European Cooperation in the field of Scientific and Technical Research - COST -

Secretariat

Brussels, 2 July 2008

COST 235/08

MEMORANDUM OF UNDERSTANDING

Subject :	Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action IC0802: Propagation tools and data for integrated Telecommunication, Navigation and Earth Observation systems

Delegations will find attached the Memorandum of Understanding for COST Action IC0802 as approved by the COST Committee of Senior Officials (CSO) at its 171st meeting on 18-19 June 2008.

MEMORANDUM OF UNDERSTANDING

For the implementation of a European Concerted Research Action designated as

COST Action IC0802

PROPAGATION TOOLS AND DATA FOR INTEGRATED TELECOMMUNICATION, NAVIGATION AND EARTH OBSERVATION SYSTEMS

The Parties to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 270/07 "Rules and Procedures for Implementing COST Actions", or in any new document amending or replacing it, the contents of which the Parties are fully aware of.
2. The main objective of the Action is to create a coordinated database of models, techniques and data of the physical channel to improve the design and performance of Global Integrated Networks (examples include satellite mobile and fixed communication systems, terrestrial networks for mobile and fixed terminals, satellite navigation systems, and Earth Observation systems).
3. The economic dimension of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at EUR 15 million in 2007 prices.
4. The Memorandum of Understanding will take effect on being accepted by at least five Parties.
5. The Memorandum of Understanding will remain in force for a period of 4 years, calculated from the date of the first meeting of the Management Committee, unless the duration of the Action is modified according to the provisions of Chapter V of the document referred to in Point 1 above.

A. ABSTRACT

Telecommunication, Navigation and Earth Observation systems and services are developing world-wide with a multiplicity of standalone terrestrial and space systems that operate in diverse frequency bands. Global Integrated Networks (GIN) will be necessary in the near future to provide better integrated services. Their design requires a comprehensive knowledge of the various propagation media. Up to now radio channel modelling has been performed separately for each type of radio systems.

This activity will develop a coordinated set of models, techniques and data related to the radio channel in order to improve the design and performance of Global Integrated Networks.

The activity will recommend and provide the most appropriate radio channel models, channel assessment techniques and data for the design and operation of these GINs.

The frequencies of interest range from 100 MHz to 100 GHz (VHF to W band) and cover optical free space communications. The target architectures include mobile and fixed, satellite and terrestrial communication systems (including optical links), satellite navigation systems and Earth Observation systems. The physical propagation fundaments will be based on experimental and climatological data.

The activity will bring together remote sensing, propagation and systems experts at the European level, thus contributing to advance the state-of-the-art in the field, with a clear added value for Europe.

Keywords

1) Convergence between fixed and mobile Terrestrial and Satellite Telecommunications, Earth Observation and Navigation systems,
2) Global Integrated Networks (including GMES & Disaster Management and Relief)
3) Radiowave Propagation (including Optical Free Space Links)
4) Atmospheric Remote Sensing techniques & Meteorology

B. BACKGROUND

B.1 General background

European countries are heavily investing in developing global telecommunication, navigation and Earth observation services that benefit of citizens and states. Considerable benefits arise from combining systems, like satellite navigation and Global Monitoring for Environment and Security (GMES), into an integrated network as this is the only means to develop and operate new services. Another example is disaster management and relief, where a large quantity of Earth observation and meteorological data must be distributed; reliable communication systems must be implemented in a short time; and navigation services must operate for localisation, Search and Rescue and asset tracking.

The EU SPASEC (Space and Security Panel of Experts) specifies a high data rate mobile communication system as a primary requirement. The development of a Global Integrated Network (GIN) for security is a high priority for Europe. This system will be based on highly reconfigurable hybrid (terrestrial and satellite) radio networks providing both traditional (voice, text) and multimedia services operating at RF frequencies ranging from 100 MHz to 100 GHz and optical frequencies. Such a GIN will face many spectrum management and interference issues.

In this context, the influence of the radio channel is a critical issue, and the design, performance assessment and real-time operation of such a global integrated network will require an integrated set of data and models encompassing all the frequencies and types of links (satellite, terrestrial, indoor, VHF to W band, optical links, etc).

