



EUNADICS-AV DELIVERABLE (D -N°: D8)

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Abstract

As the air traffic management and air traffic control is a shared responsibility of many countries and various national and international entities, a proactive communication and networking strategy is of utmost importance to warrant a successful uptake of EUNADICS-AV project results. Within work package 2, Task 2.5 is in charge to establish links and communication channels to relevant stakeholders and international activities. EUNADICS-AV already established cooperation and exchange with 15 selected organisations/activities including aviation-related stakeholders, monitoring infrastructure service providers, data analysis and atmospheric transport modelling service providers, international metadata networks and European Commission Entities. As the EUNADICS-AV product piloting phase progresses, further collaborations or arrangements may become relevant in the second project phase, when their practical usability will be evaluated.

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Executive Summary

Safe flight operations, air traffic management (ATM) and air traffic control (ATC) are a shared responsibility of EUROCONTROL, national authorities, airlines and pilots. To allow smooth operations and rapid decision making also during challenging situations, it is important that all decision makers are well coordinated and have fast and equal access to the available technical information as far as it concerns them. EUNADICS-AV aims at facilitating a coherent provision of information in case of the occurrence of an airborne hazard. For this purpose, communication and established interfaces with relevant air traffic management, control organisations and stakeholders responsible for data acquisition and data analysis/modelling service provision is key for success.

In the first project phase, EUNADICS-AV established collaborations and interfaces with 15 relevant European stakeholders which can be subdivided in:

- aviation-related stakeholders (EASA, EUROCONTROL/EACCC, ICAO, air navigation service providers, airlines, pilots, aircraft and engine producers),
- monitoring infrastructure service providers (ESA, EUMETSAT, EUMETNET E-PROFILE, EARLINET), data analysis and atmospheric transport modelling service providers (VAACs, WMO RSMCs, National Meteorological Services)
- Initiatives providing standardised metadata for sharing data with other portals and service initiatives (GEO/GEOSS, COPERNICUS).
- European Commission entities.

Various agreements or arrangements with different stakeholders have been established so far, ranging from regular information about the project progress to more technical interfaces (e.g. EUROCONTROL's SWIM principles), data exchange agreements (e.g. EarlyNet) or preliminary mutual expressions of interest for the usage of EUNADICS-AV project results (e.g. VAACs, Rolls Royce engines). In addition, a continuous strategic exchange was established with EASA, EUROCONTROL, VAACs Toulouse and London, EUMETNET, SEASAR, ESA and the European Cockpit Association via the project advisory board.

Further ways of cooperation may evolve during the second phase of the project after the preliminary project results have been evaluated and have shown their added value.

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1. Introduction

Aviation is one of the most critical infrastructures of our times. Even comparably short interruptions in commercial aircraft operations can seriously impair transport of persons and goods and thus would cause economic damages in the billion-dollar range. Natural or manmade airborne hazards such as volcanic ash clouds and nuclear releases may crucially affect the operations of the worldwide aviation system. The Eyjafjallajökull eruptions in Iceland 2010 showed the vulnerability of such a complex system, with thousands of passengers stranded and stakeholders as well as decision makers unprepared to cope with such an event.

Safe flight operations, air traffic management (ATM) and air traffic control (ATC) are a shared responsibility of EUROCONTROL, national authorities, airlines and pilots. To allow smooth operations and rapid decision making also in challenging situations, it is important that all decision makers are well coordinated and have fast and equal access to the available technical information as far as it concerns them. Despite experiences as in 2010 there is still a significant gap between available data and information and the stakeholders' needs for high quality data in order to make consistent decisions.

With the EUNADICS-AV (“European Natural Disaster Coordination and Information System for Aviation”) Project, the Consortium envisions to close this gap. Bringing together national weather services, measurement data specialists, modelers, aviation experts and flight plan managers from 12 countries the advantage is to take usage of existing infrastructure and knowledge but also to gather all respective requirements considering crisis management for airborne hazards.

