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# WMO RA VI European Conference on Meteorology for Aviation (ECMA-2015)

13–14 October 2015, Vienna, Austria

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ALL PRESENTATIONS ARE AVAILABLE ON: <https://www.wmo.int/aemp/ecma-2015>



## **1. INTRODUCTION**

### **1.1 Background**

1.1.1 At its 16<sup>th</sup> Session held in Helsinki in September 2013, the WMO Regional Association VI (Europe) considered the vigorous developments towards a more efficient organization of the air traffic management (ATM) in the Region as formulated in the European ATM Master Plan endorsed by the European Council as a key element of the European Single European Sky (SES) initiative. The Association noted that the SES regulations, and their recent extension SES 2+, would have a major impact and would require changes in the way meteorological services are provided as part of the air navigation services by most RA VI Members (both EU and non-EU Members). It was understood that these changes were industry-driven based on the demand for capacity and efficiency and would require all air navigation stakeholders to align their services due to increasing pressure for more competitive and efficient service provision. The Association underlined that these trends need to be carefully monitored and discussed, given the importance of assuring aviation safety and service quality, and sustaining fair and equitable cost recovery mechanisms.

1.1.2 The Association agreed on the need to gain a greater understanding of these issues to better inform future discussions and requested the WMO Secretariat to organize a regional conference that would also build on the outcomes of the WMO/ICAO Conjoint MET Divisional Meeting, 2014. The Association adopted Resolution 2 (RA VI-16), *Conference on the future of meteorological service provision in Europe*.

1.1.3 The MET Divisional Meeting held jointly by ICAO and WMO in July 2014 was an important milestone in the development of enhanced meteorological service provision to civil aviation in response to the new global ATM Concept. It gave clear directions for the future of aviation meteorology, in particular the need for full integration of the MET information and services in the global framework presented in the ICAO Global Air Navigation Plan (GANP) and its Aviation System Block Upgrades (ASBU) methodology. The MET Divisional Meeting adopted 29 recommendations that mark the future performance improvements of the MET services throughout the ASBU time blocks with horizon 2028 and beyond. The WMO will be a key stakeholder in the coordinated follow-up action on those recommendations, in particular in providing the necessary scientific and methodological backgrounds for those improvements and organizing respective capacity development with its Member countries. WMO RA VI (Europe) is the arena of vigorous development of new ATM environment, both in technology and regulations, therefore, ECMA-2015 will be an opportunity to coordinate the European response to the MET DIV 2014 and promote a regional cooperation approach.

1.1.4 WMO is a UN specialized agency for meteorology (weather and climate), operational hydrology and related geophysical sciences. ICAO, as specialized UN agency working with its 191 Member States and global aviation organizations to develop international Standards and Recommended Practices (SARPs) which States reference when developing their legally-enforceable national civil aviation regulations. In accordance with the working arrangements between ICAO and WMO, the roles and responsibilities of the two Organizations in aviation meteorology are determined as follows: ICAO is responsible for the definition of user requirements for meteorological information and services; WMO has the responsibility for developing the means and methodologies to fulfill these user requirements.

1.1.5 ECMA-2015, in line with these general working arrangements, focused on those areas where the coordination and collaboration between WMO Member States, in the framework of the Regional Association VI, would help addressing the new requirements for meteorological services in support to ATM, thus enabling RA VI Members to develop appropriate actions in response to the emerging challenges of the ICAO GANP and ASBU and related regional developments.

## **1.2 Objectives**

1.2.1 The main objective of ECMA-2015 was to raise the awareness among RA VI Members concerning:

- Current and future developments in Europe towards more efficient organization of the air traffic in the Region as formulated in the European Air Traffic Management (ATM) Master Plan endorsed by the European Council, as a key element of the European Single European Sky (SES) and related institutional and technological changes with impacts on the provision of MET service;
- Major outcomes of the MET DIV 2014, related to the GANP and ASBU, that would require adjustment of existing or new business models for service delivery, including the shift from "product-centric" to "data-centric" information services, regionalization and globalization;
- New technology to achieve performance improvements in the light of SESAR (Single European Sky ATM Research) and other large projects, new concepts and systems (e.g., SWIM).

1.2.2 ECMA-2015 would promote the development of a coordinated approach among the RA VI Members in addressing organizational, regulatory and operational issues related to the meteorological service provision in the new European ATM environment and enhance regional coordination and cooperation.

1.2.3 ECMA-2015 would endeavor to strengthen the mutual understanding and cooperation between the MET community and the ATM stakeholders at national and regional level.

## **1.3 Stakeholders/Partners**

1.3.1 The ECMA-2015 was organized under the aegis of WMO Regional Association VI (Europe) and under the patronage of the RA VI President, Mr Ivan Cacic. The main target group was the senior management of the RA VI Members' National Meteorological and Hydrological Services (NMHS), preferably at the level of Directors and/or managers of the aviation services branches. The Conference also benefited of the exchange with MET service providers that belong to other agencies, such as air traffic services (ATS) organizations. Sharing experience and coordination with European sub-regional bodies like EUMETNET and the Interstate Council on Hydrometeorology of the Commonwealth of the Independent States (ICH/CIS) was also useful in synchronizing future plans and activities.

1.3.2 The event was supported thematically by the WMO Commission for Aeronautical Meteorology (CAeM) in view of the global character of the discussed issues. In this regard, the ECMA-15 will serve as a model regional event for all WMO regions.

1.3.3 Participation of representatives of the ATM community from different segments (airlines, ANS providers, airport management, etc.), was crucial for building common awareness and understanding. Primary partners in organizing the event were ICAO and EUROCONTROL; other partners, such as EASA, IATA, IFALPA contributed greatly to the deliberations. Last but not least, the conference learned about the engagement of the private sector in the SESAR research and development, which would call for more public-private partnership actions in the future.

## **1.4 Attendance**

1.4.1 The Conference was kindly hosted by the Central Institute for Meteorology and Geodynamics (ZAMG) and Austrocontrol at the Arcotel Wimberger Hotel, Vienna, from 13 to 14 October 2015. It was attended by a total of 86 participants from 37 Member States in Europe; one representative of Regional Association II (Asia); representatives of seven international organizations: EUROCONTROL, EUMETNET, EASA, IATA, ICAO, IFALPA, and WMO; and one representative of SELEX ES GmbH. A full list of participants is in Annex.

## 2. OPENING AND KEY NOTES

RA VI

### Opening Speech: Aeronautical Meteorology – RA VI Perspective



**Ivan CACIC**, President of RA VI (Europe) and Permanent Representative of Croatia with WMO

Let me first express my sincere thanks to all who contributed to the organization of this remarkable event – the European Conference on Meteorology for Aviation (ECMA-2015). My thanks go to the two organizations of the host country, ZAMG and Austrocontrol, Mr Michael Staudinger and Mr Michael Ableidinger.

I would like to express also my gratitude to the Organizing Committee for ECMA-2015, under the leadership of the RA VI Working Group on Service Delivery and Partnership, Mr Axel Thomala, the WMO Secretariat and all contributors. I am also aware of the significant role played by our regional partners, in particular, EUROCONTROL, Mr Dennis Hart, who contributed to the development of the programme for ECMA-2015.

I am very grateful to see the representatives of major aviation stakeholders, ICAO, IATA, IFALPA and EASA. We also have representation of the private partners engaged in the SESAR through Selex.

Last but not least, the presence in this room of representatives of 37 RA VI Member States and a representative of RA II gives me the assurance that the main objective of this event, which is to build a common awareness of the dynamic development in the field of aeronautical meteorology, will be achieved.

Two years ago, at the 16th Session of RA VI in Helsinki, we discussed the challenges to our European meteorological community. The discussion encompassed emerging challenges and how to prioritize in view of the already quite limited financial and human resources of the NMHSs. Climate change issues, weather extremes, WIGOS (WMO Integrated Global Observing System) and WIS (WMO Information System), were on top of the agenda. However, those of you who were in Helsinki may recall that one of the liveliest discussions we had was about the future of the aviation meteorology in Europe.

We realized that the issues were complex and they were not limited to the meteorology but to all air navigation services and to the whole aviation industry.

Let's look at some EUR traffic figures:

- Currently about 10 million flights/year, about 27,000 flights every day
- 1,4 billion passengers/year
- More than 450 international airports
- Even with some slowdown of the traffic growth, according to a recent forecast, there will be 14.4 million flights in Europe in 2035, which is about 1,5 times the level of 2012.

To cope with the extremely dense traffic over Europe and the predicted growth, the European Council endorsed the European ATM Master Plan as a key element of the European Single European Sky (SES) initiative. It was published in 2012 and a new 2015 version is being finalized. This plan has established some very ambitious performance improvement goals:

- Cost efficiency – 30-40% reduction of ANS costs per flight;
- Operational efficiency – 3-6% reduction of flight time; 5-10% reduction in fuel burn; 10-30% reduction in departure delays;
- Capacity – 5-10% additional flights at congested airports; A system able to handle 80-100% more traffic;
- Environment – 5-10% reduction in CO2 emissions;
- Safety – Improvement by a factor 3-4.

The key to achieving these goals is in the deployment of a series of operational changes through SESAR solutions which will result in a number of expected benefits for the European economy and society. In monetary terms, the expected benefit of SESAR deployment varies between €8 and €15 billion per year.

These are just a few figures to give us the flavor of the vigorous development in the aviation industry in our region. We, the providers of the aeronautical meteorological information and services, are part of these developments and, in the spirit of the WMO traditional cooperation between Member States, should strive to establish a well-coordinated and synchronized response to the significant challenges posed by the aviation industry.

