Guide to Aeronautical Meteorological Services Cost Recovery

Principles and Guidance

2023 edition

WEATHER CLIMATE WATER

WORLD METEOROLOGICAL ORGANIZATION

WMO-No. 904

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EDITORIAL NOTE

The following typographical practice has been followed: Standard practices and procedures have been printed in **bold**. Recommended practices and procedures have been printed in regular font. Notes have been printed in smaller type.

METEOTERM, the WMO terminology database, may be consulted at https://wmo.int/wmo-community/meteoterm.

Readers who copy hyperlinks by selecting them in the text should be aware that additional spaces may appear immediately following http://, https://, ftp://, mailto:, and after slashes (/), dashes (-), periods (.) and unbroken sequences of characters (letters and numbers). These spaces should be removed from the pasted URL. The correct URL is displayed when hovering over the link or when clicking on the link and then copying it from the browser.

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NOTE

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Date	*Part/ chapter/ section*	*Purpose of amendment*	*Proposed by*	*Approved by*
February 2023	All	To align with presiding cost recovery principles and examples of good practice	Recommendation 2 (SC-AVI-2) and Recommendation 13 (SERCOM-2)	Resolution 8 (EC-76)

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FOREWORD

This Guide was originally published in 1999 and subsequently updated in 2007. Over the years the Guide has proved of great value to WMO Member States and Territories. It has guided them on the cost recovery process, since for many National Meteorological and Hydrological Services (NMHSs), as well as non-NMHS entities, the provision of aeronautical meteorological services represents a significant proportion of their output.

In 2016/2017 the Commission for Aeronautical Meteorology (CAeM) conducted a global survey of WMO Members on the provision of aeronautical meteorological services. More than 90% of the 193 Members of WMO responded to the survey. Some 40% of WMO Members provided information concerning cost recovery arrangements in their State or Territory. Notwithstanding the existence of cost recovery guidance from WMO as well as the International Civil Aviation Organization (ICAO), many survey respondents commented that their State or Territory lacked a cost allocation system, that existing cost recovery programmes were ineffective, or that their State or Territory lacked such a system or detailed plans to implement one.

In 2019 the CAeM conducted a further global survey. This survey sought to ascertain the sensitivity of WMO Members and their aeronautical meteorological service providers to prevailing and foreseen changes in the supply of aeronautical meteorological services, linked to a more general modernization of the air transport system (a system of systems). The survey found that while most WMO Members with a cost recovery scheme for their aeronautical meteorological services were satisfied that their scheme could sustain basic and underpinning meteorological infrastructure into the next decade (2020s), a number of WMO Members expressed dissatisfaction in this regard, especially Members in WMO Regional Association I (Africa) and Regional Association III (South America).

These two surveys highlighted a need to ensure that WMO-No. 904 continues to provide reliable, relevant principles and guidance for Members so that they can implement cost recovery schemes at national, regional or global levels that enable their aeronautical meteorological services – NMHS or non-NMHS – to be adequately and sustainably resourced.

As aviation stakeholders work collectively to support modernizing strategies, including those envisioned in the ICAO Global Air Navigation Plan, it will be necessary to harness scientific advances, invest in new technologies and update working practices, and WMO Members will need to ensure that their cost recovery arrangements continue to meet their needs as the aviation industry adopts digital information services.

I wish to express my gratitude to all those who have devoted time and effort to the task of updating this Guide, including Colin Hord for authoring the Guide and others listed below for providing input to or a review of all or part of the Guide.

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CHAPTER 1. INTRODUCTION

INSTITUTIONAL ARRANGEMENTS

1.1 National Meteorological, Hydrometeorological and Hydrological Services (hereinafter referred to simply as National Meteorological Services) are funded in many different ways. They are often funded as part of a government department (such as transport or environment), and at least one National Meteorological Service is a private sector (commercial) enterprise. National Meteorological Services have many responsibilities, but in many countries one of their key responsibilities is to service the needs of aviation; indeed, in many developing countries providing services for aviation is their primary or sole responsibility. While most National Meteorological Services provide aeronautical meteorological services, in some countries they are provided by different entities, such as air navigation service providers, the military, separate government organizations or commercial companies. For this reason, this Guide will, where appropriate, refer to aeronautical meteorological service providers rather than National Meteorological Services. The institutional setup of an aeronautical meteorological service provider must not affect the fundamental principles of cost allocation, nor must the institutional setup have any disadvantages for aviation.

1.2 Early on in the history of aviation, it was decided that, in the interests of safety, regularity and efficiency, each country would provide agreed services for international civil aviation such as air traffic services, search and rescue, aeronautical telecommunications as well as meteorology, which would be paid for by international aviation, usually through the collection of fees for landing at airports in a country (referred to as landing fees) and fees charged for flying within a country's area of responsibility (referred to as en-route charges).

THE CHICAGO CONVENTION

1.3 To formalize the provisions for serving international civil aviation, the Convention on International Civil Aviation was drawn up in Chicago in 1944. This Convention, usually known as the Chicago Convention, is an international treaty, and the provisions contained in its articles are legally binding on the signatories, known as Contracting States (hereinafter referred to simply as States), without exception. Unless they officially notify the International Civil Aviation Organization (ICAO) otherwise, the States undertake to comply with ICAO standards. Since States have to deliver air navigation services according to ICAO standards, they must define a national policy for their financing that complies with the ICAO global charging policy. The global policy established by ICAO in the area of airport and air navigation facility charges is contained in Article 15 of the Chicago Convention, which in summary sets out three basic principles:

(a) Uniform conditions shall apply to the use of airport and air navigation facilities in one State by aircraft of all other States;

(b) Charges for facilities shall not be higher for aircraft of other States than those paid by national aircraft;

(c) No charge shall be imposed by a State solely for granting authorization for a flight into, out of, or over its territory.

Note: In this instance and henceforth throughout this Guide, the use of the word "State", meaning Contracting State of ICAO, is synonymous with the word "Member", meaning Member State or Territory of WMO. "Country" (or "countries") is also sometimes used herein interchangeably with "State(s)" or "Member(s)".

ANNEX 3 TO THE CHICAGO CONVENTION

1.4 The Chicago Convention has 19 annexes dealing with various aspects of aviation. The annex dealing with meteorology is Annex 3, titled *Meteorological Service for International Air Navigation*. Annex 3 contains the international standards and recommended practices (SARPs), and is amended, when required, by ICAO in consultation with States and concerned international organizations including WMO.

Note: The following references to paragraphs within Chapter 2 of Annex 3 pertain to those provisions in the twentieth edition, July 2018, of Annex 3 comprising Amendments 79 and 80 applicable on 5 November 2020 and 4 November 2021, respectively. Future amendments, such as Amendment 81 to Annex 3 with intended applicability on 28 November 2024, may amend these provisions.

1.5 It is worth noting some of the opening general provisions in Chapter 2 of Annex 3. Paragraph 2.1.1 states that "The objective of meteorological service for international air navigation shall be to contribute towards the safety, regularity and efficiency of international air navigation." Paragraph 2.1.2 of Annex 3 indicates how this is to be achieved, that is, "by supplying the following users: operators, flight crew members, air traffic services units, search and rescue services units, airport managements and others concerned with the conduct or development of international air navigation, with the meteorological information necessary for the performance of their respective functions."

1.6 Paragraph 2.1.3 of Annex 3 specifies how the meteorological service which a State provides to meet the needs of international air navigation shall be determined, that is, in accordance with the SARPs of Annex 3 and with due regard to ICAO regional air navigation agreements. The meteorological service to be determined in this way shall be provided to meet the needs of international air navigation over international waters and other areas which lie outside the territory of the State concerned.

Notes:

1. Standards and recommended practices (SARPs): Annex 3 indicates those actions and services that "shall" be provided, which in these terms are taken as being a regulatory standard. These standards are recognized as being necessary for the safety, regularity and efficiency of international air navigation, and States must conform to them. On the other hand, actions and services that "should" be provided, as indicated in Annex 3, are recommended practices to which it is desirable for a State to conform.
2. Domestic services: It is important to recognize that Annex 3, as part of the Chicago Convention and related ICAO Regional Air Navigation Plans, only applies to international air navigation. The provision of services for domestic flights is wholly the responsibility of the State concerned. It is advisable that States adopt practices similar to those specified in Annex 3, but this is not mandatory. Similarly, it should be noted that the information given in this Guide relating to cost recovery is primarily written with respect to international services provided in accordance with Annex 3; however, costs relating to domestic services may also be recovered provided agreement is reached between the stakeholders concerned.

METEOROLOGICAL AUTHORITY

1.7 Another important concept is that of the role of the "meteorological authority". Paragraph 2.1.4 of Annex 3 states that "Each Contracting State shall designate the authority, hereinafter referred to as the meteorological authority, to provide or to arrange for the provision of meteorological service for international air navigation on its behalf." It is important that an aeronautical meteorological service provider know who, in their State, the designated meteorological authority is with respect to ICAO, since only the meteorological authority can recover costs directly from aviation through air navigation charges. However, this may not be as simple as it sounds. While the authority responsible for providing the meteorological services to aviation is listed in the ICAO Directory of National Civil Aviation Administrations (DGCA Directory), which can be found on the ICAO secure portal, there can be different interpretations on the role of the meteorological authority.

Notes:

1. The meteorological authority in some States has a regulatory function, with the responsibility both for arranging for the services to be provided and for the regulatory aspects of the aeronautical meteorological service. This role should be considered separately from that of the meteorological service provider that has the responsibility of providing aeronautical meteorological services for a State.
2. For example, in the European Union (EU) aeronautical meteorological service provision is within the Single European Sky (SES) legislative framework. This framework sets out the responsibilities of regulators, supervisors and service providers for international air navigation. There is a requirement for functional separation to exist between regulatory duties, such as certification, oversight and enforcement tasks, and the provision of the service. An EU Member State has the possibility of designating a meteorological service provider on an exclusive basis, for safety considerations, but may also choose to leave the service open to several service providers, provided that they have a certificate proving that they comply with the EU legislation. For EU Member States it is common practice to have the ICAO-recognized meteorological authority established at the regulatory/supervisory level, often as part of their national civil aviation authority, rather than at the service-provision level.
3. However, for approximately 20% of States worldwide, the regulatory aspects of the meteorological authority currently remain the responsibility of the National Meteorological Service. While there are advantages and disadvantages in each option, it is a matter for the State to decide.
4. Should a State find that the entry for its meteorological authority in the ICAO Directory of National Civil Aviation Administrations (DGCA Directory) is outdated or missing, steps should be taken by the national civil aviation authority to ensure that either the National Meteorological Service or the national civil aviation authority is listed in the ICAO directory as the meteorological authority for the State. A simple letter to ICAO headquarters in Montreal from the national civil aviation authority advising ICAO of the designation is sufficient.
5. Where the aeronautical meteorological service provider is not the National Meteorological Service there is usually a bilateral agreement (or similar) between the aeronautical meteorological service provider and the National Meteorological Service to enable the exchange of basic meteorological data (for example, basic synoptic data, weather radar data and satellite imagery) required to produce the ICAO Annex 3 products and services.

NATIONAL CHARGING POLICY

1.8 Given that any service has a cost, any air navigation service, including an aeronautical meteorological service, has to be financed in some form. It is the responsibility of the State, through its meteorological authority, to take appropriate cost recovery measures for such financing to be organized. The financing arrangements that are in general use around the world, consistent with Article 15 of the Chicago Convention and the ICAO key charging principles, include the following:

(a) Financing of all or part of the service provision by taxpayers through the general State budget.

(b) Financing of all or part of the service provision through specific taxes, part of which is directly allocated to the service provider. The decision to establish such taxes is a sovereign decision of the State and no justification is required.

(c) Financing of all or part of the service provision through user charges (en-route charges or landing fees). It is generally understood that the level of charges is directly related to the service delivered, and that it should be justified. In such cases, the service provider is generally requested to justify in a transparent manner the use of the funds allocated from the user charges, as service provision costs are carefully monitored by the national authorities (this is sometimes called “economic regulation”).

(d) Financing of all or part of the service purely under market conditions while still adhering to the SARPs set out in Annex 3.

(e) A combination of the above options.

1.9 Entities that deliver meteorological services to international air navigation may well be financed from several sources for this service, depending on the national policy. In any case, it is increasingly necessary for an aeronautical meteorological service provider to properly assess the cost of the service it delivers.

QUALITY MANAGEMENT

1.10 Since 2010, Annex 3 has required States to establish and implement a properly organized quality system comprising procedures, processes and resources necessary to provide for the quality management of the meteorological information to be supplied to aviation users. It is recommended that this quality system be in conformity with the International Organization for Standardization (ISO) 9000 series of quality assurance standards and be certified by an approved organization.

1.11 Quality management is a process that focuses not only on the quality of the product or service but also on the means to achieve it. It is centred on four activities: quality planning, quality control, quality assurance and quality improvement. Quality control aims to ensure that quality requirements have been fulfilled prior to the dissemination of a product or the delivery of a service. Quality assurance aims to instill confidence that quality requirements have been met. It involves the systematic monitoring and evaluation of the processes associated with the generation of a product or service. The quality management system provides essential information for any State that is undertaking cost recovery. Some of the key quality management principles are: a customer focus, a process-driven approach and evidence-based decision-making. All of these assist cost recovery activities.

1.12 The *Guide to the Implementation of Quality Management Systems for National Meteorological and Hydrological Services and Other Relevant Service Providers* (WMO-No. 1100) describes quality management systems, provides guidance on their implementation and contains a number of useful annexes to assist that process.

1.13 The quality management system provides many organizational benefits, especially in relation to cost recovery, such as the following:

(a) Having a strong customer focus, which ensures that customers' needs and expectations are identified, met and monitored. The quality management system will assist with ensuring that all relevant stakeholders are identified and their expectations are being met – making certain these relationships are being well managed.

(b) Having suitable planning and management systems that allow for a good control and cost reporting regime to be in place so that costs can be allocated appropriately.

(c) Performance evaluation through the monitoring of externally provided products and services using verification and key performance indicators (KPIs), which enables continuous improvement. These may include indicators associated with forecast accuracy, service timeliness (that is, ensuring services are delivered to customers punctually), compliance with international coding standards, up-time of computer systems (such as those that provide briefing services) and user-driven metrics (such as the number of minutes of delay at an airport that occurs due to low-visibility procedures being in place).

(d) Corrective actions are implemented when processes fail, or lower-quality products, often called backup products, are produced, thereby guaranteeing customer satisfaction.

1.14 Many States have also implemented a service delivery strategy which has at its heart increasing user engagement throughout the service delivery chain. When delivering aeronautical meteorological services, focusing on customers is considered one of the most important quality management principles. As noted, the quality of the services as perceived by the users should be monitored. This can be achieved by verification of the services, regular satisfaction surveys and liaison group meetings with customer representatives (such as pilots, dispatchers, air traffic

personnel and civil aviation authority representatives). These meetings can serve as excellent fora for discussing cost recovery related issues, for example current and evolving user needs, how services will be used, changes in service requirements, quality versus cost, and cost allocations. *The WMO Strategy for Service Delivery and its Implementation Plan* (WMO-No. 1129) provides more details and includes a toolkit of documents and templates which can assist those undertaking cost recovery activities.

STAKEHOLDER RELATIONSHIP MANAGEMENT AND CONSULTATION

1.15 A key element of undertaking cost recovery is to ensure that stakeholders (service users, regulatory bodies and government departments) and the aeronautical meteorological service provider have regular opportunities for consultation. This ensures that all services being provided are relevant and that there is transparency in costs. It is recommended that consultation between the aeronautical meteorological service provider, the authorities and the users should take place on a regular basis, at least once a year.

