CREATING A GLOBAL STRATEGY FOR AVIATION SAFETY

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Transition to a truly global ATM system

Flight Inspection Primer

Verifying satellite-based approach procedures

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FEATURES

UPDATE

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Promoting the Development of International Civil Aviation

The International Civil Aviation Organization, created in 1944 to promote the safe and orderly development of civil aviation worldwide, is a specialized agency of the United Nations. Headquartered in Montreal, ICAO develops international air transport standards and regulations and serves as the medium for cooperation in all fields of civil aviation among its 189 Contracting States.

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DGCA DIRECTORY: ICAO has developed an electronic database of information on national civil aviation administrations from around the world. The *Directory of National Civil Aviation Administrations* (Document 7604) is continuously updated, based on information received from ICAO's 189 Contracting States. The online directory is available through ICAO's website at an annual subscription fee of U.S. $150. For further information, please contact the Database Administrator (dgca@icao.int).

Global safety conference heralds new era of openness

In renewing their commitment to a coordinated global safety effort, the world's civil aviation leaders have embraced a strategy that demands full transparency and sharing of safety information

ICAO SECRETARIAT

CIVIL aviation leaders from around the world have adopted a declaration which ushers in a new era of openness and transparency concerning safety information. The landmark agreement binds directors general of civil aviation (DGCAs) of ICAO member States to several actions intended to reinforce the safety framework, which has come under public scrutiny in recent months following a series of high-profile accidents.

The declaration was adopted at the end of a highly focused conference, which continued for just over two days at ICAO's Montreal headquarters. The meeting resulted in a comprehensive set of conclusions and recommendations that give shape to an action-oriented global strategy, with greater transparency as its cornerstone.

"Transparency and sharing of safety information are fundamental tenets of a safe air transport system," explained ICAO Council President Dr. Assad Kotaite, who served as Chairman of the Conference, at the conclusion of the meeting. "I believe that this initiative and others taken at the conference will foster mutual trust between States, increase public confidence in air travel, and help maintain the integrity of the safest and most efficient means of mass transportation ever created."

The crucial meeting was precipitated by major accidents last year that served as a clear reminder that systemic deficiencies need to be addressed in a global effort by all parties concerned. While significant progress had been made in addressing deficiencies, certain shortcomings disclosed by safety oversight audits conducted by ICAO have yet to be eliminated because of a lack of effective corrective action. The delegates agreed that further improvement in safety could be achieved only by implementing a comprehensive and proactive approach involving worldwide application by States and operators.

Gerry Ercolani

Some 560 participants from 153 Contracting States and 26 international organizations attended a global safety conference at ICAO's headquarters on 20-22 March 2006.

Delegates were urged by the Council President to work together by forging a strategy that recognizes that a weakness in one DGCA is a weakness in all. "By being transparent and freely sharing information with each other and the public," he emphasized, "you recapture the ability to act as one, to reinforce one another's actions, and to strengthen public confidence. You will be better able to stand united against those who compromise aviation safety."

The DGCAs voiced their commitment to a renewed effort to reinforce the safety network through four specific initiatives. First, they agreed to sharing, as soon as possible, appropriate safety-related information among all aviation stakeholders including the public, an issue that proved sensitive but which was successfully addressed through compromise. Second, they agreed to exercise safety oversight of their aircraft operators, and to assure themselves that foreign operators present in their territory receive adequate oversight from the State concerned, while taking appropriate action when necessary to preserve safety. They decided, moreover, to expeditiously implement safety management systems across all safety-related disciplines to supplement the existing regulatory framework (a separate article on implementing safety management systems begins on page 14). Finally, the DGCAs made a commitment to develop sustainable safety solutions, including the formation or strengthening of regional and sub-regional safety oversight organizations and initiatives.

At the same time, the DGCAs called on States, ICAO, the aviation industry and donor organizations to direct precious resources towards the establishment of sustainable safety oversight solutions. With respect to ICAO in particular, the United Nations agency was urged to develop and actively support information exchange mechanisms that allow for an unrestricted flow of safety data between all stakeholders and, in the same vein, to develop a mechanism to make available aircraft registration and operator information (see "Data system to promote safety through increased transparency," page 25).

The DGCAs also called on ICAO to develop guidelines and procedures for the recognition of certificates and licences, such as a certificate of airworthiness or pilot's licence. Before recognizing the validity of certificates and licences issued by other States, there is a need to verify that the conditions for such recognition have been met or, in other words, to confirm that the documents were issued under requirements at least equal to the applicable ICAO standards. The conference decided that guidance will help ensure that this process of mutual recognition — a process that is mandatory under Article 33 of the Chicago Convention — is effective and uniform.

DISCLOSURE AUTHORIZED

By the time the conference of DGCAs concluded on 22 March, 66 Contracting States had signed consent forms permitting ICAO to disclose safety information. The States that have agreed to this disclosure — many have authorized release of the full safety oversight audit report and not simply an executive summary — are as follows: Australia, Austria, Bahrain, Benin, Bhutan, Bosnia and Herzegovina, Bulgaria, Burundi, Canada, Cape Verde, Chad, China (including the Special Administrative Regions of Hong Kong and Macao), Comoros, Congo, Costa Rica, Côte d'Ivoire, Cuba, Cyprus, Czech Republic, Denmark, Estonia, Fiji, Finland, France, Gabon, Gambia, Georgia, Hungary, Iceland, Italy, Ireland, Lesotho, Lithuania, Luxembourg, Madagascar, Maldives, Marshall Islands, Mexico, Monaco, Netherlands, New Zealand, Niger, Norway, Oman, Papua New Guinea, Portugal, Republic of Moldova, Republic of Slovenia, Romania, Saudi Arabia, Senegal, Singapore, Slovakia, Solomon Islands, Spain, Sri Lanka, Sweden, Switzerland, Tanzania, Thailand, The Former Yugoslav Republic of Macedonia, Togo, United Arab Emirates, United Kingdom, United States, and Zambia.

Gerry Ercolani

The DGCA conference was opened by ICAO Council President Dr. Assad Kotaite (left), Lawrence Cannon, Minister of Transport, Infrastructure and Communities of Canada (centre), and ICAO Secretary General Dr. Taïeb Chérif. The worldwide meeting was presided over by Dr. Kotaite, who will step down as Council President at the end of July.

Maintaining public confidence

In his opening statement to the conference, ICAO Secretary General Dr. Taïeb Chérif predicted that the discussions and decisions among DGCAs representing most of the world's countries would lead to concrete results in solving the safety issues that continue to undermine the integrity of the global air transport system. The meeting, which attracted more than 560 participants from 153 Contracting States and 26 international organizations, was arguably the most important safety conference ever held by ICAO.

Conference participants arrived in Montreal already convinced that something had to be done to prevent the number of fatalities and accidents from rising as air traffic continues to increase in the years ahead. As Lawrence Cannon, Minister of Transport, Infrastructure and Communities of Canada, summed up in his welcome address, the historic meeting was "about people having confidence in flying." Future demographics, he explained, "tell us that the current safety framework simply is not sustainable."

Mr. Cannon called on ICAO to provide leadership in implementing a global strategy that effectively addresses systemic safety deficiencies, asserting that "there is no better tool for international cooperation and action than ICAO."

The meeting was organized around three key themes that generated numerous working papers from States and international organizations, as well as proposals by the ICAO Secretariat. All of the documentation submitted to the meeting, as well as the declaration, conclusions and recommendations, is available at the ICAO website (www.icao.int/icao/en/dgca/).

Fittingly, the meeting opened with a review of the status of aviation safety today, with particular focus on worldwide and regional trends in aviation safety, the status of safety oversight activities, and a look at the initiatives by States and industry to improve safety. On this last topic, Conference Secretary William Voss, the Director of the ICAO Air Navigation Bureau, pointed out that there had been so many initiatives it was impossible to list them all, and the need today is "to talk about better coordination of all these efforts."

But the theme that occupied most of the conference's time was the various ways of improving aviation safety. Delegates discussed numerous proposals concerning a range of topics, among them transparency, management of aviation safety, ICAO's recently adopted unified strategy to resolve safety-related deficiencies, and safety oversight enhancement.

And in this respect, the decision to release results of ICAO audits to the public was clearly the most significant outcome. The mandatory audits, conducted under the Universal Safety Oversight Audit Programme (USOAP) that was mandated by a DGCA conference in 1997, assess the level of implementation of ICAO standards and recommended practices (SARPs), identify safety concerns or deficiencies, and provide recommendations for their resolution. (For a brief update on the status of USOAP, see "Comprehensive safety oversight audits well under way," page 24.)

Until now, the results of such audits have been available only to the Contracting States themselves, and further dissemination has been left to the discretion of each State. The decision to allow ICAO to release such information came after a debate in which some delegates asserted that such data should remain restricted because of the potential for misuse; others argued that full transparency was crucial to safety enhancement.

In a spirit of give-and-take over a difficult issue, participants agreed that new audit reports should continue to be shared among Contracting States, while at a minimum summaries of the audit results should be released publicly to allow travellers to make informed decisions when using air transportation. As a further compromise between diverging views, the conference recommended that States be allowed a maximum of two years to update safety information before such data are released to the public. The information, to be posted at ICAO's public website, will focus on compliance levels relative to the critical elements of a safety oversight system. A deadline of 23 March 2008 has been announced for releasing the latest information, after which ICAO will identify those member States that fail to authorize public disclosure.

Conscious of the public interest in the outcome of the conference, a number of countries confirmed their willingness to have the safety data released without delay; indeed, by the time the meeting concluded on 22 March, 66 Contracting States had signed consent forms permitting ICAO to disclose safety information (see box, page 6).

The summary safety reports will cover eight specific areas of a safety oversight system, namely the status of compliance with SARPs in terms of:

• primary aviation legislation;
• specific operating regulations;
• State civil aviation system and safety oversight functions;
• technical personnel qualification and training;
• technical guidance, tools and the provision of safety-critical information;
• licensing, certification, authorization and approval obligations;
• surveillance obligations; and
• resolution of safety concerns.

Summary reports and other safety-related information will be posted at an ICAO website known as the Flight Safety Information Exchange (FSIX), which was launched during the conference (www.icao.int/anb/fsix). The site is maintained by a newly created unit within the ICAO Air Navigation Bureau that is dedicated to managing the organization's unified safety strategy.

As summaries are posted, States will be given the opportunity to update the information to assist the public in assessing the progress that has been made since completion of the last audit. The DGCAs also called on ICAO to develop a strategy for communicating the safety information effectively to the public.

In looking to the future, the conference concluded that economic liberalization was having a major impact on the aviation industry (see "Evolving commercial and operating environment presents safety and security challenges," Issue 1/2006, page 5), and agreed on the need to ensure that the safety framework continues to be effective in the new era of globalization. Among recommendations issued under this theme were a proposal to develop a new Chicago Convention annex on safety oversight, safety assessment and safety management, and a suggestion that ICAO Council should study the issue of flags of convenience, taking into account the experience of other international organizations in dealing with the same issue.

At the conclusion of the meeting, Dr. Kotaite emphasized that implementation and enforcement of all safety-related provisions of the Chicago Convention, its annexes and ICAO Assembly resolutions were essential to ensure aviation safety.

"Together, these documents constitute the essential regulatory framework for global air transport and must be fully utilized by all stakeholders, in a cooperative manner, to achieve optimum safety. Accidents most often happen when standards and regulations are not applied on a consistent basis," he stated.

The delegates were informed by the ICAO Secretary General that the ICAO *Safety Management Manual* (Document 9859) had been posted at the ICAO website, and printed copies of the manual had been made available at a nominal cost.

Dr. Chérif also assured participants that the conclusions and recommendations of the conference would be acted on promptly, following the customary review by the organization's governing body, the ICAO Council. The Secretariat, he affirmed, "will

continued on page 32

DELEGATES PAY TRIBUTE TO COUNCIL PRESIDENT

The DGCA conference of 20-22 March 2006, together with a meeting of regional air navigation planners that immediately followed it (see text, page 26), were the last high-profile events to be presided over by Dr. Assad Kotaite, who has served as President of the ICAO Council since 1976, and before that as ICAO Secretary General from 1970 to 1976. His impact as a civil aviation leader was highlighted as the two events drew to a close.

A number of participants at the DGCA conference commended the veteran, who will leave his post at the end of July, for his conduct of the historic worldwide meeting. But they also praised him for his strong leadership and remarkable contribution to civil aviation over a period of years that had witnessed major technological, economic and regulatory change.

continued on page 34

Satellite-based approaches facilitate more efficient inspection process

Once commissioned, it would appear the safeness of an approach procedure based on satellite navigation can be verified effectively without resorting to periodic flight inspection

TODD WALTER • J. DAVID POWELL
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WITH the advent of advanced navigation technologies, the opportunity exists to employ more efficient methods for inspecting approach procedures. Unlike procedures that depend on ground-based navigation aids, approach procedures based on satellite signals do not appear to require periodic flight inspection. Before examining the basis for this conclusion, it is informative to review current technologies and flight inspection requirements.

