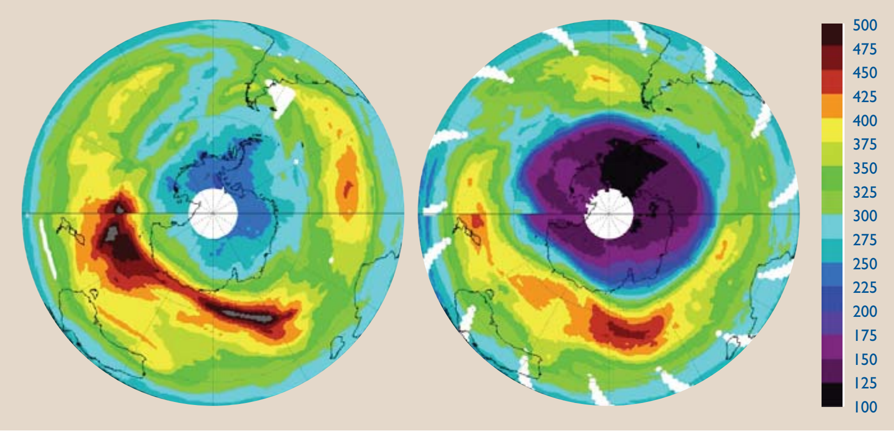
Over two decades ago, atmospheric scientists warned that the annual appearance of the Antarctic ozone hole and the probability of increasing depletion of the stratospheric ozone layer had serious consequences for all life forms. This came after discoveries in the mid-1970s that some man-made chemicals could destroy ozone, resulting in increased ultraviolet radiation reaching the Earth (see figure on this page).

Although ozone is a small component of the atmosphere, the ozone layer plays a vital role in shielding life on Earth from harmful ultraviolet (UV-B) radiation from the sun. Human exposure to UV-B is known to increase the risk of skin cancer, cataracts, and a suppressed immune system. UV-B exposure can also damage terrestrial plant life, single-cell organisms and aquatic ecosystems.

The evidence that human activities were destroying the stratospheric ozone layer was compelling. Emissions of certain man-made chemicals used in many common products such as refrigerators, air conditioners, cars, fire extinguishers, foams and cleaning solvents were reaching the stratosphere, between 10-16 kilometres and up to 50 kilometres above the Earth's surface, and destroying ozone molecules. With the appearance of the ozone hole, many countries joined efforts for the first time to combat this global environmental threat. Over 180 countries to date have ratified the landmark international environmental treaty, the 1987 *Montreal Protocol on Substances that Deplete the Ozone Layer*. Parties to the Montreal Protocol are committed to eliminating production of ozone-depleting substances by meeting specific phase-out deadlines.

Almost 20 years later, the parties to the Montreal Protocol are now gauging the success of the ozone protection policies and regulations that have been implemented, and are reviewing atmospheric measurements that could indicate the beginnings of a recovery of the ozone layer. In addition, they are identifying sectors that lag in moving away from the use of ozone depleting substances and consequently have the potential to significantly delay or prevent this recovery.

Halon phase-out. Owing to the high ozone depletion potential of halons, the Montreal Protocol called for an end to their production by 1994. Before production ceased, however, halons found extensive use worldwide as clean, safe and very effective gaseous fire suppression



NASA images

The ozone "hole," visible over Antarctica, in 1979 (left) and 2005.
(Dobson Units: Dark Gray < 100 and > 500 DU)

agents. In particular, two halons emerged as the agents of choice for many military and commercial fire protection applications: halon 1301, used in fixed total flooding fire extinguishing systems; and halon 1211, used for streaming applications, primarily in handheld fire extinguishers.

Over the last two decades, the availability of many substitutes and alternative technologies has significantly reduced the need for halons in virtually all new installations, and in most applications retrofit has been possible to further reduce the need for halons. In some sectors, however, difficult fire/explosion suppression problems have posed significant technical challenges in making the transition away from halons. This was the case for the military, the merchant marine community, the oil and gas production industry, and the civil aviation industry.

In the military sector today, new facilities or new designs of military equipment no longer require halons (although stockpiles are maintained to service existing equipment that cannot be retrofitted). Military development and testing of halon alternatives have helped in the adoption of alternatives in other sectors. In the merchant shipping sector, halons were banned from use in new ships in 1992 and managed stockpiles service pre-1992 vessels. The oil and gas production sector protects new facilities using available halon alternatives and is managing stockpiles to maintain existing halon equipment.

In contrast with these sectors, the commercial aviation industry has lagged behind in adopting alternatives and new technologies. Existing aircraft and new designs continue to depend on halons for the majority of their fire protection applications.

Halons and aircraft

Halon is used for fire suppression on civil aircraft in lavatory trash receptacle extinguishing systems, handheld extinguishers, engine nacelle/auxiliary power unit (APU) protection systems, and cargo compartment extinguishing systems.

With the exception of lavatory trash receptacles on some Airbus aeroplanes, all new installations of fire extinguishing systems for lavatory trash receptacles, engines and cargo compartments use halon 1301, and all new installations of handheld extinguishers use halon 1211. There has been no retrofit of halon systems or portable extinguishers with available alternatives in the existing worldwide fleet of aircraft. In other words, the airline industry is still heavily dependent on halons; given the anticipated 25-30 year lifespan of commercial aircraft, this dependency is likely to continue well beyond the time when existing recycled halon stocks expire.

Application	Date of Finalized MPS	Status of Testing to MPS		Alternatives installed on aircraft
		Alternatives tested to MPS	Alternatives meeting MPS requirements	
Lavatory Trash Receptacle	February 1997	HFC-125, HFC-227ea HFC-236fa, Envirogel	HFC-227ea HFC-236fa	Airbus A340-600 (HFC-236fa)
Handheld Extinguishers	August 2002	HFC-236fa HFC-236fa/HFC-23 HCFC Blend B HCFC Blend E Envirogel (two versions)	HFC-227ea HFC-236fa HCFC Blend B	None
Cargo Compartment	April 2003	Water mist Water mist/nitrogen HFC-125 Bromotrifluoropropene ("BTP")	Water mist/nitrogen	None
Engine Nacelle/APU	Not available	CF3I, HFC-125	Not available	None

Status of the development of minimum performance standards and the testing of halon alternatives.

With no new halon production allowed, commercial aircraft manufacturers must look either to their own stockpiles of halons or to the limited amounts of recycled halons available on the open market to avoid grounding aircraft because of a lack of appropriate fire protection. This situation is a major cause for concern because even if the parties to the Montreal Protocol were to allow future halon production to service aircraft safety needs, it is estimated that the cost to restart production for a relatively small market would result in halons priced in the U.S. $400 to $600 per kilogram range. (This calculation assumes, of course, that a chemical company would be willing to invest in the manufacture of halon.)

Substitutes for halons include both in-kind gaseous agents and not-in-kind alternatives. In-kind alternatives to halon 1301 used in total flooding fire extinguishing systems include conventional agents such as carbon dioxide and those addressed in the U.S. National Fire Protection Association 2001 standard, *Clean Agent Fire Extinguishing Systems*, which include hydrofluorocarbons (HFCs), hydrochlorofluorocarbons (HCFCs), a fluoroketone and inert gases. Not-in-kind halon alternatives include water sprinklers, fine water mist, foam, dry chemicals and aerosols.

Since 1994, when halon production ended in developed countries, initiatives such as the U.S. Environmental Protection Agency's (EPA) Significant New Alternatives Policy (SNAP) Programme and the U.K. Halon Alternatives Group (HAG) Toxicological *Report on Alternative Agents to Halon* have evaluated many substitutes and alternative technologies for replacing halons. Typically, the programmes assess overall risks to human health and the environment posed by use of the substitutes and consider information such as the substitute chemical's toxicity, ozone depletion potential, global warming potential, environmental fate and transport, occupational and end-use exposure, and commercial availability. The SNAP Programme's evaluations and EPA's determinations of the acceptability or otherwise of substitutes for halon 1301 and halon 1211 are published through formal notices and rules. The listings are posted and updated on its website (http://epa.gov/ozone/snap/fire/halo_10_01_04.pdf), and are legally binding in the United States. The latest HAG report can be found on the website www.hunc.org, and is provided for information only to the general public and regulators.

Minimum performance standards. Key to the acceptance of one or more of the approved substitutes has been their ability to demonstrate a fire extinguishing performance equivalent to halon in specific applications. As such, substitutes for halons in civil aviation fire extinguishing systems are evaluated and approved according to the relevant minimum performance standards and testing scenarios developed by the International Aircraft Systems Fire Protection Working Group (IASFPWG), originally established in 1993 by the U.S. Federal Aviation Administration and cooperating agencies and known then as the International Halon Replacement Working Group.

The recent EPA report on the transition away from halons in the U.S. civil aviation sector examined the current minimum performance standards and test scenarios as part of the process of identifying transition barriers. The 2004 report concluded that the minimum performance standards test protocols for lavatory trash receptacle extinguishing systems, hand-held extinguishers and cargo compartment protection systems have been adequately designed to provide an equivalent level of safety to that provided by halons, and the fire test protocols for the halon alternatives were found to be realistic without being excessively stringent.

The exception to the foregoing is in the case of engine nacelle/APU protection systems, where the lack of finalized minimum performance standards is a barrier to using alternatives to halons in this application. The table on page 7 summarizes the status of the development of each minimum performance standard, and lists the substitutes that have been tested and that meet the requirements of the relevant, finalized standards.

For aircraft fire protection, having an alternative that passes the relevant minimum performance standard is only the first step in the extended process that needs to be completed before installation on board aircraft. There are also regulatory and manufacturing procedures that need to be followed. The 2004 EPA report also describes the procedures that need to be completed in the United States in order for halons to be replaced in the specified applications on new airframes, along with the estimated time for their completion. It highlights the extraordinary length of time that has been spent developing the minimum performance standards, and the slow progress made in installing alternatives that have satisfactorily completed the testing process. However, the report also indicates that there are no obvious immediate incentives for aircraft manufacturers and airlines to begin the change away from the use of halons, even with the looming uncertainty of future halon supplies.

The availability of substitutes and alternative technologies has significantly reduced the need for halon

In addition to the long approval process, the lack of a regulatory requirement to eliminate halon use has often been cited as a reason for the slow transition away from halons in civil aviation. Regulations that allow the continued use of recycled halon have enabled airlines to avoid the costs of early equipment retirement and have not encouraged them to opt for a smooth transition to available alternatives, as in the other sectors. Current halon needs are consequently being met by using existing stockpiles or decommissioned systems reaching the end of useful equipment lifetime. Further, the trend is that new aircraft are continuing to rely on halons. However, as is true for all finite resources, the halon stockpile will diminish and eventually disappear as the number of remaining halon installations dwindles. Some airlines may have taken the necessary steps to ensure a secure supply, but most probably rely on service companies that simply purchase from the currently available, but increasingly uncertain, market.

Economic barriers to the transition away from halons in civil aviation are the relatively low cost of halons at present and the comparatively higher cost of alternatives — up to 10 times higher in some cases. Therefore, until supplies of recycled halon become prohibitively expensive to procure or are simply unavailable, the civil aviation industry lacks an economic incentive to move away from halons to the higher-priced alternatives. With a steady or increasing demand and a dwindling supply, however, it is clear that prices of recycled halons will eventually rise significantly. This is a reality that many in the industry must anticipate and plan for now in order to avoid an uncertain and potentially significant economic burden later. Additionally, with the exception of lavatory waste receptacle bottles, the identified alternatives present weight and volume penalties that translate into further economic disincentives. However, this should be considered in the context of overall aircraft operating and equipment lifetime costs.

It is notable that despite similar cost penalties in the other sectors that have difficult problems to overcome, users outside the civil aviation community have successfully made the transition away from halons by maintaining existing systems (thus retaining the initial equipment investment) while adopting halon alternatives in all new installations. This is a model that civil aviation should follow to prepare itself for the future.

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* The 2004 EPA report, *Review of the Transition Away from Halons in U.S. Civil Aviation Applications*, examines in particular the current minimum performance standards developed by the International Aircraft Systems Fire Protection Working Group (IASFPWG) — formerly known as the International Halon Replacement Working Group — for the U.K. Civil Aviation Authority (CAA), the U.S. Federal Aviation Administration (FAA), the European Joint Aviation Authorities (JAA) and Transport Canada, as well as the fire test scenarios employed to evaluate and approve alternatives to ozone-depleting halons in civil aviation. The report, on which this article is based in part, may be obtained at the EPA website (http://www.epa.gov/ozone/snap/fire/index.html).

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Airport readiness for possible pandemic benefits from experience with SARS

With the threat of avian flu on everyone's mind, the time may be ripe to develop a new airport contingency plan for addressing a pandemic, and, moreover, to establish applicable provisions and guidelines for preventing the spread of communicable diseases by air transport.

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THE outbreak of severe acute respiratory syndrome (SARS) that occurred in 2003 dealt a severe blow to airports and airline operations in the affected countries. ICAO acted swiftly to help contain the impact by developing a set of anti-SARS protective measures. The second phase of the ICAO initiative focused on establishing a contingency plan for handling a resurgence of SARS. This plan is flexible enough that it can cater to other newly emerging infectious diseases such as the avian flu, about which there is growing concern.

An official uses a portable infrared sensor system to check a passenger's forehead temperature.