These consultations should cover:

(a) Establishment and agreement over the inventory of the facilities and the international services required as set out in Annex 3 (for example, observations, forecasts, advisories, warnings and briefings) along with any services agreed at a national level (for example, additions to the international Annex 3 services, domestic services and services for general aviation, ballooning, etc.);

(b) Agreement on the quality of the service;

(c) Planned aeronautical meteorological research and development;

(d) Discussions on any significant changes in services and products, along with the impact on potential costs and the quality of the services being provided;

(e) The cost allocation methodology used for both “direct” and “core” facilities and services, including any expected changes to allocations or use of different cost categories;

(f) Discussions on the cost recovery process.

The aims of the consultation process are to ensure that:

(a) The services provided meet user expectations;

(b) Services are being delivered in an efficient manner, are effective and provide value for money in relation to the quality of the service required;

(c) Services and costs are transparent and accepted by the users;

(d) Cost allocation is equitable, with no users being burdened with costs not allocable to them.

RELEVANT ICAO DOCUMENTS

1.16 Before any cost recovery activities are undertaken, the following ICAO documents (as a minimum) should be obtained either from the national civil aviation authority or directly from ICAO, as they provide the necessary detailed, official information:

(a) ICAO Directory of National Civil Aviation Administrations (DGCA Directory), which can be found on the ICAO secure portal. This details the entity designated to ICAO by the government as the meteorological authority in each State.

(b) Annex 3 to the Convention on International Civil Aviation – *Meteorological Service for International Air Navigation*.*[1]

(c) Annex 11 to the Convention on International Civil Aviation – *Air Traffic Services*.*

(d) *Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM)* (ICAO Doc 4444).*

(e) *Procedures for Air Navigation Services – Meteorology (PANS-MET)* (ICAO Doc 10157).*†[2]

(f) The relevant Regional Air Navigation Plan publication.*

(g) *ICAO's Policies on Charges for Airports and Air Navigation Services* (ICAO Doc 9082). This document encourages States to incorporate the four key charging principles – non-discrimination, cost-relatedness, transparency and consultation with users – into their national legislation, regulations, policies and service agreements.

(h) *Airport Economics Manual* (ICAO Doc 9562). Guidance material for those responsible for airport management, including setting and collecting charges on air traffic.

(i) *Manual on Air Navigation Services Economics* (ICAO Doc 9161). The most important document in the context of cost recovery, this manual contains a number of appendices, including one which gives detailed guidance on determining and allocating aeronautical meteorological costs.

(j) *Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services* (ICAO Doc 9377). This document includes a description of the operational structure to provide air traffic and meteorological services, including coordination of actions between air traffic services and meteorological offices. This information should be used to create an inventory of facilities and services needed to meet aviation user requirements.

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1 * These documents detail the meteorological services that States agree are necessary for aviation.

2 † To be available from November 2024.

CHAPTER 2. GENERAL PRINCIPLES

2.1 Three cost elements need to be derived to recover the cost of aeronautical meteorological service provision:

(a) Direct costs of the aeronautical meteorological services provided as part of a State's responsibilities under Annex 3 to the Chicago Convention, along with the costs of any services agreed to be provided nationally;

(b) Cost allocations associated with the share of the meteorological infrastructure (known as "core costs") for aeronautical meteorological service provision;

(c) Overhead costs associated with running the aeronautical meteorological service (administration, depreciation, maintenance, etc.).

2.2 Aeronautical meteorological service providers that provide services for international air navigation are bound by ICAO's policies concerning air navigation service charges, which are detailed in ICAO Doc 9161.

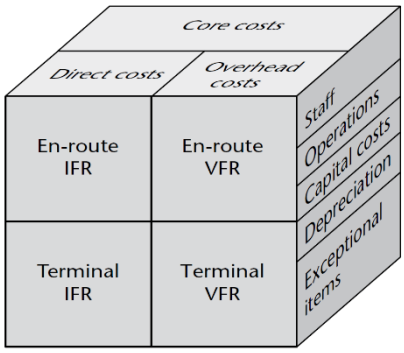
2.3 Meteorological services are provided to many users across a spectrum of sectors, which can include aviation, maritime and other transport domains, civil protection, agriculture, fishing, hydrology, energy, retail, sports and recreation, tourism, building and construction, the press and other media, and private weather companies, as well as being provided to the general public. To ensure that they can provide all these services in a cost-efficient manner, National Meteorological Services typically develop them using common key meteorological infrastructure. Associated costs are known as "core costs". Core costs should be allocated to all users in an equitable manner.

2.4 Furthermore, when establishing general principles for the determination, allocation and recovery of the cost of meteorological services to international air navigation, a clear distinction should be made with other air navigation services (for example, air traffic services and aeronautical information services) by all the authorities and users involved. It should also be noted that there is no correlation between the full cost associated with meteorological services being provided and the number of aircraft landing at an airport in a State or overflying a State's territory.

2.5 Where meteorological services provided are solely for aviation, often referred to as direct services, the full costs of providing these services can, at the discretion of the State, be recovered from users. This is usually achieved through agreement between the users, the national civil aviation authority, the meteorological authority and the aeronautical meteorological service provider. Precise arrangements for cost recovery will vary from one State to another depending on the size of the operation, the range of services provided and the legislative arrangements in place. Nonetheless, under the ICAO guidelines, it is necessary to ensure that where a service is solely for an airport the costs are solely recovered from airport fees, while if the service solely applies to aircraft in flight (en-route) the costs are solely recovered from air navigation charges. If this clear distinction cannot be made, costs should be apportioned between airport and en-route services. Some of these services and their suggested allocation are indicated in Annexes I and II to this Guide. Besides differentiating between airport and en-route utilization, it may appear necessary to allocate costs among categories of users. A further distinction is made between a service solely for flights operating under instrument flight rules (IFR), to ensure that the costs are recovered only from IFR users, and flights solely operated under visual flight rules (VFR), whose costs should be recovered from VFR users. Annexes III and IV to this Guide indicate services used solely for IFR flights, solely for VFR flights or for both in varying proportions if a clear distinction cannot be made.

2.6 As alluded to in 2.3, National Meteorological Services generally provide services to a number of different users (and sectors) in addition to those in aviation. In these instances it becomes necessary to consider an equitable apportionment of the costs of the shared facilities and services that underpin the national capability of the meteorological service; these are

referred to as core services. For instance, the central infrastructure and facilities of any National Meteorological Service, such as the observing network and equipment, communications facilities, centralized administration, training, computing, data processing facilities, and research and development, are all used to provide services to several user groups, including aeronautical users (see Annex V to this Guide). These services are also essential for aeronautical meteorological service providers designated or contracted by a State that provide meteorological services to international aviation without being part of a National Meteorological Service (for example as part of the air navigation service).



Breakdown of cost elements

When the costs of these core services are equitably apportioned amongst all users, the total costs to be recovered from each user are reduced. It would be advisable for each State to clearly define and agree on the core services after consultation with all user groups. The diagram above gives a schematic breakdown of cost elements.

2.7 Special recognition should be given not only to the importance of National Meteorological Services' core services to the State itself but also to the value that observations and forecast products have when shared with other States as well as ICAO-designated world area forecast centres (WAFCs), volcanic ash advisory centres (VAACs), space weather centres (SWXCs) and tropical cyclone advisory centres (TCACs). Observations are a crucial component of meteorological services and are primarily used to create accurate forecasts (via assimilation into the numerical weather prediction models) and verify the accuracy of forecasts and warnings. Observations can also be used directly by users and meteorologists to understand the current weather and how it may change in the short term. All National Meteorological Services are dependent upon the global exchange of essential data using common standards for use within forecast and observing systems. WMO and other international organizations assist the exchange of essential data through the establishment of the WMO World Weather Watch, one of the aims of which is to address the data gaps globally. Exchanging this information is an important component of a meteorological service's national capability. Thus, even in cases where the services to international air navigation by a National Meteorological Service are very limited, it is still appropriate for a portion of the cost of core services to be recovered through the national cost recovery system from international air navigation.

2.8 States should also take into account any investments that may be required to accommodate international initiatives seeking to substantially modernize the entire aviation system. ICAO's Global Air Navigation Plan (GANP) sets out how the global air navigation system is creating a series of operational improvements to increase capacity, efficiency, predictability and flexibility while ensuring interoperability of systems and the harmonization of procedures. Two global technical frameworks have been developed, a basic building block (BBB) framework, which conveys the essential air navigation services that will be provided for international civil aviation, and a series of aviation system block upgrades (ASBUs), which details a series of modules that define a flexible global engineering approach allowing States to advance their air navigation capacities based on their operational requirements. A number of meteorology-related ASBUs have been defined which include improvements to how meteorological information is distributed. One of the block upgrades, for example, introduces the use of system-wide information management (SWIM), which will enable all types of information, including meteorological information, to be distributed in a form that will easily be processed by machines.

2.9 The cost of providing an aeronautical meteorological service will vary considerably from State to State. Some States may have only one or two international airports, whereas others may have many airports and be responsible for providing a meteorological watch office (MWO) or an international aeronautical meteorological service at the regional or global level (for example, WAFC, VAAC, SWXC or TCAC). The cost of providing the required services will obviously be much higher in the latter case due to the wider range of responsibilities. Similarly, the allocation of core costs between the different user groups can differ widely between States, and so it is not possible to provide specific guidance in the form of a percentage here.

2.10 An Extraordinary Session of the World Meteorological Congress in 2021 (Cg-Ext(2021)) adopted a revised data policy for WMO. The key principles are that WMO has created definitions for core and recommended data (as described in Annex 1 to Resolution 1 (Cg-Ext(2021)). "Core data" are provided on the basis of free and unrestricted use for all applications and users, whereas "recommended data" are provided on a level playing field basis, that is, the same fee for all users. In cost recovery terms, when basic meteorological data (for example, observational data) are provided using a national meteorological infrastructure, which has a specific and agreed requirement from aeronautical users, costs for these data should be recovered on the basis of an allocation of marginal costs (on top of costs for WMO recommended data). When data, products, services or infrastructure are provided solely for aeronautical users, then full cost recovery should be undertaken through the air navigation charges. When aeronautical meteorological data, products, services or infrastructure are provided as part of the National Meteorological Service's basic data set, then the allocation to aviation will incur marginal costs, that is, full cost recovery should not be undertaken through air navigation charges.

CHAPTER 3. GENERAL PROCEDURES FOR ALLOCATING COSTS

3.1 When allocating costs, it is necessary to look closely at each element of the meteorological services concerned and determine the extent to which its functions are attributable to aeronautical requirements. To do this, it is necessary to:

(a) Establish and agree on an inventory of the facilities and services to be provided by the aeronautical meteorological service provider to meet the international requirements stated in the provisions of Annex 3 to the Chicago Convention and any additional requirements specified and agreed at national level by the national civil aviation authority and/or the meteorological authority.

(b) Determine all associated costs attributable to the provision of aeronautical meteorological services for the following: operational, research, administrative and maintenance technician staff; operations (supplies, consumables, equipment rental, fixed-line and mobile telecommunications, etc.); equipment maintenance activities; property; research and development; and overheads and costs associated with the capital asset register. Each of these costs should be assessed for each facility and service.

(c) Establish an appropriate basis for allocating costs of the core services between all user groups on the basis of a level playing field.

These steps are described below in more detail.

INVENTORY OF FACILITIES AND SERVICES NEEDED TO MEET AERONAUTICAL REQUIREMENTS

3.2 It is necessary to specify all the meteorological facilities and services needed to meet the international requirements as given in the provisions of Annex 3 to the Chicago Convention. The meteorological services for international air navigation include: meteorological observations, reports, forecasts and warnings; wind shear warnings and alerts; briefing and flight documentation; en-route forecasts; tropical cyclone, volcanic ash and space weather advisories; SIGMET and AIRMET information; meteorological information for search and rescue operations; production and processing of World Area Forecast System (WAFS) data used for flight planning; operational meteorological (OPMET) information for inclusion in VOLMET and D-VOLMET broadcasts and Automatic Terminal Information Service (ATIS); international OPMET centres and databanks; aeronautical fixed service (AFS) facilities and any other meteorological service required by States for aeronautical use. The facilities required to provide such services include world area forecast centres (WAFCs), volcanic ash advisory centres (VAACs), tropical cyclone advisory centres (TCACs), space weather centres (SWXCs), meteorological watch offices (MWOs), aerodrome meteorological offices, aeronautical meteorological stations, meteorological equipment for aeronautical purposes (including observing instruments and systems) and telecommunications equipment for aeronautical meteorological purposes. Additionally, the inventory may include various supporting (core) facilities and services that also serve meteorological requirements in general. These include forecast guidance issued centrally, as well the running of computer models that provide numerical weather prediction forecasts, surface and upper-air observing networks, meteorological communication systems, data processing centres and supporting research and development, IT support, quality control, training, management and administration. The contribution of experts to support the work of international organizations such as WMO and ICAO may also be a consideration. In the case of facilities and services used for many different purposes (for example, public weather services, disaster reduction services, marine meteorological services and aeronautical meteorological services), the attribution of costs must be appropriately allocated between aeronautical and non-aeronautical users. ICAO's four key charging principles – non-discrimination, cost-relatedness, transparency and consultation with users – are of critical importance in this regard (see ICAO Doc 9161).

3.3 Additional services may be specified and agreed between the national civil aviation authority and/or the meteorological authority along with the designated/contracted meteorological service provider and the aviation users. Such additional services could include forecasts to support general aviation activities (gliding, ballooning, etc.) and forecasts for optimizing air traffic services operations (for example, impact-based forecasts for arrival/departure sequencing and air traffic flow management). Any additional facilities or services, including bespoke or customized forecasts, provided at the request of a single or limited number of aviation users that are not approved and agreed to by the national civil aviation authority and/or meteorological authority are deemed to be beyond the scope of the aforementioned cost recovery arrangements and, accordingly, should be directly charged by the aeronautical meteorological service provider to the aviation user(s) concerned.

3.4 The inventories of facilities and services will vary from State to State depending on the aeronautical requirements to be met. They can be divided into:

(a) Facilities and services needed to serve exclusively aeronautical requirements;

(b) Facilities and services needed to serve both aeronautical and non-aeronautical requirements.

3.5 Annexes I and III list facilities and services intended to serve aeronautical users exclusively, as related to their utilization. Annexes II and IV list the products and functions to be provided by the aeronautical meteorological service provider to meet these aeronautical requirements, as related to their utilization. Annex V lists the core facilities and services, which may serve both aeronautical and non-aeronautical users.

3.6 Not every aeronautical meteorological service provider is required to provide all the facilities and services listed in Annexes I to V. However, apart from any extra services agreed nationally, a subset of these inventories should describe the facilities, services, products and functions to be provided by every aeronautical meteorological service provider.

3.7 The process of establishing an inventory of services needed for aeronautical use is based on a common understanding between users, authorities and provider(s) on what is needed to ensure safety, efficiency and regularity of the air transport system in the area of responsibility. Where this common understanding is not possible, the national civil aviation authority and/or the meteorological authority in consultation with the aeronautical meteorological service provider should institute a service based on a list of required meteorological services for aeronautical use as described in the provisions of Annex 3 to the Chicago Convention. As a result, there is always a formal State requirement for the services to be provided by the aeronautical meteorological service provider and therefore a solid foundation for full cost recovery.

IDENTIFYING THE COST OF EACH FACILITY OR SERVICE

3.8 After discussion with the national civil aviation authority and/or the meteorological authority as well as users, a list of required aeronautical meteorological services should be established. Following this, all the appropriate costs should be identified for each facility or

service. These costs are likely to include the following: operations, research, administration, equipment maintenance activities, property, research and development, and overheads and costs associated with the capital asset register.

