



InfoSymbiotics/DDDAS 2017

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*Environmental Particulate FOD - Data Integration in US and UK for
Operational Decision Making*

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Scope

- The current situation
- Where do we want to get to?
- How do we get there?
 - Technical/organisational challenges
 - Data confidence
 - Data ownership & responsibility
 - Overall sponsorship
- Expanding the community – keeping the impetus going

Current situation

- NATO Applied Vehicle Technology Research Task Group (AVT-RTG) 213 reported on “Assessment of Volcanic Ash on Military Platforms”
 - Framework elements to mitigate impact of VA:
 - ‘Sense’, ‘Protect’ and ‘Coordinate and Standardise’
- Volcanic Ash Advisory Centers (VAACs) receive volcanic ash (VA) warnings and pass them to flight planning centers as ‘Volcanic Ash Advisories’ (VAAs)
 - It can take up to 55 minutes to get the information to flight crews
- Flight planning adopts the ‘avoid’ mitigation philosophy
 - i.e. ‘visible’ VA
 - But how can you avoid something that (at night) you can’t see?

Where do we want to get to?

- Identification of the Problem & therefore an idea of the Solution
 - AVT-RTG-213 “Assessment of Volcanic Ash Effects on Military Platforms”
 - Link via NATO Science Connect website
 - NATO Unclassified
 - AVT-RSM-272 “Impact of Volcanic Ash Clouds on Military Operations” held in Lithuania in May 2017”
 - Followed the framework elements of ‘Sense’, ‘Avoid’ and ‘Coordinate & Standardise’
- Common themes/requirements:
 - Rapid detection of VA events, timely information exchange to Operators/Flight Crews and accurate/trustworthy onboard sensors

How do we get there?

- Technical/organisational challenges
 - Gaps in the information chain need closing (Gen Zadalis, USAFE/CENTCOM/AMC)
 - Information streams work mainly in silos
 - US Geological Survey (USGS) party to the development of Volcanic Cloud Analysis Toolkit (VOLCAT)
 - Volcanic Ash Advisories (VAA) provided by VAACs – up to 55 minute warning time
 - Post-flight reporting – ad-hoc, reactive, questionable content, voluntary
 - Eyjafjallajökull (E15) incident prompted World Meteorological Organisation (WMO) workshop (2012)
 - Compare the world's ash cloud models (x12)
 - Best practices identified
 - Acquisition of data for model validation still difficult
 - Onboard sensors
 - Need to give value-for-money and be trustworthy (prevent false indications)
 - Determine concentration of media and integrate with Health Management System
 - Be multifunctional (media concentration, warning time (5-10 mins), plume formation/location/direction)

How do we get there?

- Data confidence
 - VAAs give information on location, 50% confidence in height
 - Satellite data; VolcView (Alaska Volcanic Observatory ash cloud detection/analysis)
 - Operator add extra margin (Gen Zadalis +2k feet)
 - Incidents under-reported, hard to quantify
 - Onboard sensing/detection important
 - 'Aviation Safety Action Program' or ASAP, run through the FAA
 - Availability of quality data
 - VIPR III test program (https://www.grc.nasa.gov/www/cdtb/aboutus/workshop2015/HM_2_Simon.pdf)
 - Engine damage data = IP restrictive – needs to be overcome
 - E15 provided wealth of data for world to take notice of
 - First time such volume of data available
 - Sensing & Detection
 - Onboard – AVOID system (<https://nicarnicaaviation.com/technology/avoid/>); NRC Particle Detector Probe
 - Off-board – Lidar, VOLCAT, plus...?
 - Reliable – needs to minimise false indications

How do we get there?

- Data ownership & responsibility
 - ICAO overarching authority
 - VAACs responsible for reducing time between alert (via VOLCAT etc) and VAA issuance (as an alert)
 - Reliance on satellite data plus Volcanic Observatories reporting to VAACs
 - VAACs provide VAA via International Airways Volcano Watch Programme manual procedures
 - Forecasting at 6, 12 and 18 hour following issue of VAA
 - Test/data gathering aircraft – during/post E15:
 - European Facility for Airborne Research (EUFAR) - <http://www.eufar.net/>
 - Support from Germany (DLR), The Netherlands (NLR), UK (NERC; FAAM), SAFIRE (France), Spain (INTA), Switzerland (Metair)
 - National Met Office controlled
 - OEMs retain data on engines/systems
 - ‘IP’ reason for non-disclosure – needs to be overcome/made accessible

How do we get there?

- Overall sponsorship question
 - Many parts to the solution but no cohesive approach
- No overall 'Champion' for making this happen
 - Difference in requirement between civil and military Decision Maker/Operator
- Develop an Organisational Matrix of Data Ownership
 - For data responsibility also i.e. accuracy and upkeep

How do we get there?

- DDDAS assistance
 - Philosophy – “ability to dynamically incorporate additional data *into* an executing application, and, in *reverse*, the ability of an application to dynamically *steer* the measurement (instrumentation) processes”
 - Development in tools and techniques impressive
 - (Summarise/highlight relevant DDDAS presentations to show relevance?)
 - Work within AFOSR framework to identify common research collaboration threads to assist in ‘eating the elephant’
 - How to evolve ‘Large-Scale-Big-Data’ (Dr Frederica Darema) to inform the Environmental Particulate – Foreign Object Damage (EP-FOD) effort
 - Utilising advances in modelling using scarce data to feed VA plume path models
 - How to automate multiple model simulation runs for accurate VA plume plots

Expanding the community – keeping the impetus going

- Access to AVT-213 NATO report “Assessment of Volcanic Ash on Military Platforms” via CSO
- Access to AVT-272 Specialist Meeting proceedings “Impact of Volcanic Ash Clouds on Military Operations”
 - Estimated end-September 2017 (may get authority to obtain abstracts via next Vice-Chair of the Propulsion & Power Systems Technical Committee)
- Participation in AVT-250 work & follow-on for collaborative work
 - Montreal workshop 22nd – 25th August 2017
 - October meeting in Utrecht, Netherlands, 9th-13th October 2017
 - Contact: Dr Don Erbschloe (don.erbschloe@gmail.com), AVT-250 Technical Support
- Identification of **quick wins** in speeding up data/processed information to the Civil Operator and the Military Duty Holder/Operational Commander
- ***The ultimate aim:*** to marry **all** of the data available (*at the time of a VA eruption*) to give the Civil Operator and the Military Duty Holder/Operational Commander the ‘**Go/No-Go**’ **tool** to inform his Executive Decision on operating the aircraft system in the High Threat Environment