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| **World Meteorological Organization &****Intergovernmental Oceanographic Commission (of UNESCO)****Satcom 2016** Madrid 27-29 September 2016 | Image result for ioc logo unesco**Satcom2016 Final Report** |
| 18/X/2016**Ver 1.1** |
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# Final Report of Satcom2016 27-29 September 2016



Figure 1 Satco 2016 Forum (Sean Burns introducing CGMS requirements)



Figure 2 Joint Satcom2016 & CIMO Teco Opening (Mike Prior-Jones presenting on Satcom)

# DISCLAIMER

**Regulation 43**

Recommendations of working groups shall have no status within the Organization until they have been approved by the responsible constituent body. In the case of joint working groups the recommendations must be concurred with by the presidents of the constituent bodies concerned before being submitted to the designated constituent body.

**Regulation 44**

In the case of a recommendation made by a working group between sessions of the responsible constituent body, either in a session of a working group or by correspondence, the president of the body may, as an exceptional measure, approve the recommendation on behalf of the constituent body when the matter is, in his opinion, urgent, and does not appear to imply new obligations for Members. He may then submit this recommendation for adoption by the Executive Council or to the President of the Organization for action in accordance with Regulation 9(5).

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# FINAL REPORT OF SATCOM2016 27-29 SEPTEMBER 2016

# 1 Organization of the meeting

## 1.1 Introduction

1. [Satcom2016](http://wis.wmo.int/page%3DSatcom2016) was the first formal session of the WMO-IOC International Forum of Users of Satellite Data Telecommunication Systems ([Satcom](http://wis.wmo.int/page%3DSatcom)) following its establishment under Resolution 31 of the Seventeenth Session of the World Meteorological Congress ([Res.31, Cg-17](http://library.wmo.int/pmb_ged/wmo_1157_en.pdf)) in 2015. Participation was by voluntary self-registration and by invitation through WMO and IOC processes.
2. The meeting was held at IFEMA – Feria de Madrid, in Spain as a side event of the Meteorological Technology World Expo 2016([Meteo Expo](http://www.meteorologicaltechnologyworldexpo.com/index.php)), 27-29 September 2016 hosted by Spain. Meteo Expo also included CIMO [TECO 2016](https://www.wmo.int/pages/prog/www/CIMO/cimo-teco-meteorex.html) and the "Metrology for Meteorology and Climate, 2nd conference" ([MMC-2016](http://mmc-2016.org/)).
3. Satcom2016 was also supported by the Association of Hydro-Meteorological Equipment Industry ([HMEI](http://www.hmei.org/)) and [UKIP Media Events](http://www.ukipme.com/). The meeting was chaired by Dr Michael Prior-Jones (UK) and co-chaired by Mr Johan Stander (South Africa). Secretariat support was provided by [WMO](http://public.wmo.int/).

## 1.2 Welcome

1. Satcom2016 was formally opened in a joint session of CIMO TECO 2016, Satcom2016 and MMC-2016. Opening speeches were given by Mr Miguel Angel Lopez Gonzalez (Permanent Representative of Spain with WMO), Dr Wenjian Zhang (Assistant Secretary General of WMO), Prof. Bertrand Calpini (President of CIMO), Dr Michael Prior-Jones (Chair of the Satcom Forum), Dr Johan Stander (Co-President of JCOMM), Dr Andrea Merlone (MMC16 Conference Director), Mr Brian Day (Chairman of HMEI) and Dr Bruce Forgan (CIMO Teco Director)
2. Dr Michael Prior-Jones welcomed all to the first official meeting of Satcom Forum, and highlighted that other conference participants are welcome to attend Satcom talks and discussions. He thanked the organizers of CIMO-TECO for supporting Satcom through this joint session.
3. Dr Prior-Jones especially thanked WMO and IOC of UNESCO for agreeing to establish Satcom Forum, which he believed will prove a great benefit to scientific organizations operating on land and at sea. He then introduced the joint session to the concepts of the WMO-IOC International Forum of Users of Satellite Data Telecommunication Systems (Satcom) designed to serve the needs of scientific organizations that make use of satellite communications to collect and distribute data. He described the Satcom2016 agenda and expected outcomes of Satcom2016.
4. He summarised by highlighting that Satcom is trying to help scientific users bring the right data, in the right format, to the right people, at the right time, for the right price. It’s a big challenge, but the forum has a lot of willing people who are keen to make it happen, and a lot of good connections into the industry, which he hoped will strengthen as the Forum begins its work in earnest. A transcript of his presentation is available online ([Doc01](http://wis.wmo.int/file%3D3114)).
5. Participants of Satcom2016 then adjourned to the Satcom2016 meeting room.

## 1.3 Working arrangements

1. The agenda ([Annex 1](#_Annex_1_Draft)) and work plan ([Annex 2](#_Annex_2._Work)) of the forum are available from the meeting page at [http://wis.wmo.int/page=Satcom2016](http://wis.wmo.int/page%3DSatcom2016). Included on the page is list of registered participants, abstracts and presentations. A profile of registered participants by country and industry sector is provided in [Annex 3](#_Annex_3._Profile). The forum had 73 registered participants and 18 accepted abstracts. Not all registered participants were able to attend. A list of actual attendees is provided in [Annex 4](#_Annex_4_–).
2. The work plan included an information sharing stage, that included two sessions each of “satellite communications service providers”, “equipment manufacturers” and “users”. It also had three formal stages, one being the opening, one the elections of the Satcom executive committee and the other being review the working arrangements and deliverables based on discussions from this meeting and from the [report](https://www.wmo.int/pages/prog/www/ISS/Meetings/Satcom1_Paris2013/documents/Ad-hoc-Satcom-Final-Report.pdf) on the first [Ad hoc International Forum of Users of Satellite Data Telecommunication Systems](http://www.jcomm.info/index.php?option=com_oe&task=viewEventRecord&eventID=1298) (Paris, France, 03-04 October 2013), and setting up a prioritised work plan. The forum considered eight submissions from Satcom network providers, three from equipment manufacturers and three from users.
3. A list of presentations with links to their abstracts and online copies (where available) is in [Annex 5](#_Annex_5._List).

# 2 Satcom network providers

1. The meeting had two sessions on Satcom Network Providers. Both sessions were chaired by Mr Sean Burns from EUMETSAT. Eight presentations were considered and are summarised in [Annex 6](#_Annex_6_–). They included Mr Sean Burns on “[CGMS and meteorological data collection systems](#_A6.1__CGMS)”, Ms Laura Kay Metcalf on “[NOAA's GOES Data Collection System](#_A6.2__NOAA's)”, Mr Nicholas Coyne on “[Meteosat Data Collection System](#_A6.3__Meteosat)”, Mr Scott Rogerson and Mr Michel Sarthou on “[Argos Data Collection & Location System](#_A6.4_Argos_Data)”, Mr Allan Place on, “[Iridium satellite network](#_A6.5_Iridium_satellite)”, Mr Tony Hopko and Mrs Mariuxi Chávez Suárez on “[Orbcomm satellite network and services](#_A6.6_Orbcomm_satellite)”, Dr Mike Prior-Jones on “[Globalstar, Inmarsat, Thuraya and VSAT](#_A6.7_Globalstar,_Thuraya)”, and Ms Nada El Marji on "[Inmarsat BGAN M2M](#_A6.8_Inmarsat_BGAN)".
2. Mr Burns thanked the satellite providers for their contributions. There were several discussions, mostly involving clarifications. The meeting noted the success of some satcom operators in fulfilling WMO requirements for making information available through the WMO information system, in particular the World Weather Watch Global Telecommunications Network (GTS). This included the incentive of Eumetsat by providing the services for free to non Eumetsat members if platform owners agree to make their data available in WIS. Argos, which has been processing collected data in WMO codes for insertion on GTS in the last 30 years, and Inmarsat, which has been providing a service whereby ship dated formatted in FM-13 SHIP format and transmitted through Code-41 and Land Earth Stations (LES) facilitated insertion of the data on GTS, although at the cost of the receiver NMHS​. It further noted that Iridium, as stated by JouBeh, has provided data successfully to the GTS for the last few years. Some issues that would need following up, included the following. The meeting noted that the operators had different ways of managing stations that ceased to transmit or stations that drifted off frequency or time. It noted that de-allocating slots was difficult for some operators even when stations have been silent for a long period. It agreed that utilising time from GPS component helped avoid time drift. The meeting agreed that Satcom should look further into these issues.
3. Address the need for guidance on how to handle silent, obsolete or other problematic stations.
4. The meeting noted the importance of radio frequency allocation and management to data collection systems. It was emphasized that spectrum management was a long process managed by ITU with much of the necessary coordination taking place in the mission planning stage. Participants raised the question of whether Satcom should interact with frequency allocation bodies either directly or through established groups such as the WMO Steering Group on Radio Frequency Coordination (SG-RFC), the CGMS or the Space Frequency Coordination Group (SFCG)? If so how?
5. Investigate if Satcom should concern itself with spectrum management issues and if so what would this involve and how should Satcom go about this?
6. The co-chair of Satcom, Mr Johan Stander, noted that it would be useful if system providers provided a brief statement on future plans, bandwidth and capacity. Operators agreed to submit a brief statement by Wednesday 5 October.
7. Operators to provide a brief statement on future plans, bandwidth and capacity to the Chair of Satcom.
8. The meeting noted that some operators were planning to utilise small satellites such as cube sat or nano/pico satellites as part of their constellations. It decided that Satcom should maintain awareness of such systems as another source of what is coming in the future.
9. Monitor the potential pros and cons of utilising small satellites as a part of future solutions and service systems.