I would also like to recall the outcome of the Conjoint WMO/ICAO Meteorology Divisional Meeting held in Montreal in July 2014. I had the chance to participate personally in this historical meeting and also in the 15<sup>th</sup> Session of the Commission for Aeronautical Meteorology. For me, the main message of these meetings was that the aeronautical meteorology should be fully integrated in the future Global Air Traffic Management in line with the ICAO Global Air Navigation Plan (GANP) and its Aviation System Block Upgrade (ASBU) methodology. So these two acronyms, GANP and ASBU, are now common colloquial terms for all of us, engaged in the aviation MET service provision. Achieving the GANP objectives on safety, efficiency and environment, will definitely require significant performance improvements of the meteorological information and services, which have been embedded in the ASBU time blocks from now to 2028 and beyond. I believe that, for us as meteorologists, the recognition of the integration of the MET information in the System Wide Information Management (SWIM) as a "key enabler" of the future ATM improvements should be a major stimulus.

But we should also recall that a number of Members of our Regional Association expressed concerns with regard to the ATM developments, including the SES 2+ regulations, since they may have an important impact on the way we provide meteorological services as part of the air navigation services (ANS) in RA VI. Such concerns were heard from both EU and non-EU Members. Therefore, the Association underlined that these trends need to be carefully monitored and discussed, given the importance of assuring aviation safety and service quality, and sustaining fair, equitable and inclusive approach to related institutional and service delivery aspects, such as the regionalization of services and cost-recovery.

The WMO 17th Congress held in Geneva in May-June this year, reinstated the aviation meteorology as one of the Organization's strategic priorities for the financial period 2016 – 2019. Congress gave us clear directives for the development of the aeronautical meteorology within the WMO programmes and in close coordination and collaboration with ICAO and other aviation stakeholders. Among those, are raising awareness of the Members of the forthcoming changes in the global ATM and development of adequate support by the MET service providers, development of better guidance on the institutional aspects in order to optimize the service delivery models and ensure sustainability of the service provision. WMO will also continue to support the implementation of underpinning elements of the service delivery, such as Quality Management System (QMS), competency and qualification of the aeronautical meteorological personnel.

Ladies and Gentlemen,

As president of the Regional Association, I am extremely happy to see in this room such a broad representation of WMO Member States, partner organizations and stakeholders. This



comes to confirm that the decision to organize such a large-scale regional event was correct and that there are high expectations about the outcome of this two-day event. So, let me turn to the main objectives of ECMA-2015. As discussed at the 16<sup>th</sup> Session of RA VI and at Cg-17, such regional Conference should be regarded as a major awareness event.

Why building such awareness is necessary? We all know the complexity of our Region with its variety of political, economic, geographic, language and cultural differences, groupings, etc. Different organizations and structures exist with regard to aviation activities, but there is a visible trend to consolidation; we can now see that EUROCONTROL has 41 Member States which is the basis for the Single European Sky policy of the European Union. In the East of the region, the members of the Commonwealth of the Independent States (CIS) are also working together towards a better integration. We are also aware that there are significant differences in the field of aeronautical meteorological service provision. Our survey from 2013 indicated that in more than 60% of the RA VI Member States, the NMHS is the certified MET Service provider; in the rest of the states, the MET Service provider is an entity outside the NMHS, in most cases belonging to an Air Navigation Services provider. We have always promoted that, regardless of the existing national institutional arrangements, the national MET and ANS entities should keep close relationship in order to gain efficiency and make a full use of the existing infrastructure and information resources.

Coming back to the need of common awareness and understanding, the ECMA-2015 programme has been designed from the start with the idea that we need a dialogue and information sharing between all players in the aviation MET domain, including the MET Service providers of different type, the regional partners, such as EUROCONTROL, EASA, the users' representatives from IATA, IFALPA, etc. Thus, during the next two days, we would like to encourage a broad exchange and to learn from each other about needs, capabilities, challenges and opportunities.

This exchange will allow us to ensure the best response from the MET community to the user needs under the different institutional and business models. We would also discuss about the need for optimization, including a broader regionalization in the service provision. The regionalization is embedded in the SES through the Functional Airspace Blocks (FAB) but we are yet to build and implement multinational service provision that will ensure the desired seamless approach across the boundaries. ECMA-2015 should try to identify how the WMO RA VI cooperation mechanisms could contribute to such performance improvements. Of course, we should be very cautious and prudent in developing new business models and should agree on common principle, develop adequate guidance on the related institutional and cost-recovery issues.

Furthermore, we should continue building a better safety culture that includes compliance culture and service quality culture. We need to work in a coordinated manner in enhancing the safety oversight as required by ICAO.

We would also like to build a better understanding of the fact that the quality of the aviation MET service is strongly dependent on the underpinning basic infrastructure composed of the basic observing networks of the RA VI Member States, the collective capability for satellite monitoring, the established national and regional weather radar networks, the capacity for numerical weather forecasting with the spatial and temporary resolution required by aviation, the education and training and the underpinning research and development carried out by WMO Member States. Thus, the final product we deliver to the aviation users, the METAR or TAF or SIGMET is based on a collective effort and collective capacity which determines our collective performance. That is why, we have always insisted that these core elements of the service are of paramount important for the quality and sustainability and should not be neglected in the development of transparent, fair and equitable cost-recovery mechanisms.

Ladies and Gentlemen,

We can proudly state that our Region establishes standards for quality services and user focus. Nevertheless, we need to address existing deficiencies. Recently, ICAO raised their initiative "No Country Left Behind". I believe we should also embrace this initiative and through our traditional regional cooperation ensure that the exciting new developments in the aviation



meteorology through SESAR and other related projects would not be limited to few highly developed countries or sub-regions, but would bring benefits to all Members and to society as a whole.

I would like to finish this opening speech with sharing my main expectation from ECMA-2015. Based on the very interesting presentation prepared by a number of NMHSs and aviation stakeholders, we will be able to formulate some highly constructive recommendations and actions towards an enhanced performance of the European aviation MET system, composed of different stakeholders, but cooperating closely, in order to ensure our contribution to the safety, efficiency and environment.

WMO

## Opening Speech



**Xu TANG**, Director, Weather and Disaster Risk Reduction Services Department, WMO

Mr Michael Staudinger, Director of the Central Institute for Meteorology and Geodynamics (ZAMG) and PR of Austria with WMO

Mr Michael Ableidinger, Director Meteorology, Austrocontrol

Mr Ivan Cacic, President of Regional Association VI (Europe) and PR of Croatia with WMO

Mr Chris Keohan, representative of ICAO Regional Office for Europe and North Atlantic

Distinguished guests from partner international organizations – EUROCONTROL, EUMETNET, EASA, IATA, IFALPA

Dear colleagues representing national aeronautical meteorological authorities and service providers,

It is a great pleasure for me to welcome you to the European Conference on Meteorology for Aviation (ECMA-2015) which is kindly co-hosted by ZAMG and Austrocontrol in the beautiful city of Vienna in the hearth of Europe. I would like to express my gratitude to both organizations for providing excellent support to this high priority WMO event.

Ladies and Gentlemen,

ECMA-2015 is a very important event in our calendar for this year for several reasons which I will highlight briefly:

**Firstly**, the 17<sup>th</sup> WMO Congress held in May-June this year had a particular focus on aeronautical meteorology. A special session was held under the "Future Challenges and Opportunities" Congress agenda on the WMO response to the Global Air Navigation Plan (GANP) endorsed by ICAO. Congress expressed full support to the objectives of the GANP and is forward looking vision for a safe, sustained growth of the air transport sector with increased efficiency and, at the same time, addressing related environmental issues. It was realized that the ICAO Global Air Navigation Plan (GANP) and related Aviation System Block Upgrades (ASBU) methodology as a key development for the coming decades, is imposing enormous challenges but is also offering opportunities to Members to modernize and rationalize the meteorological services provided to aviation. Congress welcomed the recognition that the meteorological information, through its integration to the System-Wide Information Management (SWIM), would become a key enabler for the realization of the future Global Air Traffic Management concept. Congress emphasized the need for WMO to adopt an inclusive approach to encompass all Members, with appropriate assistance and guidance by the CAeM and other relevant technical commissions, and with strong engagement of the regional associations, to ensure a coherent approach in addressing related technological enhancement,

evolving institutional developments and related capacity development needs at all levels. In view of this, Congress re-established aeronautical meteorology as one of the WMO's Strategic Priorities for the forthcoming financial period 2016 – 2019.

**Secondly**, ECMA-2015 is taking place in the European region where the most dynamic transformation processes in the aviation industries are taking place. The Single European Sky initiative was launched by the European Commission in 2004 to reform the architecture of the European Air Traffic Management (ATM) in order to overcome the fragmentation and flight capacity limitation by structuring airspace and air navigation services at a pan-European level. At the same time, the SESAR programme was initiated to develop the needed technological capacity. We are aware that SESAR evolved from research and development to the current deployment phase, which puts new requirements for the provision of aeronautical meteorological service. One of the main objectives of ECMA-2015 is to raise the awareness of the meteorological community in Europe of these new requirements, their relation to the GANP and ASBU, and thus contribute to an informed decision-making in the national and regional planning of aeronautical meteorological systems and programmes. In this regard, I would like to thank all our guests from international and regional stakeholder organizations, for their support to this Conference and for sending their representatives here to present their needs, requirements and expectations for MET information and services. I believe that this will contribute to bundling much better mutual understanding between the users and providers of information, which will bring significant benefits in the future.