With the possible threat of a new, and possibly global, pandemic on everyone's mind, it is timely to review the details of the SARS contingency plan. Although developed in response to a particular public health crisis, the 2003 plan can serve as the starting point for development of a new plan tailored to address an emerging disease.

The outbreak of SARS in several countries in south-east Asia and elsewhere in early 2003 led to intensive consultations and decisions by those affected. In addition to the combined effort to combat the contagious disease, ICAO was equally concerned about the possibility that air transport could contribute to the spread of SARS, and the organization moved quickly when asked by Singapore to assist in the development of anti-SARS protective measures at airports.

A reactive phase to the outbreak, managed by ICAO's Technical Cooperation Bureau, was successfully completed in mid-2003. The purpose of this intervention was not only to combat the spread of SARS via air travel, but to fully restore the travelling public's confidence in the safety of air transport (see "Inspections of anti-SARS measures at key airports pay dividends," Issue No. 7/2003, page 23).

Following this experience with a public health crisis, ICAO adopted a more proactive approach to the problem presented by emerging infectious diseases. The new approach includes the development of a standard system to allow a phased response, commensurate with the threat of recurrence of SARS as determined by the World Health Organization (WHO). This proactive approach matches an epidemiological risk analysis with different levels of readiness to implement the eight protective measures developed under the auspices of ICAO.

The proposal to set out a standard contingency plan received strong support and was immediately taken up by a number of countries. A meeting to finalize the plan, hosted by the Civil Aviation Authority of Singapore in November 2003, was well attended by representatives of the concerned authorities, China, the Hong Kong Special Administrative Region, ICAO, the International Air Transport Association (IATA) and the Association of Asia Pacific Airlines (AAPA).

ROLE OF ICAO

ICAO SECRETARIAT

ICAO is in the midst of forming a task team to provide well informed and timely advice to States, airlines and airports in an effort to ensure that the global aviation industry can mount a harmonized response should the level of risk of human infection by avian influenza (commonly known as "bird flu") increase in the future.

The international team will comprise experts from different sections of ICAO as well as participants representing the International Air Transport Association (IATA) and Airports Council International (ACI). The team will work closely with the World Health Organization (WHO) and the United Nations Foreign Affairs Office. While avian influenza will be the focus of attention, the team will define procedures to be put in place that could address a variety of public health risks which potentially involve the spread of disease via air travel.

Recently ICAO and other concerned agencies participated in a WHO meeting in Geneva to consider the threat posed by avian influenza and human pandemic influenza. The meeting's participants agreed that the

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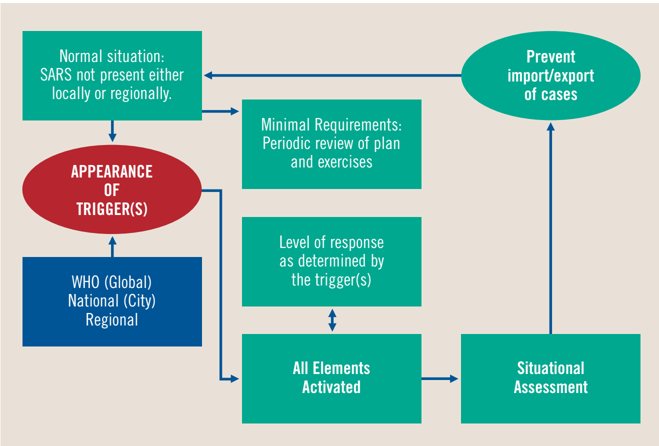
The group of public health and air transport experts focused on developing a phased response plan in the event of resurgence of SARS, but with an eye on the future, it also spelt out a plan that could be adapted for any contagious disease that may impact airport or airline operations. To implement this phased plan effectively, an airport needs guidelines that spell out the policies and procedures.

The guidelines for a phased response plan need to cover the widest possible spectrum, ranging from a desirable disease-free environment on one end of the spectrum, to a confirmed outbreak of the disease, both locally and internationally. (During a pandemic phase, all measures outlined in the airport anti-SARS measures should be in place.)



Example of an airport contingency plan flow chart that might apply to a newly emerging contagious disease.

Each phase of the plan needs to be clearly defined by the airport authority or national aviation authority, preferably with time lines indicated. It is recommended that the various phases be denoted in either a numerical or colour-coded scheme that takes account of the prevailing national policy. Time lines for the different phases would have to allow for sufficient resources to be allocated at each step.

Other agencies would be involved in implementing the airport contingency plan, and the airport authority should have a list of these participating agencies. Ideally, an organizational chart should be drawn up, detailing the working relationship between these various agencies. The person assigned to be the focal point for coordination with the other agencies would normally be the airport's designated public health official.

The contingency plan needs to include a triggering event for each step of the phased response. In normal circumstances, these "triggers" are defined by notifications received from the WHO global alert and response system.

In the case of larger countries, a national alert may be confined to a limited number of cities. In this situation, only the airports in the affected cities would need to implement the response plan.

Where embarking passengers are concerned, a public health screening process would usually be initiated as soon as WHO has informed authorities that disease transmission is occurring locally, a notification that is based on an index case. The contingency plan should also specify the time line for screening departing passengers. Cessation is usually triggered by a WHO declaration that the affected area has remained free of disease transmission for a minimum period of time and that other important WHO criteria have been met.

Although the current WHO preparedness plan places an emphasis on screening departing passengers, an airport authority should also consider implementing the screening process for arriving passengers, when this is recommended by WHO because the global alert and response system shows an outbreak of contagious disease in a specific country or region. This is particularly important if the alert concerns a country or region that has direct air links. At the same time, it must be recognized that infected passengers could transit through airports that do not have direct links with the airport where the contingency plan is in effect.

The airport contingency plan should outline the basic elements of command, coordination and communication, starting with a clear indication of the organization authorized to activate the plan. Such authority would usually be given to the relevant health ministry, in consultation with the transport ministry. The plan should feature an activation list on which all personnel required for carrying out activities related to each step of the response are identified, as well as indicating the individual responsible for contacting personnel.

Lines of communication between the participating agencies need to be spelt out. An important aspect is arrangements, through the appropriate authority, for providing information to the news media as well as educational information for the public that may help in preventing panic from arising.

The appropriate authority also needs to designate the ambulances and hospitals to be used in addressing the crisis. A properly equipped emergency response room or control centre also needs to be designated.

The possibility that an airport worker could become infected must be taken into account, and sufficient thought given to a plan for overcoming any disruption to airport activities resulting from such incidents.

Drills and exercises to ensure the contingency plan remains workable and effective should form part of the plan. Essentially, these would be conducted periodically in order to confirm that the plan can be implemented effectively. A continuous process of review is recommended, with an audit process put in place by the national authority.

While the SARS contingency plan can form the basis of planning for any infectious disease that could affect an airport, it is important to bear in mind that the mode of infection by other diseases could be different, and similarly, the cardinal symptoms and signs of the disease may not be the same. In such a situation, the process of screening passengers would have to be modified in accordance with WHO criteria. For example, the SARS contingency plan included a recommendation for passenger screening at the arrival point, whereas the WHO preparedness plan for global influenza does not include such a recommendation (except for those flights on which one or more people have developed symptoms).

The accompanying flow chart (page 10) is an example that might apply to a newly emerging contagious disease, and summarizes the flow of events related to implementation of a contingency plan at airports.

With the current concern about avian flu, it may be prudent for aviation authorities to now develop a similar airport contingency plan to combat the spread of that disease. It may also be timely to evaluate and possibly proceed with developing ICAO standards and recommended practices and/or guidelines related to the medical preparedness contingency plan. Indeed, the 35th ICAO Assembly held in 2004 resolved to take action in this respect. For the first time, the health of passengers and crews on international flights was recognized as an integral element of safe air travel, with adoption of a resolution calling for ICAO to review standards relating to health issues, to create new ones where appropriate, and to support further research on the health consequences of air transport. Among other things, ICAO was directed to develop, as a matter of priority, standards and recommended practices in the appropriate annexes to the Chicago Convention in order to address contingency plans to prevent the spread of communicable diseases by air transport.

As a quick review, following is an abbreviated description of the eight protective measures developed for implementation at airports — in this case in response to the 2003 SARS outbreak. The full description of the recommended anti-SARS measures is posted at ICAO's website (http://www.icao.int/cgi/goto_m_med.pl?icao/en/trivia/AvMedSARS.htm). This list of protective measures is to be updated periodically.

The Boeing Co.

Following the experience with SARS, ICAO adopted a proactive approach to the handling of emerging infectious diseases.

As a first step, an airport public health emergency official should be appointed and made responsible for all protective measures; this person, who is not necessarily a physician, coordinates the protective measures at the airport.

Second, warning is given (e.g. posters, PA announcements) to crew and passengers before or immediately on entering the airport premises that no one with symptoms of the disease will be allowed to board any flight.

Third, screening of departing passengers for symptoms is undertaken in accordance with WHO recommendations. This is accomplished by interviewing departing passengers no later than at check-in.

Fourth, disembarking passengers arriving from affected areas are normally screened by responding to questionnaires, completed during the flight or, at the latest, immediately upon disembarkation. These questionnaires are reviewed at the time of disembarkation. Passengers offering positive responses are referred for secondary screening. Passengers arriving from non-affected areas, but who may have been routed through an affected area, are normally screened as well.

It is important that all passengers are provided with information about the symptoms of the disease and the appropriate public health contact numbers, if available, and that procedures are in place to respond to the arrival of an aircraft with a possible case on board.

Finally, among the anti-SARS protective measures are two steps concerning airport personnel directly. First of all, airport workers in a SARS affected region should be subject to daily temperature screening at the beginning of their work shift. Furthermore, workers need to be reminded by posted information or other means of their obligation not to report to work if they are not well. □

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Study examines ways to extend essential air services schemes to international level

A recent study concludes that it is feasible for States to implement an international regulatory scheme which can act as a safeguard for international air services of a public service nature, as well as an instrument for the development of tourism routes.

TORU HASEGAWA
ICAO SECRETARIAT

ONE important role of any government is to ensure the provision of essential services. Although there is no uniform definition of what constitutes an essential service, this might be described as any basic economic service that is necessary for the efficient functioning of society. Some essential services, like clean water and electricity, are indispensable to life and health, while others are vital to economic prosperity and societal development.

In the air transport sector, the question of how to assure the provision of essential air services (EAS) has attracted considerable interest, especially in an increasingly liberalized setting.

An essential air service is generally regarded as any service of a public or social service nature which a State may consider necessary but where the market may not have sufficient incentive to respond. Air service to remote destinations, for example, may be viewed as indispensable by some States. Many of these routes, however, are characterized by very limited demand or the exceptionally high cost related to external factors over which airlines have no control. On such "thin" routes, an airline may not be able to cover its operating cost no matter how much it charges for the service. In such situations, services may be limited or non-existent without some form of external support.

The issue of guaranteeing essential air services is often related to regional development, and specifically government policy aimed at facilitating or even driving economic and social development. Among routes that are not currently operated or that are under-served, there may be services that are potentially viable and that can generate substantial spin-off benefits to the airport catchment area, given appropriate support. Without reliable, attractive air services and harmonized aviation and tourism policies, such benefits simply cannot be realized or are at best constrained.

Jim Jorgenson

Although government assistance may impact negatively on trade and competition, a targeted direct subsidy for airline operation on a specific route can be justified when properly designed and applied.

To secure the provision of air services, domestic- and regional-level essential air service schemes have been established in several jurisdictions where liberalization or deregulation has already taken place. Australia's Remote Air Service Subsidy (RASS) scheme, the U.S. EAS Programme, and the European Union's Public Service Obligation (PSO) scheme, are some examples. These are mechanisms whereby support, in the form of a targeted direct financial subsidy or exclusive concession, can be provided to airlines for operating on specific routes and for providing certain services in a liberalized environment. The mechanisms enable support to be established using criteria defined by a legislative body and in accordance with a defined administrative process. Until now, however, essential air service schemes have been less common at the international level.

Joint study

In cooperation with the World Tourism Organization (WTO), ICAO completed a study in spring 2005 on how the concept of support for essential air services could be extended to the international arena. The study looks at how existing essential air service schemes have supported specific domestic and regional routes, and how these approaches might be applied in the international context. At the same time, the study elaborates on the WTO concept known as the essential tourism development route (ETDR). The "Study of an Essential Service and Tourism Development Route Scheme" is downloadable from the ICAO website (www.icao.int/cgi/goto_m.pl?icao/en/atb/ecp/Services.htm).

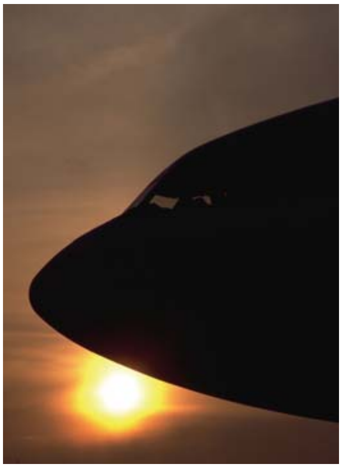
The ICAO-WTO study has its origins in the work of the Fifth Worldwide Air Transport Conference of 2003, which concluded that "States should consider the possibility of identifying and permitting assistance for essential service on specified routes of a public service nature in their air transport relationships."