Specimen list of costs

Operational staff costs
- Salaries
- Allowances
- Pension contributions
- Social insurance
- Overtime/On call payments

Equipment costs
- Capital costs
- Renewal costs

Maintenance staff costs
- Salaries
- Allowances
- Pension contributions
- Social insurance
- Overtime/On call payments

Property costs
- Rent
- Maintenance
- Utilities (gas, electricity, water, sewerage, backup power, etc.)
- Communications (telephone, Internet)

Operational costs
- Operational consumables
- Operating licences
- Equipment rental
- Operational staff transport
- Consultants
- Meteorology-related training
- Telecommunications

Overheads
- Management
- Administration
- Training (not meteorology related)
- Insurance
- Verification/Quality control/Quality management
- International subscriptions
- Stakeholder engagement costs
- Research and development for aeronautical meteorological services

Maintenance costs
- Materials and spares
- Software maintenance
- Maintenance staff transport
- Contractors

Capital asset register
- Capital costs of capital acquisitions or depreciation
- Interest

3.9 The costs of aeronautical meteorology-related training, research and development should typically be about 10% of all aeronautical meteorological service costs. In order to ensure that aviation-related research and development remains focused on user needs, consultation with users is advised. It is possible that additional research may be funded through national (and transnational) science funds.

3.10 A full list of the meteorological core facilities and services used by all user groups should be agreed after consultation with each user group. Once the list and the full cost of each item have been agreed, it will be necessary to negotiate an appropriate apportionment of the costs amongst all the users, which may be a complex process. It must be based on sound, equitable cost sharing, considering the use of core services and products made by each group of users. Those listed in Annex V to this Guide are suggested as being appropriate core services required to support the provision of meteorological services to all users. There are some States that do not allocate core costs to any specific user and, in this case, costs for these items are ignored when determining the meteorological element of air navigation charges. Once again, consultation with the national civil aviation authority, the meteorological authority as well as the users should ensure that a method of calculating these costs is agreed. Further consultations should take place regularly, and certainly before any changes or revisions to the costs are made.

ESTABLISHMENT OF AN APPROPRIATE BASIS FOR ALLOCATING COSTS BETWEEN USER GROUPS

3.11 The items listed in Annexes I to IV to this Guide are exclusively for aviation, and the total cost is allocated to aviation users. Any use of one or several of these items by non-aeronautical users should be framed by an agreement between the parties concerned and is likely to have consequences for the cost allocation of the items to aviation.

3.12 The costs of facilities and services that are not exclusively used for aeronautical purposes (Annex V to this Guide) can be divided between aviation and other users by using any or a combination of the following methods:

(a) In proportion to the estimated aeronautical and non-aeronautical use made of the products supplied or facilities used. For example, forecasting offices issuing guidance and severe weather warnings may be serving multiple users, with perhaps only about 25% of the effort being directly for aeronautical users. In this case, 25% of the costs would be charged to aviation.

(b) In proportion to the estimated time used by computers for aeronautical and non-aeronautical purposes. For instance, computing and communications facilities, although generally conducting core activities, usually produce output for direct use by users. The proportion of time dedicated to aeronautical products may be used in calculating the allocation of the costs attributed to aviation.

(c) In proportion to the volume of information transmitted for aeronautical and non-aeronautical purposes. For instance, most meteorological telecommunication facilities handle both general meteorological information and information specifically for aeronautical purposes. The latter could be encoded reports of aeronautical data such as METARs and TAFs, or more sophisticated coded data in GRIB or BUFR code form such as WAFS information. The proportion of such aeronautical data to other general meteorological data would then form the basis of charges to aviation.

(d) In proportion to the number of personnel working on aeronautical and non-aeronautical meteorological services.

(e) On the basis of results from an analytical accounting system which ensures an equitable allocation of the costs. This is the method preferred by ICAO since it provides the highest level of transparency.

3.13 Ideally, the allocation of meteorological costs between aeronautical and non-aeronautical use should be based on one or more of the above methods. However, there may be circumstances when these suggested methods are not applicable and, in these cases, alternative methods should be agreed upon. For instance, one possible approach could be to establish a ratio between the cost of facilities and services needed to serve exclusively aeronautical requirements and the cost of those intended to serve exclusively non-aeronautical requirements. This ratio could then be applied to the costs of those core facilities that serve multiple user groups in order to estimate the aeronautical proportion of these costs.

3.14 It is important to note that costs should include the depreciation and capital cost of items such as equipment and buildings. These are necessary when creating reserves to replace the equipment and buildings concerned, once their useful life is over. The original value of an asset should be depreciated over its estimated useful life and such depreciation included in the annual costs of the service concerned. Land is not depreciated since, unlike other fixed assets, it does not deteriorate and its useful life is not limited. Depreciation should not commence until a facility is put into service. National legislation may in some countries prescribe the length of time over which equipment, buildings and infrastructure may be depreciated. Where such regulations are not in force, aeronautical meteorological service providers may wish to use the practical examples of depreciation periods listed in Annex VI.

3.15 In principle, the allocation of costs should be determined in such a way that no users are burdened with costs not properly allocable to them. For this reason, it is necessary to have frequent discussions with all parties to agree on a full definition of "user requirements" which includes a specification of the products and facilities required to support the aeronautical meteorological service and the performance metrics that detail the quality of service expected.

3.16 ICAO Doc 9082 recommends that:

> The costs of all MET [meteorological services] provided to civil aviation should, where appropriate, be allocated between air traffic services provided for airports and air traffic services provided en route. In States where more than one international airport is involved, consideration could be given, where possible, to allocating the costs attributable to airport utilization between the airports concerned.

This can prove difficult, but guidance on how this should be done is given in ICAO Doc 9161 and its appendices. Again, it is essential that the method of allocating these costs be agreed with the national civil aviation authority and/or meteorological authority and discussed with the stakeholders concerned. When developing criteria for this cost sharing, the following should be taken into account:

(a) The allocation of aeronautical costs among users should be carried out in a manner equitable to all;

(b) The allocation should be made in such a way that costs are recovered from the appropriate user;

(c) The allocation of facilities and/or services should be based on the flight utilization (that is, airport or en-route).

3.17 Where costs are being allocated between airport and en-route phases of flight, the criteria described earlier with reference to aeronautical and non-aeronautical use may again be applied here. The facilities and products listed in Annexes I and II to this Guide can be qualified to indicate whether they refer to en-route (E), mainly en-route (mE), airport (A), mainly airport (mA), or airport and en-route (A/E). Core facilities and services costs are also required to be allocated between airport and en-route phases of flight, as well as between IFR and VFR flights. Rather than assessing each core service or facility individually, it may be less complicated to use the same proportion for airport/en-route and IFR/VFR for these particular costs.

3.18 A particular difficulty may arise where an aerodrome meteorological office provides a service for multiple airports. The amount of resources required to prepare and disseminate TAFs, aerodrome warnings, etc., may well be the same for each airport served, despite the fact that one airport may have more flights than another. Users may feel unfairly treated if the costs are shared equally between each airport, resulting in a higher user charge at a smaller, less busy airport. In such cases, the aeronautical meteorological service provider and the users or the national civil aviation authority may need to agree on a level of meteorological service for each airport, depending on the level of activity (for example, number of flights). Doing this may facilitate reaching an agreement on the sharing of costs between the airports. Annex VII to this Guide show in some detail how to calculate the costs to aviation of providing meteorological services at typical aeronautical meteorological stations and aerodrome meteorological offices.

3.19 Where appropriate for reasons of equity, and where the necessary basic data including all required statistics are available, consideration could be given to allocating the costs between IFR and VFR flights. In doing so, care should be taken that meteorological cost recovery mechanisms permit the financing of the meteorological service needed for safety, regularity and efficiency of air navigation and all the user categories. When developing criteria for the allocation of costs to IFR and VFR flights, the following could be taken into account:

(a) The allocation of aeronautical costs among users should be carried out in a manner equitable to all;

(b) The allocation should be made in such a way that costs are recovered from the appropriate users;

(c) The allocation of facilities and services should be based on the type of flight (that is, IFR or VFR).

3.20 Where allocation of aeronautical meteorological costs between IFR and VFR traffic is required, the allocation criteria described earlier in reference to aeronautical and non-aeronautical use may also be applied here. The facilities and products listed in Annexes III and IV to this Guide can be qualified to indicate whether the requirement for and utilization of the facilities or products concerned are IFR (I), mainly IFR (mI), VFR (V), mainly VFR (mV) or IFR and VFR (I/V). However, this indication may vary significantly between States owing to different national policies on VFR flights.

GUIDANCE ON MULTINATIONAL COST RECOVERY

3.21 Increasingly, States are working together to share resources and ensure that users receive cost-effective services. Some collaborations are informal arrangements where States simply share information, while others operate under formalized agreements with detailed terms of reference.

3.22 Where one State provides services to users in another State (or States), arrangements for cost recovery may be straightforward to administer. However, due to ever-increasing costs, a financially sensible approach is for multiple aeronautical meteorological service providers to collaborate, reduce duplication and provide services as efficiently as possible, especially now that there is a growing demand for phenomenon-based information that is not solely restricted to areas of responsibility. In these situations, cost recovery can become complex. The number of stakeholders, different regulatory regimes and diverse accountancy standards all increase the complexity of agreeing on how costs should be apportioned; it is therefore necessary to ensure there is an equitable basis for recovering costs. ICAO Doc 9161 provides additional guidance on establishing air navigation services charges in such situations.

3.23 Cost recovery arrangements can be complex where subregional, regional, multiregional and global services are provided by multiple aeronautical meteorological service providers to users in multiple States, and then costs are recovered across multiple States. When there is more than one State providing the service, the same principles apply regarding gaining agreement from all the provider States on how the cost base is derived. This allows the allocation of costs to be determined in a manner that is fair to the users through the use of sound accounting principles, ensuring that no users are unfairly burdened with costs that are not applicable.

3.24 When establishing a multinational cost recovery scheme it is important to ensure that financial control is maintained whenever and wherever services are provided in a multinational arrangement. It is essential that there is an agreement between the States (parties) concerned that contains clauses on how costs are determined.

3.25 An inventory should be developed that details the operational, maintenance, administrative and capital costs. Any costs related to depreciation and interest should also be listed. Additionally, the inventory should detail any special capital outlay projects (including research and development activities) that may be undertaken by the multinational service to maintain and enhance the services being provided by the multinational entity. The agreement should also detail the accounting system used so that any charges solely reflect the costs attributable to the services provided, to be allocated in a fair, transparent and equitable manner. To enable a more common accounting format, States may adopt international accounting principles. Any and all accounting systems used should facilitate responsible planning, budgeting, management of resources, auditing and governance. These accounting systems can then be used to provide information on the revenues and expenses as well as the profit or loss

situation during any given period, plus the status of the collaboration regarding the entity's assets and liabilities. They also provide service management personnel with data to enable them to manage operations and assess the performance of the multinational collaboration over time.

3.26 A standardized approach to expenses is also required. Accounting for air navigation services expenses is normally a two-step procedure: accounting by category of expense (salaries, supplies, etc.) and then accounting by activity (for example, en-route services (IFR or VFR)) and/or location (for example, aerodrome meteorological office, aeronautical meteorological station or meteorological watch office). Once the various categories are established, the associated costs for each element can be compiled and entered into the associated template. Alongside the template, guidance should be prepared for those who are responsible for its completion; this will ensure a consistent approach with the other members of the collaboration that are providing the services.

3.27 Additionally, aeronautical meteorological service providers that provide multinational services should ensure that the costs being recovered through the multinational entity solely relate to that multinational aspect and not to those being provided to the users within their own State.

3.28 At present there are multiple regional cost recovery systems in operation, such as the Secure Aviation Data Information Service (SADIS), the Denmark/Iceland (Den/Ice) Agreements and Height Monitoring Unit (HMU) Arrangement, which are all administered by ICAO's Joint Financing Unit. Other regional services for which cost recovery is undertaken include: those provided by the Agence pour la sécurité de la navigation aérienne en Afrique et à Madagascar (Agency for Aerial Navigation Safety in Africa and Madagascar) (ASECNA); the Corporación Centroamerica de Servicios de Navegación Aérea (COCESNA), which provides air navigation services in the Central America region through the Central American Agency for Air Navigation (ACNA); the Northern Europe Aviation Meteorology Consortium (NAMCON); and the European Organisation for the Safety of Air Navigation (EUROCONTROL), which operates a range of aviation services and administers cost recovery arrangements across Europe. A number of regional cost recovery systems are summarized in Annex XIV to this Guide.

CHAPTER 4. GENERAL PROCEDURES FOR RECOVERING AERONAUTICAL METEOROLOGICAL COSTS

4.1 Having established how to calculate the meteorological costs to be allocated to aeronautical users, the recovery of these costs must be considered. The method adopted will vary from State to State, but it is strongly recommended that, wherever possible, the aeronautical meteorological service provider not try to recover the costs directly from the users and airport authorities. In many instances the national civil aviation authority will already have a system in place, in accordance with ICAO Doc 9562 and ICAO Doc 9161, for the recovery of air navigation (traffic) services costs. Therefore, adding a process for the meteorological costs would enable an efficient and convenient method of recovering these costs that would benefit to the aeronautical meteorological service provider concerned. The above-mentioned documents give guidance on charging and tariff determination with respect to airspace, airports, aircraft type or flight distance. Again, close cooperation between the civil aviation authority and the meteorological authority and/or aeronautical meteorology service provider is indispensable. Special care should be taken, when allocating costs between IFR and VFR flights, to ensure sound arrangements for cost recovery from the VFR users. Cost recovery from VFR flights is normally a matter for the national civil aviation authority to decide within each State. When cost recovery from VFR flights is a responsibility of the civil aviation authority, clear and transparent arrangements should be established between the authorities concerned to ensure full recovery of the costs for the aeronautical meteorological service provider concerned. Furthermore, it should be stressed that all the services provided to aeronautical users contribute towards the safety of the air transport system. For this reason, the need to allocate costs between IFR and VFR use, with its associated difficulties, by no means lessens the State's obligation to provide all aeronautical users with the relevant meteorological services.

4.2 The procedures to recover aeronautical meteorological costs vary to some extent from State to State, but the following steps seem to be essential:

(a) From the ICAO Directory of National Civil Aviation Administrations (DGCA Directory) ascertain which entity is the State's meteorological authority. If it is not indicated in the Directory, request that the government department representing the State as signatory to the Chicago Convention nominate the meteorological authority and advise ICAO accordingly.

(b) If the meteorological authority is also the aeronautical meteorological service provider, consult with the national civil aviation authority and other aeronautical users to agree a service specification based on the user's requirements listed in Annexes I to IV to this Guide.

(c) Where the aeronautical meteorological service provider is not the meteorological authority, carry out the inventory of services required, as suggested in Annexes I to VI to this Guide.

(d) Where the National Meteorological Service is neither the meteorological authority nor the aeronautical meteorological service provider, an agreement should be in place between National Meteorological Service and the aeronautical meteorological service provider. The agreement should state that the aeronautical meteorological service provider will likely make use of the infrastructure of the National Meteorological Service (for example, computing facilities, telecommunications, radar, satellite receiving and observing networks). Where this occurs, a proportion of the National Meteorological Service's costs may be allocated to aeronautical users as part of the full costs recovered by the aeronautical meteorological service provider and transferred to the National Meteorological Service. Such an agreement should ensure that all recipients of data or services from the National Meteorological Service receive the same conditions.

(e) In light of the capital expenditure involved, any formal agreements with the aeronautical meteorological service provider and the aviation authorities should initially cover a period of not less than five years, as this will enable depreciation charges and expenditure on

dedicated equipment to be amortized over the period concerned. Suggested depreciation periods are detailed in Annex VI to this Guide. After this initial period, however, agreements may be reviewed at shorter intervals.

(f) Once a fair and equitable allocation of the cost of the required meteorological services for civil aviation has been agreed, arrangements should be made with the national civil aviation authority for the costs to be recovered. Some authorities may collect air navigation (traffic) service costs from users and airports on an annual basis, while others may collect them quarterly or even monthly. Whichever the case, the costs due to the aeronautical meteorological service provider should be collected at the same time.