Capabilities of WAAS

Satellite-based augmentation systems (SBAS) are now being implemented around the world in order to improve the accuracy and integrity of navigation based on the global navigation satellite system (GNSS). One of these is the wide area augmentation system (WAAS), the SBAS implemented by the U.S. Federal Aviation Administration (FAA) in 2003. WAAS now provides continuous horizontal navigation throughout the U.S. national airspace system, as well as vertical guidance to most of the continental United States. The European geostationary navigation overlay service (EGNOS) is a similar system that will provide coverage for Europe. Other parts of the world — Japan and India among them — are also developing augmentation systems. All of these systems will include instrument approaches that utilize improved navigation accuracy.

WAAS provides for two types of approach procedures with vertical guidance: lateral and vertical navigation (LNAV/VNAV) and lateral precision with vertical guidance (LPV). LNAV/VNAV was originally developed for barometric vertical guidance, with lateral guidance provided by either a stand-alone global positioning system (GPS) or a ground-based navigation aid called distance measuring equipment (DME). WAAS improves on these by providing both LNAV and VNAV functions. An LPV approach improves even further on this: by taking advantage of the horizontal accuracy of WAAS, the horizontal obstacle clearance zone is reduced to a tenth of its original area, enabling much lower decision altitudes.

National civil aviation authorities the world over are responsible for the safety of their airspace systems, a role that calls for the use of specially equipped flight inspection aircraft.

LPV is capable — depending on local obstacles and runway markings — of bringing an aircraft to within 200 feet of the ground. Functionally, it is very similar to a Category I (CAT I) instrument landing system (ILS) approach. A pilot flying an LPV approach would do so in the same manner as an ILS approach, using the same displays in the cockpit for guidance.

How WAAS works. WAAS-equipped aircraft use GPS satellites to determine the position of aircraft, but importantly, the GPS position so obtained is enhanced in several ways. WAAS improves position accuracy, for example, by sending corrections for the largest errors in the GPS signals. It also provides integrity by broadcasting confidence bounds for the remaining errors, and improves availability by providing additional satellites for use in determining position.

WAAS employs a network of 25 ground reference stations throughout the United States which monitor the health of the GPS satellites. This information is then broadcast to aircraft through a geostationary earth orbit satellite that also sends a signal virtually identical to that which the GPS satellites broadcast. Aircraft can incorporate this extra signal into their position solution, thereby increasing the probability that four or more satellites are available as required.

Because WAAS is a nationwide network and uses a geostationary satellite for its data link, it can provide service throughout

U.S. national airspace without the need for local infrastructure. To use WAAS at a local airport, no additional ground navigation aid (navaid) needs to be installed.

The 25 WAAS reference stations are at precisely surveyed locations. Each has three dual frequency GPS receivers that can be used to cross-check the measurements. By taking measurements from two frequencies, the propagation delay arising from the signal's passing through the ionosphere can be separated from the other error sources.

WAAS sends corrections for the ionospheric delay as well as for the GPS satellites' clock and orbital errors. Each correction is sent to the user at least once every five minutes. Because the reference stations know their location to within centimetres, they can determine what errors may be present on the ranging signals from the satellites. These errors are separated into their individual components for efficient broadcast. Together, the corrections yield an accuracy that is a little less than one metre horizontally and a little over one metre vertically, 95 percent of the time.

Photos courtesy of Nav Canada

Flight inspection of an ILS installation involves checking the accuracy of signals transmitted by a localizer antenna (Figure 1, above), and a glide slope antenna (Figure 2).

The WAAS Programme

The wide area augmentation system was initially commissioned on 10 July 2003. The performance is very good, but it has some limitations. These are being addressed with a series of improvements designed to establish LPV performance over the continental United States in early 2008.

Although WAAS availability has been very high, the geostationary satellites used are not ideally placed over the United States, and their signal capability is limited. Consequently, FAA is procuring two new geostationary satellites whose signals should be available in late 2006. These satellites will be higher in the sky and offer continuous, overlapping coverage. Their signals, which will better emulate GPS signals, will be provided on a second civil frequency. Another improvement to WAAS is the addition of 13 new reference stations in Alaska, Canada, and Mexico, expanding coverage so that LPV approach capability is available over all of the continental United States more than 99 percent of the time. Finally, there will be enhancements made to the internal algorithms of WAAS, which will improve both the continuity and availability of the system.

In the longer term, WAAS will likely take advantage of improvements planned for the GPS constellation. Primarily this involves the use of a new civil frequency at L5. By having both frequencies measured onboard the aircraft, ionospheric delays can be directly measured and removed. This significantly reduces the largest error source currently affecting GPS and WAAS.

A dual frequency equipped aircraft will have several advantages over one using the current WAAS. It will have significantly better performance for LPV, which will no longer be vulnerable to outages caused by ionospheric disturbances. It will also have some immunity to radio frequency interference that can block either the L1 or L5 signals, and in addition will offer CAT I service. Thus, modernizing WAAS to match the improved GPS capabilities offers significant benefits to the aviation community.

Another planned improvement is to incorporate the European counterpart to GPS, called Galileo, as it becomes available. The additional measurements from the Galileo satellites will dramatically increase availability and reduce continuity breaks. The final version of WAAS, which will not be available before 2015, will offer full availability of CAT I throughout the continental U.S. and a very reliable LPV service even in the presence of interference.

WAAS can easily be added to any aircraft. Consumer receivers have been using WAAS for a long time, and two manufacturers offer certificated WAAS receivers for aviation use. Several more are expected in the next few years. WAAS can currently be used for over 4,400 approaches.

Importance of flight inspection

National civil aviation authorities the world over are responsible for the safety of their airspace systems. If an accident were to be caused by a faulty navigation aid or an improper landing approach procedure, the government would not have done its job adequately and could be liable for damages. To help avoid this possibility, specially equipped aircraft periodically inspect all ground-based navaids. The accuracy of a navigational aid is evaluated using flight inspection aircraft that have equipment on board to determine their true location independently of the navaid being evaluated. This makes it possible to verify that the accuracy of the navaids is within the allowable tolerances.

In the United States, the FAA carries out such a flight inspection upon initial commissioning of the navaid, and periodically thereafter. Flight inspection is also part of the commissioning process of new landing approach procedures. The purpose of this inspection is to verify that all data to be published for the approach are correct, that the flight path clears obstacles and terrain by an acceptable margin, and that the achieved flight path is the same as the flight path intended by the procedure designer.

Flight inspection of an ILS. An instrument landing system consists of antenna arrays that provide electronic beams for guidance of aircraft along their approach to landing. More specifically, it provides a signal that the aircraft is on the correct glide slope and is also on the extended runway centerline. The extended runway centerline information is provided by a signal from a localizer antenna (see *Figure 1*) at the far end of the runway, and the vertical information is provided by a signal from the glideslope antenna located beside the runway about 1,000 feet from the landing threshold (see *Figure 2*).

In some cases, the ILS electronics on the ground require adjustments to provide correct signals along the entire length of the approach. In the United States, flight inspection aircraft complete several low passes that fly along the runway at a height of approximately 50 feet, making sure that the camera system captures the runway thresholds at both ends. After each pass, the technician on board the aircraft communicates with technicians on the ground and informs them what, if any, adjustments need be made to correct the glide-slope and localizer signals within the required tolerances. A flight inspection to verify the accuracy and, if necessary, recalibrate the ILS, is carried out every 270 days.

Flight inspection of approach procedures. An "approach procedure" is a set of instructions to pilots which provides them with all information required to descend to a runway using a particular navigation system for guidance (see *Figure 3*). Many runway ends have more than one approach procedure; for example, for a specific runway end there might be an approach using an ILS, another utilizing a nearby en-route navigation aid, and yet another based on GPS. The data for each is published by national civil aviation authorities and updated as required.

Flight inspection identifies and corrects any problems arising from poor survey data, incorrect database content, or poor design before a facility is commissioned or an approach procedure is published. Many en-route navigation aids do not have approach procedures associated with them, but they will also be flight inspected periodically to ensure their accuracy for navigation.

Figure 3. All types of approach procedures, such as the area navigation (RNAV) GPS approach procedure illustrated here, warrant flight inspection prior to their commissioning.

Because all ILS installations have a procedure associated with them, the flight inspection of the ILS accuracy and its approach procedure are typically carried out at the same time. Currently, there is a periodic flight inspection requirement to verify the accuracy of both en-route navaids and instrument landing systems. There is also a requirement to flight inspect an approach procedure when it is commissioned, and periodically thereafter. The periodic requirement is to ensure the continued safety of the approach, and specifically to ensure that clearance is maintained from any new obstacles that may be introduced.

Flight inspection of WAAS procedures. The wide area augmentation system is self-monitoring. WAAS monitors, corrects, and bounds the errors in the system itself, and this information is broadcast in real-time to the aircraft via the geostationary satellite signal. WAAS meets a six-second time-to-alarm requirement, meaning that it will detect any violation of its confidence bounds and alert the pilot within six seconds of an error occurring. In addition, the FAA performs off-line monitoring of WAAS using a network of static ground receivers. This continuous monitoring establishes the health of the overall system and ensures that the models used to form the real-time error bounds remain accurate over the life of the system. Flight inspection is not required for checking WAAS accuracy.

Flight inspection for procedure safety. Prior to commissioning a new approach, it is essential to perform a flight inspection to ensure database integrity and the absence of interference from nearby transmissions. The inspection is also necessary to verify obstacle clearance and establish that the procedure is flyable.

A new WAAS approach is designed by using the surveyed coordinates of the runway as well as details of the local terrain and obstacles. The approach procedure designer uses databases to construct a WAAS LPV approach. These data contain critical elements used in the development of the final approach segment of the designed procedure, including information used for the descent glide path and course alignment. After this information has been coded into binary files by the procedure developer, the procedure integrity is protected by applying a cyclic redundancy check which shows whether data were transferred without corruption. If the results highlight a discrepancy, the data errors must be resolved. This process is used throughout the entire instrument approach procedure development process to ensure that the data of required quality are used to develop, flight inspect, and chart the procedure.

The approach may look very different when seen from the cockpit than it did on the approach designer's desk. This qualitative evaluation of the designed approach procedure is a very important part of the safety assessment. Flight inspection must verify the accuracy of the runway survey point, as any database error could render an approach unsafe. *Figure 4* illustrates an actual case where an error in the database manipulations caused a substantial offset in the designed approach from the actual runway. This situation was discovered by flight inspection and corrected before the approach procedure was commissioned and published.

An important component of the flight inspection is the verification of the approach data and its relationship to actual obstacles and terrain. Any significant obstacles not entered into the database or erroneously recorded must be identified and reassessed. It may be necessary as a result to raise the minimum altitudes and/or change the design of the approach.

DETERMINING THE AIRCRAFT'S TRUE POSITION

ICAO recommends that the error in the system used as a source of true position (or "truth source") on the flight inspection aircraft should be no more than one-fifth of the tolerance of the parameters being measured. The flight inspection computer can use a variety of measuring systems to determine its true 3-D position with acceptable accuracy. One system, known as "hybrid GPS," uses multiple input sources and GPS. It is also possible to use differential GPS, which uses a ground GPS unit. Hybrid GPS is the most frequently used truth system in the day-to-day operations of the FAA flight inspection programme. The selection of the truth system depends on the application, since each system provides its own unique capabilities.

Although fairly accurate and stable, the hybrid GPS truth system by itself is not accurate enough for inspecting precision landing systems without additional data inputs to provide a more precise horizontal and vertical position. A television positioning system (TVPS) provides this additional information.

When the flight inspection computer uses the hybrid GPS truth system with TVPS for precision landing systems, it combines data inputs from a specialized inertial reference unit, a GPS receiver, a TVPS camera and computer unit, a barometric altimeter, and a radio altimeter.

Flight inspection is required to verify the correctness of published approach data

Position information from the onboard inertial reference unit, GPS receiver, and barometric altimeter are all combined to provide an aircraft position until the beginning of a precision approach. During level flight, the flight inspection computer uses the barometric altimeter input to calibrate the inertial reference unit's vertical accelerometer bias. Once the aircraft begins to descend on the precision approach, the flight inspection computer extrapolates aircraft position using only the inertial reference unit lateral velocities (N-S, E-W) and vertical velocities with all the accelerometer biases removed. This process continues until the aircraft reaches the runway end.

During the approach, the TVPS camera takes pictures when the aircraft crosses the runway threshold and runway end. The flight inspection computer uses these pictures to determine exactly when the aircraft crossed the runway threshold and runway end, as well as the horizontal displacement from the runway centreline. The radio altimeter provides the aircraft's altitude above the runway at both fixes. Once the flight inspection computer has processed the fixes, it extrapolates and recalculates the aircraft's path to provide improved position and velocity information for the entire preceding approach path. The flight inspection system can then accurately determine the errors of the navaid and the data used for precision instrument landings at airports.