**Thirdly**, for WMO, ECMA-2015 is also a great demonstration of a coordinated and collaborative approach between our Regional Associations and Technical Commissions. As a joint venture of RA VI and the Commission for Aeronautical Meteorology, it will help to identify regional needs and issues and to engage the necessary technical expertise for finding effective technological solutions. We strongly promote this approach across WMO, realizing that building effective and efficient service solutions is a cross-cutting matter that needs to be supported by many expert bodies. The CAeM has already provided a good example by collaborating closely with the Commission of Atmospheric Sciences, Commission of Basic Systems, the Education and Training Panel, on specific issues, thus ensuring that the best available expertise is fully utilized in developing state-of-the-art solutions that are then offered for uptake by the operational services.

I hope that ECMA-2015 will become a model event for discussing the hot topics in the current and future aeronautical meteorological service provision that could be reproduced in all WMO regions, where challenges are similar or even greater than in Europe. As representative of the WMO Secretary-General, I look forward to the very interesting presentations and discussions during the next two days and to the recommendations that will emerge for a concerted effort towards enhanced services bringing tangible contributions to the safety and efficiency of the air transport with due regard of the need to reduce the environmental impacts.

<b>CAeM</b>	<b>Keynote: Challenges and opportunities for Aeronautical Meteorological Service Providers in the new era of Aviation Weather Service</b>
	<p><b>C.M. SHUN</b>, Hong Kong, China</p> <p>Appointed as Director of the Hong Kong Observatory in 2011, Mr Shun specialized in aeronautical meteorology since the 1990s and led a team of researchers to develop the world-first and award-winning Light Detection And Ranging (LIDAR) Windshear Alerting System for the Hong Kong International Airport.</p> <p>In the international arena, Mr Shun is President of the Commission for Aeronautical Meteorology (CAeM) of the World Meteorological Organization (WMO) and Permanent Representative of Hong Kong, China with WMO. He is also Chair of the Hong Kong Meteorological Society, Fellow of the Royal Meteorological Society (FRMetS) and Member of the Chinese Meteorological Society Executive Committee.</p>

**Abstract:** As the aviation industry seeks performance improvements in the aviation systems to cope with the fast growing air traffic worldwide, through the latest Global Air Navigation Plan (GANP) and its associated Aviation System Block Upgrades (ASBU) framework, the meteorological community must respond to upgrade the aeronautical meteorological services at the same time. The upgrades will drive new business models, utilize the latest information technologies and scientific researches, harness innovative ways of service delivery, and leverage a higher level of regional and international cooperation to bridge existing gaps and to meet the increasing user expectations. The presentation will outline the relevant GANP and ASBU components relevant to aeronautical meteorological services, and highlight the challenges and opportunities to the aeronautical meteorological service providers (AMSPs) from the perspectives of the speaker as the president of the WMO CAeM as well as the director of a National Meteorological and Hydrological Service (NMHS) which is also an AMSP.

ICAO

Regional Implementation – ASBU Bn-AMET



**Christopher KEOHAN**, ICAO EUR/NAT Office, Paris


Christopher Keohan is a regional officer in aeronautical meteorology at the International Civil Aviation Organization (ICAO) Europe and North Atlantic (EUR/NAT) Regional Office in Paris and mainly facilitates States accredited to the EUR, NAT and MID ICAO Regions in the implementation of global standards in aeronautical meteorology for international civil aviation. Currently in his seventh year at ICAO, Christopher spent his first three years in the same capacity at the ICAO Asia and Pacific (APAC) Regional Office in Bangkok.

Accomplishments include facilitating volcanic ash exercises in Kamchatka and the Kurile Islands as well as volcanic ash exercises in Iceland, Portugal and Italy; facilitating the establishment of a Regional OPMET Centre in the MID Region necessary in improving OPMET data exchange intra- and inter-regionally which is used for flight planning and tactical decision making by operators; providing support as Secretariat of the respective Meteorology groups in the EUR and MID Regions focusing on facilitating States in implementing ICAO provisions related to Meteorology for International Civil Aviation.

**Abstract:** This presentation is about regional implementation of ICAO provisions related to supporting aviation System Block Upgrade (ASBU) for MET elements. In particular, mapping expected outcomes from the global MET Panel and its working groups to the METG of EANPG (European Air Navigation Planning Group) is provided and will be adapted where necessary at each METG.

### 3. THEME 1: EUROPEAN AVIATION LANDSCAPE

#### 3.1 Presentations' abstracts

TITLE OF PRESENTATION	Single European Sky (SES) - The big picture
	<p><b>Dennis HART, EUROCONTROL</b></p> <p>Dennis Hart is the EUROCONTROL Senior Aviation Meteorology Expert. He has experience in Aeronautical Meteorology (MET) from various operational, regulatory and policy perspectives. He represented the Dutch Government and the Royal Netherlands Meteorological Institute (KNMI) at ICAO and at WMO and represented the European Aeronautical Meteorological Providers at European Community level. In summer 2007, Dennis joined EUROCONTROL with the clear task to facilitate the needed interaction between the MET and ATM community to support improved integration of meteorological information into ATM decision making. He is one of the principal sponsors of the (I)WXXM development and of the envisaged evolution of MET service provision towards the concept of System-wide Information Management.</p> <p>He is member of several ICAO and WMO groups to establish new standards for MET provision and use and on SWIM. In his current position, he is also the Technical Contract Manager for the MET related activities in the SESAR Programme. He is principal advisor on MET to the European Commission, EASA, ECAC and SJU and in that role supporting the technical coordination activity for Europe in support of the ICAO/WMO Meteorology Divisional Meeting 2014. Dennis is a members of the ICAO MET Panel and Rapporteur of its Working group on Met requirements and Integration (WG-MRI).</p>


**Abstract:** The presentation is intended to give a general description of the current ATM system in Europe in the context of the Single European Sky (SES) and the major directions for its evolution. The role and the position of the EUROCONTROL in the "big picture" are explained, including its history, membership, structure and major functions. Monetary figures on the annual "cost" of the ATM services for the airlines indicate between 7 and 8 billion Euros. The presentation provides the outline of the European ATM Master Plan and what is the role of meteorology (MET) from pan-European perspective. The drivers for change are based on the traffic projections by 2035 which indicate the needs for capacity and efficiency. Major issue for the region is the current fragmentation of the air space and related service provision (64 Area Control Centres, 700 sectors, etc.). The current shortcomings of the European ATM system are estimated to cost some 4 billion Euros. The SES with its five pillars: Performance, Safety, Technology, Airports, Human factor, is aimed to establish the environment which will help to get inefficiencies out of the system. MET has a prominent role in this endeavor since the weather constrains have significant impact on the performance of the ATM system.

<b>TITLE OF PRESENTATION</b>	<b>MET matters in SESAR</b>
<b>Dennis HART, EUROCONTROL</b>	

**Abstract:** The presentation focuses on the Technology Pillar of SES and ATM Master Plan. SESAR phases are defined as:

- 1) Definition phase 2005-2008 (led to the creation of the ATM Master Plan);
- 2) Development phase 2008 – 2024 (developments of new standards, operational procedures and methodologies; continuous update of the ATM Master Plan; 3.6 billion Euros of budget);
- 3) Deployment phase 2014 – 2025 (already started with early deployment projects).


SESAR partnerships involve all aviation stakeholders and the SESAR Joint Undertaking (JU) ensures engagement of industry – from manufacturers to ANS providers, air space users, etc. A EUMETNET consortium encompassing Météo-France, UK Met Office, DWD, FMI, Met.No, KNMI and SMHI has been contracted by EUROCONTROL as a MET partner in SESAR. The SESAR concept of operations is a paradigm shift for ATC with the goal of moving to “trajectory management”, i.e., to know and share the current and planned position of the aircraft. This would require to overcome the current fragmentation and to provide for better synchronization between the different stakeholders and systems. The presentation outlines the main SESAR priority business needs and the key role of the System Wide Information management (SWIM). Furthermore, the role of the MET information is highlighted based on the figures of weather-related airport delays, en-route delays and aviation accidents. A key issue is the need to build a common understanding between MET and ATM regarding the current and future ATM system requirements and current and future MET capabilities. This includes, in particular, the understanding and accounting for the inherent uncertainty. A decision making model will include an impact assessment and risk management and the roles of the MET and ATM in this model should be better defined and understood. The level of integration of the MET information in the ATM system will be gradually moved from level “0” (no integration) to level “4” (full integration for decision support). This would involve innovations and use of advanced technics, such as ensemble and probability forecasts. Making the MET information SWIM-compliant will be another key factor. The presentation also provides the identified key MET capabilities required for SESAR.

<b>TITLE OF PRESENTATION</b>	<b>From Requirement to Solution</b>
	<p><b>André WEIPERT, Selex ES GmbH</b></p> <p>André Weipert is head of the Meteorological Information System Development and SESAR Programme Manager at Selex ES GmbH in Neuss/Germany. He has a master in electrical engineering and 23 years’ experience in research and implementation of integrated meteorological data processing, fusion, dissemination and display systems. During the last 20 years, he managed project and research implementations successfully in more than 50 countries worldwide.</p>

**Abstract:** The presentation “From Requirement to Solution” outlines the evolution process of an industrial solution within the SESAR framework. It begins with the global view (GANP), the structured implementation approach (ICAO ASBUs), the European Master Plan, the definition of SESAR operational changes, the specification of requirements and –finally- the definition



and deployment of a representative industrial solution based on the technical specification derived from the SESAR Operational Services & Environment Description. The overall process will be explained using the SESAR component GWMS (Ground Weather Monitoring System, WP15.4.9). The complexity of keeping MET requirements will be demonstrated. The necessity of innovative MET services (in terms of multi sensor fusion and data provision) will be discussed. The presentation concludes with the description of the external verification exercise of the prototype and a "lessons learned".