In order to facilitate these objectives and to foster the uptake of the project results, work package (WP) 2 of the EUNADICIS-AV project was built to assess and translate user needs and to establish links and communication channels to relevant stakeholders and international activities. This includes aviation-related stakeholders (EASA, EUROCONTROL/EACCC, ICAO, air navigation service providers, airlines, pilots, aircraft and engine producers), monitoring infrastructure service providers (ESA, EUMETSAT, EUMETNET E-PROFILE, EARLYNET), data analysis and atmospheric transport modelling service providers (VAACs, WMO RSMCs, National Meteorological Services), international metadata networks (GEO/GEOSS, COPERNICUS) an European Commission entities (DG-RTD, JRC). Especially within Task 2.5 these international networking activities were concentrated. In the following section, the interaction with these stakeholders and networks are described.

2. Established communication and links to international activities

As air traffic management and air traffic control is a shared responsibility of countries and various institutions a proactive communication and networking strategy is of utmost importance for the successful uptake of EUNADICS-AV project results. Mainly centered at the project coordinator, the EUNADICS-AV advisory board was also conceived in such a way to assure a steady exchange and communication with various international activities, frameworks and institutions. At the end of project period 1, direct interaction with 15 relevant international stakeholders was established, with the majority of them directly addressed by members of the project advisory board as listed below:

Strategic cooperation with relevant traffic management and aviation safety institutions

- EASA: Kevin Hallworth
- EUROCONTROL: Kenneth Thomas
- European Cockpit Association/Pilot: Klaus Sievers
- SESAR: Tatjana Bolic

Strategic cooperation with the meteorological community

- EUMETNET: Eric Peterman

Strategic cooperation with observation networks

- ESA: Claus Zehner
- Bundesamt für Strahlenschutz: Hartmut Walter

Strategic cooperation with international modelling community

- VAAC London: Anton Muscat
- VAAC Toulouse: Philippe Hereil
- University of Alaska Fairbanks : Martin Stuefer

Except Hartmut Walter and Martin Stuefer all members of the advisory board represent institutions which will be briefly described in the following sections.

Hartmut Walter from the Bundesamt für Strahlenschutz in Germany provides important input to aviation hazards related to the uncontrolled release of radioactive substances and the respective interface to the ICAO.

Martin Stuefer from the University of Alaska Fairbanks has developed and is operating a wild fire- and volcanic ash forecasting system for Alaska. He has contacts with Airlines located in the USA and is experienced in dispersion modeling and the impact of hazardous events on aviation.

2.1 Strategic cooperation with relevant air traffic management and aviation safety institutions

2.1.1 EASA

The European Aviation Safety Agency (EASA) is an agency of the European Union (EU) with regulatory and executive tasks in the field of civilian aviation safety. Its agenda includes the monitoring of safety rules, advising on the drafting of legislation, and granting approval to aeronautical product manufacturers.

EASA's main concern with regard to aviation is to install proper risk management procedures. Safety risk management is about collecting data and information and drawing conclusions from the information available.

From the EASA perspective, the following contributions from the EUNADICS-AV project would be of interest and need to be further investigated:

- Contribution of EUNADICS-AV to the work of the European Aviation Crisis Coordination Cell (EACCC) – what information can be provided during a crisis event in near-real-time
- Contribution of EUNADICS-AV to perform Safety risk management for aviation: Which data should be used for this purpose, and how could this data be regularly made available
- Contribution of EUNADICS-AV with regard to exchange of big data – IT organization, big data analytics

At least for the first two items, proper use cases shall be elaborated and tested in the second phase of the project. Therein the European Aviation Crisis Coordination Cell (EACCC) procedures executed during crisis situations (nuclear accident and volcanic eruption in Europe) will be tested in the frame of the comprehensive EUNADICS-AV exercise. The third item needs further, rather basic, research and proper consideration.

EASA is one of the key stakeholders of the project and is included as entity in the project and also represented in the project advisory board. Besides a continuous exchange according to project related tasks, also the EUNADICS-AV stakeholder workshop took place on 12/13 October 2017 at EASA premises in Cologne.

2.1.2 EUROCONTROL/EACCC

The European Organisation for the Safety of Air Navigation, commonly known as EUROCONTROL, is an international organisation working to achieve safe and seamless air traffic management across Europe. In May 2010, the European Commission (EC) and EUROCONTROL jointly established the European Aviation Crisis Coordination Cell (EACCC) to coordinate the management of crisis responses in the European ATM network. In addition, the EC included crisis management aspects in the network manager (NM)

implementing rule (NM IR), which lays down detailed rules for the implementation of ATM network functions.

