International Civil Aviation Organization

SIXTEENTH MEETING OF THE COMMUNICATIONS/NAVIGATION/SURVEILLANCE AND METEOROLOGY SUB-GROUP (CNS/MET SG/16) OF APANPIRG

Bangkok, Thailand, 23 – 27 July 2012

Agenda Item 14: **MET Support to ATM**

REPORT OUT ON THE DEVELOPMENT OF CONCEPT OF OPERATIONS AND COLLABORATIVE DECISION MAKING

(Presented by the United States of America)

SUMMARY

This paper presents background information on two concepts that are becoming more common in aviation. They are the "Concept of Operations" and "Collaborative Decision Making".

This paper relates to –

Strategic Objectives:
A: Safety - ***Enhance global civil aviation safety***
C: Environmental Protection and Sustainable Development of Air Transport - *Foster harmonized and economically viable development of international civil aviation that does not unduly harm the environment*

Global Plan Initiatives:
GPI-19 Meteorological Systems

1. Introduction

1.1 At the International Airways Volcano Watch Operations Group (IAVWOPSG) and the Meteorology Warning Study Group (METWSG), it was agreed that ICAO undertake the responsibility to develop a Concept of Operations (ConOps) in support of services that need to be defined for space weather, (IAVWOPSG/6 Conclusion 6/31) volcanic ash (International Volcanic Ash Task Force, [IVATF]/2 Task 10), and the provision of regional advisory centers in support of SIGMET (METWSG/4 Action Agreed 4/1). Similarly, it was also agreed that there was a need for a ConOps for the provision of radioactive cloud information in support of international air navigation (IAVWOPSG/6, Conclusion 6/29).

1.2 In the past, new concepts or proposals or changes in services were introduced through various means and eventually a group consensus emerged that evolved in the establishment of a standard and recommended practice (SARP) in Annex 3. As the international community moves forward to newer technology that will further advance how and what is required for aeronautical meteorology, it is recognized that that this way of doing business can no longer be supported in that it lacks configuration management of how and why there is a need for a change in service. ICAO recognizes that there is a need for a plan that defines how all future services are envisioned and will be provided.

1.3 At the same time, there has also been movement in promoting a collaborative decision process that allows both the provider of information and the user of information to interact more effectively in a real time environment to improve or support the operational decisions. No longer can we look at just providing a product that conforms to a model template, but rather the provider of information will need to develop skills on interacting with the user of the information as part of the effort to integrate meteorological information into decision support tools. This process has an umbrella referred to commonly as collaborative decision making (CDM).

1.4 What brings these together is the ICAO document *Flight and Flow Information for a Collaborative Environment* (FF-ICE). The Information for Collaborative Environment (ICE) is composed of multiple domains with meteorology being an essential part of this process. But to make it work those involved need to understand the processes.

1.5 The purpose of this paper is to inform the group of what is involved in the development of a ConOps and to provide an over view of what is involved with collaborative forecasting in its relation to CDM.

2. Discussion

2.1 <u>FF-ICE</u>

2.1.1 The present-day ICAO flight planning provisions were developed on the basis of a manual, paper-based, point-to-point, teletype communications system. A fundamental change is required to support the implementation of the *Global Air Traffic Management Operational Concept* (ICAO Doc 9854) including its advanced performance management processes—even though some elements have been addressed within existing flight planning provisions.

2.1.2 The vision of a performance-based air traffic management (ATM) system can only be actualized with information required for performance management and flexibility to support performance-driven changes. These include system-wide information sharing, providing early intent data, management by trajectory, CDM, and high automation support requiring machine readability and unambiguous information

2.1.3 The idea of FF-ICE is to provide mechanisms for ensuring data consistency, interoperability and persistence. These enable an evaluation of end-to-end ATM system performance.

2.1.4 To illustrate part of this concept, Figure 1 shows the relationship or the interaction that has to be undertaken in demand and capacity balancing (DCB) of airspace.