# 3. Equipment Manufacturers

1. The meeting held two sessions on equipment manufacturers. The first session was chaired by Mr Alan DeCiantis of FTS (Canada), representing HMEI. The second session was chaired by Professor David Meldrum from the UK. Three presentations from industry were considered and are summarised in [Annex 7](#_Annex_7_–). They included Mr Andy Sybrandy on “[How the satcom networks can best serve scientific equipment manufacturers](#_A7.1_Pacific_Gyre,)”, Mr Rudolph Duester on "[Telemetry meets Water: Reliable Data for Measuring and Monitoring Tasks in Early Warning Systems (Surface Water, Groundwater, Water Quality)](#_A7.3_SEBA_Hydrometrie,)", and Mr Simon Van den Dries on “[Satellite M2M communication service](#_A7.2_Rencos,_Satellite)”.
2. The chair thanked Mr DeCiantis and Prof Meldrum for chairing the equipment manufacturing sessions and he expressed his appreciation on behalf of the meeting.to the speakers for their presentations and contribution to discussions. The manufacturers’ presentations and use cases had provided a useful insight into the range of services used by a wide range of application areas. The meeting noted the manufacturers recommendations on the future requirements for satcom systems and the lessons learned which fully aligned with discussions in the user sessions. It was agreed that one of the actions of Satcom should be to work with industry and users to put together some use cases that demonstrate the needs of users and the likely scale or uptake of services.
3. Involve manufactures in the development of use cases demonstrating the user requirements and potential uptake.
4. The meeting noted the significant relevance of involving the Commission for Hydrology and the Commission for Agricultural Meteorology in the Satcom forum in addition to JCOMM. It noted the common requirements for low data volumes and suitable packages that would facilitate the implementation of early warning systems.
5. Prof. Byong-Lyol Lee (President CAgM) to brief CAgM management group on Satcom and their potential participation
6. Mr Johan Stander (Co-president JCOMM) to brief president of CHy on Satcom and their potential participation.

# 4 Satcom users

1. The meeting had two sessions on Satcom users. Both sessions were chaired by Mr Johan Stander (South Africa), vice-chair of Satcom, co-president of JCOMM and representative of EC-PORS. The session included a [statement from the Assistant Secretary General of WMO](#_A8.1_Statement_from), Dr Wenjian Zhang. It also considered presentations from Mr Steven Colwell on “[The challenges of accessing Antarctic meteorological data in near real-time](#_A8.2_The_challenges)”, . Mr Etienne Charpentier on “[Development of the Global Cryosphere Watch (GCW)](#_A8.3_Development_of)”, and Mr Bryan Hodge on “[Support to nowcasting and real time reporting](#_A8.4_Support_to)”. Summaries of the presentations are in [Annex 8](#_Annex_8_–).
2. The session chair, Mr Stander thanked Dr Zhang, Mr Colwell, Mr Charpentier and Mr Hodge for their presentations. He noted that, as indicated by the equipment manufacturers, many countries cannot cope with the pricing models for satcom services. He emphasised that this would be worse for least developed countries, small island developing states and small land locked countries and that supporting such countries should be a priority for Satcom.
3. Satcom should pay special attention to Least Developed Countries (LDC), Small Island Developing States (SIDS), etc with an aim to facilitating their use of satcom systems.
4. The meeting noted that observing systems deployment and operation is driven by the needs of the services and research activities that use them. It agreed that, as indicated by Dr Zhang, there is a real need to identify telecommunications necessary to meet observation system requirements with an aim to fully develop flexible pricing models that better match the users’ needs. Satcom services should also take into consideration other user requirements identified by equipment manufacturers and users. These included the different needs for: simplex and duplex communications, short burst and low volume data requirements, latency metrics, automatic and delayed activation of systems (including on demand or random activation for alerting systems). It also noted that some needs could be addressed by the equipment and terminal manufacturers such as robustness for operating in extreme environments, ability for basic I/O and programming of terminals and use of off the shelf solutions that can be applied across networks.
5. Satcom should work with satcom providers with an aim to introducing more flexible and focused access plans enabling greater use of satcom systems to facilitate new services.
6. The meeting decided that for suppliers to be able to address the above, Satcom should take the lead in identifying use cases that show the range of needs and applications as an initial priority. This should involve two components. First a survey of WMO and IOC members and building on the information call for case studies.
7. Conduct a market survey. The chair will coordinate with the vice-chair, WMO and IOC secretariats and Mr Simon Van Dries to prepare the survey, circulate this to the Satcom executive council for review and then distribute through WMO and IOC channels. For WMO, this will be the WIS Focal Points. Mr Stander will liaise with IOC.
8. Identify case studies on satcom requirements, draw up call for case studies and example template and send out via official channels and via personal contacts
9. The meeting noted a common need among manufacturers’ users and the users participating in Satcom2016 and recognized the importance of early warning systems as a part of the climate adaptation strategies being put in place. It noted that Eumetsat has a special channel to support such activity and that Inmarsat has within its terms of reference a role in supporting emergencies at sea. It agreed that all satcom providers should be made aware of this societal need and to seek their support in establishing a special package under the WMO disaster risk reduction programme.
10. Explore the possibility of establishing a “WMO branded disaster alerting tariff” considering hydrological community (flood warnings) as a test case and find candidate projects. Establish contacts with networks at senior level (use WMO brand) and try and build a consensus.
11. The meeting noted that many of the identified needs of users were available from some providers but the users were not aware of these services or simply did not know how to go about accessing them. This was typified by the slow uptake of Eumetsat’s high data rate services and by the availability of special channels for alerting systems. It recalled the publication prepared by the Chair (Dr M. Prior-Jones), a copy of which is available at [http://wis.wmo.int/file=1781](http://wis.wmo.int/file%3D1781), has proved very useful to potential satcom users. It agreed that updating this Satcom Buyers Guide would be very beneficial. It noted that the Guide could be published as a formal WMO numbered publication and could be accompanied by a web page containing more dynamic and recent information.
12. The chair to review and update the Satcom Buyers Guide. Satcom will investigate web hosting options (WMO to host, IOC to link or mirror)

