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Survey on Pilot's Requirement on Uplinking

of Meteorological Information

C.M. Cheng

Eighth Meeting of the Communications/Navigation/Surveillance

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Agenda Item 13: **MET component of the CNS/ATM systems**

**SURVEY ON PILOT'S REQUIREMENT ON
UPLINKING OF METEOROLOGICAL INFORMATION**

(Presented by Hong Kong, China)

SUMMARY

This paper presents the results of a survey on pilot's requirement of uplinking of meteorological information conducted in Hong Kong, China.

1. **INTRODUCTION**

1.1   In the Global Air Navigation Plan for CNS/ATM Systems, ICAO sets out a global plan on the implementation of CNS/ATM systems to achieve integrated global air traffic management.   To accomplish this goal, Hong Kong, China is carrying out studies and trials on CNS/ATM systems.   In respect of meteorological information uplink, Hong Kong, China conducted a survey in early 2004 to solicit views from pilots regarding their requirements of uplinking weather products.

2. **PURPOSE OF SURVEY**

2.1   The purpose of the survey was to identify, in respect of meteorological information uplink:

   (a)   whether the information required by the pilots are adequately covered by existing weather products and services;

   (b)   improvement area on existing weather products and services to meet pilot's need; and

   (c)   potential new weather products and services.

2.2   Appendix I contains the survey form.   It consists of two sections.   The first section pertains to general information such as availability of data link facilities onboard aircraft. The second section is composed of three parts.   The first part contains a list of existing meteorological information/products. Pilots were asked to indicate if the existing meteorological information/products are acceptable to them and to indicate their preference on the update frequencies for these information/products. In the second part, pilots were asked to indicate which types of potential new information/products they would require for uplink and to indicate their

preference on the update frequencies for the new information/products.   In the third part, pilots were requested to assign priorities 1 to 5 to their choice of five meteorological information/products out of those existing and potential new information/products in the first and second parts. This is to identify the types of meteorological information/products pilots most needed.

3.   SURVEY RESULTS

3.1   A total of 66 replies from pilots of 10 airlines were received. Here below are the results of the survey:

3.2   *Data link on-board*

3.2.1   Pilots were asked if the aircraft they fly are equipped with data link equipment such as ACARS and CPDLC. Results indicate that a great majority of aircraft the pilots fly are already 'data-link-capable' (ACARS: 95%, CPDLC: 77%).

3.3   *Existing meteorological information/products*

3.3.1   In respect of acceptability of existing meteorological information/products, most of the pilots who responded to this question considered existing information/products acceptable.

3.3.2   Comments from pilots regarding areas for improvement/development for the existing meteorological information/products are summarized as follows:

(i)   Some pilots indicated a need for the use of plain language for runway weather observations, METAR/SPECI and TAF/Landing Forecast. They also indicated that these three types of information/products be updated only upon significant change, but more frequent update is required for TAF/Landing forecast at time of extreme weather conditions;

(ii)   For windshear and turbulence alert, some pilots would like the alerts to specify whether they are based on PIREP or not and would like to know the probability of windshear;

(iii)   For SIGMET, pilots indicated a need to receive them via data links. They also indicated that SIGMETs be updated upon significant change. For SIGMET on tropical cyclone, information on probability of maximum wind speed was considered helpful. For SIGMET on thunderstorm/hail, information on direction and speed of movement was requested;

(iv)   In respect of Wind/Temp forecast, some pilots indicated a need for closer spacing of data between flight levels for high level (FL 260-630) to allow better assessment of choice of flight levels;

(v)   Regarding SIGWX forecast, there was a request for all volcanic areas be overlaid. There is also a suggestion for presenting area of turbulence with probability of occurrence.

3.3.3   Regarding update frequencies, some pilots indicated that the existing information/products should be made available on request.   Apart from 'on request', the most desirable update frequencies indicated by the pilots are shown in Table 1. Here, the most desirable update frequency refers to the range of frequencies which relatively more pilots preferred.

3.3.4   Generally speaking, the most desirable update frequencies for existing meteorological information are:

(i)   30 minutes or less for runway weather observations, METAR/SPECI, and windshear and turbulence alerts;

(ii)   1 to 3 hours for TAF/Landing Forecast;

(iii)   1 hour or less for SIGMET messages, except for SIGMET of volcanic ash, which some pilots prefer an update frequency of as long as 12 hours; and

(iv)   3 to 6 hours for wind/temperature forecast and SIGWX forecast, except for SIGWX forecast for high level, which more pilots prefer 1 to 3 hours.

3.4   *Potential new meteorological information/products*

3.4.1   Table 1 contains a list of new meteorological information/products that pilots desired, together with the desirable update frequencies.

