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MET Symposium 2019

International Meteorological System Developments and Progress

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Seamless Global MET - Update

- **Space Weather System**
- **Regional Hazardous Weather Advisory Centres**
- **Volcanic ash concentration and dosage concepts**
- **Sulphur dioxide (SO_2) information**
- **IWXXM and SWIM**
- WAFS Enhancements
  - High ice water content
  - Wake vortex
  - Turbulence
  - Wide terminal area forecasting
- PANS MET

Refer 2018 Presentation

The changes in MET are gathering pace, reflecting the changing needs of aviation.

Heading quickly into BIG global data

International MET Developments

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ATM – Air Traffic Management
GANP – Global Air Navigation Plan
IAVW – International Airways Volcano Watch
MA – Meteorological Authority
PANS – Procedures for Air Navigation Services
RHWAC – Regional Hazardous Weather Advisory Centre
RRM – Release of Radioactive Material
SADIS - Secure Aviation Data Information System
SWX – Space Weather
SWIM – System-wide Information Management
WAFS – World Area Forecast System
WG – Working Group
WS – Work Stream
Note – The *primary* JC and WS responsibilities of are as shown. There are numerous areas where several WG and WS teams collaborate.

WS – In temporary abeyance

WS – At work

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METEOROLOGY PANEL

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ICAO and WMO

Increasing collaboration, alignment, joined up development between ICAO, WMO, and others.

- ICAO MET Panel White Paper on Future Aeronautical Meteorological Information Service Delivery

  https://www.icao.int/airnavigation/METP/Pages/Public-Documents.aspx

- WMO Aeronautical Meteorology Programme

  http://www.wmo.int/aemp/LTP-AeM

- MET Panel Management Group Meeting November 2019 with full WMO representation.

As aviation continues to develop, new critical MET factors will continue to arise.

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The Value of MET information

The annual net direct benefit of meteorological information for:

- Global air transport is around **US$ 20-30 Billion**
- New Zealand air transport is around **NZ$ 65 Million**

MET information and data is critical to aviation safety risk management and to domestic and global economies.

As the level of aviation activity increases, the value and significance of MET increases.

The financial value of MET is around half of the overall global profit margin of airlines.

ICAO SWX Advisory System

- **Responsibility**: MET Panel – WG/Meteorological Information and Systems Development
  - Space Weather Work Stream.

- **ICAO Council Selected 3 SWX Centres in early 2019:**
  - **United States** (NOAA);
  - **PECASUS** Consortium; *Finland (Lead),* Austria, Belgium, Cyprus, Germany, Italy, Netherlands, Poland and the United Kingdom *(and possibly South Africa later);*
  - **ACFJ** Consortium of; *Australia, Canada, France, Japan.*
  - (**Russia-China** Consortium; late 2020?).

- Duty, primary B/U, Secondary B/U – Cookbooks
- SWX Centre operations from 7 November 2019 - products specified in Annex 3
- SWX Manual due shortly - ICAO Doc 10100 - Manual on Space Weather Information in Support of International Air Navigation.

ICAO SWX Information

- One or more of the following space weather effects will be included in the space weather advisory information:
  - HF communication (propagation, absorption) **HF COM**
  - GNSS-based navigation and surveillance (degradation) **GNSS**
  - Radiation at flight levels (increased exposure) **RADIATION**
- The following intensities will be included in space weather advisory information:
  - Moderate **MOD**
  - Severe **SEV**

SWXA Example

FNXX01 YMMC 020100
SWX ADVISORY
DTG: 20190502/0054Z
SWXC: ACFJ
ADVISORY NR: 2019/319
SWX EFFECT: HF COM MOD
OBS SWX: 02/0054Z DAYLIGHT SIDE
FCST SWX + 6 HR: 02/0700Z DAYLIGHT SIDE
FCST SWX + 12 HR: 02/1300Z DAYLIGHT SIDE
FCST SWX + 18 HR: 02/1900Z NOT AVBL
FCST SWX + 24 HR: 03/0100Z NOT AVBL
RMK: SOLAR FLARE EVENT IN PROGRESS IMPACTING HF COM ON DAYLIGHT SIDE. PERIODIC LOSS OF HF COM ON DAYLIGHT SIDE POSSIBLE NXT 12HRS.
NXT ADVISORY: WILL BE ISSUED BY 20190502/0654Z=

No graphics will be provided.

Global Regional Hazardous Weather Advisory Centres - RHWAC

- **Responsibility**: MET Panel – WG/Meteorological Information and Systems Development, RHWAC Workstream
- **Objective**: provision of globally harmonised, phenomena-based, hazardous weather information.

