



Agenda Item 1: Safety Management Issues
1.2 Actions to reduce coordination loop errors in the ATC between adjacent ATS units related to large height deviation (LHD)

**ACTIONS TO REDUCE ATC COORDINATION LOOP ERRORS
BETWEEN ADJACENT ATS UNITS**

(Presented by the Secretariat)

SUMMARY	
This Working Paper presents actions required to reduce coordination loop errors between adjacent ATS units, considering new ICAO Circular 314, Threat and Error Management (TEM).	
References:	
• <i>Global Air Navigation Plan - Doc 9750</i> • <i>Threat and Error Management (TEM) in Air Traffic Control - Circ 314</i> • Eleventh Air Navigation Conference (Montreal, 22 Sept-3 Oct. 2003) • GREPECAS/15 Meeting (Río de Janeiro, Brasil, 13 – 17 October 2008) • Third Meeting of North American, Central American and Caribbean Directors of Civil Aviation (NACC/DCA/3) (Punta Cana, Dominican Republic, 8-12 September 2008) • ATM Multilateral Meeting (Armenia, Colombia, June 2009)	
Strategic Objectives	<i>This working paper is related to Strategic Objectives A and D.</i>

1. Introduction

1.1 Annex 11 requires the implementation of ATS safety programmes, which should be based upon risk analysis related to SMS and SSP. The Eleventh Air Navigation Conference (AN-Conf/11), with Recommendation 2/5, “Monitoring of safety during normal operations,” led to the development of Circular 314, Threat and Error Management (TEM) and guidance material for Normal Operations Safety Survey (NOSS).

1.2 To enhance safety, GREPECAS, through its Conclusion 15/36 urged States to take measures to reduce operational errors in the ATC coordination loop between adjacent Air Control Centres (ACCs), including early implementation of ATS Interfacility Data Communication (AIDC).

1.3 Conclusion NACC/DCA/3/7 urged States, Territories and International Organizations of the CAR Region to use of the interface control document (ICD) and review automated systems capacities to improve ATC coordination.

1.4 The ATM Multilateral Meeting agreed on actions to reduce Large Height Deviations (LHDs) through corrective measures based on Circular 314 and to develop particular ATC Safety Management Programmes and agreements to interface ATS automated systems in accordance with GREPECAS guidelines. The meeting achieved an initial agreement to interfacing ATS automated systems between Colombia-Netherlands Antilles; Colombia-Jamaica; and Jamaica-COCESNA.

2 Discussion

2.1 Based on Recommendation 2/5, ICAO developed *Circular 314*, Threat and Errors Management (TEM) as a precursor of the NOSS Manual. The TEM framework can be applied in all ATS operations, regardless of the implementation of NOSS. However, NOSS cannot be implemented without embracing the TEM concept.

2.2 The main objective of introducing the TEM framework to the Air Traffic Services (ATS) community, in general, and to the Air Traffic Control (ATC) community in particular, is to enhance aviation safety and efficiency. This is achieved by providing an operationally relevant and highly intuitive framework for understanding and managing system and human performance in operational contexts.

2.3 A further objective in introducing TEM is to lay the foundation for ATS providers for the adoption of a TEM based tool that involves monitoring NOSS as part of ATC safety management systems.

2.4 TEM and NOSS are neither human performance/human factors research tools, nor human performance evaluation/assessment tools. TEM and NOSS are operational tools designed to be primarily, but not exclusively, used by safety managers in their endeavours to identify and manage safety issues as they may affect safety and efficiency of aviation operations.

2.5 This circular contains the following:

- a) a generic introduction to the TEM framework, including definitions; components of the framework; threat and error countermeasures; and threats, errors and undesired states in relation to outcomes;
- b) a discussion on TEM in ATC, including definitions; threats in ATC; errors; undesired states; managing threats and errors; TEM-based analysis of actual ATC situations; TEM training for ATC personnel; integrating TEM in safety management; and normal operations monitoring; and
- c) a list of related documents.