# 5. Elections of Satcom Executive Committee

1. The formal elections of the new Satcom Executive Committee took place at Satcom 2016 from 9am to 10:30am Wednesday 28 September 2016. The WMO secretariat (Mr David Thomas) introduced the meeting to the election process ([WDoc01](http://wis.wmo.int/file%3D3111)) and presented the meeting with a list of names standing for the committee. He thanked the interim Satcom organizing committee for the work that they had done, first under Professor David Meldrum and more recently under Dr Michael Prior-Jones in successfully developing the Satcom concept and having it established through the WMO process and finally approved at the seventeenth session of the World Meteorological Congress (Resolution 31, Cg-17) in 2015. He then read out the terms of reference of the Satcom Executive Committee and its membership structure noting that he would chair the session for the elections of the Satcom Chair and Vice-chair, then hand over to the elected chair. He noted that Dr M Prior-Jones was standing for the chair and that Mr J Stander was standing for the vice chair. He then invited any other nominations from the floor. There were none.
2. The meeting unanimously elected Dr Michael Prior-Jones (UK) as the Chair of Satcom and Mr Johan Stander (South Africa) as the vice-chair.
3. Mr Thomas congratulated the new chair and vice chair and handed the meeting over to the Dr Prior-Jones to complete the selection of the remaining committee members.
4. The chair presented the list of candidates, noting that with the retirement of Mr Tom Gross from IOC of UNESCO, that he was unable to fill the IOC secretariat position as this time. The meeting reviewed the list of candidates, including three positions proposed by the chair (B. Hodge representing Australia, S.Burns representing CGMS and D.Meldrum representing the wider user community).
5. The meeting noted the close link between the work of the Joint Tariff Agreement (JTA) and the goals of Satcom and the importance of representation of the JTA on Satcom.
6. The meeting agreed to having JTA as a sub-programme of Satcom and a representative on the executive committee.
7. Mr Johan Stander will liaise with JTA inviting them to formally confirm participation in Satcom as a sub-programme.
8. The meeting agreed to the membership of the Satcom Executive Committee as per [Annex 10](#_Annex_10._Elected) noting that IOC secretariat will provide someone for the IOC secretariat position later.

# 6. Panel Discussion - Working Arrangements and Work Plan

1. The chair led a discussion based on the actions and decisions identified during the meeting as summarised in [Section 8](#_8._Action_and) below. The focus of the discussion was what will the forum do for the next four years addressing some broad aims, some specific objectives and some immediate actions, as described in Working Document 3 ([WDoc03](http://wis.wmo.int/file%3D3128)), and who will do the work.
2. The market survey will be distributed via WMO and IOC contact points, as well as asking HMEI members to distribute to their clients, to determine how much is spent on satcom worldwide. Ideally with a breakdown by type of satcom (voice vs data, stream data vs message data, simplex vs duplex, DCP vs commercial, and volumes). See action A8 and decision D1.
3. The “**Satcom** **Guidebook**” should be a factual guide to networks and their services suitable for new users. It should include a directory of suppliers (probably with a link to a web page where listings can be kept current, along with links to description pages editable by suppliers). The Guide should have a WMO number and have content that, noting that updating official guides takes two or more years due to the need for CBS approval, is slow changing while the web site will hold the same information but with more readily updated information. *See action A11 and decision D2.*
4. The **call for case studies** of systems in service should include what is being measured or monitored, which satcom systems are being used, what equipment was purchased, any comments, issues or lessons learned. Photographs, maps and a short description should be included. Case studies should also be encouraged for proposed systems (such as the presentation by Mr B Hodge from Australia ([Doc15](http://wis.wmo.int/file%3D3115)) addressing how many terminals, projected data volumes and how is it to be paid for. *See action A9 and decision D1.*
5. It will be necessary to **follow up on tariff ideas** in particular the **Disaster alerting tariff** concept for sensors that raise the alarm. Need to address upfront charges for registration, zero standing charges, limited number of messages permitted and (if necessary) high per-message charge when activated. The idea of collective purchases should be encouraged. Other aspects include low data usage, tariffs for messaging systems, low service charges, data caps, collectivised over multiple terminals, multiyear upfront service charge payment and to demonstrate opportunity for networks/VARs. *See* [*Annex 9*](#_Annex_9_–Tariffs) *and actions A7 and A10*.
6. It would be useful for users to follow up on **random activation**. Possible solutions include user paying upfront registration charge, these may include a small number of prepaid messages for testing but he standing charge would not start until the prepaid messages have been used up. *This could be seen as part of action A7 or an additional action A12.*
7. Investigation of a mechanism to allow random activation
8. The meeting decided to investigate if Satcom should interact with **frequency management** bodies and if so, how? Issues to be investigated include what is the impact on satcom users of frequency allocation issues, can Satcom assist WMO and CGMS frequency coordinators in scanning the horizon for frequency management issues? *See action A2*.
9. The meeting also considered the issue of **training and outreach**. The chair offered to prepare a draft standard set of slides for Satcom members to use when at meetings to help provided a consistent image of Satcom. The meeting also considered other outreach activities such as conducting electronic seminars on satcom for new users or perhaps a satcom clinic. It also considered that the web page and guide would benefit from having a help desk contact, possibly making use of the current wis-help@wmo.int. This would be an additional task. *See action A13*.
10. Look into training and outreach, starting with a standard set of slides and help desk contact.
11. The chair then led a discussion on the working practices of Satcom. The meeting noted that the Congress and CBS decisions (See [Res.31 (Cg-17](http://library.wmo.int/pmb_ged/wmo_1157_en.pdf))) set the terms of reference for Satcom, but not specifically for the Satcom Executive. Furthermore, the meeting recommended that the operating practices proposed from Satcom 1”[Ad hoc International Forum of Users of Satellite Data Telecommunication Systems](http://www.jcomm.info/index.php?option=com_oe&task=viewEventRecord&eventID=1298)” Paris, France, 03-04 October 2013 (See final report online at <https://www.wmo.int/pages/prog/www/ISS/Meetings/Satcom1_Paris2013/documents/Ad-hoc-Satcom-Final-Report.pdf>) left room for Satcom to refine its working arrangements. As such, the meeting reviewed the document and agreed to updating the Terms of Reference of the Satcom Executive Committee and Membership described in the [report of Satcom 1](https://www.wmo.int/pages/prog/www/ISS/Meetings/Satcom1_Paris2013/documents/Ad-hoc-Satcom-Final-Report.pdf) as proposed in [Annex 11](#_Annex_11_–) to this report.
12. Update the Terms of Reference of the Satcom Executive Committee and Membership as proposed in [Annex 11](#_Annex_11_–).
13. The meeting considered the membership of the forum.and agreed that the initial membership will consist of those who registered for Satcom2016 as listed on the meeting page [http://wis.wmo.int/page=Satcom2016](http://wis.wmo.int/page%3DSatcom2016) and that the email for the group will continue as satcom2016@wmo.int. It noted that the meeting registration page is closed and that future registrations may be made through the online registration at [http://wis.wmo.int/page=Satcom-Reg](http://wis.wmo.int/page%3DSatcom-Reg).
14. Current membership of Satcom will be those who registered for Satcom2016. Future registrations can be online or via normal WMO/IOC notification processes.

# 7. Closure of the meeting

1. The chair thanked all participants for their contribution during the meeting. He also thanked the support staff for their assistance during the meeting and he thanked HMEI and UKIP Media Events for assisting in the preparation and running of the meeting. He noted that it will most likely be two or more years before the full Satcom meets again, preferring to keep working via email and online. He advised that the Satcom Executive will also continue to work via correspondence with the occasional video conference when necessary. Finally, he thanked WMO and Spain for their support to the meeting. He wished everybody a safe trip home.
2. The meeting closed at 1230 on Thursday 29 September 2016.