Referring to these existing regulations EUROCONTROL is one major EUNADICS-AV stakeholder and possible user of EUNADICS-AV products and helps to set up demand-driven and supportive products for crises management. For the purpose of an optimal integration and knowledge exchange, EUROCONTROL is also represented in the project advisory board (Kenneth Thomas). At the EUNADICS-AV stakeholder workshop Zarko Sivcev substituted Mr. Thomas.

Furthermore, EUNADICS-AV intends to build its services, to the extent possible, on existing and stable information exchange formats, standards and channels. In this context, the project coordination and WP8 collaborates with EUROCONTROL's System Wide Information Management (SWIM) unit (Dennis Hart). As a consequence, EUNADICS-AV participated at SWIM specification information workshops and will apply SWIM principles for information exchange.

In addition, EUROCONTROL is interested regarding the integration of EUNADICS-AV analyses/products into the European crisis Visualisation Interactive Tool for ATFCM (EVITA), where airlines could readily access it. EVITA has been designed and developed to support decision making in crisis situations. EVITA is available on the Network Operations Portal (NOP) for registered users. Feeding of EUNADICS-AV analyses into EVITA is consistent with the general approach of the project to disseminate through existing and established channels to the extent possible.

As part of a EUNADICS-AV use case and the exercise, possibilities to provide tailored information into the EACCC during relevant crisis situations will be further explored.

2.1.3 ICAO

The International Civil Aviation Organization (ICAO) is a specialized agency of the United Nations. It codifies the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth. The connection to ICAO makes sure that EUNADICS-AV is compliant with the standards and procedures of the aviation industry. One example is that ICAO defines an International Standard Atmosphere (also known as ICAO Standard Atmosphere), a model of the standard variation of pressure, temperature, density, and viscosity with altitude in the Earth's atmosphere. This is useful in calibrating instruments and designing aircraft.

In order to establish a regular exchange of information between ICAO and the EUNADICS-AV project, Klaus Sievers was integrated in the project advisory board. He is a former pilot and member of the ICAO MET panel.

EUNADICS-AV was mentioned in connection with the ICAO volcanic ash exercise VOLCEX 17. It is planned to send a EUNADICS-AV observer to the VOLCEX exercise

2018. It is very important to have use cases ready at this time to demonstrate the added value of the project.

2.1.4 SESAR

Single European Sky ATM Research (SESAR) is a collaborative project to completely overhaul European airspace and its air traffic management (ATM). Tatjana Bolic is involved in EUNADICS-AV as contractor/expert in aviation safety and air traffic management (ATM). She is also a member in the scientific committee of SESAR. In the frame of EUNADICS-AV she is supporting the project with contributions to WP 1 and WP 2. She is member of the EUNADICS-AV advisory board and acts as link to the SESAR JU Scientific committee e.g. to forward project related needs and questions to the meteorological part of the programme. The overall goal is to find the best way to integrate the EUNADICS-AV project results in the available aviation safety- and air traffic management systems. She was actively participating in the Stakeholder Workshop 2017 in Cologne where she acted as chair for the advisory board and will be present at the midterm meeting.

2.1.5 Aircraft and Engine Manufacturers

Besides volcanic ash, modern engines also suffer deterioration from SO₂, sand, other aerosols and even ice crystals. As a consequence, the EUNADICS-AV project is of high interest for engine manufacturers like Rolls-Royce. Starting at the EUNADICS-AV stakeholder workshop, where Rory Clarkson was invited as keynote speaker, the idea of intensified collaboration between EUNADICS-AV and Rolls-Royce (RR) Engines was further elaborated. Based on the fact that 80% of RR engines are under „total care“ service contracts (power by the hour) there is strong interest to reduce maintenance costs by avoiding traffic in areas with conditions detrimental to engine function and lifetime. EUNADICS-AV would be in a good position to provide relevant data and analyses that could be fed into flight planning systems.

Regarding the planned EUNADICS-AV exercise 2019, it was discussed whether and how RR could be involved. It was concluded that manufacturers like RR will have to be involved for upcoming real events anyway. RR acknowledged its interest in EUNADICS-AV, and would like to be regularly informed about the status of the project, participate in meetings (e.g. travel costs will be covered for Mid-Term meeting in Rome) and contribute to its results if possible (e.g. through sub-contract).

