COMMON ROUTE AHEAD

Global Aviation Safety Roadmap demands sharper safety focus by states, regions and industry.

BY WAYNE ROSENKRANS

A strategic action plan detailing preferred practices for states and industry to address high-priority safety deficiencies has been delivered to the International Civil Aviation Organization (ICAO) by the Industry Safety Strategy Group (ISSG).[1] Titled *Implementing the Global Aviation Safety Roadmap,* the plan distills the ISSG's consensus on 2006–2014 priorities into one document and represents an industry commitment to tightly coordinate future safety initiatives through one process.[2]

Published in December 2006, the plan provides a common framework to match limited resources to almost unlimited needs, according to R. Curtis Graeber, Ph.D., senior technical fellow, aviation safety, for Boeing Commercial Airplanes. Presenting the plan this past October at the International Air Safety Seminar in Paris, Graeber said on behalf of the ISSG, "Future industry support in global and regional safety initiatives will be tied to the *Roadmap* — if you want some help, show us how [your request] is tied to the *Roadmap* and we'll have the discussion. If it's something that's really different, it goes to the back of the line. Organizations were pulled in different directions without the *Roadmap.* Regions can use the [*Roadmap*] objectives and best practices to engage international stakeholders [and] to develop a regional safety plan."

The *Roadmap* identified areas where national governments need improvement: inconsistent implementation of international standards; inconsistent regulatory oversight; impediments to reporting errors and incidents; and ineffective incident and accident investigation. Regions need to improve coordination of regional programs, the *Roadmap* said. The focus areas for industry are: impediments to reporting and analyzing errors and incidents; inconsistent use of safety management systems (SMSs); inconsistent compliance with regulatory requirements; inconsistent adoption of industry best practices; nonalignment of industry safety strategies; insufficient number of qualified personnel; and gaps in use of safety-enhancing technology.

Roadmap Origins

The ISSG was formed after the ICAO Air Navigation Commission (ANC) invited industry representatives to a May 2005 meeting to discuss methods of integrating disparate efforts, ensuring consistency and reducing duplication. The ISSG prepared and received the ANC's approval of *Global Aviation Safety Roadmap, Part 1,* seven months later, and the *Roadmap* was endorsed by the Directors General of Civil Aviation Conference on a Global Strategy for Aviation Safety in March 2006. The Council of ICAO in June 2006 asked the ISSG for the *Roadmap* implementation plan to help update its Strategic Objective on Safety.

Coming in time to be considered during the early 2007 revision of ICAO's Global Aviation Safety Program (GASP), the plan also has been advanced as "the primary guide to how states and industry work together," Graeber said. The ISSG will coordinate any further activity with the ANC GASP Ad Hoc Working

Group; ICAO Technical Cooperation Bureau; Cooperative Development of Operational Safety and Continuing Airworthiness Programs (COSCAPs); and ICAO regional offices.

In 2007, the ISSG's outreach will include industry segments not explicitly part of the current ISSG or ICAO activities, such as cargo, on-demand and corporate operators. "While regional differences will dictate different implementations of best practices at different levels of maturity, there is much benefit that can be gained by sharing what works — and what doesn't — in various regions that share common challenges," the plan says. In the *Roadmap*, the ISSG considers best practices to be collective lessons learned by the commercial aviation community.

The plan provides the following detailed elements to regions, states and industry:

- Twelve defined *Roadmap* focus areas;

- Acceptable objectives for regional safety teams that choose to work on any *Roadmap* focus area;

- Best practices for identifying and analyzing gaps between the current safety status and the targeted status;

- Technical knowledge, methods and information sources to correct safety deficiencies, including processes for developing regional action plans. In one of the appendixes to the *Roadmap* strategic action plan, the ISSG demonstrates a completed regional assessment template for Sub-Saharan Africa with entries based on sources such as the ICAO Universal Safety Oversight Audit Program (USOAP) results for states;

- Guidance on acceptable metrics for evaluating the effectiveness of corrective actions; and,

- A "best practice maturity model" that enables classification of a state, region or company overall or with respect to any focus area. The model provides criteria for assigning one of four maturity levels from "developing" to "highly evolved" as a method of comparing relative performance over time.

Basis for Safety Initiatives

Although inherently reactive, planning based on accident data still provides an acceptable basis for mapping safety initiatives. "It is absolutely essential that the lessons learned from … accidents remain at the forefront of safety-enhancement activities," the plan says. "Analysis of recent accidents in regions with poorer safety records shows that nearly all were caused by previously well-understood factors with equally well-understood mitigating actions."

