ICAO

INTERNATIONAL CIVIL AVIATION ORGANIZATION

SWIM/AIM and
Global ATM

With information management specifications maturing on pace, NextGen/SESAR solutions to 21st Century capacity challenges move closer on the horizon.

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Leadership and Vision
in Global Civil Aviation

Meeting the Challenge

The contribution of air transport to the economy of nations is well recognized and the need to create an efficient and sustainable civil aviation industry can therefore not be over-emphasized. Having participated for a number of years in the international arena, I am particularly cognizant of the power of widespread co-operation in promoting the growth of air transport on a sound economic and administrative footing.

I am working with my senior management colleagues in adjusting the course of the Air Transport Bureau (ATB) to better assist our Member States in managing demanding realities brought on by rapidly-changing economic and political situations. We also want to be more responsive to the challenges faced by industry. Our focus is on security, sustainability and economic policy.

Aviation security has always been a two-sided objective—States must put in place measures to prevent unlawful interference with civil aviation while facilitating the rapid and efficient flow of travelers and cargo through airports. Our job is to provide States with the regulations, procedures and other support to achieve those twin goals. I am now overseeing a fundamental realignment of our programmes and resources to not only keep pace but also anticipate the needs of States and the aviation community.

Achieving maximum compatibility between the safe and orderly development of civil aviation and the quality of the environment is an extraordinarily complex challenge—technically, economically, socially and politically. I believe we are on the right track. ICAO has been working on environ-mental issues since the 1960s while the Environmental Unit was formally created within ATB in 2004 and has since been expanded to more accurately reflect the urgency of dealing effectively with environmental protection. At the centre of this call for action is coordination with and among relevant United Nations bodies and other international organizations dealing with the environment. I am very excited by this challenge and by the leadership and consensus building that ICAO can provide in devising appropriate measures.

Many of the other priorities of ATB will come under the microscope this coming September at a worldwide conference (CEANS) for improving efficiency and cost-effectiveness in the provision and operation of airports and air navigation services. Privatization will be prominent in discussions on how best to update ICAO policies. I heartily welcome the world to this timely event.

Since taking office some nine months ago, I have developed a keener appreciation for the essential role played by ICAO in bringing all concerned stakeholders together. My team and I look forward doing our share for the benefit of air transport users everywhere. ■

Mrs. Folasade Odutola
Director, Air Transport Bureau

Global Air Traffic Management: ICAO's Efforts toward Implementation

By Vincent Galotti, Chief, Air Traffic Management Section, ICAO Air Navigation Bureau

THE WISH OF EACH AND EVERY AIRCRAFT OPERATOR IN THE GLOBAL AIR TRAFFIC MANAGEMENT (ATM) SYSTEM IS THAT THEY WILL BE AFFORDED THE OPPORTUNITY TO OPERATE ALONG THEIR PREFERRED FOUR DIMENSIONAL TRAJECTORIES (TIME, SPEED, VERTICAL, HORIZONTAL) AT ALL TIMES. IN MOST CASES THESE PREFERRED TRAJECTORIES WILL BE BASED ON OPTIMUM FUEL BURN, BUT ADDITIONAL CONSIDERATIONS—SUCH AS SCHEDULING, GATE AVAILABILITY AND HAVING THE RIGHT AIRPLANE AT THE RIGHT LOCATION—WILL ALSO BECOME MUCH MORE ACHIEVABLE IN THIS 'OPTIMIZED' AIR NAVIGATION ENVIRONMENT.

Currently, the main impediment to the highly efficient scenario noted above is the existing ATM system. This is not the fault of those who provide ATM services—on the contrary, any air traffic controller will tell you that they consistently do their utmost to afford the most efficient flight paths to aircraft while ensuring safety. Air navigation service providers (ANSPs) are also continually making effective improvements—some more so than others—primarily through the implementation of technology and methodologies that make better use of aircraft capabilities; e.g. automatic dependent surveillance-broadcast (ADS-B), performance based navigation (PBN), reduced vertical separation minima (RVSM) and continuous descent arrivals.

Implementing new technology and making better use of aircraft capabilities are not all that can be done. Efforts to improve the productivity of the ANSPs through identification of key performance areas (KPAs) and the establishment of key performance indicators (KPIs) will doubtless lead to reduced costs to aircraft operators as well as improved service levels across the board. It is logical therefore that aircraft operators are keenly interested in how effectively and efficiently the ANSPs conduct their core business.

The goal of providing a service that supports a four dimensional trajectory is worthy indeed, but the difficulty lies in the fact that thousands of aircraft operators now flying in the increasingly complex global ATM system each have their own best outcomes. To compound this further, best outcomes go beyond aircraft operators and extend outward to the larger ATM community as well.

Global ATM

As business processes improve and ATM community members become more adept at taking advantage of specific, local and organization-dependent opportunities, scenarios for additional improvement become very difficult to develop. To make even greater gains in efficiency, more far-reaching co-operation is necessary requiring a global vision, wider planning perspectives, implementation of facilities and services over larger geographical areas, and a global framework for performance measurement.

Put another way, greater opportunities for efficiency gains will only come through implementation of a more global and seamless ATM system.

A global ATM system can be described as one which achieves interoperability and seamlessness across all regions for all users during all phases of flight. It needs to meet agreed levels of safety, provide for optimum economic operations, be environmentally sustainable and meet national security requirements.

Consider for a moment Reduced Vertical Separation Minimum (RVSM), which was first implemented in 1997 in the airspace of the North Atlantic followed by Europe, the Pacific, Asia, the Middle East, the Europe/South America corridor, the Caribbean and the South and Central American Regions. Implementation continues and RVSM will soon cover all airspace around the world. A cost/benefit analysis in the North Pacific showed a 0.5% to 1.0% reduction in fuel cost for a saving of approximately US $8 million per year for aircraft using this airspace. In Europe, it is estimated that airlines save close to $60 million annually. For the Caribbean and South and Central American Regions, airlines will save approximately $400 million over a 15-year period for international flights, while for North America the fuel-saving benefits are estimated to be approximately US $5.3 billion for the same period.

ICAO's role in supporting the realization of RVSM was and continues to be significant. It began with the detailed safety-related work leading to the development of Standards, Recommended

Practices, Procedures for Air Navigation Services and supporting guidance material, and continues with the extensive planning and safety assessments conducted by the regional planning groups. RVSM could not have been implemented globally without ICAO's leadership.

Continued ATM Evolution

ICAO's efforts to continually improve the ATM system are focussed on the *Global Air Traffic Management Operational Concept*. This Concept was endorsed by the ICAO Eleventh Air Navigation Conference in 2003 and is now an important part of all major ATM development programmes, including the Next Generation Air Transport System (NextGen) under development in the United States and the Single European Sky ATM Research (SESAR) effort underway in Europe.

Performance-Based Transition Guidance. Rather than emphasizing improvements solely in the fields of efficiency or safety as the sought-after outcome, the operational concept recognizes that competing interests for the use of airspace will make airspace management a highly complex exercise, necessitating a process that equitably balances varied objectives. Each of those interests must be considered on the basis of a "weighting or desired outcome contribution".

In an effort to assist planners in weighing outcomes and making appropriate decisions, the *Manual on Performance Based Transition Guidelines* (PBTG) was developed. The PBTG supports an approach to planning based on performance needs, expected benefits and achievement timelines. Such explicit management and planning of ATM performance will be needed to ensure that throughout the transition process to a more global and seamless system the expectations of the entire community are met.

The Global Air Navigation Plan and the planning process. To assist States and regional planning groups in identifying the most appropriate operational

improvements and also to support implementation, ICAO has recently revised its Global Air Navigation Plan so that it clearly describes a strategy aimed at achieving near and medium term ATM benefits on the basis of available and foreseen aircraft capabilities and ATM infrastructure. On this basis, planning will be focused on specific performance objectives supported by a set of Global Plan Initiatives.

Initiatives that meet performance objectives are identified through an analytical process specific to the particular needs of a State, region, homogeneous ATM area or major traffic flow. Development of work programs is then based on the experience and lessons learned in the previous cycle of the CNS/ATM implementation process. The Global Plan therefore focuses efforts toward maintaining consistent global harmonization and improving implementation efficiencies by drawing on the existing capabilities of the infrastructure and successful regional implementations over the near and medium terms.

Achieving the global ATM system will be accomplished through the implementation of many initiatives over several years on an evolutionary basis. The set of initiatives contained in the Global Plan are meant to facilitate and harmonize the work already underway within the regions and to bring needed benefits to aircraft operators over the near and medium term. ICAO will continue to develop newer initiatives on the basis of the operational concept which will be placed in the Global Plan. In all cases, initiatives must meet global objectives. On this basis, planning and implementation activities begin with application of available procedures, processes and capabilities. The evolution progresses to the application of emerging procedures, processes and capabilities and, ultimately, migrates to the ATM system based on the operational concept.

All regions have well established implementation plans in place and are progressing their individual work programmes.

36th Session of the ICAO Assembly

ICAO's 36th General Assembly reached several important conclusions with respect to ATM, reinforcing the need for the Organization to continue its leadership role in the planning and implementation of a performance-based, global ATM System. Of the many issues discussed and agreements reached, a few stand out as being particular supportive to global ATM objectives.

The Assembly agreed that States and planning and implementation regional groups (PIRGs) should complete a performance based navigation (PBN) implementation plan by 2009 to achieve:

- Implementation of RNAV and RNP operations (where required) for en route and terminal areas according to established timelines and intermediate milestones.

- Implementation of approach procedures with vertical guidance (APV) (Baro-VNAV and/or augmented GNSS) for all instrument runway ends, either as the primary approach or as a backup for precision approaches by 2016, and with intermediate milestones of 30 per cent by 2010 and 70 per cent by 2014.

The Assembly urged that States include in their PBN implementation plans the provision for implementation of approach procedures with vertical guidance (APV) to all runway ends serving aircraft with a maximum certificated take-off mass of 5700 kg or more, according to established timelines and intermediate milestones.

The European Community presented information to the Assembly on the Single European Sky ATM Research (SESAR) program and the United States updated the Assembly on its Next Generation Air Transport System (NextGen). Both of these efforts recognized the importance of ICAO's Operational Concept and the Global Air Navigation Plan as effective tools to guide the global effort and to serve as the framework for

continued improvements. The Assembly agreed that all efforts should be aligned with these two documents, stressing that a common global framework would help to achieve interoperability and harmonization.

As NextGen and SESAR will be far-reaching, the Assembly urged that ICAO coordinate the progress of these two programmes and any similar initiatives that would have worldwide impact.

The Assembly also agreed on the need for close co-operation and commitment among all members of the ATM community toward achieving shared goals, and that collaborative decision making at all levels in the planning process would serve as an important tool for continued improvements to the global ATM system.

Conclusions

The aviation community has been working on ATM operational improvements steadily since the 1920s. The work accelerated with the onset of CNS/ATM systems. Technology development has been more rapid in recent years and improvements are now coming about more quickly. A major operational improvement was the implementation of RVSM, which brought significant operational benefits to aircraft operators in terms of reduced fuel burn, availability of optimal flight levels, an increase in capacity, as well as environmental benefits.

ICAO has a central role to play in planning for the implementation of operational improvements. In addition to developing the necessary standards and guidance material, ICAO has developed a global ATM Operational Concept that was widely endorsed and used as the basis for planning. ICAO also provides the planning framework through the Global Air Navigation Plan and several other documents and tools that support planning and implementation efforts.

Every ICAO Region has identified performance objectives and has developed work programs to foster near and medium term benefits while integrating those programmes with the extensive work already accomplished.

Global interoperability and harmonization are key to making further improvements to the global ATM system. In fact, most improvements can only be made through recognition of the need to work at the global level and to cooperate at a global level. This requires a broader more inclusive vision, a wider planning perspective and planning for implementation of facilities and services over larger geographical areas. It also requires a global framework for performance measurement.