As automated data analysis and short-term forecast products for air pollution and aerosols based on remote sensing and satellite earth observation data and atmospheric transport models are currently not readily available to aviation, one of the business cases of EUNADICS-AV could be to provide such data in a way that flight planning software and aircraft operations systems could make use of it. Important would be accessibility and interoperability with existing system and tools.

Contacts were also established to Airbus as major European aircraft manufacturer. Airbus was involved in a previous study funded by the EU and conducted by EUMETNET, namely the Wezard project (Weather Hazards for Aeronautics). Future cooperation could involve (i) to identify possibilities how onboard volcanic ash detection and avoidance system observations could be used as additional data source for modellers, and (ii) how future automated pilot support systems fed with airborne hazard data analyses could support aircraft operations.

2.2 Strategic cooperation within the Meteorological Community

2.2.1 WMO

The World Meteorological Organization (WMO) is an intergovernmental organization with a membership of 191 Member States and Territories. Established by the ratification of the WMO Convention on 23 March 1950, WMO became a specialised agency of the United Nations for meteorology (weather and climate), operational hydrology and related geophysical sciences a year later.

To coordinate emergency response activities, an Expert Team on Emergency Response Activities was established. One of the tasks of this team is to coordinate the cooperation between the International Atomic Energy Agency (IAEA) in Vienna and the WMO Regional Specialized Meteorological Centers (RSMCs) for Atmospheric Transport Modelling. The EUNADICS-AV Coordinator is member of this Expert Team, and the ET Chairperson is member of the EUNADICS-AV advisory board. The cooperation between EUNADICS-AV and the WMO RSMCs is described in section 2.2.3.

As another activity in the international cooperation task, the WMO-IUGG Volcanic Ash Science Advisory Group (VASAG) was contacted, and the EUNADICS-AV progress was shared with them. The aim of the VASAG is to create a single, authoritative source of scientific expertise in the field of volcanic ash affecting civil aviation with emphasis both on meteorological (remote sensing and in-situ observations, transport and dispersion modeling) as well as geophysical/volcanological issues such as eruption source parameters, ash characteristics, ash fallout and aggregation. Through the exchange with this group, EUNADICS-AV gets access to the most recent knowledge and developments of WMO scientists in the field of threats caused by volcanic ash.

Finally as further international cooperation task, the EUNADICS-AV Consortium is in contact with the WMO lidar expert team for volcanic ash. This team conducts an assessment on the potential use of lidars and ceilometers as part of a global volcanic ash detection and alerting system.

2.2.2 Volcanic Ash Advisory Centres (VAACs)

ICAO and WMO have set up the International Airways Volcano Watch (IAVW) program, establishing the framework for the operations of the 9 Volcanic Ash Advisory Centres

(VAACs). The VAACs are one of the key stakeholders of EUNADICS-AV, and a close collaboration with VAACs Toulouse and VAACS London was established already from the project start. Both VAACS are represented in the EUNADICS-AV advisory board and are regularly updated about the project's progress. In addition they participated and are invited to all relevant meetings and workshop, including the stakeholder workshop in Cologne and the midterm meeting in Rome.

Besides, for the purpose of co-conception of mutually useful products, a teleconference between EUNADICS-AV partners (organised by BIRA) and representatives from VAAC Toulouse (Phillipe Hereil) and VAAC London (Anton Muscat) took place on 16th November 2017. From the exchanges between VAAC and EUNADICS-AV representatives, several important points related to the VAAC's technical needs in terms of products and interfaces have been addressed and discussed:

- Both London and Toulouse VAAC recognize that the project objective of making available consistent and coherent observational data in a central repository is ambitious and very useful. However, both VAACs also clearly expressed their concern that sensitive automatic products would become freely available to the general public, possibly leading to conflicts with the work performed by them as the designated and internationally mandated entities.
Hence, EUNADICS-AV will coordinate with the VAACs and other key users what data products could be made openly available to the general public via the EUNADICS-AV data portal and what are the data products that would only be accessed by the VAACs via a protected specific interface.
- Generally speaking, London and Toulouse VAAC have similar needs and comparable approaches. However, London VAAC area of responsibility is much smaller than the respective area of Toulouse, and all relevant volcanoes are located in Iceland where the observational networks are very advanced. London VAAC already has access to all observational data in real time (or near real time) while it is more difficult for Toulouse VAAC to access data from Africa quickly and with a comparable quality.
- A general need expressed by the VAACs is to improve their situational awareness via a unique information source. The 9 VAACs meet regularly - their goal is to have a shared platform to exchange data and products. Currently, data and information exchange is mainly done per e-mail and should thus be optimized. A common platform is particularly relevant in case that a volcanic plume gets transported into another area of responsibility and therefore a proper liaison between two different VAACs is needed. If EUNADICS-AV can provide such a prototype e.g. for UK and Toulouse VAACs (importantly to share model data) this could raise attention also for the others on a global scale.
- Requirements in terms of interfaces: London and Toulouse VAACs are mainly interested in a web interface (with an access restricted to the VAACs) where data could be visualized. Satellite and lidar imagery were explicitly mentioned. This could possibly