The European scientific community is well placed to address this task thanks to its long-standing experience. EU framework programmes (FP5 GEOCAST, FP6 BROADWAN, NoE SatNEx); COST Actions (no. 235, 255, 280, 291, 296, 297); ESA activities on SatCom, GNSS and Earth Observation systems as well as national projects have created a cooperative scientific environment that developed new channel models for a variety of dedicated radio links. Meteorology and remote sensing studies (e.g. The Cliwanet and Baltex, EU FP5 Cloudnet and ERA40, FP6 AMMA, COST Actions 712, 716, 717, 731 and 733) have also promoted the collaboration between the various European organizations by sharing data collected from ground instruments (e.g. microwave

profilers, radars, GPS networks) and from space borne instruments (e.g. ENVISAT, Meteosat SG, radio-occultation systems), and by developing weather forecast models.
European organizations use to conduct experimental validation in all the above mentioned areas: past OLYMPUS and ITALSAT, current Eutelsat HB6, anticipated ESA ALPHASAT Q/V band experiments, recent COST actions 712, 716, 717 and running COST actions 731 & 733 on radiometric, GPS, Radar and atmospheric profiling techniques, and on meteorological models and climate classification. Also, European organizations cooperate with non-EU countries in the framework of International activities (e.g. the World Climate Research Project GEWEX, the USA Atmospheric Radiation Measurement, The International Precipitation Working Group) and the International Telecommunication Union study groups.

COST is the best framework for achieving a collaborative action on providing and gathering various data and models, because it is well suited for non competitive research like this. Consequently, participants may feel free to share their experience and data, especially with young researchers.
The expected participating labs are among the top leaders in their field, so their research programs are most of the time funded at the national level or in ESA & EU projects. However COST funding still helps in building networking activities, and is complementary to the other funding frameworks. Moreover there is a long experience for most of the expected participants in the COST way of collaborating.

B.2 Current state of knowledge

Up to now, radio channel modelling has been performed separately for each type of services or links (e.g. satellite navigation systems, terrestrial mobile communications, fixed satellite communications, remote sensing systems, and so on: see for example COST Actions 231, 235, 255, 259, 273, 280 and 296). Refer to the Scientific work plan for more information.

The Action will tackle the overall problem of the propagation and interference channel by following an innovative integrated approach, thus characterising the various wireless channels according to a unified modelling framework, leading to better predictions in terms of robustness of operation and performance.

B.3 Reasons for the Action

The Action is mainly aimed at European economic/societal needs, and is based on scientific and technological knowledge already developed in Europe.
The development of a global integrated network (GIN) for GMES, Disaster Management & Relief, and Security is a high priority for Europe. Considerable benefit arises from combining systems into an integrated network as this is the only means to develop and operate a wide panel of services and converging applications. A large amount of new data is available in the Earth Observation, Remote Sensing and Meteorology community, which could be used for propagation prediction.

So, there is a strong need for a coordinated assessment and development of channel models and propagation databanks for the required different architectures and frequencies to fulfil the specific needs of this multiservice GIN design.

The European scientific community has the know-how, the data and the tools to satisfy this request in the framework of this COST Activity.
Consequently, the outputs of this Action will be directly usable by Industry, Telecom operators, standardization bodies, Earth Observation end-users and Institutional Agencies to improve systems and services, and build such kind of GIN services.

B.4 Complementarity with other research programmes

This new activity is complementary to other research projects which concentrate on specific services or systems, which are part of the future Global Integrated Network.
For example, some ESA studies deal with propagation issues linked to satellite fixed and mobile communications or Galileo navigation services. The SATNEX Network of Excellence focused on satellite communications and navigation techniques. COST Actions, such as COST Action 2100, concentrate on terrestrial mobile communications services. FP6 and FP7 projects also address this issue but their activity on propagation channel concerns only a specific system rather than improving the state of the art of the whole scientific community.
Earth Observation, Remote Sensing and Meteorology missions or research projects (such as Cloudsat, a-Train, Meteosat NG, OPERA, MANTISSA, CARPE DIEM, …) deal with improving

measurements and providing new sets of data for their own scientific objectives, but these data can be used for this Action.

The proposers of this Action are aware of the above mentioned research frameworks, and some of them are taking part to these complementary activities, ensuring that no duplication with other research projects will occur.
Specific workshops will also be organised with the complementary COST ICT or ESSEM Actions (such as COST Actions 296, 2100, 731, 733) to gain mutual benefits of the results.

C. OBJECTIVES AND BENEFITS

C.1 Main/primary objectives

The major objective of this Action is to create a coordinated database of models, techniques and data of the physical channel to improve the design and performance of Global Integrated Networks. The target architectures include satellite mobile and fixed communication systems, terrestrial networks for mobile and fixed terminals, satellite navigation systems, and Earth Observation systems.

During the course of the Action, channel models for local environmental effects (multipath, shadowing, blocking) and atmospheric effects, as well as channel assessment techniques for PIMT shall be developed and/or improved. The measurements from past or ongoing national, ESA or EU experimental campaigns will be gathered and put at disposal of European industry and operators, wherever applicable.

Likewise, the prospective Action will recommend and provide the most appropriate radio channel models, techniques and data for the design and operation of GINs encompassing Earth observation, navigation and communication systems.