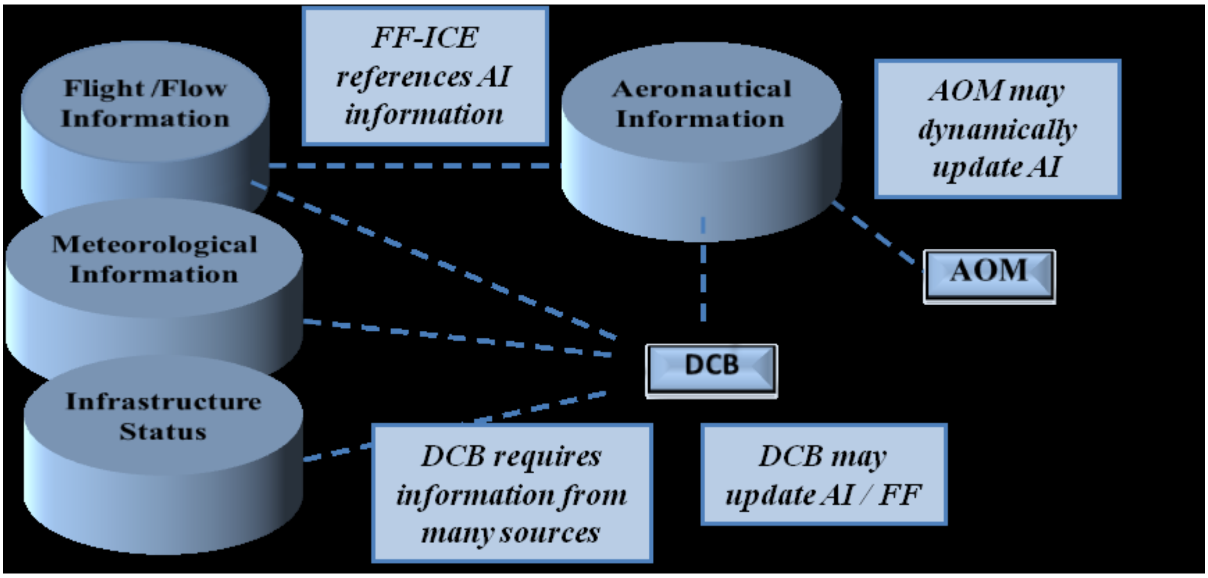

Figure 1: Concept of Demand and Balancing

Note the figure just shows there is a relationship for this situation. What is not understood is what are the specific meteorological services required to support this situation.

2.1.5 For more information on FF-ICE and the overall program, it is suggested that the group become familiar with Doc 9965 which can be found under WP 8 as posted on the ICAO Web page for the 12th ANC at: http://www.icao.int/Meetings/anconf12/Pages/Reference-Documents.aspx.

2.2 <u>Concept of Operations</u>

2.2.1 A ConOps is a process that describes how services are envisioned in the future. Typically one tends to think of ConOps in system engineering in support of the development of a system, but it does not have to be applied along those lines. It shows the relationship between providers of information and users of information.

2.2.2 A ConOps needs to describe the following:

- Some type of problem statement with identification of goals and objectives. In other words why are we doing this
- Description of current services and capabilities that are related to user needs
- Identification of the existing operational services that require change
- Identification of the shortfall in the services
- Description of the changes and the benefits to be achieved
- Identification of the priorities and the associated constraints with the changes
- Concept of how the service is to be provided
- Identification of future targets of opportunity associated with a performance to measure whether those targets are achieved
- Examples of possible scenarios of how services can be provided.
- Organization changes in services

2.2.3 A ConOps is not an operations plan on how the services are to be provided, which is the purpose of procedures documents. The procedures documents defines how the services are fulfilled based on the ConOps. Neither is the ConOps a requirements document. However, the ConOps is the basis for a SARP.

2.2.4. The ConOps also serves as a means to define the functional and performance requirements. The use of functional and performance at times can be confusing. The functional requirement describes what service or need is required and by whom. With the functional requirement is an associated performance requirement that measures the quality of the information for the purpose of assessing whether the information has any utility or value added.

2.2.5 Many times there is concern about agreeing to develop a ConOps. Providers of information are weary that they may be bound to the performance metrics. That is contrary to the goal of performance metrics which rather should be viewed as moving objectives to demonstrate how well the service is being provided and what may be needed in support of research and development or perhaps training to improve the skill and quality of information being provided. In other words, going back to defining existing capabilities there is a need to establish a baseline for the services with a long term objective of how to improve those services. Thus one can have an initial baseline capability, a near or mid-term objective and finally a long tern objective of what is required. These metrics can be reviewed on a periodic basis to assess the quality of the service being provided and whether the vision in the ConOps is lending itself to a benefit. On the other hand functional requirements should not change unless technology has advanced that the function for the service is no longer required because an equivalent level of service has satisfied the function. For example, there is a need for wind at the touchdown zone and along the runway. The need is in support of operational decisions by the pilot and the controller. Each user has a different need for the same information one being the performance of the aircraft during landing or takeoff and the other on whether there is a need to reconfigure the operation of the airport. So the functional need is understood but the performance may vary depending on the technology where a baseline could be very fundamental such as a wind sock to a more sophisticated sensor such as a sonic anemometer.