Put another way, greater opportunities for efficiency gains will only come through implementation of a more global and seamless ATM system. ■

TABLE 1. GLOBAL PLAN INITIATIVES AND THEIR RELATIONSHIPS TO THE MAJOR GROUPINGS				
GPI	En-route	Terminal Area	Aerodrome	Supporting Infrastructure
GPI-1 Flexible use of airspace	X	X		
GPI-2 Reduced vertical separation minima	X			
GPI-3 Harmonization of level systems	X			
GPI-4 Alignment of upper airspace classifications	X			
GPI-5 RNAV and RNP (Performance-based navigation)	X	X	X	
GPI-6 Air traffic flow management	X	X	X	
GPI-7 Dynamic and flexible ATS route management	X	X		
GPI-8 Collaborative airspace design and management	X	X		
GPI-9 Situational awareness	X	X	X	X
GPI-10 Terminal area design and management		X		
GPI-11 RNP and RNAV SIDs and STARs		X		
GPI-12 Functional integration of ground systems with airborne systems		X		X
GPI-13 Aerodrome design and management			X	
GPI-14 Runway operations			X	
GPI-15 Match IMC and VMC operating capacity		X	X	X
GPI-16 Decision support systems and alerting systems	X	X	X	X
GPI-17 Data link applications	X	X	X	X
GPI-18 Aeronautical information	X	X	X	X
GPI-19 Meteorological systems	X	X	X	X
GPI-20 WGS-84	X	X	X	X
GPI-21 Navigation systems	X	X	X	X
GPI-22 Communication infrastructure	X	X	X	X
GPI-23 Aeronautical radio spectrum	X	X	X	X

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GENERAL DYNAMICS

Implementing the Single European Sky:
Achievements to Date and Challenges to Overcome

By David McMillan, Director General, EUROCONTROL

See article end for all footnote and similar references.

If growth is an indication of success, then the European Air Transport industry is very successful indeed. Liberalisation in the European Union (EU) market has been largely responsible for ongoing average growth rates of around 4% per year, leading to lower ticket prices and greater consumer choice for EU citizens.

But air passengers are also increasingly aware that aviation is a consumer of non-renewable resources, a contributor to climate change and a tangible source of local noise and air quality problems.

Those of us working in Air Traffic Management have a dual duty: primarily, we must ensure that aviation continues to be safe, efficient and responsive to society's need for mobility and continuing social and economic development. But we also have a duty to make aviation more acceptable—and its growth sustainable—in environmental terms.

This double challenge is daunting in that air traffic continues to rise. If expected growth rates of between 4 and 5% per year continue as indicated, by 2020 Europe will need 75% more capacity than it had in 2005. For this to be achieved a significant number of practical issues need to be addressed.

Safety

Safety is Air Traffic Management's raison d'être. Safety performance needs to be improved ten-fold to make sure that the rate of accidents does not increase together with the rise in traffic growth.

Fragmentation

In the short- to medium-term, the problem of fragmentation needs to be addressed. Europe currently has 67 Air Traffic Control Centres, a variety of civil-military coordination arrangements and a number of different operating systems. Research has shown that if fragmentation could be reduced in Europe some €2 billion could be saved.

Airport Capacity

There are indications that the biggest capacity crunch is going to be at Europe's airports. EUROCONTROL's Challenges to Growth study reveals that by 2025 more than 60 of Europe's airports could be detrimentally congested, with the top 20 airports overly congested from eight to ten hours a day. EUROCONTROL is working with airports on solutions to extract the greatest amount of capacity possible from existing infrastructure.

En Route Airspace Capacity

Providing sufficient en route airspace capacity for both the expected growth in civil air traffic and in order to meet expanding air defence requirements is another issue that EUROCONTROL is dealing with. As with any commodity in short supply, either more has to be provided or better use has to be made

Fig. 1: States Participating in EUROCONTROL

of what currently exists. EUROCONTROL is now pursuing both these options and trusts that, through research and development into better technology and improved operations, more capacity can be created.

Capacity is also being managed more effectively through various initiatives, one of which is a framework programme known as DMEAN, the Dynamic Management of the European Airspace Network. Its aim is to release all latent capacity in the system and to improve flight efficiency using advanced information exchange processes to cope more dynamically with demand. DMEAN will gradually be superseded by SESAR, the Single European Sky ATM Research Programme, which will begin to be deployed from 2013 onwards *(see SESAR sidebar, p.10)*.

Civil-Military Coordination

Airspace temporarily reserved for military use can be found in every State in Europe. Civil aircraft have to fly around these areas while they are in military use. A concept called the *Flexible Use of Airspace* (FUA), developed by EUROCONTROL and in effect since 1994, allows both civil and military users to have ongoing access to specified parts of this restricted airspace as and when they need it. Approximately one third of the upper airspace volume is now shared between civil and military users and there is potential for expanding this amount substantially in the future.

In parallel with the growth of civil air traffic, air defence requirements are also increasing. The new generation of ultra high-performance aircraft, the need for multinational and combined air operations, as well as the growing numbers of unmanned aerial vehicles means that the military need larger volumes of airspace for their activities.

Bilateral agreements between civil and military authorities will allow these requirements to be accommodated, even with increasing capacity demand. EUROCON-

TROL encourages States to improve civil-military coordination of the interface between ATM and national military organizations which is paramount for both safety and security.

Given that defence and sovereignty issues go hand-in-hand, it becomes clear that States will always retain the right to guard their territories—even if they do outsource other activities *(see Duties of a State, below right)*. With good co-operation at senior levels, much can be done to integrate key military requirements into the future ATM system.

The Environment

Air Traffic Management can help reduce aviation's impact on the environment in several ways: it can provide more efficient routes so that aircraft burn less fuel creating lower emissions, and; it can help with take-off and landing procedures, reducing noise and emissions.

Air Traffic Management measures are already reducing aviation emissions by over three million tonnes of CO_2 annually. Once European regulations on the environment are in place, EUROCONTROL's Central Flow Management Unit will play a key role in monitoring air traffic flows and advising on the use of even more efficient routes.

A Performance-driven Framework

Performance targets for safety, delays, efficiency and cost-effectiveness were adopted in late 2007 by EUROCONTROL's Council and will be monitored by EUROCONTROL's Performance Review Commission.

This is the first time that any continent has agreed to such challenging targets[1] and has paved the way for the development of the Single European Sky (targets have been built into the SESAR Implementation Packages), as well as helping drive a global process of performance-based development in the context of ICAO's global priorities.

SES: Achievements and Challenges

The Single European Sky (SES) initiative has led to greater co-operation and transparency among all players in the air transport industry, including regulators, civil and military airspace users and professional organizations.

Service provision has now largely been separated from regulation, a fact which should diminish conflict of interest. Harmonised controller licensing will improve mobility for controllers and improve safety standards and effective transparency in air navigation service charges has now been achieved.

Workable arrangements for the sharing of military airspace with civil users—the *Flexible Use of Airspace* noted previously—

DUTIES OF A STATE

Every State has an obligation to provide air traffic control and flight information/alerting services. In Europe, EUROCONTROL carries out Air Traffic Flow Management for flights going into, out of and around the continent on behalf of its Member States.

EUROCONTROL also provides an air traffic control service for the upper airspace of Belgium, Luxembourg, the Netherlands and the northern part of Germany, on behalf of these States. Other European States secure the provision of their own air traffic services.

In principle, each State is responsible for the implementation of national rules as well as those in force in the European Union. These include:

- Security and Defence
- Safety
- Liability
- Provision of Air Navigation Services over the national territory
- Certification, Designation and Supervision of service providers
- Search and Rescue operations
- Investigation of incidents and accidents

States may, if they choose, allow third parties to provide these services, but the States maintain ultimate responsibility for them.

have been built into regulation. Additionally, an interoperability mechanism has been established for the development of EU specifications for technical systems and their operational use.

But there are still some challenges to overcome. The independent Performance Review Commission, in a report released in February 2007[2], pointed out that regulation might create burdens without providing clear benefits.

They argued that there is no guarantee that the SES, in its current form, will produce tangible performance improvements in respect of efficiency. Inefficiencies in the system, such as low productivity, duplication of infrastructure, small scale facilities and the lack of optimised route and sector design, already cost airspace users €3 billion per year.[3]

The Performance Review Commission has therefore called for the development of quantified success criteria. It believes that there is considerable scope for improvement through non-regulatory actions such as guidance material,

support to National Supervisory Authorities (set up under Single European Sky legislation) and the facilitation of co-operation between all parties. An appropriate balance should be made, it has indicated, between mandatory requirements and voluntary means of compliance for greater flexibility and fewer regulatory burdens.

For its part, the European Commission deplores the fact that Functional Airspace Blocks (FABs) have not yet been created. In a recent report it noted:

"While [this] is a new challenge and suffers from significant technical and organisational difficulties, sovereignty, particularly concerning Member States' responsibilities and associated liability for their airspace, and the involvement of the military, remains an issue. Instead of framing innovative mechanisms to exercise sovereignty, it has been used as a showstopper by those who wish to resist enhanced cross-border co-operation and integration."[4]

EUROCONTROL agrees that FABs can deliver improved route efficiency and the environmental benefits that accrue from it. There are eight FAB projects now in the pipeline and, even if progress is slow, the willingness to implement them is there. In areas of service delivery and network planning, as well as others, EUROCONTROL and the European Commission can work together to provide the FAB projects with the assistance they require.

Another difficulty being encountered in the implementation of the Single European Sky has been pointed out by the High Level Group Report:[5]

"although existing frameworks for civil-civil and civil-military co-operation work well from an operational perspective, there is no equivalent pan-European mechanism for military-military co-operation and there is limited engagement of the military at the strategic, Defence Minister, level. The military has, therefore, indicated that more political support for strategic engagement of the military at the

pan-European level in the development of the European aviation system would be welcome."

As a civil-military Organization in Europe, EUROCONTROL is deeply committed to improving civil-military coordination and has aligned its services to progress this matter.

Combining Forces to Overcome Challenges

A harmonised, Pan-European system will be the best solution for the European ATM network system. In essence, there are two ways of building it: the horizontal, inter-governmental method that works through consensus; and the Community method, used by the European Institutions.

The intergovernmental approach as practised by EUROCONTROL has proved relatively well-suited for cooperative network design, route optimisation and performance review. It has brought delays down from crippling levels (and closer to the economic optimum) even though air traffic has increased significantly, and it has done so while improving safety levels.

On the other hand, the Community Method, as practised by the European Commission, brings an added advantage through its enforcement powers. This has been demonstrated in its ability to drive large-scale programmes, such as SESAR. The Community Method clearly assists in adding pace to the process.

So, a combination of these two existing methods can bring real benefits. When considering the example of cooperative network design, firstly areas which require regulation are identified and regulation strengthens the implementation of segments of the cooperative network design process. Performance review then results in corrective action in both the design and its regulation.

There is just one caveat: over-regulation must be avoided, as the Performance Review Commission has pointed out. Combining forces and methods of work

will surely result in closer coordination between players—coordination that is needed to facilitate the sought-after, harmonised ATM development across the whole of Europe. This includes all the European Civil Aviation Conference States and not just those belonging to EUROCONTROL or the European Union *(see Fig. 1, p. 8).*

Conclusions

Regulation, although necessary, does not lead directly to harmonisation. Compliance follows, but it can be loose. There is often divergence in details and this can be problematic in aviation—where precision does matter. EURO-CONTROL is well-placed to obtain consensus and has the expertise to know just which details will be important.

EUROCONTROL has been in existence for over forty years and has undergone several changes in purpose and function over the years. Now could well be the time for another overhaul. It needs more input from States, service providers, airspace users and industry. It needs to adapt to new realities—such as the expanding role of the European Commission—and to continue to come up with innovative solutions and mechanisms to deal with growing traffic in a safe and sustainable way.

