International Civil Aviation Organization

INFORMATION PAPER

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MEETING OF THE METEOROLOGY PANEL (METP) WORKING GROUP MOG

SEVENTH MEETING

Frankfurt, Germany, 11 to 13 April 2018

Agenda Item 3: Work required in support of WAFS Developments
3.3.31 Matters relating to the delivery mechanism of WAFS

NEXT GENERATION WAFS DELIVERY SYSTEM

(Presented by the WAFC Provider States)

SUMMARY

Large planned increases in WAFC data volume, and the requirement for delivery of SWIM compliant services has led the WAFCs to review the future of the SADIS and WIFS delivery system. This paper presents initial ideas on the next generation system that will need to be developed to meet the GANP requirements.

Action by the METP-WG/MOG is in paragraph 4.

1. INTRODUCTION

1.1 This paper provides a discussion of the potential development activities which will need to take place by November 2022 to upgrade the existing SADIS and WIFS systems operated by WAFC London and WAFC Washington.

1.2 The Global Air Navigation Plan (GANP) 2016 to 2030 Aviation System Block Upgrades (ASBU) includes key objectives to improve harmonization and interoperability of aviation systems through the introduction of a system-wide information management (SWIM) services, applications and infrastructure.

1.3 In order to meet this objective (B1-SWIM) and to support the WAFC 10-year plan to provide enhanced gridded data sets that will support B1-AMET objectives, the existing SADIS and WIFS systems will need to be upgraded. These upgrades will support the following activities: trajectory based operations (B1-TBO), free route operations (FRTO), continuous descent operations (B1-CDO), and improved air traffic flow management (B1-NOPS).

1.4 This paper provides some preliminary information on conceivable characteristics of the next generation WAFS data delivery service.

2. DISCUSSION

2.1 In November 2022 the WAFCs are planning on producing gridded data at 0.25 degree resolution at many more levels and time-steps than at present. This data will enable aviation users to benefit from advances in meteorological science as well as to have access to data sets designed to meet the requirements specified in the GANP ASBUs.

2.2 The planned increases to the horizontal, vertical and temporal data resolutions means that a complete download of one run of WAFC gridded data will increase from 28MB to approx. 6.5GB – a factor of 230 increase. From November 2020 the provision of IWXXM format OPMET data will become mandatory, and this will also result in larger files than at present.

2.2.1 Current gridded data downloads are in the form of pre-set concatenated files. For example, users can download wind, temperature, geopotential height and relative humidity for a particular time-step, but users could not download only the wind data, or only the wind data for the chosen levels. OPMET data files also take the form of concatenated files, with data being provided in a "get everything" approach, even though the user may only be interested in data for their country or region or flight path.

2.3 This "download everything" approach, in conjunction with much larger data files would lead to a massive download bandwidth demand that cannot be delivered using the existing SADIS and WIFS infrastructure in a realistic timeframe.

2.4 Technological advances mean that there are now better ways of exposing data to users, in a way that can be customised to their particular requirements. In the future a user could request "wind data, for FL300, FL320 and FL340 over China, for T+9 and T+12" or "the latest TAF, METAR and SIGMET data for a single FIR" and receive this in a file containing only the information they require. Flight planning operations could request high resolution wind, temperature and hazard data that is relevant to the flight trajectory.

2.5 To move into the SWIM environment, it is necessary to introduce a new mechanism for accessing WAFC and OPMET data sets is necessary in order to provide fast, reliable, tailored downloads that will meet the needs of the aviation industry.

NEXT GENERATION WAFS DELIVERY SYSTEM CHARACTERISTICS

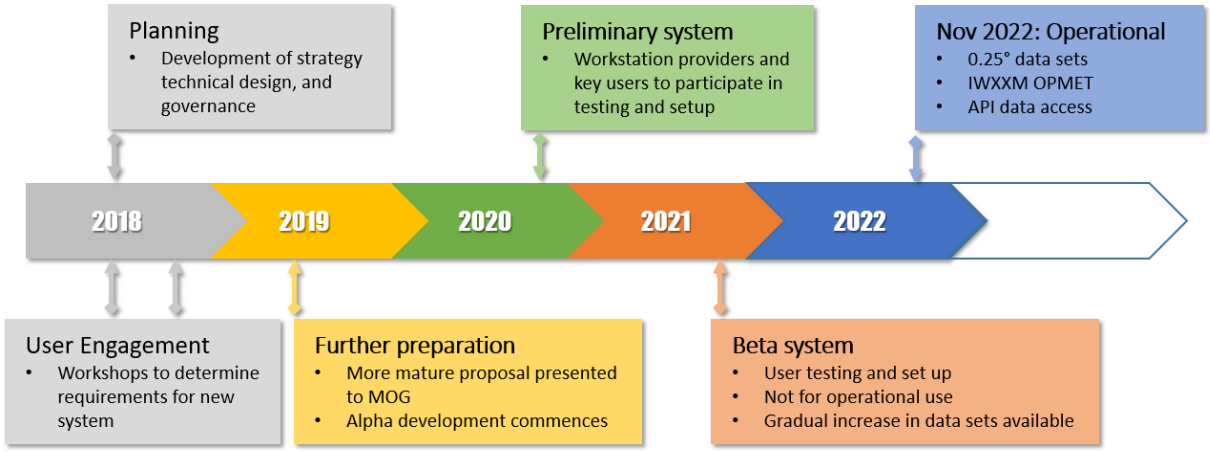
2.6 The Next Generation WAFS data delivery system(s) will be developed to be interoperable with other SWIM services, whilst still providing data forecast visualisation systems. Appendix A provides some basic system information.