# 8. Action and Decision Summary

## 8.1 Actions

[**A1** Address the need for guidance on how to handle silent, obsolete or other problematic stations.](#_Toc464579585)

[**A2** Investigate if Satcom should concern itself with spectrum management issues and if so what would this involve and how should Satcom go about this?](#_Toc464579586)

[**A3** Operators to provide a brief statement on future plans, bandwidth and capacity to the Chair of Satcom.](#_Toc464579587)

[**A4** Monitor the potential pros and cons of utilising small satellites as a part of future solutions and service systems.](#_Toc464579588)

[**A5** Prof. Byong-Lyol Lee (President CAgM) to brief CAgM management group on Satcom and their potential participation](#_Toc464579589)

[**A6** Mr Johan Stander (Co-president JCOMM) to brief president of CHy on Satcom and their potential participation.](#_Toc464579590)

[**A7** Satcom should work with satcom providers with an aim to introducing more flexible and focused access plans enabling greater use of satcom systems to facilitate new services.](#_Toc464579591)

[**A8** Conduct a market survey. The chair will coordinate with the vice-chair, WMO and IOC secretariats and Mr Simon Van Dries to prepare the survey, circulate this to the Satcom executive council for review and then distribute through WMO and IOC channels. For WMO, this will be the WIS Focal Points. Mr Stander will liaise with IOC.](#_Toc464579592)

[**A9** Identify case studies on satcom requirements, draw up call for case studies and example template and send out via official channels and via personal contacts](#_Toc464579593)

[**A10** Explore the possibility of establishing a “WMO branded disaster alerting tariff” considering hydrological community (flood warnings) as a test case and find candidate projects. Establish contacts with networks at senior level (use WMO brand) and try and build a consensus.](#_Toc464579594)

[**A11** The chair to review and update the Satcom Buyers Guide. Satcom will investigate web hosting options (WMO to host, IOC to link or mirror)](#_Toc464579595)

[**A12** Mr Johan Stander will liaise with JTA inviting them to formally confirm participation in Satcom as a sub-programme.](#_Toc464579596)

[**A13** Investigation of a mechanism to allow random activation](#_Toc464579597)

[**A14** Look into training and outreach, starting with a standard set of slides and help desk contact.](#_Toc464579598)

## 8.2 Decisions

[**D1** Involve manufactures in the development of use cases demonstrating the user requirements and potential uptake.](#_Toc464582065)

[**D2** Satcom should pay special attention to Least Developed Countries (LDC), Small Island Developing States (SIDS), etc with an aim to facilitating their use of satcom systems.](#_Toc464582066)

[**D3** The meeting unanimously elected Dr Michael Prior-Jones (UK) as the Chair of Satcom and Mr Johan Stander (South Africa) as the vice-chair.](#_Toc464582067)

[**D4** The meeting agreed to having JTA as a sub-programme of Satcom and a representative on the executive committee.](#_Toc464582068)

[**D5** The meeting agreed to the membership of the Satcom Executive Committee as per Annex 10 noting that IOC secretariat will provide someone for the IOC secretariat position later.](#_Toc464582069)

[**D6** Update the Terms of Reference of the Satcom Executive Committee and Membership as proposed in Annex 11.](#_Toc464582070)

[**D7** Current membership of Satcom will be those who registered for Satcom2016. Future registrations can be online or via normal WMO/IOC notification processes.](#_Toc464582071)

## 8.3 Pending

[Pending: 1. Participants list (Annex 4) to be updated on receipt of UKIP report from meeting scanner](#_Toc463467413)

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# Annex 1. Agenda

|  |  |  |
| --- | --- | --- |
| Session | Agenda Item | Day |
| 1 | Formal opening and introduction | Tuesday (am) 27 Sep 2016 |
| 2 | Satcom network providers (Part 1) | Tuesday (am) 27 Sep 2016 |
| 3 | Equipment manufacturers (Part 1) | Tuesday (pm) 27 Sep 2016 |
| 4 | User Forum (Part 1) | Tuesday (pm) 27 Sep 2016 |
| 5 | Formal proceedings (Election of Satcom Executive Committee, Adoption of working arrangements) | Wednesday (am) 28 Sep 2016 |
| 6 | Satcom network providers (Part 2) | Wednesday (am) 28 Sep 2016 |
| 7 | Equipment manufacturers (Part 2) | Wednesday (pm) 28 Sep 2016 |
| 8 | User Forum (Part 2) | Wednesday (pm) 28 Sep 2016 |
| 9 | Panel discussion | Thursday (pm) 29 Sep 2016 |
| 10 | Forum summary and closure | Thursday (pm) 29 Sep 2016 |

# Annex 2. Work Plan

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| --- | --- | --- | --- |
| Session | Subject | Chair | Time slot |
| 1 | **Formal opening and introduction** | Joint session with CIMO Teco ([Opening remarks](http://wis.wmo.int/file%3D3114)) | Tuesday 09:30 to 11:00 |
|  | Relocate to Satcom2016 forum meeting room (10 minutes) |
| 2 | **Satcom network providers (Part 1)** | Mr Sean Burns (CGMS) | Tuesday 11:15 to 12:30 |
|  | Mr Sean Burns, CGMS and meteorological data collection ([Abstract](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1191)) ([Presentation](http://wis.wmo.int/file%3D3106)) |
|  | Ms Laura Kay Metcalf, NOAA's GOES Data Collection System ([Abstract](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1133)) ([Presentation](http://wis.wmo.int/file%3D3105)) |
|  | Mr Nicholas Coyne, Meteosat Data Collection System ([Abstract](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1194)) ([Presentation](http://wis.wmo.int/file%3D3107)) |
|  | Discussion  |
|  | Registrations and lunch break 12:30 to 14:00 |
| 3 | **Equipment manufacturers (Part 1)** | Mr Alan DeCiantis (HMEI) | Tuesday 14:00 to 15:00 |
|  | Mr Andy Sybrandy, How the satcom networks can best serve scientific equipment manufacturers ([Abstract](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1204)) ([Presentation](http://wis.wmo.int/file%3D3112)) |
|  | Mr Simon Van den Dries, Satellite M2M communication service ([Abstract](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1188)) ([Presentation](http://wis.wmo.int/file%3D3100)) |
|  | Discussion |
| 4 | **User Forum (Part 1)** | Mr Johan Stander (EC-PORS) | Tuesday 15:30 to 17:30 |
|  | Mr Steven Colwell (The challenges of accessing Antarctic meteorological data in near real-time) ([Abstract](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1174)) ([Presentation](http://wis.wmo.int/file%3D3110)) |
|  | Discussion |
|  | Introduction of Wednesday’s election of committee and representatives ([Presentation](http://wis.wmo.int/file%3D3111)) |
| 5 | **Formal proceedings** (Election of Satcom Executive Committee, Adoption of working arrangements) | WMO Secretariat | Wednesday 9:00 to 10:30 |
|  | Introduction of election procedures by WMO Secretariat ([Presentation](http://wis.wmo.int/file%3D3111)) |
|  | Elections |
|  | Morning tea break |
| 6 | **Satcom network providers (Part 2)** | Mr Sean Burns (CGMS) | Wednesday 11:00 to 12:30 |
|  | Mr Scott Rogerson, Argos Data Collection & Location System, ([Abstract](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1182)) ([Presentation](http://wis.wmo.int/file%3D3101)) |
|  | Mr Allan Place, Iridium satellite network ([Abstract](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1209)) |
|  | Mr Tony Hopko & Mrs Mariuxi Chávez Suárez, Orbcomm satellite network and services ([Abstract](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1211)) ([Presentation](http://wis.wmo.int/file%3D3117)) |
|  | Dr Mike Prior-Jones, “Globalstar, Inmarsat, Thuraya and VSAT” (Abstract) ([Presentation](http://wis.wmo.int/file%3D3116)) |
|  | Discussion |
| 7 | **Equipment manufacturers (Part 2)** | Prof David Meldrum | Wednesday 14:00 to 15:00 |
|  | Mr Rudolph Duester ("Telemetry meets Water: Reliable Data for Measuring and Monitoring Tasks in Early Warning Systems (Surface Water, Groundwater, Water Quality)") ([Abstract](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1195)) ([Presentation](http://wis.wmo.int/file%3D3122)) |
|  | Ms Nada El Marji ("Inmarsat BGAN M2M") ([Abstract](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1232)) ([Presentation](http://wis.wmo.int/file%3D3119)) |
|  | Discussion |
| 8 | **User Forum (Part 2)** | Mr Johan Stander (EC-PORS) | Wednesday 15:30 to 17:00 |
|  | Mr Etienne Charpentier (Development of the Global Cryosphere Watch (GCW) ([Abstract](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1203)) ([Presentation](http://wis.wmo.int/file%3D3118)) |
|  | Mr Bryan Hodge (Support to nowcasting and real time reporting) ([Abstract](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1234)) ([Presentation](http://wis.wmo.int/file%3D3115)) |
|  | Discussion |
| 9 | **Panel discussion** | Satcom Chair | Thursday 10:30 to 12:00 |
|  | Opening of session - Satcom chair  |
|  | Discussion of issues raised |
|  | Satcom four year work plan |
| 10 | **Summary and closing** | Satcom Chair | Thursday 12:00 to 12:30 |
| 11 | **Visit exhibitors** | Thursday 12:30 onwards |

# Annex 3. Registration Profile

The 72 registered participants represented 29 countries. 23 registrations were from meteorological or related services, seven were from research or universities, ten were consultants, five were from renewable energies, ten were from manufacturing, twelve were from satellite operators and service providers, and five were from Non-Government Organizations or the United Nations. A list of attendees as recorded in the meeting is provided in [Annex 4](#_Annex_4._List).