SESAR is one way forward: it is the joint plan for the future and it must be made to work. EUROCONTROL is firmly committed to the concept of a Single European Sky and its outcome. We deem it essential that energies continue to be mobilised for SESAR, this ambitious programme which, for the first time ever at an international level, unites all stake-holders in the quest for a common goal. ∎

Footnotes:

[1] Safety: a minimum level of 70% for all Air Navigation Service Providers and State Regulators by 2008.

Delays for en route air traffic flow management: one minute average per flight over the next five years.

Efficiency: reduction of unnecessary distance flown by each aircraft of 2km/year—equivalent to removing 24,000 flights from the European system.

Cost effectiveness: real unit cost per kilometre reduced by 3% per year for the next five years.

[2] Performance Review Commission: "SES Impact on ATM Performance".

[3] Performance Review Commission: "SES Impact on ATM Performance", page ii.

[4] Communication from the Commission: "First Report on the implementation of the Single Sky Legislation: achievements and the way forward", page 7.

[5] Report of the High Level Group for the future European Aviation Regulatory Framework: "European Aviation: A framework for driving performance improvement", July 2007.
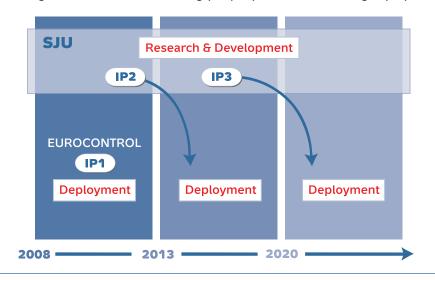

Fig. 2: SESAR Joint Undertaking (SJU) Implementation Packages (IPs)

SJU

Research & Development

IP2   IP3

EUROCONTROL
IP1

Deployment   Deployment   Deployment

2008 ——— 2013 ——— 2020

The NextGen Vision

THE BROADER CONCEPTS OF CURRENTLY-EMERGING AIR NAVIGATION TECHNOLOGIES AND STRATEGIES ARE STILL NOT FULLY FAMILIAR TO ALL AVIATION STAKEHOLDERS. TO HELP PROVIDE SCOPE AND PERSPECTIVE, THE *ICAO JOURNAL* IS GRATEFUL FOR THE OPPORTUNITY TO REPRODUCE AN ABRIDGED VERSION OF THE COMPREHENSIVE STATEMENT OF **CHARLES LEADER, FAA DIRECTOR, JOINT PLANNING AND DEVELOPMENT OFFICE,** BEFORE THE U.S. HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY, SUBCOMMITTEE ON SPACE AND AERONAUTICS.

The US air transportation system has become a victim of its own success. We have created the most effective, efficient and safest system in the world, but we now face a serious and impending problem: the system is at capacity.

The warning signs are everywhere. Flight delays and cancellations have reached unacceptable levels. Other issues, ranging from environmental concerns to the complexities of homeland security, are placing additional stresses on the system. A MITRE study done for the FAA concluded that the current system cannot handle the projected traffic demands expected by 2015. Absent modernization, the consequences for aviation will be serious.

NextGen is about a long-term transformation of our air transportation system. It focuses on leveraging new technologies, such as satellite-based navigation, surveillance and network-centric systems. The FAA's 2008–2012 Capital Investment Plan (CIP) includes $4.6 billion in projects and activities that directly support NextGen. These technologies and programs include: Automatic Dependent Surveillance-Broadcast (ADS-B); System Wide Information Management (SWIM); NextGen Data Communications; NextGen Network Enabled Weather; NAS Voice Switch; and, NextGen Demonstrations and Infrastructure Development. FAA proposes to spend $173 million on these programs in FY08.

Perhaps the most significant of these transformational technologies is Automatic Dependent Surveillance-Broadcast or ADS-B, which uses GPS signals to provide air traffic controllers and pilots with much more accurate information on aircraft position that will help keep aircraft safely separated in the sky and on runways. When properly equipped with ADS-B, both pilots and controllers will, for the very first time, see the same real-time displays of air traffic; thereby substantially improving safety.

ADS-B has been successfully demonstrated through the FAA's Capstone program in Alaska, and it has contributed to the recent reduction of GA accidents in Alaska by more than 40 percent for ADS-B-equipped aircraft. The FAA is looking at a rulemaking that would mandate the avionics necessary for implementing

ADS-B in the national airspace system, and is working closely with stakeholders to determine an appropriate proposed timeline.

In today's NAS there are a myriad of systems with custom-designed, developed, and managed connections. The future, however, demands an infrastructure that is capable of flexible growth, and the cost of expanding today's point-to-point system is simply prohibitive. System Wide Information Management (SWIM) responds to that need. SWIM will provide high quality, timely data to many users and applications. By reducing the number and types of interfaces and systems, SWIM will reduce unnecessary redundancy of information and better facilitate multi-agency information-sharing. When implemented, SWIM will contribute to expanded system capacity, improved predictability and operational decision-making, and reduced cost of service. In addition, SWIM will improve coordination to allow transition from tactical conflict management to strategic, trajectory-based operations. It will also allow for better use of existing capacity en route.

The heart of the NextGen advanced airspace management concepts lies—like much of our society—in the ability to communicate large amounts of complex information in a fast, efficient, and robust manner. Data communications-enabled services, such as 4-D trajectories and conformance management, will shift air traffic operations from short-term, minute-by-minute tactical control to more predictable and planned strategic traffic management. Eventually, the majority of communications will be handled by data communications for appropriately-equipped users. It is estimated that with 70 percent of aircraft data-link-equipped, exchanging routine controller-pilot messages and clearances via data can enable controllers to safely handle approximately 30 percent more traffic [FAA ATO-P Future En route Work Station Study, Preliminary Results, 2006].

The NextGen Network Enabled Weather will serve as the backbone of the NextGen weather support services, and provide a common weather picture to all NAS users. Approximately 70 percent of annual national airspace system delays are attributed to weather. The goal of this investment is to cut weather-

related delays by at least 50 percent. The weather problem is about total weather information management and not just the state of the scientific art in weather forecasting.

The NAS Voice Switch will provide the foundation for all air-to-ground and ground-to-ground voice communications in the air traffic control environment. The new voice switch allows us to replace today's rigid, sector-based airspace design and support a dynamic flow of traffic. Voice communications capabilities and network flexibility provided by the NAS Voice Switch are essential to the FAA's ability to implement new NextGen services that are necessary to increase efficiency and improve performance.

It is important to understand that NextGen is a portfolio program. The technologies described above, and those that will be defined over the next several years, are interdependent, creating a series of transformations that will truly modernize today's system. Let me provide a few examples of this.

In the high performance airspace of the future, each airplane will transmit and receive precise information about the time at which it and others will cross key points along their paths. Pilots and air traffic managers on the ground will have the same precise information, transmitted via data communications. Investments in ADS-B, SWIM and Data Communications are critical to trajectory-based operations.

The NextGen system will enable collaborative air traffic management. The increased scope, volume, and widespread distribution of information that SWIM provides will improve the quality of the decisions by air traffic managers and flight operators to address major demand and capacity imbalances. SWIM and NAS Voice Switch are instrumental in achieving this collaborative air traffic management.

Another vital consideration in the development of the NextGen system is successfully managing aviation's environmental impacts. A preliminary JPDO analysis has shown that long before we run into limits from technology, we run into constraints to capacity from noise and emissions impacts. In fact, we potentially lose tens of billions of dollars in foregone aviation activity. That's why the NextGen re-authorization is so important. It offers a number of programs that are essential if we are to meet our environmental objectives and foster capacity expansion and benefits to the American public. These include: demonstrating the use of new environmentally-friendly procedures; underwriting the implementation of such procedures at airports; targeting research of environmental issues at the airport level; accelerating the maturing of new noise and emission reduction technologies for use in aircraft; and exploring the use of alternative fuels to enhance supply security and environmental performance.

The importance of developing this system is also quite clear to policymakers in Europe. Creating a modernized, global system that provides interoperability could serve as a tremendous boost to the aerospace industry, fueling new efficiencies while creating jobs and delivering substantial consumer benefits. The further opening of US and European markets in the recently-agreed "Open Skies" agreement reinforces this need. Alternatively, we could also see a patchwork of duplicative systems and technologies develop, which would place additional cost burdens on an industry already struggling to make ends meet.

The FAA and the EC are identifying opportunities and establishing timelines to implement, where appropriate, common, interoperable, performance-based air traffic management systems and technologies. This coordination will address policy issues and facilitate global agreement within international standards organizations such as ICAO, RTCA, and Eurocontrol, and contribute greatly to the success of this critical initiative.

While SESAR focuses almost exclusively on air traffic management, NextGen takes what's called a "curb-to-curb" approach, and includes not only air traffic control, but also airports, airport operations, security and passenger management, and DoD and DHS NAS requirements.

Our overarching goal in the NextGen initiative is to develop a system that will be flexible enough to accommodate a wide range of users—very light jets and large commercial aircraft, manned and unmanned aircraft, small airports and large, business and vacation travelers alike, while handling a significantly increased number of operations with a commensurate improvement in safety, security, environment and efficiency. Research will continue to help us find the right balance between a centralized satellite and ground system and a totally distributed system, where aircraft "self-manage" their flight with full knowledge of their environment. ■

Aiming for SWIM

AS NEXTGEN/SESAR DEFINITION CONTINUES ON PACE, THE ON-GOING DEVELOPMENT OF AERONAUTICAL INFORMATION MANAGEMENT, AIRCRAFT DATA COMMUNICATIONS AND ADS-B SURVEILLANCE WILL CONVERGE TO REALIZE AN ATM NETWORK BASED ON SYSTEM-WIDE INFORMATION MANAGEMENT, OR SWIM. THE *JOURNAL* SPOKE RECENTLY WITH **PHILIP CLINCH, VP AIRCRAFT COMMUNICATIONS & MESSAGING—SITA COMMUNICATIONS SERVICES,** WHO PROVIDED AN OVERVIEW OF THE CURRENT COMMUNICATIONS ENVIRONMENT AND THE IMMEDIATE CHALLENGES FACING NEXTGEN/SESAR PLANNERS.

ICAO Journal: The ambitions of SESAR/NextGen depend upon a communications environment featuring nothing short of system-wide information management (SWIM) and air-ground data integration. How far-off is the realization of this vision based on the industry's current communications capabilities?

Philip Clinch: The next generation Air Traffic Management system is often called "satellite-based" but it will actually be much less dependent on satellites than on data exchanges providing the information needed to manage the traffic. The development has started on several of the ATM data communications components and we need to begin defining how they will converge into an interconnected SWIM system.

One of the data communications systems called for in both the SESAR and NextGen 2020+ Air Traffic Management systems is Controller Pilot Data Link Communications (CPDLC) using VHF Digital Link (VDL) Mode 2. The establishment of this aircraft data communications infrastructure is most advanced in the Eurocontrol led Link 2000+ project, which is driving the implementation of CPDLC by European ANSPs and aircraft operators.

This project is the beginning of a process that will require the installation in most European and US short haul jet aircraft of new cockpit communications computers and VHF digital radios. This is being accelerated by the fact that the aircraft operators can use the VDL Mode 2 link for pilot ACARS communications with their airline ops centers, providing 20 times more capacity than the ACARS VHF analog link. This justifies VDL avionics installation in advance of CPDLC implementation by ANSPs. The aircraft operators' installation of these systems depends on the access to equipment from vendors such as Rockwell Collins and Honeywell and on the business case to make the installation. This process is only starting now and nobody can really predict how the individual airline's installations and the ANSPs' implementation of CPDLC will build into the seamless data communications network envisaged in SESAR and NextGen frameworks.