C.2 Secondary objectives

A secondary objective will be to improve the knowledge in various fields as the synergy resulting from a common basis arising through collaboration between the remote sensing and radiowave propagation communities will improve our understanding of:

- Atmospheric radio and optical waves propagation
- Observation means and retrieval methodologies

The competence base (constituted by experts, models and measurements) will contribute actively to new system design and deployment.
Another secondary but important objective of the Action will be to integrate more deeply researchers from non-EU countries and countries which have recently joined the European Community, and to favour exchange between researchers from different fields of expertise.

C.3 How will the objectives be achieved?

The objectives will be achieved by means of a close collaboration between experts from different fields of expertise (satellite communication, terrestrial networks, satellite navigation, Earth Observation, Remote Sensing, Earth Weather and Climate …).
Sharing measurements and data products coming from different instruments and missions will enable improvements in the characterisation of the propagation channel, and therefore improvements in propagation channel models.
Coordinated assessment of channel models and databanks for the required different systems architectures and frequencies will fulfil the specific needs of the future multiservices Global Integrated Networks.

C.4 Benefits of the Action

Until now, because of the way it has been funded, channel modelling and radiowave propagation research has been targeted almost exclusively at the specific issues of whatever individual system provided the support, as for instance, spectrum regulators, terrestrial mobile operators, broadcasters, bodies interested in agricultural land use, weather forecasters, the military, navigation system designers etc. with no or little common ground. Therefore anyone designing a GIN faces a multiplicity of data, algorithms and models tailored towards specific applications.

The main benefit of this new COST Action will be a common and integrated assessment of the radio channel issues relevant to a GIN providing communication, positioning, meteorology and remote sensing services.

Concrete outputs will include a set of required dedicated models and tools, as well as a common experimental database of measured results suitable for modelling, validation and system simulation.

The Action will also expand the European network of experts by multidisciplinary interaction and will create the competence and support needed for the development and deployment of such a system.

The collaboration between remote sensing and radiowave propagation experts will improve modelling by assessing the physical fundamentals of radiowave propagation using experimental climatic data and including results from new Earth observation missions and new Numerical Weather Forecast models.

The Short-term Scientific Missions (STSMs) will offer young researchers opportunities to work in an international and multicultural environment and to promote integration between fields and researchers. They will also learn to apply skills in complex and evolving projects using a multidisciplinary approach.

C.5 Target groups/end users

End-users of the expected results will be:

- The European industry, namely in the fields of communication, navigation and Earth Observation;
- Telecom operators including SatCom;
- Standardization bodies (e.g. ITU-R, ETSI);
- Institutional Agencies (such as the ESA or the EU Galileo project);
- End-users for GMES, disaster relief and security information or systems;
- Research organizations;
- Universities and education bodies.

D. SCIENTIFIC PROGRAMME

D.1 Scientific focus

The major objective of this new COST Action is to constitute a coordinated database of models, techniques and data of the physical channel to improve the design and performance of Global Integrated Networks (GINs).

The driver of the Action is initially the requirements definition for a GIN, taking into account systems performances, propagation properties, spectrum management and interference issues. These requirements will be written also after a review of channel models, channel assessment techniques and experimental/operational data, to be performed at the early beginning of the Action, and after a review of available data coming from the remote sensing and radiowave propagation communities (i.e. collected from past or on-going national, ESA or EU FP funded measurement campaigns including: propagation campaigns for communication and navigation systems, ground atmospheric remote sensing campaign, Earth Observation missions, Meteorological databases and Numerical Weather Prediction archives).

The synergy resulting from a common basis arising through collaboration between the remote sensing and radiowave propagation communities will improve the knowledge on the one hand of atmospheric radio and optical waves propagation and, on the other hand, of observation means and retrieval methodologies. Concerning atmospheric radio and optical waves propagation, new inputs coming from Earth observation systems will allow a better accuracy of propagation models to be obtained, thanks to a better knowledge of the environment, such as digital terrain including buildings and vegetation, or atmospheric parameters such as electron, water vapour, liquid water or ice contents as well as rain characteristics such as rain rate, rain height or rain space correlation. Regarding observation means and retrieval methodologies, the use of accurate propagation models (and in particular deterministic models) and of propagation measurements will be helpful to retrieve these environmental parameters from meteorological measurements performed either on the ground or on-board satellites.

The use of experimental data, along with data access and distribution policies will be harmonized and an evaluation of data processing procedures and tools will be performed at the beginning of the Action. Comparison of data quality and completeness will be achieved, and specifications for future

measurements will be setup.
The main innovation of this Action will then be the coordinated assessment and development of radio channel models for all types of communication (including optical link), navigation and remote sensing applications that could be used in a Global Integrated Network. Model validation and testing will use the newly coordinated set of experimental data collected during the Action.
It should be noted that propagation activities carried out in ongoing COST Actions such as no. 296 (for ionosphere data collection and propagation modelling) or no. 2100 (channel modelling for mobile and wireless communication systems) will be out-of-scope of this COST Action. Specific workshops will be organised with these COST Actions to build up on their results.