4.3 The principle that the cost of providing a required meteorological service for civil aviation should be met by the users is very important, having been agreed by ICAO, hence by all the signatories to the Chicago Convention. However, it is imperative that these costs be allocated properly and in accordance with sound accounting principles. Past disputes, if any occurred, can be reconciled if all concerned discuss the problems in as transparent a manner as possible and, using the official guidance provided, arrive at an agreed, equitable allocation of costs.

4.4 Annexes VIII to XIII to this Guide give examples of aeronautical meteorological services cost recovery in Argentina, Cuba, France, Germany, Singapore and the United Kingdom of Great Britain and Northern Ireland, respectively.

ANNEX I. FACILITIES AND SERVICES INTENDED EXCLUSIVELY TO SERVE AERONAUTICAL USERS AND THEIR COST ALLOCATION BETWEEN EN-ROUTE AND AIRPORT

Facilities and services	*Utilization**
World area forecast centres (WAFCs)	E
Volcanic ash advisory centres (VAACs)	E
Tropical cyclone advisory centres (TCACs)	E
Space weather centres (SWXCs)	mE
Meteorological watch offices (MWOs)	E
Aerodrome meteorological offices	A/E
Aeronautical meteorological stations	A/E
Operation of a regional OPMET databank	E
Aeronautical fixed service (AFS) telecommunications for aeronautical meteorological purposes	A/E
Facilities to provide meteorological data processing of WAFS products	mE
Provision of D-VOLMET or VOLMET broadcasts	E
Observing instruments provided for aeronautical purposes (e.g. transmissometers, ceilometers)	mA
Specific aeronautical meteorological research	A/E
Specific aeronautical meteorological training	A/E
Specific aeronautical technical support (including administration)	A/E

* E = en-route, mE = mainly (75%) en-route (and 25% airport), A = airport, mA = mainly (75%) airport (and 25% en-route), A/E = airport (50%) and en-route (50%).

ANNEX II. PRODUCTS AND FUNCTIONS INTENDED EXCLUSIVELY TO MEET AERONAUTICAL REQUIREMENTS AND THEIR COST ALLOCATION BETWEEN EN-ROUTE AND AIRPORT

Products and functions	*Utilization**
Meteorological observations and reports for local ATS units	A
Meteorological observations and reports disseminated beyond the aerodrome (METAR, SPECI)	mE
Aerodrome forecasts (TAF, including amendments thereto)	mE
Landing forecasts (i.e. TREND) and forecasts for take-off	A/E
Area and route forecasts, other than those issued within WAFS (including GAMET)	E
Aerodrome and wind shear warnings	A
SIGMET, AIRMET, volcanic ash advisories, tropical cyclone advisories	E
Preparation of aerodrome climatological information	A
Provision of flight documentation (WAFS products, SIGWX forecasts for low-level flights and required OPMET data)	mE
Meteorological watch by MWOs over FIR/UIR for the issuance of SIGMETs and AIRMETs	E
Aerodrome weather watch by the meteorological office concerned for the issuance of amendments to TAFs, aerodrome and wind shear warnings	A/E
Volcanic ash and tropical cyclone watch by VAACs and TCACs for the issuance of VA and TC advisories	E
Briefing and consultation (including display of OPMET and other meteorological information)	A
Provision of information to meteorological information systems (for use in remote briefing/consultation systems)	A/E
Provision of information to ATS and AIS units	A/E
Provision of information to SAR units	E
Provision of WAFS and OPMET data to operators	mE
Provision of OPMET information to VOLMET and D-VOLMET systems	mE

* E = en-route, mE = mainly (75%) en-route (and 25% airport), A = airport, mA = mainly (75%) airport (and 25% en-route), A/E = airport (50%) and en-route (50%).

ANNEX III. FACILITIES AND SERVICES INTENDED EXCLUSIVELY TO SERVE AERONAUTICAL USERS AND THEIR ALLOCATION BETWEEN IFR AND VFR

Facilities and services	*Utilization*[*]
World area forecast centres (WAFCs)	I
Volcanic ash advisory centres (VAACs)	I
Tropical cyclone advisory centres (TCACs)	I
Space weather centres (SWXCs)	I
Meteorological watch offices (MWOs)	I
Aerodrome meteorological offices	I
Aeronautical meteorological stations	I
Operation of a regional OPMET databank	I
Aeronautical fixed service (AFS) telecommunications for aeronautical meteorological purposes	I
Facilities to provide meteorological data processing of WAFS products	I
Provision of D-VOLMET or VOLMET broadcasts	I
Observing instruments provided for aeronautical purposes (e.g. transmissometers, ceilometers)	I
Specific aeronautical meteorological research	I
Specific aeronautical meteorological training	mI
Specific aeronautical technical support (including administration)	mI

* I = IFR, mI = mainly (75%) IFR (and 25% VFR), V = VFR, mV = mainly (75%) VFR (and 25% IFR), I/V = IFR (50%) and VFR (50%).

ANNEX IV. PRODUCTS AND FUNCTIONS INTENDED EXCLUSIVELY TO MEET AERONAUTICAL REQUIREMENTS AND THEIR ALLOCATION BETWEEN IFR AND VFR

Products and functions	*Utilization**
Meteorological observations and reports for local ATS units	I
Meteorological observations and reports disseminated beyond the aerodrome (METAR, SPECI)	I
Aerodrome forecasts (TAF, including amendments thereto)	I
Landing forecasts (i.e. TREND) and forecasts for take-off	I
Area forecasts, other than those issued within WAFS (including GAMET)	I/V
Forecasts for VFR aviation and air sports (e.g. GAFOR)	V
Aerodrome and wind shear warnings	I
SIGMET, volcanic ash advisories, tropical cyclone advisories	I
AIRMET	I/V
Preparation of aerodrome climatological information	I
Preparation of flight documentation WAFS products, SIGWX charts/forecasts for low-level flights and required OPMET data)	I/V
Meteorological watch by MWOs over FIR/UIR for the issuance of SIGMETs	I
Meteorological watch by MWOs over FIR for the issuance of AIRMETs	I/V
Aerodrome weather watch by the meteorological office concerned for the issuance of amendments to TAFs, aerodrome and wind shear warnings	I
Volcanic ash and tropical cyclone watch by VAACs and TCACs for the issuance of VA and TC advisories	I
Briefing and consultation (including display of OPMET and other meteorological information)	I/V
Provision of information to meteorological information systems (for use in remote briefing/consultation systems)	mI
Provision of information to ATS and AIS units	I
Provision of information to SAR units	I
Provision of WAFS and OPMET data to operators	I
Provision of OPMET information to VOLMET and D-VOLMET systems	mI

* I = IFR, V = VFR, mI = mainly (75%) IFR (and 25% VFR), mV = mainly (75%) VFR (and 25% IFR), I/V = IFR (50%) and VFR (50%).

ANNEX V. CORE FACILITIES AND SERVICES THAT MAY SERVE BOTH AERONAUTICAL AND NON-AERONAUTICAL REQUIREMENTS

Cost allocation between airport and en-route use

Core facilities and services	*Utilization**
General analysis and forecast offices	A/E
Meteorological data processing	A/E
Commonly used meteorological telecommunications facilities and services	A/E
Surface synoptic observation stations	mE
Climatological observation stations (precipitation stations to be excluded)	mE
Upper-air observation stations	E
Weather radar	A/E
Meteorological satellite image reception	mE
Core training	A/E
Core research	A/E
Core technical support (including administration)	A/E

* E = en-route, mE = mainly (75%) en-route (and 25% airport), A = airport, mA = mainly (75%) airport (and 25% en-route), A/E = airport (50%) and en-route (50%).

Cost allocation between IFR and VFR

Core facilities and services	*Utilization**
General analysis and forecast offices	mI
Meteorological data processing	mI
Commonly used meteorological telecommunications facilities and services	mI
Surface synoptic observation stations	mI
Climatological observation stations (precipitation stations to be excluded)	mI
Upper-air observation stations	mI
Weather radar	mI
Meteorological satellite image reception	mI
Core training	mI
Core research	mI
Core technical support (including administration)	mI

* "Mainly IFR" means core facilities and services that may serve both aeronautical and non-aeronautical requirements more than 90% (as identified by the States concerned).

ANNEX VI. EXAMPLES OF TYPICAL DEPRECIATION PERIODS

Item	*Depreciation period*
Buildings (freehold)	20–40 years
Buildings (leasehold)[a]	Over the period of the lease
Furniture and fittings	10–15 years
Motor vehicles	4–10 years
Electronic equipment (including telecommunications equipment)	7–15 years
General equipment	7–10 years
Computer equipment	5–10 years
Computer software	3–8 years

[a] Buildings built on leased land.

ANNEX VII. ALLOCATING THE COSTS OF OPERATIONAL AERONAUTICAL METEOROLOGICAL FACILITIES

1. AERONAUTICAL METEOROLOGICAL STATION

1.1 As discussed in Chapter 2, there are four stages in the allocation process, though not all will be appropriate in every case:

(a) Identify the total cost;

(b) Allocate costs between aeronautical and non-aeronautical users;

(c) Allocate costs between airport and en-route services;

(d) Allocate costs between IFR and VFR operations (if possible and if required).

1.2 In the first instance, it is assumed that the aeronautical meteorological station only serves aviation, providing routine and special observations, encoding the information into METAR and/or SPECI reports and disseminating these reports to users. The total cost of the station would be the sum of the costs of the staff, accommodation (including heating, lighting, cleaning, telephone and Internet, etc.), furniture and equipment (including the observation and telecommunication equipment), general maintenance and repair, overheads and depreciation. Since the only service being provided is exclusively for aeronautical use – that is, the provision of METARs and SPECIs – the full cost (100%) of the station is allocable to aeronautical users.

1.3 The allocation of these costs, however, between airport and en-route services will vary depending on any agreement within the State or Territory between the meteorological authority or aeronautical meteorological service provider and the civil aviation authority on the apportionment of costs between the provision of observations for airport usage and the provision of METAR/SPECI reports for pre- and in-flight planning. If reports are included in a VOLMET broadcast to aircraft, then a larger proportion of the cost may be allocated to en-route.

1.4 Where allocating costs between IFR and VFR is possible (preferably based on traffic statistics), and is considered necessary, an estimate of the proportion of use and effort for each should be made.

1.5 In cases where the aeronautical meteorological station facilities are also utilized to prepare synoptic (SYNOP) messages, which contain basic meteorological (non-aeronautical) information to be exchanged internationally via the WMO Global Telecommunication System (GTS) or WMO Information System (WIS), only part of the total cost of the station should be allocated to aeronautical users. The proportion will vary depending on the amount of time and effort spent on each task. Aviation should be charged accordingly and without subsidizing the provision of the SYNOP messages.

1.6 In every case, the costs of instruments related to specific aeronautical requirements, such as runway visual range (RVR) systems (for example, transmissometers), ceilometers, wind shear detection systems, lightning detection systems and lidars, should be allocated wholly to aviation, in this particular case IFR. When instrumentation is situated at the airport and is also used to support other (non-aeronautical) activities, the costs should be allocated appropriately to both activities.

2. AERODROME METEOROLOGICAL OFFICE

2.1 The aerodrome meteorological office may be at the airport or elsewhere, and it may be dedicated to aeronautical services or it may be multifunctional. Whatever the situation, it is necessary to identify the total costs of the office, including the costs of staff, accommodation, furniture and equipment, communications, etc. If the office is exclusively dedicated to aeronautical services, then all the costs (100%) can be allocated to aeronautical users. If, however, the office is multifunctional, then the total costs of the office should be divided among the users, using an agreed method, as discussed in Chapter 3. For instance, if it is determined that 60% of the operational staff are dedicated to aeronautical services while 40% are not, then only 60% of the total costs are allocated to the aeronautical users.

2.2 Aerodrome meteorological offices provide services to both airport and en-route users, as they are responsible for aerodrome forecasts (TAFs), landing and take-off forecasts, area forecasts, aerodrome warnings, wind shear warnings and alerts, briefings and consultations, etc. The allocation of costs between airport and en-route users will vary from office to office, depending on the number of flight movements and the number of airports being served.

2.3 Many aerodrome meteorological offices support more than one airport and, where necessary, the total costs allocated to airports generally should be shared between the airports serviced. The amount of effort spent by the aerodrome meteorological office on supporting each airport is probably very similar even though the amount of traffic at each airport may vary considerably. As discussed earlier, allocating costs between individual airports using "effort spent" as the guide may not be considered equitable by the users. In consultation with all the stakeholders concerned and the civil aviation authority, an acceptable and fair method of sharing the costs should be determined. Costs should also be allocated between IFR and VFR if sufficient data are available to make such a distinction and where this distinction is required.

3. METEOROLOGICAL WATCH OFFICE

3.1 As discussed above for aeronautical meteorological stations and aerodrome meteorological offices, the four stages in assessing the allocation of costs should be taken into account for meteorological watch offices. The meteorological watch office may operate as a standalone facility, or the responsibilities may be shared across two or more meteorological watch offices. Where responsibilities are shared, the division of responsibility should be determined by the meteorological authority and the aeronautical meteorological service provider, in consultation with the appropriate air traffic services authority.

3.2 Meteorological watch offices provide a range of services including provision of SIGMET and AIRMET messages for the flight information regions for which the State or Territory has responsibility and the receipt and redistribution of volcanic ash reports and special air reports received from aircraft in flight. Meteorological watch offices also provide services to air traffic services units, which are increasingly using more sophisticated meteorological forecasts that enable them to more reliably maintain safe and efficient operations and reduce delays.

3.3 Almost all services provided by the meteorological watch office will need to be allocated to en-route services, noting that where the office's accommodation is shared with an aerodrome meteorological office appropriate cost allocations will need to take place. Similarly, staff costs will need to be apportioned to the airport or en-route costs when they undertake service provision for airport and en-route activities.

ANNEX VIII. AERONAUTICAL METEOROLOGICAL SERVICES COST RECOVERY IN ARGENTINA

INTRODUCTION

In Argentina, the government department responsible for aviation is the Ministry of Transport. The Administración Nacional de Aviación Civil (ANAC), which operates as a National Public Organization (NPO), is the civil aviation authority (CAA). The CAA reports to the Ministry of Transport.

The National Meteorological Service of Argentina (Servicio Meteorológico Nacional (SMN)), which is a self-sufficient NPO operating within the sphere of the Ministry of Defence, is responsible for the provision of all meteorological services, as stated in its mission. SMN has a framework agreement in place with ANAC, which sets out the high-level principles of how the two organizations should work together with respect to aeronautical meteorological services and regulations.

For many years the meteorological services in Argentina were provided by the air force, which also acted as the State's aviation authority, air transportation safety board and air navigation service provider. In 2007, following a presidential decree, SMN was designated as Argentina's meteorological service provider and as the meteorological authority. In 2009 ANAC was created and was designated both the CAA and the air navigation service provider.

In 2016, law 27161 was introduced which gave responsibility for providing all air navigation services, including meteorological services, to Empresa Argentina de Navegación Aérea, (EANA S.E.), a public company which reports to the Ministry of Transport. This law stipulates that SMN provides the meteorological services for air navigation purposes to EANA S.E., whereas EANA S.E. provides all the air navigation services for Argentina, including air traffic services (ATS), aeronautical communications services, communications, navigation and surveillance services, search and rescue services and aeronautical information services (AIS).

SERVICES PROVIDED BY SMN

International services

- Products related to Argentina's role as an ICAO-designated volcanic ash advisory centre (VAAC) (namely VAAC Buenos Aires).

