International Civil Aviation Organization

WORKING PAPER

ASSEMBLY — 36TH SESSION

TECHNICAL COMMISSION

Agenda Item 28: Protection of certain accident and incident records and of safety data collection and processing systems in order to improve aviation safety

ANALYZING PRECURSORS OF ACCIDENTS: THE NEED FOR A COMMON APPROACH

(Presented by the United States)

EXECUTIVE SUMMARY

Comprised of industry and government safety experts, the Commercial Aviation Safety Team (CAST) came together in a unique industry government partnership in 1997 and set a goal to reduce the United States commercial aviation fatal accident rate by 80 percent over the next 10 years. Recent history has documented the results. At the close of 2006, the United States fatal accident rate has improved substantially and the rate is expected to continue to decrease in 2007 and beyond. CAST is redirecting its efforts to the analysis of incident data to identify emerging safety risks. The use of the ICAO Common Taxonomy by all States will be critical to further advancements in aviation safety. Globally, the absence of a common taxonomy, and the lack of industry data-sharing initiatives, greatly diminishes the ability to recognize emerging risks and increasing threats prior to their manifestation in an accident or serious incident.

Action: The Assembly is invited to:
a) *Urge* the ICAO Council and ICAO Contracting States to review, implement and monitor as many of the CAST safety enhancements as possible;
b) *Urge* the ICAO Council and ICAO Contracting States to remove legal barriers to the sharing of de-identified incident data and other safety information;
c) *Urge* the ICAO Council to expand the existing ICAO Accident/Incident Data Reporting (ADREP) system to include as much incident data as possible (in addition to data currently required on each accident) and provide resources in ICAO to ensure that a high level of data quality is maintained in the database; and
d) *Urge* ICAO Contracting States to use the CAST/ICAO Common Taxonomy and provide the infrastructure for automated tools to monitor known safety problems and help identify emerging threats by providing this electronic data to the ICAO ADREP system.

Strategic Objectives:	This working paper relates to Strategic Objectives A.
Financial implications:	No additional resources required.
References:	DGCA/06-WP/16, AN-WP/7768 29/10/02

1.	**INTRODUCTION**

1.1	The United States airline industry accident rate of 0.4 fatal accidents per million departures is already among the lowest in the world. That rate is much lower than the overall worldwide commercial aviation fatal accident rate of 0.73 fatal accidents per million departures. Nevertheless, no State may assume that accident rates will remain low given the projected growth in air travel.

1.2	The Commercial Aviation Safety Team (CAST), a United States government-aviation industry partnership, has developed an integrated, data driven strategy to reduce the commercial aviation fatality risk in the United States. To date, CAST has completed forty of the sixty-five most promising safety enhancements identified to reduce the leading causes of fatal commercial aviation accidents in the United States. Adoption of these enhancements has been a major factor in an 80-percent reduction in the fatal accident rate over the past ten years.

1.3	Though CAST has focused primarily on the United States aviation system, throughout its history CAST has reached out internationally to help improve aviation safety around the world. A large number of international organizations are members and observers of CAST, including the European Aviation Safety Agency (EASA), Joint Aviation Authorities (JAA) and other ICAO Contracting States. CAST's impact and leadership extends to regional safety alliances around the world, and its principles have been incorporated into the newly-released ICAO global safety roadmap. Additionally, CAST has inspired the helicopter community to undertake its own safety teams.

1.4	To continue to achieve reductions in the accident rate, it is necessary to expand into analysis of incident and normal operation data to unearth changing and emerging threats in a proactive manner. Access to the data is thus a vital component of this risk analysis.

2.	**BACKGROUND**

2.1	A reduction in the worldwide accident rate is a long-term ICAO goal. To accomplish this, States must adopt enhancements that have proven to be successful. ICAO has already adopted key CAST recommendations such as requiring ground proximity warning systems. ICAO panels should consider how other key accomplishments of CAST could be incorporated into ICAO guidance.