2.3 Collaborative Decision Making

2.3.1 CDM is a joint government/industry initiative aimed at improving air traffic flow management (ATFM) through increased information exchange among aviation community stakeholders. CDM is comprised of representatives from government, general aviation, airlines, private industry and academia who work together to create technological and procedural solutions to the ATFM challenges faced by national airspace systems (NAS).

2.3.2 CDM is an operating paradigm where ATFM decisions are based on a shared, common view of the NAS and an awareness of the consequences these decisions may have on the system and its stakeholders. There are two central tenants to CDM; that better information will lead to better decision-making, and tools and procedures need to be in place to enable air navigation service providers and the flight operators to more easily respond to changing conditions. By sharing information, values and preferences, stakeholders learn from each other and build a common pool of knowledge, resulting in ATM decisions and actions that are most valuable to the system.

2.3.3 As described in the WP/10 of the 12th ANC (http://www.icao.int/Meetings/anconf12/Pages/default.aspx), CDM is defined as an explicit supporting process focused on deciding on a course of action in pursuit of articulated objectives between two or more community members. Through this process, ATM community members affected (in all ways) by a decision, share information related to that decision and agree on and apply a decision making approach and principles. The overall objective of the process is for the ATM System as a whole to improve its performance while balancing against the individual performance needs of individual ATM Community members.

2.3.3.1 CDM is a supporting process always applied to other activities such as Demand/Capacity Balancing (figure in paragraph 2.1.4) CDM can be applied across the timeline of activities from strategic planning (e.g. infrastructure investments) to real-time operations. CDM is not an objective but a way to reach the performance objectives of the processes it supports. These performance objectives are expected to be agreed upon collaboratively. Since CDM likely will require investments, these will need to be justified in accordance with the performance-based approach.

2.3.3.2 Although information sharing is an important enabler for CDM, the sharing of information is not sufficient to realize CDM and the objectives of CDM.

2.3.4 In that regard, in support of CDM, the meteorological community contributes via collaborative forecasting. Not all services provided by Meteorological Watch Offices (MWO), Volcanic Ash Advisory Centers (VAAC), and other meteorological service providers require collaborative forecasting, however there are a select number of hazards that probably tend to lend themselves to collaborative forecasting because of the implications on operations where there is a need to mitigate inconsistency of information that transcends flight information regions. Most notable are volcanic ash and radiation. Collaborative forecasting becomes most important in those situations where the hazard transcends flight information regions. Sharing of information among MWOs that are adjacent is no doubt challenging .

2.3.5 At the recent ICAO Volcanic Ash Best Practices meeting held in Montreal in June 2012, the VAACs are being challenged on how to improve the coordination of information among the experts for the sole purpose of providing a high level of confidence to the end user of the location and forecasted position of ash. VAACs are also being challenged to mitigate the inconsistencies in the provision of information between the VAACs in support of that information being integrated into decision support tools via a collaborative forecasting process. That information is then used in an operational plan to avoid ash without unwilling restricting airspace unnecessarily.

2.3.6 A very important point regarding the final forecast product is that the forecast should not be biased by any impact to an airport or airspace element. Forecasters must provide the users with their best prediction of where the hazard will be, then let the decision makers (e.g., air traffic managers) make their plans, which may include multiple options, based on the forecast probability.

2.3.7 The United States provided information at the Best Practices meeting on the work underway to foster collaborative forecasting during a real time environment. A demonstration was provided to the group on the use of the tool referred to as Envirocast Collaborative Module – Government version or EVCM-G tool). This tool allows for the following:

1) *Highlighting tool* – allows the session leader to highlight features during a collaborative session;

2) *Drawing tools* – allows the session leader to create lines, shapes, polygons, etc. to denote features during a collaborative session;

3) *Capture screen* – Allows the session leader to capture what is shown on the Google Earth display and make it available to a web site or to be saved as a .jpg, .gif or other format for emailing to an external stakeholder;

4) *Send URL* – Allows the session leader to send an URL to session participants for common situational collaboration;

5) *Capability to pull a product from a local database* and share it collaboratively with participants of the session;

6) *Labeling feature* – Allows the session leader to create a label or banner to be included on collaboration session

7) *Time synch animation* – Allows the session leader to sync all animations on each participants session; and

8) *Archiv*e – Each session is archived for replay at a later time. This feature may be used for post-event analysis, training, or event review.

3.0 Action by the meeting

3.1 The meeting is invited to note the information in this paper.

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