Another independent truth system is differential GPS (DGPS). The DGPS truth system is much simpler than that of the hybrid GPS with TVPS. It provides extremely accurate 3-D aircraft position throughout the approach, and no runway fixes are required. Although DGPS is sufficiently accurate to update the flight inspection system, it requires a reference receiver to be set up at a surveyed location near the inspection site, which is a time-consuming process.

Finally, flight inspection verifies that the WAAS signal is received and reliable throughout the approach, and that there are no sources of interference that prevent reception of the GPS or WAAS signals.

The flight inspection aircraft is equipped to detect and locate interference sources. Illegal or unintentional sources of interference are eliminated, while other sources may result in operational restrictions or may even prevent the approach from being used.

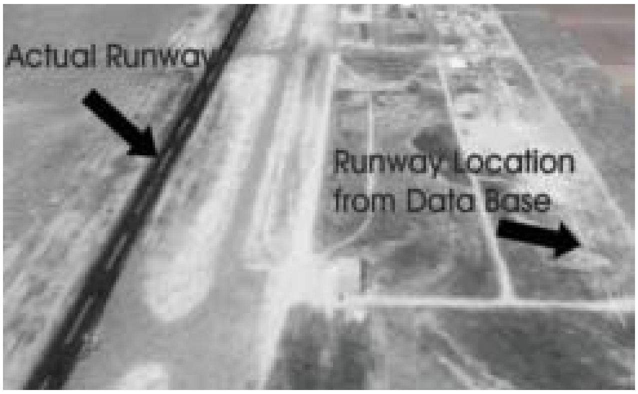


Figure 4. An error in database manipulation can cause a substantial offset in the designed approach from the actual runway, as evident in this example featuring Runway 26 at Moriaty, New Mexico.

Unique aspects of SBAS. Satellite-based augmentation systems are unique in that they require no specific local infrastructure at the airport. This makes it extremely simple to plan and design new procedures. The performance of the system at the location is known beforehand, so procedures are only designed for airports that are known to meet the SBAS requirements.

One interesting consequence of having no local equipment arises from the fact that airports are actually in motion. The surface of the Earth is composed of tectonic plates that move with respect to one another, and therefore a particular runway's coordinates may shift relative to the SBAS reference stations, leading to an error in the guidance.

For the most part, the velocity vectors in North America are small and in the same direction. The exceptions are the western part of California and Hawaii, where the relative velocities can reach five centimetres per year. Thus, over 10 years there could be a half-metre error in the survey point for a runway in these regions.

While this effect of continental drift does not represent a hazard for an LPV approach, at some point it will be necessary to update the survey points for the runway. This effect is analogous to the change in magnetic variation over time. The magnetic north pole and the Earth's true north pole are not at the same place. The correction to the compass measurement required to obtain true north is the magnetic variation. However, the magnetic north pole is not in a fixed position and is in motion relative to the true pole. This means the measured compass heading for a particular runway will change over time; if the magnetic heading changes sufficiently, the runway designation number and charts will have to be updated. Similarly, when the SBAS reference stations and runway drift sufficiently far apart, the runway coordinates and waypoints for the approach procedure need to be updated.

Because the change is small and well known in advance, an update to the station coordinates would not need to be flight inspected for a continental drift update. The update will probably be less than a metre, and in a direction that is easily predicted years in advance. As long as the integrity of the database can be maintained, the new waypoint does not need to be verified by conducting test approaches.

Even after an earthquake, flight inspection is also probably not required. The changes are probably small and not easily discerned on approach. The runway condition and local environment will be inspected by ground crews. For a large change in position, it is possible that flight inspection would be desirable. The exact shift of the waypoints is not so predictable, so the need for a flight inspection would depend on the level of confidence in the new measurements. If there is a sufficient degree of confidence in the new waypoints, no flight inspection would be required. If the measurement process is not completely trusted, however, a new flight inspection should take place.

Conclusion

As with all approaches, SBAS approach procedures must be flight inspected prior to commissioning. A flight inspection verifies that the published approach information is correct. In particular, waypoints, obstacle clearance, frequency spectrum interference, pilot workload and overall procedure design need to be assessed.

Because problems arising from poor survey data, incorrect database content, obstacle clearance, signal interference, or poor procedure design must be identified and corrected, a flight check ensures the overall safety of the procedure.

Once a WAAS approach has been successfully commissioned, it is current FAA policy to carry out periodic flight inspections to ensure that no new obstacles or interference sources have been introduced. The presence of obstacles, however, can be monitored by means other than flight inspection. New construction can be monitored by the airport manager's office, as is the current policy in the United Kingdom. Pilots should of course report problems with signal reception so that the civil aviation administration and airport authority can investigate. With sufficient reporting by pilots and monitoring by the airport, it would appear that the periodic flight inspection of SBAS approaches might not be necessary. □

Todd Walter is the leader of the WAAS research effort in the Aero/Astro Department at Stanford University, which has been heavily involved with the creation of WAAS from its inception. He may be contacted via e-mail (TWalter@stanford.edu). J. David Powell, a Professor (Emeritus) in the Aero/Astro Department at Stanford and a charter member of the International Committee on Airspace Standards and Calibration (ICASC), has been involved with the WAAS research effort throughout its development. He may be contacted at JDPowell@stanford.edu.

More information about flight inspection and the flight inspection community is available at the website of the International Committee for Airspace Standards and Calibration (www.icasc.org).

Global Plan stresses initiatives that lead to direct performance enhancements

The second amendment to the Global Air Navigation Plan currently under review focuses on operational and technical improvements that will benefit aircraft operators worldwide

ICAO SECRETARIAT

ICAO has disseminated a draft of the amended *Global Air Navigation Plan for CNS/ATM Systems* (Document 9750) to member States and international organizations for comment by 9 June 2006. One important change reflected in the revised edition of the document — first published in 1993 — is the incorporation of relevant material from an implementation "roadmap" developed by industry as a follow-up to the 11th ICAO Air Navigation Conference held in Montreal in 2003. Created with the primary objective of providing a common frame of reference for all stakeholders involved in enhancing aviation safety, the roadmap was formally presented to ICAO by the International Air Transport Association (IATA) last December.

The revised Global Plan describes a strategy aimed at achieving near- and medium-term air traffic management (ATM) benefits on the basis of available and foreseen aircraft capabilities and ATM infrastructure. It contains guidance on the improvements necessary to support a uniform transition to the ATM system envisioned in the operational concept that was endorsed by the 11th Air Navigation Conference.

There are many ways to present a transition map: as it is difficult to address all aspects of ATM transition in a single document, the revised Global Plan focuses on the operational and technical improvements in air traffic management that will bring benefits to aircraft operators. Long-term initiatives that are necessary to guide the evolution to the global ATM system envisioned in the operational concept will be added to the plan as they are developed.

Jim Jorgenson

Among recent achievements that facilitate implementation of global ATM are improvements in aircraft navigation systems that bolster the efficiency and effectiveness of oceanic air traffic control.

In line with this approach, the Global Plan will focus on a set of initiatives that will result in direct performance enhancements. States and regions will choose initiatives that meet performance objectives identified through an analytical process which is specific to the particular needs of a country, region, homogeneous ATM area or major traffic flow. Planning tools will assist with this analysis.

Achieving a global ATM system. A global ATM system can be described as a system that achieves interoperability and seamlessness across all regions, for all users during all phases of flight. It must accomplish this while meeting predetermined levels of safety and providing for optimum economic operations. Such a system also has to be environmentally sustainable and must, of course, meet national security requirements.

The planning process described in the revised edition of the Global Plan is based on the model contained in the previous version of Document 9750, which served as a step in the evolution toward a global system. The updated process supports that evolution. Existing detailed plans are in different stages of implementation, with some plans having already identified performance objectives. The revised planning process, with various tools at hand, will further this work and provide the necessary guidance to complete the transition.

Development of work programmes must be based on the experience and lessons learned in the previous cycle of the

continued on page 31

This article was prepared by the Air Traffic Management Section in the Air Navigation Bureau at ICAO headquarters, Montreal.

Systematic approach to managing safety calls for conceptual shifts

A safety management system provides the potential to weave a strong safety net from disparate safety programmes, and offers airlines a more realistic picture of operational risks and an objective method to allocate constrained resources while eventually enabling regulators to focus on system-level oversight

FLIGHT SAFETY FOUNDATION

SINCE Canada's announcement in June 2005 that the country's airlines would be required to implement a safety management system (SMS) and to name an accountable executive ultimately responsible for safety, the conceptual shifts involved in an SMS have gained attention from airlines around the world. An SMS has been described informally as a structure of systems to identify, describe, communicate, control, eliminate and track risks. Some proponents also visualize an SMS as a "roof" or "umbrella" overarching the many existing safety programmes of a typical airline.

As explained by the then Canadian Minister of Transport, the goals for an SMS are "to increase industry accountability, to instil a consistent and positive safety culture and to help improve the performance of air operators. … This approach represents a systematic, explicit and comprehensive process for managing risks to safety … [complementing] the strong oversight programme of inspections and audits already in place."

The SMS also has been called "the first major effort to bring structure to safety programmes in a standardized way" and a "course toward a degree of self-regulation."

Jim Jorgenson

Airlines that implement a safety management system can anticipate important benefits. Aside from fewer incidents, for example, SMS implementation can lead to improved employee morale.

In a landmark amendment to the Canadian Aviation Regulations (CAR), an SMS was defined as "a documented process for managing risks that integrates operations and technical systems with the management of financial and human resources to ensure aviation safety or the safety of the public."

The amendment said that an SMS for airlines in Canada includes the following:

• a safety policy on which the system is based;

• a process for setting goals for the improvement of aviation safety and for measuring the attainment of those goals;

• a process for identifying hazards to aviation safety and for evaluating and managing the associated risks;

• a process for ensuring that personnel are trained and competent to perform their duties;

• a process for the internal reporting and analyzing of hazards, incidents and accidents and for taking corrective actions to prevent their recurrence;

• a document containing all SMS processes and a process for making personnel aware of their responsibilities with respect to them (see figure, page 16);

• a process for conducting periodic reviews or audits of the SMS and reviews or audits for cause [i.e., for a specific reason] of the SMS; and,

• any additional requirements for the SMS that are prescribed under these regulations.

The amendment requires the following SMS components to be incorporated into the air operator's company operations manual and maintenance control manual:

• "A safety management plan that includes the safety policy that the accountable executive has approved and communicated to all employees; the roles and responsibilities of personnel assigned duties under the quality assurance program …; performance goals and a means of measuring the attainment of those goals; a policy for the internal reporting of a hazard, an incident or an accident, including the conditions under which immunity from disciplinary action will be granted; and a review of the SMS to determine its effectiveness;

• "Procedures for reporting a hazard, an incident or an accident to the appropriate manager;

FSF DIGEST

This article is an abbreviated adaptation of a report that originally appeared in *Flight Safety Digest* (November/December 2005), a publication of the Flight Safety Foundation. The article, "Unlocking the Potential of a Safety Management System," may be viewed in its entirety at the organization's website (www.flightsafety.org).

ICAO Journal Issue No. 6/2006, which is scheduled to appear in mid-December, will be dedicated to the subject of safety management systems and their implementation.

• "Procedures for the collection of data relating to hazards, incidents and accidents;
• "Procedures for analyzing … during audit … and for taking corrective actions;
• "An audit system …;
• "Training requirements for the operations manager, the maintenance manager and personnel assigned duties under the SMS; and,
• "Procedures for making progress reports to the accountable executive at intervals determined by the accountable executive and other reports as needed in urgent cases."

As explained by Transport Canada, although all airline employees make choices, an SMS generates greater awareness of the company-wide consequences of some choices, including decisions that are distant in time and space from aircraft operations.

"The aim is to break down communication barriers between different areas of an organization and to establish links between such areas of responsibility as marketing, maintenance and operations to facilitate the recognition that a decision in any part has an impact on all other parts and may create an unintended safety hazard," Transport Canada said.

"Currently, safety is the responsibility of a safety officer who reports to management but who is ultimately not responsible for safety performance. With the introduction of SMS, the focus [of Transport Canada] will be at the systems level [where] inspectors will assess the effectiveness of an SMS within an organization. Therefore, SMS adds a layer of safety. Some air operators have already begun implementing these systems and have had positive results."

Among these operators, Transport Canada cited Air Transat, an air carrier based in Montreal, which voluntarily initiated an SMS in 2002 and has shown economic benefits exceeding costs. Transport Canada said that the same results are expected for other airlines.

"SMS involves a [transfer] of some of the responsibility for safety issues from the regulator to the individual organization," Transport Canada said in 2002. "[In this transfer,] the regulator oversees the effectiveness of the SMS and withdraws from a day-to-day involvement in the companies it regulates. The day-to-day issues are discovered, analysed and corrected internally, with minimal intervention from Transport Canada."

With respect to Canadian airlines, the initial requirements for an SMS only apply to operators whose operating certificate was issued under CAR Subpart 705. Airlines that qualify for and elect to have an exemption (a method of delaying the date for full compliance) may comply with the regulations through a four-phase process that begins with a gap analysis and a project plan, and continue to implement scheduled SMS elements to the satisfaction of Transport Canada between 30 September 2005 and 30 September 2008. Otherwise, the regulations required full compliance within 30 days of the amendment's publication.