Annex 3 services

- Aerodrome routine and special meteorological reports (METAR/SPECI) for 52 aerodromes;
- Local routine and special meteorological reports (MET REPORT/SPECIAL) at 14 aerodromes;
- Aerodrome forecasts (TAFs) for 39 aerodromes, 16 distributed internationally and 23 distributed nationally;
- Low-level wind forecasts;
- SIGMETs for the five flight information regions (FIRs) in Argentina;
- Trend forecasts at Ezeiza, Aeroparque and Córdoba airports;
- Aerodrome climatological data for 45 airports.

While there are no ICAO South American regional requirements or agreements for GAMET or AIRMET, SMN issues a PRONAREAS, a national area forecast for Argentina's 5 FIRs four times a day.

Services for air traffic services

- A range of products and data services that provide situational awareness to EANA S.E. for its en-route operation, these are used for both tactical and planning use and help ensure the company provides safe and efficient ATS. These services include observational and forecast data over the national airspace; additionally, a daily briefing every six hours is provided to both the air traffic flow management (ATFM) centres and Area Control Centres (ACCs).

- Meteorological services are also provided to ATS at aerodromes for use in both terminal control and approach operations.

Services for general aviation and helicopter operations

Observational and forecast data over Argentina and neighbouring countries are provided on an aviation portal hosted on the Internet. This is available free to all general aviation groups and business jet operators. This site also includes:

- Observations and reports (AEROMET and METAR/SPECI);

- TAFs;

- Synoptic charts, issued every three hours;

- Gridded wind and temperature profile charts and text forecasts;

- Area forecasts (PRONAREAS) for Argentina's 5 FIRs, issued four times a day;

- SIGMET (in both graphic and textual form).

SMN also provides weather briefings at aerodrome meteorological offices, which are located at nine aerodromes. Briefings and products are provided to help ensure general aviation and offshore helicopter operations are managed safely in the national airspace in accordance with Annex 3 to the Convention on International Civil Aviation. The services are provided to support helicopter emergency service operators as well (police, search and rescue, and air ambulance).

Aeronautical facilities

In order to understand the costs associated with the services described above, SMN has established an inventory of the facilities and services that are exclusively used to serve aeronautical users. This details both the costs and investments that are required to support and improve the operational meteorological service provided to aviation. The facilities and services that are detailed in the inventory are:

- Volcanic ash advisory centre (VAAC);

- Meteorological watch offices;

- Aerodrome meteorological offices;

- Aeronautical meteorological stations;

- Computing and data processing facilities for aeronautical meteorological information;

- Meteorological observing equipment used for aeronautical purposes;

- Research and development for aeronautical meteorology (for example, VAAC dispersion modelling);
- Training for aeronautical meteorological personnel;
- Aeronautical meteorology technical support and administration (for example, customer liaison);
- Aeronautical meteorological quality management system;
- Aeronautical climatological information derived from the OPMET database;
- Visualization in real time of the meteorological information and products specifically for aeronautical meteorological users on the aeronautical services section of the SMN website.

For each of the above, a list of costs is compiled, which include operational staff costs, maintenance staff costs, operational costs (consumables, etc.), maintenance costs (spare parts, etc.), property costs, overheads (management administration, etc.) and, where appropriate, depreciation.

CORE SERVICES

Meteorological cost assessment

The analytical accounting system adopted by SMN is based on a practical model distinguishing between the following two types of activities:

(i) "Core" activities, with associated costs, for which an appropriate share has to be allocated to aviation;

(ii) "Activities dedicated exclusively to aviation stakeholders and to air navigation services", with associated direct costs fully allocable to aviation.

In this regard, SMN's services, products and activities were analysed following the directives and recommendations of ICAO Doc 9161.

The first step in the process is to identify which items are classified as either (i) or (ii) above. Those items that were classified as (i) above are identified and a percentage applied for aeronautical meteorology activities. In Argentina the cost of core services is distributed across all the sectors for which services are provided, namely: public services and disaster risk reduction, hydrological and energy, agrometeorology, aeronautical meteorology, maritime meteorology and climatology.

The following activities have been identified as core facilities or services:

(a) Core management, including administration (finance, human resources, IT, facility management, etc.);

(b) Core training;

(c) Core research and development;

(d) Core facilities, which include:

- Data processing centre, including the systems relating to meteorological communications (for example, message switching system, exchange of meteorological information with other States and archiving of meteorological information).

- Operation of a regional telecommunications centre.
- Databases and associated systems for archiving both synoptic and climatological observational reports.
- Telecommunications, including satellite links and landlines, with the exception of the ATS Message Handling System (AMHS), which is EANA S.E.'s responsibility.
- Central forecast office, issuing synoptic surface and upper-air charts, alerts and warnings for disaster risk reduction and public services.
- Numerical weather prediction (NWP), using a high-performance computing facility running the SMN NWP model based on the advanced capabilities of the Weather Research and Forecasting model (WRF-ARW). Note: Several products are generated using meteorological variables, which are the primary input for creating forecasts for the general public and generating the early warning system as part of the SMN's disaster risk reduction remit. Images, maps, meteograms and vertical profiles are also generated. SMN runs a high-resolution (4 km) ensemble system over its area of responsibility that is used as an input for aeronautical meteorology service provision.
- Forecast verification using an objective verification system where NWP forecasts are compared with observations which include precipitation, surface wind and surface temperature.
- Surface synoptic observing network at 125 sites.
- Upper-air observing stations at 7 sites.
- Weather radar network consisting of 11 sites, and an additional three sites for which SMN is responsible for maintenance.
- Satellite data reception system for GOES and Geonetcast satellites.
- Quality control of observational data, including serving as a regional component of the WMO Integrated Global Observing System (WIGOS) Data Quality Monitoring System (WDQMS).
- Regional Instrument Centre (Buenos Aires) for calibration and maintenance of meteorological sensors, in particular temperature, humidity, solar radiation, pressure and wind sensors.
- International commitments, including staff time and resources for attendance at regional and global aeronautical meteorological groups.
- SMN Meteorological Information Centre, which creates and shares information with users and stakeholders across various sectors. For aeronautical meteorological services this includes the National Safety Board, which reviews accidents and incidents.
- Web-based portal containing a range of meteorological data, including weather forecasts and observational data.

QUALITY MANAGEMENT

As required in Annex 3 to the Convention on International Civil Aviation, a quality management system (QMS) was adopted and implemented by SMN, as the aeronautical meteorological service provider. The QMS established by SMN follows the Annex 3 standards and recommended

practices, as it is based on the quality assurance standards of the International Organization for Standardization (ISO) 9000 series and is certified by an approved organization. SMN's QMS covers the following areas of aeronautical meteorology:

- Observations and aeronautical meteorological messages;
- Aeronautical meteorological forecasts and weather watch;
- Inspections of aeronautical meteorological stations, aerodrome meteorological offices and meteorological watch offices;
- Regional Instrument Centre (Buenos Aires) for calibration and maintenance of meteorological sensors for national operation and on request of other Regional Association III and WMO Members;
- VAAC Buenos Aires.

The QMS ensures that there is regular assessment of operational staff competencies and includes a gap analysis to indicate where training activities are required to improve services or knowledge gaps.

COST CALCULATION

The air navigation service provider EANA S.E. is responsible for collection and redistribution of the en-route and aerodrome landing fees.

SMN and EANA S.E. have been working together to agree on the percentage of en-route fees that is appropriate to fund the aeronautical meteorological services (and the associated core services and facilities). These discussions also take into account the number of flights that have taken place during the year. In the past SMN received 16% of the flight protection fees collected through en-route charges only; landing support fees were not included for recovering the cost of aeronautical meteorological services. However, recently the aviation stakeholders have considered this percentage too high, and a review is being undertaken to determine a revised percentage. To assist with negotiations SMN is creating a detailed service specification that will form part of a service level agreement. This will allow both organizations to more easily agree on the services that are required to be provided and, where needed, amend the agreement to include any additional services required specifically for Argentina. This document will also formalize the provision of performance indicators.

PERFORMANCE MEASUREMENT

Currently, the key performance indicators (KPIs) used to measure the performance of the aeronautical meteorology activities include:

- Timeliness of the issuance of METARs and TAFs;
- Compliance with Convention on International Civil Aviation (Annex 3) coding formats for METAR, TAF and volcanic ash advisories;
- Forecast verification of TAFs using a scheme based on the operationally desirable accuracy of forecasts (refer to Annex 3, Attachment B);
- Timeliness of the issuance of the VAA as set out by the ICAO Meteorology Panel (METP) Working Group on Meteorological Operations Group (WG-MOG).

GOVERNANCE

In summary, monthly meetings are held with stakeholders (the CAA, the air navigation service provider (EANA S.E.) and other aeronautical users). In addition, every three months a comprehensive report of the services and products provided by SMN to the aeronautical sector is shared with EANA S.E., which evaluates performance against the KPIs.

SMN is part of the National Interministerial Commission for Air Transport Facilitation, which meets monthly, and SMN participates in these meetings. The main function of the meetings is to facilitate cross-sector communications, and they give stakeholders of the aeronautical community an opportunity to discuss matters related to the affairs of the organizations associated with the aeronautical community.

ANNEX IX. AERONAUTICAL METEOROLOGICAL SERVICES COST RECOVERY IN CUBA

INTRODUCTION

Under the Decree-Law No. 296 of the Republic of Cuba, created on 1 August 2012, the Ministry of Transport owns and exercises the powers of the Aeronautical Authority, which exercises oversight of both public and private third parties for both national and international regulations. As one of the State organizations of the Central Administration, the Aeronautical Authority is in charge of directing, executing and controlling the policy of the State and the Government with regard to air transport, civil air navigation and all related services.

The Ministry of Transport meets the provisions of the law set out in Decree-Law No. 296 through Resolution number 646/2012 of 12 September 2012, which created the Instituto de Aeronáutica Civil de Cuba (IACC), an independent legal entity with its own responsibilities for all legal matters, subordinate to the Ministry of Transport.

IACC is the organization that is in charge of conducting the functions of the Aeronautical Authority in Cuba.

Within IACC sits the Meteorological Authority, whose functions are conducted through its Air Navigation Directorate. The Meteorological Authority determines the services required to meet the needs of air navigation users in accordance with the provisions within the Cuban Aeronautical Regulations for Aeronautical Meteorology (RAC 3) and the appropriate regional air navigation agreements. These documents set out the services that are required to be provided for national and international air navigation within the flight information region (FIR) assigned to the Republic of Cuba, namely the Havana FIR.

IACC has designated the Cuban Air Navigation Company (ECNA S.A.), which is part of the Corporation of Cuban Aviation (CACSA), as the air navigation service provider, to provide meteorological service for national and international air navigation on its behalf.

METEOROLOGICAL SERVICES FOR CIVIL AVIATION

Meteorological services to aviation are provided in accordance with the Cuban Aeronautical Manual (MAC) for Aeronautical Meteorology, which was developed and introduced by IACC. The MAC complies with the standards and recommended practices of Annex 3 to the Convention on International Civil Aviation and national requirements for meteorological services, thus ensuring the safety, regularity and efficiency of flights within the Havana FIR.

Meteorological services cover the following activities:

- Aeronautical meteorological observations;
- Dissemination of routine and special aerodrome meteorological reports;
- Dissemination of en-route and area forecasts;
- Provision of SIGMET information and aerodrome warnings;
- Supply of significant weather (SIGWX) charts;
- Briefings for the crew during pre-flight preparations;

- Provision of meteorological information to air traffic control and air traffic flow management unit;
- Issuance of volcanic ash advisories, tropical cyclone advisories and space weather advisories;
- Provision of information on the release of radioactive material into the atmosphere;
- Provision of climatological information for aerodromes and air routes.

ECNA S.A. has a directorate responsible for providing research and development services dedicated to air navigation services, where the needs of the aeronautical meteorological service provider are taken into account.

Meteorological services to civil aviation are provided by the following entities in Cuba:

- Seven aeronautical meteorological stations, which operate as a combined service with air traffic control in the control towers of two international and five national airports.
- Aerodrome meteorological offices at eight international airports, which operate as a combined service with aeronautical information services (AIS) and Air Traffic Services Reporting Offices (AROs).
- One meteorological watch principal office, which prepares meteorological forecasts and warnings for all national and international airports with the exception of Havana, which has its own aerodrome meteorological office that produces the forecasts and warnings, and also performs the function of the meteorological watch office of the Havana FIR. All forecasters in Cuba use the latest techniques for aeronautical meteorological forecasting.

In Cuba, the aeronautical meteorological service provider is not part of the structure of the National Meteorological Service, namely the Instituto de Meteorología de Cuba (Institute of Meteorology of Cuba). The aeronautical meteorological service provider and the Institute of Meteorology work together on matters related to the provision of meteorology in Cuba, but administratively they are two separate entities. An agreement is in place between the aeronautical meteorological service provider and the Institute of Meteorology to ensure that both entities complement each other's services with meteorological information and forecasts.

The following facilities are used to obtain aeronautical meteorological information:

- Aerodrome automatic meteorological stations;
- A meteorological satellite receiving station;
- The meteorological radar network of the Institute of Meteorology;
- Dedicated equipment and connections for aeronautical meteorological communications;
- Computer facilities.

Meteorological information and forecasts prepared by the aeronautical meteorological service provider are made available on the website http://aismet.avianet.cu/ as well as the aviation intranet.

Since 2004, the quality management system of the aeronautical meteorological service provider has been certified by a national entity, namely Oficina Nacional de Normalización (the National Standardization Office), and internationally by Buró Veritas and Lloyd´s Register.

Personnel who undertake the provision of Cuba's aeronautical meteorological service are appropriately qualified and meet the competency requirements as set out in Annex 3 to the Convention on International Civil Aviation and WMO *Technical Regulations* (WMO-No. 49), Volume I.

COST RECOVERY POLICY

The State (via IACC) requires ECNA S.A. to provide the meteorological services detailed above, to ensure the safety of air navigation within the specified airspace for which Cuba is responsible. The costs of these services are charged to both en-route and airport users in line with ICAO guidance such as Doc 9082 and Doc 9161. The part of the fees charged to the airlines that corresponds to meteorological services covers the total cost of the aeronautical meteorological service.

Currently, in the Republic of Cuba, aeronautical meteorological services are recovered in two ways:

(a) For the provision of meteorological information for en-route services, ECNA S.A. charges according to the public rates approved by the Ministry of Transport for air navigation services. They are calculated according to an estimate of the total annual cost of the meteorological watch principal office that provides aeronautical meteorological services for en-route services. This cost estimate is based on the cost of the overall service provided, the volume of air transport operations and the costs of aeronautical meteorology operations that are dependent on the volume of aircraft operations being provided.

(b) For the provision of aerodrome meteorological information, the cost is considered part of the air navigation services rate applied to landings and take-offs. The services include the provision of meteorological information to crews and air traffic control agencies at airports. The cost varies depending on the type of aircraft. It is determined by a specific coefficient based on the maximum take-off weight and is established by ECNA S.A. on an annual basis and approved by the Ministry of Transport. The Republic of Cuba's Aeronautical Information Publication (AIP Cuba) publishes the rates that apply.

For ECNA S.A., the provision of aeronautical meteorological services is a non-profit activity, where these costs are recovered by applying the principle that the income received is used to cover the cost of production, processing and transmission of information, as well as the cost to maintain the observation network and to improve meteorological services to civil aviation.

Meteorological costs are assigned based on the estimates made for each aeronautical navigation unit of ECNA S.A. and for ECNA S.A. as a whole. The cost estimates are periodically compiled in a document, as regulated by the competent body (Ministry of Economy or Ministry of Finance), and are submitted to IACC for consideration and the Corporation of Cuban Aviation (CACSA) for approval. They ensure transparency in aviation user administrations and ensure that there is no double accounting for the costs of meteorological services. In addition, they serve as a basis for evaluating the allocation of costs between airport services and en-route services.