The ETDR is a variation of the essential air service concept, and refers to an international route between markets that generate and attract tourists. This is particularly the case where the tourist destination is a least developed country, and where an adequate level of service is not fully supplied or would be at risk under existing market and regulatory arrangements.

The study concluded that it is possible to construct a single international regulatory scheme known as an essential service and tourism development route (ESTDR) by applying the basic parameters and modalities of existing EAS schemes internationally. States could use this scheme for granting a targeted direct subsidy or regulatory assistance to an airline operating on a specific international route that may be considered an essential air service or essential tourism development route, either separately or jointly.

The objectives of an ESTDR scheme are to assure provision of "lifeline" air services for remote or peripheral locations anywhere in the world, irrespective of profitability, and to facilitate the economic development of tourism countries, including least developed countries. In other words, the scheme is expected to work as a safeguard exclusively for assuring provision of international air services of a public service nature, as well as an instrument used solely for tourism route development.

Although government assistance may impact negatively on trade and competition, a targeted direct subsidy for airline operation on a specific route — when properly designed and applied on a limited scale — can be justified. The subsidy may be considered reasonable if it could help generate a sustainable service that could not be provided on a for-profit basis, and if the economic and social benefits outweigh the cost of the subsidy provided and the cost of inefficiency resulting from the potential market distortion. The empirical evidence from domestic air transport and other sectors in several developed countries supports this hypothesis, indicating that targeted direct subsidies aimed at meeting particular needs of individual communities have marked advantages in terms of keeping the cost of subsidies low, guaranteeing a continued minimum level of service, and ensuring that local service requirements are met.



Airbus S.A.S.

ESTDR schemes provide an efficient means of assuring service to particular destinations

Considering the positive impact of existing EAS schemes, together with the common aspects of domestic and international air transport economics, there is ample justification for applying a domestic EAS scheme to an international market. The demand and cost characteristics of international services are the same as domestic air transport, and are similar to those of other service sectors. Economically speaking, a number of financially unprofitable international routes of a public service nature or important potential for tourism in least developed countries might be considered de facto equivalent to domestic and regional routes currently supported by existing EAS schemes.

An ESTDR scheme does not have general applicability at the international level. Since it is an extension of existing EAS schemes, its application presupposes the existence of, or transition towards, a liberalized international market. In exceptional cases, the ESTDR scheme could be applied to non-liberalized routes that have untapped tourism potential. The use of the scheme for non-liberalized routes should, however, be a last resort because traditional air services agreements already provide implicit assistance to airline operations on such routes by limiting competition. In many instances, the airlines themselves may well be able to offer and exploit creative ways of meeting the service requirement at a lower cost once they have gained some experience in serving the market.

The seven pillars

While most parameters and modalities of existing EAS schemes are transferable to the international environment, it is important to ensure that an ESTDR scheme remains transparent, accountable, non-discriminatory and sufficiently flexible. As far as possible, it is also necessary to ensure that the scheme is market-oriented to mitigate potential negative impacts on the marketplace and to encourage efficiency.

The ICAO-WTO study took a step-by-step analytical approach to the construction of an ESTDR scheme around seven pillars, specifically those of route selection, service level specification, carrier selection, contract duration, payment of subsidies, financing sources and supplementary options. Each of these pillars is described briefly below.

Route selection. Eligible routes should be solidly based on socio-economic objec-

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The objectives of an ESTDR scheme are to assure provision of lifeline air services for remote or peripheral locations anywhere in the world, irrespective of profitability, and to facilitate the economic development of tourism countries.

tives and economic justification. The ICAO-WTO study proposed use of a two-stage test in selecting routes; in the first stage, the test would examine in qualitative terms whether there is a demonstrable need for a particular international air service. Such needs may include, but not be limited to, assuring lifeline provisions to remote or peripheral areas, supporting vital economic sectors (especially in the case of tourism development areas), and maintaining international links to major commercial and political destinations.

The second stage of the test would be a quantitative economic assessment, based on demand for air services and airline operating costs at both the individual route and network levels. The candidate routes should be classified as either not being commercially viable (i.e. a route rendering any operation unprofitable) or sustainable as a natural monopoly. The latter situation occurs when a single airline could provide all of the services at a lower cost to the consumer than could two or more airlines, and market forces in any event will not support more than one air carrier.

Service level. An adequate level of air service should be specified, usually in terms of frequency and seating capacity, as a minimum requirement on each selected route. A number of factors need to be taken into consideration, among them the particular need for air services, the level of demand, the availability of connecting air services, the presence of third-country airlines, services by non-scheduled operators, and other forms of available transport. Also to be considered are air fares and their associated conditions, as well as the effect on other airlines operating or intending to operate on the route or adjacent routes.

In performing such an exercise, a flexible and market-oriented approach is advocated. Under such an approach, the goal is to set the capacity requirement only (e.g. blocked space or part-charter arrangements), leaving the air carrier free to decide other elements. In this way, the airline's entrepreneurialism would not be constrained.

Carrier selection. The airline chosen for a route should be selected through a competitive tendering or bidding process, with clearly-defined criteria. Such competitive bidding is advantageous because it tends to minimize the extent of subsidy payment. In principle, a State should not confer a special advantage on its national airlines, but treat them on equal terms with other interested airlines, subject to the applicable air services agreements governing the route concerned.

In using an auction to select a carrier, the successful bidder would be either the tender requiring the lowest financial compensation or the overall best tender in terms of the applicant's financial soundness, proposed business plan, ability to develop partnerships with the tourism sector, and the amount of compensation requested.

Some States may wish to award an exclusive concession or licence (i.e. a franchise) to one airline in conjunction with, or in place of, a subsidy when the route is considered to be a sustainable natural monopoly. Any market protection measure, however, requires legal certainty in the form of an air services agreement and robust economic justification.

Contract duration. The duration of a contract for provision of essential air services should be determined carefully, on a case-by-case basis, since it may serve as an incentive and has implications for efficiency. For example, there is a significant economic trade-off between increasing the investment risk for potential bidders (in the case of short-term contracts) and creating a strategic advantage for the incumbent (in the case of a long-term contract). In both cases, but particularly in the case of long-term arrangements, it may be necessary to provide for a mid-term review and/or enforcement or monitoring process, such as an audit. Renegotiation may be necessary to deal with unforeseeable developments. Regardless of the length of contract, applications to operate an essential service and tourism development route should be for a transitional or start-up period.

Subsidy payments. When the contract includes payment of a subsidy by way of compensation for providing the required operation, this should be paid on a reimbursable basis. The amount of compensation should correspond to the figure identified in the tender as the expected shortfall between revenues and costs generated

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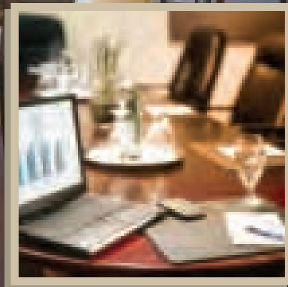
Downtown Montreal



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Many factors affect crew effectiveness in handling emergency or abnormal situations

A major research effort is required to find solutions for many of the dilemmas faced by flight crews when an emergency or abnormal situation arises, and to lay a foundation for best practices that help prevent accidents.

BARBARA K. BURIAN
IMMANUEL BARSHI • KEY DISMUKES
NASA AMES RESEARCH CENTER
(UNITED STATES)

EMERGENCY and abnormal situations occur aboard aircraft every day. The seriousness of these daily occurrences ranges from life-threatening and highly time-critical to mundane and relatively trivial. Fortunately, emergency and abnormal situations aboard aircraft rarely result in accidents. Yet even when the aircraft lands safely, shortcomings are often evident in checklists, procedures, training, crew coordination, and the way the situations are managed.

What influences the manner in which an emergency or abnormal situation will be handled? To answer this question fully, it is necessary to first examine pertinent issues within six interrelated areas:

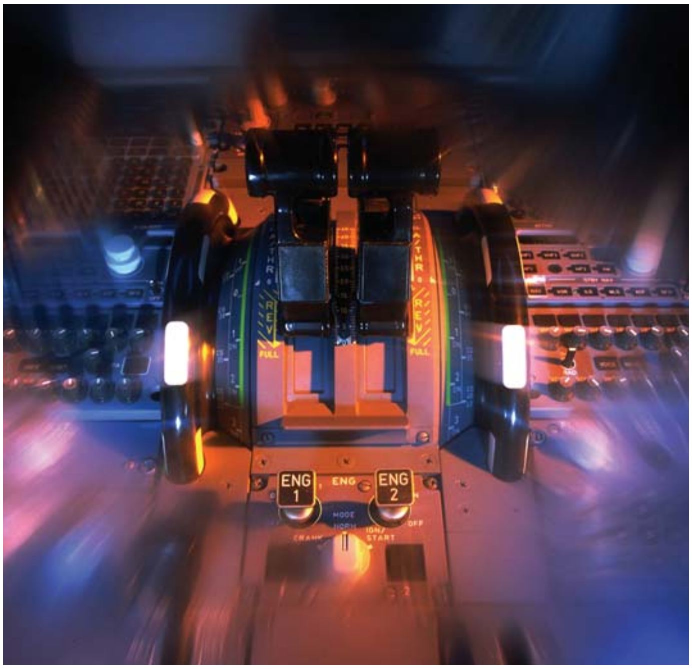
- specific aspects of emergency or abnormal situations;
- training for emergency and abnormal situations;
- economic and regulatory pressures in aviation;
- human performance capabilities and limitations under high workload and stress;
- aircraft systems and automation; and
- philosophies and policies within the aviation industry.

The issues in each of these areas must then be explored as they relate to the design of procedures and checklists and ultimately to crew response, coordination, and management of emergency and abnormal situations in aviation.

Specific aspects of abnormal situations. Emergency and abnormal situations vary along several dimensions. Determining the degree of time criticality and level of threat — two of these dimensions — is crucial and can be especially difficult when the cues presented to the crew are contradictory or ambiguous. Is the odd smell an indication of a fire or merely commonplace output from the air conditioning system? The crew of Swissair Flight 111 was unable to tell initially.

The complexity, amount of increased workload, and degree to which a situation is novel or familiar, are other dimensions along which these situations may vary. Many non-normal situations involve a single, well-isolated malfunction. However, even these situations often go beyond the scope of published procedures and checklists.

It is important to keep in mind that some situations may be so time-critical or may unfold so quickly that all energy and attention must be given to controlling and landing the aeroplane with few resources to spare for even consulting a checklist. Such was the case in 1988, when an 18-foot section of fuselage separated from a Boeing 737-200 that was levelling off at 24,000 feet. The flight crew estimated that they completed — largely from memory — all or significant parts of 17 different checklists in the 13 minutes it took for them to complete an emergency descent and landing.



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Human performance under high stress and workload needs to be taken into account when developing procedures and checklists to be followed in an emergency or abnormal situation.

Training for abnormal situations. Training is another important factor that significantly affects how an emergency or abnormal situation is handled. In the United States, training is generally driven by the need to complete Federal Aviation Administration (FAA) mandated manoeuvres described in FAR Part 121. Training under the Advanced Qualification Programme (AQP) allows more flexibility but here, too, time constraints and cost tend to restrict the range and depth of training for emergencies.

Under both AQP and FAR Part 121 crews rarely, if ever, face a situation in the simulator for which there is no checklist or procedure, even though this can be the case in actual emergencies. Likewise, they rarely encounter an event for which the checklist procedures do not work as expected — the light on the overhead panel goes out, the crossfeed opens, the engine fire is contained.[1] It is typically only in line-oriented flight training (LOFT) or line operational evaluation (LOE) simulator sessions, if even then, that crews might be required to avoid other traffic or deal with deteriorating weather conditions while responding to an emergency. Thus the degree to which training truly reflects real-life emergency and abnormal situations with all of their real-world demands, especially with regard to communicating and coordinating a response with others, is often limited.

Despite these drawbacks, however, flight crews do benefit from the training for emergency and abnormal events they currently receive. In a review of 107 reports involving emergency or abnormal situations filed with the U.S. Aviation Safety Reporting System (ASRS), researchers found 25 described situations that appear to have been handled quite well.[2]

Nineteen of these 25 reports involved what might be called "textbook" abnormal or emergency situations — those situations that generally involve only a single system malfunction (as opposed to multiple problems), are highly trained and practiced in a simulator, and for which good checklists exist. As one ASRS reporter remarked, "Our simulator training really paid off. This was my first engine shutdown in 20 years of flying, and it felt like I had done it a thousand times before!"

Thus, most textbook emergencies were handled smoothly and as planned. Most of the ASRS reports which were reviewed, however, described events that were not textbook emergencies (85 in all), and the vast majority of these (93 percent) involved a problem with the way in which the flight crew or others responded to the situation, and/or with the materials and resources they were to use (see accompanying table).

Economic and regulatory pressures. As mentioned above, regulatory and economic pressures significantly affect training for emergencies. To a large degree, regulatory requirements dictate what is trained and, in a vicious circle, economic pressures then dictate that what is not required by regulation is not trained. The latter occurs because the time devoted to various types of training is regarded by most airlines as being fixed at a certain number of days per year. Pulling crews off the line to participate in training has tremendous economic impact on an airline and adding to the training "footprint" is avoided if at all possible.