2.7 It is anticipated that the new system will be cloud hosted which delivers key benefits such as the ability to scale dynamically according to demand. This would lead to fast, reliable data downloads without any slowdown at peak periods. Cloud hosting also increases operational availability as the system is hosted on an extensive underlying network of servers, so should one server fail the system will seamlessly migrate to another.

2.8 Cloud hosting means that the provision of separate SADIS and WIFS "mirror" systems may not be the most appropriate future approach, and the WAFCs in conjunction with METP-WG/MOG will investigate the different options. Similar approaches of cloud hosting are being proposed for SESAR and NEXTGEN meteorological data delivery.

IMPLEMENTATION TIMELINE

2.9 In order to meet the objectives set out by the GANP, the aim is for the new system to be in operation by November 2022. A development timeline is shown below:



3. CONCLUSION

3.1 The WAFCs will continue to prepare plans for the next generation WAFS delivery system and will present further information at the MOG meetings in 2019.

3.2 To ensure that the future system meets the needs of its users, the WAFCs are planning to embark on a programme of engagement with existing and potential future users of WAFS data sets. This will enable the requirements and specifications of the next generation system to be determined. The assistance and engagement of the METP-WG/MOG is sought in facilitating this activity. Workshops will be run to identify user requirements.

3.3 From November 2024 usage of the legacy SADIS and WIFS systems will be reviewed to determine a suitable retirement date for the system. This is expected to happen by November 2028 at the latest.

4. ACTION BY THE METP-WG/MOG

4.1 The METP-WG/MOG is invited to:

a) note the information contained in this paper

APPENDIX A

NEXT-GENERATION WAFS DELIVERY SYSTEM

System Characteristics

A cloud based delivery approach will be used which will enable the system to scale dynamically as user demand changes to maintain consistent operating and download speeds. The cost to operate a cloud based system is expected to be less than the legacy systems, and system availability times will increase.

Figure 1 below shows a basic system architecture.