Another ATM system data component is being defined by the Eurocontrol and FAA Aeronautical Information Management (AIM) programs. They are defining the transition from the traditional Aeronautical Information Service process based on telex and paper to a system using Web sites and the Internet. This includes the delivery of AIS and weather data to the cockpit.

The SESAR documents say that SWIM air-ground exchanges will initially use the CPDLC VDL link and later other links that remain to be developed. The NextGen plans do not yet go into that level of detail. Meanwhile aircraft are beginning to be equipped with a new cockpit display system, generally called an Electronic Flight Bag, which can display AIS data. The plans do not yet make clear if all aircraft will need EFBs to display SWIM data, which could make air-ground SWIM implementation very expensive. The SWIM definition is not advanced enough to identify exactly what exchanges the application will generate and therefore what link capacity they will need.

Are there any other practical SWIM 'increment' options, or should planners really be confining themselves to work with VDL Mode 2 capabilities for the time being?

SWIM air-ground components, such as weather map transmissions to the cockpit, could use broadband links shared with passenger communications such as the Inmarsat Swift Broadband link or maybe the emerging Aircell broadband link. These SWIM transmissions would probably go to the EFB display in the cockpit rather than the aircraft's Communications Management Unit (CMU), which will host the CPDLC function and have a link to the VHF data radio accessing VDL service.

As the ANSPs progress in the definition of what SWIM contains, it will be possible to identify exchanges that do not have an immediate impact on safety and that can take advantage of these broadband links—assuming the airlines will have installed them to provide passenger communications.

The SWIM concept sometimes looks as though it also covers exchanges of aircraft position data that should go through ADS-Broadcast, which on air transport aircraft likely to be equipped with CPDLC will use the 1090 MHz Mode-S Extended Squitter. However SWIM may only cover the downloading, probably via the CPDLC VDL link, of the future route trajectory held in the Flight Management System to compare it with the system in the ATC center systems.

In my view the NextGen and SESAR ATM system definitions need to be refined to clarify what SWIM covers, better define how Aeronautical Information Management—including Flight Information Services broadcast—will complement CPDLC & ADS-B, as well as determine what links will be used by the different functions.

Do you feel that current Global ATM planning with respect to the leveraging of various technologies and capabilities toward an envisioned 'end-state' takes adequate regard of the need for an evolutionary approach on a State-by-State, or even cockpit-by-cockpit basis?

The ATM modernization planning in the area of aircraft communications falls into two categories: the implementation in EU/US domestic airspace of ICAO standard CPDLC/ATN/VDL; and implementation in other ICAO regions of FANS-1/A ADS/CPDLC over ACARS—mostly for long haul aircraft. The implementation

approach is generally to set minimum aircraft capability thresholds required to use new data link based procedures. The FANS-1/A capability requirements are relatively simple for aircraft operators to comply with because they are standard Boeing/AIRBUS features. The ATN requirements are more complicated to comply with because they will not always be standard aircraft manufacturer features. AIRBUS is developing standard cockpit implementation for new aircraft, but a more pervasive CPDLC implementation will require the retrofitting of the older A320 family and Boeing 737 aircraft.

The ANSP use of CPDLC in more dense EU/US airspaces will only start to generate major benefits as the aircraft equipage goes up above 70%, so it may be more realistic at this stage to expect

some less-than-optimal airborne implementation scenarios rather than to try and demand a more complete compliance regimen that would be prohibitively difficult for many aircraft operators to achieve. The Eurocontrol Link 2000+ program has understood the next generation ATM system will not work without having a basic CPDLC platform to build on and has defined a minimal set of initial transactions. The FAA has only recently revived its CPDLC work and risks setting the capability bar too high for the airlines to equip, which would leave the US with a virtually obsolete ATC system not capable of being significantly assisted by only ADS-B.

As this process continues, in your view should cockpit avionics or satellite/ground-based developments be the primary driver of future capabilities?

The definition and development of avionics is very time consuming, so the various phases of aircraft capability are good reference points on which to build generations of ATM modernization. The aircraft need to fly across ANSP borders so they need to find compatible ground systems. It wouldn't work for ANSPs to base ATM modernization on their ground ATC center system evolution and hope that aircraft will be modified to comply with their ground system changes.

Another key point is that aircraft equipage with ADS-B will generate limited benefits unless they are also equipped with CPDLC. If aircraft were equipped with just ADS-B avionics pilots could get a cockpit display of the surrounding aircraft, but if the system detected a potential conflict the pilot would need to use CPDLC to load the Flight Management System with an alternative route not conflicting with flight plans of the other aircraft held in the ANSPs' Air Traffic Management system. If the pilots still depended on voice communications with controllers, ADS-B equipage would not enable any significant changes in ATM in the dense airspace of the US and Europe—where completely autonomous navigation will not be feasible.

The pilot's cockpit display will be the point at which the whole SESAR and NextGen ATM systems come together. The display will need to show surrounding aircraft detected using ADS-B, AIS data coming from AIM ground systems and offer simple access to CPDLC transactions enabling the negotiation of any required changes in route or altitude. ATM service quality will increase as the airborne and ground decision support systems get access to more of the relevant information through an expanding SWIM network. ■

Eyes on the Skies

METEOROLOGICAL CONDITIONS ACCOUNT FOR A SIGNIFICANT PORTION OF CURRENT FLIGHT DELAYS—MORE THAN ALL OTHER NAVIGATION-RELATED FACTORS COMBINED. TO HELP REDUCE THE ADVERSE AFFECTS OF WEATHER ON AVIATION EFFICIENCY AND SAFETY, ICAO OVERSEES THE ONGOING OPERATION OF A WORLD AREA FORECAST SYSTEM (WAFS), LED BY THE METEOROLOGY AND AERONAUTICAL INFORMATION MANAGEMENT SECTION AND ITS CHIEF, **DR. OLLI M. TURPEINEN.**

ICAO Journal: **It was suggested in a recent document that almost 70% of current air navigation delays are meteorologically-related. I was curious if that was a figure that seemed accurate to you, and wondered if you could touch upon the activities your Section is engaged in to help minimize the affects of meteorological factors on global aviation.**

Dr. Olli Turpeinen: There is quite a wide range of figures that have been quoted by various sources regarding this matter. Rather than attempt to isolate an exact percentage I would prefer to simply indicate that meteorological conditions have a 'significant impact' on flight delays in all sectors.

Our work in the meteorological field affects two key areas relating to ICAO's Strategic Objectives: safety and efficiency. This particular question touches upon the efficiency aspect of our activities, which is dealt with most directly by the World Area Forecast System (WAFS). WAFS was initiated in the early '80s to provide standardized meteorological information that is used for pre-flight planning and flight documentation worldwide.

What was the driving force behind the WAFS development?

In the past, each individual State used to provide pre-flight data information: they prepared the charts, the forecast and so forth. Because there was no standardized method of producing and representing this data, from an international standpoint the system was neither uniform, efficient nor cost-effective. Today we have two world centres that are providing the data globally—one in the United States and the other in the United Kingdom. In fact, only one of these systems is actually needed to collate and provide the global, uniform data now provided by the WAFS, but two are maintained in the event that a back-up is required.

What role does ICAO play in this system?

I am currently the Secretary of the ICAO World Area Forecast System Operations Group (WAFSOPSG). This group oversees the ongoing development and operation of the WAFS and

meets every 18 months to review pertinent scientific and technical advances relating to how meteorological data is analyzed and transmitted under the system.

The Group is currently reviewing the production of significant weather (SIGWX) forecasts which are still produced by a 'man-machine' mix: i.e. by highly sophisticated computer models amended by a forecaster, as necessary. In the future these forecasts will be produced without the need for human intervention, making the WAFS system as a whole even more objective and increasing its data uniformity and cost effectiveness—both of which will be beneficial to end-user aircraft operators.

Related work, which we discussed more specifically at a meeting in February 2008 in Cairo, surrounds proposed amendments to the meteorological content of WAFS SIGWX forecasts.

How does the data from the WAFS get disseminated to these end-users? Does it go directly to aircraft operators?

The WAFS computer model forecasts are up-linked to three satellite distribution systems which form part of the ICAO aeronautical-fixed service (AFS). The first of these satellite systems, known as SADIS and operated by the UK, provides the WAFS forecasts directly to States in Europe, Africa, the Middle East and western sectors of Asia. The ISCS (International Satellite Communications system) is a US-run operation that has two satellites covering the Atlantic and Pacific Oceans respectively. Together with SADIS these satellites provide global coverage with respect to provisional meteorological information.

I should note that, in addition to the WAFS forecasts, the data distributed via the satellite distribution systems includes operational meteorological (OPMET) messages—90% of which are meteorological messages and 10% being made up of NOTAMs relating to volcanic ash.

The end users in States must have authorized access to the satellite broadcasts—which is granted in consultation with the contracting State. Though it varies from State to State, end

CONTROLLING THE VOLCANIC THREAT TO AVIATION

Volcanic ash is composed of pulverized rock—siliceous materials with a melting temperature of 1,100 degrees—well below the normal 1,400 degree operating temperature of a jet engine at cruise altitude. Volcanic ash in the atmosphere is usually accompanied by gaseous sulphur dioxide and chlorine, and together these materials and temperatures can cause erosion of compressor rotor paths and rotor blade tips, erosion of the leading edges of high-pressure rotor blades, as well as fused volcanic debris on the high-pressure nozzle guide vanes and turbine blades of jet engines.

Though it may come as a surprise to many, there are globally between 10–20 volcanic events of importance occurring every month. Because normal aviation radar operates based on moisture detection, it is ineffective in locating volcanic ash clouds caused by the more rare explosive eruptions that can pose a danger to aircraft. To respond to this safety threat, ICAO coordinates the activities and operations of nine Volcanic Ash Advisory Centres *(VAACs—see map below)* in strategic areas around the globe. These centres produce advisory information about volcanic ash and its presence in the atmosphere that is used by airlines in flight planning and air traffic services units to warn aircraft in flight.

Once the Volcanic Ash Advisory Centres detect that an eruption has taken place and can discern the geographic and meteorological features of the event in question, they generate a forecast of how it is going to disperse into the atmosphere. Standard advisories include eruption location, the specific volcano producing the event, wind speed and direction and, most importantly, flight levels affected by ash so that aircraft en route or scheduled to depart can be advised to fly well-above or around the affected areas.

Certain eruptions, however, do not afford volcanologists the luxury of much advance notice—such as the one that occurred in Iceland three years ago. Fortunately, the industry was able to respond quickly enough to avoid any safety-related incidents in this instance, however this eruption was a typical example of the main problem faced by aviation in this regard: how to obtain the best balance between safety and efficiency of aircraft operations.
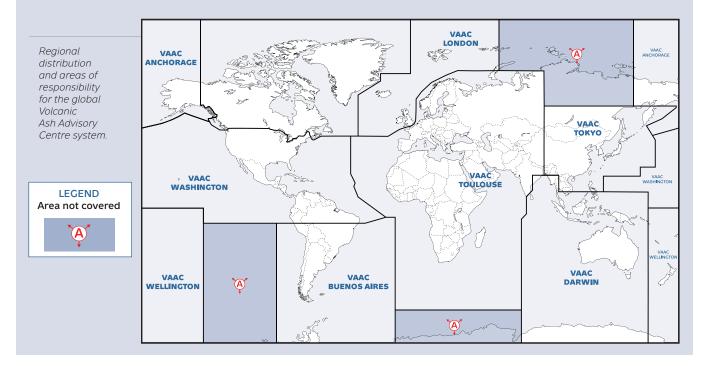
With respect to safety, the goal is to avoid aircraft encounters with volcanic ash. From an efficiency standpoint, the goal is to minimize the re-routing of aircraft. After the Iceland incident some operators complained that the closing of the airspace had been an over-reaction, but it is generally agreed that ash can persist at flight levels dangerous to engines and aircraft for several days after an initial eruption and should therefore be avoided.