TITLE OF PRESENTATION	SESAR Deployment
	<p><b>Bart NICOLAI</b>, Belgocontrol</p> <p>Bart Nicolai is Expert Public Affairs in the International domain at Belgocontrol, the Belgian ANSP. He holds a diploma degree in Mathematics - Astronomy &amp; Mathematical Physics from the University of Leuven. He has been working for Belgocontrol since 2000. In the first years of his career, he was responsible for the implementation of the renewal of the Belgian airport MET observation network as well as for a number of forecast and display related projects. In the European SESAR R&amp;D project, Bart was Task Leader, responsible for consolidating all Operational requirements for MET information.</p> <p>He has also been very active in numerous ICAO, WMO and European MET groups. As such, he acted as co-chair of the WMO Expert Team on Met Services to ATM &amp; MET Information Exchange (ET-M&amp;M) until 2014 and he is acting chairman of AVIMET, the aviation working group of EUMETNET since 2012. Since end 2014, he is part of the Belgocontrol SESAR Coordination Group and, as such, responsible for coordinating all SESAR related projects in Belgocontrol projects.</p>

**Abstract:** After several years of SESAR Research and Development, the time is right to start deploying the mature solutions that have been developed to enhance safety, capacity and efficiency of Air Traffic Management.

The presentation will aim at giving the audience a high level overview of what SESAR Deployment is all about, how it is governed on both a political and service provider level and it will focus in detail on the MET component.

The presentation is intended to stimulate MET Service Provider decision makers to look for opportunities in deploying MET solutions on a local, multi-state and pan-European scale in cooperation with other MET Service Providers and/or with stakeholders.

TITLE OF PRESENTATION	SES Performance
	<p><b>Dennis HART</b>, EUROCONTROL</p>

**Abstract:** Starting with the SES Performance Pillar, the presentation focuses on the Network manager and its relation to MET. The SES performance scheme is briefly explained with Key Performance Areas (KPA), European targets, and reference periods. The Network Manager

(NM) has been designed and put into operation as the single flow management system over Europe. NM has to tackle a number of issues and bottlenecks at the level of the network. Among those are weather related delays and constraints that have a significant impact on the system. Meteorological information in the NM decision-making is tackled through the Impact Assessment/Risk management process that leads to informed decisions. The NM requires a consolidated service provision which is currently realized (in part) through a contract with a consortium of four European NMHSs. The consortium provides "traditional" MET (ICAO-defined), but also additional services specific to the NM functions and this is done in a consolidation non-confronting manner. This is very important for the operational decision maker – consistency, unification, consolidation is of prime importance. The MET information integration is illustrated through the Network Weather Resilience Initiative with the goal to assess the impact of the MET information vis-à-vis thresholds and constraints, combined with actual demand, resources and configuration, and run through decision-making models to get a set of possible options and solutions. Thus, the initiative demonstrates a methodology for transforming MET information into operational scenarios. This is needed for crisis management and is underpinned by respective regulatory framework and system architecture of the tool. The MET information from probability models feeds the risk assessment models which are complemented by impact models that need to be further developed. The presentation provides some "food for thought" concerning expected potential improvements. From NM point of view, the consistency of data sets used throughout the whole area is the main issue (e.g., all aircraft flying on the same wind data).

<p><b>TITLE OF PRESENTATION</b></p>	<p><b>SES safety and ATM/ANS regulations</b></p>
	<p><b>Jussi MYLLÄRNIEMI, EASA</b></p> <p>Jussi Myllärniemi (Finnish national) holds a degree (M.Sc.) in electrical engineering. He has worked in the field of aviation over the last 25 years. During his 10 years at the Finnish CAA (service provider, currently FINAVIA, Jussi worked as the ANS Director, chief of the Air Navigation Services Centre for South-Finland and was the responsible project manager for the modernization of the national ATM system and the implementation of the secondary radar network in Finland.</p> <p>In 2000, he moved to Brussels to work as a transport Counsellor representing Finland in the aviation group of the EU Council. Both the EASA Basic Regulation and the Single European Sky Regulations were prepared and adopted during that time. In 2005, he joined the European Aviation Safety Agency (EASA) to progress the extension of its remit into ATM/ANS and aerodromes. Since 2009, he has acted as the Head of the ATM/ANS and Aerodromes Department at EASA.</p>

**Abstract:** Single European Sky (SES) main objective is to reform the Air Traffic Management (ATM) in Europe in order to enable a sustained air traffic growth under the safest, most cost- and flight-efficient and environmentally friendly conditions. The European Aviation Safety Policy aims at ensuring that all European citizens can enjoy the same level of aviation safety. The backbone of this safety system is the European Aviation Safety Agency (EASA) and the set of common safety rules, which are directly applicable in a uniform manner across the EU, applying both to the industry as well as to the civil aviation authorities. In order to form the safety pillar of SES, in 2009, EASA's competences were extended to cover all ATM/ANS services, including the organizations, personnel and technical systems used in their provision. Such service providers, including those providing Meteorological services for aviation (MET), are subject to certification - by the respective independent competent authority with a purpose to comply with related common rules addressing the various elements of their provision.



MET service provision is already subject to verification against organizational requirements, including requirements that are intended to ensure the proper quality and safety management by their providers. EASA and the European Commission are currently addressing a new regulatory proposal intended to align these rules, including the ones for their oversight, with the latest standards for safety and global interoperability. This proposal includes a set of common European rules providing a common transposition of ICAO Annex 3, including its latest amendments. It is envisaged that this proposal will be formally adopted still in 2015.

Beyond ensuring a high level of safety for the passengers, external hazards have always been a challenge to aviation safety. Aviation accident data shows that within scheduled commercial air transport (in the last decade) an average of 13 % of all accidents were categorised as weather-related. Several recent incidents and accidents, where prevailing weather conditions are considered a contributing factor in the causal chain, have raised concerns and safety recommendations by the investigating authorities. Ensuring safe and globally interoperable MET services for aviation in Europe, in a continuously evolving environment, is a clear priority for EASA.

<b>TITLE OF PRESENTATION</b>	<b>International Coordination of Aviation Met Information</b>
	<p><b>Ashwin JADHAV, IATA</b></p> <p>An aerospace engineer by profession, Ashwin’s expertise includes Airline Strategy, Network &amp; Fleet Planning, Flight Operations and Meteorology. Ashwin joined IATA in 2010 and has been leading the Flight Operations Support Task Force (FOSTF) ever since. He has led the transition of the Task Force from purely Meteorology-focused to currently include Flight Dispatch, Meteorology, System Wide Information Management, ATM support and Airline Cost Recovery. The next Task Force meeting is scheduled for March 2016 in Dubai hosted by Emirates Airlines. Attendance at the Task Force includes 20+ airlines, ICAO, FAA, EUROCONTROL, WMO, UK MET Office, WSI, Sabre, Lido, Jeppessen, WOVO, various research organizations and vendors.</p> <p>Ashwin also manages several other portfolios such as Airline Operational Strategies, Critical Problem-Solving for member airlines in the Flight Operations domain, Global ATM Harmonization Support and the Fuel Management Information System.</p> <p>He speaks English, Russian, French and 3 Indian languages. In his free time, he is a Canadian national level soccer coach, a delirious poker player and aviation blogger.</p>

**Abstract:** As aviation moves towards System Wide Information sharing platforms, big data management will play a pivotal role in this transition. Through various programs and initiatives, the International Air Transport Association (IATA) aims to deliver enhanced products and processes to its member airlines and the aviation industry. This presentation will focus on the various programs in place for the identification, extraction, assimilation and release of MET information and data. The benefits, concerns and focus areas will be highlighted with regional and global snapshots. Finally, the near-term roadmap for the transformation of the MET data exchange models will be outlined and IATA’s role will be defined.

**TITLE OF  
PRESENTATION**

**Aeronautical Meteorological Service Provision - Governance  
and Business Models**



**Jan SONDIJ, KNMI**

Jan Sondij is Senior Advisor Aviation Meteorology at the Royal Netherlands Meteorological Institute (KNMI). KNMI is designated and certified as Air Navigation Service Provider for Meteorology in the Amsterdam Flight Information Region. Jan liaises with stakeholders in order to realize an optimum in aeronautical meteorological service provision within The Netherlands. This includes maintaining relations with the Ministry of Infrastructure and the Environment (regulator), the National Supervisory Authority (oversight) and stakeholders as Amsterdam Airport Schiphol, KLM, and ATC The Netherlands (LVNL).

**Abstract:** In response to the continuous growth of aviation transport and the need of new concepts for air traffic management, aeronautical meteorology is entering into an era of rapid and fundamental changes. It is anticipated that this will result in changes in the business and service delivery modalities, including regionalization of service delivery and increased competition for provision of service to aviation users. The presentation will highlight a number of developments including function separation between regulator, oversight and service provider, and governance aspects. The changing environment offers both challenges and opportunities, and one aspect that will be considered in particular is the sustainability of national infrastructures that are currently cost recovered via aviation.