2.2	CAST enhancements were developed based on the study of the most common categories of aviation accidents, e.g. Controlled Flight Into Terrain, Approach and Landing, Loss of Control, Weather (Turbulence), Runway Incursion and Uncontained Engine Failure. In addition, Icing, Maintenance, Mid-air Collisions and Cargo-related accidents have been studied and safety enhancements were finalized in early 2007.

2.3	CAST has supported the development of many tools that can easily be used by both operators and States. For examples of CAST outputs, see the references materials listed below. For example, the Air Line Pilots Association "Online Runway Safety Education Course" *(http://flash.aopa.org/asf/runway_safety_alpa/)* has developed an internet-based interactive program to increase situational awareness in the airport environment and help reduce chances of a runway incursion. (Other training can be accessed from the Flight Safety Foundation).

2.4   CAST has proven that data is the key to success. For each focus area, CAST analyses past accidents and incidents with a disciplined, data-driven, focused approach to identify accident precursors. Specific safety enhancements are developed to address these precursors and contributing factors. The safety enhancements are implemented and their implementation is tracked for effectiveness. The knowledge gained is used to continually improve the aviation system.

2.5   CAST has recently redirected its analytical efforts to the development of diagnostic and prognostic capabilities using incident and other available data to identify emerging safety risk. Support for this initiative will require the establishment of a safety information analysis system that is significantly more extensive and sophisticated than the current basic systems to monitor known safety problems and the implementation and effectiveness metrics of existing enhancements.

2.6   ICAO has the opportunity to be a key stimulant to data sharing by creating an integrated, barrier-free architecture for sharing critical aviation safety data. The future success of safety information analysis and sharing of results can only be achieved when data are commonly described, then the de-identified, aggregated data can be freely shared among all aviation community members and protected from inappropriate use. CAST believes that this future safety vision will require the collaborative support of all ICAO Contracting States to remove the barriers and obstacles to data sharing and to instil a Safety Management System (SMS), with supporting culture that allows data-driven decision making to reduce the occurrence of accidents and incidents.

3.   **DISCUSSION**

3.1   CAST will continually monitor performance-based data, tracking the occurrence of known accident causal factors while also seeking to identify any emerging causal factors that need to be addressed in the future.

3.2   The future of aviation safety is dependent on safety information analysis and sharing of results both to ensure that the solutions to the repetitive historical causes of accidents and loss of life are effectively implemented and to identify and mitigate future threats prior to accidents occurring.

3.3   The ICAO Accident/Incident Data Reporting (ADREP) system has been defined as the international standard for reporting occurrences to ICAO. As such, each Contracting State should provide aviation accident and incident data to ICAO for inclusion into ADREP. This data must be as complete and correct as possible.

3.4   In reporting data, it is important for States to use the CAST/ICAO Taxonomy and definitions, which establish a standard industry phraseology that improves the quality of information and communication, references as provided in the Appendix to this paper. The CAST/ICAO Taxonomy is the result of a joint working group that has developed descriptions of data elements when reporting occurrence categories, phases of flight, aircraft data, etc. This Common Taxonomy can be found at: http://www.intlaviationstandards.org. The CAST/ICAO Taxonomy defines 1) phases of flight such as take-off, maneuvering, approach, etc.; 2) occurrence categories such as controlled flight into terrain (CFIT), loss of control – in-flight, system/component failure or malfunction (powerplant) and (non-powerplant), etc; and 3) standard definitions for aircraft and engine make and model; 4) etc. With this common taxonomy, the aviation community's capacity to focus on common safety issues is greatly enhanced. The absence of a common taxonomy, and the lack of industry data-sharing initiatives, seriously

diminishes the ability to recognize emerging risks and increasing threats prior to their manifestation in an accident or serious incident.