Mr. Raúl Romero oversees ICAO's Volcanic ash activities as part of his role as Technical Officer, Meteorology Section, Air Navigation Bureau.

The economic cost of volcanic ash to international civil aviation is staggering, involving complete engine changes, engine overhauls, airframe refurbishing, window re-polishing and/or replacement and pitot-static system repair, etc. Combined with maintenance down-times, delays and rerouting issues, as well as volcanic ash effects to airport equipment and buildings, estimates generally put the cost of ash to aviation well in excess of $250 million since 1982.

Given the safety and economic implications of volcanic ash to aircraft operations, it is necessary to maintain the ICAO International Airways Volcano Watch facilities much in the same way that airport fire services are maintained: in constant readiness but with the fervent hope that they will rarely have to be used.

Regional distribution and areas of responsibility for the global Volcanic Ash Advisory Centre system.

LEGEND
Area not covered

VAAC ANCHORAGE

VAAC LONDON

VAAC ANCHORAGE

VAAC TOKYO

VAAC WASHINGTON

VAAC TOULOUSE

VAAC WASHINGTON

VAAC WELLINGTON

VAAC BUENOS AIRES

VAAC DARWIN

VAAC WELLINGTON

users are usually charged for the WAFS and OPMET data under a cost-recovery regimen proscribed by ICAO.

Does the WAFS and OPMET information included in the satellite distribution systems conform to standards that ICAO has helped to develop?

They do. The ICAO standards provide for and govern the performance requirements for these systems. They are quite detailed in this respect and allow for the uniformity of global WAFS and OPMET information distributed worldwide.

ICAO's role is to be the moderator in order to help the international community to come up with a consensus and develop a road map of how to direct the evolution of these systems. Because the WAFS forecasts and OPMET information are of global importance to a wide range of States and end-users—with varying levels of traffic and infrastructure development—ICAO plays an important role in this regard.

It would seem that the efficiency aspect of the WAFS relates primarily to flight path development for specific aircraft in specific regions… What are the safety aspects of the meteorological work within ICAO which you noted earlier?

There are two primary safety-related issues which are currently being addressed. The first is the International Airways Volcano Watch (IAVW), and the second would be the tropical cyclone warning system.

The establishment of the IAVW, consisting of nine volcanic ash advisory centres, was prompted by the volcanic eruptions in the early '80s—specifically by the serious incident whereby a 747 enroute to Australia lost power on all four engines after flying into a cloud of volcanic ash. They were fortunately able to restart the engines at a lower altitude and land without incident, but as a result of this it was realized that volcanic ash poses a significant safety hazard *(see*

'Controlling the Volcanic Threat to Aviation', p.19).

The second type of weather phenomena that can lead to a cancellation of a flight at the pre-flight planning stage is a tropical cyclone. There are seven cyclone advisory centres covering the tropical oceans and the surrounding land areas exposed to cyclones to manage this safety threat.

All the ICAO systems, including the WAFS, IAVW and tropical cyclone warning system, have been developed and established in close coordination with a UN sister organization, the World Meteorological Organization (WMO).

What challenges lie ahead where the future of the aeronautical meteorology is concerned?

The implementation of Aeronautical Information Management (AIM) will have a long-term influence on the methods used to provide meteorological

information. It may be expected that a more 'Net-centric' provision of information will emerge and that some of the dedicated circuits currently being employed will be phased out. The well-defined OPMET messages specified in ICAO documentation will evolve towards purer forms of data as the AIM technologies evolve, allowing for queries relating to specific variables: e.g. wind speed, visibility, etc., rather than receiving the aggregate MET message which is provided today. In parallel, systems such as WAFS will also progress from the broadcast-oriented structure it reflects today to a more database-oriented configuration.

The road to the net-centric system will be long and my own estimate would be that this data-centric provision of information will likely mature over the next eight to fifteen years. There will eventually be a series of required amendments to Annex 15 that will cascade to Annex 3 and therefore the standards involving meteorological data. ■

Putting Safety First

ICAO'S SEPARATION AND AIRSPACE SAFETY PANEL (SASP) IS ONE OF THE PRINCIPAL STANDARDS GENERATING BODIES REVIEWING NEW TECHNOLOGIES AND PROCEDURES PRIOR TO THEIR APPROVAL FOR USE BY PILOTS OR CONTROLLERS. SASP SECRETARY, DRAŽEN GARDILČIĆ, SPOKE TO THE *JOURNAL* RECENTLY REGARDING THE EVOLUTION OF AIRCRAFT SEPARATION MINIMA AND THE EXTENSION OF NDB/VOR/DME-BASED SEPARATION STANDARDS TO AIRCRAFT EQUIPPED WITH GNSS-BASED NAVIGATION SYSTEMS.

ICAO Journal: **The evolution of aircraft separation standards, in order to permit ever-increasing capacity, is being counted upon as one of the most important solutions to the efficiency dilemmas that are beginning to confront high-traffic regions. Do you feel that it is realistic to presume that this evolution will match the pace of the growth levels currently projected?**

Dražen Gardilčić: There can be no doubt that the evolution of separation standards, now and in the future, will continue to help in alleviating capacity problems brought upon by the growth of the industry. Whether the pace of this evolution will be rapid enough to satisfy those of us on the regulation producing side is a different question. We need to remember that the goals of regulators and the industry are different. As regulator, we could say our product is ensuring that safety levels are kept as high as possible. On the other hand, the industry needs to strike a delicate balance between its objectives of production (profit) and protection.

Aircraft equipage, as far as the industry is concerned, falls mainly on the "protection" side of the equation. Until the industry is forced to equip with something, or they see a tangible benefit in its use, they will generally lag in the installation of new technology. Implementation of technology for technology's sake is a non-starter with the industry. This is one of the big reasons why the implementation of new equipment or procedures to enhance safety and sometimes efficiency always seems to lag behind the onset of the regulation in question or the respective technology's availability.

Another reason that the implementation of a reduced separation standard or the broader use of new technologies for ATC seems to lag behind actual technology development is that, given the safety-of-life implications that these changes bring, they all have to be very carefully evaluated and assessed prior to operational approval. Within ICAO, the Separation and Airspace Safety Panel (SASP) is one of principal standards generating bodies that works on safety assessments of new technology or procedures prior to their approval for use by pilots or controllers. The work that SASP produces is the result of studies, group meetings and consultations among subject matter experts. Consensus building and the drafting of the comprehensive documents can require significant time and consultations.

Unfortunately, the delays don't end there. Once a change has been agreed upon and formulated at the panel level, it needs to be reviewed by the Air Navigation Commission (ANC), circulated among ICAO contracting states for comments, and reviewed again by the ANC for final approval. Subsequently, those changes will be published in the appropriate ICAO documents. This process alone takes between 18 and 24 months.

So, going back to your question, will implementation keep pace with the demand posed by growth? I would say the answer would have to be a qualified yes.

The interoperability between ground-based navigation aids and cockpit avionics will be of fundamental concern as separation reductions are sought-out over the coming decades. How do you see this relationship evolving?

Although ground based navigation aids will continue to play a role in the future, their function, or the way they interface with aircraft avionics, is certainly changing. For example, 20 or 30 years ago, VOR/DME-based navigation constituted

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the main method used by aircraft to navigate in airspace. Before that it was NDBs. Today, we rely much more on space-based systems such as GNSS to navigate.

Traditional ground-based systems such as VORs and NDBs simply provided aircraft with position information by broadcasting signals that allowed aircraft to determine their position relative to the navigation aid. Today's ground based systems, such as GNSS augmentation systems, fulfill a completely different role. They constitute enhancements or integrity checks to GNSS systems. In the past, if a ground based navigation aid such as a VOR or NDB went out of service, aircraft had nothing left to navigate with. Today, if an augmentation system were to fail, aircraft could still use the un-augmented GNSS signal for navigation.

The challenge today is taking those NDB/VOR/DME-based separation standards used by controllers and allow those standards to be used by aircraft equipped with GNSS-based navigation systems. Once again, a significant focus of the work of the SASP consists in carrying out comparative safety assessments to show that GNSS-based navigation can function as well as navigation using NDBs or VOR/DMEs for a particular separation standard.

What percentage of commercial aircraft flying today would you estimate are able to take advantage of the most advanced separation standards now permitted under ICAO standards?

That is a tough one to answer. One thing is for sure, there is an ever-growing number of aircraft that are equipped with GNSS navigation packages as well as more sophisticated capabilities such as ADS-B for surveillance and CPDLC for communications. As the turnover of older aircraft increases to give way to new equipment, the number of aircraft able to take advantage of the newer standards will also certainly increase.

Does this mean that in the future we will do away completely with ground-based navigation aids?

Yes and no. As more and more aircraft become equipped with GNSS, it is envisioned that, in the long term, service providers will be able to obtain savings by reducing the number of ground based aids. I think the complete elimination of ground based aids is still quite far away. Although in theory we would like to think that we can do away completely with VORs, I think prudence dictates that at least a skeleton network of VORs be maintained into the foreseeable future.

How much of the Separation and Airspace Safety Panel's current workload is focused on the evaluations and safety-case analyses required to permit aircraft to take maximum advantage of avionics already in the aircraft?

I would say that the majority of the work of the SASP is focused precisely on that. As an example, we are currently working on extending the application of DME separation standards to GNSS-equipped aircraft in oceanic areas. We are also heavily engaged in the deter-

mination of aircraft-to-aircraft separation minima for Performance Based Navigation (PBN) applications.

Additionally, we have recently produced a document, ICAO Circular 311, which outlines the steps needed in order to use ADS-B as a surveillance tool using five mile separation between aircraft, just as we do with radar today. The next step will be to prove that ADS-B and perhaps multilateration will support a three mile separation minima as surveillance tools. Within the oceanic en route environment the SASP is looking at the possibility of allowing in-trail climb-through procedures using ADS-B between aircraft for separation.

On a related matter, the conducting of safety assessments prior to implementation of any airspace re-organization, or significant changes to the provision of ATC, is an ICAO requirement placed upon States and service providers. The problem is that the term 'safety assessment' has come to mean different things to different people. I am hopeful that the SASP may be able to come up with some guidance in this regard in the fairly near future as well. ∎

Vision and Leadership: Putting Policy into Practice

SINCE IT'S INCEPTION, ICAO'S TECHNICAL CO-OPERATION BUREAU (TCB) HAS FOCUSED THE ORGANIZATION'S RESOURCES AND EXPERTISE TO ASSIST CONTRACTING STATES AND AUTHORITIES WITH VITAL IMPLEMENTATION PROJECTS AROUND THE WORLD. NOW INTO ITS SIXTH DECADE OF ACTIVITY, TCB HAS COME UNDER THE LEADERSHIP OF ITS NEW DIRECTOR, **RICARDO J. HEIGHES-THIESSEN**, WHO SPOKE TO THE *JOURNAL* ABOUT HOW TCB PLANS TO CONTINUE TO HELP CONTRACTING STATES TO EFFECTIVELY MEET THE CHALLENGES OF A SWIFTLY AND CONSTANTLY CHANGING 21ST CENTURY AIR TRANSPORT ENVIRONMENT.

ICAO Journal: **You have over 30 years of experience in the world of international aviation** *(Editor's note: see biographical summary, p.26)*, **and have seen the industry go through some profound changes. What are some of the key first impressions you've had since coming to ICAO and taking over the reigns at TCB?**

Ricardo J. Heighes-Thiessen: When I first came to ICAO I was extremely encouraged by the level of technical expertise evident throughout the Organization. In TCB we often need to have instant access to the knowledge-base represented by the individuals here as well as the various Bureaus and Sections that they're grouped under, and I am very encouraged to experience first-hand the professionalism and diligence with which each area organizes and carries out its responsibilities. Having always been a bridge-builder, I am always on the look-out for new ways to improve harmonization and the sense of joint accomplishment between the departments and groups

that I'm privileged to work with, and that won't be any different here at ICAO. Thus far I have been very optimistic by the elements of teamwork and responsibility present in the day-to-day culture of this organization.