Crew response	Textbook Emergency	Non-Textbook Emergency	Totals
Handled Well	19	6	25
Not Handled Well	3	79	82
Totals	22	85	107

Crew performance in handling emergencies
(based on study of 107 ASRS reports)

Economic pressures can affect the handling of emergency or abnormal situations in other ways as well. For example, flight crews may also feel some reluctance to divert to an alternate airport or may divert to one where maintenance or other services are available rather than one that is closer. Pilots' fears of reporting requirements or regulatory action may affect their decisions whether or not to declare an emergency with Air Traffic Control, and real or perceived pressures from companies can also have profound implications for how situations are handled. In one safety report, for instance, a pilot admitted: "Had there been an actual engine fire, the fear of being punished by my employer for causing a customer delay may have raised safety concerns because of my reluctance to perform the required engine shutdown."

Human performance. Most emergency and abnormal situations increase the workload on the flight deck. Sometimes this increase is transitory and limited, but at other times it is great and continues for the remainder of the flight. In high workload situations, crew errors and less-than-optimal responses often can be linked directly to inherent limitations in human cognitive processes. These are limitations all humans experience when faced with threat, or when under stress or overloaded with essential tasks.

Studies reveal that cognitive performance is significantly compromised under stress. When experiencing stress, human attention narrows — a phenomenon referred to as tunnelling. Tunnelling restricts scanning the full range of environmental cues, causing the individual to focus narrowly on what are perceived to be the most salient or threatening cues. Thus, under stress pilots may focus on a single cockpit indicator and not notice other indications also relevant to their situation.

Additionally, working memory capacity and the length of time information can be held in working memory decrease under stress. Working memory is the crucial resource that allows individuals to hold and manipulate information cognitively. When working memory capacity is exceeded, individuals' ability to analyse situations and devise solutions is drastically impaired.

Therefore, when experiencing stress and high workload, crews are vulnerable to missing important cues related to their situation and can experience difficulty making sense of information, especially when it is incomplete, ambiguous, or contradictory. Pilots' problem-solving abilities may be impaired, and they will generally have difficulty performing complex mental calculations, such as figuring landing distances on a wet runway with reduced flaps.

Stress-induced limitations on human performance capabilities are often overlooked when considering how crews respond to emergency and abnormal situations. Researchers at NASA recently conducted an in-depth analysis of several airline accidents and determined that normal cognitive limitations experienced by all humans when dealing with

The Boeing Co.

The degree to which training reflects real-life emergency and abnormal situations, especially with regard to communicating and coordinating a response with others, is often limited.

stress, concurrent task demands, and time pressure, underlie those errors made by the accident crews. As is discussed below, human performance limitations have implications for appropriate checklist design.

Aircraft systems and automation. Various automated aircraft and warning systems can also affect the handling of emergency and abnormal situations. For example, in 1991, while an MD-81's engines were surging, the automatic thrust restoration (ATR) feature on the aircraft increased the engine power without the pilots' knowledge. This increased the intensity of surging, which contributed to the failure of both engines. During the investigation of this accident it was discovered that the pilots and the air carrier were unaware that the ATR feature even existed on the aircraft.

The numbers and types of warnings and warning systems aboard modern aircraft have greatly increased in recent years. The large number of warnings can result in information overload as crews attempt to make sense of the various alerts and respond properly. This is especially true when multiple or contradictory warnings are presented in close succession or at the same time.

These issues were involved in 1996, when erroneous information was sent to a Boeing 757 captain's airspeed indicator by the left air data computer because of a blocked pitot tube. Although the crew agreed that the back-up airspeed indicator was correct, they never attempted to fly the aircraft manually by reference to it. Instead, the first officer selected Altitude Hold but the power setting was too low to maintain altitude and the aircraft crashed soon afterward.

It can be difficult for flight crews to determine the most appropriate level of automation to use during emergency and abnormal situations. In some cases automation can help reduce crew workload, but attempting to use some aspects of automation can also impair a crew's ability to respond appropriately.

Additionally, pilots may become so accustomed to using automation to fly the aircraft that they may have trouble reverting to manual flying when required by an emergency. As stated in one ASRS report, "We were both very absorbed in flying the aircraft by hand, as it's something we don't often do."

Finally, crews have difficulty determining the correct response when they receive a warning that has a long-standing history of being unreliable, as foreseen in this ASRS excerpt: "The cargo compartment smoke alarm system has a maintenance history of false warnings. The frequency of these reports is going to lead some crews to ignore the warnings."

Indeed, between 1994 and 1999, the ratio of false cargo smoke alarms to real cargo smoke alarms was 200 to 1. Making an unnecessary diversion and emergency landing when an alarm is false can have tremendous costs and safety implications. However, not diverting when there is a fire can have even greater costs and safety ramifications.

Philosophies, policies and practices. Almost everyone in the industry — from manufacturers to instructors to directors of flight operations to line pilots — has ideas about how emergency and abnormal situations should be managed. These ideas derive from individual experiences, beliefs and perspectives related to various cost-benefit trade-offs. Often, these ideas are not explicitly expressed in a written document but are evident in choices made throughout the aviation industry, choices such as: (1) the directions and information given to crews in checklists; (2) the types of scenarios emphasized during training; (3) the degree

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1. Restrictions in simulator design may limit the types of problems that can be presented to flight crews. For example, it may not be possible to program some simulators so that a light on the panel remains illuminated after a crew has correctly completed the pertinent checklist procedures.

2. ASRS reports are filed voluntarily; therefore the numbers presented in this article related to these reports cannot be considered representative. They only indicate frequencies within the set of reports used in the study, not the rates of occurrence in aviation operations.

This article was co-authored by Barbara K. Burian, a Senior Research Associate with the San Jose State University Foundation at the NASA Ames Research Center; Immanuel Barshi, a Research Psychologist at the NASA Ames Research Center; and Key Dismukes, Chief Scientist for Human Factors in the Human Factors Research and Technology Division at the NASA Ames Research Center. Dr. Burian directs the Emergency and Abnormal Situations Study sponsored by NASA Ames Research Center, and can be reached at bburian@mail.arc.nasa.gov.

The article is an abridged version of a U.S. National Aeronautics and Space Administration (NASA) technical memorandum (NASA/TM-2005-213462), *The Challenge of Aviation Emergency and Abnormal Situations*, published in June 2005. The TM, including an extensive list of references that do not appear here, is available in electronic form at the NASA Ames Research Center website (http://human-factors.arc.nasa.gov/eas).


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Use of incorrect grease during maintenance led to wheel fire and evacuation of B747

The investigation of a brake fire accident that resulted in serious injuries during the evacuation found that incorrect and excessive grease had been applied to the landing gear axles, and that an over-wing slide failed because it was punctured by an object probably worn or carried by a passenger.

AUSTRALIAN TRANSPORT SAFETY BUREAU

ON 2 July 2003, a Boeing 747-438 aircraft with 350 passengers, 14 cabin crew and four flight crew members was operated on a scheduled passenger flight from Singapore to Sydney. The flight crew included the pilot in command (PIC), the co-pilot, a second officer and a second officer pilot under initial training.

Due to the forecast weather for Sydney and the expected arrival time within the airport's curfew period, the crew requested additional fuel in Singapore to allow for possible holding at Sydney or a diversion to Brisbane. That gave the aircraft an expected landing weight at Sydney of 270,700 kilograms (596,780 lb), approximately 15,000 kilograms less than the maximum allowable landing weight. The co-pilot was the handling pilot for the flight.

At approximately 0508 local time, in darkness, the flight crew commenced an instrument landing system (ILS) approach to Runway 34 Left (34L) at Sydney Airport. After commencing the approach, the aircraft encountered a varying tailwind. The landing reference airspeed was 150 knots for the flap 30 configuration and the planned aircraft landing weight. During the approach, the Sydney tower controller advised the crew that the surface wind was 180 degrees magnetic at 14 knots, with a tailwind component of 13 knots. [Runway 34L was in use despite the southerly wind because of noise abatement procedures. The airport had in force a curfew that operated from 2300 to 0600 daily, but limited international passenger jet arrivals were permitted between 0500 and 0600 provided that arriving aircraft used Runway 34L and deployed no more than idle reverse thrust during the landing roll.]

ACCIDENT REPORT

This article is comprised of extracts from the accident report released by the Australian Transport Safety Bureau in March 2005. The report may be viewed in its entirety at the ATSB website (www.atsb.gov.au/aviation/pdf/200302980.pdf).

Jim Jorgenson

Factors contributing to brake fires after a B747 landing at Sydney included presence of incorrect and excessive grease on the landing gear axles, inadvertent deselection of reverse thrust, and heat generated by the brakes on the landing roll and subsequent taxiing.

The crew planned to exit the runway at Taxiway Golf to facilitate a minimal taxi distance to their allocated parking bay, and had set the automatic wheel brakes to position three for the landing.[1] The landing distance available to Taxiway Golf was 2,826 metres (9,270 ft), which was more than adequate for the prevailing conditions, with an automatic wheel brake setting of three being appropriate for the conditions.

At approximately 0511, the aircraft touched down about 430 metres past the threshold of Runway 34L at an airspeed of 164 knots with a tailwind of approximately 12 knots. The landing was normal and soon after touchdown the spoilers automatically deployed and the auto-brakes activated. The flight crew advised the control tower that the aircraft's flight management computer (FMC) had indicated a tailwind component of 18 knots down to approximately 100 feet on final approach, and 11 knots at touchdown.

Approximately five seconds after landing, at 150 knots indicated airspeed, the co-pilot selected the reverse thrust levers

Examination of the wheel axle revealed the presence of two different types of grease, one a general purpose grease (Aeroshell 33) that was not approved for use in this part of the landing gear.

to the idle reverse position. Recorded flight data confirmed that the reverse thrust levers were raised to the idle reverse detent with the thrust reversers beginning to deploy normally. However, before any of the reversers reached the fully deployed position, and within two seconds of their selection, the reverse thrust levers returned to the retracted position and the thrust reversers began to retract. The aircraft's speed at that time was 136 knots. None of the crew members reported noticing that the thrust reversers had deselected and the engines remained at forward idle thrust for the remainder of the landing roll.

As the aircraft decelerated through 100 knots, the PIC assessed that a higher rate of deceleration was required to allow exiting the runway at Taxiway Golf. He directed the co-pilot to disarm the automatic wheel brakes and to apply manual braking. The co-pilot took those actions, reducing the aircraft's speed to approximately 10 knots by the Taxiway Golf turn-off.

When the aircraft was aligned with the designated parking bay, the flight crew instructed the cabin crew, via the passenger address system (PA), to disarm[2] the cabin doors. The flight crew then observed a "BRAKE TEMP" message on the primary engine indication and crew alerting system (EICAS) display screen on the flight deck instrument panel. The PIC checked the landing gear display page on the secondary EICAS screen and observed that the wheel brake temperature on wheel number 12 — the rear right wheel on the right body landing gear — was showing an amber five indication.

As soon as the aircraft stopped, the ground crew commenced their aircraft arrival procedures. One of the ground engineers (GE1) connected his headset at the nose landing gear for communication with the flight crew, and advised them that the wheel chocks were in place. The aircraft's flashing beacon was turned off and the co-pilot advised the ground engineer of the aircraft's status, including the hot brakes information. In the meantime, the cabin crew had disarmed the doors, and some passengers were standing holding their cabin baggage in readiness to disembark, even though the seat-belt sign was still illuminated. There was a slight delay before the seat-belt sign was extinguished because the PIC had been dealing with the "BRAKE TEMP" message.

On the ground, the second ground engineer (GE2) and a number of ramp personnel positioned on the right side of the aircraft noticed a fire in the right wing landing gear. GE2 immediately told GE1 of the fire, who then advised the flight crew. The PIC asked GE1 to confirm that there was a fire, and GE1 confirmed this. Communication between the flight crew and GE1 then ceased. The aircraft's flashing beacon was then turned back on to signal ramp personnel to remain clear of the aircraft.

The PIC then made an "Alert" PA to the aircraft cabin instructing all passengers to pay attention, to remain seated and await further instructions. All aircraft cabin doors except Door L1 remained closed and disarmed. A small number of passengers had already left the aircraft.

Within seconds of making the alert announcement, the PIC gave the order "evacuate, evacuate, evacuate," and activated the emergency evacuation signal system, causing the main cabin lighting to extinguish and the cabin emergency lighting to illuminate. It was still dark outside, but the aircraft and surrounding area were illuminated by tarmac floodlighting. The cabin crew commenced evacuation procedures immediately, with the first passenger escape slide, recorded on the airport security camera video, deploying at 0519:09.

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OTHER BRAKE FIRE OCCURRENCES

In November 2000, one of the operator's Boeing 747s that had recently completed maintenance sustained a brake fire. On that occasion, the wheel interior and brake void were found to contain excessive amounts of grease, including Aeroshell 33 [a general purpose grease that was used instead of the correct grease, Aeroshell 22]. That incident resulted in the operator issuing a safety alert bulletin to the maintenance facility that had carried out the maintenance tasks, highlighting the incident and the importance of following correct maintenance procedures.