### 3.2 Summary of sessions on European Aviation Landscape



As expressed in the ECMA-2015 Concept Note, one of the main objective of the Conference was *to raise awareness among RA VI Members concerning current and future developments in Europe towards more efficient organization of the air traffic in the Region as formulated in the European Air Traffic Management (ATM) Master Plan endorsed by the European Council, as a key element of the European Single European Sky (SES) and related institutional and technological changes with impacts on the provision of MET service.*

Raising awareness among the MET community was considered highly important in view of the complexity of the existing regional governance and normative arrangements in ATM/ANS domain, different groupings of Member States, variety of service provision business models and relationships with stakeholders. Therefore, ECMA-2015 included a series of three sessions aimed at building a better knowledge and understanding of the **European Aviation Landscape**. Presenters from European Commission, EUROCONTROL, European Aviation Safety Agency (EASA), were invited to cover relevant aspects of the major regional initiatives and projects, such as SES and SESAR and their linkages with the MET domain. The "landscape" was further filled through presentations by SESAR-supporting industry (represented by SELEX) and users' community (represented by IATA and IFALPA). An overview of the current aviation MET service provision modalities was also presented on the basis of a survey with the EUMETNET Member countries.

The "landscape" within which the aeronautical meteorological authorities and service providers in Europe operate is of high complexity. The following were the main elements of this "landscape as presented and discussed at ECMA-2015

#### ***Institutional picture***

In addition to the global framework established by ICAO and WMO, several international bodies in the region have various governing, regulating or operational functions with bearing to the provision of meteorological service to aviation.

- **EUROCONTROL** (European Organization for the Safety of Air Navigation): 41 Member States; various functions including collecting air navigation charges on behalf of States across Europe; pan-European function – Network Manager; founding member and major player in the SESAR Joint Undertaking.
- **EASA** (European Aviation Safety Agency): 32 Members (28 EU countries + 4 EFTA countries); main concern regarding MET is related to aviation safety and weather (13% of all accidents – weather related); the MET factor in EASA Risk Portfolio focuses on "management of flight operations in extreme weather conditions".
- **EUMETNET** is a grouping of 31 European National Meteorological Services and five cooperating NMHSs. EUMETNET members cooperate in different areas of aviation MET services including SESAR R&D.
- **ICH/CIS** (Interstate Council on Hydrometeorology of the Commonwealth of Independent States) coordinates the activities of the Eastern part of the region and pursues harmonization of regulatory and operational aspects with the rest of the region.

An important feature of the European "landscape" is the establishment of "common rules" as part of the European aviation safety system. ECMA-2015 provided a unique opportunity for the MET community to receive a direct briefing on the relevant European ATM/ANS rules that are valid for the 32 EASA Member countries. The implementation of EASA rules would be a challenging task for the European AMSPs.

### ***Air Traffic Management (ATM) picture***

- **ATM Today** (EUROCONTROL area): 63 Area Control Centre (ACC); over 700 sectors when at full capacity; 17,000 air traffic controllers; 41,000 other staff.
- **Traffic:** current traffic reaches 30,000 flights/day during peak period; traffic growth – slowed down after 2009, but still growing with about 5%/year with a 2035 forecast for about 15 million flights.
- **Main issue:** Fragmentation of air space, inefficiency; costs up to €2 billion to users.
- **Future ATM:** European ATM Master Plan; Single European Sky (SES):
  - Consolidation of air space and services: 9 large Functional Airspace Blocks (FAB) instead of 63 ACC.
  - Pan-European approach: Network manager – a single Flow Management System over Europe.
  - SES with 5 pillars: Performance, Safety, Technology, Airports, Human factor.
  - SES ATM Research (SESAR) programme: the realization of the European ATM Master Plan.

### ***Cost of ATM and MET in Europe***

- Current cost of ATM in Europe is about €8 billion/year (EUROCONTROL Member States). The shortcomings of the European ATM system are estimated to cost some €4 billion: €2 billion because of fragmentation of the ATM network; €1 billion because of non-optimized flights; €1 billion because of delays.
- Aviation MET service cost: rough estimate of the MET portion of the ATM cost is about €400 million (on the assumption of 5% share of the total ATM service charges).

### ***Weather impact on ATM in Europe***

Several presentations provided facts and figures on the high impact of weather on the safety and efficiency of aviation operations and ATM. Winter conditions, strong winds, low visibility, thunderstorms, volcanic ash cause significant disruptions and contribute to aviation incidents and accidents in Europe. More than 20% of the airport delays and 15% of Air Traffic Flow management delays in Europe are weather related. The US National Transportation Safety Board (NTSB) attributes more than 20% of the aviation accidents to weather (this includes general aviation). EASA figures for occurrences (accidents, serious incidents and incidents) in Europe show that 8% are weather related; the risk factor "Management of flight operations in extreme weather conditions" is high in the EASA Risk Portfolio.

### ***Aeronautical Meteorological Service Provision picture***

The result of a survey with the EUMETNET member NMHSs showed the variety of organizational models with regard to the provision of meteorological services to aviation. The two most common organizational models are: AMSP is in the NMHS; AMSP is a part of an ANS provider. Within the EUMETNET area, the distribution of these two models is 70%/30% (according to an earlier RA VI survey (2013), the ratio for the whole region is approximately 40%/60%). Differences exist also in the methods and schemes for cost-recovery, including in recovering the "core" costs (e.g., the allocation of satellite costs (EUMETSAT)). The current complex picture in the organizational arrangements by individual States, presumes further regional efforts on harmonization and standardization through sharing experience and best

practice. The picture is further complicated by the trend for commercialization of some services and increasing presence of private sector providers.

### ***Users' perspective***

ECMA-2015 learned from IATA about their plan for global sharing of MET data from aircraft. A feasibility study should be conducted to validate this idea and establish respective partnerships including the World Area Forecast Centres (WAFc). IATA's plans are based on the need to adapt to "big-data" management approach.

The view of airline pilots expressed by IFALPA was clearly towards much faster incorporation of research and technology advancement into operational practice. That means, pilots need better information in the cockpit in terms of update (e.g., near real-time data uplink) and data representation (time to update the very old black & white Annex 3 model charts).

### ***MET matters in SESAR and SESAR deployment***



ECMA-2015 gave an opportunity for the MET community to learn more about SESAR as the main ATM development in Europe. The MET information in SESAR is provided under the Impact Assessment/Risk management model and will undergo different phases of integration into the ATM decision making. A critical element of the successful integration is building a common understanding between the MET and ATM communities about current and future ATM system requirements and respective MET capabilities. Inherent uncertainties of the MET information should be tackled in the decision making models. Specific additional MET capabilities required for SESAR include: Radar composite for 3D convection; Nowcasting of convection; Super-ensemble forecast of convection; Diagnostic for forecasting of icing; Diagnostic for clear air turbulence (CAT); Forecast of impact of winter conditions at airport; MET parameters for Network management; MET parameters for 4D trajectory calculation.

SESAR Deployment phase that started in 2014 provides a framework for implementation of the results of the Development phase to meet the established performance targets. ECMA-2015 learned about the deployment governance and setting-up of (pilot) common projects (PCP) and related funding opportunities. ECMA participants were encouraged to consider the opportunities for submitting proposals for projects in the form of "local projects" (airport & FIR), "cross-border projects" (e.g., in relation to FAB), or "pan-European projects" (e.g., in support of Network Manager).

ECMA-2015 provided a good opportunity to learn about the engagement of industry partners (SELEX ES Germany) in the SESAR research and deployment. In particular, the business case of Ground Weather Monitoring System (GWMS related to SESAR WP 15.4.9) was presented from industry perspective, i.e., finding efficient integrated solutions in response to SESAR requirements. Several key issues have been emphasized including the need to understand the operational processes and the interdependency between the ATM and MET requirements in order to build relevant solutions. Participants acknowledged the engagement of the industry in SESAR as a fact that need to be fully understood by the State AMSPs and to look for collaboration and partnership in this regard.

## 4. THEME 2: MET RESPONSE – OPPORTUNITIES AND RISKS

### 4.1 Presentations' abstracts

TITLE OF PRESENTATION	Austria Aeronautical MET Services - Part of an ATC Provider
 	<p><b>Michael STAUDINGER</b>, Director of the Central Institute for Meteorology and Geodynamics (ZAMG) and PR of Austria with WMO</p> <p><b>Michael ABLEIDINGER</b>, Director Meteorology, Austrocontrol</p>

**Abstract:** The current structure of government-regulated meteorological service provision in Austria is presented, detailing the relative roles of the "General" Meteorological Service provided by ZAMG (Central Institute for Meteorology and Geodynamics), and the services for aviation provided under legal designation by the Meteorology Department of the Air Navigation Service Provider Austrocontrol, a limited company owned by the Republic of Austria. Austrocontrol is a company with limited liability, self-financing, with revenues generated by fees charged to the users and employs approximately 1.000 staff, of which around 60 are working in Meteorology. The synoptic network, a numerical model operated with 8 other European countries and special now-casting systems are used by ZAMG for general warning services for the public and special services for different societal sectors, whereas Austrocontrol operates the Weather Radar Network and 3 of the 4 Radiosonde sites. Austrocontrol specializes in providing highly focused special forecasts for the in-house Air Traffic Management, participates in several SESAR Projects with its expertise in the translation and impact conversion of meteorological phenomena and elements into ATM-relevant outcomes, thereby achieving an excellent record in minimizing weather related delays and diversions. The two organizations cooperate in several projects, where ZAMG provides scientific expertise that, combined with the ATM competence of Austrocontrol, results in satisfied customers.