3.5   *Most needed meteorological information/products*

3.5.1   Pilots assigned priorities 1 to 5 to their choice of five meteorological information/products. The following marking scheme was adopted to identify the most-needed information/products:

Mark for priority 1 = 5 (highest priority)
Mark for priority 2 = 4
Mark for priority 3 = 3
Mark for priority 4 = 2
Mark for priority 5 = 1

$$\text{Total mark} = \sum_{n=1}^{5} (no.\ of\ priority\ n)\ x\ (mark\ for\ priority\ n)$$

3.5.2   Figure 1 shows the most-needed meteorological information/products in order of priority based on the above marking scheme.
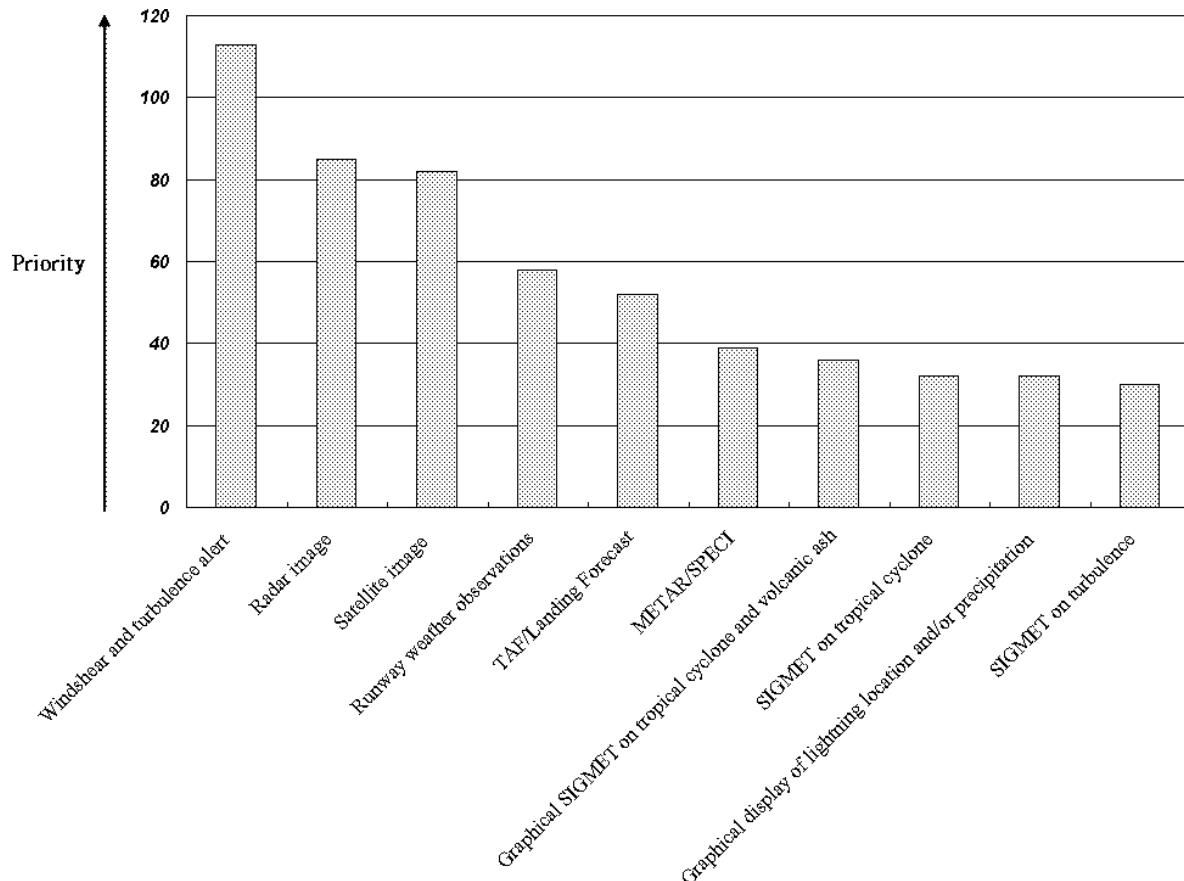
Figure 1 – Top ten most-needed meteorological information/products

4.   REMARKS

4.1   Among the first five most needed meteorological information/products, windshear and turbulence alerts as well as runway weather observations are currently made available to the pilots through digital ATIS broadcasts and verbal communications by air traffic controllers. These are essential information for pilots to consider on approach.

4.2   Regarding windshear alerting, Hong Kong, China operates a suite of weather sensors for monitoring of windshear and turbulence conditions in and around the Hong Kong International Airport. These include a Terminal Doppler Weather Radar (TDWR), a LIght Detection And Ranging (LIDAR) and a number of anemometers and weather buoys.   Recently, efforts are made to automate windshear alerts based on LIDAR data.   Hong Kong, China will explore the use of automatic windshear alerts from the windshear and turbulence warning system for uplinking to the cockpit to meet the need of pilots.