D.2 Scientific work plan – methods and means

To achieve the goals of this Action, three Working Groups will be set up:
- WG 1: Channel modelling for mobile Satcom & Satnav systems from VHF to C band
- WG 2: Channel modelling for fixed and mobile Satcom systems from C to W band
- WG 3: Channel modelling for terrestrial free space optical systems and airborne terminals

An interdisciplinary specific Group on measurements and products will be set up to constitute a common database of relevant products and data.

WG 1: Channel modelling for mobile Satcom & Satnav systems from VHF to C band

In this Working Group, the application systems to be referred to are mainly satellite communication systems or satellite navigation systems providing services for terrestrial mobile end-users that can be pedestrian or on-board vehicles. A terrestrial component will be considered for propagation studies related to Digital Mobile Broadcasting systems which include terrestrial gap fillers. Frequency bands of interest are mainly UHF, L, S and C bands, but the LMS Ku and Ka band channel will also be considered here as far as local environment effects are concerned.
In this frequency range, the main propagation effects to be studied are local environment effects, ionospheric effects (not addressed in this Action because studied in COST 296) and a few tropospheric effects (addressed in Working Group 2 with the other atmospheric effects). Local environment effects are due to the presence of obstacles (buildings, vegetation) around the receiver, leading to effects of multipath, shadowing or blockage of radiowaves. Even if the fundamentals of

these effects are well known and have already been studied in other European contexts, the propagation models developed so far (statistical models or deterministic models) are not fully convincing from the operator point of view, either because they have been fitted from experimental measurements performed in specific areas or because they need a fine and accurate description of the mobile environment, which is not always available and require long computing time.

The activity of this Working Group will be focused on different issues such as exploitation of experimental campaigns, hybrid physical-statistical channel models, satellite-to-indoor propagation and Propagation Impairment Mitigation Techniques (PIMT) including diversity techniques:

- Propagation measurements have been or are currently performed by anticipated participants of this Action in different frameworks (ESA, EU) and in different environments such as urban, sub-urban, rural, forest or indoor areas. These propagation campaigns have been performed mainly at L, S and C bands; results of these campaigns will be put at disposal of this Action to improve propagation models. On the other hand, data from Earth observation systems can be used to obtain digital terrain with a better resolution or to get a better description of vegetation.
- Using these results, new hybrid physical-statistical channel models will be developed, tested and upgraded against these new measurements results. Physical-statistical channel models rely on a statistical description of the environment (virtual city, virtual forest …) and on the hybridization of statistical models (e.g. multipath using appropriate Rayleigh distribution) with physical models (such as those using the Uniform Theory of diffraction).
- The investigations on the satellite-to-indoor propagation channel will rely on various measurement campaigns carried out in the last years and on new campaigns carried out at various institutions. The goal will be to precisely describe the satellite-to-indoor propagation channel, to develop new models to accurately assess the multipath behaviour, and to adjust the models to various receiver types.
- Examples of activities devoted to PIMT are diversity techniques including MIMO (Multiple Input Multiple Output systems), to produce a realistic physical-statistical model for the investigation of polarisation behaviour in Satcom links, to investigate MIMO behaviour if the channels are distinguished by polarisation only (not space), to determine the role of 3D polarisation in satellite environment or to elaborate an electromagnetic tool for the simulation of polarisation behaviour.

WG 2: Channel modelling for Earth-Space systems from C to W band

The objective of this Working Group is mainly to study the influence of propagation on satellite telecommunication systems operated at high frequencies to deliver multimedia content to fixed Earth stations or mobile terminals (on trains for example), and on Earth Observation systems (mainly atmospheric remote sensing). The frequency bands of interest range from C to W band with a main focus on C and Ku band for high-availability systems, Ka-band for access systems, Q/V band for backbone systems and W-band for space exploration. Ku and Ka bands are also of interest for future satellite to mobile services. Atmospheric remote sensing may use any of these bands, or even higher bands. Note that some terrestrial broadband communications systems also use the millimetre waves.

The effects to be studied by this Working Group are caused by the influence of the troposphere on radiowave propagation. Tropospheric effects such as attenuation (due to oxygen, water vapour, cloud, rain and melting layer), tropospheric delay (even though for navigation systems), scintillation (in clear sky, within clouds and during rain), depolarisation (due to rain and to ice) and sky noise temperature (in both scattering and non-scattering conditions) have to be taken into account. So far, in previous COST Actions (255, 280) and in ESA and EU projects, deterministic and statistical propagation models have been developed and tested against statistics calculated from Ka and Q/V band propagation data collected in Europe. On the other hand, especially within COST 280, a new generation of models has been developed allowing attenuation and scintillation time series to be synthesised and rain attenuation fields to be generated. Now, full space-time channel models need to be developed and tested.