# Annex 4. List of Attendees

The following list of attendees is from the meeting records, provided by UKIP Media Events.

1. Participants list (Annex 4) to be updated on receipt of UKIP report from meeting scanner

| **Title** | **Given Name** | **Family Name** | **Organization** | **Country** |
| --- | --- | --- | --- | --- |
| Mr | Bryan | Hodge | Bureau of Meteorology  | Australia |
| Mr | Allan | Place | JouBeh Technologies | Canada  |
| Mr | Philip | Bartlett | FTS | Canada |
| Mr | Alan | DeCiantis | FTS | Canada  |
| Mr | Mahmoud | Abdou | Egyptian Meteorological Authority (EMA) | Egypt  |
| Mr | Amr Mohamed | Amr | Egyptian meteorological authority (EMA) | Egypt |
| Mrs | ANNE MARIE | BREONCE | CLS | France |
| Mr | Michel | SARTHOU | CNES | France |
| Mr | Nicholas | Coyne | EUMETSAT | Germany  |
| Mr | Sean | Burns | EUMETSAT | Germany |
| Mr | Rudolf | Krockauer | Deutscher Wetterdienst | Germany  |
| Mr | Rudolf | Duester | SEBA Hydrometrie GmbH & Co. KG | Germany |
| Mr | Peter | MUTAI | KENYA METEOROLOGICAL DEPARTMENT | Kenya  |
| Mr | Simon | Van Den Dries | Rencos B.V. | Netherlands  |
| Mr | Ahmed | Alharthi | world meteorological house | Oman |
| Mr | Badee | Khayyat | PME/GAMEP | Saudi Arabia |
| Mr | Johan | Stander | JCOMM | South Africa |
| Prof. | Byong-Lyol | Lee | WMO CAgM | South Korea |
| Mrs | Mariuxi | Chávez Suárez | ORBCOMM INC. | Spain  |
| Mr | Mohamed | Al Ebri | National Centre of Meteorology & Seismol | United Arab Emirates |
| Ms | Nada | El Marji | Inmarsat | United Arab Emirates  |
| Dr | Salim | Javed | Environment Agency-Abu Dhabi | United Arab Emirates  |
| Mr | Abdulhamid | Alraeesi | NCMS | United Arab Emirates  |
| Mr | Adnan | Yar Mohammed | NCMS | United Arab Emirates |
| Dr | Michael | Prior-Jones | The Technology Partnership plc | United Kingdom |
| Mr | Steven | Colwell | British Antarctic Survey | United Kingdom  |
| Prof. | David | Meldrum | DML | United Kingdom  |
| Dr | Andrew | Sandford | Campbell Scientific Ltd | United Kingdom |
| Mr | Scott | Rogerson | NOAA (NESDIS) | United States  |
| Ms | Laura Kay | Metcalf | NOAA (NESDIS) | United States  |
| Mr | Anthony | Hopko | Orbcomm | United States |
| Mr | Andy | Sybrandy | Pacific Gyre | United States |
|  |  |  |  |  |
| Mrs | Champika | Gallage Dona | WMO | Switzerland |
| Mr | David | Thomas | WMO | Switzerland |
| Mr | Etienne | Charpentier | WMO | Switzerland |

# Annex 5. List of Presentations considered in the meeting

| **Doc No.** | **Presenter(s) / representing** | **Title & Document or Presentation link** | **Abstract Link** |
| --- | --- | --- | --- |
| [Doc01](http://wis.wmo.int/file%3D3114) | Dr M. Prior-Jones (Chair) | Welcome statement ([http://wis.wmo.int/file=3114](http://wis.wmo.int/file%3D3114)) | No |
| [Doc02](http://wis.wmo.int/file%3D3106) | Mr Sean Burns (CGMS)  | CGMS and meteorological data collection ([http://wis.wmo.int/file=3106](http://wis.wmo.int/file%3D3106))  | [Yes](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1191) |
| [Doc03](http://wis.wmo.int/file%3D3105) | Ms Laura Kay Metcalf (NOAA) and Mr Scott Rogerson (NOAA NESDIS)  | NOAA's GOES Data Collection System ([http://wis.wmo.int/file=3105](http://wis.wmo.int/file%3D3105)) | [Yes](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1133) |
| [Doc04](http://wis.wmo.int/file%3D3107) | Mr Nicholas Coyne (EUMETSAT) | Meteosat Data Collection System ([http://wis.wmo.int/file=3107](http://wis.wmo.int/file%3D3107)) | [Yes](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1194) |
| [Doc05](http://wis.wmo.int/file%3D3112) | Mr Andy Sybrandy (Pacific Gyre) | How the satcom networks can best serve scientific equipment manufacturers ([http://wis.wmo.int/file=3112](http://wis.wmo.int/file%3D3112)) | [Yes](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1204) |
| [Doc06](http://wis.wmo.int/file%3D3100) | Mr Simon Van den Dries (Rencos B.V.) | Satellite M2M communication service ([http://wis.wmo.int/file=3100](http://wis.wmo.int/file%3D3100)) | [Yes](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1188) |
| [Doc07](http://wis.wmo.int/file%3D3110) | Mr Steven Colwell (British Antarctic Survey) | The challenges of accessing Antarctic meteorological data in near real-time ([http://wis.wmo.int/file=3110](http://wis.wmo.int/file%3D3110)) | [Yes](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1174) |
| [Doc08](http://wis.wmo.int/file%3D3101) | Mr Scott Rogerson (NOAA NESDIS) and Mr Michel Sarthou (CNES) | Argos Data Collection & Location System ([http://wis.wmo.int/file=3101](http://wis.wmo.int/file%3D3101)) | [Yes](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1182) |
| [Doc09](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1209) | Mr Allan Place (JouBeh Technologies) | Iridium satellite network (Contact Mr Place for information on presentation) | [Yes](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1209) |
| [Doc10](http://wis.wmo.int/file%3D3117) | Mr Tony Hopko & Mrs Mariuxi Chávez Suárez (Orbcomm) | Orbcomm satellite network and services ([http://wis.wmo.int/file=3117](http://wis.wmo.int/file%3D3117)) | [Yes](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1211) |
| [Doc11](http://wis.wmo.int/file%3D3116) | Dr Mike Prior-Jones (Chair)  | Globalstar, Inmarsat, Thuraya and VSAT ([http://wis.wmo.int/file=3116](http://wis.wmo.int/file%3D3116)) | No |
| [Doc12](http://wis.wmo.int/file%3D3122) | Mr Rudolph Duester  | Telemetry meets Water: Reliable Data for Measuring and Monitoring Tasks in Early Warning Systems (Surface Water, Groundwater, Water Quality) ([http://wis.wmo.int/file=3122](http://wis.wmo.int/file%3D3122)) | [Yes](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1195) |
| [Doc13](http://wis.wmo.int/file%3D3119) | Ms Nada El Marji (Inmarsat) | Inmarsat BGAN M2M" ([http://wis.wmo.int/file=3119](http://wis.wmo.int/file%3D3119)) | [Yes](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1232) |
| [Doc14](http://wis.wmo.int/file%3D3118) | Mr Etienne Charpentier (WMO) | Development of the Global Cryosphere Watch (GCW) ([http://wis.wmo.int/file=3118](http://wis.wmo.int/file%3D3118)) | [Yes](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1203) |
| [Doc15](http://wis.wmo.int/file%3D3115) | Mr Bryan Hodge (Bureau of Meteorology) | Support to nowcasting and real time reporting ([http://wis.wmo.int/file=3115](http://wis.wmo.int/file%3D3115)) | [Yes](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1234) |
| [WDoc01](http://wis.wmo.int/file%3D3111) | WMO Secretariat | Introduction of election procedures ([http://wis.wmo.int/file=3111](http://wis.wmo.int/file%3D3111)) | No |
| [WDoc02](http://wis.wmo.int/file%3D3127) | Dr M. Prior-Jones (Chair) | Working Procedures | No |
| [WDoc03](http://wis.wmo.int/file%3D3128) | Dr M. Prior-Jones (Chair) | Actions, priorities and work plan | No |