4.3   For radar and satellite images, they are currently made available to airline operators for flight planning. For the purpose of uplinking, the presentation format of these images will need to be developed in consultation with users. An effective means of encoding and compressing the images for uplink is also required.

4.4   Runway weather observations and TAF/Landing Forecasts are currently made available to pilots via data links.   Pilots can get access to these information via the D-ATIS and D-VOLMET while flying into or out of Hong Kong, China. A way to uplink runway weather observations and TAF/Landing Forecasts at higher frequencies will be explored.

4.5   A number of templates for uplinking meteorological information have been developed by ICAO and are available for preparing the uplink products.

4.6   To facilitate uplinking of weather products to the cockpit using minimum bandwidth, it is essential to efficiently encode/compress the data, particularly graphical products. Techniques such as GRIB, BUFR and Weather Huffman have been studied for compressing graphical meteorological information. The availability of ICAO standards for efficient graphical compression would facilitate the development of meteorological graphical information uplink.

4.7   To bring forward meteorological information uplink in Hong Kong, China, the following efforts will be made:

(a)   develop uplink meteorological products using standard templates. For products without standard templates, presentation format may be designed in consultation with users;

(b)   develop communication procedures for secure access taking into consideration the update frequency requirement of pilots;

(c)   explore techniques in encoding/decoding of graphical meteorological products for uplink; and

(d)   identify cost-effective means for uplinking weather products to cockpit in near-term and long-term.

5.   ACTION BY THE MEETING

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

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Table 1 List of meteorological information/products and the desirable update frequency (other than 'on request')

Meteorological information/products	Most desirable update frequency
Existing Meteorological information/products	
Runway weather observations (e.g. winds, RVR)	15-30 min
METAR/SPECI	15-30 min
TAF/Landing forecast	1-3 h
Windshear and turbulence alert	<=15 min
SIGMET on tropical cyclone	30 min – 1 h
SIGMET on volcanic ash	Diverse result: 30 min - 12 h
SIGMET on thunderstorm / hail	15-30 min
SIGMET on turbulence	<= 15 min
Wind/Temp forecast for high level (FL250-630)	3-6 h
Wind/Temp forecast for medium level (FL100-250)	3-6 h
Wind/Temp forecast for low level (FL100 and below)	3-6 h
SIGWX forecast for high level (FL250-630)	1-3 h
SIGWX forecast for medium level (FL100-250)	3-6 h
New meteorological information/products	
Satellite images	30 min – 1 h
Radar images	15-30 min
Graphical SIGMET on tropical cyclones and volcanic ash	30 min – 1 h
Graphical display of lightning location and/or precipitation	15 min – 30 min
Graphical display of vertical cross-section of en-route wind/temperature	1 –6 h
Surface analysis	6 h
Turbulence report chart	3 h
Graphical area forecast for clouds and weather	6 h
Graphical area forecast for turbulence, icing and freezing level	6 h

Survey on User Requirement on Uplinking Weather Information

Background

In the Global Air Navigation Plan for CNS/ATM Systems, ICAO sets out a global plan on the implementation of CNS/ATM systems to achieve integrated global air traffic management.   To comply with this plan, Hong Kong is conducting studies and trials on CNS/ATM systems.   To meet the future meteorological information need of the aviation under the CNS/ATM systems, Hong Kong Observatory is studying, *inter alia*, the uplinking of weather information to the cockpit.

Purpose

The purpose of this survey is to solicit views from the pilots in respect of their requirements on the uplinking of meteorological information to cockpit.   Specifically, the survey is focused on the following areas:

(a)   To identify if the information required by the pilots are adequately covered by existing products and services made available to the cockpit;

(b)   To identify the area for improvement on existing products and services to meet the need of the pilots; and

(c)   To identify necessary new products and services for pilots.

The results of the survey will be used by the Hong Kong Observatory in planning of weather information uplink products.

Submission of questionnaire

(a)   Go to the website **http://www.weather.gov.hk/aviat/survey_2004.htm**, fill in and submit the questionnaire online following the instructions contained therein; or

(b)   Fill in and return the questionnaire to the Hong Kong Observatory by fax ((852) 2375 2645) or by email (amids@hko.gov.hk). A copy of the questionnaire is attached. Softcopy of the questionnaire is available at the abovementioned website.

Deadline for submission: **15 March 2004**.

Thank you for spending your valuable time in responding to this questionnaire. Your views are very useful to the development of meteorological uplink products for aircraft.