On 3 July 2003, the day after the subject occurrence, another of the operator's Boeing 747s experienced a brake fire shortly after reaching the parking bay following a landing at Sydney. That aircraft also landed on Runway 34L during the

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1. The automatic braking system on Boeing 747-400 series aircraft allowed the crew to preselect a desired deceleration rate during the landing roll (there were six settings: RTO, 1, 2, 3, 4 and MAX). Brake torque was automatically adjusted to achieve a programmed rate of deceleration depending on, among other factors, the amount of reverse thrust that the crew had selected. For example, at a given automatic brake setting, if reverse thrust was not used, higher brake torques would be required than if reverse thrust was used.

2. The doors had two operating modes. Disarmed mode allowed the doors to be open without deployment of the escape slides. Armed mode automatically activated the escape slide on door opening.

New safety focus essential, Council President emphasizes

Recent accidents highlight the need to implement SARPs rather than develop new standards, Dr. Kotaite stresses in address to civil aviation leaders

While emphasizing that the global aviation system remains fundamentally safe despite a series of recent accidents, ICAO Council President Dr. Assad Kotaite told a gathering of civil aviation leaders recently that regulators and the industry are under pressure to act quickly and decisively in preventing further accidents.

Although 2003 and 2004 were the safest years since 1945, he informed directors of civil aviation (DCA) from the North American, Central American and Caribbean region at a meeting in Tegucigalpa, Honduras on 11 October, "the unusually high number of fatal accidents we experienced this summer has again focused public attention on the safety of air transport."

In response, Dr. Kotaite added, ICAO has decided to convene a two-day global conference on the subject of aviation safety early next year. The gathering of the world's directors general of civil aviation (DGCAs) at ICAO headquarters in March will focus on shaping a renewed global strategy for aviation safety (see accompanying article, page 25).

Dr. Kotaite urged delegates of the meeting, sponsored by the Government of Honduras and the Central American Corporation for Air Navigation Services (COCESNA), to participate actively in the forthcoming conference. The worldwide meeting of DGCAs will review the current status of aviation safety, identify ways to further improve safety, and consider enhancement of the safety framework to meet the evolving needs of international civil aviation.

The Council President cited reasons why global aviation remains fundamentally safe, in particular ICAO initiatives to address safety concerns. The Universal Safety Oversight Audit Programme (USOAP) has been quite effective, he noted, in assessing the level of implementation of safety-related standards and recommended practices (SARPs). More recently, the ICAO Assembly in 2004 adopted a unified strategy to resolve safety-related deficiencies, and ICAO is now establishing a safety management process to help meet that objective while also encouraging Contracting States to establish safety management systems. Dr. Kotaite also highlighted a measure promoting greater transparency of safety deficiencies as yet another important initiative.

"We all know that standards and procedures alone will not prevent accidents," Dr. Kotaite reminded the delegates. "They must be implemented and they must be enforced, systematically, consistently and continually." This is why ICAO's focus has shifted from one of developing standards to resolving safety deficiencies. USOAP audits have highlighted the fact that correcting deficiencies remains a serious challenge for many States.

ICAO's new unified strategy also strongly promotes the establishment of regional or sub-regional safety oversight organizations, the President added. Regional safety oversight organizations can provide an excellent framework for optimizing resources and for recruiting, training and retaining qualified personnel.

The President underscored the importance of regional bodies such as COCESNA/Central American Agency for Aviation Safety (ACSA), which was established with the aim of helping States of the region comply with SARPs, and the Regional Aviation Safety Oversight System (RASOS), set up in the Caribbean for the same purpose.

In the case of ACSA, for example, all Central American States are pooling their resources and achieving significant improvements in meeting their safety oversight obligations. "By your actions," Dr. Kotaite stated, "you have inspired others … to foster the creation of regional or sub-regional partnerships. You have thereby demonstrated how the right combination of technical knowledge and political support can bring about remarkable results."

Dr. Kotaite reviewed developments in the field of security, noting that ICAO's newly formed Universal Security Audit Programme (USAP) had so far audited 97 States, including 11 from the North American, Central American and Caribbean region. He added that ICAO, through its regional office, had made sustained efforts to assist States, territories and international organizations in obtaining aviation security training, and that the Government of Canada had provided funding for a security awareness training programme conducted by ICAO and Transport Canada.

The President stressed the importance of information for security and safety alike. In terms of safety, he said, the unobstructed flow of related information should be embraced

Pictured following a meeting in Tegucigalpa, Honduras are (l-r): Adan Suazo Morazán, Representative of Honduras on the Council of ICAO; Eduardo Marin, Executive President of COCESNA; Alberto Díaz Lobo, Vice-President of the Republic of Honduras; Dr. Kotaite; Jorge Carranza, Minister of Transport of Honduras; and Eduardo Pavón Cámbar, Vice-Minister of Transport of Honduras.

by everyone involved in air transport. In security as well, he said, information is “the basis of progress.”

The meeting, the second of its kind, was attended by 73 participants from 18 States and territories and seven international organizations. The first-ever meeting of directors of civil aviation of North America, Central America and the Caribbean was held in Grand Cayman in October 2002.

Discussions with government leaders. While in Honduras from 10 to 13 October, the Council President discussed aviation matters with the Vice-President of Honduras (in his capacity as Acting President), the Minister and Vice-Minister of Public Works, Transport and Housing, the Vice-Minister of Foreign Affairs, and the DGCA (see photo, page 23). Their discussions covered the significant progress made by Honduras in implementing the recommendations of ICAO safety and security audit teams, and ratification by Honduras of amendments to the Chicago Convention and other international air law instruments.

The Council President also visited COCESNA’s office, and met with its Executive President and other officials. He also toured the modern air traffic control centre that COCESNA operates. During the DCA meeting, COCESNA organized a ceremony to pay tribute to Dr. Kotaite, in recognition of his contribution to the development of international civil aviation over a period of 50 years. □

Secretariat restructured to focus more sharply on new priorities

ICAO recently merged two of the 10 sections within its Air Navigation Bureau and has created a new unit that will concentrate on managing the organization’s unified safety strategy. The changes reflect a shift in priorities, with new emphasis on a more active approach to the implementation of ICAO standards as opposed to their development, and a new focus on the safety management process and the creation of safety management systems among the world’s civil aviation administrations and the industry at large.

The newly formed Flight Safety Section (FLS) succeeds the Personnel Licensing and Training Practices (PEL/TRG) Section and the Operations and Airworthiness (OPS/AIR) Section. The FLS Section is responsible for the development of standards and recommended practices (SARPs); procedures and guidance material related to the operation, registration, certification and airworthiness of aircraft; the design of instrument procedures; licensing and training of personnel; the units of measurement used in aviation operations; and the safe transport of dangerous goods by air. The FLS Section has shared responsibility with ICAO’s Air Transport Bureau in the development of SARPs related to aircraft noise and engine emissions.

The new section is also responsible for training and safety initiatives including the ICAO Aviation Training Programme, the Flight Safety and Human Factors Programme and the Prevention of Controlled Flight into Terrain (CFIT) Programme, as well as activities related to safety management systems and safety aspects of air transport liberalization and implementation of aviation security programmes.

The newly created Unified Strategy Programme (USP) Unit is responsible for implementing the unified strategy to resolve safety-related deficiencies which was adopted by the ICAO Assembly in 2004. The unified strategy involves a shift in focus away from developing standards towards facilitating their implementation. □

MRTD SYMPOSIUM

A symposium on ICAO-standard machine readable travel documents (MRTDs) and biometric enhancement held in Montreal in late September attracted nearly 300 participants from 58 Contracting States, eight international organizations and more than 50 companies and institutions. Experts highlighted various elements of the ICAO programme established to assist States in their transition to either the ICAO standard machine-readable passport or the e-passport. A concurrent exhibition, with 13 participating companies, highlighted MRTD-related products and services.

States encouraged to support ICAO’s security plan of action

ICAO continues to encourage member States to provide funding for the implementation of the ICAO aviation security plan of action, recently disseminating a letter inviting the States to pledge financial contributions on a systematic basis in order to ensure the proper planning and execution of security-related programmes over the remainder of the 2005-07 triennium.

While the ICAO aviation security plan of action, established soon after the events of 11 September 2001, depends on voluntary contributions, ICAO is exploring ways to progressively integrate the activities into its regular programme budget. In the meantime, regular financial contributions by donor States are vital. Many aspects of the plan of action also rely on contributions in-kind by States, in particular through the secondment of auditors to the Universal Security Audit Programme (USAP), a key component of the plan of action, as well as instructors needed to conduct ICAO courses, and assistance given directly to States in need of security expertise.

In urging States to make pledges, late last year ICAO disseminated a package of information on achievements to date, as well as financial details concerning actual and suggested levels of contributions. More recently, the organization informed Contracting States on the financial status of the plan of action, including the level of contributions received up to the end of September. The projected activities of the remainder of this triennium, and a summary of other major accomplishments completed under the plan of action during the first three quarters of 2005, are posted on the ICAO website and will be updated on a regular basis. □

Conference to develop a safety framework for the 21st century

ICAO will convene a global safety conference at its Montreal headquarters in March 2006 to address safety concerns that have arisen following a series of fatal accidents that took place earlier this year.

The worldwide safety conference, scheduled to take place from 20 to 22 March, will be attended by directors general of civil aviation (DGCAs) from ICAO's 189 Contracting States. The DGCAs will gather in Montreal to assess the current status of aviation safety and identify ways to achieve significant improvements. The primary aim of the conference is to develop a safety framework for the 21st century in an assertive, coordinated and transparent manner. As such, transparency and sharing of information will be among the major issues to be discussed.

Although the global air transport system is fundamentally safe, explained ICAO Council President Dr. Assad Kotaite, the recent fatal accidents "focused attention on the urgent need to eliminate remaining systemic deficiencies."

The forthcoming conference is arguably the most significant international meeting on aviation safety since a similar DGCA conference held in 1997 authorized the organization to perform regular and mandatory safety audits on a systematic basis in all ICAO Contracting States. The highly successful initiative arising from the 1997 conference, known as the Universal Safety Oversight Audit Programme (USOAP), was launched in 1999 after it received the ICAO Assembly's endorsement.

"The time is now ripe to review and bring all of our safety initiatives under the umbrella of a global strategy, while incorporating any new element that will further strengthen aviation safety, based on transparency and sharing of information," Dr. Kotaite stated.

Earlier this year the President called for more effective information sharing between all stakeholders, asserting that there must be "an unobstructed flow of safety-related information by everyone involved in air transport, at every level and across every safety discipline. At the same time, airlines and regulators must put in place safety management systems that can make use of this information." □

Council elects vice-presidents and committee chairmen for 2005-06

The ICAO Council has elected three vice-presidents to serve for the 2005-06 period. The newly appointed vice-presidents are: Lionel Dupuis, Representative of Canada (First Vice-President); Mokhtar Ahmed Awan, Representative of Pakistan (Second Vice-President); and Adan Suazo Morazán, Representative of Honduras (Third Vice-President).

The Council also elected the chairmen of the five Council committees for a one-year period. Those appointed are: Air Transport Committee, Harold Wilson (Saint Lucia); Joint Support Committee, Igor Lysenko (Russian Federation); Finance Committee, Simon Clegg (Australia); Unlawful Interference Committee, Horst Mürl (Germany); and Technical Cooperation Committee, Olumuyiwa B. Aliu (Nigeria).

The ICAO Council, the governing body of ICAO, comprises representatives of 36 States elected by the ICAO Assembly. □

Cairo seminar focuses on regional cooperation for safety oversight

ICAO conducted a four-day seminar on regional cooperation for safety oversight at Cairo, Egypt in September 2005. Attended by 60 participants from various regions, the seminar, an element of ICAO's unified strategy to resolve safety-related deficiencies, provided a forum for operational staff of existing and emerging regional entities from around the world to share experiences and exchange safety oversight-related information and materials.

Hosted by the Egyptian Ministry of Civil Aviation, the seminar was opened on 19 September by ICAO Council President Dr. Assad Kotaite, who stressed the importance of cooperation to the enhancement of safety. "Any improvement in safety on a worldwide basis," the President emphasized, "depends on the collaboration of all stakeholders."

Dr. Kotaite pointed to an innovative regional programme that focuses on the cooperative development of operational safety and continuing airworthiness. COSCAP — as it is known for short — is a good example of how partnerships are being formed to enhance aviation safety. A dedicated forum for promoting continuing dialogue, coordination and cooperation in matters related to flight safety, the programme has created an environment for harmonization and advancement in safety oversight policies, procedures and regulations. To date, seven COSCAPs are in place worldwide, and four more programmes are to be established in the next two years.

The seminar in Cairo represented the beginning of a series of efforts taken by ICAO to raise the level of commitment among States for their safety oversight obligations. The campaign is also intended to assist States in overcoming their safety-related deficiencies. "Our hope is that you will become better acquainted with the tools and databases of ICAO designed to facilitate the exchange of information regarding safety oversight," Dr. Kotaite informed participants.

"What is important above all is that a commitment for the establishment of a regional safety oversight system be made at the highest levels of government," the Council President explained. "States within a region must agree to come together to share their experiences and resources. Strong

Dr. Kotaite met with Ahmed Shafiq, the Minister of Civil Aviation of Egypt (at left), as well as other government and industry leaders during a visit to Cairo in September.

partnerships with stakeholders, such as industry and financial institutions, can further improve regional aviation safety oversight by helping to secure the necessary assistance."