All these models rely on a description of the atmospheric conditions using radio-climatological parameters that are non-standard from the meteorological offices point of view, such as: rainfall rate, liquid water content or water vapour content. From the end of the 90’s, data coming from re-analyses of weather forecast models (e.g. ERA 40 database of ECMWF) have been made available, allowing digital maps of these radio-climatological parameters to be produced. However, the maps generated from these new databases of re-analysis data contain some inaccuracies due to the limitations of weather forecast models, especially for tropical and equatorial areas, coastal areas and high altitude regions (these regions gather the majority of the population in the world, and especially the 15 highest populated cities). These limitations can translate in high prediction errors. Nowadays, new Earth observation missions have been launched (TRMM, Cloudsat, a-Train, etc…)

which allow a worldwide cartography of all these radio-climatological parameters. Therefore, these new data can be used to correct the current maps obtained from re-analysis data, and to improve radiowave propagation models.

To achieve this goal, the activity of this Working Group will follow four main axes:

- A specific activity will be defined to coordinate experimental campaigns currently performed with the satellite EUTELSAT HB6, to benefit from results of the ISRO GSAT-4 propagation experiment carried out in tropical regions in India that will be available from the end of 2008, and to prepare the ASI-ESA Alphasat propagation campaign. On the other hand, complementary experimental campaigns using radiometric, GPS, Radar and atmospheric profiling techniques will be used to characterise radio-climatological parameters and the propagation channel.
- Mapping of radio-climatological parameters will be done using new products available from Numerical Weather Forecast models, Earth observation systems and meteorological gridded data. The most relevant data will be analysed and, when needed, correction procedures will be developed and applied after cross-check of data coming from these different sources. Here, the objective is improve the accuracy, reliability, space and time resolution of radio-climatological parameter maps, with information on inter-annual, seasonal and diurnal variations.
- Using improved maps of radio-climatological parameters and new propagation data, development/upgrade and test of propagation channel models will be done to test multi-dimensional channel models: such as space-time models and instantaneous frequency scaling models. Development of new methods to test these multi-dimensional channel models are required and will be developed and used against the data gathered in the previous activity.
- The development and test of channel assessment techniques for Propagation Impairment Mitigation Techniques will be the object of this last activity. Channel detection techniques using a monitoring of communication links, beacon signals or meteorological data will be compared and real-time short-term prediction models will be developed and tested for different time constants (seconds, minutes, hours). Investigation of the MIMO technology for Interference Exploitation and Capacity Enhancement in Satellite Communications at Ku band and above will also be considered.

WG 3: Channel modelling for terrestrial free-space optical systems and airborne terminals

The applications targeted by this Working Group are on the one hand Free Space Optical links and, on the other hand, satellite communication systems for airborne terminals. Free Space Optical links can provide "last mile" solutions for access networks and are interesting emerging technologies for deep-space communications or inter-platform links, platform meaning satellite, High Altitude Platforms (HAP) or Unmanned Aerial Vehicle (UAV). On the other hand, satellite communication systems for airborne terminals, either related to Air Traffic Management at L or C band and coupled with satellite navigation systems or related to internet services for airborne end-users at higher frequencies (such as Ku or Ka band) will be addressed in this Working Group too.
As far as Free Space Optical (FSO) links are concerned, propagation effects impacting link performances are mainly tropospheric effects caused by weather conditions, such as signal attenuation due to gas absorption, signal attenuation and noise increase due to scattering by particles ranging in size from fractions of a wavelength to many wavelengths, fluctuations of signal amplitude, phase and direction of arrival due to beam refraction and turbulence. New recommendations have been recently standardized by ITU-R (Rec. ITU-R P.1621, P.1622, P. 1814 and P.1817) but they rely either on well-known deterministic model (e.g. calculation of atmospheric absorption using a line-by-line method) that are computationally intensive or on rough empirical models whose accuracy needs strongly to be assessed. The activity to be done in this area will be concentrated on the exploitation of experimental campaigns, on propagation model development and on Propagation Impairments Mitigation Techniques:

- Propagation measurements on terrestrial Free Space Optical links have been started recently by anticipated participants of this Action and are still ongoing. The results of these experiments will be analyzed in this Working Group and the statistical distributions generated will be put at disposal of the Action for the modelling activity.
- Development of propagation models will concentrate on the influence of atmospheric particles, such as fog, clouds, rain and aerosols, both in terms of statistical distributions and in terms of dynamics (event or inter-event duration, rate of change, …), as well as on the modelling of the impact of tropospheric turbulence, both on the statistical and on the spectral point of views.
- Examples of activities devoted to Propagation Impairment Mitigation Techniques to improve the performances of Free Space Optical links will be: adaptive Optics using deformable mirrors to correct scintillation, small-scale spatial diversity and wavelength diversity, adaptive coding

and modulation with new coding and modulation formats and networking techniques, investigation of the MIMO Technology for Interference Exploitation and Capacity Enhancement at optical frequencies.