# Annex 6 – Summary of presentations by Satcom providers

## A6.1 CGMS and meteorological data collection

1. Mr Burns presented on CGMS and meteorological data collection systems ([Doc02](http://wis.wmo.int/file%3D3106)). He described the work of CGMS in the global coordination across all meteorological satellite operators of the operational meteorological satellite systems. The scope included protection of in orbit assets, contingency planning, improvement of quality of data, support to users, facilitation of shared data access and development of the use of satellite products in key application areas. Mr Burns then focused on the CGMS activity of meteorological satellite operators’ Data Collection Systems including Geostationary and Low Earth Orbit Systems.
2. The meeting noted that six meteorological satellite operators are operating Data Collection Systems (DCS). These are EUMETSAT, NOAA and the Japanese Meteorological Agency (JMA) (coordinated by CGMS) along with Chinese Meteorological Administration (CMA), Indian Space Research Organisation (ISRO) and Roshydromet (Russia).
3. Mr Burns highlighted that a particular coordination role related to how to make best use of the 401 to 403 MHz frequency band including partitioning the use of the band across DCS operators so as not to interfere with each other’s operations.
4. Mr Burns, noting that JMA was not able to attend the forum, also presented details on the JMA DCS services operating on Himawari-8 which took over from MTSAT-DCS services in July 2015. The meeting noted that Slide 12 of his presentation included specific parameters of the service including frequency, time mode, transmission rate and bandwidth.

## A6.2 NOAA's GOES Data Collection System

1. Ms Laura Kay Metcalf, NOAA GOES DCS Program Manager, presented on NOAA’s GOES data collection system ([Doc03](http://wis.wmo.int/file%3D3105)). The GOES DCS has developed since its first experimental service in 1974 into an essential telecommunications provider in the U.S. Observation systems used for emergency warning and resource management all across the U.S. and the neighbouring areas (Latin America, Caribbean, Pacific, etc). Restricted by federal regulation to environmental, government or government sponsored users, GOES relays critical data in support of flood monitoring, water resource management, wildland fires support, tide levels, tsunami and storm surge alerting, atmospheric measurements, transportation hazards and many other environmental related services.
2. The meeting noted that the biggest users of NOAA’s DCS were related to water resources, an aspect that should be of interest to the Commission for Hydrology in engaging in Satcom forum. It further noted that the target distribution time is five seconds from site to user and the importance of such services to disaster risk reduction and multi-hazard early warning services.
3. Ms Metcalf highlighted the performance metrics (slide 3) noting that twenty seven thousand active platforms deliver an estimated eight million observations per day into the global observing system.

## A6.3 Meteosat Data Collection Systems

1. Mr Nicholas Coyne, Eumetsat, presented on Eumetsat’s Meteosat data collection systems and satellite broadcast system ([Doc04](http://wis.wmo.int/file%3D3107)). He provided some background information on the role of Eumetsat in providing space based observations and communication services in its mission to support its member national meteorological services to protect human life, property and infrastructure.
2. Mr Coyne described the types of data collection platforms supported by the Meteosat satellites, including both Standard and High Data Rate transmitters. His presentation included details on these service (Slides 5 & 7), the present and planned coverages of their DCP services and the advantages of using the new High Rate data collection platform (HRDCP). The meeting noted Meteosat 7 DCP service is purely used for Tsunami Warning System over the Indian Ocean. It also noted that the uptake of HRDCP has been slow despite the advantages and steps being taken to promote this service.
3. Mr Coyne reported that 66 countries across Europe, Africa and Asia were using the system. Application areas consisted of hydrological and meteorological, each account for about 35 percent, with other use areas covering the Indian ocean tsunami services, the Ocean Data and Information Network (ODIN) Africa and agro climatology among other areas. He also describe the data flow of the DCP services and their distribution channels. These included direct MSG dissemination, the Internet, Eumetcast and via the WMO Global Telecommunication System (GTS). The meeting noted that 633 of the 1066 allocated regional DCPs were transmitting.

## A6.4 Argos Data Collection & Location System

1. Mr Scott Rogerson (NOAA-NESDIS) and Mr Michel Sarthou (CNES) presented on the Argos Program ([Doc08](http://wis.wmo.int/file%3D3101)) administered under a joint agreement between the National Oceanic and Atmospheric Administration (NOAA) and the French Space Agency, Centre National d’Etudes Spatiales (CNES). The meeting noted that Argos is an international cooperation utilising satellites from NOAA, EUMETSAT and the Indian Space Research Organization (ISRO). Their presentation included coverage diagrams, descriptions of the uplink and downlinks and the development history of the platforms and the chipsets. The meeting noted that Argos was near completion on developing low cost, low power, duplex micro chipsets (5x5 mm), samples of which were expected to be available within a few weeks.
2. Mr Rogerson and Mr Sarthou informed the meeting on the new functionalities in Argos 4 with an increase in bandwidth (includes new band 399.9 to 400.05 being considered under Agenda 1.2 at WRC-19), dedicated bands for high data rate platforms and low power platforms. A timeline and further details on Argos 4 were included in their presentation ([Doc08](http://wis.wmo.int/file%3D3101) – Slides 9-14).
3. Mr Sarthou also described studies under way in CNES looking at new technologies to integrate all “signal processing” in one single “System on Chip” component. This would open up opportunities for use of very small satellites (eg Nano Satellites) and the possibility of an Argos constellation.

## A6.5 Iridium satellite network

1. Mr Allan Place (JouBeh Technologies) presented on the Iridium satellite network ([Doc09](https://wiswiki.wmo.int/tiki-view_tracker_item.php?itemId=1209)) and its new generation of satellite systems call Iridium NEXT. Satellites supporting NEXT will be in orbit by the end of 2017 and new services will be starting in 2018. The meeting noted that the Iridium system offered data and voice and that there were over 800,000 platforms using the system at present, many are voice enabled but a large percentage were for data. It noted that the current system Short Data Burst (SDB) functionality will continue to be supported on NEXT utilising current transceivers but the new functionalities associated with the NEXT system such as increased data speed and enhanced SBD will only be available on the new transceivers.
2. Mr Place’s presentation included details of the new transceivers and operating information. For more information on these systems or details included in his presentation, participants will need to contact Mr Place directly (allan.place @ joubeh.com).

## A6.6 Orbcomm satellite network and services

1. Mr Tony Hopko presented on Orbcomm satellite network and services ([Doc10](http://wis.wmo.int/file%3D3117)). He also included information on Skywave services acquired by Orbcom in 2015.
2. The ORBCOMM network is based on VHF radio transmissions (137-150 MHz) utilising low-Earth orbit (LEO) satellites to provide reliable and cost-effective machine to machine (M2M) communications to and from in the most remote areas of the world. Mr Hopko informed the meeting on the characteristics of the current OG1 satellite system and the next generation (OG2) which will have much greater capacity than OG1 (each OG2 satellite has the ability to handle that of 6 OG1 satellites). The meeting noted that data rates in OG2 compared to OG1 will be increased to 4.8kbit/s from 2.4kbit/s for subscriber uplink and increased to 7.2kbit/s from 4.8kbit/s for subscriber downlink.
3. Mr Hopko advised that OG2 satellites will continue to support OG1 systems as well has having High Data Rate (HDR) services and additional transmitter to support downloading. The meeting noted that the satellites processes messages directly from modems and store on board, then download them at the next gateway, avoiding issues of line of sight. Details of this process and of the OG2 satellite capabilities are available on slides 5 and 6 of this presentation ([Doc10](http://wis.wmo.int/file%3D3117)).
4. Mr Hopko informed the meeting on Orbcomm’s Skywave service which operates in the L-Band range providing two-Way, reliable Inmarsat Satellite Service Messaging Up to 6.4/10 kBytes. Skywave also supports broadcasting and Multicasting.
5. Mr Hopko advised the meeting that Orbcomm now manufactures their own transceivers, details of which are on slides 10 to 12 of his presentation ([Doc10](http://wis.wmo.int/file%3D3117)).