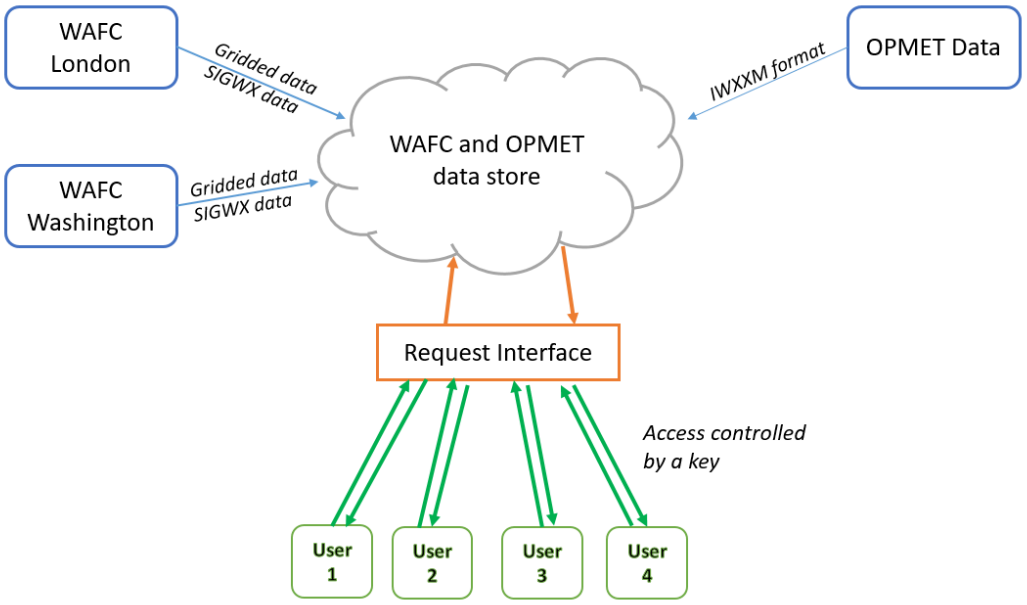


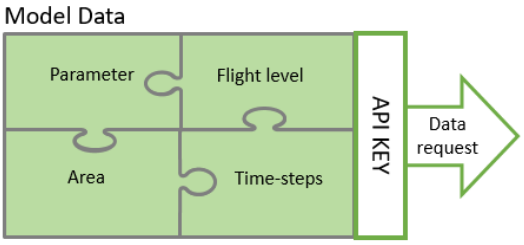
Figure 1, basic system architecture for the next generation SWIM compatible WAFS data service.

Data Store

The Data Store will contain 0.25 degree gridded data sets and multiple time-step SIGWX "Objects" produced by both WAFCs as specified in Annex 3 and from 2022 in PANS-MET. The full range of OPMET data will also be available in IWXXM format only.

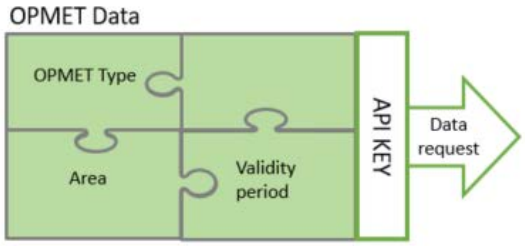
Requesting Data

Users' systems will request data via API (Application Programming Interface), a set of industry standard subroutines and protocols which enable specific user defined data to be downloaded. The key components of a model data request is shown in Figure 2, whilst the key components of an OPMET data request is shown in Figure 3.



Component	Probable Options
Parameter	Single or multiple WAFC gridded data type for example temperature and/or turbulence. SIGWX Object data type. Choice of EGRR or KWBC data.
Area	Flight Information region, Functional Airspace Block, ICAO region, or defined by a set of co-ordinates.
Flight Level	Single level, multiple levels, or all.
Time-steps	Single time-step, selection, or all within a specified range.

Figure 2, Model data API request components and potential request options. Note: it may be possible to offer a choice of resolution in the downloaded data sets.



Component	Probable Options
OPMET Type	Single or multiple WAFC OPMET data type for example METAR and/or TAF and/or SIGMET
Area	Flight Information region, Functional Airspace Block, ICAO region, or defined by a set of co-ordinates.
Validity Period	Latest, Last hour, Last 6 hours

Figure 3. OPMET data API request components and potential request options

User authentication and access to data will be controlled by an API key (a code which will identify the user). The keys would be controlled by the WAFCs and use of the system would be governed by ICAO (as is carried out for today's SADIS and WIFS systems).

It is anticipated that two main forms of data request would be possible

- Request-Response: An API data request will generate a data file in response. This type of request is suited to requesting data along a particular flight trajectory, or for bespoke sets of OPMET data

- Publish-Subscribe: Users can subscribe to data feeds, and are either notified when new data is available or sent the latest data file. This type of request is suited to providing a regularly used data set, for example winds in the vicinity of an airport or a region, or to get a feed of the latest OPMET for a region whenever it becomes available.

Output formats

Gridded data sets would be made available in GRIB2 format, and potentially offered in other formats as well. SIGWX Objects and OPMET data will be provided in IWXXM XML format only.

Example: A flight from London to New York

	Example request
Preliminary Data set for initial route planning	Lower resolution (e.g. 1.0 degree resolution) wind and temperature data set "subscribed" data feed. For: ● FL300, FL320, FL340, FL360, FL380, FL400 ● Area bounded by 75W, 05E, 42N and 62N ● Time-steps: T+12, T+18, T+24, T+30, T+36
Fine tuning the route	Request made for ● wind and temperature data ● along and near the initial flight route (data corridor). ● Time-steps: appropriate to the timing of the flight (1 hr intervals)
OPMET data request (planning)	Request made for: ● Latest TAF, METAR, SIGMET and any advisories KZNY and EGRR FIRs ● Advisories and SIGMETS for the flight trajectory ● Latest TAF and METAR for diversion airfields.
Pre take off:	Request made for: ● turbulence, icing and CB at 0.25 degree resolution, along (and near) flight trajectory, using T+6, T+9, T+12 data ● FL050 to FL300 winds in the London FIR ● Latest OPMET
In Flight	● Requests made for updated TAF, METAR and SIGMET data ● Requests for latest turbulence, icing and CB data every 6 hours
Prior to descent phase	Request made for: ● FL360 to FL050 wind data at 1000ft intervals, at 0.25 degree resolution for descent path