How do you feel these bridge-building instincts will fit-in with ICAO's existing culture?

During a conversation with the Secretary General shortly after I arrived, I mentioned an upcoming mission to Xi'an which was to help increase our support in that region as well as the basic level of co-operation currently enjoyed between ICAO and China. As a strong supporter of the Technical Co-operation Bureau's work, he regretted not being able to attend the Conference at the time, as he is aware of the positive difference it makes when several members of the Organization are able to cooperate and participate together in these types of activities.

It's precisely this deep acknowledgement of the value of teamwork that I find so refreshing at the Executive level—both from the Secretary General and the President of the Council.

At the TCB level, one of my first actions upon arriving was to insist that the TCB management staff located here in Montreal now meet together every two or three weeks to discuss joint objectives and discover areas where they can support and assist each other. This kind of co-operation to me is the essence of an effective management team. It is noteworthy to mention that, from the onset, I was very happy to see little internal competition in TCB—it's all about the teamwork and this is something that we will continue to build on.

Field Procurement Section and Regular Programme Procurement Section. Back row l-to-r: Thierry Alberny, Patrick Molinari, Ariana Lisio, Anatoly Pchelnikov, Louise LeBlanc, Thamara Gonzalez, Viera Seben, Fitzroy Hackett, Jean Wong, Ruben Gallego, Patricia Frai. *Front l-to-r:* N'Goran Kouadio, Giovanna Garcia, Anna Ficko, Colleen Gelinas, Marie-Ange Baraer, Maureen Roach.

Field Operations Section-Africa. Back row l-to-r: Daniela Chivu, Romain Ekoto. *Front row l-to-r:* Anita Musafiri, Charles Maurice Diop, Marielle Provost.

Has this been reflected at the strategic level?

We have produced a new strategic plan for the Bureau based on a Quality Management and Continuous Improvement System (QMCIS), which will adjust TCB's mission and values in order to better react to the industry's dynamic culture and better reflect newer and important issues of relevance—such as the environment. There's a lot of demand on TCB from the many Contracting States where we assist with projects. We've begun consultations internally with all the staff to ensure that the Bureau is providing its people and their projects with the support and resources they need to deliver quality work at the lowest possible cost to the Contracting States—this is a very important priority for us.

The new TCB is really about this new culture of constant change and improvement with respect to every aspect of how the Bureau delivers the fundamental assistance and leadership that Contracting States are requesting of it, with constant quality improvement and cost-effectiveness as our continuing goals.

You mentioned China and Asia earlier. In view of the expected growth in the area, would you consider TCB to be a major contributor towards the civil aviation initiatives in the region?

One of our most important near-and long-term goals is to create global regional balance with respect to all of TCB's activities. When I took over the Bureau, many of the ongoing projects were taking place in the Americas, where we are implementing important projects such as designing and developing Airport Master Plans, building Area Control Centres, constructing airports, procuring airport and air navigation equipment, etc. However, this year we are focusing on increasing our participation in projects in Africa, Europe, the Middle East and Asia-Pacific.

Where the Asia-Pacific region is concerned, our job at this stage is to work as closely as possible with our civil aviation colleagues there, delivering as much of our valuable expertise and experience to them as we can. With respect to management support, efficiency improvements to help it adapt to its rapid growth, as well as essential safety/security structural issues and also training, ICAO has a great deal to offer the Asia-Pacific region and we need to do a better job of improving awareness to that fact.

How do you plan to improve regional presence in a more general sense?

When I arrived in 2007 we only had one TCB officer permanently located in one of ICAO's Regional Offices. Part of our new strategy is to place at least one TCB officer in all of the seven Offices so that we are closer to the Contracting States and closer to the issues that are currently affecting them locally and regionally.

I should add here that during the 2007 Assembly, ICAO hosted delegates from 179 countries as well as representa-

tives from important international aviation organizations. This event provided TCB with the opportunity to carry out and document more than 70 meetings and consultations with Senior Officials from National Civil Aviation Authorities requesting support from TCB for the implementation of projects worth between 50 and 100 million US dollars that will commence at the beginning of this year.

Does this represent an improvement for the Bureau over its past performance? How is TCB doing with respect to previous years?

2006 was a record year for TCB, with the overall programme implementation budget reaching an unprecedented 158 million US dollars. 2007's total will surpass that record with figures totaling 186 million US dollars, and this year we are projecting implementation in the area of 211 million US dollars. This volume of implementation clearly demonstrates how global recognition of the value of partnering with ICAO on major aviation-related initiatives is constantly increasing. These initiatives involve over 500 international experts and over 1500 national experts in various countries around the world.

In every case projects funds are going toward benefiting and modernizing infrastructure, administrative processes and capacity to ensure higher levels of safety, security and efficiency in respective local or regional air transport activities. It's in this sense that our activities closely reflect the new Strategic Objectives that ICAO has set for itself and the industry. It is also help-

ing us to train local individuals in the operation and maintenance of the equipment we help Contracting States to procure so that we create true legacy development and not just quick-fixes.

Are you happy with the level of global understanding that currently exists between ICAO and Contracting States with respect to what TCB does and how it accomplishes its goals?

The short answer to this question is no. One of the major problems TCB still encounters internationally is the misperception that ICAO is a donor organization. We are often approached by project stakeholders who think that we have huge budgets at our disposal to fund their planned developments or programmes. This type of perception can only be changed over time, especially as we extend our regional presence, but for the moment we need to reinforce with industry stakeholders that ICAO is here to provide leadership and expertise, and whenever possible provide advice on how funding can be locally or regionally developed and maintained.

A large portion of your background in aviation revolved around training activities—which is also a main focus for TCB. What will be your priorities in this area as your mandate evolves over time?

Expanding, focusing and harmonizing ICAO's training activities through TCB is also another key element of our new direction, with intensive research and development standards being implemented regarding both existing training services and those

Field Operations Section-The Americas. From l-to-r: José Riveros, Isabel Baeza, Diego Martínez, Connie Morales, Marina Gutman, Grethel Neumann.

Field Operations Section-Asia and Pacific. From l-to-r: Leda Galeano, Wolfgang Sander-Fischer, Claire San Diego.

Office of the Director. Back row l-to-r: Matthias Warmbold, Quang Tan Loung, Mary Vranckx-Amy, Alessandra Andrade, Claudia Mendoza, Alistair O'Hara, Francisco Moreno. *Front row l-to-r:* Fernando Marrero, Ricardo J. Heighes-Thiessen, Vanda Pasquariello.

Field Personnel Section. Back row l-to-r: Jane Marie Carroll, Jocelyne Ng-Chin-Yue, Bernadette Wan, Viviane Younan, Vladimir Lenkov, Michael Buch, Carol Hislop-Shatilla, Selia Nair, Marie-Helene La Rocque. *Front row l-to-r:* Marcia Milburn, Diane Thibodeau, Roland Sergerie, Agnes Yan Sun Yuen, Rhoda Cullen.

that TCB plans to implement over the coming months. Our new training strategy can be summarized based on five key elements:

1. The new ICAO/TCB Diploma Programme.
2. TRAINAIR (continue, refine and improve existing methodology, networking and support).
3. Technical Training Programmes on demand.
4. Harmonization in the delivery of all ICAO training programmes and training related activities.
5. Technical training carried out on cooperative projects.

Basically, every time that ICAO launches a new technical programme or passes a new technically-related resolution, the goal will be to consider all training-related of the development and its implications for the industry. The ultimate objective is to develop what will become a new ICAO training department, with intensive and ongoing research being a key driver behind all of its activities to ensure that course content and objectives remain relevant.

With respect to training partnerships, we have an ongoing fellowship programme with the Singapore Aviation Academy. The success of this initiative was not lost on China, who came to us shortly afterward indicating that they also had training programmes that they were proud of and that they would like to provide fellowships for through TCB. Subsequently we received offers

from Korea as well as India. All of these States are very proud of their programmes and are helping us to be able to provide free training to the world.

This year we will also be launching the first ever ICAO Diploma Programme comprising of 5 individual disciplines. This is a very exciting development for me personally due to my long career affiliation with aviation training. Because of ICAO's leadership role our intention is to create this as an 'unselfish' diploma programme—meaning that rather than creating new courses that would compete with organizations and programmes already existing, we will instead survey the existing courses of other training organizations and offer them the invitation to present specific and appropriate classes as part of the new ICAO Diploma Programme.

TCB will develop content and assessment standards that the selected Diploma Programme courses will need to reflect, but the courses themselves will be offered by the organizations currently providing them. The first such Diploma will cover the Effective Management of Civil Aviation Organizations, but eventually we will establish other Diplomas in areas such as Aviation Law, Safety, Security, Air Navigation, etc. Our intention is to offer this training here on our premises and at regional loca-

> "2006 was a record year for TCB, with the overall programme implementation budget reaching an unprecedented 158 million US dollars. 2007's total will surpass that record with figures totaling 186 million US dollars, and this year we are projecting implementation in the area of 211 million US dollars. This volume of implementation clearly demonstrates how global recognition of the value of partnering with ICAO on major aviation-related initiatives is constantly increasing. These initiatives involve over 500 international experts and over 1500 national experts in various countries around the world. "

Field Operations Section-Europe and the Middle East. From l-to-r: Moona Assad, Ragia Greiss, Bill Hodge, Yahya Mir.

Programme Budget Unit. From l-to-r: Daniel Souhami, Eulanda Fernandez, Frank Martinez, Joann Gallant.

tions where ever possible, using ICAO's leadership position to create a win-win situation for both the training organizations we partner with and the students who participate. All of these Diplomas will be signed by the ICAO Secretary General, which will bring an incredible element of prestige to the Programme and help to reflect the quality of the course materials we intend to present.

Any final comments?

Our greatest challenge now is to continue to convey the message to our Contracting States that we are ICAO, that we are here, and that we have a tremendous amount of expertise at our disposal to assist our Contracting States in improving and modernizing virtually every aspect of their aviation infrastructure and operations. This, along with improving their perception of what we have to offer and how we can help them, will allow TCB and ICAO to continue to provide the tremendous leadership in the air transport realm that is the hallmark of this organization. ◾

TCB Travel Unit. From l-to-r:
Emmanuel Liapakis, Sophie Belanger, Ha-Young Cho.

CEANS: Conference on the Economics of Airports and Air Navigation Services

ICAO Headquarters, Montreal, 15-20 September 2008

THE CONFERENCE ON THE ECONOMICS OF AIRPORTS AND AIR NAVIGATION SERVICES (CEANS) PROVIDES AN IMPORTANT FORUM FOR MORE EFFECTIVE CO-OPERATION BETWEEN AVIATION'S GLOBAL STAKEHOLDERS. THE CO-OPERATION HAS BEEN HELD EVERY 8 TO 10 YEARS SINCE ITS FIRST INCARNATION AS THE AIRPORT CHARGES CONFERENCE IN 1956, AND SINCE THE LAST EVENT HELD IN JUNE 2000 SIGNIFICANT CHANGES HAVE TAKEN PLACE IN MANY STATES REGARDING THE TOPICS TO BE COVERED IN THE CONFERENCE ITSELF AND THE PRECEDING SYMPOSIUM.

Taking into account the often monopolistic characteristics and capacity limitations of airports and air navigation services, together with the broader liberalization of air transport globally, the CEANS Conference will help stakeholders deal with current questions arising from the application of the non-discrimination principle in Article 15 of the *Convention on International Civil Aviation* (Chicago Convention) and of ICAO's charging policies, such as consultation with users, transparency and the cost relationship of charges.