An implementation procedures guide provides a checklist for airlines to compare their existing overall management of safety programmes to the required Canadian SMS elements. Moreover, the SMS assessment guide used by Transport Canada officers contains sample questions and SMS scoring criteria. These and other guidance materials are available from the Transport Canada Internet site (www.tc.gc.ca).

Beyond Canada, some senior managers and safety professionals have asked themselves whether their own advanced safety programmes, taken as a whole, constitute an SMS. Unless the civil aviation authority has required specific elements of an SMS for airlines and verified compliance – under pending ICAO standards – any answer could be premature. Nevertheless, comparisons with SMS-related recommendations of several countries would enable an airline to take advantage of the consensus on best practices.

Jim Jorgenson

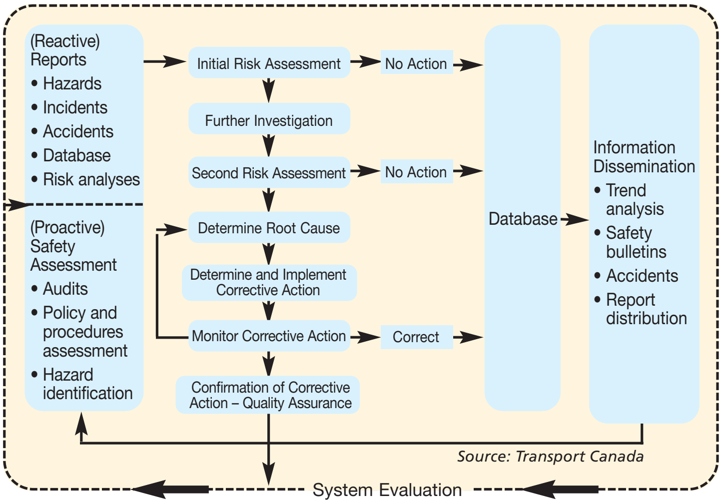
The integrated application of an SMS — embedding proactive safety processes throughout airline management — represents the best overall method of improving existing countermeasures against unsafe acts or conditions.

ICAO requirement

In December 2004, the ICAO Council adopted strategic objectives for ICAO for the 2005-10 period, including the objective to "support the implementation of SMS across all safety-related disciplines in States."

On 6 October 2005, the ICAO Air Navigation Commission approved a related proposal to harmonize SMS-related provisions in ICAO Annexes 6, 11 and 14.*

The pending standards, to become applicable this November, would distinguish between a "safety programme" to be implemented by States and "an SMS" to be implemented by an aircraft operator, airport operator, air traffic services



Flow chart illustrates the safety management system process

(ATS) provider or maintenance organization. The safety programme comprises "an integrated set of regulations and activities aimed at improving safety." An SMS is defined as "a systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures."

When the changes take effect, civil aviation authorities in Contracting States would require aircraft operators and other types of aviation organizations to implement a State-approved SMS. The standards require that the SMS:

• identifies actual and potential safety hazards;

• ensures that remedial action necessary to maintain an acceptable level of safety is implemented; and,

• provides for continuous monitoring and regular assessment of the safety level achieved.

Moreover, the standards require that "an approved SMS shall clearly define lines of safety accountability throughout the operator's organization, including a direct accountability for safety on the part of senior management."

Accompanying the ICAO standards and recommended practices (SARPs) is the new ICAO *Safety Management Manual*, already available from the ICAO website (www.icao.int). According to the manual, the integrated application of an SMS — embedding proactive safety processes throughout airline management — represents the best overall method of improving existing countermeasures against unsafe acts or conditions.

Like Transport Canada, ICAO believes that airlines can experience benefits from an SMS comparable to those experienced by Air Transat, which had a 72 percent decrease in irregular operating costs (saving more than U.S. $1 million per month, compared with the period prior to SMS implementation), while improving employee morale, reducing incidents and increasing overall awareness of operations.

Conceptual shifts

The framework for implementing an SMS involves conceptual shifts:

• from prescriptive regulations to performance-based regulations;

• from highly specialized and technically trained inspectors with significant resource requirements to system auditors and analysts who focus on areas of greatest risk; and,

• from an aviation industry that responds to regulatory requirements to an industry that becomes a partner in safety with civil aviation authorities.

Under conventional reactive strategies for preventing accidents, "constant catching up is required to match human inventiveness for new types of errors," an ICAO official informed seminar participants in Almaty, Kazakhstan in September 2005. "Traditionally," he explained, "safety has been about avoiding costs. Current thinking and research show that safety, efficiency and productivity are positively linked. … An SMS involves constant and aggressive seeking of risk information through hazard/incident reporting systems for identifying latent unsafe conditions, safety surveys to elicit feedback from front-line personnel, flight data analysis for identifying operational exceedances and confirming normal operating procedures, [and] operational inspections and operational audits to identify vulnerable areas. The safety officer [in recent years] … had, in effect, no authority to make changes that would enhance safety. The safety officer's … effectiveness depended on the ability to persuade management to act."

ICAO has cited the following SARPs from its annexes as early precedents for an SMS for airlines:

• a standard in Annex 6 (Part I) requiring an accident-prevention programme and a flight safety programme for operators;

• a standard in Annex 11 requiring safety management programmes in air traffic services, including the acceptable level of safety and safety objectives that became effective on 27 November 2003; and,

• a recommended practice in Annex 14 for an SMS for airports and a standard requiring an SMS for airports that became effective on 24 November 2005.

An often-cited European precedent in the evolution of SMS has been Joint Aviation Requirements-Operations (JAR-OPS) that require that "the operator must have nominated an accountable manager acceptable to the [civil aviation] authority who has corporate authority for ensuring that all operations and maintenance activities can be financed and carried out to the standard required by the authority." JAR-OPS 1 also says that "an operator shall establish an accident prevention and flight safety programme, which may be integrated with the quality system, including programmes to achieve and maintain risk awareness by all persons involved in operations."

Role of leadership. Leadership and accountability should be viewed as key

continued on page 32

* Annex 6 to the *Convention on International Civil Aviation* (also known as the Chicago Convention), contains provisions, including standards and recommended practices, for the operation of aircraft. Annex 11 addresses air traffic services, and Annex 14 is concerned with aerodromes. In all, 18 annexes to the Chicago Convention contain provisions for the safe, secure, orderly and efficient development of international civil aviation.

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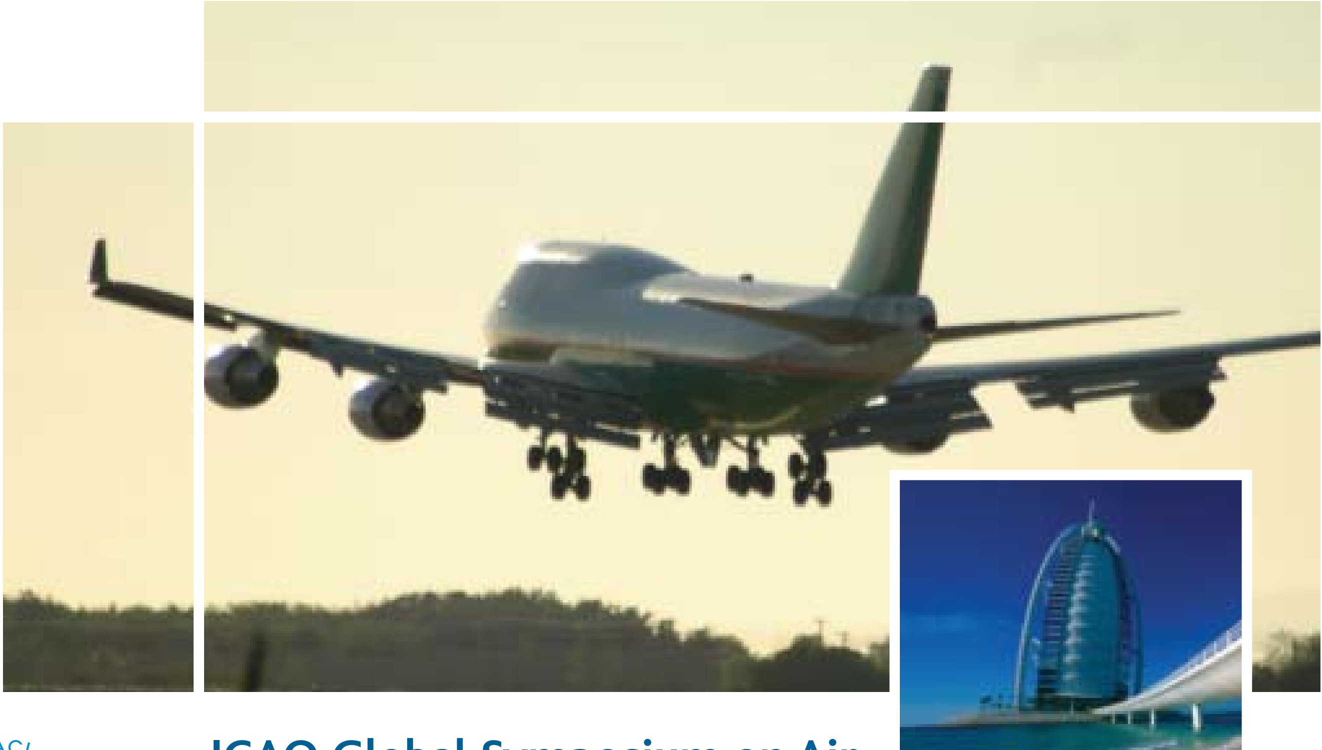

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Maintenance shortcomings lead to B757's precautionary landing

On its first flight following a major maintenance check, a Boeing 757 is forced to land at the nearest suitable airport because of a persistent hot oil smell in the cockpit and cabin, a problem later traced to maintenance mishaps that highlight systemic issues

AIR ACCIDENTS INVESTIGATION BRANCH
(UNITED KINGDOM)

AN investigation of a serious incident involving a British Airways Boeing 757-236 shortly after departure from London Heathrow Airport on 7 September 2003 cites several immediate causal factors including flawed maintenance procedures, organizational culture and ineffective quality assurance. Despite difficulty controlling the aircraft, the pilots landed at nearby Gatwick Airport without injury to any of the passengers or crew, and without damage to the aircraft.

The U.K. Air Accidents Investigation Branch (AAIB) issued a number of safety recommendations to the airline and one recommendation to the European Aviation Safety Agency (EASA), with the intention of preventing similar incidents in the future.

History of flight

The aircraft involved in the incident was being operated on a scheduled passenger flight from London to Paris. After completion of the external pre-flight inspection, it was noted from the technical log that this was the first flight following major maintenance, but there were no special requirements or any deferred defects. The auxiliary power unit (APU) was started and the air conditioning packs selected on. All checks progressed normally.

The right engine was started during the pushback and shortly afterwards a smell of hot oil became noticeable on the flight deck. The commander had experienced this before and with all the right engine indications normal, the left engine was started. The flight deck crew discussed the hot oil smell, but they were not concerned about it at that point (see box, page 20). After the tug had been disconnected and thrust increased on both engines to commence the short taxi for Runway 27L, the hot oil smell disappeared.

Shortly after lift off the hot oil smell returned, stronger than before. The crew had a brief discussion about the smell and the commander, operating as pilot not flying (PNF), donned his oxygen mask. The smell worsened as the aircraft continued its climb so the first officer (FO) also went on oxygen. The pilots established communication with each other and then informed Air Traffic Control (ATC) that they had fumes in the cockpit, were on oxygen and wished to return to Heathrow. ATC instructed them to level off at FL180, and offered the option of returning to Heathrow or diverting to London Gatwick. The commander called the cabin service director (CSD) on the interphone and asked him if the smell had been detected in the passenger cabin. The cabin crew in the forward cabin had become aware of a smell that they described as electrical burning. With this additional information, the commander elected to divert to Gatwick, the nearest suitable airfield.

The CSD was again called on the interphone and given a briefing for the landing at Gatwick. The "SMOKE OR FUMES AIR CONDITIONING" emergency checklist was actioned and the cabin outflow valve opened as the aircraft descended below 10,000 feet, in order to purge the cabin and flight deck of the fumes that were still present.

The aircraft was radar vectored towards Biggin Hill to comply with the commander's request for a 25 nautical mile (NM) track distance to touchdown. The commander consulted the approach plates for Gatwick and gave an abbreviated briefing to the FO for an autoland using the instrument landing system (ILS) on Runway 26L. This was in accordance with the airline's standard operating procedures (SOPs) when operating on oxygen.