Regarding satellite communication systems for airborne terminals, as stated in Recommendation ITU-R P.682, propagation effects in the aeronautical mobile-satellite service differ from those in the fixed-satellite service and other mobile-satellite services because: of the use of small antennas and of the impact the aircraft structure, of high aircraft speed resulting in large Doppler spreads, and of aircraft safety considerations which impose high availability requirements. All this specificity justifies including this issue in a Working Group separated from WG1 and WG2. In this area, propagation impairments to be modelled are tropospheric effects (including gaseous attenuation, cloud and rain attenuation, fog attenuation, refraction and scintillation, with a link with WG2); ionospheric effects such as scintillation; local environment effects (aircraft motion, surface reflection depending on sea state or land surface type). In this area, the activity will be concentrated on exploitation of experimental campaigns and channel modelling.

- Very few propagation measurements have been performed by anticipated participants of this Action in different European frameworks (ESA, UE) and mainly at L and Ku/Ka band. A review of past propagation experiments for the aeronautical channel will be carried out and the accessible results will be put at disposal of the participants to this Action.
- The main activity related to the aeronautical channel will be devoted to channel modelling. In this context, different types of models will be considered, such as statistical and deterministic models. The activity will be focused on the development of simulators relevant for the different scenarios, allowing these models to be used jointly, for instance using stochastic models to predict the temporal evolution of typical events (atmospheric conditions, multipath, …) and deterministic models to generate the interactions with the aircraft structure and with the ground for different phases of the flight (especially take-off and landing).

SGMP: Specific group on measurements and products

The channel modelling activity will use experimental data from past and on-going campaigns. An interdisciplinary working group on measurements and products will give inputs and support on key issues including: review, collection and distribution of data, coordination of measurements,

definition of data processing procedures and signal processing techniques for radiowave propagation and remote sensing. With these data and tools, the physical properties of the atmosphere will be characterised, and as such will give a solid base of propagation models.
This group will review and select data from: propagation campaigns for communication and navigation services, ground atmospheric remote sensing techniques, Earth Observation satellites, meteorological campaigns and Numerical Weather Prediction systems. It will work on the assessment of data quality and completeness, comparison on datasets from different origins. The main task of this working group is to define a common database of measurements and products to be recommended for GIN design and simulation and to specify new measurement campaigns or missions that would be useful in the future to better improve the performances of the systems.

It should be noted that for all Working Groups, the list of activities is not exhaustive and will be updated in the first phase of the Action, after a first phase of review of the propagation effects, data and models. Then, Sub-Groups gathering a sufficient number of members could be created on each identified subject.

E. ORGANISATION

E.1 Coordination and organisation

The Action will be guided by the usual COST structure with a Management Committee (MC).
The MC will elect a chairperson and a vice-chairperson. The Management Committee will usually have two annual meetings and associated technical meetings.
The chairperson will report, annually, to the Domain Committee in the field of Information and Communication Technologies on the status of the Action, on the progress of the work and on the short-term work-plan. The chairperson will also be in charge of achieving working liaisons between the Action and other related COST Actions, and also with other frameworks such as EU FP or ESA.
The vice-chairperson will help the chairperson and will be especially responsible of managing STSMs issues in order to promote this tool in the Action.
The secretariat will be responsible for taking care of the administrative matters of the Action, for supporting the MC and the chairperson in their activities, and for taking charge of documentation

flow within the Action. For this purpose, e-mail reflectors will be established, thus favouring the exchange of documents in electronic format.
A web site will also be set up by the secretariat, not only as a support for the exchange of documents within the Action, but also to promote worldwide dissemination of results.
Delegates representing parties in the MC are expected to attend and contribute to meetings of the MC according to the objectives and milestones of the Action, to take responsibility for specific items of the Action, to liaise with the national research groups in their own country. Besides the Delegates, it is expected that Experts from the various parties will attend the WG meetings, to present technical documents, and to participate in the technical discussions of the work.
The scientific activity will be conducted in three Working Groups (see below). Each WG will elect a chairperson, to coordinate the work within the group, and to ensure the exchange of information with the other WGs and with the MC

E.2 Working Groups

The activity will be driven by a multidisciplinary Advisory Committee (AdC) that will identify the development of GINs. This committee will pursue interactions with EU, ESA and National stakeholders by means of periodic reviews. To this end a kick-off panel discussion and a closing workshop with the participation of the European Industry will be organised.