To: Aviation Forecast Systems Division
    Hong Kong Observatory
    134A, Nathan Road
    Kowloon
    Hong Kong
    Fax: *(852) 2375 2645*

Please provide the information below. The information will be used only for communication with you when required.

Signature (*not required if questionnaire is returned by email*): _____

Name: _____

Email: _____

Position: _____

Airline: _____

Date: _____

Section I – General information
Please insert a tick on the relevant check box and provide details as appropriate.

1.   Please indicate the current type(s) of aircraft you are flying (e.g. A320, B737, B747, MD-11)

    _____

2.   Please indicate your total flying hours: _____

3.   Is the aircraft you fly capable of flying in:

    • Cat I   • Cat II   • Cat III

4.   Is the aircraft you fly equipped with the following data link(s)? (*can select more than one item*)

    • ACARS   • CPDLC

    • Other (please specify): _____

Appendix I

Section II – Areas for improvement/development on meteorological information/products

Part A   Existing meteorological information/products

Meteorological information / products	Information / products acceptable? A = acceptable I = improvement required N = new product required	Expected update frequency of information / products (*please select a box and fill in information as appropriate*)	Area for improvement / development in respect of content / format of information / product. (e.g. require graphic-based products). Please provide details below.
Aerodrome weather information:			
A Runway weather observations (e.g. winds, RVR)	• A • I • N	• ___ min. • ___ hour • on request	
B METAR/SPECI	• A • I • N	• ___ min. • ___ hour • on request	
C TAF/Landing forecast	• A • I • N	• ___ min. • ___ hour • on request	
Hazardous weather warning for aerodrome:			
D Windshear and turbulence alert	• A • I • N	• ___ min. • ___ hour • on request	
Warning of significant weather:			
E SIGMET on tropical cyclone	• A • I • N	• ___ min. • ___ hour • on request	
F SIGMET on volcanic ash	• A • I • N	• ___ min. • ___ hour • on request	
G SIGMET on thunderstorm / hail	• A • I • N	• ___ min. • ___ hour • on request	
H SIGMET on turbulence	• A • I • N	• ___ min. • ___ hour • on request	
En-route forecasts:			
I Wind/Temp forecast for high level (FL250-630)	• A • I • N	• ___ min. • ___ hour • on request	
J Wind/Temp forecast for medium level (FL100-250)	• A • I • N	• ___ min. • ___ hour • on request	
K Wind/Temp forecast for low level (FL100 and below)	• A • I • N	• ___ min. • ___ hour • on request	
L SIGWX forecast for high level (FL250-630)	• A • I • N	• ___ min. • ___ hour • on request	
M SIGWX forecast for medium level (FL100-250)	• A • I • N	• ___ min. • ___ hour • on request	
Others (please specify details):			
N	• A • I • N	• ___ min. • ___ hour • on request	
O	• A • I • N	• ___ min. • ___ hour • on request	
P	• A • I • N	• ___ min. • ___ hour • on request	
Q	• A • I • N	• ___ min. • ___ hour • on request	

Part B   *Potential new meteorological information / products*

Here is a list of potential new meteorological information / products.   Some can be developed based on existing meteorological information. For others, concepts are being developed by ICAO for future applications.   Your views on these products are welcome.   (The availability of these latter products will depend on the state of the datalink technology and on the availability of resources.)

	Potential new meteorological information / products (*please specify as necessary*)	New product required?	Expected update frequency of information / products (*please select a box and fill in information as appropriate*)	Area for improvement / development in respect of content / format of information / product. (*Please provide details below.*)
a	Satellite images	• Y • N	• ___ min. • ___ hour • on request	
b	Radar images	• Y • N	• ___ min. • ___ hour • on request	
c	Graphical SIGMET on tropical cyclones and volcanic ash	• Y • N	• ___ min. • ___ hour • on request	
d	Graphical display of lightning location and/or precipitation	• Y • N	• ___ min. • ___ hour • on request	
e	Graphical display of vertical cross-section of en-route wind/temperature	• Y • N	• ___ min. • ___ hour • on request	
Others (please specify details):				
f		• Y • N	• ___ min. • ___ hour • on request	
g		• Y • N	• ___ min. • ___ hour • on request	
h		• Y • N	• ___ min. • ___ hour • on request	
i		• Y • N	• ___ min. • ___ hour • on request	

Part C   *Priority of development*

Out of the items that require improvement or development in Part A and Part B above, select up to five (5) items the development/improvement of which is most needed. Please indicate your preference on the priority of development for these items by inserting the labels of the items (e.g. A, B, C, a, b, etc.) in the space below.

- Priority one
  (most important)
- Priority two
- Priority three
- Priority four
- Priority five