**TITLE OF PRESENTATION**

**Response to the Changing Environment in Europe, the perspective of the German Weather Service**



**Klaus STURM, DWD**

- 1986 M.Sc. Meteorology at the University of Innsbruck, Austria
- 1986 – 1988 Scientist at German Institute on Polar and Marine Research, Bremerhaven working in polar glaciology and meteorology
- 1988 – 1993 Scientist at the Department of Remote Sensing, Institute for Meteorology and Geophysics, University of Innsbruck working in the field of radar detection of snow and ice.
- 1995 – 1998 Operational forecaster in the German Meteorological Service, regional office Stuttgart
- 1998 – 2001 Head of the forecasting department of the regional office in Stuttgart
- 2001 – 2007 Head of the Operation Division, Department of Aeronautical Meteorology of the German Meteorological Service
- 2007 – today Head of the Department of Aeronautical Meteorology of the German Meteorological Service

**Abstract:** The aviation industry is a global economy in which the weather services and aviation weather services are involved. Weather services which, up to now, are defined essentially over their stately mandate for meteorological safeguarding and servicing for national society and economy, are now pushed towards a global economic marketplace. Moreover, within this global economy, meteorology has developed towards to a digital networked economy for many years now, a trend continuing. Thus, the weather services are now faced with rapidly changing customer relations and rapidly changing competitive conditions on an international scale. The aviation industry constantly transfers their cost pressure on their suppliers. The development programs of ICAO and the European Union demand the meteorological services to develop new services simultaneously reducing costs. Politics and national supervising authorities discuss the dissolution of national monopolies. For these new conditions, the weather services and aviation weather services have to find solutions that ensure their national obligations, their performance and their contribution to Aviation and thus overall to ensure their existence. Are the actual organizational structures on national level still up-to-date? Are the traditional international partnerships still reasonable? What new relationships between weather services have to be build up? And what will a business model to be ready for the future? Further developments of aviation meteorology will be presented from the perspective of the German Weather Service.



**TITLE OF PRESENTATION**

**Meteorological Services for Civil Aviation – Opportunities & Risks arising from the GANP/ASBU Implementation**



**Marina PETROVA**, Roshydromet

1973-1976 Forecasting Engineer, airport in Dushanbe (Tajikistan)

1976-1998 Roshydromet - Involved in MET services to civil aviation, hydrometeorological services

Tackled MET services for aviation safety

Developed methodological and organizational techniques for MET services to aviation

Addressed strategic and tactical issues for implementing MET services systems

1998-2010 Director General, Meteoagency of Roshydromet

2010 (up to now) Director General, Aviamettelecom of Roshydromet

Involved in specialized hydrometeorological services to civil aviation

Co-Chair of the WMO CAeM Expert Team on Communication, Coordination and Partnership (ET-CCP)

**Abstract:** The RA VI Members have already become actively involved in the implementation process intended to support a “One Sky” concept for international air navigation fostered by the Global Air Navigation Plan (GANP) framework and the aviation system block upgrades (ASBU) methodology, the integration of digital MET information into the future system-wide information management (SWIM) environment, and the enhancement of global, multi-regional, regional, sub-regional and local MET service provision.

The capabilities available allow the Russian Federation to adapt flexibly to the evolving requirements for aeronautical MET services and address the short-, medium- and long-term enhancements to MET service provision.

In order to enhance meteorological information delivery, which in the framework of ASBUs is an integral part of the system-wide information management (SWIM), apart from aeronautical and flight information, Roshydromet has drawn up an Action Plan to meet the Recommendations adopted by ICAO MET/14/WMO CAeM-15 in support of Block 0 (2013-2018) of the Aviation System Block Upgrades (ASBU) methodology. In line with this Action Plan, it proves feasible to establish and put into operation two Regional Centres by 2018.

Conjoint meetings of the CIS Interstate Council for Hydrometeorology Working Group – 4 – Meteorological Services for Civil Aviation (CIS ICH WG-4) and the ICAO Meteorology Group Project Team have established a subregional mechanism to take forward an agreed Implementation Plan and to serve as a focus for cooperation efforts in the CIS countries.

**Stéphanie DESBIOS, France**

Development for the regional climatology project REKLIP at the Météo-France North-East regional centre. Main activities and responsibilities: climatological data processing, end user products conception. Météo-France, Illkirch-Graffenstaden, France. Dates: 08/1991-09/1993.

Applications' conception, design and development in aeronautics for the Météo-France information system for forecasters, SYNERGIE. Main activities and responsibilities: graphical applications for aeronautical meteorological products, processing of World Area Forecast System BUFR data. Météo-France, Toulouse, France. Dates: 10/1993 - 03/2008.



Co-chair of the Expert Team on Information & Services for Aviation of the WMO Commission for Aeronautical Meteorology (07/2014 – today). Core member then chairperson of the Expert Team for New Terminal Weather Forecast, renamed Met Services to ATM & Met Information Exchange to ATM & Meteorological Information Exchange (11/2006 – 07/2014). Main activities and responsibilities: contribution to the WMO CAeM initiative for new Met services to ATM, and on information exchange, chairing responsibility. Dates: 11/2006 – today.

Advisor/member in several ICAO studies, operations or working groups, including the newly MET Panels groups: the former AMOFSG and WAFSOPSG, the METP WG on Met Requirements and Integration, the METP WG on Met Information Services & Development and the METP Met Operations Group. Dates: 09/2006 – today.

Deputy Head of the Research and Development unit at Météo-France Met Services for Aviation. Main activities and responsibilities: coordination and steering of R&D activities in aeronautical meteorology. Météo-France, Toulouse, France. Dates: 03/2008 – today.

**Christiane GIVONE, France**

July 2010 – Present: Head of Meteorological Services to Air Navigation, Head Office, Météo-France

October 2006 – June 2010: Observing Systems Deputy Director, Météo-France

October 2000 – September 2006: Head of Developments and Projects, Head Office, Météo-France

September 1999 – September 2000: Deputy Head of Regional Coordination, Head Office, Météo-France

December 1993 – August 2000: Head of the studies and developments Office, Centre-East Regional Directorate, Météo-France



September 1987 – November 1993: Studies Engineer, Centre-East Regional Directorate, Météo-France

Member of the ICAO Meteorology Panel; French representative in ICAO EANPG/METG; Météo-France representative in AVIMET (EUMETNET Working Group of Aviation MET Service Providers); Météo-France representative in MET Alliance Steering Committee; Core member of EASA rulemaking group on MET services (2011 – 2014)

**Abstract:** According to the Single European Sky regulations, the French National Meteorological Service, Météo-France, has been designated as the exclusive aviation service provider over the whole French national air space which includes the French overseas air spaces. As an aviation MET service provider, Météo-France has implemented a Quality Management System that includes a continuous aviation user consultation process. This allows Météo-France to hear and gather users' needs and to provide innovative solutions aiming at fulfil the evolving needs of the French and European aviation community.

Météo-France also has ICAO international responsibilities such as the Volcanic Ash Advisory Centre (whose responsibility area covers the main part of Europe, Africa, Middle-East and west Asia ~160 FIRs) located in Toulouse at the National Centre for Prediction, the three Meteorological Watch Offices for eight French FIRs (1 MWO for the 5 FIRs of continental France, and 2 MWO in overseas territories), the Tropical Cyclone Advisory Centre in south-west Indian Ocean and the Regional OPMET Data Bank for Europe and data Centre for Europe and Africa.

Those responsibilities and further involvement in aviation-related MET activities and in the SESAR program are also opportunities for Météo-France to be involved in the implementation process of the "One Sky" concept for international air navigation fostered by the Global Air Navigation Plan (GANP) framework and the aviation system block upgrades (ASBU) supporting methodology.

This presentation provides some of the activities or projects in Météo-France for the enhancement of global, multi-regional, regional, sub-regional and local MET service provision to the aviation community.

## TITLE OF PRESENTATION

### Regional Service Delivery in Northern Europe



#### **Jaakko NUOTTOKARI**, NAMCon

Jaakko Nuottokari is the General Manager of the Northern Europe Aviation Weather Consortium (NAMCon), a cooperation between the National Meteorological Services of Denmark, Estonia, Finland, Iceland, Latvia, Norway and Sweden. He has previously worked as Head of the Group of International Consulting Services at the Finnish Meteorological Institute (FMI) and has a background as an aviation weather forecaster.

He has previously chaired the WMO VCP Informal Planning Meeting and is currently a member of the WMO CAeM Expert Team on Governance (ET-GOV).

**Abstract:** The Northern Europe Aviation Weather Consortium (NAMCon), a cooperation between the National Meteorological Services of Denmark, Estonia, Finland, Iceland, Latvia, Norway and Sweden emerged from an increasing pressure on the NMHSs as MET service


providers to air navigation to at the same time increase efficiency, harmonize production, innovate and develop new services for emerging user applications. The task is for one small to medium-sized NMHS a great challenge, and a grouping of seven NMHSs can pool together the resources and expertise to meet these challenges much better. The long history of cooperation in NWP, weather radar and training combined with the strong organizational will to create the NAMCon consortium has been and remains the backbone of the cooperation.

The main goal of the consortium is to reduce the cost of aviation weather services in line with the Single European Sky (SES) Reference Period 2 (RP2) targets and beyond. The main tool to achieve this is to join the production of services and products and reduce overlap. Examples of such initiatives are the cross-border TAF production over Southern Sweden by the Danish Meteorological Institute and the joint production of the Nordic Significant Weather Chart (NSWC) by the Swedish Meteorological and Hydrological Institute (SMHI) and Finnish Meteorological Institute (FMI). Information management and production methods are also to be streamlined and an example of this is the upcoming launch of the NAMCon Aviation Weather Briefing Portal on 1 December 2015.

There are many challenges for NAMCon to overcome in order to meet its strategic objectives. The single greatest challenge so far has been to adequately resource the very ambitious work plan developed. Due to the fact that there are only a handful of aviation weather experts in the region, progress cannot be achieved fast. By selecting 2-3 key priority projects per year, we can focus our efforts to make the biggest gains in productivity. Member NMHSs are also in very different political and economic environments and thus all members do not share all issues. Indeed, costs would need to increase in the Baltic States to include research and development costs.