The Advisory Committee inputs will be used in the Working Groups by the experts involved in the Action to identify, improve, develop, validate and test radio channel models and to provide recommendations for their use in the design of global integrated networks.
To achieve the scientific activity, three vertical working groups will be setup:

1) WG1 : Channel modelling for mobile Satcom and Satnav systems from VHF to C band
2) WG2 : Channel modelling for Earth Space systems from C to W band
3) WG3 : Channel modelling for terrestrial free space optical systems and airborne terminals

Moreover an interdisciplinary Specific Group on Measurements and Products (SGMP) will give inputs and support on key issues including: review, collection and distribution of data, coordination of measurements, definition of data processing procedures and signal processing techniques for radiowave propagation and remote sensing, assessment of data quality and completeness, comparison on datasets from different origins, specification of new measurement campaigns or missions.

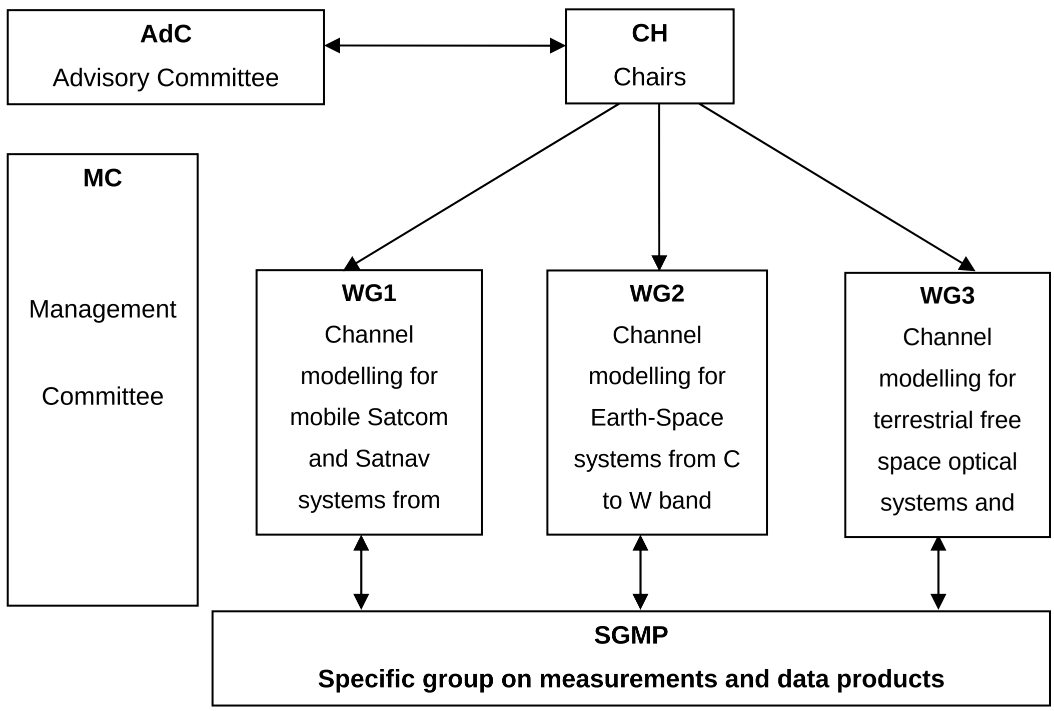

Figure 1 – Action organization.

E.3 Liaison and interaction with other research programmes

Considering the proposed multidisciplinary approach, joint workshops with other running COST Actions on related fields (such as COST Action 296 or COST Action 2100), will be organized. The Advisory Committee will pursue interactions with EU, ESA and National stakeholders by means of periodic reviews.

E.4 Gender balance and involvement of early-stage researchers

This COST Action will respect an appropriate gender balance in all its activities and the Management Committee will place this as a standard item on all its MC agendas. The Action will also be committed to considerably involve early-stage researchers. This item will also be placed as a standard item on all MC agendas.

STSMs will be especially focused on early-stage researchers and will offer opportunities to them to work in an international and multi-cultural environment and to promote integration between scientific fields and between researchers.

F. TIMETABLE

The duration of the programme will be four years, with the following planned activities.