Discussions with Egyptian authorities. During his visit to Cairo from 17 to 22 September, the Council President discussed a wide range of aviation issues with government and industry leaders. Dr. Kotaite — accompanied by the ICAO Regional Director for the Middle East Office — met with the Minister of Civil Aviation of Egypt, the Chairman of the Civil Aviation Authority, the Deputy Assistant Minister of Foreign Affairs, and the First Under Secretary General of the League of Arab States. The Council President also met with the Director General of the Arab Civil Aviation Commission (ACAC) and the President of EgyptAir. Discussions with Egyptian authorities covered safety, security, ratification of certain air law instruments, technical cooperation activities, and the ICAO regional office and meeting facilities provided by the Government of Egypt under a special agreement with ICAO. Also discussed was coordination on civil aviation matters between the League of Arab States, ACAC and the ICAO regional office.

During his stay in Egypt Dr. Kotaite toured the new state-of-the-art Aviation Medical Centre in Cairo as well as the EgyptAir Training Centre, which is equipped with a number of flight simulators; both facilities offer training and assistance to personnel from other countries. The Council President also visited the ICAO Middle East Office, where he addressed the staff on the unified strategy recently adopted by ICAO and on current budgetary constraints facing the organization. □

Legal framework needs continual strengthening, lawyers told

In his keynote address to the European Air Law Association annual conference in Budapest on 4 November, ICAO Council President Dr. Assad Kotaite focused on safety concerns and recent initiatives to address them, as well as aviation security and air law matters.

"As we move in the direction of safer, more secure and increasingly liberalized air transport," he informed the gathering of lawyers, "we need to continually strengthen the global aviation legal framework."

The 1944 Chicago Convention, he remarked, is a strong foundation on which to build a legal edifice. The clarity, logic and depth of the Chicago Convention are such that "we find it today almost unchanged, in spite of the major political, economic and social upheavals of the second half of the 20th century and the stormy beginning to the 21st century."

Several legal instruments concerning international civil aviation have been adopted by the international community in the ensuing decades, among them the Montreal Convention of 1999 — in force since November 2003 — which modernizes and consolidates into a single legal instrument a set of international instruments of private international law governing air carrier liability. More recently, Dr. Kotaite observed, ICAO has focused on modernizing the 1952 Rome Convention. In light of recent trends and developments in international liability law, a group of legal experts is developing a new draft convention that will address third-party damage caused by foreign aircraft.

"I expect the new convention to be another fine example of universal acceptance," Dr. Kotaite predicted. "As an internationalist associated with ICAO for the past 52 years, I have observed the progressive and steady evolution of legal instruments toward internationalism."

For the past 60 years, he added, conventions on air law have reflected the evolution of air transport and of society, including change in an era of globalization.

Discussions with Hungarian authorities. While in Budapest from 1 to 5 November, the Council President met with high-level government officials on matters related to civil aviation. Accompanied by the Representative of Hungary on the Council of ICAO, Dr. Kotaite met with the Minister of Economy and Transport and with the Director General of Civil Aviation, concurrently the President of the European Civil Aviation Commission (ECAC). Dr. Kotaite also met with industry officials, including the Chief Operating Officer of Budapest Airport and the Director General of the HungaroControl Centre. Discussions with the Hungarian authorities focused primarily on issues related to safety, security and the environment. □

ICAO Council President Dr. Assad Kotaite discussed aviation matters with Hungarian authorities during a recent visit to Budapest. Pictured at a meeting on 3 November are (l-r): Dr. Attila Sipos, Representative of Hungary on the Council of ICAO; Dr. Kotaite; Dr. Laszlo Kiss, DGCA of Hungary and President of ECAC; and János Kóka, Minister of Economy and Transport of Hungary.

IFFAS issues its first annual report

In its first published annual report, the International Financial Facility for Aviation Safety (IFFAS) indicated that it received a total of U.S. $354,000 in contributions during 2004. In addition, IFFAS benefited from a donation of $105,900 from the Agence Intergouvernementale de la Francophonie which was used to help defray its administrative costs.

Since it was established by ICAO in December 2002, IFFAS has received total contributions of approximately $2.8 million. IFFAS was set up with the goal of financing safety-related projects for which States cannot otherwise obtain the necessary financial resources.

IFFAS has so far considered assistance for 10 projects since it became operational in mid-2003. Based on recommendations from a panel of experts, to date it has funded five projects in five different regions, with a total of 25 States benefiting from financial assistance in the form of grants. All of the selected projects are of a regional or sub-regional nature and involve States defined by the United Nations as least developed countries. □

ICAO membership grows

The Democratic Republic of Timor-Leste became a Contracting State of the International Civil Aviation Organization on 3 September 2005, shortly after ICAO was notified of the country's adherence to *Convention on International Civil Aviation*, also known as the Chicago Convention. The development brings the total number of ICAO Contracting States to 189.

ICAO was founded in 1944, when 52 States signed the Chicago Convention. □

Questionnaire focuses on land-use planning around airports

ICAO recently disseminated a questionnaire to its member States on land-use planning measures related to airports, at the same time urging States to promote appropriate land-use planning practices around airports. The organization noted that the 2005 theme for the United Nations World Environment Day, "Green Cities," provided an opportunity for promoting such measures.

The questionnaire, to be returned to ICAO headquarters by 15 December 2005, requested information on current State policy on land-use planning and management related to lands adjacent to airports, as well as State best practices and unsuccessful practices.

Guidance on land-use planning is available in the *ICAO Airport Planning Manual*. Part 2 of the manual, *Land Use and Environmental Control* (Document 9184), contains a description of current practices in certain countries. As well as land-use planning guidance, the document examines environmental control in terms of airport development and operations.

ICAO's Committee on Aviation Environmental Protection (CAEP) continues to update guidance material contained in the manual. CAEP is also in the process of updating a circular on the recommended method for computing noise contours around airports. Circular 205 is being revised in order to offer States the best possible information on aircraft noise modelling. □

Regional air navigation system planners meet in Bangkok

The group of experts responsible for air navigation planning and implementation in the Asia/Pacific region met in Bangkok in late August to address a number of technical and operational issues. The 16th meeting of the regional group was attended by 95 participants from 25 States and three organizations. Among other things, the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) conducted a thorough review of the current and future Asia/Pacific air traffic services (ATS) route network and developed a route catalogue as a planning tool. It also discussed development of a model contingency plan that could be used by States in the region to prepare national contingency plans for addressing situations such as labour disruptions or natural disasters that may affect civil aviation operations. In addition, the regional strategy for implementing GNSS in the Asia/Pacific region was updated. □

Council President presented with award for half-century of service

ICAO Council President Dr. Assad Kotaite was in London from 18 to 22 October to accept an award presented by His Royal Highness Prince Philip, the Duke of Edinburgh, on behalf of the International Association of Institutes of Navigation (IAIN) on the occasion of its 30th anniversary (see photo). The Council President also met with high-level government officials to discuss aviation matters.

The John Harrison Award was bestowed on Dr. Kotaite at a ceremony at the Royal Geographic Society headquarters in recognition of the Council President's half-century contribution to the development of international civil aviation, and was followed by a reception attended by Prince Philip.

During his stay in London, Dr. Kotaite met with the Secretary of State for Transport of the United Kingdom, the Director General of Civil Aviation (DGCA) and other high-level officials from the Department of Transport. Discussions with the U.K. authorities focused mainly on the DGCA conference on aviation safety to be held at ICAO in March 2006 (see accompanying article, page 25), and on the progressive integration of the Universal Security Audit Programme (USAP) into ICAO's regular programme budget. Also discussed were strategies for implementing remedial action for safety- and security-related deficiencies around the world, a subject that it was agreed should be considered by the forthcoming DGCA conference and the next ordinary session of the ICAO Assembly in 2007.

While in the United Kingdom, Dr. Kotaite also participated in meetings of the Aviation Study Group of Oxford University's Linacre College at the Royal Air Force Club on 20 October and at the Royal Aeronautical Society on 21 October.

Dr. Kotaite accepts the John Harrison Award from His Royal Highness Prince Philip in London on 19 October. The award was bestowed on Dr. Kotaite by the International Association of Institutes of Navigation (IAIN) in recognition of the Council President's half-century contribution to the development of international civil aviation. □

ICAO Council appointment

Dr. O.B. Aliu (Nigeria)

Olumuyiwa Benard Aliu was appointed the Representative of Nigeria on the Council of ICAO in January 2005.

A Doctor of Technical Sciences specializing in aeronautics, Dr. Aliu has over the course of his career received training in several aviation disciplines in a number of academic and industrial institutes in Nigeria as well as in Canada, Egypt and several countries in Europe. He commenced his aviation training at the then Kyiv Institute of Civil Engineers (since renamed the Kyiv International University of Civil Aviation), where he graduated with a Master of Science degree in aeronautical engineering. Dr. Aliu acquired a doctorate in 1987. He also obtained an aircraft maintenance engineer licence, with airframe and engine ratings on several aircraft types.

Dr. Aliu's professional experience includes several years with the Nigerian Civil Aviation Authority (NCAA), where he held positions of increasing responsibility in safety oversight and economic regulation. He played an active role in the development of the NCAA's Department of Air Transport. As Director, Air Transport Regulation, he coordinated activities in the regulation of air transport, licensing and economic policy, domestic and international operations, and the negotiation of bilateral and multilateral agreements. He was also assigned the role of Acting Director General of the Nigerian CAA on several occasions, and has also served as a technical adviser/assistant to the Minister of Civil Aviation.

Dr. Aliu has participated in many international air transport conferences and seminars, and was a member of the Nigerian Delegation to the last three regular sessions of the ICAO Assembly. □

Panel proposes amendments related to data link applications

The first meeting of the ICAO Operational Data Link Panel (OPLINKP), formerly known as the Automatic Dependent Surveillance Panel, assessed ongoing data link trials and finalized material that will assist in the implementation of air traffic services (ATS) data link applications.

The meeting, held at ICAO headquarters from 12 to 23 September, drafted proposals for the amendment of a variety of ICAO annexes and the *Procedures for Air Navigation Services* (PANS), as well as completing complementary guidance material. The amendments proposed by the panel concern a number of data link applications, with particular emphasis on ATS interfacility data communications (AIDC), automatic dependent surveillance-broadcast (ADS-B) and controller-pilot data link communications (CPDLC).

The panel also completed development of suitable provisions relating to the use of required communication performance (RCP) in the provision of air traffic services. The ICAO Air Navigation Commission is scheduled to review the panel's report early in the new year.

The OPLINKP meeting was attended by experts from 12 States and three international organizations. □

ICAO Council appointment

J.-C. Chouvet (France)

Ambassador Jean-Christophe Chouvet has been appointed Representative of France on the Council of ICAO. His tenure commenced on 21 September 2005.

Mr. Chouvet has pursued studies at the Institut d'Études Politiques in Paris and the École Nationale d'Administration, and holds a Diploma of Advanced Studies specializing in monetary and banking economics.

In 1980, Mr. Chouvet joined the Ministry of Foreign Affairs of France, where he held positions of increasing responsibility. In 1988, he was appointed Deputy Director for Human Rights at the Ministry's Department of Legal Affairs. Other positions held by Mr. Chouvet include those of Deputy Director of the Office of the Minister of Foreign Trade; Director of the Office of the Minister Delegate of Trade and the Craft Industries; and Inspector of Foreign Affairs. In 1997, Mr. Chouvet was appointed to the post of Diplomatic Adviser to the President of the National Assembly. Prior to his most recent appointment, he served as the Deputy Director of Economic and Financial Affairs of the Ministry of Foreign Affairs, and as Policy Officer for New Information and Communication Technologies.

Mr. Chouvet is an alumnus of the École Nationale d'Administration ("Voltaire" Class of 1980) and a Chevalier of the National Order of Merit. □

Large-scale technical cooperation projects under way

New large-scale technical cooperation projects are being implemented by ICAO in Egypt and Guatemala, and several ongoing projects have been allocated additional funding.

Valued at $600,000 (all financial figures in U.S. dollars), the new project in Egypt is aimed at updating and upgrading training standards at the National Civil Aviation Training Organization (NCATO). The project, funded entirely by the Government of Egypt, has an expected duration of one year. The preparatory phase has been finalized and project operations are scheduled to begin in January 2006.

A project in Guatemala to modernize La Aurora International Airport commenced in 2005 for a two-year period with more than $38.5 million in funding. Funded entirely by the Government of Guatemala, the project entails construction of a taxiway, ramp and landside roads; the enlargement and modernization of the international terminal building; relocation and remodelling of hangars and the cargo terminal; and technical assistance in the preparation of a master plan, new aeronautical laws and procurement of equipment.

Major ongoing technical cooperation projects that have been allocated new funding include two projects in Argentina concerned respectively with human resources and implementation of communications, navigation and surveillance (CNS) services, with newly approved funding of $2.8 million each; updating of installations and services at the Tocumen International Airport in Panama City, Panama, with more than $1.9 million in additional funds; a project to improve search and rescue services in African Civil Aviation Commission (AFCAC) member States with more than $844,500 in new funding; a project to carry out European geostationary navigation overlay service (EGNOS) trials in the Caribbean and South American region, with additional funding of $557,000 (with the goal of developing tests and studies to assess the technical and operational benefits that the satellite-based augmentation test system can bring to the region); and a project in Saudi Arabia focused on strengthening the capacity of the Presidency of Civil Aviation that has been extended by one year with an additional $6.7 million in funding. □

ICAO's business plan

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ICAO standards and recommended practices (SARPs), training, performance monitoring, and providing assistance to States. The sharpened focus could come at the expense of other ICAO activities, if necessary — in this case, in all likelihood, the development of new SARPs.