The aircraft, with the right autopilot and autothrust engaged, was configured for landing early during the approach, with Flaps 1 and then Flaps 5 being selected on the speed schedule. When the localizer had been captured, the "Approach" mode was armed and the remaining two autopilots were engaged. As the aircraft levelled at 3,000 feet, there was no increase in thrust as expected and the FO noticed that the indicated airspeed was reducing. Autothrottle response appeared sluggish, so the FO advanced the thrust levers manually to 1.3 EPR (engine pressure ratio). The engines seemed slow to respond, but when the FO engaged the "Speed" mode the autothrottle applied the appropriate thrust setting. The landing gear was then selected down, the speed reduced and Flaps 20, 25 and finally Flaps 30 lowered for the autopilot-coupled approach.

The runway was clearly visible at 10 NM and the FO monitored the progress both from the flight instruments and visually.

INCIDENT REPORT

This article is comprised of extracts from the report on the serious incident involving a Boeing 757 on 7 September 2003, during the climb after departure from London Heathrow Airport and the immediate diversion to nearby Gatwick Airport. Published by the Air Accidents Investigation Branch on 15 December 2005, the report can be viewed in its entirety at the AAIB website (http://www.aaib.dft.gov.uk/home/index.cfm).

SUPERVISION AND ORGANIZATION OF HANGAR STAFF

THE guidance and example set by supervision can have a strong influence on working culture. There was evidence of a lack of adequate leadership displayed by the licenced aircraft engineers (LAEs) involved with this incident in that they did not have sufficient oversight of how the tasks were being performed, and did not ensure that best practices were being used. They also displayed an over-willingness to rely on assumptions, rather than verify that work had been performed correctly.

It is not sufficient to issue maintenance staff with authorizations and expect that they will always stick to them rigidly while ignoring all external pressures and factors applied to them in the workplace; this is ignoring the influence of human factors. Simply relying on procedures and assuming that people will always adhere to them is unrealistic and can, over a period of time, result in a gradual shift in the norm away from best practice as people inevitably respond to the most pressing environmental and peer influences around them. This is a risk that is more apparent in a regime of quality assurance, where more responsibility is placed on the individual and there is less independent checking on the quality of an individual's work.

It was apparent that working practices had evolved in the hangar that were expedient in getting the job done, but not necessarily consistent with maintaining high standards of airworthiness, and were in some cases deviating from approved company procedures. This was not a conscious, deliberate compromise of standards, but rather an invisible erosion of standards based on the more pressing need to "get the job done" in as expedient a fashion as possible, which is a natural trait of engineers. The implications on standards of airworthiness of adopting certain procedures and methods are not always obvious at first sight and an awareness that standards might be compromised requires a certain degree of training, experience and awareness of airworthiness issues in general. Without a continual focus on airworthiness standards, through training, effective supervision and adequate quality monitoring, it is inevitable that staff will deviate from best practices.

He noticed that the aircraft was drifting to the right of the runway centreline and this was confirmed by a full "fly left" indication on the localizer and lateral guidance flight director bar. He informed the commander and stated that he would disconnect the autopilot. As he did so he needed to apply some 40 degrees of left control column to maintain wings level.

HISTORY OF OIL SMELL PROBLEMS

As stated in the AAIB report's section on aircraft information (para 1.6.14: Previous history of oil smell problems), the airline has a history of problems of oil smells in the cabin and cockpit on the Boeing 757 fleet. Previously, the problem was largely restricted to the airline's older Rolls-Royce RB211-524C powered 757s, but these aircraft have since been sold and the problem began to manifest itself on the RB211-535E4 powered aircraft which, given the engine design differences, should be less susceptible to contamination of the cabin air supply by engine oil.

A review of the U.K. Civil Aviation Authority Mandatory Occurrence Report database [during a previous safety investigation published in January 2004] showed that the Boeing 757 experienced a high rate of reporting of oil smell issues. As pointed out in the report analysis (para 2.2.: Hot oil/electrical burning smells), according to Boeing and Rolls-Royce overfilling the engines with oil can cause hot oil smells in the cockpit and cabin, an issue that is addressed by instructions in the Aircraft Maintenance Manual.

The FO applied a small amount of left rudder, which assisted in turning the aircraft back onto the localizer. Because the control inputs were symptomatic of an engine failure, the crew checked the engine indicating and crew alerting system (EICAS) display, noting that all engine parameters were normal. At this point the commander took control of the aircraft. He checked that the control trim and flap positions were normal and increased the landing reference speed from 125 knots to 145 knots in order to expedite the approach. The commander continued the approach visually, cross checking the ILS information presented on the flight director while the FO checked the EICAS lower display, noting that an estimated 75 percent of left aileron was being applied. During the flare, the offset control column position was maintained and the aircraft touched down initially on the left main landing gear. Autobrake level "4" and full reverse thrust were used to stop the aircraft.

After touchdown ATC informed the crew that there had been smoke visible under the wing area. The commander thought that this was probably tire smoke, but having obtained the Rescue and Firefighting Services (RFFS) frequency from the tower, he spoke to the RFFS officer who had seen smoke from the area of the landing gear. The crew shut down the right engine and started the APU before shutting down the left engine.

The flight deck windows were opened and the flight crew removed their oxygen masks. The commander spoke to the CSD on the interphone and instructed him to maintain the cabin crew at their doors and then spoke to the passengers to explain the situation. It was agreed with the RFFS that the aircraft would be towed to a remote stand and the passengers disembarked normally.

Investigation findings

1. The roll control problem on the approach to London Gatwick was caused by the asymmetric aerodynamic effects induced by the absence of flap access panels 666AR/666BR on the right wing outboard flap.

2. Access panels 666AR/BR had not been replaced during recent maintenance.

3. The technician who incorrectly certified for fitting flap panels 666AR and 666BR was appropriately trained and qualified for the level of task being performed.

4. The technician responsible for certifying for the fitting of the flap panels had misinterpreted the panel diagram in the 757 Aircraft Maintenance Manual and did not recognize that the panels 666AR/BR are hidden by the flap drive fairings when the flaps are retracted.

5. The same technician assumed incorrectly, after inspecting the right wing on a number of occasions and seeing no "holes" in the wing, that flap panels 666AR/BR had already been fitted and proceeded to certify for their fitment.

6. In certifying for their fitment, the technician exceeded the scope of his certification privileges … in that he was only permitted to certify for work that he had performed.

7. The missing panels were not identified during an inspection of the hangar racks at the end of the maintenance activity.

8. The missing panels had been placed on the same shelf as panels removed from the leading edge slats that were similar in size and appearance and were not required to be refitted to the aircraft.

9. The missing flap panels, not being clearly visible when the flaps are retracted, were not noticed prior to the aircraft reentering service, or during the pre-flight inspection prior to the departure from London Heathrow.

10. A non-procedural approach was used to refit the panels on the right wing whereby all of the panels were installed prior to stamping the job cards.

11. The remoteness of the job card racks from the work area encouraged a non-procedural approach to fitting the panels.

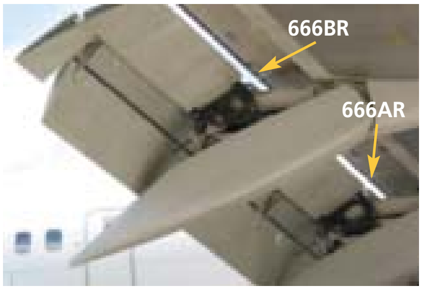
12. Maintenance staff frequently did not certify for tasks they had performed prior to going off shift, placing the responsibility on other maintenance staff and thereby encouraging the practice of "blind stamping."

13. Maintenance staff were often willing to certify for tasks performed by others without verifying that the task had been completed correctly.

14. The culture of "blind stamping" was reinforced by the duplication of panel job cards.

15. Some maintenance staff did not fully appreciate the role that certification plays in the chain of airworthiness control.

Jim Jorgenson



AAIB photo

The incident to the Boeing 757 occurred on the first flight following a 26-day major maintenance check. At left is pictured the righthand outboard flap showing the locations of the missing access panels 666AR/BR.

16. No defects were found that could explain the oil and burning smells in the cockpit and cabin.

17. Incorrect procedures were used to service the engine oils during maintenance.

18. The incorrect servicing of the engine oils possibly caused the oil smells in the cockpit and cabin.

19. The technician who performed the "Daily Check" engine oil servicing task and the licenced aircraft engineer (LAE) who certified for the task were appropriately trained and qualified.

20. The technician who performed the engine oil servicing task did not comply with the Aircraft Maintenance Manual instructions.

21. The "Daily Check" oil servicing task instructions were inappropriately engineered for an aircraft docked in a hangar on heavy maintenance and could not be accomplished practically in accordance with the maintenance manual instructions.

22. The LAE who certified for the oil servicing task did not have sufficient oversight of the task and certified for its completion based purely on assumption that the task had been performed correctly.

23. Both the technician and the LAE involved in the engine oil servicing task exceeded the scope of their authorization by certifying for work that had not been performed in accordance with approved procedures.

24. The "Daily Check" engine oil servicing task was not being consistently performed on the ramp as a result of inadequate maintenance planning, which failed to ensure that the time limitations for engine oil servicing were complied with.

25. A culture existed within parts of the airline's maintenance organization in which LAEs and technicians deviated from approved maintenance instructions and company procedures, without being aware of the airworthiness implications and without a perceived need to seek approval from higher authority.

26. Ineffective supervision of maintenance

continued on page 33

Technological advances facilitate change in licensing and training standards

The new multi-crew pilot licence represents a significant new approach to training pilots for a career in air transport. Ultimately, it could allow the industry to sustain rapid growth by generating an influx of more appropriately trained pilots.

XAVIER HERVÉ
MECHTRONIX SYSTEMS INC.
(CANADA)

AMONG the winds of change sweeping the world of aviation is a new concept that could radically transform pilot training. The multi-crew pilot licence (MPL), as it is known, provides an alternative to traditional pilot training approaches that date back to the 1940s. In fact, the first major review of the international training standards only took place as a result of a meeting in Madrid in October 2000, when the MPL approach was first proposed; subsequent meetings of an ICAO panel of experts in 2002, 2003 and 2005 continued to advance the concept toward testing and fruition.

The MPL concept was adopted recently by ICAO as part of an amendment to Annex 1 to the Chicago Convention (see "Changes to Annex 1 include new upper age limit for pilots, page 25). A test evaluation of MPL is to be conducted in 2007, followed by flight performance testing for initial MPL holders in 2008. In 2009, an ICAO "proof of concept" meeting will be conducted to ascertain the programme's viability.

Among the notable changes that MPL would effect are:

- very specific training oriented towards line operations in modern jet transports, with emphasis on working in a multi-crew environment;
- a requirement for competency-based training and assessment of licence candidates;
- greater emphasis on the use of flight simulation training devices;
- concentrated threat and error training; and
- mandatory upset recovery training.

Once in place, the MPL programme will prepare a freshly trained pilot to occupy the co-pilot's seat on a jet transport after logging a minimum of 240 hours of flight time, including as many as 170 hours in appropriate flight simulators.

The initiative to create the multi-crew pilot licence is driven by several developments. First, it is evident that meeting the industry's growing demand for pilots cannot be sustained by traditional training methods. With air traffic predicted to double over the next 15 years and a significant number of pilots expected to retire, the need for a large influx of new pilots is foreseen. This calls for more effective training approaches that can position pilots more readily in the right seat of a modern airliner.

Second, the traditional training orientation, where the emphasis is on single-pilot operations, is not compatible with strong industry growth since safety must be maintained or even improved while increasing operational activity. To perform safely in this environment, new flight crews must receive adequate training in multi-crew aspects, including crew resource management (CRM).

Third, the economic fallout from 9/11, increased airline competition, and rising operating costs have pressured the industry to adopt new business and operational paradigms. MPL is seen as part of the solution to today's economic challenge, in part because the programme can be undertaken with newly affordable, high-quality non-legacy flight simulation technology.

Although the nature of flight operations has changed dramatically in recent times, today's training organizations are not fully meeting the need for pilots with the skill set desired for a complex cockpit environment. Ultimately, MPL is about offering an alternative path to the modern flight deck that meets industry's needs.

Too much training time today is dedicated to logging hours in small piston-powered aircraft, with a misplaced emphasis on solo operations. The industry might be better served if the would-be commercial pilot were schooled as early as possible in settings that promote effective cooperation with other crew members, and exposes trainees to advanced cockpit technologies. This approach focuses on the competence needed to work safely on the modern flight deck.

Addressing the operational and technological aspects of advanced aircraft at an early stage of training for air transport pilots is particularly valid today, given the growing importance of ab initio training schools. In many countries, such schools have overtaken the military as the primary source of new airline hires. And while many of these flight schools offer CRM courses and line oriented flight training (LOFT) programmes, such training is still not compulsory, and is offered to a limited extent.

More effective training and licensing requirements that incorporate more explicit criteria for measuring pilot competence are therefore much in need. Indeed, the absence of common criteria against which to measure flight crew competency has led to significant variations in the pilot performance standards applied by different States, and in some countries no explicit standards of performance exist.

The MPL brings a competency-based approach to training. This is a key to establishing common standards around the world, with a more uniform training process and proper emphasis on training outcome. A licensing standard based on competency clearly delineates what is demanded of trainees in terms of performance, and by measuring their performance in this manner, provides instant feedback. Competency-based training is also less dependent on the availability of instructors, relying more on the use of instructional materials, and competency assessment is more transparent for both examiners and candidates.