3.5   One of the critical elements of future safety efforts in the United States will be the establishment of the Aviation Safety Information Analysis and Sharing (ASIAS) system that will provide the infrastructure for the free sharing of de-identified, aggregated safety information. The ASIAS programme picks up where the historical accident case study effort leaves off. It will integrate aggregated safety information from many sources, including international events, in a protected environment. ASIAS will use improved analytical techniques to enable early identification of atypicalities or aberrations and emerging threats.

3.6   Improved data and analytical methodologies are key considerations. The information system must provide access to numerous databases, maintain database currency, enable interoperability across differing database formats, provide the ability to identify future threats, conduct a causal analysis of threats, and recommend mitigations. As an aviation community, we need to look at data in new ways that allow flightcrew members, operators, manufacturers, and the regulatory authorities to focus on breaking causal chains and taking action before an identified potential chain of events actually leads to an accident.

3.7   An example of the importance of data sharing in preventing accidents is evident in the case of Helios Airways Flight 522. CAST is currently reviewing data on pressurization after the Helios accident. From 1999 to 2004 there were eight pressurization events, and in only two cases did the Contracting States involved file a report with ICAO. In four cases, an ADREP file was opened using unofficial information since the Contracting State filed neither a preliminary report nor a data report with ICAO. Two events had no record in ADREP.

3.8   There are three basic purposes for an information system – evaluating the effectiveness of the current safety interventions, monitoring known problems and risks, and identifying future risks. All of these purposes could be met by a single system that provides access to the necessary databases while maintaining the anonymity of owner-sensitive data.

3.9   The critical ingredient to future safety gains is a worldwide aviation safety information analysis and sharing system. Toward this end, we challenge all the ICAO Contracting States to support and institutionalize database systems that use the CAST/ICAO Taxonomy definitions and are exchangeable with both the ICAO ADREP and the ASIAS systems.

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APPENDIX

REFERENCE MATERIALS FROM CAST

Joint CAST/ICAO Web site:

Official Site for Aviation Common Taxonomies: http://www.intlaviationstandards.org

FAA Publications:
Standard Operating Procedures for Flight Deck Crew Members (AC 120-71).

Crew Resource Management Training (AC 120-51).

Operator's *Aviation Safety Handbook*, SAE-G18 committee document, and the FAA Audit Tool. *Handbook Bulletin Air Transportation – 14 CFR Part 121 and 135 air carrier safety departments, programs, and safety directors* (HBAT 99-19).

Handbook Bulletin Air Transportation – Policy Company Operating Manuals and Company Training Program Revisions for Compliance with Current Airplane or Rotorcraft Flight Manual Revisions (HBAT 99-07)

Handbook Bulletin for Air Transportation – Airplane Flight Manual Revisions and Aircraft Manufactures Operations Bulletins (HBAT 99-16)

Flight Standards Information Bulletin for Airworthiness – Cold Weather Servicing of Aircraft Nose Landing Gear Struts (FSAW 97-10)

Handbook Bulletin for Airworthiness – Air Carrier Operations Specifications to Make Arrangements with Other Organizations to Perform Substantial Maintenance and Aircraft and Maintenance Provider Contracts (HBAW 96-05C and 98-01

Joint Handbook Bulletins for Air Transportation and Airworthiness (HBAT 98-18 and HBAW 98-09)

Part 91 Pilot and Flight Crew Procedures during Taxi Operations and Part 135 Single-Pilot Operations (AC 91-73)

FAA CD (*FAA Taxi 101*). Guidance for mechanics and others who tow or move aircraft within airport movement areas

FAA CD *Commercial Aviation Safety Team (CAST)*. Includes Risk Assessment Tool, reference materials, team reports and listing of safety enhancements.

Training:
Flight Safety Foundation (http://www.flightsafety.org/technical_initiatives.html) has conducted research and training in the following areas, as contained in the ALAR Tool Kit CD:

- Controlled Flight Into Terrain
- Continuing Airworthiness Risk Evaluation
- Flight Operations Risk Assessment System
- Flight Operational Quality Assurance
- Ground Accident Prevention
- Operators Guide to Human Factors in Aviation

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