## A6.7 Globalstar, Thuraya and VSAT

1. The chair provided a presentation on other satellite systems supporting data collection services ([Doc11](http://wis.wmo.int/file%3D3116)) that, at the time of his preparing the presentation, were not expected to be able to speak at Satcom2016. His presentation included Inmarsat which is covered under section 2.8 below.
2. **Globalstar** utilises low Earth orbit systems. Designed originally for telephone calls, satellites must be in range of ground stations to offer service, thus limited ocean or polar coverage. Globalstar’s SPOT system provides duplex data service at 9.6kbs as well as simplex. A coverage map is included in the presentation ([Doc11](http://wis.wmo.int/file%3D3116) Slide 4).
3. **Thuraya** operates two geostationary Earth orbiting (GEO) satellites covering Europe, Middle East, most of Africa, most of Asia and Australia. It offers around 400kbit/s IP service and various narrowband services. Thuraya’s new M2M terminal (900g, 180x130x42mm) offers various levels of IP connectivity and adds coverage in North America as well as their traditional coverage area. The coverage map is included in the presentation ([Doc11](http://wis.wmo.int/file%3D3116) Slide 7).
4. **VSAT** (very small aperture terminal) is a geostationary satellite service in C-band, Ku-band or Ka-band. Services can be through a dedicated transponder or shared with up to over 1Mbit/s bandwidth. Used extensively for ground stations with dish sizes typically 70 to 150cm, its mobile (vehicle/marine) versions are bulky, expensive and power hungry.
5. **Geonets** is a Russian LEO operator. Fully operational in 2015, it has 12 satellites providing global coverage although, but there can be 25 minutes between passes. Satellites have store and forward with four downlink stations in Russia. It operates in the UHF (300-400MHz) band and offers 9.6 to 64kbit/s data rate.
6. **O3b** uses medium earth orbit Ka-band satellites. It offers high bandwidth, low-latency IP connections, relying on steered antennas to track satellites and works to 45 degrees latitude (Ottawa, Venice, Dunedin). It provides excellent marine coverage, and marine terminals are available. Pricing likely to be comparable with VSAT, although the land-based terminals will be more expensive than VSAT due to the need for tracking.
7. **OneWeb** and **LeoSat.** The chair spoke briefly about these two start-up operators aiming to offer internet service from large numbers of LEO satellites. However, neither service has satellites in orbit yet.

## A6.8 Inmarsat BGAN M2M

1. Ms Nada El Marji, from Inmarsat, presented on Inmarsat’s BGAN M2M services ([Doc13](http://wis.wmo.int/file%3D3119)). Established in 1979 by the International Maritime Organization (IMO) to provide communications for shipping, Inmarsat has four geostationary satellites giving global coverage to about 75 degrees north and south. These are the three I4 satellites and Alphasat, the latter having higher capacity utilising a smaller antenna. Inmarsat also has its I5 (Global Express) series of Ka-band satellites. Three satellites provide global coverage and a fourth satellite provides additional capacity. Ms El Marji’s presentation included coverage maps of these systems, along with a diagram showing a matrix of the types of service (i.e. Voice, M2M, and Broadband data and voice), their application (i.e. portable, mobile and fixed) and the service names align. See [Doc13](http://wis.wmo.int/file%3D3119) slide 7 for details.
2. The meeting also noted from [Doc11](http://wis.wmo.int/file%3D3116) the following data rates applied to Inmarsat services: BGAN – 448kbit/s; various “legacy” services at 64-128kbit/s; IsatM2M – 10 or 25 byte messaging, 60s latency; and, IsatDataPro – <6400 byte messaging, 15-60s latency.
3. Ms El Marji presentation included a video (<https://youtu.be/j2XQoGcwShA>) of a BGAN M2M case study.

# Annex 7 – Summary of presentations from equipment manufacturers

## A7.1 Pacific Gyre, How the satcom networks can best serve scientific equipment manufacturers

1. Mr Andy Sybrandy, of Pacific Gyre (USA), provided an equipment manufacture’s view on how satcom networks can best service scientific equipment manufacturers ([Doc05](http://wis.wmo.int/file%3D3112)) and thereby assist their customers as satcom users. Mr Sybrandy described the range of instruments that they manufacture and provide for remote sensing activities. They also provide communications systems and associated visualisation and processing, including internet based. They already have an extensive reliance on satellite communications globally including two-way communication to enable dynamic sampling and instrument recovery.
2. Mr Sybrandy provided a list of requirements including: global real time coverage, two-way communication, low power, small footprint antenna, automatic/delayed activation, API for provisioning, test accounts, single point of payment, flexible billing plans, 24/7 technical assistance, 99.9% up time, and reliable and available OEM modems. Some of these items are already available but he emphasised that the current pricing plans with monthly fees and no very low data volume plans (i.e. below a thousand bytes per month) prevented large scale deployments. He also highlighted the need for random activation as some early warning alerting systems or instruments can be stored long term or only activated in events (e.g. flood warning systems).

## A7.2 Rencos, Satellite M2M communication service

1. Mr Simon Van den Dries, of Rencos B.V., presented on satellite M2M communication services ([Doc06](http://wis.wmo.int/file%3D3100)). Rencos provide communication solutions for remote sensing and control systems utilising off the shelf equipment. They support several satellite services, although many of their systems are through Skywave and Inmarsat BGAN, with plans down to 500 bytes per month and up into the megabytes and gigabytes. The meeting noted the versatility of Rencos solutions such as sending images via SBD by breaking the images down into small packets. Software from Rencos included Remote Terminal Manager (RTM), Simple Sat Sensor (based on IDP) offering configure, connect and control, and Online Billing Service (IBIS) which included activation and deactivation management.
2. Mr Van den Dries listed the typical services provided to the meteorological community and the lessons learnt. Services included weather station connectivity, marine/buoy connectivity and individual analogue or digital sensor inputs. His presentation included a comparison table of features of L-band and Ku-band as well as some specifications of the Skywave and BGAN hardware elements.

## A7.3 SEBA Hydrometrie, Reliable Data for Measuring and Monitoring Tasks in Early Warning Systems

1. Mr Rudolph Duester, of SEBA Hydrometrie, presented [Doc12](http://wis.wmo.int/file%3D3122) titled “Telemetry meets Water: Reliable Data for Measuring and Monitoring Tasks in Early Warning Systems (Surface Water, Groundwater, Water Quality)”. SEBA provides mobile and stationary measurement and monitoring systems for hydrology, hydrometry, and meteorology with a focus on water as a "hazard" (monitoring) and as a "resource" (management). Sensors and data loggers are usually combined with telemetric equipment and optimized for low power consumption for self-sufficient, battery or solar powered permanent monitoring networks. Mr Duester’s presentation included more details on each of the above elements and examples where their systems have been implemented. The meeting noted that the use of cameras in some applications proved useful for verification of remote sensing alerts as it allowed the hydrologist of meteorologist to validate an observation without having to go to a site.
2. Mr Duester described the ideal satellite communication system breaking it into two sets of factors, namely, Soft Factors and Hard Factors. The soft factors, related to service and included: Real-time transmission, Instant alarm messages, Duplex communication, High data transmission rates and Low transmission costs. The hard factors related to hardware and included: Low power consumption, Ability to operate in harsh environments, Compact dimensions, Compact antenna and Low equipment costs.

# Annex 8 – Summary of presentation from Satcom users

## A8.1 Statement from the Assistant Secretary General of WMO, Dr Wenjian Zhang

1. Dr Zhang thanked the meeting for providing him the opportunity to address the Satcom 2016 forum. He noted that although the WMO rolling review of requirements has been well addressed for observations, he believed that it is important to also take into consideration the communications side necessary to collect and transport the resulting data, in particular those observations from remote sites, including the polar and marine areas. He also highlighted that as with the recently operational Japanese satellite “Himawari”, a series of new generation satellites will be providing 100 times more data rate than past generations. He noted that the USA and Europe will be following shortly.
2. Dr Zhang further explained the importance of understanding future requirements emphasising the global cryosphere watch as an example. He congratulated the organizing committee of Satcom for their work to date and wished the Satcom Forum a very successful meeting and productive future.