Beyond reactive methods, however, the plan urges consideration of prognostic/predictive approaches to risk assessment such as flight data monitoring and periodic auditing of civil aviation authorities, airlines, airports, air navigation service providers (ANSPs), maintenance organizations and training organizations. Best practices for these methods include using metrics from standards of the USOAP and the IATA Operational Safety Audit (IOSA), ICAO annexes and safety oversight/management manuals, and products developed by the international consensus of specialists, such as the Flight Safety Foundation *Approach-and-Landing Accident Reduction (ALAR) Tool Kit.*

A closely related objective is designed to help states, regions and industry apply risk-assessment principles. It says, "The intention of [programs that collect and analyze data] is to both derive appropriate metrics/measures for identifying the precursors to safety incidents so that they can be managed in day-to-day operations [and] identify and reinforce those behaviors that have a positive effect on safety performance."

To develop a regional action plan, the recommended steps are: select the region for analysis, working from the ISSG's categorization of countries or subsets if possible; include and engage all affected stakeholders; outline existing strengths and enablers, i.e., local factors that support the safety of aviation; identify current and future risks/factors in the operating environment; conduct a gap analysis for the majority of the organizations, establishing their current maturity levels relative to their counterparts and to *Roadmap* best practices; develop prioritized recommended actions; and assign this action plan to industry organizations or government entities responsible for correcting safety deficiencies.

Straight Talk

The plan is unequivocal about the role of the global commercial aviation community as a potent force for change wherever standards have not been implemented, and a catalyst for universal adoption of best practices. This translates into several best practices, including one that says, "States apply coordinated initiatives to ensure that noncompliant states do not engage in activity which could be seen as unacceptably increasing the risk of operation."

Also among the plan's recurrent themes are adoption of "just culture"

principles including "open reporting" of incidents by all aviation professionals, sharing and analysis of data at regional and worldwide levels and free exchange of lessons learned from operations. The plan says, "[Just culture is] defined as an atmosphere of trust in which people are encouraged and even rewarded for providing essential safety-related information, even if self-incriminating, [so that hazards and risks may be more clearly understood] but in which all parties clearly understand which types of behaviors are acceptable or unacceptable … and persons reporting need not fear reprisal." Open reporting "encourages reporting … beyond that which is mandated [and is] also confidential in that the reporter's identity is protected," the plan says.

SMSs Everywhere

Although the value of an SMS in risk reduction cannot be overestimated, the ISSG says that this potential has not been realized yet. "To maintain the safety of the whole aviation system, it is important to ensure consistency in the use of SMS across all sectors and

disciplines of the aviation industry," the plan says. "ICAO [SMS requirements do] not yet extend to all … [suppliers of goods and services such as] aircraft maintenance, aeronautical information services and meteorology." Audit processes of industry organizations should include SMSs. "To be truly effective, the interface with other SMSs must also be recognized and managed," the plan says.

Leaders of states, regions and industry must have "both detailed knowledge of current best practices and an organizational commitment to adopt them in a timely manner," the plan says. Designated individuals should take responsibility for researching, updating and disseminating best practices, recommending which to adopt and following up on line managers who ideally will have been empowered to ensure implementation of safety-critical items. Quantitative and qualitative assessments of threats and technology by regional specialists — with early involvement of regulators — also are appropriate to avoid "piecemeal solutions that do not recognize system issues."

Considerable Technology

The plan highlights current technologies designed to enable aircraft operators, ANSPs, airports and others to address approach-and-landing accidents, loss of control, controlled flight into terrain (CFIT), rejected-takeoff accidents, fuel-related forced landings, midair collisions, ground accidents, in-flight fires, severe weather, turbulence encounters, wind shear avoidance, and aircraft maintenance risks. Appendixes recommend sources of ICAO standards and recommended practices, industry best practices, standard operating procedures (SOPs) and education/training. A few examples show how *Roadmap* recommendations

would address some of these accident types.

To reduce the risk of approach-and-landing accidents, aircraft operators should consider how to facilitate stabilized approaches by providing "aircraft capability to fly constant-angle/constant-slope final approaches [including] flight path target or flight path director, other vertical flight management system (FMS)/autopilot/flight director modes [or] both; aircraft capability to fly area navigation (RNAV) and required navigation performance (RNP) RNAV approaches; head-up displays (HUD) for enhanced situational awareness during visual approaches at night or in marginal daytime visual meteorological conditions; [and] auto-land capability."