also include options to download the data displayed but a specific dissemination channel (e.g. ftp) is not a priority.

- Requirements in terms of products: among the three types of EUNADICS-AV products (alerting products, tailored observation data products, model products), the VAACs are mostly interested in tailored data products that could (possibly) improve situational awareness
- Time/performance requirements: the data products shall be operational or quasi-operational. The data shall be available in real-time or near-real-time otherwise the products will not be used.
- Communication requirements: the system shall provide an easy monitoring of data flows, and include information whether the data are available or not, and messages on possible errors.
- Data/file format requirements: preferred formats are netCDF, grib, kmz (google earth). Toulouse VAAC also uses geosisom. London VAAC mentioned that they would be very interested to obtain data on visual observations of volcanic ash from pilots. Minimal information needed would be latitude, longitude, height and time of observation. This data could be overlaid with satellite and model data for instance.
- The option to use the ECMWF Product Dissemination System (ECPDS, <https://www.ecmwf.int/en/forecasts/documentation-and-support/data-delivery/manage-your-data-transmission-ecpds>) to transmit real-time data is discussed. The London and Toulouse VAACs state it might be useful in the future but it is not a priority for them in the short run.
- Both UK and Toulouse VAAC mention they are also RSMC's and therefore also interested in nuclear aspects.

2.2.3 WMO Regional Specialized Meteorological Centres (RSMCs)

A Regional Specialized Meteorological Centre (RSMC) under WMO designation is responsible for the distribution of information, advisories, and warnings regarding the specific program they are part of, agreed by consensus at the World Meteorological Organization as part of its World Weather Watch Program. RSMCs have been established in many topical areas. RSMCs for Atmospheric Transport Modelling were established to provide support to the International Atomic Energy Agency (IAEA) and delegated national authorities in the event of a nuclear and radiological incident or emergency. The designation is currently being expanded into the non-nuclear area.

In the framework of the EUNADICS-AV project, a regular contact was established between the chairperson of the WMO Emergency Response Activities Coordination Group and the EUNADICS-AV project coordinator to assure that EUNADICS-AV results could support the work of the WMO RSMCs for Atmospheric Transport Modelling. Up to now, no support by RSMCs is provided for aviation purposes. Current ICAO regulations foresee a circular non-

fly zone around a Nuclear Power Plant (NPP) in the case of an accident extending vertically from the surface until infinity. As part of the EUNADICS-AV project, input to decision support systems and into flight planning systems based on ATM output shall be facilitated, taking into account that surface radiological pollution is typically not extending into the upper troposphere.

2.2.4 EUMETNET

EUMETNET is a network of 31 European National Meteorological Services based in Brussels, Belgium. It exists to provide a framework to organise co-operative programmes between the members in fields of meteorology, data processing and forecasting products. The EUMETNET Director General is involved in the project on a strategic level, and the Europe Office in Brussels supports interaction with the commission and with European stakeholders. The EUNADICS-AV coordinator reports about the project at meetings of the Policy and Financial Advisory Committee. A report to the EUMETNET Aviation Committee is also planned.

EUMETNET was involved in a predecessor project of EUNADICS-AV, namely 'WEather haZARDS for aeronautics' (WEZARD) funded by the EC under FP-7. As a result of WEZARD, it was identified that Meteorological organizations have clear orientations on the improvement of forecasting, new technologies to be deployed for observations and a rational to data standardization. The establishment of an operational data hub for collection, dissemination and archiving of observations was seen as important. This was one of the pillars the EUNADICS-AV project was built on.