The ICAO guidance material on key aspects related to commercialization and privatization, such as economic oversight, best commercial practices, performance measurement, benchmarking and application of economic pricing principles, will also be reviewed at CEANS based on the experiences of a variety of Contracting States. With growing attention being given to multinational co-operation in the financing and operation of air navigation services, CEANS will also consider the role that ICAO plays in this area.

The draft agenda for CEANS, developed by the Secretariat and based on input from stakeholders, has been structured around four components:

1. issues involving interaction between States, providers and users;
2. specific issues related to airport economics and management;
3. specific issues related to air navigation services economics and management; and
4. implementation of ICAO's policies on charges.

This structure will provide for discussions of key issues that are common to airports and air navigation services—in a broader context at first in order to avoid duplication of discussion in the following specific agenda items. A description of the main topics to be discussed at CEANS can be found on ICAO's Web site at: www.icao.int

The Secretariat is currently developing documentation for each agenda item with the assistance of the Airport Economics Panel and the Air Navigation Services Economics Panel. The completion of all substantive documentation is expected by end April 2008. States will be made aware of the issues well in advance, and reference materials will include the latest editions of the *ICAO's Policies on Charges for Airports and Air Navigation Services* (Doc 9082), the *Airport Economics Manual* (Doc 9562) and the *Manual on Air Navigation Services Economics* (Doc 9161).

A letter of invitation to attend CEANS, together with the agenda, was sent to all Contracting States and selected international organizations by the Secretary General on 7 December 2007 (State letter SD 38/1-07/69), also inviting recipients who wish to submit brief working papers to the various agenda items. Submissions must be received no later than 4 August 2008, so that the papers can be produced in the working languages in due time.

Preparatory Symposium

A preparatory Symposium will be held in conjunction with CEANS and will take place on 14 September 2008. The theme for the Symposium will be *Challenges for Airports and Air Navigation Services*. It will include topics such as the liberalization of air transport and its effects on airports and air navigation services providers, environmental issues, and the main CEANS topics: i.e. economic oversight; performance management; consultation; and status of ICAO's policies on charges.

Commercial events

There is no fee for official delegates from ICAO Contracting States attending the Symposium and CEANS, but each delegate must have been officially nominated by their State (in writing). A limited number of international organizations have been invited to the events with no fee for up to three delegates, while the fee for any additional attendees is US$ 695. The fee for any other attendee (from an organization, company or the public) is US$ 995. As the number of seats is limited, acceptance to attend the events will be granted on a first come, first served basis. In addition, there will be an exhibition area directly in front of the main ICAO Assembly Hall for companies wanting to exhibit products and services, and event sponsorship packages are available to those interested. ∎

For additional information on attending, exhibiting, or sponsoring the CEANS events, please contact Ms. Susan Joseph at: sjoseph@icao.int

Middle East Aviation Safety Summit Takes Global Lead in Implementing Safety Roadmap

The International Aviation Community met in Abu Dhabi, the capital of the United Arab Emirates, on 21 and 22 January for a two-day Aviation Safety Summit aimed at beginning implementation of the Global Aviation Safety Road Map in the Middle East Region.

His Highness Shaikh Hamdan Bin Zayed Al Nahyan, Deputy Prime Minister, attended the first day of the Aviation Summit along with other senior officials. Emirates dignitaries included Sultan Bin Saeed Al Mansoori, Minister of Development for Government Sector and Chairman of the General Civil Aviation Authority (GCAA), and His Excellency Khalifa Al Mazrouei, Chairman and Managing Director of the Abu Dhabi Airports Company.

ICAO Secretary General Dr. Taïeb Chérif commended the timely and comprehensive initiative of the Summit to formulate a safety action plan based on the Global Aviation Safety Roadmap developed by the Industry Safety Strategy Group (ISSG), in co-operation with ICAO. He noted that the action plan will make it possible for the Middle East Region to ensure that its aviation industry maintains an enviable safety record and growth rate, and firmly establishes itself as a strong partner within the world air transport community.

The Summit was planned and directed by Mr. Jalal Haidar, Permanent Representative of the UAE on the Council of ICAO, and Mr. William Voss, CEO of the Flight Safety Foundation. The proceedings resulted in the signing of the Abu Dhabi Resolution, a commitment of the region to accept the Global Aviation Safety Roadmap as the basis for the development of safety action plans within the region.

Copies of Parts 1 and 2 of the Global Aviation Safety Roadmap are available on the ICAO Web site at: http://www.icao.int/fsix/library1.cfm. ■

Public Key Directory Certificate Upload

ICAO ATB Director, Mrs. Folasade Odutola (left), acknowledges the upload of the United States' CSCA Certificate into the secure facilities at the ICAO PKD Operations Centre. Representing the U.S. at the event are AMB Donald T. Bliss (centre) and Mr. Richard Martin, US Alternate PKD Board Member, US Dept of State (right). The CSCA certificate will permit the validation of Document Signer Certificates and the Document Signer Public Key included on the U.S. travel document. ■

New ICAO Council Appointment

Name: Martin Abgor Mbeng ■ Country: Cameroon

Minister Plenipotentiary (Exceptional Class) Mr. Martin Abgor Mbeng is currently the Appointed Minister Counsellor, Cameroon High Commission, Canada. From 1997 thru 2006 he performed the duties of First Counsellor, Deputy High Commissioner Cameroon High Commission, United Kingdom. He has held additional diplomatic titles and postings in Cameroon and in Washington, DC.

Mr. Mbeng has a Post-Graduate Diploma in Development Management, Open University, United Kingdom, an M.A. (Doctorat de 3e Cycle) in International Relations, Institute of International Relations, Yaoundé, Cameroon, as well as a Diploma in Diplomatic and Consular Training in Negotiation Techniques, Bonn, Geneva.

Mr. Martin Abgor Mbeng was named Representative of Cameroon on the Council of ICAO on 1 June, 2007. ■

EC/ICAO Symposium on Regional Organizations

EUROPEAN COMMISSION | Directorate-General for Energy and Transport | ICAO·OACI·ИКАО 国际民航组织

10–11 April 2008, ICAO Headquarters, Montreal

The European Commission, in close association with ICAO, will hold a Symposium on Regional Organizations from 10–11 April at ICAO Headquarters in Montreal.

The Symposium will analyse the nature and consequences of regionalization trends in air transport by examining the different facets of regional organizations in terms of their goals, geographical coverage, scope and degree of integration. Case studies from Africa, Latin America, the Caribbean, Asia, the Pacific and Europe will assist in this analysis.

The political, economic and regulatory challenges of regionalization in air transport will be discussed, with a focus on regional safety oversight organizations, as well as initiatives to remove barriers to the economic development of air transport at the regional level. Finally, possible guidance and assistance methods will be assessed whereby the international community (ICAO and the European Commission, among others) can support the effective development of regional organizations in the field of civil aviation.

An information session will be held prior to the Symposium to provide an overview of ICAO programmes, which can offer assistance to regional and sub-regional organizations, including the Global Safety Plan, the Industry Road map for Safety, COSCAPs and the AFI Implementation Plan.

Participants from Contracting States, the regional civil aviation Commissions, safety and economic regional organizations as well as scholars and civil society will be attending the Symposium.
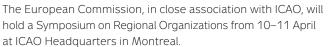
The draft program, registration formalities and other information on the Symposium can be found at http://www.icao.int/ec-icao/. ∎

The Scope and Impact of
Business Aviation

WITH ITS CONTINUING GROWTH AND INCREASING PROFILE, BUSINESS AVIATION PROVIDES AN IMPORTANT AND VALUABLE ROLE IN AIR TRANSPORTATION. ITS CONTRIBUTION TO ECONOMIC GROWTH AND PRODUCTIVITY IS WELL APPRECIATED BY ITS ADHERENTS, WHILE IN OTHER QUARTERS ITS OPERATIONAL IMPACT REMAINS LESS COMPREHENSIVELY UNDERSTOOD. PETER R. INGLETON, IBAC DIRECTOR, ICAO LIAISON, PROVIDED THE *JOURNAL* WITH AN OVERVIEW OF THIS VERSATILE AND COMPLEMENTARY AIR TRANSPORTATION OPTION.

While the rich history of business air travel dates back to the earliest days of aviation, arguably it has only really 'come of age' over the last fifty years. As it stands today, and with an eye to the future, business aviation can no longer be considered as the 'step child' of other sectors of aviation. With the profound improvements in power plant technology, aerodynamic design, advanced materials and construction techniques, this industry sector has recently experienced nothing short of a revolution.

The diversity of aircraft types employed by business aviation today is unmatched in history, as are current safety, performance, payload and comfort/amenity levels. It is therefore not surprising that the modern business aircraft is often referred to as an 'office-in-the-sky', or that this versatile transportation service provides an effective and much valued complement to services offered by airlines. The number of airports with runways capable of accommodating most business aircraft types actually far exceeds the number of airports served by scheduled airline service.

The Why

Stripped to its fundamentals, business aviation is about enhancing business productivity—be it for corporations or individuals conducting their affairs locally, nationally, regionally or globally. The versatility offered by this means of air transportation is unparalleled.

Today, thousands of companies worldwide, from sole-proprietorships to multi-nationals, are embracing business aviation. Companies are using business aircraft in many ordinary ways that have an extraordinary impact on their ability to compete. This may involve transportation of personnel and/or priority cargo, to bring customers to factory tours and product demonstrations, to help sales people cover 'remote' territories and to bring sales people together for collaborative meetings *(see 'Top Ten Benefits of Business Aviation, p.35)*.

The types and models of business aircraft in production today is nothing short of encyclopaedic, be they recips, turboprops or turbojets, not to mention the quest for a certifiable, environmentally acceptable supersonic business jet (SSBJ).

Operational Classification

It might come as a surprise to many readers that business aviation flights are not necessarily confined to general aviation (i.e. private) operations, but also encompass commercial operations—the latter being conducted by holders of Air Operator Certificates and offering whole aircraft charter &/or air taxi services. In some instances this may involve the use of a privately or company owned aircraft rather than an aircraft owned by the AOC holder.

Defining the Sector

Whereas there is no ICAO definition of business aviation[1] (and, strictly speaking, there is no such thing as a 'business aircraft'), the International Business

An eclectic collection of business aircraft on display at EBACE 2007, Geneva.

Aviation Council (IBAC) has defined business aviation and three sub-categories as follows:

Business Aviation: That sector of aviation which concerns the operation or use of aircraft by companies for the carriage of passengers or goods as an aid to the conduct of their business, flown for purposes generally considered not for public hire and piloted by individuals having, at the minimum, a valid commercial pilot license with an instrument rating.
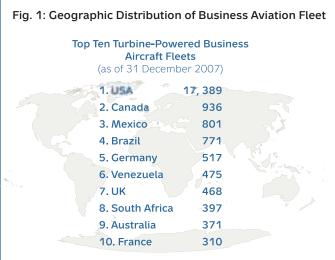
Business Aviation—Commercial: The commercial operation or use of aircraft by companies for the carriage of passenger or goods as an aid to the conduct of their business and the availability of the aircraft for whole aircraft charter, flown by a professional pilot(s) employed to fly the aircraft.

Business Aviation—Corporate: The non-commercial operation or use of aircraft

by a company for the carriage of passengers or goods as an aid to the conduct of company business, flown by a professional pilot(s) employed to fly the aircraft.

Business Aviation—Owner Operated: The non-commercial operation or use of aircraft by an individual for the carriage of passengers or goods as an aid to the conduct of his/her business.
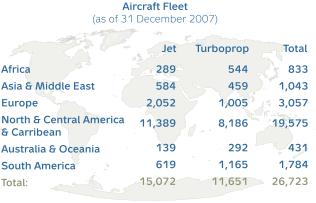
Innovation Stimulates Growth

The foregoing glosses over one of the more important developments in the last several decades affecting business aviation— the advent of Fractional Ownership. This form of ownership, wherein the owner purchases a share or shares (typically in unit(s) of 1/8) of an aeroplane from the fractional provider, who operates the aeroplane in a pool on the basis of a 'lease/interchange agreement', has significantly expanded the access to business aviation and the production of business aeroplanes.