INDIRECT COST RECOVERY MECHANISMS

Multitasking for operational staff

The national and international airports of the Republic of Cuba only have a limited number of operations. In order that the airports are operated as efficiently as possible, the operational staff working for ECNA S.A. have a number of roles. This ensures the operation is cost effective so as to reduce the costs that need to be recovered.

At the national airports where air traffic control services are provided, the air traffic controllers (ATCOs), in addition to having an ATC license, are also trained as Aeronautical Meteorological Observers (AMOs) as per WMO's Technical Regulations. Here, both the roles of ATCO and AMO are provided by the same person, who is responsible for making meteorological observations and for ensuring that the reports are disseminated. Personnel who undertake meteorological observing duties are required, under Cuban regulations, to undertake a competency assessment every two years.

Similarly, at international airports, the Air Traffic Control Services Reporting Service, the aeronautical information services and the aeronautical meteorological services are provided by the same person. However, at the José Martí International Airport in Havana, individual staff provide each function. All staff are required to be qualified as Aeronautical Meteorological Forecasters or Aeronautical Meteorological Observers, as set out in the basic instruction packages of WMO, with meteorological competencies evaluated every two years. These personnel also receive qualifications following training in the other aeronautical services such as aeronautical information services and air traffic services.

Technological innovation

The aeronautical meteorological service provider has developed a range of technical innovations to reduce the cost burden of third-party software licences for computer applications and for the acquisition, processing and visualization of meteorological information.

Because it uses computer applications it has developed in house using open-source software, ECNA S.A. own the intellectual property rights and is not required to pay for software from system providers or for updates and licences. These cost savings mean that additional funds can be used to train operational and technical personnel and for the purchase of more modern meteorological sensors and equipment when required.

Through technological innovation ECNA S.A. has been able to achieve the following:

- Aeromet is the automated system for the acquisition, processing and visualization of meteorological information at the airports, implemented in all the aerodrome meteorological offices and in their units of the Air Traffic Control Service.

- Automatic Terminal Information Service (ATIS) is used at the José Martí International Airport in Havana. Development work is being carried out so that the system can operate Digital Automatic Terminal Information Services (D-ATIS).

- Meteorological information is processed and transmitted in ICAO Meteorological Information Exchange Model (IWXXM) format. This includes the development of software to translate Traditional Alphanumeric Code to IWXXM, to allow the transmission of meteorological information to the Regional OPMET Centres.

- Introduction of the RADCON M Automated System for Air Traffic Control, developed by specialists from ECNA S.A. This system is capable of obtaining and processing information from the meteorological radars of the Institute of Meteorology and presenting it in a user-friendly way to ATCOs, thus allowing a better situational awareness for ATCOs by highlighting potential deviations from routes when there are dangerous weather conditions.

CONCLUSIONS

In Cuba aeronautical meteorological services are provided by the air navigation service provider. At this time it is not possible to establish a direct estimate of the cost of aeronautical meteorological services. The costs of the services are calculated by the aeronautical navigation

units where the meteorological service is part of the combined total service. Work will be carried out in the near future to be able to determine the costs by aeronautical speciality and in this way estimate the contribution for each service.

ANNEX X. AERONAUTICAL METEOROLOGICAL SERVICES COST RECOVERY IN FRANCE

In France, the Direction des Services de la Navigation Aérienne (DSNA) is the air navigation service provider as set out in Article 4 of Regulation (EC) No. 549/2004 of the European Parliament and of the Council of the European Union (10 March 2004), which lays down the framework for the creation of a Single European Sky.

A decree of the Government of France (20 December 2011) along with Article 9 of Regulation (EC) No. 550/2004 of the European Parliament and of the Council of the European Union (10 March 2004) relating to the provision of air navigation services in the Single European Sky designates the public entity Météo-France, France's National Meteorological Service, as the provider of meteorological services to air navigation on an exclusive basis. Météo-France provides meteorological services in the airspace in which France's administration provides air navigation services as well as at any aerodrome located on France's territory (excluding military aerodromes).

Like other European countries, France charges aeronautical users for the various costs of providing air navigation services (in particular air traffic control, aeronautical information and meteorological information) by including the costs of core services and facilities.

As an indication, in 2020, 5.4% of en-route charges from non-overseas airspace received by France were allocated to Météo-France, which represented 22.2% of its annual budget.

As with other air navigation services, the charges imposed on air carriers cover the entire cost of the meteorological service, including a contribution to the costs of the core facilities and services. In accordance with the regulations of the Single European Sky, Météo-France details the costs of the services provided within this framework each year.

FRAMEWORK OF AERONAUTICAL METEOROLOGICAL SERVICES

By application of Annex 3 to the Convention on International Civil Aviation, the meteorological services provided by Météo-France in the airspace under the responsibility of France include:

- En-route weather forecasts and warning services for international and domestic flights;
- Provision of low-level significant weather charts intended for general aviation;
- Aerodrome weather services;
- Provision of delivery system facilities;
- Provision of research and development services dedicated to aviation;
- Provision of a volcanic ash advisory centre and a tropical cyclone advisory centre, as agreed with ICAO.

Moreover, some additional data and services beyond the Annex 3 requirements were defined by the Government as being necessary for air navigation safety. The complete list of data and products required for air navigation safety is in the annex to the certificate of compliance with the Single European Sky regulations issued to Météo-France.

The Direction Générale de l'Aviation Civile (DGAC) defines the meteorological services, including those provided overseas, as services provided to:

- All aerodromes listed in the Journal Officiel de la République Française, which is published annually.

- All air traffic control (ATC) and aeronautical information units serving the flight information regions (FIR) under the responsibility of France.

The Single European Sky regulations require full transparency on the methods used to estimate the costs charged by the State to air navigation and associated aviation users. To ensure this transparency, close collaboration and exchange between Météo-France and the DGAC has been formalized through the holding of regular meetings on technical and financial issues. Official meetings are also organized periodically within the Conseil Supérieur de la Météorologie (CSM) chaired by France's Minister in charge of Transport. The CSM's aviation committees examine the needs of all users, including commercial aviation, general aviation and sport aviation (gliders, powered ultralight aircraft, balloons, etc.). Users have the opportunity to express their requirements and Météo-France must respond to them. Any negative response requires justification.

SCOPE OF COSTS ALLOCATION TO AVIATION CHARGES

The valuation of the costs of meteorological services to air navigation falls within the following scope:

- Excluded from the cost basis are those services that Météo-France provides to some aeronautical users on a strictly commercial basis.

- Services that Météo-France provides to general aviation, for the purposes of investigations, for State flights, etc. are also excluded from the basis for costs charged to aeronautical users.

METHODOLOGIES FOR ESTIMATING COSTS OF SERVICES TO AIR NAVIGATION

Météo-France serves three main categories of customers or users:

- Public services (mainly defence and civil security), funded as part of its public service mission;

- The air navigation sector within the framework of safety requirements, funded mainly through air navigation charges with respect to meteorological services;

- The commercial sector, which is entirely financed by its own revenues.

Access to Météo-France products and services financed by air navigation charges is reserved solely for aeronautical users. Their use, including their rebroadcasting, is open and free within the aviation community.

The cost of meteorological services to air navigation is assessed on the basis of an annual cost accounting audited since 2010 by an external oversight body.

Météo-France's cost accounting uses a methodology based on real costs (as registered in its income statement) and full costs (direct and indirect). All the costs actually borne by the organization and recorded in its financial accounts are thus reclassified into cost categories corresponding to the various activities or expense items of Météo-France. Based on a functional model, these cost categories are ranked and classified by different levels to take account of their interdependencies. In this way, the higher cost categories flow to the lower cost categories according to allocation keys, which ensure that costs are allocated to the most appropriate

cost categories. This process makes it possible to break down all recorded costs in the income statement over the three production branches of Météo-France: public services, air navigation and commercial.

As previously indicated, the cost accounting system adopted by Météo-France is based on a functional model which separates:

Primary cost categories – the activities and costs related to meteorological production, themselves divided into three groups:

(a) Support activities: the costs of several technical activities supporting the core business in meteorology: intensive computing, storage, operational IT and data transmission (in 2020, 9% of Météo-France costs).

(b) General meteorological production activities (known as "upstream production") intended for various applications which cannot be attributed to any specific user: general observations, general forecasting, climatology, research, initial training of personnel (in 2020, 46% of Météo-France costs).

(c) Customer-related production activities (known as "downstream production") which are directly and exclusively attributable to an identified customer sector: air navigation, public services or commercial (in 2020, 26% of Météo-France costs).

Secondary cost categories:

(d) Activities and costs relating to site logistics (purchase, rental, operation and maintenance of non-technical premises), administration and management (senior management, financial management and human resources, legal activity), internal communication and continuous training (in 2020, 19% of Météo-France costs).

Therefore, costs of meteorological services include:

- A portion of the support activities costs described in (a) above, broken down according to use of supercomputers for storage and intensive computing, for calibration and monitoring of transmission networks, for IT staff associated with supporting the aeronautical meteorologists' workstations, etc.

- A portion of the upstream production costs described in (b) above, broken down according to allocation keys based on considerations specific to the operation; these depend on the nature of the activity (for example, ratio of the workforce assigned to the air navigation service to the total workforce assigned to the development of products intended for users for observation and general forecasting, analysis of the activity of the various study groups for research and development).

- The direct costs related to downstream production activities described in (c) above, identified without ambiguity (for example, observational systems that are used solely for aviation (lidars, transmissometers, ceilometers, etc.), aeronautical meteorological stations, aerodrome meteorological offices, meteorological watch office, etc.).

- A portion of the secondary costs described in (d) above, broken down by production activity for real estate infrastructure and logistics, and by the operating staff associated with each production activity for supervision, financial management or human resources and continuous training.

Météo-France's cost accounting makes it possible to precisely trace the origin of these costs, as it has a breakdown by cost type (personnel, operations, depreciation), a breakdown by activity centre (interregional centres, thematic departments, etc.), and a breakdown by activity of origin (direct aeronautical cost, cost resulting from radar observations, research, etc.).

Mixing these different axes of analysis allows Météo-France to accurately cost the various elements of the aeronautical service provision. As the regulations in force require a breakdown of the costs of the meteorological service between en-route use and aerodrome use, the allocation is carried out in accordance with the guidance given in ICAO Doc 9161.

CONCLUSION

Météo-France's cost accounting has been the subject of external audits since 2010 which certify its compliance with general accounting principles and in particular with the principles of causality, integrity, transparency and consistency. The relevance of all the allocation keys used is also assessed and confirmed.

The methodology described here for estimating the costs of the meteorological service charged to air navigation has been used by Météo-France for several years. Users have not raised any reservations to date. The results obtained are officially presented to aeronautical users twice a year:

- At the beginning of the year for the executed budget of the previous year;
- At the end of the year for the provisional budget of the following year.

ANNEX XI. AERONAUTICAL METEOROLOGICAL SERVICES COST RECOVERY IN GERMANY

INTRODUCTION

In Germany, the government department responsible for aviation services is the Aviation and Aerospace Directorate of the Federal Ministry of Transport and Digital Infrastructure.

The National Meteorological Service – Deutscher Wetterdienst (DWD) – is the officially designated meteorological authority in line with Annex 3 to the Convention on International Civil Aviation. As a statutory task, DWD is also responsible for the provision of meteorological services for civil aviation in Germany.

METEOROLOGICAL SERVICES FOR CIVIL AVIATION

The meteorological services for aviation provided by the DWD are as follows:

- Provision of data (such as METAR);
- Provision of national forecast products (such as TAF);
- Provision of warnings (such as aerodrome warnings) and other information (such as SIGMET);
- Provision of advice to and consultation with users;
- Other services (such as education and training, contribution to international organizations).

COST ALLOCATION AND RECOVERY

The products required to provide the meteorological services for aviation are defined in the ICAO *Manual on Air Navigation Services Economics* (Doc 9161) relating to:

- Instrument flight rules (IFR) and visual flight rules (VFR);
- En-route and airport.

The provision of these services entails basic tasks which can be separated into two groups:

(a) Those required solely for aeronautical meteorological services (such as monitoring of TAF and wind shear etc.).

(b) Those which are also common to other meteorological services and value-added services such as the observing network, the telecommunication network, administration and additional IT services. These costs are core costs that are incurred in general operations but are not charged to aviation cost accounting.

ALLOCATION OF THE COSTS OF AERONAUTICAL METEOROLOGICAL SERVICES

An analytical accounting system in place at DWD ensures that costs are allocated according to the service or application area, such as aviation, marine or public weather. In this accounting system, which is structured as a multilevel system, all services and products are defined as cost units:

- External cost units are either related to meteorological services for aviation or other non-aviation users who receive non-fee financed products, according to DWD's price list;
- Internal cost units representing core services (some of which are applied solely, proportionally or not applied to aeronautical meteorological services).

All DWD costs are allocated to either internal or external cost units, with an emphasis on allocation to external cost units.

A cost allocation base is generated for every internal cost unit; this makes it possible for all overheads to be distributed from each internal cost unit to the external cost units. Examples of the preferred individual overhead cost allocation bases employed in DWD are statistics, studies, expert knowledge, increase in databases, records of use/users, requirements of use/users, staff times and costs, and returns.

Internal cost units which contribute to meteorological services for aviation can represent either specific direct or core costs for aviation. For instance:

- If an internal cost unit represents exclusively aeronautical meteorological services, 100% of the costs are allocated to external cost units representing meteorological services for aviation.
- If an internal cost unit contributes to both aeronautical and non-aeronautical meteorological services, the costs are recorded as core costs. These core costs are no longer charged to aviation following a change in accounting methodology in 2017.

The full costs for each external cost unit are calculated through a summation of the specific direct costs and the 100% internal cost units.

SERVICE CHARGES FOR INSTRUMENT FLIGHT RULES (IFR) AND VISUAL FLIGHT RULES (VFR)

These costs are proportionally allocated to en-route and airport. The full costs for all meteorological services for aviation are generated through a summation of the costs of all meteorological services for aviation.

In accordance with ICAO Doc 9161 guidelines, IFR and VFR use in Germany is allocated to the costs of aeronautical meteorological services on the basis of specific direct aviation personnel costs. All specific direct IFR costs are attributed to IFR costs; similarly all specific direct VFR costs are attributed to VFR costs. The split between IFR and VFR usage is currently 92% IFR usage and 8% VFR (as of 2020).

ALLOCATION OF THE COST FOR IFR USE BETWEEN EN-ROUTE AND AIRPORT USE

Allocation of aeronautical meteorological services between en-route and airport use is based on the identified cost units. For every internal and external cost unit related to aviation, an allocation between en-route and airport use is made as follows:

- If such a cost unit represents exclusively en-route use, 100% of the costs are allocated to en-route; similarly, all specific airport costs are attributed to airport use;

- If such a cost unit represents both en-route and airport use as defined in ICAO Doc 9161, the costs are allocated to both on a pro rata basis.

BUDGET INFORMATION (AS OF 2020)

Currently, the direct costs of aeronautical meteorological services amount to 5.5% of DWD's total costs (5.1% relate to IFR). The contribution of the core costs for aeronautical meteorological services amounts to 13% of the total DWD core costs (11% relate to IFR).

As of the 2017 accounting year, the Federal Ministry of Transport and Digital Infrastructure changed the accounting methodology for aviation costs into direct costs. As a result, core costs no longer represent billable costs for aviation.

The core costs borne by Germany in 2020 amounted to approximately 30 million euros and corresponded to approximately 63% (or two thirds) of the total aeronautical meteorological service costs.

ANNEX XII. AERONAUTICAL METEOROLOGICAL SERVICES COST RECOVERY IN SINGAPORE

INTRODUCTION

In Singapore, the Civil Aviation Authority of Singapore (CAAS), a statutory board under the Ministry of Transport, is the country's national aviation authority.

