KURDISTAN REGIONAL GOVERNMENT

SULAYMANIYAH INTERNATIONAL AIRPORT

MATS

APPENDIX " L "

THREAT AND ERROR MANAGEMENT (TEM) IN ATS

(First Edition)

April 2012

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Appendix " L "

THREAT AND ERROR MANAGEMENT (TEM) IN ATS

1. GENERAL

Under the TEM framework, a threat is not a problem as such, but it could develop into one if not managed properly. Not every threat leads to an error, and not every error leads to an undesired state, yet the potential is there and so should be recognized. For example, visitors in an ATC operations room are a "threat" — their presence in itself is not a dangerous situation, but if the visitors engage in discussions with the ATC crew or otherwise distract them, they might lead the controller to make an error. Recognizing this situation as a threat will enable the controllers to manage it accordingly, thereby minimizing or preventing any distraction and thus not allowing the safety margins in the operational context to be reduced.

2. CATEGORIES OF THREATS IN AIR TRAFFIC CONTROL

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

a. internal to the ATS provider;

b. external to the ATS provider;

c. airborne; and

d. environmental.

2.2 Since awareness about these threats assists the deployment of both individual and organizational countermeasures to maintain margins of safety during normal ATC operations, the following paragraphs elaborate on the sources and nature of conditions which "threaten" safe air traffic services.

2.3 Internal Threats To The ATS Provider

2.3.1 EQUIPMENT is a frequent source of threat for ATC. Malfunctions and design compromises are among the conditions that controllers have to cope with to varying degrees during everyday operations. Other threats under this category include radio communications that may be of poor quality, and telephone connections to other ATC units that may not always be functioning correctly. An input to an automated system may become a threat if the desired input is rejected by the system, and the controller has to find out why the input was not accepted and how to remedy the situation. The lack of proper equipment is a threat in ATC facilities in many parts of the world. A significant threat in ATC is maintenance work (scheduled or unannounced) concurrent with normal ATC operations. In addition, maintenance activity may produce threats that only manifest themselves when the equipment concerned is next put into service.

2.3.2 WORKSPACE FACTORS include glare, reflections, room temperature, non- adjustable chairs, background noise, etc. A controller's work is more difficult if there are reflections from the room lighting on the screens. A tower controller may have problems visually acquiring traffic at night if there are reflections from the interior lighting in the windows of the tower. A high background noise level, e.g. from fans necessary to cool the equipment, maymake it more difficult to accurately understand incoming radio messages. Similarly, it may make outgoing messages harder to understand for the receiving parties.

2.3.3 PROCEDURES may also constitute threats for ATC. This applies not only to procedures for the handling of traffic but also to procedures for internal and external communication and/or coordination. Cumbersome or apparently unnecessary procedures may lead to shortcuts with the intent to help the traffic but with the potential to generate errors or undesired states.

2.3.4 OTHER CONTROLLERS from the same unit may be a threat as well. Proposed solutions for traffic situations may not be accepted, intentions may be misunderstood or misinterpreted, and internal coordination may be inadequate. Other controllers may engage in social conversation, creating a distraction from the traffic. Relief staff may be late. Other controllers in the unit may be handling traffic less efficiently than expected, and consequently, they cannot accept the additional traffic a controller wants to pass to them.

2.4 External Threats To The ATS Provider

2.4.1 AIRPORT LAYOUT AND CONFIGURATION can be a source of threat to ATC operations. A basic airport with just a short taxiway connecting the ramp with the middle of the runway will require ATC to arrange for backtracking of the runway by most of the arriving and departing traffic. If a taxiway parallel to the runway were available, with intersections at both ends as well as in between, there would be no requirement for aircraft to backtrack the runway. Some airports are designed and/or operated in such a way that frequent runway crossings are necessary, both by aircraft under their own power, and by towed aircraft or other vehicles.

2.4.2 NAVIGATIONAL AIDS that become unexpectedly unserviceable (e.g. because of maintenance) can pose a threat for ATC since they may cause inaccuracy in navigation and affect separation of aircraft. Instrument Landing Systems (ILS) available for both directions of the same runway are another example of this category of threat. Usually only one of the ILS is active, so with a runway change, the ILS for the current runway direction may not yet be activated when ATC is already clearing aircraft to intercept it.

2.4.3 AIRSPACE INFRASTRUCTURE/DESIGN is another potential source of threat for ATC. If manoeuvring space is restricted, it becomes more difficult to handle a high volume of traffic. Restricted or Danger Areas that are not permanently active may be a threat if the procedures for communicating the status of the areas to the controllers are inadequate. Providing an ATC service to traffic in Class A airspace is less open to threats than, for example, in Class E airspace where there can be unknown traffic that interferes with the traffic controlled by ATC.

2.4.4 ADJACENT UNITS. Controllers from adjacent units may forget to coordinate a traffic handover. The handover may be coordinated correctly, but incorrectly executed. The airspace boundaries may not be respected. A controller from the adjacent centre may not accept a proposal for a non-standard handover, forcing the need for another solution. Adjacent centres may not be able to accept the amount of traffic that a unit wants to transfer to them. There may be language difficulties between controllers from different countries.

2.5 Airborne Threats

2.5.1 PILOTS who are unfamiliar with the airspace or airport can pose a threat to ATC. Pilots may not advise ATC of certain manoeuvres that they may need to make (e.g. when avoiding weather) which can be threat to ATC. Pilots may forget to report passing a waypoint or altitude, or they may acknowledge doing something that they subsequently will not do. In the TEM framework, an error by a pilot is a threat to ATC.