A policy determination by ICAO regarding the operating regime for Fractional Ownership, i.e. non-commercial or commercial, is expected to be undertaken in the near future. This will necessitate *a priori* the adoption of an ICAO definition of Fractional Ownership.
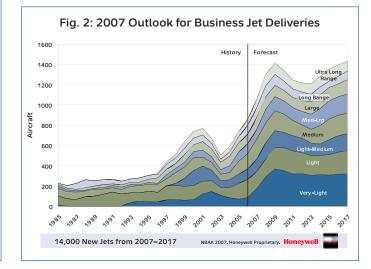
Yet another recent development is the advent of the Very Light Jet (VLJ). While this exciting and intriguing addition to the family of business aircraft continues to engender considerable attention, only time will tell how extensive and significant its impact will be. While undoubtedly revolutionary in concept, design, performance and production, many sage voices in the industry nevertheless contend the operational impact of the VLJ will be more evolutionary than revolutionary. The VLJ is, however, opening up some highly innovative business models for commercial air transportation.

A Sizable and Growing Aircraft Fleet

The world fleet of turbine-powered business aircraft currently stands at 26,723, comprising 15,072 turbojets and 11,651 turboprops. The geographic distribution of these aircraft is shown in Fig.1. This diverse community comprises in excess of 14,000 operators, with the average fleet size per operator being less than two aircraft. Typical annual aircraft utilization is in the vicinity of 550 hours.

Recent years have seen steady growth in the production and deliveries of business aircraft. The value of turbojets and turboprops delivered in 2007 totalled US$ 21 billion.[2] Forecasts indicate that this growth trend will be sustained *(see Fig. 2, below, reprinted with the kind permission of Honeywell)*.

In 2007, for the first time, the sales of business jets to non-North American customers exceeded those to North American customers. This tends to confirm the recent expectations that business aviation will progressively gain acceptance in the major and significantly expanding economies such as China, India as well as

Fig. 1: Geographic Distribution of Business Aviation Fleet

Top Ten Turbine-Powered Business Aircraft Fleets
(as of 31 December 2007)

1. USA	17, 389
2. Canada	936
3. Mexico	801
4. Brazil	771
5. Germany	517
6. Venezuela	475
7. UK	468
8. South Africa	397
9. Australia	371
10. France	310

Acknowledgement: 2007 BART International Fleet Report
with statistics provided by AVDATA/JETNET

World Turbine Powered Business Aircraft Fleet
(as of 31 December 2007)

	Jet	Turboprop	Total
Africa	289	544	833
Asia & Middle East	584	459	1,043
Europe	2,052	1,005	3,057
North & Central America & Carribean	11,389	8,186	19,575
Australia & Oceania	139	292	431
South America	619	1,165	1,784
Total:	15,072	11,651	26,723

Acknowledgement: 2007 BART International Fleet Report
with statistics provided by AVDATA/JETNET

Fig. 2: 2007 Outlook for Business Jet Deliveries

14,000 New Jets from 2007–2017   NBAA 2007. Honeywell Proprietary. **Honeywell**

those of the Russian Federation, the countries of South Asia and the Middle East.

Safety Profile: Ascending

Unsurprisingly, this growth has not gone unnoticed by a number of safety regulatory authorities. Given the relatively impressive safety record for Corporate operators, the business aviation community has not found this attention unwelcome *(ref: IBAC Business Aviation Safety Brief)*. On the other hand, pending recognition and preferably international consensus on the definitions of business aviation (and its subsets) and safety metrics and sector exposure data, meaningful peer-to peer comparisons of safety performance data and trends will continue to prove elusive. It follows that the identification and pursuit of consensual measures to further improve safety will also be elusive. Clearly more work is needed here at the international level.

Industry Representation

The industry is well served by a number of operator representative bodies. Thirteen of these are Members of the International Business Aviation Council (IBAC). Accession to membership of the fourteenth, the Asian Business Aviation Association (AsBAA), is imminent *(see logos included with footnotes)*.

The historic impetus for the creation of business-aviation-operator representative bodies at a national level in the USA, in Europe, Canada and the UK was the preservation of ACCESS—access to airports and/or access to airspace. Importantly, this remains well within the central focus of the business aviation representative bodies to this day, not, however, to the detriment of their overarching attention to safety, security and environmental responsibility. The latter two matters increasingly impinge on ACCESS.

Business aviation associations also play an increasingly significant role in supporting and contributing to the development of safety and other regulations by virtue of facilitating the consultative processes

of regulatory authorities. To the credit of the latter, this role is in general appreciated as it simplifies and invariably makes their task more meaningful and effective.

Illustrative of this was the IBAC leadership and contribution to the recent modernization of ICAO *Annex 6 Part II: Operation of Aircraft International General Aviation— Aeroplanes*. It has been acknowledged by the ICAO Air Navigation Commission and by the ICAO Secretariat that an undertaking of this scope and complexity could not have been accomplished within such a relatively short time-frame had it not been for the contributions, understanding and wisdom of the industry itself.

IBAC is proud of its contribution to the development of contemporary international standards, as described above. It is equally proud of its achievement in developing, some 5 years ago, the International Standard for Business Aircraft Operations (IS-BAO). This code of industry best practice, the center piece of which is a tailored Safety Management System (SMS), is readily scalable to all sizes of operators. The program is now in the hands of more than 500 flight departments, of which just over 100 have received Certificates of Registration— having been audited independently as being in compliance with the standard.

Versatility: The Raison d'être

The versatility of business aviation hinges on two factors: access and operational flexibility. Should one, the other or both of these factors be compromised this would strike at the very raison d'être of business aviation, and there are manifest ongoing challenges to the preservation of this versatility. These challenges range from airport capacity restrictions, landing and en-route slot availability (including incongruent departure and arrival slots), current and emergent (in the latter context, read Advanced Passenger Information— API) security measures, reduction of GHG emissions, environmentally-related airport restrictions, airborne capability-based airspace access mandates, cost recovery/charges principles, etc.

Success brings with it challenges and opportunities. Business aviation has now undoubtedly come of age and is poised to continue to grow, if not flourish. Much of the sector's future success will reside in the extent to which the value of business aviation and its significant economic contributions to local, national and the international economies is recognized by governments, civil aviation authorities, air navigation service providers and, by extension, the International Civil Aviation Organization.

That business aviation has matured into a safe, secure mode of transportation is evidenced by its currently outstanding record and increasingly widespread global acceptance. ∎

Readers who have an interest in obtaining additional information about business aviation are invited to visit the IBAC website **www.ibac.org** *and/or use the links available on this site to access the sites of the IBAC Member Associations. The IBAC website includes, inter alia, information pertaining to the International Standard for Business Aircraft Operations (IS-BAO), the Business Aviation Safety Brief and the Business Aviation Safety Strategy.*

Footnotes:

[1] The ICAO definition of Corporate Aviation is contained in Annex 17 Chapter 1.

[2] General Aviation Manufacturers Association (GAMA).

The Changing Face of Safety Oversight: The Business Aviation Perspective

By Don Spruston, Director General,
International Business Aviation Council (IBAC)

Aviation safety oversight has been with us since the early days of flight, but those first rules and inspection systems were, to say the least, rudimentary. As the system advanced, so did the volume and complexity of rules. Traditionally, aviation rules have been prescriptive, some with questionable safety value, however the paradigm is shifting as travel demands and technology have been advancing so rapidly that governments have been unable to keep sufficient staff and keep them current. Many rules were simply becoming too cumbersome to handle the incredible pace of change.

Over the past decades, we have seen a major shift towards "performance-based rules", where the safety outcome is the objective rather than rigid adherence to prescriptive require-ments. Aviation today demands safety oversight to adjust quickly and effectively to keep pace with changing technology and societal demands (i.e. the environment). It also demands partnership between participants given aviation's vast array of specialties.

We in the business aviation industry are seeing real-time examples of this partnership. ICAO readily accepted industry proposals for modernizing *Annex 6 Part II: International General Aviation—Aeroplanes* and endorsed the industry's "code of practice", the *International Standard for Business Aircraft Operations* (IS-BAO). EASA fully involved the industry in formula-ting new rules for operations and licensing. Canada has now delegated oversight responsibility for corporate-type opera-tions to the industry association.

Safety Management Systems (SMS) are important to the new "performance-based rule" concept. Systematic processes involve all participants in safety oversight. Risk profiles lead to the development of processes to mitigate those risks. The new performance-based approach is forward-looking rather than past, more reactive rule making.

Yet we must not assume that SMS and industry standards will magically reduce aviation accident rates. Like old rules, the new concepts will not work without commitment. Experience has shown that SMS does not come easily to many operators and regulators. There are examples of resistance because the shift to SMS represents change. An SMS program on the shelf gathering dust is just as ineffective as the old prescription-driven Manuals sitting next to it.

Finding effective programs to assess SMS will be an ongoing challenge for both regulators and organizations themselves. One method applied by the business aviation community, in its IS-BAO safety standard, is to progress the assessment of a company's SMS in follow-up audits. A Stage 1 audit verifies that the company has effectively implemented an SMS. Follow-up audits progressively assess in Stages 2 and 3 how well the company has integrated the SMS into its operations and how committed the personnel are.

The new aviation safety oversight paradigm demands full time commitment by all. A culture of safety is necessary to make an SMS system work effectively. This culture of doing the right thing all of the time is not something that can be imposed through rulemaking. An informed culture, a learning culture, a reporting culture and a just culture must be internally reinforced—these organizational qualities represent most important elements of the safety formula. The recently published *Business Aviation Safety Strategy* identifies eight key safety components, of which "safety culture" is the critical path of the "safety star" upon which the strategy is built. Our challenge is to find ways of fostering this type of culture.

Assessment of an organization's safety culture is similar to measuring its heart and soul. Traditional oversight such as scrutiny of documentation and new requirements such as the need for high-level safety policy are not enough to ensure success. A methodology is needed to measure the heartbeat, to gauge the understanding of the cultural commitment by 100% of the staff to doing the right thing all of the time. Common sense must be second nature. The *Business Aviation Safety Strategy* recognizes the importance of safety culture and the industry is developing methodologies to assess this critical element. Such methodology can be used by auditors, but more importantly by organizations to assess themselves. Culture self-testing will arguably become the most important element of the new safety oversight paradigm.

Full implementation of the new safety oversight paradigm will only be complete when there is 100% commitment. We are not there yet and there will be roadblocks along the way, but a performance-based approach, SMS, industry codes of practice, industry self-audits and safety culture self-testing all play a part in the new safety oversight paradigm.

Change, however, is seldom easy. ∎
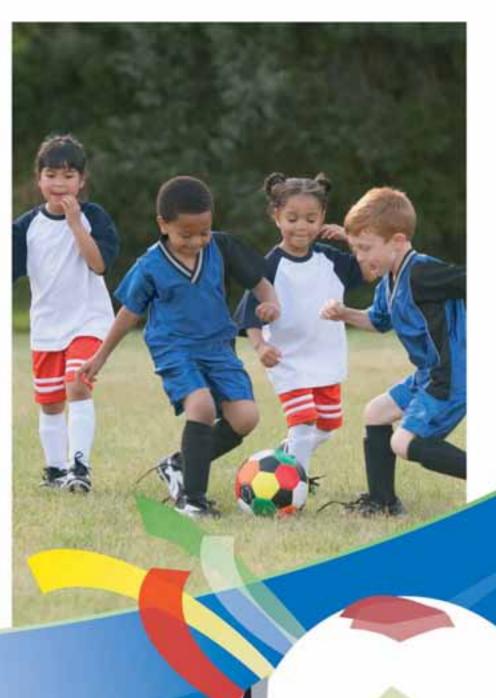
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