CAAS, pursuant to Singapore's Air Navigation Order paragraph 88E, is responsible for the regulation of the provision of meteorological services for international air navigation. It publishes and issues the Manual of Standards – Meteorological Service for International Air Navigation (MOS-MET(IAN)) specifying the national standards, requirements and procedures for the provision of meteorological services by the meteorological service provider. The MOS-MET(IAN) is based mainly on the standards and recommended practices stipulated in Annex 3 to the Convention on International Civil Aviation along with any modifications as determined by CAAS to be applicable in Singapore. The MOS-MET(IAN) also makes reference to Annexes 11 and 12 (on meteorology-related matters), Annex 19, and relevant ICAO documents, including ICAO's Asia and Pacific Region (APAC) electronic Air Navigation Plan (eANP).

The Meteorological Service Singapore (MSS) under the National Environment Agency (NEA), a statutory board in the Ministry of Sustainability and Environment (MSE), is the national meteorological authority on weather and climate.

Under Section 13 of the National Environment Agency Act, MSS is empowered to provide meteorological services for a wide spectrum of users, including the aviation and maritime communities, government agencies and the public. Through a Ministerial Direction, MSS is the service provider of aeronautical meteorological and related specialized services to support CAAS in fulfilling Singapore's obligation to comply with ICAO's standards and recommended practices.

Provision of aeronautical meteorological services by MSS to support the provision of air traffic services by CAAS in the Singapore Flight Information Region (FIR) and at Changi and Seletar Airports is specified through a bilateral service agreement between CAAS and NEA/MSS. The agreement encompasses the following areas:

- Provision of aeronautical meteorological services;
- Cost recovery for aeronautical meteorological services;
- Obligations by both MSS and CAAS to provide aeronautical meteorological services;
- Coordinated activities by both CAAS and MSS to provide aeronautical meteorological services.

METEOROLOGICAL SERVICES FOR CIVIL AVIATION

Meteorological services for civil aviation in Singapore are provided by MSS in accordance with the MOS-MET(IAN) to support and ensure flight regularity, efficiency and safety in Singapore's FIR and at its aerodromes. These services comprise both en-route and aerodrome related services, and the cost of each service is assessed by determining the resources (personnel/ infrastructure/systems) that go into providing the service. No allocation of costs is made between instrument flight rules (IFR) and visual flight rules (VFR) services. Some of the key aeronautical meteorological services provided by MSS under the service agreement with CAAS are listed in Table 1.

Table 1. Selection of key aeronautical meteorological services provided under the service agreement

No.	*Service*
1	Perform functions of a 24/7 Aerodrome Meteorological Office, including: - Preparation and forecasting of meteorological conditions for flights departing/landing at aerodromes; - Maintaining surveillance and continuous observation of meteorological conditions over the aerodromes; - Preparation of flight documentation for flight crew/operations personnel.
2	Perform functions of a 24/7 Meteorological Watch Office (MWO) to support aircraft in flight within the Singapore FIR, including: - Maintaining watch over meteorological conditions affecting flight operations within FIR; - Provision of SIGMET information.
3	Provision of 24/7 aeronautical meteorological observations and reports including: - METARs and local routine reports; - SPECIs and local special reports; - Timely dissemination of aviation weather reports to local air traffic services units and internationally.
4	Preparation and issuance of: - Aerodrome forecasts (TAFs); - Landing forecasts (TREND); - Windshear alerts and warnings; - Aerodrome warnings; - Forecasts for take-off; - Forecast of area QNH; - Low-level significant weather chart for Singapore; - Forecasts over holding stacks; - Daily briefings to air traffic controllers.
5	Provision of meteorological information/conditions for pre-flight planning and use by flight crew prior to departure and aircraft in flight, including: - Aerodrome reports, forecasts and warnings; - En-route significant weather, wind and temperature forecasts (WAFS); - Advisories of volcanic ash and tropical cyclones.
6	Provision of meteorological data and forecasts for air traffic services and search and rescue operations.
7	National and international distribution of meteorological data and reports via the Air Traffic Management System.
8	Perform the functions of a Regional OPMET Databank, Interregional OPMET Gateway and regional OPMET Bulletin Exchange centre.

MSS further supports air navigation services in its capacity as a Regional OPMET Databank (RODB), a Regional OPMET Bulletin Exchange (ROBEX) Centre, an Interregional OPMET Gateway (IROG), a TAF Collection Centre and a VOLMET Broadcast Centre.

MSS provides services to general aviation through its aviation weather services website and through the provision of flight documentation. The cost for customized pre-flight planning documentation is recovered directly from the airline operators, while the cost of the aviation weather services website is recovered through the service agreement with CAAS.

MSS provides aeronautical meteorological services under a quality management system (QMS) which is ISO 9001 compliant. Since 2009, MSS has also had a safety management system (SMS) for aeronautical meteorological services, under the requirements of ICAO's Universal Safety Oversight Audit Programme (USOAP). To ensure compliance, MSS is audited annually by the CAAS's Aerodrome and Air Navigation Services Regulation Division, which is responsible for undertaking safety oversight of the provision of aeronautical meteorological services in Singapore. Performance indicators have been agreed with CAAS and include the timely dissemination of observation reports, and accuracy of forecasts and warnings.

COST ALLOCATION AND RECOVERY

MSS, as the national authority on weather and climate, serves a wide spectrum of user groups, including government agencies (overseeing civil aviation, national defence, water resource, etc.) and the business sector. MSS's central facilities and infrastructure, including systems such as observing networks and equipment, meteorological communications, IT and high-performance computing systems as well as research and development, are key enablers for provision of meteorological services to all users. The costs of these central facilities and infrastructure are appropriately apportioned to each main user group based on the estimated usage or consumption for producing the service or product to fulfil the user's service requirements (for example, the apportionment of supercomputing resources is based on the volume of NWP modelling runs required to support each user group). This cost sharing results in reduced total costs to be recovered from each user group.

Under the service agreement between CAAS and MSS, the provision of aeronautical meteorological services to support international air navigation and airport operations is based on cost recovery principles and guided by the Singapore Government Financial Manuals. Costs are recovered for two types of services, namely:

(a) Direct services, which include all meteorological services that support domestic and international air navigation in compliance with MOS-MET(IAN) (a selection of direct services is indicated in Table 1 above);

(b) Value-added services, which are services as required by CAAS such as lectures on aeronautical meteorology, and specific studies and reports.

The costing of these services is broadly based on the approach described in the two subsections that follow.

Determining the cost items for producing aeronautical meteorological services

These comprise direct staff costs, depreciation and maintenance costs for equipment, telecommunications and infrastructure as well as indirect costs or overheads (for example, aviation-related research and development, corporate support functions). The costs of capital items are depreciated over their operating lifespan, ranging from 3–5 years for IT equipment to 10 years or more for specialized systems such as the Doppler weather radar and satellite reception systems. Overheads that are not utilized in any way for the generation of aeronautical meteorological services are not charged to CAAS. This ensures a fair and equitable allocation of costs among the user groups.

Establishing an appropriate basis for allocating costs among user groups

The methodology adopted is based on apportioning (1) the number of personnel working on aeronautical and non-aeronautical services, and (2) usage or consumption of facilities and infrastructure to produce aeronautical and non-aeronautical services. For meteorological services that serve both aeronautical and non-aeronautical users, the cost allocation is expressed as apportionment ratios of staff costs and facilities/infrastructure resources required to produce and deliver the service. For staff costs and infrastructure resources that are solely dedicated to providing aeronautical meteorological services, the costs (for example, the system to generate VOLMET broadcasts, the aviation weather services website) are fully allocated (100%) to CAAS. This ensures that no one user group is subsidizing another for the resources utilized. The apportionment ratios are reviewed when there are changes to the composition of MSS's main user groups or their service requirements.

PRICING OF SERVICES

The pricing of the collective aeronautical meteorological services under the service agreement is determined by summing the apportioned direct staff costs, costs for facilities and infrastructure, and overheads. The price of each individual service is ascertained by proportionally assessing and allocating the total price based on the direct staff hours required to produce that service.

Through a consultative process with CAAS, the annual price increase is capped at a mutually agreed percentage over the duration of the service agreement, on the assumption that service deliverables required by CAAS remain unchanged. This percentage takes into consideration the annual inflation rate. When new investments are required to build research and development capabilities or to produce additional services to meet new ICAO requirements, the baseline price of the service agreement will be reviewed and adjusted accordingly. Regular meetings are held with CAAS which include discussions on cost recovery and contractual matters. Overall governance arrangements include discussions with CAAS when there are key changes in their service requirements, conducting user engagement sessions to seek feedback and to explain any key changes in the costing elements, and formalizing the agreed costing through a service agreement, with inputs from the legal and finance departments of both MSS and CAAS.

To ensure that MSS's delivery of aeronautical meteorological services meets the standards of CAAS and Annex 3 requirements, a list of key performance indicators and corresponding targets is stipulated in the service agreement.

ANNEX XIII. AERONAUTICAL METEOROLOGICAL SERVICES COST RECOVERY IN THE UNITED KINGDOM

INTRODUCTION

The United Kingdom (UK) Government department responsible for aviation services is the Department for Transport. This department appoints the UK Civil Aviation Authority (CAA) as the National Supervisory Authority (NSA) for the UK in accordance with the Single European Sky (National Supervisory Authority) Regulations 2013 as amended by the Air Traffic Management (EU Exit) Regulations 2019.

In accordance with the functions conferred on the CAA as the UK's NSA, the CAA has designated the United Kingdom Met Office (Met Office) under Article 9 of Regulation (EU) No. 550/2004 as retained (and amended in UK domestic law) under the European Union (Withdrawal) Act 2018 to provide meteorological services subject to various rights and obligations. This includes:

- The UK Met Office shall at all times hold a certificate issued under Article 7 of UK Reg (EU) No. 550/2004 demonstrating compliance with the common requirements for the provision of air navigation services under UK Reg (EU) 2017/373.

- The UK Met Office shall provide the services referred to in this designation on an exclusive basis in relation to UK airspace. Additionally, the UK has accepted the responsibility for the provision of the World Area Forecast Centre (WAFC) London and the Volcanic Ash Advisory Centre (VAAC) London services and is part of the Pan-European Space Weather Centre consortium (PECASUS).

SERVICES PROVIDED BY THE UK MET OFFICE

(a) International and national aeronautical meteorological services and products, in accordance with Annex 3 to the Convention on International Civil Aviation, as set out in the Service Specification appendices of the Met Office designation agreement. The user requirement is updated by the CAA, as the UK's meteorological authority, in consultation with the Met Office and aviation users at the annual Met Office User Forum.

International services comprise the following:

(i) WAFC London

Services include a global data set of wind, temperature and significant weather as follows:

- Gridded wind and temperature forecasts;

- Gridded weather hazards (clear air turbulence, cumulonimbus cloud and icing potential forecasts);

- Significant weather charts.

(ii) VAAC London

Services include volcanic ash advisories and graphics, as well as supplementary volcanic ash forecasts for the area of responsibility using dispersion models and satellite imagery.

(iii) Space weather centre as part of the pan-European consortium (PECASUS)

Services include space weather advisories for GNSS, HFCOM and radiation related issues.

National services are provided as follows:

Annex 3 services:

- Aerodrome forecasts (TAF) for 55 airfields;
- Aerodrome warnings for 105 airfields;
- Area forecasts for low-level flights (GAMET);
- Low-level significant weather forecasts (SIGWX-low) and low-level wind forecasts;
- SIGMETs for the UK's flight information regions (FIRs);
- Trend forecasts;
- Take-off data;
- Wind shear alerts and warnings;
- Airfield climatological data.

Services for the UK's en-route air traffic service provider (NATS):

- Products and data services that provide situational awareness within NATS's en-route operation for both tactical and planning use;
- An on-site Met Office forecast team at the NATS en-route centre;
- Thunderstorm/cumulonimbus forecasts;
- Low-visibility forecast matrix at six high-capacity airports;
- Forecast QNH.

Services for general aviation:

- Low-level significant weather forecasts in graphical and alphanumeric form;
- Gridded wind and temperature profile charts and aerodrome warnings;
- Services for hot air ballooning.

These products are hosted on an aviation weather briefing portal which is made available free to all UK general aviation groups and business jet operators.

Services for helicopter operations:

The Met Office provides a bespoke weather briefing platform and weather products are provided to help ensure offshore helicopter operations and to support helicopter emergency service operators.

Other national aviation services:

These include an electronic portal accessible to airlines and stakeholders operating within UK airspace to optimize weather impact decision-making and to enable consistent situational awareness, telephone access to meteorologists for forecast clarification/ amplification purposes, and a range of services related to assisting the authorities with aircraft incidents and accidents.

(b) Provision of adequately trained staff in compliance with Annex 3 and relevant WMO publications. This is achieved through the provision of a robust initial training programme and ongoing competency assessment procedures.

(c) Core services (in the UK these are described as those services that underpin the national capability). They are undertaken as an element of the Public Weather Service (PWS) Programme and are detailed in the Customer Service Agreement between the Met Office and Department for Business, Energy and Industrial Strategy (BEIS) the lead Government department responsible for the Met Office. The PWS is a programme that enables the Met Office to provide a wide range of services to a large number and variety of users by sharing infrastructure costs across the different user groups. The PWS national capability comprises a range of activities related to this underpinning infrastructure: observations, computing – including numerical weather prediction, communications infrastructure as well as centralized training, research and development, and IT support and their associated overheads. International commitments are also included in the PWS Programme; this ensures that contributions to WMO, the European Centre for Medium-range Weather Forecasts (ECMWF), the European operational satellite agency for monitoring weather, climate and the environment from space (EUMETSAT), etc. are all shared appropriately. Approximately one third of the PWS is allocated to international programmes, mainly due to the costs of international satellite programmes. Oversight of the PWS is undertaken by the PWS Customer Group (PWSCG). This group consists of users from a wide range of sectors, such as transport, contingency planning, local authorities, fire, police. The CAA is a member of this group and provides technical and strategic advice to ensure an appropriate underpinning capability exists for aviation meteorological services.

(d) The aviation research and development programme, agreed by the Met Office User Forum (MOUF). The purpose of the aviation meteorology research and development programme is primarily to meet users' future safety and efficiency needs in accordance with the ICAO Global Air Navigation Plan (GANP), European Union Single European Sky ATM Research (SESAR) Common Pilot Project and the United Kingdom CAA Airspace Modernisation Strategy.

(e) Keeping of records of all aeronautical meteorological forecast products required under the service specification for a period of two years, to assist with any subsequent investigations in the event of an accident.

(f) Maintenance of a record of all official routine aerodrome meteorological observations (METARs) at UK aerodromes received by the UK Met Office. These are retained for a period of at least five years to assist with any investigations and for climatological purposes. It is the responsibility of the aerodrome operator to provide aerodrome observations. Many aerodromes have outsourced this responsibility to the aerodrome's air traffic service (ATS) provider. One aerodrome has contracted the Met Office to undertake this task. In the UK, cost recovery arrangements for meteorological observations at aerodromes are only included in the costs of the aerodrome operation and are recovered from landing and take-off fees. There is no en-route cost recovery for aerodrome meteorological observations.

(g) International distribution of OPMET and WAFS data on the aeronautical fixed service (AFS) and the Secure Aviation Data Information Service (SADIS). In the UK the role of the regional operational meteorological (OPMET) data centre (ROC London) is undertaken by the UK's ATS provider and costs are recovered separately.

(h) Specialist observing systems that are employed solely for aeronautical meteorological purposes (for example, lidar and airborne monitoring systems for volcanic ash).

(i) Technical support to the CAA as mutually agreed.

(j) Attendance at user fora and various national and international meetings, as agreed with the CAA.