The oft-cited arguments against MPL assert that its implementation is too costly for non-airline flight training organizations and, given the specific focus on certain aircraft types, is not very productive unless it includes a job guarantee with an airline. Opponents also point to the lack of actual flight experience as a flaw.

Focus on cost reduction

The need to reduce the expense of running an airline, while facing notably higher costs for jet fuel, insurance and aviation security, is a hard reality that training organizations cannot afford to ignore.

In recent years, various air carriers have achieved cost reductions by renegotiating labour agreements, including pension arrangements, and by turning to outsourcing to cover activities such as maintenance. The field of pilot training is not immune to the trend toward greater cost efficiency.

If there has been a mixed reaction to the MPL from flight training organizations, it is primarily because some training centres remain concerned about how MPL implementation could impact their business. With the introduction of the multi-crew pilot licence, an increasing number of airlines may choose to perform training in-house, or join with specialized aircraft type training facilities to create initiatives under new business models that may include job guarantees for graduates. Still other training organizations have fully endorsed the concept: CTC Group, of the United Kingdom, for example, is intending to apply for certification of its first MPL course later this year.

At an ICAO conference in Europe recently, a keynote speaker and training executive for a major European carrier was among those advocating early implementation of the multi-crew pilot licence. He cited important advantages to pragmatic training that is oriented towards aircraft types currently in the fleet. Many executives are talking about the need for change, and for some this includes the deployment of the latest microprocessor-based flight simulator technology, which can be used to support an in-house MPL programme.

Airlines can leverage current simulation technology in their bid to lower costs while also improving training effectiveness.

Technological advances

As noted above, the MPL calls for the candidate to log a minimum of 240 hours, including 70 hours in aircraft. The balance of the programme, devoted to developing the competencies required of a first officer, utilizes various flight simulation and other training tools designed to promote safety in line operations in modern jet transports.

The requirement for just 240 hours is made possible mainly because of the leap forward in simulator technology, which provides an exceptional virtual experience that promotes safety without the need to log as many flight hours as in the past, but also because of the technology employed by modern training aircraft.

While eliminating costs is a watchword for many in aviation, by using today's more efficient and less costly microprocessors in flight simulators, a realistic MPL flight environment can be duplicated without compromising safety. In other words, airlines can leverage the latest simulation technology in their bid to lower costs while also improving training effectiveness.

The revolutionary change in simulation technology draws on the same technical-economic revolution that has led general aviation aircraft manufacturers to provide full glass cockpits at affordable prices. Together, the simulator and general aviation aircraft manufacturers offer the most flexible, accessible and cost-effective training solution for implementing the

continued on page 34

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ICAO UPDATE

Comprehensive safety oversight audits are well under way

By the end of 2005 ICAO had completed a number of safety oversight audits according to the new comprehensive systems approach that came into effect in January 2005. The first comprehensive audits to be conducted under the Universal Safety Oversight Audit Programme (USOAP) involved Canada, the Czech Republic, Egypt, Gambia, Germany, Kuwait, Malaysia, Panama and Thailand. Eventually, all 189 Contracting States will undergo the comprehensive audit during a six-year cycle that ends in 2010.

The initial audits conducted under the greatly expanded programme, which now covers the safety-related provisions in 16 of the 18 annexes to the Chicago Convention, allowed ICAO the opportunity to review and fine-tune the audit process and tools. As well as the nine Contracting States identified above, the early audits included the European Aviation Safety Agency (EASA), which carries out safety oversight-related activities on behalf of its member States.

One of the changes associated with the comprehensive programme is a restructuring of the audit reports themselves, which now reflect the critical elements of a safety oversight system as described in Part A of the *ICAO Safety Oversight Manual* (Document 9734), a document that focuses on the establishment and management of a State's safety oversight system.

Distribution of the final reports has also been changed. A dedicated secure website has been developed to disseminate the final safety oversight reports and related documentation, including information derived from the Audit Findings and Differences Database (AFDD). With the transition to the Internet, the final safety audit reports are now made available in their entirety to all Contracting States, and audit reports are no longer routinely distributed in print form. To promote transparency still further, summary reports and in some cases full reports will be accessible at ICAO's public website (see article, pp. 5-7).

To ensure a more efficient auditing process, ICAO has developed a questionnaire on the aviation activity in the State to be audited, as well as compliance checklists for each annex concerned and audit protocols for each area covered by the audit team. By the end of 2005, 110 member States had submitted completed questionnaires to ICAO. The form is also available at the secure website in English, French, Russian and Spanish.

Similarly, 90 completed compliance checklists, used by States to ascertain their level of compliance with ICAO SARPs, had been submitted to ICAO by year's end. The pre-audit questionnaire and compliance checklists better enable ICAO to prepare for audits and to maintain a current database on compliance with SARPs.

ICAO anticipates that the recruitment of the required staff to implement the comprehensive systems approach should be completed by June 2006. So far, five States have seconded experts to USOAP on a long-term basis, but more national experts are needed.

In preparing for the launch of safety oversight audits under the comprehensive systems approach, ICAO conducted a seminar and workshop at each of its seven regional offices, with the participation of more than 400 experts representing national administrations, international and regional organizations and the ICAO regional offices themselves. ICAO also conducted six auditor training courses during 2005, and a total of 153 experts have now been trained since USOAP's transition to the comprehensive systems approach to audits. Recently trained experts are being provided with on-the-job training during actual missions to States.

ICAO's Safety Oversight Audit Section was recently recertified as ISO-compliant. The ISO-based quality management system was audited in late September 2005 for a new three-year period, with maintenance audits to be conducted on a yearly basis. □

DISCUSSIONS IN TOKYO

While in Tokyo in mid-January 2006 to address a ministerial conference on transport security, ICAO Council President Dr. Assad Kotaite also had discussions with Japanese authorities on various aviation matters. He is pictured being greeted by Katsutoshi Kaneda, Senior Vice-Minister for Foreign Affairs of Japan. Among topics discussed with Japanese leaders were global aviation safety, aviation security, and the ratification of certain international air law instruments.

Development Forum planned

A forum focused on ways to maximize the economic contribution of civil aviation is planned for ICAO headquarters from 24 to 26 May 2006. The forum will promote air transport as a global economic catalyst and will address issues that impact on safe, efficient and regular air services from a regional as well as global perspective. The event is being organized jointly by ICAO, the Air Transport Action Group (ATAG) and the World Bank. □

Changes to Annex 1 include new upper age limit for pilots

Airline pilots will now be able to continue flying professionally until the age of 65 as a result of an amendment to ICAO Annex 1, *Personnel Licensing*, which was approved by ICAO Council on 10 March 2006. The same amendment introduces significant changes to flight crew training and licensing standards, among them the introduction of a new aeroplane pilot licence to be known as the multi-crew pilot licence (MPL).

Once the amendment takes effect on 23 November 2006, air transport pilots will be permitted to continue their careers past age 60 on condition that they work in multi-crew operations. Another proviso is that pilots over 60 years old fly only with pilots younger than 60. In addition, all pilots over age 60 are required to undergo a medical assessment every six months.

The increase in the upper age limit was proposed in light of the results of a survey conducted in late 2003 that showed significant support for such an increase, as well as positive information provided by several States where pilots currently are permitted to work beyond their 60th birthday.

In recommending the change in the upper age limit for pilots, the Air Navigation Commission noted that since 1978, when the age 60 rule was introduced, the increase in longevity and associated good health into old age in many States, the progress of medical science, the introduction of incapacitation training for multi-pilot operations, and advances in aircraft technology have altered the flight safety risk associated with ageing pilots. Moreover, legal challenges by individuals alleging unfair discrimination caused several States to question the continued validity of the existing provisions.

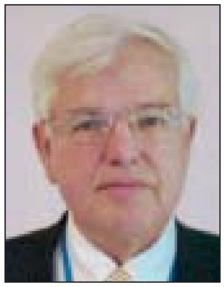
Among other changes introduced by the Annex 1 amendment are the introduction of personnel licensing requirements for airship and powered-lift aircraft, and the MPL qualification cited above. The new MPL will qualify the holder to perform co-pilot duties on aeroplanes operated with more than one pilot (for more on MPL, see “Technological advances facilitate change in licensing and training standards,” page 22). The new licence complements, and does not replace, the existing ways of qualifying as a co-pilot for multi-crew operations.

The ANC, in recommending establishment of the new aeroplane pilot licence, indicated that safety and efficiency gains had been identified by the ICAO Flight Crew Licensing and Training Panel (FCLTP), which undertook a risk and safety benefit study. In addition, MPL will involve application of specific risk control measures and a post-implementation proof-of-concept programme.

With the changes to Annex 1, a new document, *Procedures for Air Navigation Services – Training* (PANS-TRG), has been developed to provide general guidance to States on the design, development and implementation of competency-based training and assessments as well as specific guidance for the new multi-crew pilot licence.

The Annex amendment also incorporates revisions to the details of the existing flight crew licensing standards to ensure their continued relevance in meeting current and anticipated training needs while improving on safety. Another change is better recognition of the role of flight simulation training devices in acquiring or maintaining the competencies required for the various levels of licences and ratings. □

ICAO Council appointment



D. T. Bliss (United States)

Ambassador Donald T. Bliss has been appointed Representative of the United States on the Council of ICAO. Mr. Bliss’s tenure began on 23 February 2006.

After graduating from Harvard Law School in 1966, Mr. Bliss joined the U.S. federal government, serving successively with the Department of Health, Education and Welfare, Department of State, and the Environmental Protection Agency before joining the Department of Transportation, where he held the posts of Deputy General Counsel and Acting General Counsel during the administration of President Gerald Ford. During that period he worked on the U.S. aircraft noise policy and the Concorde SST plans to fly to the United States.

Since 1977, Mr. Bliss has been engaged in the practice of transportation law in the Washington, D.C. office of O’Melveny & Myers LLP. In that capacity he has represented airlines, airports, governments, trade associations and manufacturers on various policy, regulatory, legislative and other strategic issues affecting aviation. He has argued cases before the federal and state courts, including the Supreme Court of the United States and other appellate courts, and has served as a federal court-appointed Special Master on transportation issues.

From 1999 to 2001, Mr. Bliss served as Chairman of the American Bar Association’s Air and Space Law Forum, after previously serving as Chairman of the Federal Bar Association’s Transportation Law Section. He has also served as Co-Chairman of the District of Columbia Bar Association’s Administrative Law and Agency Practice Section, and President of the Harvard Law School Association of D.C.

Mr. Bliss has prepared reports on issues such as cross-border investment and substance abuse in the transportation industry, as well as numerous articles on transportation in various journals. He is the author of a book on airline-customer relations that addresses security, safety and service issues. □

Data system to promote safety through increased transparency

ICAO is in the midst of establishing a system that will provide aviation authorities with direct access to pertinent aircraft registration data supplied by States. Proposed by the Air Navigation Commission (ANC) following a recent study of Article 21 of the Chicago Convention – the article that governs the reporting of registrations in international civil aviation — the system would further increase transparency in the interest of safety. (Transparency and the sharing of safety information were important issues at a global conference held at ICAO headquarters during 20-22 March; see article, page 5.)

ICAO is currently evaluating various options for such a system, including costs and procedures, with the ICAO Council calling for a simple system that would be easy to implement and operate. As noted by the ANC, the web-based technology to create a system that provides access to pertinent aircraft registration data from States is available and well proven, and could be readily established and maintained by the organization. As currently envisioned, the system would likely consist of a website portal to the pertinent data already maintained by member States.

In presenting the safety case in favour of establishing a single source of registration data, the ANC pointed out the importance of having a means for a State to ascertain the identity of the State of aircraft registry prior to the arrival of an aircraft in its territory. “The global evolution of aviation business and operating practices has not, in some cases, been matched by States’ oversight capabilities, with resulting implications for safety. Problems in identifying lines of responsibility tend to arise …”, the Commission reported.

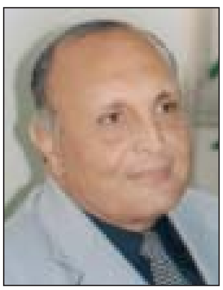
“In today’s civil aviation environment,” the report stated, “it is more and more likely that an aircraft may enter a State’s airspace without having assurances that the operator can safely fly within its territory, as the aircraft may not be subject to an appropriate level of oversight from the State of registry and State of the operator. As a consequence of the unavailability of such information about safety oversight, the practice of illegal registrations and illicit trade of aircraft is for the most part going undetected, further impacting air safety.”

From a legal perspective, the ANC study concluded that nothing would prevent ICAO from requesting information concerning aircraft registration and ownership in a systematic fashion under ICAO regulations.

At present, there is no single source of information available identifying the State of registry of all aircraft habitually involved in international civil aviation operations, and while there are commercially available sources of registry data, these are incomplete, in part because there is no obligation for States to list their aircraft with these services.