The consortium is governed by the directors of weather services in member institutions and an executive is appointed from this group to liaise with the consortium manager regularly. The heads of aviation weather and/or aviation customer services form the operational group responsible for the design and implementation of the consortium activities. Directors are briefed annually on the progress and approve the strategy and vision for the consortium. Teleconferences are held in between the bi-annual two-day NAMCon meetings. Task teams carry out all development and deliverables as defined in the annual work plan updated every year. Progress is also communicated regularly to the supervisory authorities and FABs. NAMCon is present in the NEFAB air navigation services consultative board and reports to the 7-State ministerial network meetings. The governmental connection adds political support to the activities carried out.

The NAMCon aims to set the stage for regional service delivery of aviation weather services in Northern Europe by harmonizing production and creating joint initiatives. Through incremental and systematic development and cooperation, the challenges of future service delivery can be met while ensuring the continuity of most operations.

<p><b>TITLE OF PRESENTATION</b></p>	<p><b>How climate change will affect the need for meteorological support to civil aviation</b></p>
	<p><b>Herbert PUEMPEL</b>, Austria</p> <p>Senior Analyst in the Operations Department of the European Centre for Medium Range Weather Forecasts, Reading, UK, 1978-1985</p> <p>Member of the Commission for Aeronautical Meteorology, WMO, since 1990, holding several positions as Chair of OPAGS and Expert Teams</p> <p>WMO representative, Committee on Aviation Environmental Protection, ICAO, since 2000</p>

Head of western region, Austrocontrol Aviation Met Service, 1991 - 2006  
Center Director for the Mesoscale Alpine Programme, 1998-1999  
Lecturer, Aviation Meteorology, University of Innsbruck, 2001-2006  
CEO of "Meteoserve", the commercial branch of Austrocontrol Aviation Met Service, 2005-2006  
Chief of Aeronautical Meteorology Division, WMO, 2006 – 2013  
From 01.01.2014: Officer-in-charge, Strategic Planning, MET Department, Austrocontrol and part-time Aviation Affairs Manager, EUMETNET

**Abstract:** Based on recent research in the effects of climate change, and despite a significant remaining uncertainty about details, a number of impacts on civil aviation are seen as likely over the coming decades.

A fundamental aspect of this change is the emerging recognition that aviation is likely to suffer as much from the large variations in the seasonal, inter-annual, and decadal time scale as well as from the long-term temperature and sea level rise trends. There is growing evidence that record-breaking precipitation events, heat waves, periods of intense snowfall in higher mid-latitudes will have a significant impact on operations, and will require an early and decisive planning and design response.

Extreme events will be strongly regionalized, their return times are likely to become shorter, and their impact on multi-modal transport systems will be large.

The increase in available potential energy through increased temperature and moisture in some regions may not only lead to heavier and more destructive convective storms, a change in their characteristic behavior could have a negative impact also on their predictability.

Aviation will not be singled out, as all transport modes will be affected, but aviation may play an even larger role in future disaster relief activities when surface-based transport over long distance could be highly vulnerable, putting the onus on the aviation stakeholders to invest in higher resilience, but also in improved weather observing, forecasting and warning capability to maintain the excellent safety and reliability record of the industry.



## 4.2 Summary of sessions on MET Response: Opportunities and Risks



Having heard and discussed about the big regional picture of the “European Aviation Landscape”, ECMA-2015 discussed how the European MET community should provide a relevant response to the challenges and meet industry expectations. The ATM developments guided by the GANP and ASBU needed to be regarded as providing opportunities but also posing risks to the national AMSPs.

Sharing of national and multi-national experience in organizing the provision of MET service for aviation was done through six presentations.

**Austrian business model** is typical for a number of RA VI Members where the AMSP is separate from the NMHS and belongs to the Air Traffic Services (ATS provider); in Austria this is Austrocontrol. ZAMG, as the Austrian NMHS, and Austrocontrol have established a good cooperation with clear definition of responsibilities and cooperative agreements. Thus, the Austrian observational network is shared between ZAMG and Austrocontrol bringing mutual benefits and efficiency. Having the AMSP as part of the ATS provider has the benefit of close relationship with ATM that helps delivering an excellent “package” to end users. Cooperation with ZAMG is essential in several different areas, e.g., in area of volcanic ash detection and transport based on ZAMG long-standing competence in predicting transport of atmospheric aerosols and pollutants.

**In Germany**, Deutscher Wetterdienst (DWD) acts as the national AMSP with a legal mandate to supply the aviation industry with the required MET information and products. DWD is facing currently a great challenge to decide on its strategy for the future aviation service provision. Challenges come from the market conditions under which the NMHSs should compete with other potential providers. Service quality and cost are the main criteria for being successful in this market conditions and sometime these conditions are not in favor of the NMHS. The expansion of free data policy allows the private providers to develop lower cost commercial services, while the NMHSs working on the ICAO cost-recovery basis may be less competitive. Many NMHSs will be facing the question of their future positioning in the aviation MET service provision; DWD made its clear choice to sustain its leading role as AMSP and to add in the future more commercial type services to its portfolio. At regional level, DWD encourages further cooperation under the umbrella of Single European Sky and harmonization of the business models based on shared values and goals to create an arrangement that is beneficial to all.

**Aviamettelecom of Roshydromet, as the AMSP of the Russian Federation**, has initiated national planning in line with the ICAO GANP and ASBU. That includes establishment of a Regional Centre for Space Weather and Regional Hazardous Weather Advisory Centres (RHWAC). ECMA-2015 learned about the cooperation mechanism established in Eastern Europe through the CIS Interstate Council for Hydrometeorology Working Group-4: Meteorological Services for Civil Aviation (CIS ICH WG-4), which also coordinates activities with the ICAO METG PT/EAST. Through this mechanism, the implementation of ICAO requirements, such as for QMS and competency of AMP has been successfully progressed. The future developments related to GANP and ASBU should also be fully coordinated in order to find common solutions to those issues that affect many AMSP, namely, improved cost-recovery mechanisms, data policies, dealing with competition of private sector.

**Météo-France current and futures services to aviation** have been presented as an example of business model of a "MET service provider on an exclusive basis in the airspace under French law or left to the French responsibility by ICAO". Aviation MET service is an important part of Météo-France bringing € 85 million from cost recovery (total budget of € 379 million, 2014). In addition to the national services, Météo-France provides international facilities: VAAC, TCAC (La Réunion), RODB, etc. The research and development activities have been directed to development of advanced MET services to support airport and TMA operations and collaborative decision making (CDM). Examples of such advanced services have been presented to ECMA. The new products being developed are impact-oriented using operational thresholds defined with users. Special attention is given to the better integration of the MET information in the ATC/ATM systems and the future utilization of the SWIM. The multi-national cooperation in the framework of the MET Alliance (the ATMP of eight European countries) includes SIGMET coordination, TAF verification, common procedures for AUTO METAR, etc. The planned seamless production of SIGMET across the State and FIR borders within the MET Alliance area is a very good example of regional cooperation that could be used in other parts of RA VI.

**The Northern Europe Aviation Meteorology Consortium (NAMCon)** was presented as a model for regional service provision. NAMCon was built on the understanding that the NMHSs cannot survive alone in the future aviation weather service delivery market. NAMCon members are the NMHSs of Finland, Sweden, Norway, Denmark, Iceland, Latvia and Estonia. A collaborative regional service provision had been initiated and a plan for future consolidation is put in place. This includes provision of certain service by one of the NAMCon Members on behalf of a group of countries, but also cross-border coordination and interoperability. Common briefing web portal has also been established. The NAMCon governance and cost recovery mechanisms would serve as a good practice in the future regionalization of services envisaged by the GANP and ASBU.

**How Climate Change will affect the need for MET Support to Civil Aviation** was discussed in view of the far-reaching potential consequences of the climate change and variability on the aviation industry. The CAeM Expert Team on Aviation, Science and Climate (ET-ASC) has been following the subject and collecting relevant research materials that would help assessing risks for different aviation stakeholders. There are already some research results with relatively high confidence on the expected increase of extreme weather conditions with possible impacts on turbulence, max wind speed, etc. Predictability and manageability of high-impact weather and its impact on new air traffic systems would continue to be areas of multi-disciplinary research and development in the future.



## 5. PANEL SESSION AND KEY MESSAGES



### Panellists:

(from left to right) Herbert Puempel, Dimitar Ivanov, Ivan Cacic, Marina Petrova, Axel Thomalla, Gerhard Adrian, Ian Cameron

**Ivan Cacic, the President of RA VI** stressed that ECMA-2015 succeeded in gathering the Members' NMHSs and key aviation stakeholders. The whole spectrum of regional bodies and groupings was in attendance and this provided the basis for high-quality presentations followed by good discussions. From WMO point of view, ECMA also demonstrated the cooperation between a regional association (RA VI) and a technical commission (CAeM), each addressing the issues from their specific perspectives. Aviation meteorology has been recognized as a WMO priority at both regional and global level.

### Key message:

- Both presidents (RA VI and CAeM) stressed on the need to understand and explain the impacts of the GANP and ASBU developments on the AMSPs (including NMHSs) and consider implications on the sustainability of the service provision and the underpinning core meteorological infrastructure.

**Ian Cameron** pointed out the monetary figures of the air navigation service provision in Europe – about € 8 billion per year. The estimates that up to 50% of the current cost could be reduced through optimization and efficiency measures are of great importance for all ANSPs including MET. Roughly 5% of the total ANSP cost could be attributed to MET services, which results in a figure between € 400 and € 500 million in Europe and IATA estimates the global of regulated MET services to around two billion dollars, a considered amount, therefore, cost-saving measures would be more and more important.