## A8.2 The challenges of accessing Antarctic meteorological data in near real-time

1. Mr Steven Colwell (British Antarctic Survey) presented on the challenges of accessing Antarctic meteorological data in near real-time ([Doc07](http://wis.wmo.int/file%3D3110)). The meeting noted that the main data sources were staffed research stations, automatic weather stations and to a lesser extent drifting buoys, ships and aircraft. A major issue to manage is the extreme temperatures and winds. Also, although parts of the coastal regions and waters can use geostationary based communications, anything poleward of 75 degrees south has to rely on polar orbiting satellites, although there are plans for use of highly elliptical satellites creating a virtual geostationary satellite over the poles.
2. Temperatures in the deeper parts of Antarctica can drop below -80°C during the Antarctic winter and this is well below satellite transmitters’ temperature rating. Also, directional antennas can be moved around in the strong winds. Solutions for combatting the temperatures include use of heat pads (requiring energy so mainly only suitable for research stations) or burying the transmitter in snow to shield it from the extreme cold. Other challenges include managing static electricity build up caused by blowing snow. This has to be bled off correctly to avoid it getting back into the transmitter. Cost is another issue as many of the AWS tend to be funded by research programmes or universities who will leave off the communications to reduce cost.

## A8.3 Development of the Global Cryosphere Watch (GCW)

1. Mr Etienne Charpentier (WMO) presented on the development of the Global Cryosphere Watch (GCW) ([Doc14](http://wis.wmo.int/file%3D3118)) and its core component observing systems such as CryoNet, which will rely heavily on satellite data telecommunication. The cryosphere includes polar and high mountains, much of the latter being able to use geostationary systems for communications. As noted in the presentation by Mr Colwell observing sites poleward of 75 degree have to rely on polar orbiting satellites.
2. Mr Charpentier (slide 27) summarised the issues associated with data collection in the polar and high mountain areas. These included the same aspects mention by Mr Colwell such as: Very few manufacturers (if any) offer modems that will work reliably at temperatures below -40C, Static electricity in high winds, Cost of telecommunication. He also added some new elements such as problems for polar orbiting satellites passing through the south Atlantic anomaly and particle flux in the polar regions, data processing for real time distribution and data latency. He noted that GCW would like to negotiate special rates for high value environmental data as well as negotiating a priority for low latency in high impact weather situations for disaster risk reduction applications.

## A8.4 Support to nowcasting and real time reporting

1. Mr Bryan Hodge (Australia) presented on support to nowcasting and real time reporting ([Doc15](http://wis.wmo.int/file%3D3115)). He addressed the issue related to communications solutions for one minute data from automatic weather stations (AWS) in support various services including tsunami warning (sea level) and aviation (wind). The current solution utilised cellular, Inmarsat BGAN, leased and carrier services and THISS C band (Pacific only). He also described how Iridium and Iridium SBD were used for some event driven networks in small scale (e.g. some rain on event, tsunami buoys, etc)
2. Mr Hodge then presented a use case for rainfall monitoring presently under investigation. It is based on the requirement for rainfall information to support flood warning and related services. Such services can be met by radar coverage but the size of Australia and the population distribution make radar solutions alone impractical. As such, the Bureau of Meteorology has developed a system combining high resolution multispectral satellite imagery, radar data and rainfall observations to meet this need. This requires rainfall and cooperative observe automation, expanded rain gauges under radars and utilises small messages on a big scale. (i.e. >10,000 nodes) providing real time (< 15 minutes).
3. Mr Hodge advised that in order to fulfil this need, Australia would like very low power systems (to reduce the time and cost of installation), aggregated communications plans with no or little monthly subscription, The service will need to be global and reliable and the terminals need to have at least basic I/O for tipping bucket rain gauge (TBRG) and some scripting capability. They desire LEO or low angle capability. They also require a robust business model.
4. The meeting noted that although the data usage charges are manageable, the costing of such a system under current pricing plan would incur over 100,000 AUD per month plus data. This would be very hard to justify given many stations will only report on average once a day in a month. Thus, unless a suitable business model and pricing plan is arranged, the scale and therefor the effectiveness of the network will most likely have to be reduced to within affordable limits.

# Annex 9 –Tariffs road map



Figure 3 Road map for Tariffs

# Annex 10. Elected Executive Committee

|  |  |  |
| --- | --- | --- |
| **Name** | **Role on EC** | **Org or Country** |
| Michael Prior-Jones | Chairperson | UK |
| Johan Stander | Vice-chair | South Africa |
| Bryan Hodge\* | Member representative | Australia  |
| David Meldrum\* | User community rep | UK |
| Sean Burns\* | Meteorological Satellites | CGMS |
| Yann Bernard | Operator rep | CLS/ARGOS |
| Mariuxi Chavez | Operator rep | ORBCOMM |
| Allan Place | Operator rep | JouBeh Technologies |
| Wolfgang Marxer | Manufacturer rep | SEBA Hydrometerologie |
| Andy Sybrandy | Manufacturer rep | Pacific Gyre |
| Eric Locklear | Subprogram - Joint Tariff Agreement | JTA |
| <position vacant> | IOC secretariat | IOC |
| Remy Giraud | Liaison to WMO CBS | ET-CTS, CBS, WMO |
| David Thomas | WMO secretariat | WMO |
| Etienne Charpentier | WMO secretariat | WMO |
| (\* Indicates one of three nominated by Chair) |

# Annex 11 – Updated TOR for Satcom Executive Committee

**ANNEX F**

**TERMS OF REFERENCE OF THE SATCOM FORUM EXECUTIVE COMMITTEE**

The function of the Forum Executive Committee (Forum-EC) is to conduct the sessional and intersessional business, as well as all other matters in support of the Chairperson’s duties to meet the needs of the Forum members.

Terms of Reference

The specific tasks of the Forum-EC are to:

1. Assist the chairperson in the preparation of reports, and their submission, if needed, to the Secretariats of the co-sponsoring Organizations for distribution.
2. Annually review the functions and duties of the Forum and recommend any changes to the Chairperson for discussion and approval at the Forum Session.
3. Analyze the Forum budget, and advises the Chairperson.

Membership

1. The membership shall include:
	1. Chairperson
	2. Vice-Chairperson
	3. Three additional members proposed by the Chairperson and elected by the Forum.

These members will serve a term of 4 years with an optional 4-year appointment

* 1. Representatives of the Forum sub-programmes
	2. Representatives of the Secretariats of the co-sponsoring Organizations (presently WMO and IOC, *ex officio*)
	3. Representatives of Operators and service providers of Satcom systems (*ex officio*)
	4. Representatives of Satellite equipment manufacturers (*ex officio*)

2. Careful consideration should be made to ensure a proper mix that represents co- sponsoring Organizations Members/Member Nations/Member States, user groups, and subject matter experts.

Meetings

1. As necessary, the Chairperson will convene and organize all Forum-EC meetings. The meetings can be in person, or teleconference.
2. If decisions are needed by the Forum-EC as permitted/requested by the Forum Session or the Chairperson during the inter-session, the Forum-EC shall attempt to form a consensus on decisions. If a consensus cannot be reached in a timely manner, the chair may opt to make the decisions by election. E~~e~~lections for ~~those~~ decisions may be organized with a quorum consisting of at least four members of the Forum-EC, including the Chairperson or his nominated deputy.

2.1 The following members of the Forum-EC shall have a vote if a decision is made by election:

 i. Chairperson

 ii. Vice-Chairperson

iii. The three additional members as defined under Membership 1.iii above

* 1. The following groups of members of the Forum-EC shall have one vote per group if a decision is made by election:
		1. Representatives of the Forum sub-programmes
		2. Representatives of the Operators and service providers of Satcom systems

ii. Representatives of Satellite equipment manufacturers

2.3 Where a single vote is held by a group of representatives, it is recommended that they come to a consensus of those who attend the meeting as to how they use their vote. If unable to come to consensus, they should abstain from voting.