



161st CSO Meeting, 15 – 16 March 2005

Proposal for a new COST Action

COST 297

**“HIGH ALTITUDE PLATFORMS FOR COMMUNICATIONS
AND OTHER SERVICES”**

(HAPCOS)

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DRAFT

MEMORANDUM OF UNDERSTANDING

for the implementation of a European Concerted Research Action designated as

COST 297

“HIGH ALTITUDE PLATFORMS FOR COMMUNICATIONS AND OTHER SERVICES”

(HAPCOS)

The Signatories 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 400/01 "Rules and Procedures for Implementing COST Actions", the contents of which the Signatories are fully aware of.
2. The main Objective of the Action is to increase knowledge and understanding of the use of High Altitude Platforms for delivery of communications and other services, by exploring, researching, and developing new methods, analyses, techniques, and strategies for developers, service providers, system integrators, and regulators.
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 Euro 11 Million in 2004 prices.
4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.
5. The Memorandum of Understanding will remain in force for a period of four years, calculated from the date of first meeting of the Management Committee, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST 297
“HAPCOS”

‘High Altitude Platforms for Communications and Other Services’

A. Background

High Altitude Platforms (HAPs) offer potential significant and unique benefits for the delivery of communications services, remote sensing, and navigation system support. HAPs and their applications have been the subject of considerable interest and activity internationally for the past few years, and there are several current projects worldwide on HAPs, including programmes in the US, Europe, Japan, and Korea. This COST Action aims to support the development of such applications, bring together interested parties, increase knowledge and understanding, help promote a coherent framework for economic and regulatory aspects, and support cohesive European activity in these fields.

HAPs are quasi-stationary vehicles in the stratosphere, at altitudes of typical 20 km. They provide a platform for payloads such as communications transponders, which in turn may provide services exhibiting the best features of terrestrial and satellite communications systems. HAP-based communications offers a number of potential advantages, including:

- Rapid deployment
 - useful in emergency scenarios, service restoration, or event servicing.
- Very high communications capacity
 - achieved through intensive frequency re-use, and allowing exploitation of adaptive resource management. Free-space optical communications links may also be effectively deployed on HAPs.
- Environmental advantages
 - reducing need for terrestrial infrastructure and radio masts.
- Wide service coverage coupled with low costs
 - ubiquitous service provision facilitating broadband Internet to rural and other users.

Additionally, HAPs offer unparalleled opportunity for remote sensing, surveillance, and traffic monitoring. The relatively close range (compared with satellites) gives a number of significant advantages.

HAPs may also help provide navigation and localisation services, e.g. differential GPS, or local DoA (direction of arrival) navigation services. There is considerable scope for HAP-based developments in collaboration with GALILEO.

HAPs first emerged as a serious future technology concept around 1997. There have been a few programmes in recent years to develop HAPs; the most significant being the US Aerovironment Helios series of craft (unmanned solar powered aircraft) and the Japanese SkyNet programme (based on helium airships, and now managed through NICT). Among current programmes, the Korean HAP activity by KARI and ETRI is one of the larger and more promising. In Europe activities have been limited and somewhat piecemeal, with the exception of the HeliNet 5th Framework programme (IST-1999-11214), which explored the design of a solar powered aircraft, together with applications in broadband communications, remote sensing, and navigation. The 6th Framework Programme call attracted a number of HAP-related submissions (under headings of Broadband for All, and of Risk Management), and this is indicative of the emerging widespread interest. The CAPANINA project

was selected for funding, and this commenced in November 2003, exploring development of broadband services from HAPs, including services to trains.

At the present time it is seen that progress towards successful HAP systems is inhibited by the following factors:

- a) Investment caution. HAP development demands significant sums and has unknown risks. At the same time, the technology is new to investors. A greater and more widespread understanding is required.
- b) NIH- 'Not Invented Here'. Because HAPs and their applications are seen as a new technology, there is a threshold to be overcome before companies and service providers, in particular large companies, will give them serious consideration. Some companies do not know whether HAPs are an opportunity or a threat. Again, wider involvement and education are critical.
- c) Fragmented effort. The European scene in HAPs-related projects is fragmented, with ad-hoc and incomplete groups competing for funding. Indeed, international activity is confined to a few specific and isolated projects, and a wide base of knowledge and experience remains to be established.
- d) Lack of critical mass. The overall level of activity is thinly dispersed, and hence communication and common ground is exceptionally important. Although in some areas such as broadband communications there is some established academic activity, there is very little in Remote Sensing or other application areas from HAPs. A network of information is required to pull work together and accelerate research output.
- e) Split disciplines. HAP development demands both investment and R&D in aeronautical areas (for the platform) and in communications and IT (for the applications). These areas tend to fall under separate funding directives and initiatives, making it hard to achieve coherent programmes or investment. More common ground between these areas would be highly beneficial.
- f) Challenges in developing coherent relationships between HAP manufacturers (e.g. aerospace companies) and service providers (e.g. telecom companies), who may have little understanding in common.
- g) Regulatory constraints and uncertainties. HAPs do not fit easily into existing regulatory categories, and at the same time lack an established body of interested parties to help drive such issues. One of the principal challenges facing HAP-based communications is that of suitable spectral allocations. A co-ordinated approach to national and international spectrum regulators remains to be established on behalf of European HAP interests. Other regulatory aspects may also be of concern.
- h) Trials and testing challenges. Suitable demonstration trials are essential in order to convince investors. However, these are not only costly but risky, as well as being subject to uncertain regulatory constraints (eg. in aeronautic, radio, planning, and health and safety). More shared information would facilitate such trials.

Fortunately some common understandings seem to be emerging slowly, particularly as European programmes such as CAPANINA get underway and become well known. But there remains considerable scope of action to enhance knowledge in Europe.

This COST Action will actively develop expertise and understanding within Europe, and help overcome the obstacles identified above. Among its key features will be the bringing together of HAP vehicle developers and experts with those concerned with HAP applications, and a broadening of research output and dissemination.

A COST Action represents the most effective way forward to achieve the above aims. This is due to: the mix of academic and industrial partners involved; the current state of development of the topic; the diversity of interests and specialist skill areas involved. This COST Action will be

complementary to current programmes (such as 6th Framework Programme activities), and its outputs will serve to strengthen them and other future programmes.

B. Objectives and Benefits

The **main Objective** of the Action is to increase knowledge and understanding of the use of High Altitude Platforms for delivery of communications and other services, by exploring, researching, and developing new methods, analyses, techniques, and strategies for developers, service providers, system integrators, and regulators.

The activities carried out in the Action will bring benefits not only at a national level but also at the European level as well, and indeed internationally.

Specific measurable objectives will be:

- i. To increase knowledge concerning communications applications of HAPs. To share research and ideas in not only broadband services, but also other communications opportunities such as: 3G; emergency services; ENG (Electronic News Gathering); Telemedicine; Remote education, and to strengthen the basis for further proposals and project plans.
- ii. To use the COST framework to co-ordinate with other Actions having relevant expertise. These include: COST 272 (Packet-Oriented Service Delivery via Satellite), COST 273 (Towards Mobile Broadband Multimedia Networks), COST 280 (Propagation Impairment Mitigation for Millimetre Wave Radio Systems) and COST 284 (Innovative Antennas for Emerging Terrestrial & Space-based Applications).
- iii. To highlight opportunities and business models for services from HAPs, identifying key features and benefits, and cost comparators.
- iv. To encourage, co-ordinate, and promote knowledge and understanding concerning HAP vehicles themselves; their challenges, constraints, operating parameters, and construction. Also to develop greater mutual sharing of knowledge between HAP vehicle developers, applications engineers and service providers.
- v. To identify shared concerns and requirements of those working with HAPs and their applications, and in particular to develop common requirements from a regulatory point of view.
- vi. To share and develop ideas, methodology, and good practice concerning trials of HAPs and their applications.

The benefits of the Action will be as follows:

- Broad collaboration will be engendered between research teams, to the benefit of all concerned. An enhanced 'critical mass' will be achieved, facilitating future proposal generation, providing confidence to both investors and planners, and yielding increased and better-informed output from researchers and developers.
- The research will yield enhanced international competitiveness of European manufacturers (in both Communications and HAP vehicles in particular), service providers and operators of communications systems.
- Breadth of vision will accrue to individual researchers, institutes, industrial concerns, service providers, and consumers of services. This will lead to innovative cross-disciplinary applications and technology developments, likely to significantly enhance prospects and business for HAPs.

C. Scientific programme

The technical programme for this Action is outlined below. Additionally, the Management Committee will liaise with their counterparts in other related Actions in order to encourage wider synergistic activities (some such Actions have been identified above).

The nature of Activities to meet the declared objectives will fall within 3 broad categories:

- a) Research and Development;
- b) Workshops and Technical visits;
- c) Dissemination, advisory, public relations, and promotion.