Concerning the weather impacts, it was shown that about 15% of the delays are due to weather. Opportunities exist for the MET services to add more value into preventing weather delays with estimated cost saving of € 150 million in Europe. Thus, along with the need for cost saving, opportunities exist to help industry by saving through value added MET information and service. The SES and SESAR investments should be regarded as “spend to save”, i.e., invest into improvements and to do things differently and better. ECMA also showed that the private sector industry is also spotting opportunities and has been proactive in doing research and development for SESAR. In summary, EUROCONTROL and SELEX showed

the view of the industry that if we look deeper and further, we will find opportunities to do things differently.

#### Key messages:

- Better MET services can help the industry to reduce the losses due to weather delays and bring significant benefits.
- The SES and SESAR investments should be regarded as “spend to save”.
- Innovative approaches in SESAR deployment solutions will be sought through both traditional AMSPs and private industry.

**Prof. Gerhard Adrian, DWD**, summarized the discussions on SESAR deployment and EASA safety regulations. He stressed on the role of the SESAR Deployment Management to ensure that implementation is done in a timely and synchronized approach. Governance of deployment is by EU policy and SES and management of individual projects is by stakeholders. It is important, from NMHS perspective, to understand that MET providers have a role in the provision of MET information to the end users, however, we are not always able to do this in the current environment. Furthermore, the framework of the deployment includes projects of different scale including local (with local stakeholders), cross-border – between the countries in FABs, and pan-European – linked to the Network Manager. For NMHSs, it was also very interesting and important to understand the SES performance measures and their monitoring through key performance areas on safety, environment, capacity and cost efficiency. European targets have been established as moving targets periodically reviewed. The clear common goal of establishing one single flow management system over Europe poses a strong requirement to MET providers for consistent, consolidated MET information. Currently, the MET information is not appropriately integrated in the ATM decision-support system; this should be an ultimate goal that includes the translation of the MET information into impact information to feed impact models for risk management by the end users.

Another key message is the EASA (i.e., EC) goal to establish a total system approach for safety, environment and level playing field in support of the European aviation industry, to tackle the expected growth and facilitate creation of jobs. NMHSs and other AMSPs should have clear understanding of the relationship between the ICAO and EU regulations and between EASA and governments: ICAO provides global requirements (standard and recommended practices – SARPs), EC implements these standards through a centralized rule-making process. This process ends in providing of a set of common rules for all EU and EASA Members States.

It was clear from several presentations that the weather-related impacts on air traffic are on the rise and there is a strong need for better weather information including for crisis management. EASA risk portfolio positions the weather-related risks close to the top of the list of all risks. The challenge comes also from the trend of diversification of service provision in Europe (250 certified ANSP providers, including 80 AMSPs) which is also potential for competition that should be clearly understood by the “traditional” service providers (NMHSs) and included in their forward strategic planning.

#### Key messages:

- NMHSs and other AMSPs need to understand better the SES performance framework and targets and adapt their MET services to aviation accordingly.
- A key task for the AMSPs for the near future will be the integration of MET information into ATM decision making and risk management models.
- Implementations of the common EASA rules - a specific regional challenge for the AMSPs.
- The provision of MET service to aviation will be more and more a competitive field – need to adapt.

**IATA and IFALPA presentations** sent clear messages on the needs for change in serving airlines and pilots with meteorological information that is fit for purpose and reflect the current state of technology. The IATA vision for handling big data and their interest to enter the meteorological data supply through a global facility with data from aircraft could become a game changer in the future. On the other hand, airline pilots express the need for better meteorological information NOW. The current standard products used by pilots on a daily basis have been defined 50 years back and there is a feeling that new innovative technology is coming very slow. Pilots need better information for in-flight decisions which prompts the need for uplink of near-real-time information. Overall, AMSPs have to understand better the evolving user needs and how the meteorological information is used by different stakeholders in the modern aviation realities. The MET information feeds complex decision supporting systems and the decisions are made not necessarily by humans but by machines and systems. In the future “data-centric” environment, different users will “pull” MET information according to the needs of their decision-making processes. At the same time, we should not forget that there are people that need to understand the information correctly (e.g., SIGMET), thus human factor not to be forgotten.

In an additional comment, *Ian Cameron* stressed the need to include the flight-planning companies in the “aviation landscape” picture and to understand their role and their needs for meteorological information (companies like LIDO, Jeppesen, etc.). In terms of use and decision-making process, there is an airline view, a pilot view and flight-briefing view that are not the same all the time. These should be brought together as one system view on weather information needed and available. This is critical for planning the future production and information supply at all levels; currently, discrepancies exist between the MET capability for information supply and users’ capability to ingest and use such information, e.g., WAFCs are currently able to produce better resolution data but this is hold on by the capability of the current flight briefing systems to process and handle such data.

#### Key messages (Users’ perspective):

- Airlines are striving to build global facility for handling “big data”; MET data from aircraft will become a major information source in the future “data-centric” environment.
- Strong call from pilots for delivery of better MET information to support in-flight decisions.
- Increasing need for NMHS and other AMSPs to engage with users in seeking further opportunities to enhance service provision.
- NMHSs and other AMSPs need to understand better the evolving functional needs and modes of utilization of MET information by different stakeholders (i.e., airlines, pilots, flight-planners) and their respective decision-making processes; such knowledge will be critical for development of future MET information and services.

**Axel Thomalla**, summarized the examples of national aviation MET service provision that present the different situations existing currently in Europe. Austria, with a business model of AMSP being part of ATM, demonstrated the opportunities for sharing the cost and infrastructure with the NMHS (ZAMG) through a successful cooperation agreement that brings mutual benefits. The model also poses risks and challenges in view of the overall performance requirements for centralization and harmonization of services at national and even regional level (e.g., the plan for establishment of RHWACs). A specific issue related to such regionalization, in particular for those parts of Europe with very complex terrain, is how to secure the quality and added value of the meteorological information and products.

The situation in Germany, presented in the DWD presentation, was indicative for the challenges the NMHSs are facing in the growing competitive situation. There are important strategic decisions to be made by NMHSs: whether to provide just ICAO Annex 3 (cost-recovered) services, or to enter into the broader service provision on competitive basis. The answer of this question is critical for building the strategy and positioning of the NMHSs; it is also related to the issue of right way of communication with stakeholders and the EC. There is

a general need to make governments and EC aware of the role and capabilities of NMHSs and the need to account for the core infrastructure and knowledge/expertise.

The situation in the Eastern part of the region has its own specifics and differences to the Western part, but the general trend to a more competitive market exists there, too. The well-established regional cooperation approach between the CIS States should be seen as a good sub-regional practice. The main issue there is to tackle the ICAO GANP and ASBU challenges.

#### Key messages (NMHS perspective):

- Need to enhance the cost recovery mechanisms in such a way as to account for the sustainability of the huge meteorological systems, in particular the observational infrastructure supporting aviation MET service provision.
- Need to position NMHSs properly into the aviation MET service delivery based on a better understanding of the expertise and capabilities by decision makers at national and regional level.
- Cross-border coordination and cooperation will become more and more important (e.g., the current coordination of SIGMET in some sub-regions).
- Need to develop strategies and approaches to cope with the competitive environment.
- MET community should look at EU regulation and SESAR deployment as offering opportunities; a proactive approach is needed in order to “shape the future”.

**Marina Petrova** emphasized the point that the MET community should proactively work at all levels to “shape the future” of the meteorological service provision in line with the GANP and ASBU. In this regard, the new opportunities have already been worked on as shown in the excellent presentations by Météo-France and NAMCon. Such opportunities could materialize in terms of meeting new operational requirements for information and services in terminal area, airports or en-route. At present, these services are regarded as “non-Annex 3”, therefore, it is crucial to work very closely with the ATM stakeholders in defining the design and operational procedures.

NAMCon is an excellent example of multinational cooperation and should be regarded as a model for the future regionalization of services. NAMCon is also a format that allows to adapt to the competitive conditions by gaining efficiency through synergy and optimization of resources. This approach should be strongly recommended for other NMHSs to review and learn from NAMCon experience in order to prepare for the planned regionalization of such services like SIGMET.

#### Key messages:

- Promote good practices and share information between RA VI Members in developing innovative services in support of ATM.
- Encourage sub-regional (multinational) cooperation in service provision; study the experience of NAMCon as a prototype of the future regionalization.

In his recapitulation remarks, **Dimitar Ivanov** concluded that the main objective of ECMA-2015, raising awareness of the GANP and ASBU developments and potential impacts has been achieved. The conference provided the opportunity for hearing from different stakeholders and RA VI Members. RA VI and CAeM with their respective subsidiary bodies should analyze the key messages to derive future coordinated actions. The need for further guidance on governance and business models has already been addressed by the CAeM with the plan to provide in the 2016-2017 timeframe a completely revised and updated WMO *Guide on Practices for Meteorological Offices Serving Aviation (WMO-No.732)*. In this regard, ECMA-2015 provided excellent input material.

The complexity of the European aviation landscape is a big challenge, however, it also offers many opportunities for the NMHSs and other AMSPs. There are no ready recipes about which business model is best, but we could better describe options with their “pros and cons” and share good practices. The GANP and ASBU guided developments toward the future ATM at global and regional level will require research and development in the MET and the available expertise of WMO should be better utilized. WMO should also embrace the ICAO slogan “No country left behind”. A strong message from ECMA-2015 is that regional cooperation is the key that would help our mission as a vital air navigation stakeholder.

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