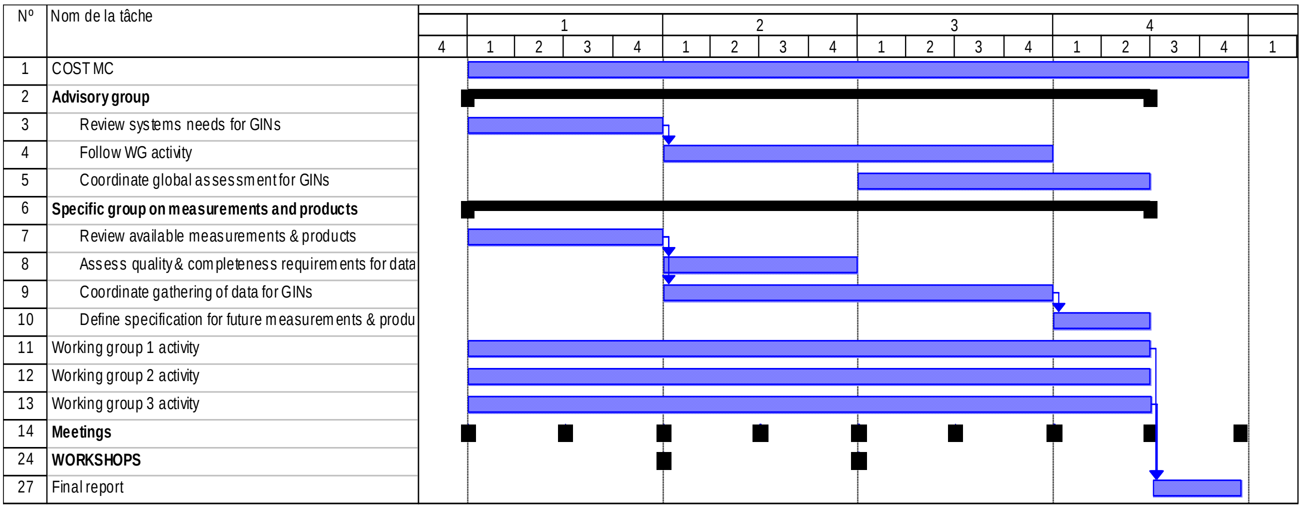

Figure 2 – Action timetable.

First Workshop after 1 year could be devoted to share experience between Earth Observation & Remote Sensing community and Propagation experts.

Second Workshop after 2 years could be devoted to share results between COST Actions related to radiocommunications systems & channel modelling issues (COST Actions 296, 2100 as well as this Action).

The Final Meeting will be organised to present all the results and outputs of the Action.

G. ECONOMIC DIMENSION

The following COST countries have either actively participated in the preparation of the Action or have otherwise indicated their interest: Austria, Belgium, Czech Republic, Finland, France, Germany, Greece, Hungary, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden, United Kingdom.

On the basis of national estimates, the economic dimension of the activities to be carried out under the Action has been estimated (in 2007 prices) at EUR 15 million for the total duration of the Action.

This estimate is valid under the assumption that only the countries mentioned above will participate in the Action. Any departure from this assumption will change the total cost accordingly.

Participating Institutions from non-COST countries (for example from Brazil, Canada, USA, and the Russian Federation) may also be involved.

H. DISSEMINATION PLAN

H.1 Who?

Dissemination of results is a key aspect in R&D today, as shown by previous COST Actions.

The target audiences for dissemination are the following entities:

- Other researchers working in the field;
- Other research projects and undertakings;
- Standardization bodies (i.e. ITU, ETSI);
- European industry, in the communication, navigation and Earth Observation domain
- Telecom operators including SatCom;
- Institutional Agencies (such as ESA, EU Galileo project, …);
- Policy makers and end-users for GMES, disaster relief and security information or systems
- Universities and education bodies.

H.2 What?

The dissemination of information will be implemented through:

- posting of general information such as objectives, dates of meetings, workshops; announcements, etc..., on a set of dedicated public web pages;
- development of web-based tools made available through a web portal;
- posting of all working documents on a password-protected web or FTP site;
- a regular newsletter;
- contributions to national and international conferences and symposia (with technical sessions devoted to present the work developed within the Action);
- exchange and discussion of scientific findings in specialised workshops organised by the Management Committee (with appropriate proceedings);
- publication of papers in scientific and technical Journals;
- publication of annual reports;
- publication of a Final Report.

H.3 How?

The Action’s web site will be setup as a support platform for the exchange of documents within the Action, as well as a means to promote worldwide dissemination of results. The web-based tools will be used to make available to European organisations the data and the algorithms developed during the Action. Furthermore, the Action’s newsletter will not only be available on the website, but it will also be e-mailed to those who are identified as being potentially interested in the Action.

Finally, the MC will organise yearly workshops, where the involvement of other Actions or other EU-related initiatives (such as NoEs, IPs etc...) will be sought. These workshops will act as an important instrument for dissemination.

This type of dissemination will increase the extent of external interaction with the ideas, suggestions and proposals originated within the Action, as well as achieving wider dissemination of results and an increased visibility of the Action.