In recommending creation of the new information system, the Commission referred to a 2001 investigative report submitted to the UN Security Council by a panel of experts which found that illegally registered aircraft were an “endemic problem.” □

ICAO Council appointment



N. E. Kamel (Egypt)

Nabil Ezzat Kamel has been appointed Representative of Egypt on the Council of ICAO, and commenced his tenure on 8 December 2005.

Mr. Kamel has pursued advanced studies in aviation and military sciences, acquiring a bachelor of science degree in 1965 from the Egyptian Air Force Academy, and a master’s degree from the Egyptian Air Force Staff and Command College in 1986. He began his career as a fighter pilot, subsequently serving as a flight instructor and later as commander of an air squadron. He has held positions of increasing responsibility with the Egyptian Air Force, where he was responsible for pilot training prior to his appointment as Chief of Staff. Over the course of his military career, he has been decorated with eighteen merits and medals.

In the civil aviation sector, Mr. Kamel was appointed in 2001 to the position of Chairman of the National Civil Aviation Training Organization. Prior to his appointment as Representative of Egypt on the ICAO Council, Mr. Kamel was serving as Counsellor in Egypt’s Ministry of Civil Aviation. □

ALLPIRG convenes meeting at ICAO headquarters

Chairmen of the various regional planning and implementation groups from around the world met at ICAO headquarters in Montreal from 23 to 24 March for the fifth meeting of the ALLPIRG Group. The meeting focused on the Global Air Navigation Plan, aviation safety and security, and interregional coordination and harmonization.

Participants in the two-day meeting were presented with details of the revised Global Air Navigation Plan and discussed planning for implementation of a global air traffic management (ATM) system (see “Global Plan stresses initiatives that lead to direct performance enhancements,” page 13). The participants were presented with a business case software tool developed by ICAO in order to assist States, air navigation service providers and airspace users in the evaluation of various scenarios and in reaching consensus on CNS/ATM systems implementation, leading to a global ATM system. They were also updated on CNS/ATM-related environmental benefits, and discussed the possible development of simplified tools and guidance material for estimating the environmental benefits of CNS/ATM systems at the national level.

The meeting, chaired by ICAO Council President Dr. Assad Kotaite, was attended by 100 participants. As well as chairmen and secretaries of ICAO’s regional planning and implementation groups and some of their sub-groups, ALLPIRG membership includes international organizations, global and regional service providers and other key partners involved in CNS/ATM systems implementation. ALLPIRG provides a close link between the various implementation bodies and discusses interregional issues involving air navigation, air transport and technical cooperation, and develops recommendations for harmonized implementation of a global ATM system. □

CD promotes aviation language proficiency

ICAO has produced a training CD with rated speech samples that can be used to develop tests for aviation language proficiency. Under language proficiency standards, pilots and air traffic controllers involved in international civil aviation are required to demonstrate a sufficient level of proficiency in aviation English by March 2008.

The CD, which is 135 minutes long, contains examples of speech rated at ICAO language proficiency Levels 3, 4 and 5. Each sample is accompanied by a detailed rating form that explains the rationale for the rating. In addition, the CD contains information on the proficiency rating scale and on language proficiency testing.

The CD is related to the *Manual on the Implementation of ICAO Language Proficiency Requirements* (Document 9835) and is of interest to civil aviation authorities, air navigation services providers, training institutions, airlines and institutions where language courses are taught or where language proficiency tests are conducted. It is available from the ICAO Document Sales Unit (sales@icao.int) at a price of U.S. $75.

For more information on aviation language proficiency, see *ICAO Journal* Issue 1/2004, which contains several articles on the subject. □

Airline passenger fatalities rose in 2005

ICAO's annual analysis of aviation safety and security data has revealed that 2005 witnessed 18 fatal accidents and 713 passenger fatalities in scheduled air services worldwide, and six acts of unlawful interference causing three deaths. The safety statistics, based on preliminary information compiled from the organization's member States, are related to commercial air transport aircraft of more than 2,250 kilograms (4,960 lb) take-off mass and reflect only those accidents resulting in passenger fatalities.

ICAO's analysis of aircraft accidents, which does not include those caused by acts of unlawful interference, revealed an increase in the accident rate in terms of fatalities per 100 million passenger-kilometres flown, which doubled to 0.02 from 0.01 in 2004. In 2004, member States reported 203 passenger fatalities as a result of nine accidents.

Non-scheduled operations experienced 18 fatal accidents in 2005, a figure unchanged from 2004. The number of passenger fatalities related to non-scheduled operations rose, however, to 278 from 207 in 2004. Accident rates related to non-scheduled transport could not be estimated because of the lack of comprehensive traffic figures for these services.

During 2005, six acts of unlawful interference were recorded in which three persons were killed and 60 were injured. Among these events were two unlawful seizures and two attacks on facilities.

Aviation safety was the focus of a conference of directors general of civil aviation which was held at ICAO headquarters at press time (for more on the outcome of the DGCA conference, see page 5). □

Air transport outlook

A conference at which government and business representatives will share views on the future of aviation is to be held at ICAO headquarters in Montreal from 27 to 30 June 2006. The Global Air Transport Outlook Conference, being organized by ICAO in partnership with Airports Council International (ACI), is intended for representatives of airports and airlines, aviation consultants, organizations concerned with travel and tourism and the media. Issues to be addressed include strategic planning, forecasting, statistics, infrastructure and the provision of services and facilities. □

ICAO Council elects its next President

R. Kobeh González

The ICAO Council elected Roberto Kobeh González (Mexico) as its President, with effect from 1 August 2006, during a Council meeting on 2 March 2006. Mr. Kobeh González, currently the Representative of Mexico on the Council of ICAO, succeeds Dr. Assad Kotaite, who has served as Council President since 1976.

The Council President is normally elected by the members of the Council following the organization's triennial session of the Assembly. Although the term for which Dr. Kotaite was elected in 2004 would normally continue until late 2007, he indicated at the opening of the 35th Session of the Assembly in September 2004 that his 11th term in office would be of a transitional nature.

The other candidate for the post was Dr. Philippe Rochat (Switzerland), a former ICAO Secretary General (1991-97) who served on the Council from 1985 to 1989 as the Representative of Switzerland.

Since his appointment to Council in 1998, Mr. Kobeh González has served as First Vice-President of the Council, Chairman of the Finance Committee, and as a member of the Air Transport and Unlawful Interference Committees. Prior to joining ICAO, he held a number of posts of increasing responsibility with his government's Directorate General of Civil Aeronautics. As Deputy Director General in the areas of Administration and Air Transport, he took part in negotiations on bilateral agreements with various countries. From 1978 to 1997, he served as Director General of the Servicios a la Navegación en el Espacio Aéreo Mexicano (SENEAM), the agency responsible for providing navigation, air traffic control, meteorology, and aeronautical communications services. Mr. Kobeh González has also been a professor of aeronautical electronics at the National Polytechnic Institute of Mexico.

Mr. Kobeh González has participated in numerous worldwide conferences and regional meetings convened by ICAO.

The President of the Council, the organization's governing body, convenes meetings of the Council, the Air Transport Committee and Air Navigation Commission. He also carries out, on behalf of the Council, the functions that it assigns to him. □

Dr. Taïeb Chérif reappointed ICAO Secretary General

Dr. Taïeb Chérif

The ICAO Council reappointed Dr. Taïeb Chérif (Algeria) as Secretary General of ICAO during its meeting of 27 February 2006. Dr. Chérif's second three-year term takes effect on 1 August 2006. The other candidate for the post was William Voss (United States), the Director of the ICAO Air Navigation Bureau.

Dr. Chérif commenced his first term as Secretary General on 1 August 2003. In his first three years he has focused on measures to further improve the efficiency and effectiveness of the organization. Among measures he has spearheaded are the more widespread use of information technology for cost-effective delivery of information and documentation services; changes to the organizational structure and realignment of human resources strategies; greater functional integration between ICAO headquarters and its seven regional offices; and the development of the organization's first business plan.

Dr. Chérif was Representative of Algeria on the ICAO Council from 1998 to 2003. In that capacity, he was Chairman of the Air Transport Committee and a member of the Finance Committee of the Council as well as specialized working groups. His career includes various high-level positions in the civil aviation administration of Algeria, and the post of Secretary of State for Higher Education. He received a doctorate in air transport economics from Cranfield Institute of Technology, in the United Kingdom, and has taught air transport economics at the Institute of Economic Sciences in Algiers. He also acquired a diploma in aeronautical engineering from the École nationale de l'aviation civile, in Toulouse, France.

As the chief executive officer of the organization, the Secretary General is responsible for ICAO's day-to-day operation and also serves as Secretary of the ICAO Council, the governing body of the international agency. The Secretary General is chosen by an election which is held every three years by the Council. □

International registry now in operation

A new international registration system for transactions concerning aircraft and aircraft engines has begun operation. The registry was created by an international treaty, the Cape Town Convention and Aircraft Protocol, which came into effect on 1 March following its ratification by eight States.

The registration system is operated by Aviareto under ICAO's supervision. Aviareto is a joint venture involving SITA and the Government of Ireland, and is based in Dublin.

The registry will reduce the risks of lending for aircraft financiers, banks and other financing institutions involved in aircraft purchasing and leasing, thus reducing the cost of credit. Financing and leasing costs represent on average about 8 percent of the total operating expenses of international scheduled airlines. (For more information about the Cape Town Treaty and the international registry, see Issue 5/2003, page 25; and Issue 9/2001, page 55.) Information about the international registry, including its regulations and procedures, is also available at the ICAO website (www.icao.int). □

Annex amendment includes safety management provisions

An extensive amendment to Part I of ICAO Annex 6, Operation of Aircraft, includes new provisions concerning State regulatory systems and the regulatory oversight of aircraft.

With the recent adoption of Amendment 30, expected to become applicable this November, a new Appendix 5 specifies the critical elements of a regulatory system needed by the State of the aircraft operator; other revisions better describe the approval and acceptances required by the State of the operator and the State of aircraft registry for inspection, certification and continued supervision of air operators.

Another change to the annex relates to the carriage of documents on board aircraft, and requires that an aircraft engaged in international operations carry a certified true copy of the air operator certificate (AOC) and related authorizations, conditions and limitations, accompanied by an English translation where the AOC is issued in a language other than English. The new requirement will enable authorities to determine, during inspections such as ramp checks, which State has responsibility for regulatory oversight of the aircraft's operations, and to also ascertain the precise nature and extent of any conditions attached to the AOC. English translations for the aircraft's certificate of airworthiness, the certificate of registry, pilots' licences, and documents attesting to noise certification are already required.

The amendment harmonizes the safety management requirements contained in different ICAO annexes. In Annex 6, Part I, it introduces new definitions and provisions related to safety management, as well as notes on new guidance material on safety management. Similar amendments have been adopted for ICAO Annex 11, which concerns air traffic services, and Annex 14, which contains provisions for aerodromes. With the changes in each of the annexes, the amendment harmonizes the approach to safety management for air traffic management providers, aircraft operators, maintenance organizations and aerodrome operators.

Another revision to Annex 6, Part I concerns the carriage of pressure altitude data sources, and serves to enhance the accuracy and effectiveness of the airborne collision avoidance system (ACAS) and ground surveillance with secondary surveillance radar (SSR) Mode S by requiring that aircraft be equipped with altitude encoders with higher resolution.

Among other revisions to the annex, adopted by the ICAO Council in March 2006, are:

• a requirement that pilots be made aware that criteria used for obstacle clearance information can differ from State to State and may also differ from the criteria recommended in ICAO Procedures for *Air Navigation Services – Operations* (PANS-OPS);

• a new definition for flight operations officers and dispatchers, and standards and recommended practices that clarify the responsibility of such officers or dispatchers for the safe dispatch and operation of a flight;

• updated references to material containing legal guidance for the protection of information obtained from safety data collection and processing systems; and

• updated provisions related to flight crew licensing and training requirements.

With respect to licensing and training, the amendment enables the evaluation of competency to be conducted by means other than examination. It also introduces threat and error management as a flight crew training requirement, and requires a biannual pilot proficiency check to be conducted on each type of aircraft that a pilot is qualified to operate. □

Global Air Navigation Plan

continued from page 13

CNS/ATM implementation process. The third edition of the Global Plan focuses, therefore, on efforts towards maintaining consistent global harmonization and improving implementation efficiencies by drawing on the existing capabilities of the infrastructure and successful regional implementation of CNS/ ATM systems over the near and medium terms.

Planning tools. The new edition of the Global Plan is supported by planning tools that take various formats; among these are software applications, planning documentation, web-based reporting forms, and project management tools. As States and regional planning and implementation groups consider possible initiatives, they will use common programme templates that serve as the means for establishing performance objectives and implementation time lines. The common templates will also be used in developing a comprehensive schedule and programme of activities to accomplish the work associated with the initiatives. In addition, planning tools will provide links to relevant guidance material and documents that will be of value to the planner. This will ensure a uniform approach to the implementation of all Global Plan initiatives.