2.6 In summary, the TEM framework captures the dynamic activity of an operational ATC crew working in real time and under real conditions. The utility of the framework is that it can be applied proactively or retrospectively, at the individual, organizational, and/or systemic levels.

Errors

2.7 Errors are defined as “actions or inactions by the air traffic controller that lead to deviations from organizational or air traffic controller intentions or expectations”. Unmanaged and/or mis-managed errors frequently lead to undesired states. Errors in the operational context thus tend to reduce the margins of safety and increase the probability of an undesirable event.

2.8 Errors can be spontaneous (i.e. without a direct link to specific, obvious threats), linked to threats, or part of an error chain. Examples of errors include: not detecting a read-back error by a pilot; clearing an aircraft or vehicle to use a runway that was already occupied; selecting an inappropriate function in an automated system; data entry errors, etc.

Threats in Air Traffic Control

2.9 Threats in ATC can be grouped into the following four broad categories:

- a) internal to the Air Traffic Service Provider (ATSP);
- b) external to the ATSP;
- c) airborne; and
- d) environmental.

2.10 These four categories can be subdivided into other categories as presented in the table below as an example. Awareness about these threats will assist the deployment of both individual and organizational countermeasures to maintain margins of safety during normal ATC operations.

ATSP Internal	ATSP External	Airborne	Environmental
Equipment	Airport layout	Pilots	Weather
Workplace Factors	Navigational Aids	Aircraft Performance	Geographical Environment
Procedures	Airspace Infrastructure/Design	R/T Communication	Distraction
Other Controllers	Adjacent Units	Traffic	

Threat and Error Countermeasures

2.11 Air traffic controllers must, as part of the normal discharge of their operational duties, employ countermeasures to keep threats, errors and undesired states (operational conditions) from reducing margins of safety in ATC operations. Examples of countermeasures would include checklists, briefings, and prescribed procedures, as well as personal strategies and tactics. It is an interesting observation from the flight deck environment that flight crews dedicate significant amounts of time and energies to the application of countermeasures to ensure margins of safety during flight operations. Empirical observations during training and checking suggest that as much as 70 per cent of flight crew activities may be countermeasures-related activities. A similar scenario is likely in ATC.

2.12 Many but not all countermeasures are necessarily air traffic controller actions. Some countermeasures to threats, errors and undesired states that air traffic controllers employ build upon “hard” resources provided by the aviation system. These resources are already in place in the system before air traffic controllers report for duty, and are therefore considered as systemic-based countermeasures. The following would be examples of “hard” resources that air traffic controllers employ as systemic-based countermeasures:

- a) minimum Sector Altitude Warning (MSAW);
- b) short-Term Conflict Alert (STCA);
- c) standard operating procedures (SOPs);
- d) briefings; and
- e) professional training.

2.13 Other countermeasures are more directly related to the human contribution to the safety of ATC operations. These are personal strategies and tactics, individual and team countermeasures, that typically include canvassed skills, knowledge and attitudes developed by human performance training, most notably, by Team Resource Management (TRM) training. There are basically four categories of individual and team threat and error countermeasures for ATC as shown in the following table:

Team Climate	
COUNTERMEASURE	DESCRIPTION
Communication Environment	Environment for open communication is established and maintained
Leadership	Supervisor shows leadership and coordinates the team/sector activities
Overall Team Performance	Overall, team perform well as risk managers
Planning	
COUNTERMEASURE	DESCRIPTION
Briefing	An interactive and operational thorough briefing is provided
Plans Stated	Operational plans and decisions are communicated and acknowledged
Contingency Management	Team members develop effective strategies to manage threats to safety
Execution	
COUNTERMEASURE	DESCRIPTION
Monitor/Cross-Check	Team members actively monitor and cross-check other team members
Workload Management	Operational tasks are prioritized and properly managed to handle primary ATC duties
Flight Strip Management	Flight strips are properly organized and updated to keep track of traffic developments
Review/Modify	
COUNTERMEASURE	DESCRIPTION
Evaluation of plans	Existing Plans are reviewed and modified when necessary
Inquiry	Team members are not afraid to ask questions to investigate and/or clarify current plans of action

2.14 In its optimal form, TEM is the product of the combined use of systemic-based individual and team countermeasures.

Normal Operations Safety Survey (NOSS)

2.15 Safety managers and supervisors should develop a tool to collect safety information on threats that personnel have to face in everyday normal operations, how these threats are managed, what errors may result from the threats and how the ATCOs manage these errors. After the information is processed, managers have a clear overview of the strengths and weaknesses with respect to threats, errors and undesired states encountered in normal operations. This is a category of safety information that is not available through any other methods.