Looking more closely at safety objectives, the business plan puts the accent on results, and not necessarily on conducting traditional activities that can contribute to safety. In distinguishing the more important priorities related to USOAP, for instance, the plan stresses the actual outcome of safety oversight audits and not simply their completion. The goal is to achieve greater compliance with ICAO standards worldwide. This results-oriented approach reflects the unified safety strategy adopted by ICAO at its 35th Assembly. Similarly, the business plan puts the onus on results in terms of ICAO's various other activities.

The business plan is important, from a safety standpoint, if only because it recognizes that it may not be realistic to achieve all objectives, no matter how laudable, but that it is possible to define safety priorities and allocate resources accordingly. This is the framework needed for addressing the issues of greatest concern and for implementing solutions that produce the greatest benefits. Where safety is concerned, the business plan offers the kind of perspective necessary to identify the root causes that underlie safety lapses, rather than their varied symptoms. It places the emphasis on achieving results by addressing these root causes.

As with any business plan, which tends to rely on the availability of good data, ICAO's decisions about safety priorities will be based largely on the safety information at hand. This reliance underscores the need to collect quality data from the world's air transport industry.

In the world of air transport, a business plan serves as the foundation for a safety management system. Similarly, ICAO's business plan contributes to safety by focusing on priorities and responding to changing times, in this case highlighting the need to ensure the effective regulatory oversight of a challenged, but rapidly growing, air transport industry. □

Contingency plan

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primary method of preventing, or delaying, a global outbreak of human influenza is to quickly identify emergence of a virus strain capable of efficient transmission between humans and then rapidly introduce effective containment measures in the affected region.

Proposed measures involve quarantining those affected and anyone who has been in contact with an affected person, while isolating the region where the outbreak occurred. At the same time, the general population in and around the affected region would be provided with antiviral drugs (e.g. "Tamiflu") for a period of some weeks as a preventive measure. By this means, the spread of a local outbreak could be delayed, providing some time to develop a specific vaccine. Such a strategy critically depends on good disease surveillance and rapid deployment of containment measures, both of which might be difficult in many parts of the world where an outbreak is likely.

Where specific aviation measures are concerned, during the SARS outbreak in 2003 airport screening of passengers probably contributed to the successful control of the disease. However, influenza behaves differently from SARS, and it is not certain how effective screening would be. An individual infected with the influenza virus may be contagious 24 hours after being infected, a condition that can last for 48 hours before symptoms, including fever, appear. With SARS, symptoms appear at around the time the patient becomes contagious, so affected individuals can be more effectively identified by use of temperature measurement. ICAO and other concerned organizations continue to work with the WHO to define the most effective response at international airports affected by an influenza outbreak.

The plan developed by ICAO for combating SARS was very useful. For the first time, airports and the wider aviation industry considered how to deal with an outbreak of a contagious disease, and many of the procedures outlined are helpful in defining an approach to future outbreaks. The current threat from highly pathogenic human influenza may not be directly analogous to that of SARS, but the work done in 2003, combined with current efforts, should provide a solid foundation on which to base a generic preparedness plan for aviation for any foreseeable future pandemic. □

Transition to halon alternatives

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Action plan. The current understanding of the status of halon supplies indicates that the time available for making the transition to halon alternatives may be much less than airlines realize. Thus, to avert a situation where aircraft are grounded because halons are unavailable, a plan of action by regulatory authorities is necessary to ensure that the industry can maintain a safe environment for the flying public. To this end, the parties to the Montreal Protocol have requested that their technical advisers cooperate with ICAO on developing an action plan for the aviation sector. The following course of action has been recommended and agreed to by the parties:

- the United Nations Environment Programme (UNEP) Halons Technical Options Committee (HTOC) will use its expertise to make a best estimate of the available halon supply, costs, and current emissions rate. These data will be given to ICAO for distribution to its member States;
- ICAO will issue a State Letter to member States in 2006, inviting them to require the use of proven alternatives in new aircraft designs to the extent practicable;
- the ICAO Secretariat will introduce an ICAO/HTOC working paper on the subject of phasing out halons at the next regular

ICAO Council appointment

D.O. Valente (Argentina)

Daniel Oscar Valente has been appointed Representative of Argentina on the Council of ICAO. Mr. Valente's tenure commenced on 1 August 2005.

A graduate of the Military Aviation School, Mr. Valente holds an air transport pilot licence and flight instructor rating. His flying career encompasses both military and civil activity, including experience as a test pilot. He has also served as an air navigation aids inspector.

Mr. Valente trained in managerial and educational fields at the Advanced School of Air Warfare in Argentina, and also trained at the U.S. Air Force's Air University and the Naval Postgraduate School in the United States. He has attended courses at the National Institute of Air and Space Law in Argentina and studied for a master's degree in international relations at the National University of La Plata. Mr. Valente received a Bachelor's Degree in air and airspace systems from the Aeronautical University Institute.

In the civil aviation field, Mr. Valente served as Head of the Operations Division in the Air Regions Command, a post involving matters related to aviation safety and security. Concurrently, he was involved in the process of awarding airport concessions in Argentina, and also worked as a civil aviation duties inspector and airline inspector.

Mr. Valente played a role in creating the Aircraft Fire Fighting and Rescue Training Centre in Argentina, and in developing and managing the institutional evaluation process for education in the Air Force.

Mr. Valente has been an instructor at military training schools and a professor at the Aeronautical University Institute in his country, where he served on the board that drafted the university's statutes. He has published a number of articles in the Spanish and Portuguese editions of the *Air Power Journal.*

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session of the ICAO Assembly in 2007; and

- if the ICAO Assembly endorses the working paper's recommendation to use alternatives in new aircraft designs where practicable, States will then be required to use halon alternatives for identified applications in new airframe designs first certificated on or after 1 January 2009.

Conclusions. The airline industry is still heavily dependent on halons for its fire suppression needs. Given the anticipated lifespan of commercial aircraft, this situation is likely to continue well beyond the day when existing recycled halon stocks expire. This is a major cause for concern.

Halon alternatives in almost all civil aviation applications have passed tests based on the relevant minimum performance standards. However, the timing of the inclusion of these halon alternatives in new aircraft designs remains uncertain, and unless the processes of designing, conforming, qualifying and certifying new extinguishing systems on commercial aircraft are made a priority by the approval authorities — and expedited accordingly — they will represent significant barriers to the transition away from halons. Currently, alternatives are used only in the lavatory fire extinguishing systems of certain Airbus aircraft, which is a poor reflection on the extensive research and testing efforts that have been expended on aviation applications to date.

The aviation industry should be encouraged by regulators to follow the lead of other user communities which have had similar difficult problems to overcome, but which, nonetheless, have successfully moved away from halons by maintaining existing halon systems (thus retaining that initial equipment investment) and adopting halon alternatives in all new installations. A commitment to a plan of action that persuades the aviation sector to transition away from halons safely and smoothly would serve the best interests of airlines, the public, and the global environment.

Essential air services

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by the service, plus a reasonable profit for the employment of capital. In the interests of good governance and transparency, the requested compensation amount and the reimbursement need to be thoroughly assessed. The risks of overcompensation and inefficiency resulting from allocation of common or joint costs to more than one route could be partially mitigated by attracting a sufficient number of potential bidders to an auction.

Sources of financing. Having called for a tender, the State should have prime responsibility for securing the funds needed for paying subsidies. The issue of the kind of taxes that could be levied to help finance subsidies has to be examined carefully, with the goal of minimizing the distortion of the national economy. If the State faces budgetary constraints or other national spending priorities, it would need to arrange for financial support from outside bodies. Among examples are bilateral aid from the other party of the air services agreement and third-party aid from international agencies. A pragmatic way to supplement public financing would be to form a public-private partnership by bringing together national and local governments (with the open participation of other interested States), tourism entities, local businesses, airports and airlines.

Supplementary options. Subsidizing air services may not be sufficient for route development, which might be achieved more effectively if an ESTDR scheme is organized strategically as one part of an integrated package. There are two types of measures for supplementing an ESTDR scheme. One, a supply-side measure, is a way of sharing the financial risk of a new service with an airline by giving various kinds of indirect subsidies and incentives to the air carrier, thereby reducing its operating cost and raising the profile of the destination. The other is a demand-side measure, such as promotional and marketing activities and the provision of incentives for tourism entities, thereby breaking the "chicken-and-egg" dilemma facing aviation and tourism development and generating sufficient inbound traffic for the route's long-term viability. Any supplementary measure, however, should be governed by the same conditions and principles as those applied to an ESTDR scheme because of the potential for distortion of the market.

Interrelated elements. The seven pillars that constitute an ESTDR scheme are interrelated and have a degree of iteration. For example, the specification of adequacy (the second pillar) affects the second stage of the route selection test (the first pillar) because the level of frequency and capacity affects demand and the airline's cost on the route concerned. In addition, supplementary measures (the seventh pillar) could indirectly contribute to reducing an airline's operating costs, thus lessening the State's financial burden for payment of subsidies (the fifth pillar) in the longer run. In order to understand the complex interdependencies of the seven pillars, and to make economic cases for a quantitative assessment, one requires a sound knowledge of basic economic theories as well as expertise of route and network planning.

In addition to the seven pillars, the study examined possible regulatory arrangements for implementing an ESTDR scheme. The simplest approach is to implement the scheme unilaterally through national laws, rules and/or regulations, but in a "reduced" form that neither guarantees a monopoly operation nor imposes restrictions on elements such as flight frequency, capacity, and/or tariffs offered by airlines of the other States. A unilateral approach may be the most feasible in practical terms, because it enables an individual country to implement the scheme fairly quickly at a single stroke.

A more complex approach is to conclude a special clause for an ESTDR scheme under a bilateral, regional or plurilateral air services agreement between the States concerned. By taking this approach, a State could implement the scheme in its "full-scale" form, which could give legal certainty to restrictions in the form of market access, frequency, capacity, number of designated airlines, and tariffs. The study developed a model annex on essential service and tourism development routes which can be used in air services agreements at the discretion of States.

Implementation of the scheme, where applicable, is left entirely in the hands of States. It requires coordination between authorities if used bilaterally or multilaterally, as well as elaboration of the objectives, criteria and procedures which would be needed to ensure a high degree of transparency, and willingness at a policy level to take up an EAS concept internationally.

Conclusion. Growing and widespread liberalization, privatization and globalization call for regulatory change with respect to State assistance for international airline operations. This is especially the case where air services need to be preserved because of socio-economic needs, but are threatened by weak financial prospects and commercial uncertainty. An ESTDR scheme provides an efficient regulatory means of assuring service to particular destinations. It also optimizes the benefits of air services for economic and social transformation where such services simply could not be supported by market forces alone. For least developed countries, the use of this scheme could plug them into tourism development through aviation, and generate even broader economic benefits than the public service objective.

Moreover, an ESTDR scheme has two potential positive effects. First, the scheme could support and even promote liberalization by attracting widespread support for such an initiative. Concerns about continued participation in international air transport may result in the reluctance of some States to embrace the liberalization process. The scheme — which would work as a safeguard for the assurance of international air services — may help to alleviate these concerns, and could act as an incentive in the negotiation of liberalized air services agreements.

Secondly, an ESTDR scheme would encourage debate on the issue of State aid and subsidies, a debate that would focus on the merits of State support for the provision of specific services instead of specific air carriers. It is widely acknowledged that generic direct subsidies for airlines on the basis of their financial needs as a whole, and implicit subsidies in the form of cross-subsidization among routes, are unlikely to stimulate economic efficiency. Such assistance is usually not transparent and may not be compatible with the increasingly competitive marketplace. The proposed ESTDR scheme could eventually replace such generic and implicit support for airlines with target direct subsidies on a route-by-route basis, thus enabling States to take a more efficient and transparent approach to the question of airline support. □

Emergency and abnormal situations

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of emphasis placed on crews strictly completing all relevant non-normal checklists; and (4) how workload is distributed on the flight deck during an emergency. The implications these philosophies have for checklist design and response to emergencies is explored further below.

Checklist and procedure design. The preceding review of safety issues within six interrelated areas provides a context for considering the design of checklists and procedures that guide and direct crew responses.

It is, of course, impossible to develop procedures and checklists for every possible situation. If this were somehow possible, the quick reference handbook (QRH) that contains them (in paper form) would be so large that finding the proper checklist, or remembering it even existed, would be exceedingly difficult. However, checklists and procedures should exist for emergency or abnormal situations that are common or that can be reasonably predicted. As one ASRS reporter observed, "There was no checklist in the aircraft or company publications that addressed a 'landing gear cannot be retracted' scenario. Had there been one, the problem may have been easily rectified."

Checklists and procedures must also include all of the necessary steps or information required to respond appropriately, and they must be consistent with guidance given to crews in other documents. For example, in an ASRS report a pilot described how a checklist had been consulted in response to an alert that occurred during taxi-out. The checklist identified the alert as a maintenance item with no flight-related consequences. However, the minimum equipment list (MEL) identified the same alert as a "no take-off" item, which the crew did not discover until after taking off.