2.5.2 AIRCRAFT PERFORMANCE. Controllers are familiar with the normal performance of most aircraft types or categories they handle, but sometimes the performance may be different to that expected. A Boeing 747 with a destination close to the point of departure will climb much faster and steeper than one with a destination that is far away. It will also require a shorter take-off roll. Some new-generation turboprop aircraft will outperform medium jet aircraft in the initial stages after take-off. Derivative aircraft types may have a significantly higher final approach speed than earlier series.

2.5.3 RADIOTELEPHONY (R/T) COMMUNICATION. Readback errors by pilots are threats to ATC. (Similarly, a hearback error by a controller is a threat to the pilot.) R/T procedures are designed with the aim to detect and correct such errors (thus avoiding threats), but in actual practice, this does not always work to perfection. Communications between pilots and controllers may be compromised by language issues. The use of two languages on the same frequency, or two or more ATC units sharing the same frequency are also considered threats under this category.

2.5.4 TRAFFIC. Controllers are familiar with the normal traffic flows in their areas and how these are usually handled. Additional traffic such as aerial photography flights, survey flights, calibration flights (Navaids), parachute jumping activities, road traffic monitoring flights and banner towing flights are threats to the handling of normal traffic. The earlier a controller is aware of the additional traffic, the better the opportunity to adequately manage the threat.

2.6 Environmental Threats

2.6.1 WEATHER is perhaps the most common category of threat to all aspects of aviation, including ATC operations. Managing this threat is made easier by knowing the current weather and the forecast trend for at least the duration of a controller's shift. For example, changes in wind direction may involve runway changes. The busier the traffic, the more crucial becomes the timing for a runway change. A controller will plan strategies to make the change with a minimal disruption to the traffic flow. For en-route controllers, knowing areas of significant weather will help to anticipate requests for re-routings or circumnavigation.

2.6.2 Appropriate knowledge of local weather phenomena (e.g. turbulence over mountainous terrain, fog patterns and intensity of thunderstorms) and/or sudden weather occurrences such as wind shear or microbursts contributes towards successful weather threat management.

2.6.3 GEOGRAPHICAL ENVIRONMENT. Threats in this category comprise high terrain or obstacles in the controller's area of responsibility. Less obvious threats can be posed by, for example, residential areas that must not be overflown below certain altitudes or during certain hours. At some airports, runway changes are mandatory at specified times of the day for environmental reasons.

3. ERRORS IN AIR TRAFFIC CONTROL

3.1 Errors may be defined here as "actions or inactions by the ATCO that lead to deviations from organizational or ATCO intentions or expectations". Unmanaged and/or mismanaged errors frequently lead to undesired states. Errors in the operational context thus tend to reduce the margins of safety and increase the probability of adverse events.

3.2 Errors can be spontaneous (i.e. without direct linkage to specific, obvious threats), linked to threats, or part of an error chain. Examples of errors would include not detecting a readback 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; and data entry errors.

4. UNDESIRED STATES IN AIR TRAFFIC CONTROL

4.1 Undesired states are defined as "operational conditions where an unintended traffic situation results in a reduction in margins of safety". Undesired states that result from ineffective threat and/or error management may lead to compromising situations and reduce margins of safety in ATC operations. Often considered the last stage before an incident or accident, undesired states must be managed by ATCOs. Examples of undesired states would include an aircraft climbing or descending to another level than it should, or an aircraft turning in another direction than it should. Events such as equipment malfunctions or flight crew errors can also reduce margins of safety in ATC operations, but these would be considered threats. Undesired states can be managed effectively, restoring margins of safety, or the ATCO's response(s) can induce an additional error, incident or accident.

Note. An undesired state is often the first indication to a controller that an earlier threat or error was not adequately managed.

5. THREAT AND ERROR COUNTERMEASURES

5.1 As part of the normal discharge of their operational duties, ATCOs employ countermeasures to keep threats, errors and undesired states from reducing margins of safety in ATC operations. Examples of countermeasures would include checklists, briefings and SOPs (Standard Operating Procedures) as well as personal strategies and tactics. Flight crews dedicate significant amounts of time and energy 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.

5.2 All countermeasures are necessarily ATCO actions. However, some countermeasures to threats, errors and undesired states that ATCOs employ build upon "hard" resources provided by the aviation system. These resources are already in place in the system before ATCOs report for duty and are therefore considered as systemic-based countermeasures. The following would be examples of "hard" resources that ATCOs employ as systemic-based countermeasures:

a. minimum safe altitude warning (MSAW);

b. short-term conflict alert (STCA);

c. SOPs;

d. briefings; and

e. training.

5.3 Other countermeasures are more directly related to the human contribution to the safety of ATC operations. These are personal strategies and tactics, and individual and team countermeasures, which typically include canvassed skills, knowledge and attitudes developed by human performance training, most notably, by TRM training.

6. INTEGRATING TEM IN SAFETY MANAGEMENT

6.1 The distinction between the different categories of threats may be trivial to operational controllers — threats exist and need to be managed during everyday shifts. On the other hand, training managers may wish to note which categories of threats are being addressed in the curriculum for their unit (although they are most likely not presented as threats in the training). Some of the threats are often addressed in a less formal way, e.g. as anecdotal information during on-the-job training.

6.2 An airport with a basic layout where backtracking on the runway is required for movements is an example. Controllers working on that airport will have received training (in the classroom, in the simulator or on the job) to enable them to control the traffic at that airport, and they will be used to managing the threat. Nevertheless, every backtracking aircraft poses a threat to the ATC operation and needs to be managed by the controllers.

6.3 From the perspective of an ATC safety manager, it is relevant to know how this particular threat is managed by the controllers on a day - to - day basis. Are they able to manage it without any significant problems, or are the difficulties to managing it so common that they go unreported? In case of the former, there might be no requirement for the safety manager to take specific action. In case of the latter, there obviously is a need for safety management action.

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