As part of EUMETNET activities, models of how EUNADICS-AV results could best be disseminated and how sustainability could be achieved are continuously explored. One of these activities is the 4DWxCube concept. 4DWxCube was designed as a virtual repository of MET information for aviation, produced under the responsibility of multiple contributors (MET service providers), from diverse locations, that will provide aviation end users with a common/harmonized weather picture. Disseminated through the MET gate, such a system could serve as model how EUNADICS-AV could integrate its harmonized analyses and various atmospheric transport products into a single crisis response and decision support system.

2.2.5 ECMWF/COPERNICUS

The European Centre for Medium-Range Weather Forecasts (ECMWF) is an intergovernmental organisation funded by many European countries. ECMWF was established in 1975, in recognition of the need to pool the scientific and technical resources of Europe's meteorological services and institutions for the production of weather forecasts for

medium-range timescales (up to approximately two weeks) and of the economic and social benefits expected from it.

ECMWF was included in the EUNADICS-AV proposal as an important stakeholder. In the first phase, two areas of work for the second phase were identified:

- a) Use of the ECMWF dissemination system – EUNADICS-AV analyses and products can be disseminated to VAACs, National Meteorological Services (NMSs) and other users through existing ECMWF dissemination channels
- b) Use of ECMWF data sources – ECMWF has various input data channels in the COPERNICUS Atmosphere Service as well as in its operational NWP system that can be co-utilized by EUNADICS-AV.

ECMWF will actively contribute to the project success with two project scientists who will implement the above mentioned IT tasks. As a consequence also in the view of the project sustainability ECMWF is a very important strategic partner.

2.3 Strategic cooperation with measurement networks and data providers

2.3.1. ESA

The European Space Agency (ESA) is an intergovernmental organisation of 22 member states dedicated to the exploration of space.

Satellite measurements play a crucial role in global monitoring of natural airborne hazards like volcanic eruptions, wildfire, and dust storms. On 13 October 2017, ESA launched the Sentinel-5P satellite, which is considered to be the first member of the next generation of atmospheric Sentinel satellites. The only instrument on board, TROPOMI, builds on the heritage of OMI, SCIAMACHY and GOME-2. The TROPOMI instrument provides more accurate measurements and at a much better spatial resolution than the currently existing instruments. Based on agreement with the ESA Sentinel-5P project officer, who is also member of the EUNADICS-AV advisory board, TROPOMI data were made available to EUNADICS-AV before the data officially became available through Sentinel dissemination channels (Level-2 data).

2.3.2. ACTRIS

The observational platforms available at European level and catalogued within the WP3 activities have been reviewed also in terms of data policy and availability. Different level of data availability are recorded from very close ones (like the E-profile and meteorological centers datasets which are not available outside their consortium) to open data. Collaboration and communication between EUNADICS-AV consortium and observational Research Infrastructures (RI) are very relevant for fostering the open data policy and crisis

management. The European Research Infrastructure for the observation of Aerosol, Clouds, and Trace gases (ACTRIS) RI is more and more moving toward fully open data policy. At the time being, the ACTRIS RI observational data (from near-surface data, to aerosol and cloud vertical profiles) are typically available after a certain time from the observations and firstly as internal data and then for the public. Volcanic eruptions posed the point of allowing data access in almost NRT and in unrestricted way. ACTRIS is now working on developing a more open data framework in agreement with the FAIR (Findable, Accessible, Interoperable, and Re-usable) principles. It is planned to have these principles in place for the ACTRIS operational phase (i.e. 2025). In the mean while for the purposes of EUNADICS -AV project, specific MoU and/or data policy agreement will be set up for the tailored products.

2.3.3. Research and operational aircraft for fast response service

Aircraft measurements represent an important element of an integrated observation system in the event of a volcanic eruption in Europe, besides satellite- and ground-based remote sensing measurements. The need for observations to support the forecasts of the dispersion of volcanic ash in the European air space particularly emerged during the Eyjafjallajökull crisis. Presently, in-situ aircraft measurements of the size distribution of ash particles in a volcanic cloud are the only direct observation-related information to derive ash mass concentrations and thereby validate corresponding model simulations. As part of EUNADICS-AV (Deliverable 17; Schlager, 2017), an overview on European research and civil contingency aircraft available for observations during a volcanic eruption was provided. The provided information includes aircraft operator, type of aircraft and engine, maximum endurance, and cruising altitudes.