2.16 To this end ICAO is pursuing the development of NOSS as a tool with unique characteristics, tailored for the ATC environment.

2.17 In its anticipated form, NOSS will entail over-the-shoulder observations during normal shifts and will not be applied in any training situations. The programme will require joint sponsorship from management and the association representing air traffic controllers. All participation will be voluntary, and data collected will be de-identified and treated as confidential and not for disciplinary purposes.

2.18 NOSS will use a standard observation form, trained and standardized observers, trusted data collection sites, and a data “cleaning” process. In addition, it will spell-out targets for safety enhancement and provide feedback to participating controllers.

2.19 The purpose of NOSS is to furnish the ATC community with a means for providing robust data on threats, errors and undesired states to safety managers. Analysis of NOSS data, together with safety data from conventional sources, should make it possible to focus the safety change process in the areas that need the most attention.

Safety Oversight Training

2.20 State/Territories safety oversight authorities have performed oversight inspections based on prescriptive elements and strict compliance with aviation regulations; Civil Aviation Authorities (CAA) and air navigation service providers interact in the resolution of safety concerns through a risk mitigation plan.

2.21 To this end, the SMS/SSP concept requires a particular training programme for ATS inspectors/supervisors on comprehensive ATC performance-based frameworks to support safety performance goals. Interaction of these two elements will also play a critical role in the success or failure of the SMS/SSP.

Interface ATS automated Systems

2.22 Several CAR States have been working on the future implementation of AIDC (ATS Inter-facility Data Communications). This technology shows the greatest potential for the reduction of ATC facility to ATC facility coordination errors, which are the single largest contributor to LHDs in the CAR/SAM Regions. It should be noted that in those FIRs where ATS have introduced AIDC, LHDs have been reduced.

2.23 Even current LHD reports only refer to RVSM airspace. Further actions are expected from E/CAR State/Territories to ensure ATC coordination in the lower airspace.

2.24 Based on the regional strategy for the integration of ATM automated systems approved by GREPECAS, the Meeting should encourage certain tasks to Improve ATM situational awareness, as part of an action plan for interfacing ATM automated systems which are related to the new *Global Air Navigation Plan* (Doc 9750).

2.25 To this end, E/CAR States and Territories should develop an action plan and conduct tests in their ATS surveillance system, in accordance with the airspace classification, as well as determine other automation requirements to satisfy future operational applications of the ATM community. An action plan should include that each State/Territory of the Eastern Caribbean:

- a) appoint an expert as point of contact to carry out work for the evolutionary interfacing of ATM automated systems;
- b) follow guidance material specified in the regional Interface Control Document (ICD) for data interfacing and common procedures to exchange messages between ATM automated systems to exchange ATS messages (EST, FPL, CPL, etc.);
- c) review the ATM automation capacities/functionalities of their corresponding Area Control Centres to meet future implementation requirements;
- d) conduct CPL tests between adjacent Area Control Centres, where benefits related to this implementation could result;
- e) establish bilateral or multilateral agreements as appropriate, among States/Territories of adjacent airspaces for trials and operational implementation/integration of ATM automated systems;
- f) establish necessary measures for human resources planning and training;
- g) identify other potential benefits for the ATM community that may be obtained in the long-term;
- h) conduct a cost-benefit analysis; and
- i) document the action plan providing best experiences to other States/Territories.

3. Suggested Action

3.1 The Meeting is invited to review the content of this paper and develop an action plan and tests to interface ATS automated systems, including actions listed in paragraph 2.25, and require States/Territories to inform the results to the ICAO NACC Regional Office **not later than February 2010**.