Human performance capabilities and limitations under high stress and workload should also influence the design and content of emergency and abnormal checklists and procedures. Obviously, attention should be given to the wording, organization and structure of these checklists to ensure that directions and information are complete, clear, and easy to follow and understand, as the following report excerpt highlights. "I called for the QRH for the loss of hydraulic pressure. While the captain read the QRH procedure, he was having some difficulty identifying the exact nature of the failure as well as the proper corrective action. While attempting to help the Captain with the QRH, I missed the 11,000 foot crossing restriction ... The QRH [for this aircraft] is a bit confusing in places and actually contains mistakes."

There are a number of dilemmas facing checklist designers with regard to human capabilities and limitations, however. For example, some highly time-critical situations may require that crews complete some actions from memory, without reference to a printed checklist. Under stress, however, normally reliable memory processes can fail. Which items on a checklist absolutely must be performed by memory, if any, and which should or could be performed by reference to a printed checklist? Definitive answers are unknown but several airlines and some manufacturers are revising their procedures to minimize the use of checklist memory items.

The need to navigate within a checklist, or to switch between checklists, can also be problematic. It is easy to lose one's place or jump to the wrong item or checklist when dealing with the many distractions, interruptions, and competing demands that typically occur during these situations. At the same time, trying to integrate all the information needed from multiple checklists into a single checklist may make the procedure quite lengthy and difficult to follow.

Electronic checklists may resolve a number of the difficulties associated with paper checklists. Sensors located throughout an aircraft can be linked to some types of electronic checklists, thus allowing the exact checklist for a particular condition to be displayed automatically. Because less time is needed to access the checklist, the number of memory items needed may be reduced. Linking within, and between, checklists can send pilots to the correct branch of items or proper additional checklists when jumping is required, reducing the likelihood of checklist navigation errors. Even with the advantages of electronic checklists, however, other obstacles remain, such as difficulty in locating a checklist that cannot be displayed automatically. Also, economic realities may constrain many companies from making a shift from paper to electronic checklists.

The design and content of emergency and abnormal checklists are inextricably linked to how well they function and how pilots use them. At an international symposium on emergency and abnormal situations in aviation, sponsored by the NASA Ames Research Center in June 2003, Capt. Bill Jones, of the Air Line Pilots Association International, likened an emergency or abnormal checklist to a parachute. To paraphrase, rarely does a military pilot pack his or her own parachute; instead, a parachute packer is relied upon to do the job with precision and skill. The pilot fervently hopes to never need to use the parachute, but if it is required, it must work as intended and may be the only thing between the pilot and death. Likewise, emergency and abnormal checklists must be developed with precision and skill. Pilots hope that they are never needed, but when they are necessary, they must function as intended, and may be indispensable in helping to avert catastrophe.

Need for research effort. Clearly, many factors affect how crews respond to emergency and abnormal situations and how well those situations are resolved. This article provides an overview of the many (but not all) broad issues raised by non-normal situations, but does not address many details of these issues, nor does it provide solutions for the dilemmas identified. A major research effort is required to do that. To that end, a team of researchers in the Human Factors Research and Technology Division at NASA Ames Research Center has been working to better understand the issues in managing emergency and abnormal situations.

The overriding goal of the Emergency and Abnormal Situations (EAS) Study[3] is to develop guidance for procedure and checklist development and certification, training, crew coordination, and situation management, drawing on knowledge of the operational environment, human performance limitations and capabilities, and cognitive vulnerabilities in real-world emergency and abnormal situations. By laying a foundation for establishing best practices, safety specialists hope to prevent the emergency and abnormal situations of tomorrow from becoming accidents. □

3. The EAS study is funded through NASA's Aviation Safety Programme. More information about EAS can be found at http://human-factors.arc.nasa.gov/eas.

AVIATION PROFILE

Algeria

Aircraft on civil register	127
Active pilot licences	1,766
Commercial air transport operators	4
Approved maintenance organizations	0
Aviation training establishments	5
Aircraft manufacturing organizations	0
Aircraft type certificates issued	0
International airports	12

(data from June 2004)

Accident report

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During the evacuation, one flight crew member and three passengers were seriously injured. The most serious injury occurred when the over-wing slide at Door 3 Right (R3) deflated with a passenger seated on the slide. Landing heavily on the tarmac, the passenger received a fractured vertebra that required surgery. A further four passengers and one cabin crew member were treated for minor injuries.

Three fires broke out. A brake fire occurred on the number 13 wheel — the forward left wheel on the right-wing landing gear — with flames rising 20 centimetres above the top of the tire and giving off a substantial amount of smoke. An additional two brake fires ignited on the right body landing gear, one of which was extinguished by the Aerodrome Rescue and Fire Fighting Service [the two other fires burned themselves out].

Landing gear examination. An examination of the axles after wheels 9 and 13 were removed revealed the presence of the correct Aeroshell 22 grease and a green-blue grease later identified as Aeroshell 33 [a general purpose grease]. Although not recommended for use in the high temperature axle area as it had a lower flashpoint than the approved Aeroshell 22 grease, Aeroshell 33 was an approved lubricant for other areas of the landing gear. The Aeroshell 33 grease was most predominant on the inboard area of the axle, with the correct Aeroshell 22 grease visible toward the axle's outer region.

Operator's maintenance practices. The aircraft's landing gears were lubricated to varying degrees during scheduled maintenance and at wheel and brake replacement. These procedures ranged from lubrication of selected points on the bogies (e.g. after a brake/wheel change or post-landing gear wash) to the entire landing gear lubrication procedure carried out during heavier scheduled maintenance. The operator followed the manufacturer's lubrication procedures, which listed four different types of grease to be used on the landing gears.

Although the manufacturer's procedures contained diagrams that clearly showed the locations to apply the appropriate lubricant, maintenance personnel worked from the operator's work sheets that give general details of components to lubricate, all materials to be used and a reference to the manufacturer's maintenance manual (for access to the lubrication diagrams), requiring personnel to independently obtain the relevant drawings. Both the aircraft manufacturer's and the operator's maintenance procedures included the instruction to wipe away any excess grease after lubrication had been carried out.

Both Aeroshell 33 and Aeroshell 22 grease had been supplied to the operator in large tins that were identical in colour. After the accident, however, the operator changed procedures to ensure that Aeroshell 33 grease was obtained in clearly marked cartridges.

Examination of the deflated slide. The over-wing escape slide R3 deflated after the slide had been used by a number of passengers. Video evidence established that the slide deflated 32 seconds after inflation.

Macroscopic and microscopic examination of the site of tear initiation revealed that the fabric of the central tube had been abraded over a short distance on the upper side of the longitudinal and transverse tear junction prior to the initiation of fabric tearing and pressure release. This surface abrasion is consistent with sliding contact between the slide and a blunt-edged object in the direction of sliding from the wing to the ground.

Conclusions. Among findings related to the aircraft were the following:

- A "BRAKE TEMP" advisory message on the right body landing gear was indicated after the aircraft parked at the terminal.
- A fire ignited on the right wing landing gear, followed by two further fires on the right body landing gear.
- The brake units associated with the fires were found to be worn, but within serviceable limits.
- The presence of an incorrect grease was found on all of the main landing gear axles.
- Excessive amounts of grease were observed around the wheels and brake units of all the landing gears.
- The maintenance equipment used to lubricate the landing gear was not clearly labelled to identify the different types of grease they contained.
- During the evacuation, three aircraft doors were opened in the disarmed mode.
- Failure of the R3 slide was considered to be due to overload of the fabric fibres.

Among findings related to the flight crew were:

- The crew assessed the weather conditions to be within operational limits for landing.
- An appropriate auto-brake selection was made.
- The PIC advised "idle reverse thrust only" requirement and placed his hand over the co-pilot's on the thrust reverser controls.
- Inadvertent deselection of reverse thrust occurred during the landing roll.
- None of the flight crew noticed the deselection of reverse thrust.
- Application of manual braking was required to exit the runway at Taxiway Golf.
- The flight crew observed a hot brake indication and reported it to the ground crew.
- On receiving confirmation of a brake fire, the PIC initiated an evacuation.
- The flight crew did not advise the cabin crew of the nature of the emergency when the evacuation was announced.
- The co-pilot was injured while evacuating down the right upper deck slide while carrying a three kilogram fire extinguisher.

Among the findings related to the cabin crew were:

- Some cabin crew members did not control passengers leaving their seats while the seat-belt signs were illuminated.
- Some passengers were not prevented from evacuating with cabin baggage.
- The cabin crew did not evacuate the aircraft to assist the passengers on the ground.

Findings related to the aircraft maintenance engineers and other ground staff:

- Poor or inadequate maintenance practices during lubrication of the landing gear resulted in the presence of incorrect and excessive amounts of grease on the landing gear wheels and brakes.
- There was no training provided to the ground staff for aircraft emergency evacuation situations at airport terminals.

Significant factors. Significant factors identified with respect to flight crew actions were:

1. The inadvertent deselection of reverse thrust.
2. The undetected deselection of reverse thrust.
3. The decision to utilize Taxiway Golf to minimize the taxi distance led to the requirement for additional manual braking during the latter part of the landing roll.

Significant factors with respect to the brake fire:

1. Incorrect grease of a lower flash point was applied to the landing gear axles during maintenance.
2. Excessive amounts of grease were present on landing gear wheels and brake voids.
3. The worn brake units generated a higher peak temperature over a short time frame.
4. Inadvertent deselection of reverse thrust during the landing roll resulted in increased auto-brake and manual brake applications.
5. Use of Runway 34L and Taxiway Golf minimized the taxi distance to the terminal, reducing the effective brake unit cooling time.

Significant factors with respect to the evacuation and slide failure:

1. Passengers standing in the aisles with cabin baggage at the time of the evacuation announcement caused congestion.
2. A number of passengers evacuated down the slide in possession of their cabin baggage and personal belongings.
3. During passenger evacuation the R3 slide sustained an overload failure of its fabric fibres when punctured by a blunt-edged object.
4. The use of the over-wing slides during the evacuation presented passengers with the potential hazard of being placed in close proximity to the fire source.

Recommendations. As a result of the investigation, the Australian Transport Safety Bureau recommended a review of the procedures for the deployment of over-wing slides during known brake fire situations. The ATSB recommendations were addressed to the operator and to the Australian Civil Aviation Safety Authority. □

Brake fire occurrences

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curfew period, with a tailwind component of eight knots. The landing and deceleration were normal and idle reverse thrust was used. The fire occurred on wheel number 11, which had a brake temperature indication of five. On that occasion, the fire self-extinguished before ground crew could apply an extinguisher. Examination of the landing gear revealed the presence of Aeroshell 33 grease and an excessive amount of grease around the wheel and brake unit. The brake unit was found to be worn and towards the end of its serviceable life.

After the incident on 3 July, the operator conducted a survey of its Boeing 747 fleet to examine the landing gear axles for signs of incorrect grease application and the presence of excessive amounts of grease. After examining 12 aircraft, the operator found two aircraft (the subject accident aircraft and the aircraft from 3 July) that had both incorrect type and excessive grease present. One other aircraft showed signs of excessive grease, with no other aircraft in its fleet displaying evidence of Aeroshell 33 on the axles.

As a result, the operator issued a maintenance memo highlighting the precautions to be taken when lubricating wheel and brake assemblies. The memo also provided a warning in regard to the use of incorrect Aeroshell 33 grease on axles. □

IN THE SPOTLIGHT...

SAFETY SEMINAR IN MOSCOW

ICAO conducted a seminar on runway safety and air traffic services (ATS) safety management in Moscow from 12 to 15 September 2005. The event, sponsored jointly with the Federal Authority for Transport Oversight (FATO), was attended by 128 participants from 23 States and six international organizations. The seminar brought to an end a three-year campaign to promote awareness of runway safety — specifically the prevention of runway incursions — as well as ATS safety management through seminars conducted in all seven ICAO regions.

MONTREAL CONVENTION RATIFICATION

Switzerland deposited its instrument of ratification of the Montreal Convention of 1999 during a brief ceremony at ICAO headquarters on 7 July 2005, bringing the number of parties to the Convention, which entered into force on 4 November 2003, to 66. Shown on the occasion are (l-r): Laurent Noël, Legal and International Affairs, Federal Office of Civil Aviation (FOCA), Switzerland; Matthias Suhr, General Secretary and Member of the Board, FOCA; and Denys Wibaux, Director of the ICAO Legal Bureau.

RATIFICATION BY COSTA RICA

Costa Rica deposited its instrument of ratification of the Convention on the Marking of Plastic Explosives during a brief ceremony at ICAO headquarters on 12 July 2005. Shown on the occasion are (l-r): Paola Porras Pastrana, Consul, Consulate of Costa Rica in Montreal; Carlos Miranda, Ambassador of Costa Rica in Ottawa; ICAO Secretary General Dr. Taïeb Chérif; and Denys Wibaux, Director of the ICAO Legal Bureau.

WORKSHOP IN LIMA

A workshop on forecasting and economic planning was conducted by ICAO in Lima, Peru from 5 to 9 September 2005. The regional workshop, designed for countries of Latin America and the Caribbean, was attended by 29 participants from seven States and two international organizations. The workshop focused on forecasting methods, CNS/ATM implementation economics and business case development, airport and air navigation planning, future prospects for the region, and other economic and planning issues.