In the second phase of EUNADICS-AV, all aircraft operators will be contacted to establish an agreement on (i) exchange of metadata information and (ii) exchange of data in the event of an emergency situation.

2.3.4. GALION

The Global Aerosol Lidar Observation Network (GALION) is a federated network of lidar network at global scale promoted by WMO. Even if EUNADICS-AV is focused on Europe, the cooperation with pan-European observational networks is important for event alerting and at large for the improvement of aerosol lidar quality. Harmonization of lidar products provided by the GALION networks (EARLINET, MPLnet, ADnet, Lalinnet) is even more crucial when addressed to potential operational users of such data like aviation services. Within EUNADICS-AV project, data from not-European lidar networks and for stations located in Europe have been included into the observation catalogue.

2.4 Strategic cooperation with European Commission Entities

2.4.1. JRC

The Joint Research Centre (JRC) is the European Commission's science and knowledge service which employs scientists to carry out research in order to provide independent scientific advice and support to EU policy.

A video conference was organized with JRC Head of Sector Radioactivity Environmental Monitoring and EP&R to discuss possibilities for real-time access to the ECURIE system and needs/questions regarding research and coordination in the area of radionuclide monitoring in Europe. It was agreed that JRC and EUNADICS-AV will explore possibilities for a real-time data exchange of ECURIE data. There was also exchange of information with regard to the Ru-106 detections in Europe in autumn 2017. With regard to real-time data exchange, JRC finally concluded that such an exchange should best go via project consortium members that already have access to these data.

2.4.2. DG RTD/ GEO / EUROGE OSS

A close integration of EUNADICS-AV into GEO (Group on Earth Observation) and its implementation framework (GEOSS), was proposed by DG-RTD at a dedicated meeting in Brussels in December 2017. As a further action, EUNADICS-AV applied successfully for inclusion into the 2017-2019 GEO Work Programme Activities as a showcase, with potential GEO Flagship visibility. The technical Implementation for sharing data through standardised and interoperable metadata, data services and interfaces will be referred to the GEOSS webportal.

EuroGEOSS was launched in October 2017 by the European Caucus of the Group on Earth Observations (GEO) as a regional initiative. The vision of EuroGEOSS is to enhance environmental, social and economic benefits from the European participation to GEO. Through inclusion into such initiatives, EUNADICS-AV intends to improve the user uptake for its data and information.

Beginning of 2018, EUNADICS-AV participants proposed a volcanic ash activity Show Case for Disaster Risk Reduction within an H2020 proposal for EuroGEOSS. It is also planned to re-use experiences from the EUNADICS-AV stakeholder processes as part of this activity.

3. Conclusions and outlook

Since the first conception of the EUNADICS-AV project, the international positioning and networking with relevant stakeholders and already established partners was an important task to be fulfilled in order to guarantee both the production of user-oriented products as well as the successful integration and uptake of those. Therefore, in the first project phase a list of organisations/activities relevant for air traffic management, aviation safety, meteorology and atmospheric modelling and observation networks was identified and contacted. In order to facilitate the exchange with some of the organizations, representatives were asked to become members of the EUNADICS-AV project advisory board. By this means, a strong interlinkage to eight European organisation could be established. In total EUNADICS-AV, is currently in contact with fifteen European organization/activities and has established various forms of cooperation ranging from project partner/consultant contracts to formal/informal exchanges or mutual expressions of interests.

Further arrangements have not yet been discussed as the project is still in its piloting phase for preliminary analysis products and any more formal engagements will strongly depend on the final levels of usability. The project consortium however is fostering a stronger collaboration with Rolls Royce engines and intends to actively reach out to airplane producers like AIRBUS in order to collaborate with the respective R&D units in the direction of automated aviation systems and the possible integration of EUNADICS-AV 4D analysis products.

Further planned dissemination activities in 2018 and 2019 e.g. along with the EUNADICS-AV exercise (Salzburg), may also provide a platform for representing the EUNADICS-AV project and its results to civil and military stakeholders.

4. References

Schlager, H., 2017: Identification of existing research and operational aircraft for fast response service; EUNADICS-AV Deliverable D17, 17 pp;
<http://www.eunadics.eu/sites/default/files/2017-11/EUNADICS-D17-Identification%20of%20existing%20research%20and%20operational%20aircraft.pdf>