Evolution of the global system. Achieving the desired global ATM system will be accomplished through an evolutionary implementation of many initiatives over a period of several years. The set of initiatives contained in the plan are meant to facilitate and harmonize the work already under way within various regions in addition to generating important benefits for aircraft operators.

ICAO will continue to develop new initiatives for advancing the Global Plan. In all cases, these must meet objectives that are based on the ATM operational concept. Planning and implementation activities begin with the application of available procedures, processes and capabilities, and gradually apply the emerging elements, with ultimate migration to the envisaged ATM system.

Business planning. The Global Plan initiatives were developed in unison with ICAO's business planning process, and as such reflect the key activities and critical tasks related to the organization's strategic objectives for the 2005-10 period. Linking the Global Plan initiatives to the business plan of the organization should ensure that ICAO's strategic objectives are adequately addressed and should also allow for implementation of an effective performance framework for ICAO's work in the field of air navigation.

Measurable achievements. In recent years, important developments have taken place and opportunities have emerged as technologies mature, research and trials conclude successfully, and procedures and specifications become finalized. To cite specific examples, automatic dependent surveillance – broadcast (ADS-B) is now being successfully implemented and is widely available for surveillance in domestic airspace; modern aircraft are being equipped with FANS 1/A, systems that improve the efficiency and effectiveness of oceanic air traffic control; and the concept of required navigation performance (RNP) has evolved. Moreover, ICAO will soon publish new performance-based navigation guidance material and amended standards which were established through consensus and are based on current aircraft capabilities.

The revised edition of the Global Plan will facilitate planning and implementation of these developments through new and innovative methods. A set of Global Plan initiatives will ensure that the available near- and medium-term opportunities are fully exploited, while planning tools will provide guidance on preparatory activities and serve as the basis for establishing performance objectives and implementation time lines.

The Global Plan is being gradually transformed into the baseline for measurable achievements and implementation of a truly global ATM system. It serves as the benchmark for the continuing evolution to a performance-based approach to planning and implementing the world's air navigation infrastructure. □

Safety management systems

continued from page 16

factors in implementing an SMS, especially in developing the airline safety culture, according to one corporate aviation director. A strong safety operating discipline — led from the top, with clear line-management accountability — provides the foundation, explained William McCabe, the director of DuPont Aviation and a member of the FSF Board of Governors.

The safety leadership must be visible to the employee, he added. "In DuPont Aviation, for example, we have clear accountability standards regarding personal safety leadership that all management layers of the DuPont Co. have to meet. There is no hiding."

Typical safety leadership demands that the responsible individual:

- conduct planning, integration of activities and challenging goal-setting that support corporate safety policies and principles;
- establish clear standards and high expectations of safe behaviour, including line-manager accountability;
- provide safety professionals to help line managers;
- demonstrate effective oversight of employees' working conditions and safety behaviours, including correction of unsafe behaviours;
- engage employees in developing best practices for risk management;
- foster robust employee-manager communication and motivation about safety;
- conduct proactive injury/accident reduction activities, including effective audits and re-evaluations;
- investigate and prepare timely reports for all types of safety-related events; and
- continuously develop best practices through safety training.

While DuPont has one of the world's lowest industry injury rates, most injuries and accidents that have occurred in the company have been caused by unsafe actions and behaviours, including management behaviours, pointed out Mr. McCabe. For example, a line manager may give a directive that places an employee at greater risk.

"From our history of business competition in very hazardous industries, we have learned to employ our robust operating discipline — comparable to crew resource management in an aircraft — proactively recognizing interdependence and mutual accountability to keep each other safe. Our company safety culture, like our business culture, comprises the same elements of strong leadership, the right structure and action focused clearly on core values and critical operating tasks. When all members of the work force follow such leadership and truly feel this accountability from top to bottom, they integrate their efforts to achieve the safety goals."

Other corporate aircraft operators have become familiar with SMS concepts through common audit procedures. For example, the basis for audits under the International Standard for Business Aircraft Operations (IS-BAO) is a company's SMS, according to the International Business Aviation Council (IBAC). The IS-BAO, introduced in 2002 as a voluntary code of best practices with accredited auditors (including FSF auditors), requires that corporate flight departments implement an SMS to effectively manage risks.

Summary. The new SARPs for ICAO Annex 6 are expected to influence how civil aviation authorities practice safety-risk management and how the implementation of an SMS by the accountable executive of an airline builds unprecedented synergy from current and future safety efforts. Meanwhile, the rapidly expanding literature of civil aviation authorities and safety specialists in several countries provides a clearer picture of the future for airlines that have an SMS — and examples of SMS implementation that airline senior managers can compare with their oversight of company wide risk-management activities. □

AVIATION PROFILE

Sri Lanka

Aircraft on civil register	28
Active pilot licences	332
Commercial air transport operators	6
Approved maintenance organizations	4
Aviation training establishments	4
Aircraft manufacturing organizations	0
Aircraft type certificates issued	0
International airports	3

(data from December 2004)

Safety conference

continued from page 7

implement each and every [recommendation] in a timely, collaborative and cost-effective manner." He stressed that ICAO was becoming more focused on obtaining results from its efforts, having recently implemented a business plan (see "New ICAO business plan is part of a broad strategy initiative," Issue 6/2005, page 5).

"At all levels, we are introducing new working methods that lead to increased efficiency and effectiveness, while making prudent use of limited resources. … And a built-in review process will ensure that our activities are realigned periodically, so as to better support you in your efforts to further the safety of air transport operations in your respective countries and regions," he informed the DGCAs. □

Incident report

continued from page 21

staff had allowed working practices to develop that had compromised airworthiness control.

27. The Quality Assurance Programme was not wholly effective in highlighting unsatisfactory practices on the shop floor.

28. The established number of quality engineers and the broad scope of their responsibilities limited the amount of time they were able to spend in the maintenance environment.

29. There was no consistent policy in the maintenance organization's approach to human factors issues and its conduct of maintenance error investigations (MEI).

30. Maintenance staff did not believe that the MEI process was objective and saw it as being a means only to effect disciplinary action.

31. The maintenance organization took corrective action following the incident; however, this information was not entered in the airline's safety database, known as "eBASIS," to enable the safety management loop to be closed.

32. The maintenance organization had not responded in a timely manner to safety recommendations issued by the safety services department's "BASI 4" investigation into this incident.

33. The safety services department's method for tracking safety recommendations to ensure the implementation of timely and appropriate safety actions lacked robustness.

34. The airline's "BASI 4" procedure lacked clarity in defining that the safety services department's investigation took precedence over other company investigations, with the result that two independent, uncoordinated investigations were carried out.

35. The management of quality standards had been heavily devolved to the various sections of the airline, with a limited degree of central control.

Causal factors. The following causal factors were identified:

1. The tasks of refitting the panels to the right wing and correctly certifying for the work carried out were not performed to the required airworthiness standard.

2. Ineffective supervision of maintenance staff had allowed working practices to develop that had compromised the level of airworthiness control and had become accepted as the "norm."

3. There was a culture, both on the ramp and in the maintenance hanger, which was not effective in ensuring that maintenance staff operated within the scope of their company authorization and in accordance with approved instructions.

4. The maintenance planning and task instructions relating to oil servicing on the Boeing 757 fleet were inappropriate and did not ensure compliance with the approved instructions.

5. The airline's Quality Assurance Programme was not effective in highlighting unsatisfactory maintenance practices.

Safety recommendations. The AAIB issued eight safety recommendations as a result of the investigation. Seven of the recommendations were addressed to British Airways, and were concerned primarily with maintenance practices and quality management. Another recommendation, directed to EASA, concerned maintenance requirements. □

Pilot training

continued from page 23

MPL concept — a solution that was simply not available until recently.

Clearly, if the MPL candidate is to be granted an aircraft type rating after accumulating only 70 hours of actual flight time, affordable training tools must be available at levels not provided before now. MPL sets a new baseline in the definition of these tools, the flight simulation training device (Levels I to IV).

The Level II simulation training device is commonly used to meet training requirements. The greatest attempt at innovation, however, may lie in the Level III device, often referred to as the "missing link" in the training chain because these devices have not yet been produced and certificated in appreciable quantities.

The definition of the Level III device describes a system that could be termed a generic turbojet trainer. In the notes related to the definition, ICAO also indicates that a Level III training device can constitute a full flight simulator (FFS Level B).

COPA Airlines of Panama is one of the first operators to utilize Level III technology at its own training facility, where it has installed a generic Boeing 737 FFS to conduct 80 percent of initial and 100 percent of recurrent training. With this new class of simulator built on the foundation of microprocessor technology costing half that of comparable traditional simulators, COPA no longer has to rely on more expensive training hubs located abroad.

By utilizing its own simulator, COPA achieves a total cost savings of U.S. $4 million per year. In addition, the technology will support an MPL training programme, if desired. The equipment also provides the small airline with new revenue potential by allowing it to market simulator time to other operators in the region.

Summary. Traditional training, with extensive time dedicated to ageing technology, is no longer meeting the fluid needs of airlines that value a skill set which is more appropriate for today's technologically sophisticated airliners. The path to the flight deck's right seat is unnecessarily long when using outdated technology and methodology, and the traditional approach simply cannot adequately meet the demand for new pilots required for the industry's anticipated growth in the years ahead.

Many airlines seek to recruit pilots who have been trained specifically to fly the aircraft in their fleet, and who have been schooled in the skills needed to work in a dynamic and technologically advanced multi-crew environment. While there may be resistance from some quarters to the changes represented by MPL concept, forward thinking training organizations understand the need to adapt to licensing and training standards that have been made possible by improvements in technology.

With the emergence of the multi-crew pilot licence, flight training technology will have to demonstrate its effectiveness in imparting trainees with the skills needed for conducting safe operations in a sophisticated jet airliner. Clearly, it is the new generation of flight training technology that will make MPL both practical and affordable on an industry-wide scale. □

Tributes

continued from page 7

The name Assad Kotaite, declared the Ethiopian Delegation, "will continue to shine and serve as a beacon in the years to come." The Council President's contribution to the safe and orderly development of international civil aviation will have its appropriate place in aviation history, the spokesman predicted.

Canada announced that it was launching the Assad Kotaite Fellowship for the development of post graduate studies in international civil aviation law and management. The fellowship will honour Dr. Kotaite's 53 years of commitment to international civil aviation, air law and aviation management.

In his closing remarks, Dr. Kotaite urged the delegates to work actively to improve civil aviation from the moment they return home. Civil aviation is a complex domain that transports billions of passengers per year, he said, and aviation administrations have a duty to protect them by implementing the provisions of the Chicago Convention, and not bending to any kind of weakness or political pressure.

In reflecting on the achievements of the conference and on past accomplishments, the Council President reminded delegates in emotion-filled words that his achievements in life had been collective achievements. "I have always counted on your cooperation," he told the full Assembly Hall. "I cannot find words to express to you how much I am in debt to your cooperation, to your trust, to your friendship and to your assistance." □

IN THE SPOTLIGHT...

DRAFT CONVENTION

The third meeting of the Special Group on the Modernization of the Rome Convention of 1952 was held at ICAO headquarters from 13 to 17 February 2006 under the chairmanship of Henrik Kjellin (Sweden), and was attended by 38 delegates from 19 Contracting States as well as a number of observers from States and international organizations. The group of legal experts was established in May 2004 to further develop and refine the text of a draft convention that will address third-party damage caused by foreign aircraft. A new convention is considered necessary to reflect recent trends and developments in international liability law.

MTSAT MODEL SATELLITE

During a brief ceremony on 20 March 2006, Japan presented ICAO with a miniature model of its Multifunctional Transport Satellite (MTSAT), a key element in support of the CNS/ATM systems. MTSAT-1R and MTSAT-2 were launched in February 2005 and February 2006 respectively for the purpose of providing aeronautical satellite communications, global positioning system (GPS) augmentation services and meteorological services to the civil aviation community in the Asia/Pacific regions. Shown at the presentation of the model on the occasion of the DGCA Conference of 20-22 March are (l-r): Haruhiko Kono, Representative of Japan on the Council of ICAO; ICAO Council President Dr. Assad Kotaite; Shinsuke Endo, Director General of the Engineering Dept. of the Civil Aviation Bureau of Japan; and ICAO Secretary General Dr. Taïeb Chérif.

DEPOSIT BY THAILAND

Thailand deposited its instrument of accession to the *Convention on the Marking of Plastic Explosives for the Purpose of Detection* during a brief ceremony at ICAO headquarters on 25 January 2006. Shown on the occasion are (l-r): Chatchai Viriyavejakul, First Secretary; and Ambassador Snanchart Devahastin, Embassy of Thailand in Ottawa; ICAO Secretary General Dr. Taïeb Chérif; and Silvério Espínola, Principal Legal Officer in the ICAO Legal Bureau.

REGIONAL WORKSHOP

A regional workshop on aerodrome operational planning was held in Mauritius in early December. The event, which was hosted by the Department of Civil Aviation in collaboration with Airports of Mauritius Ltd., was attended by 42 participants from 15 States in the Eastern and Southern African regions.