Operators also should facilitate "optimum use of braking devices such as anti-skid systems … auto-brake system; [and] thrust reversers." ANSPs should consider methods of "preventing unstabilized approaches by gaining an enhanced understanding of modern aircraft performance characteristics, e.g., deceleration characteristics; [FMS] reprogramming requirements [for flight crews responding to ATC instructions]; and SOPs." They also should consider implementing the minimum safe altitude warning (MSAW) capability of terminal/approach radars.

Airports should consider implementation of "visual approach slope indicator/precision approach path indicator at each runway end … ; the installation of a visual glide slope indicator at each runway end … ; runway-remaining markings/runway-edge lighting; [and an] EMAS (engineered material arresting system) … bed at each runway end where the terrain configuration does not allow

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for the provision of a runway [end] safety area." The FSF *ALAR Tool Kit* is among the plan's recommended resources.

To reduce the risk of CFIT, operators should consider "horizontal situation display/navigation displays (NDs); terrain awareness and warning systems [TAWS], in association with GPS [global positioning system] navigation; radio altimeter or TAWS automatic altitude callouts, with standardization across the fleet to maximize effectiveness; primary flight displays (PFDs) with vertical situation displays for enhanced terrain awareness and enhanced awareness of applicable minimum safe altitude; aircraft capability and operating policy for the conduct of constant angle/[constant] slope final approaches for all types of approaches; aircraft capability and operating policy for the conduct of RNP RNAV approaches; [and] aircraft capability for the conduct of approaches with FMS-based or GPS-based vertical guidance (e.g., FMS landing system and global navigation satellite system landing system approaches)."

To reduce the risk of loss of control, operators of aircraft without full flight envelope protection[3] should consider providing a "stall warning system … ; excessive pitch attitude warning; excessive bank-angle warning (e.g., as provided by certain models of TAWS); low-speed protection or warning … ; flight envelope warning; [and] PFD with speed, attitude, etc., warning symbols." ANSPs should consider "gaining an enhanced understanding of performance characteristics of modern aircraft (e.g., maneuvering and go-around characteristics, systems-reconfiguration requirements and SOPs)."

Work Force Realities

The plan projects a 15-year passenger-traffic growth of 4.1 percent annually — a demand for air transport by as many as 7 billion passengers by 2020 — requiring all industry sectors to take action without delay. "Even today, some sectors in some regions are experiencing significant shortages of suitable technical staff," the plan said. "As a result, the industry is witnessing significant migration of professional staff from one region to another to meet this need. This relocation is to the [safety] detriment of certain regions.

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"A major challenge faced by all sectors of the aviation industry concerns the recruitment, training and retention of technically qualified staff, including those engaged in regulatory oversight functions. The failure to recruit and retain a core of well-trained, competent staff has considerable safety implications."

A corresponding objective for states and regions is to "actively encourage a sufficient number of people to enter accredited training institutions." Additional suggested strategies include routinely auditing the quantity and quality of human resources; "promoting the acceptance of licenses

and qualifications issued by other regulatory authorities/civil aviation authorities; [and] providing incentives to attract potential candidates into the industry."

Small, deliberate steps are the most likely path to success under these *Roadmap* concepts, according to the ISSG. "Otherwise, an attempt [at] the immediate implementation of all best practices may detract from the basic obligations of states and industry organizations to correct those infrastructure and other deficiencies that are already identified," the plan says. "No region of the world has attained the highest level of focus area maturity by all of their states, airlines/operators and other constituents." ●

Notes

1. The Industry Safety Strategy Group (ISSG) comprises Airbus, Airports Council International, Boeing Commercial Airplanes, Civil Air Navigation Services Organisation, Flight Safety Foundation, International Air Transport Association (IATA), and International Federation of Air Line Pilots' Associations.

2. ISSG. *Implementing the Global Aviation Safety Roadmap.* Dec. 4, 2006. The complete document is available at <www.flightsafety.org/pdf/roadmap2.pdf>.

3. Full flight envelope protection is recommended by the U.S. Commercial Aviation Safety Team. Various systems that directly and automatically operate an airplane's flying controls can provide this protection, including the high-incidence protection system, which prohibits the airplane from stalling by limiting the angle of attack at which the airplane can be flown during normal low-speed operation, and the alpha-floor system, which increases thrust to the operating engines under unusual circumstances where the airplane pitches to a predetermined high angle of attack or bank angle.