QUALITY MANAGEMENT

The Met Office has a quality management system (QMS) which is ISO 9001:2015 accredited, in conformity with Annex 3. This ensures that the processes designed to discharge the aviation requirements are carried out in a consistent, predictable way and result in high-quality meteorological services.

The QMS that is in place assists in managing performance, non-conformances, ensuring that staff are appropriately trained, service resilience, security and aviation stakeholder relationships. The QMS at the Met Office is subject to regular internal and external audit, including annually by the National Supervisory Authority.

COST CALCULATION

The Met Office runs a detailed accounting system, where each activity can be identified by a unique code. Within this system, each activity accrues costs based on the staff time devoted to the task, equipment and depreciation charges and any externally-sourced contracted services. Additionally, the system can appropriately allocate overheads and corporate services (for example, human resources, finance and senior management). This determines the costs on which all services are based, including aeronautical meteorological services. Each year a budgeting exercise takes place. This enables costs to be provisionally allocated to each cost category, which allows staff resource allocation and equipment procurement to be undertaken. Once the budget is in place each month, the accounting system alerts any department where costs are higher than anticipated.

CHARGES FOR DIRECT SERVICES AND THE PUBLIC WEATHER SERVICE PROGRAMME

All aeronautical meteorological service costs are determined to be in line with ICAO guidelines and take into account UK legislation and related guidance. To ensure this is the case, reference is made to the *Manual on Air Navigation Services Economics* (ICAO Doc 9161). All charges and costs reflect generally accepted accounting and costing principles.

In summary the UK's aeronautical meteorological service costs (as at 2019) were £ 27.6 million, which comprised £ 16.7 million core costs (international subscriptions of £ 5.5 million and other national capability totalling £ 11.2 million) and represents 15% of the Met Office's core costs.

Direct services, that is, those supplied as required by Annex 3, cost £ 7.1 million to provide, with domestic services provided in agreement with the CAA costing £ 3.6 million.

While there are increases in this cost base, primarily due to staff salaries, the UK Met Office applies efficiencies within the processes which seek a 2% reduction in cost per annum.

As noted above, the UK provides services to offshore helicopter operators under a separate cost recovery arrangement. A range of key performance indicators (KPIs) have been agreed, including forecast accuracy and operational availability of the offshore helicopter weather briefing system.

The recovery of costs for this service uses an efficiency performance calculation. This approach is intended to drive efficiencies and therefore yield value to the helicopter industry, while the

consultation process and agreed KPIs help ensure oversight of the quality and reliability of the services provided. The charges for the services are agreed annually following a stakeholder consultation process that includes operators, the ATS provider and the UK CAA.

The calculation is as follows:

For subsequent financial years (FY:n) is calculated by:

(a) Deducting charges for discontinued services (at FY:n–1 prices);

(b) Applying an inflation factor (I), as specified below;

(c) Applying an agreed efficiency factor (E), as specified below;

(d) Finally, adding an agreed charge (at year n prices) for the provision of additional products or new services specified by ICAO and/or agreed with the stakeholder, the ATS provider and the CAA for operational purposes in accordance with the following formula:

CDS for FY:n = ((CDS for FY:n–1 – PD) × I × E) + PA

where:
CDS = charge for the services;
FY:n = the financial year for which the charge for the services is to be calculated;
FY:n–1 = the financial year prior to FY:n;
PD = the price for discontinued services at FY:n–1 prices;
I = 1 + the annual increase in the Consumer Price Index (CPI) (expressed as a decimal) published annually in December of FY:n–1 by the Office for National Statistics;
E = (0.975), reflecting the agreed 2.5% annual efficiency improvement;
PA = the additional charge, if any, (at FY:n prices) for the provision of additional products or new services specified by ICAO, the users or the ATS provider for operational purposes.

PERFORMANCE MEASUREMENT

The UK Met Office is required by BEIS and the CAA to report and publish its performance on an annual basis supplemented by interim quarterly updates. A range of KPIs are agreed as part of the service specification and are then monitored.

For core services, performance measures form part of the Public Weather Service Customer Service Agreement and include KPIs for the availability of critical underpinning IT infrastructure, the availability and timeliness of common forecast capabilities and the exchange of essential data with other National Meteorological Services. A KPI has also been developed that assesses how the wider aviation industry makes use of and takes the necessary actions when using the National Severe Weather Warning Service for warnings for snow and thunderstorms.

For direct services, KPIs have been developed for a range of services, including TAF accuracy, accuracy of aerodrome warnings, global numerical weather prediction (NWP) accuracy for wind and temperature, timeliness of various forecasts and compliance of TAF and SIGMET with international coding standards.

Performance is also reported for services in support of NATS en-route functions; these include the accuracy of low-visibility procedure (LVP) matrices and the quality of the on-site meteorologists' advice.

ANNEX XIV. EXAMPLES OF MULTINATIONAL COST RECOVERY SCHEMES

1. DENMARK/ICELAND AGREEMENT (DEN/ICE)

These two joint financing agreements cover the operation and financing of air navigation facilities and services provided by Denmark and Iceland, respectively, for civil aircraft flying across the North Atlantic, north of the 45° North latitude. These services comprise air traffic control, communications and meteorology. There is a similar cost recovery agreement for the operation of height monitoring units (HMU) that are in place for flights that cross the Atlantic.

For both the Danish and Icelandic cost recovery agreements, the cost base comprises, as its first element, the operational services themselves, namely air traffic services, meteorological services, aeronautical and meteorological telecommunication services and radio navigation aids. Included for each of these services are expenses for the salaries of operational staff, consumables, operating expenses (electricity, heating, lighting, etc.), transportation and miscellaneous expenses.

The second element comprises costs related to maintenance activities, which covers the upkeep of items in the inventory (buildings, antennas, machinery, storage, communications equipment, meteorological equipment, vehicles, boats, office equipment and IT equipment). Expenses in this category include salaries of regular and contract maintenance staff, material and labour for maintenance activities, and miscellaneous expenses (including any new or renovated items greater than USD 15 000).

The third item relates to indirect expenses and includes miscellaneous overheads, administration, depreciation, interest and residual value of any assets which were disposed of.

In the Den/Ice agreement different cost recovery mechanisms are used for the different services. For instance, for air traffic services, the charge per flight (r) through the applicable flight information regions (FIRs) is based on the distance flown (d) multiplied by the unit rate (t):

$$r = d \times t$$

The unit rate is calculated by taking the estimated costs of the air traffic service and dividing by the total number of units forecast in the next year.

For the user charge covering communication services a charge is levied for each flight that operates in the applicable FIRs. Here the charge is calculated by dividing the approved estimated costs for the communication services by the total number of crossings in the applicable FIRs forecast for the next year.

For meteorological services a charge is levied when a flight crosses between Europe and North America and where any portion of the flight lies north of latitude 45° North and between longitudes 15° West and 50° West. This charge is calculated by dividing the approved estimated costs for the meteorological services for the current year by the total number of crossings forecast for the next year.

The above charges are calculated each year by ICAO's Joint Financing Unit and allocated to States that have airlines which have crossed this airspace. States then decide the most appropriate way to recover these costs, taking into account ICAO's key charging policies.

2. SECURE AVIATION DATA INFORMATION SERVICE (SADIS)

SADIS, operated by the United Kingdom, is an Internet-based File Transfer Protocol (FTP) service that makes available the WAFS forecasts and OPMET information mandated by Annex 3 to the Convention on International Civil Aviation.

SADIS provides the WAFS forecasts in both digital format (BUFR and GRIB) and PNG chart format and OPMET information in alphanumeric and IWXXM formats for use in pre-flight planning and flight documentation.

The SADIS Agreement stipulates how the cost recovery for SADIS is to be undertaken. The SADIS Agreement was established by the Council of ICAO on 24 November 2000.

All SADIS user States (with the exception of States that are defined by the United Nations as least developed countries (LDC)) are required to share the costs borne for the provision of the SADIS service. The cost payable by each State is calculated annually by ICAO through the SADIS Cost Recovery Administrative Group (SCRAG). The precise mechanism and responsibilities of signatory parties are set out in the SADIS Agreement.

The SADIS cost base (inventory) includes the following main elements:

- Cost of operation and maintenance. These refer to personnel costs (including direct remuneration, pension contributions, social security costs, etc.), supplies, services contracted or procured (such as server operating costs and telecoms) and other costs of operation and maintenance.

- Administrative costs. Costs incurred in administering SADIS, including invoicing and collection of payments, and in the preparation of reports to the SCRAG.

- Depreciation.

A meeting of the SCRAG takes place annually to agree the costs and the associated cost allocation.

Each State's share of the total costs of the SADIS arrangement is in proportion to the total number of available tonne-kilometres (ATKs) in scheduled services (international and domestic) performed by air carriers based in the State. The share for each State is then calculated from the total number of ATKs performed by all air carriers based in the territory of the State as a percentage of the total number of such ATKs performed by all air carriers of all the States participating in the arrangement. The total costs to be shared includes the costs attributable to the States exempted from paying.

Each State's share for the current year is calculated on the basis of the SADIS cost estimates for that year (as approved by the SCRAG) and the ATKs as provided with regard to each State by the ICAO Secretary General for the two prior years. The cost basis for the assessments for each year are first adjusted (upwards or downwards as the case may be) by the amount by which the total estimated costs for two prior years were below or above the approved actual costs for the current year. Similarly, the assessment of each State is adjusted to take into account any difference between the amounts it paid under the SADIS Agreement as advances for two prior years and its share as determined on the basis of actual ATKs and approved actual costs.

ICAO's Meteorology Panel (METP) oversees the operational aspects of SADIS through one of its working groups. Similar to the SCRAG, the METP working group overseeing the operation of SADIS meets annually.

3. AGENCY FOR AERIAL NAVIGATION SAFETY IN AFRICA AND MADAGASCAR (ASECNA)

ASECNA was established on 12 December 1959 at Saint Louis in Senegal and is governed under the 2010 revised Dakar Convention. ASECNA's mission is to ensure safety and regularity of air navigation. The following States are signatories to the Dakar Convention:

> Benin, Burkina Faso, Cameroon, Central African Republic, Comoros, Congo, Côte d'Ivoire, Equatorial Guinea, France, Gabon, Guinea-Bissau, Madagascar, Mali, Mauritania, Niger, Senegal, Chad, Togo.

ASECNA has responsibility for providing a range of services across 6 FIRs, which cover an airspace surface area of more than 16 million square kilometres.

ASECNA services include providing en-route air navigation services, along with organizing the airways in compliance with the ICAO provisions, publishing aeronautical information, weather forecasting and the dissemination of aeronautical meteorological information.

ASECNA has responsibility for providing aerodromes under its responsibility with air traffic, approach control and aerodrome services. Its responsibilities also include firefighting and aircraft rescue services, publication of aeronautical information and undertaking the role of an aeronautical meteorological station. It provides meteorological forecast services and disseminates the information to the users. ASECNA also runs a number of training schools.

Cost recovery arrangements are in place amongst the States that are signatory to the Dakar Convention that enable the costs of the services provided by ASECNA to be shared equitably. The principle is that for each flight made in airspace managed by ASECNA a user fee covering the costs of providing the respective navigation aids used and the associated services is paid. This fee complies with the principles of Article 15 of the Convention on International Civil Aviation (Chicago Convention, 1944). A scale of fees is included in the Manuel d'Information Aéronautique (Manual of Aeronautical Information) of ASECNA and reviewed as often as necessary. Only one fee is collected for each flight that may cross a number of FIRs that are under the jurisdiction of ASECNA. Each fee is paid by the aircraft operator using the company code as used in the flight number (as stipulated in ICAO Doc 8585). For aircraft weighing between 4 and 14 tons a flat fee is applied regardless of distance flown. In 2020, domestic and regional flights within the ASECNA airspace were charged a flat fee of € 84.99, while international flights were charged € 204.13.

For aircraft heavier than 14 tons, several rates apply depending on the specific aircraft weight and the distance flown. In 2020, for a domestic flight the charge was € 63.54, for a regional flight it was € 81.65, and for an international flight it was € 102.06. These charges (unit fees) were then used as the basis of the charge upon which a multiplying factor called "coefficient de vol" (flight coefficient) was applied. The coefficient applied depends on the aircraft weight and distance flown, as shown in the table.

So, for example, in 2020 a domestic flight for an aircraft of 18 tons travelling 500 km would be charged 1 × € 63.54 = € 63.54, whereas a regional flight with an aircraft weighing 150 tons travelling 1 000 km would be charged 9 × € 81.65 = € 734.85. Similarly, an international flight with an aircraft weighing 220 tons travelling 2 500 km would be charged 24 × € 102.06 = € 2 449.44.

ASECNA is responsible for collecting the fees. Each month ASECNA sends an invoice to users along with a statement detailing the flights that have taken place across the region under their responsibility.

Table des coefficients de vol/Flight coefficients table				
Poids/Weight tons	*Distance (km)*			
	0–750	*750–2 000*	*2 000–3 500*	*>3 500*
14–20	1	5	12.0	20
20–50	1.2	6	14.4	24
50–90	1.4	7	16.8	28
90–140	1.6	8	19.2	32
140–200	1.8	9	21.6	36
200–270	2	10	24	40
270–350	2.15	10.75	25.8	43
350–440	2.3	11.5	27.6	46
440–540	2.45	12.25	29.4	49
540–650	2.6	13	31.2	52

ASECNA is responsible for collecting the fees. Each month ASECNA sends an invoice to users along with a statement detailing the flights that have taken place across the region under their responsibility.

4. NORTHERN EUROPE AVIATION METEOROLOGY CONSORTIUM (NAMCON)

In 2011, the Directors General of a number of Scandinavian meteorological services signed the Copenhagen Declaration, which laid out the principles establishing NAMCON. In 2014, the National Meteorological Services of Denmark, Estonia, Finland, Iceland, Latvia, Norway and Sweden signed a memorandum of understanding establishing NAMCON. In 2020, Lithuania joined NAMCON.

The consortium is built on the concept of equal partnership, improved efficiency and the provision of high-quality aeronautical meteorological services. This cooperative arrangement amongst the NAMCON members allows services to be developed and operated with fewer forecasting staff and software developers compared with individual/independent service provision and reduces duplication of effort.

National Meteorological Services providing aeronautical meteorological services are increasingly under pressure, by aviation regulators, aviation users or others concerned, to reduce costs and demonstrate efficient processes as well as reducing duplication of effort. Through cooperative arrangements such as NAMCON, these demands can be met. Moreover, scientific and technological innovations can more quickly be integrated into operational services since developments can be shared between NAMCON members.

Since September 2013, the consortium has operated a virtual office composed of the Aviation Weather Services Managers of NAMCON members. The virtual office is managed by a consortium manager.

Joint operations and shared tools across NAMCON include:

- Joint low-level significant weather chart production coordinated between Finland Sweden, Denmark and Norway using a SWIM-compliant Significant Weather Chart tool;
- Joint aviation weather briefing portal (www.northavimet.com);

- Joint low-level forecast (LLF) production between Sweden, Finland and Denmark using an interactive tool;

- Provision, by Denmark, of TAFs for aerodromes in southernmost Sweden continuously and SIGMETs in case the Swedish Meteorological and Hydrological Institute (SMHI) is incapable of producing them;

- Backup arrangements for the aeronautical fixed service (AFS) between Denmark and Sweden;

- SIGMET coordination between all NAMCON members;

- Harmonized TAF verification in use in all NAMCON members.

Cost recovery arrangements within NAMCON are based on an annual budget, of which approximately 76% of the costs for consortium management are allocated collectively to Denmark, Norway, Sweden and Finland, and 10% are allocated to Iceland. The remaining costs (~14%) are allocated collectively to Estonia, Lithuania and Latvia. Each year, an annual work plan is put together and agreed between the NAMCON members; the plan sets out the division of work and the tasks of the Consortium Manager.

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