Weather does not recognise boundaries…

2216Z 25th August 2019 – SkyVector.com

The objectives…

- Phenomena-based, regional hazardous weather information that is not constrained by FIR boundaries.
- Will replace the SIGMET for all phenomena except, initially, volcanic ash, tropical cyclone and radioactive cloud.
- Global dissemination proposed to be only in IWXXM format

Progress

- MET Panel progress is slow – politically difficult concept
- However, material work being done on aligning SIGMET between adjacent FIR
- Working Group now has two development focus areas
  - Use Case – from various airlines etc
  - System architecture proposals
- Timeline – 5 years

IAVW Activities

- IAVW management and operations optimisation continues through the MET Panel WG/MET Operations Group (MOG) in close collaboration with WMO.
- Development of probabilistic VA density forecast/exposure product now underway in the MET Panel WG/Meteorological Information & Service Development (MISD), VA Work Stream, in close collaboration with WMO.
  - Allows dose rate calculations
  - Time-line 3 – 5 years.
  - Also looking at sulphur dioxide SO_2
  - Significant November 2019 VA meetings in Washington

Key paper

- Maximising Airspace Use During Volcanic Eruptions: Matching Engine Durability against Ash Cloud Occurrence- Rory Clarkson (NATO paper - unclassified)

https://www.wmo.int/aemp/sites/default/files/Matching_Engine_Durability_Against_Ash_Cloud_Occurrence_Rolls_Royce.pdf

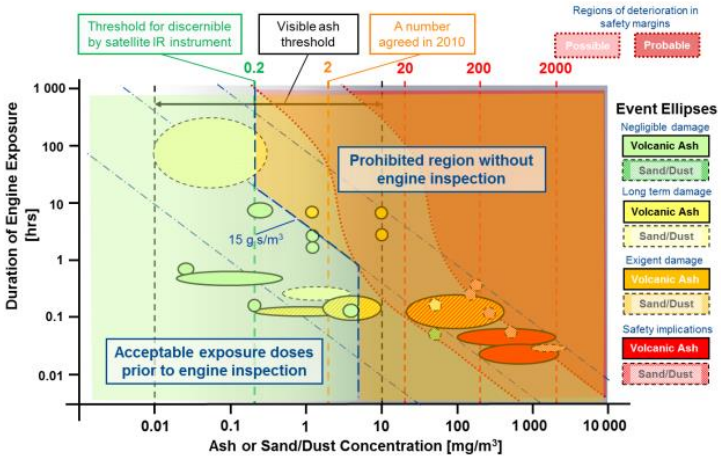

Figure 9: DEvAC chart showing a potential definition of engine susceptibility to volcanic ash.

All RB211 and Trent Engines - Volcanic Ash Limits defined: "Exposure to a cumulative volcanic ash dose equivalent to operating for 120 minutes in an actual ash concentration of 2 mg/m3 (i.e. 14.4 g s/m3), or lower, should not lead to a significant reduction in engine related flight safety margins if all measures are taken to maximise engine operability margins"

https://www.wmo.int/aemp/sites/default/files/VA_Limits_Guidance_Rolls-Royce.pdf

ICAO Meteorological Information Exchange Model (IWXXM)

- MET information in XML/GML
- Supports machine-to-machine
- Integration into decision support tools
- Enables the development of cost-effective MET information displays
- Easy and reliable extraction of specific MET elements
- METAR now 332 lines of code!
- **Responsibility**: Met Panel, WG/Meteorological Information Exchange.

Improving situational awareness and operational decisions.

IWXXM Progress

- METP – MIE detailed work – collaboration with WMO Task Team on Aviation XML (TT-AvXML) and ICAO Information Panel.
- Doc. 10003 - Manual on the Digital Exchange of Aeronautical Meteorological Information
- IWXXM 3.0 shortly to be adopted by WMO and then be published in the Manual on Codes (WMO No. 306) Vol. I.3 Part D “Representations derived by data models”, around November 2019.
- Complexity still and issue: recognising or retiring old schemas, extensions, some MET elements, geo-referencing, map projections, and harmonisation with AXIM and FXIM, limitations of AMHS.

IWXXM Implementation

- All standard products (incl METAR AUTO, TAF, SIGMET, VAA, SWXA) now codified
- Until 4 November 2020, standard MET information **should** be disseminated in IWXXM GML
- From 5 November 2020, standard MET information **shall** be disseminated in IWXXM GML form
- Possible early 2024 cessation of TAC
- Testing progressing currently
- Humphrey Elton (MetService) is our key expert

MET in SWIM

Supporting:

- Flexible airspace management
- Airborne re-routing
- Improved situational awareness
- Collaborative decision-making
- Dynamically optimized flight trajectory planning
- ATM impact conversion and ATM decision support
- Hazard avoidance

Supporting operational efficiency and safety.

Transition to a System Wide Information Management (SWIM) Environment

- The introduction of SWIM will see a complete change in the culture and nature of aviation meteorological (MET) services that will evolve over time.
- It is essential that there is clarity regarding what MET services are required, how users will access MET information in a SWIM environment and what is needed to provide these services.
- Effective engagement between the suppliers and users of this information is crucial to achieving long term objectives.
- **Responsibility**: Met Panel, WG/Meteorological Information Exchange.

SWIM Progress

- Ref: Doc 10039 Manual on System Wide Information Management (SWIM) Concept
- The MET-SWIM Roadmap has been updated to include the planned transition from traditional alphanumeric code (TAC) format to IWXXM format aligned with the Annex 3 Amendment cycle.
- Technical and “business” Governance matters in collaboration with the ICAO Information Panel (IMP).
- Cost Recovery in collaboration with ICAO Airport Economics Panel and Air Navigation Services Economics Panel (AEP-ANSEP)
- See later presentation from David Wills on NZ “MET in SWIM” Workshop outcomes