In order to make most effective use of specialist expertise, three Working Groups (WGs) will be established in the first instance:

- WG1. Radio Communication Aspects. This will deal with wireless communication services (including backhaul aspects) based upon HAPs.
- WG2. Optical Communication Aspects. This will deal with free-space optical communication links and services to and from HAPs.
- WG3 Aerial Platform Developments. This will deal with development of HAP vehicles themselves, in the context of application for communication services, including control, telecommand, telemetry, critical HAP sub-systems, HAP navigation, and HAP operation.

These working groups may interact and overlap and their build-up may be phased following the establishment of the COST Action. Further WGs, covering other related areas, will be established later within the Action should both need and critical mass become identified.

a) Research and Development Activities

The Action will bring together and discuss activities in research and development undertaken by the signatories. It will identify key issues and develop solutions. The principal topics currently to be addressed are:

- i. Platform operating parameters, dynamics, constraints (WG1, WG2, WG3)
Issues such as stability, vibration, and motion all influence communications systems design. Power supply limitations may also be critical. Such parameters have been hard to come by to date. This Action will identify and compare such features.
- ii. Antenna technology applied to HAPs, including pointing and steering mechanisms (WG1, WG2)
Antenna technology is key to good communications performance from HAPs, which represent a unique and challenging operational scenario. Theoretically ideal solutions such as phased arrays present practical difficulties. Research output and design experience will be shared and developed, and knowledge increased. Links will be established with work in COST 284.
- iii. Payload design and integration aspects, including power supply and conditioning (WG1, WG3)
HAP payloads have less stringent operating conditions than satellite payloads, yet present some unique opportunities and problems. These will be explored and developed in the context of achievable platform constraints.
- iv. Optical communications link research and design (WG2)

There is a good deal of interest, and some activity, in free-space optical communications to/from HAPs, for both HAP-ground and inter-HAP links. Research output and design experience will be shared and developed, and knowledge increased. Also, the opportunity will be provided for those working in this area to interact with system-level designers.

- v. **Network integration and Operational Support Systems (WG1, WG2)**
The integration of HAPs transmission links into communications networks presents new challenges of management, maintenance, charging, and OSS. Design issues will be developed, and the resulting greater understanding will facilitate realistic system design.
- vi. **HAP operation and support (WG3, WG1)**
Launching, operating, and maintaining aerial platforms for long endurance services is a new and uncertain area, having some elements of synergy with satellite and aeronautical experience. Key elements of methodology will be identified, developed, and shared.
- vii. **Trials methodologies, results, and assessment (WG3, WG1, WG2)**
Successful trials are crucial prior to full investment for commercial or other services. They call for specialist facilities and experience, and the Action will identify and develop some common yardsticks in assessment of results.
- viii. **Operational cost analysis, through-life costings, and business plan issues (WG3, WG1)**
Cost analyses for HAPs and HAP services lack firm evidential basis at present. The Action will identify issues and relevant factors, and establish methodologies to serve effective production of convincing business plans. This research will require to involve service providers with relevant economic expertise.
- ix. **Critical HAP technologies**
Research will be co-ordinated in key factors affecting the viability of HAPs. These are expected to include energy systems and storage (solar cells, fuel cells, and power management), positioning, and station-keeping techniques.
- x. **Remote Sensing from HAPs**
The key issues relating to Remote Sensing from HAPs will be explored, with a view to engendering further activity in this area.

b) Workshops, Technical Visits, and Short Term Scientific Missions

The Management Committee will organise a series of **workshops**, initially on the themes of the three Working Groups in the order listed above, and then subsequently on the ten specific topics. Workshops will usually be co-located with meetings of the WGs. Associated Technical Visits to the laboratories or facilities of the host institutions will be organised, to achieve a clear view of engineering activities. The precise nature and number of Workshops will be defined as the Action progresses. Workshops will be followed by published proceedings.

Technical visits to facilities of interest to the Workshop attendees and Management Committee delegates will be arranged around the workshops where appropriate.

Opportunities for **shared activity** with other running Actions will be identified and explored at an early stage, and synergies exploited where appropriate. Co-operative Workshops may then be arranged; such Workshops increase the visibility of the Action and also make it possible to bring knowledge from outside experts into the Action.

Active participation in international **seminars and conferences** will also be promoted (seeking technical sessions devoted to present the work developed within the Action). This will increase the number of interactions with the activities, outputs, suggestions, and proposals originating from within the Action, as well as effecting wider dissemination and promoting visibility of the Action.

Short Term Scientific Missions will be established, to provide maximum integration and cross-fertilisation of ideas within Europe. These are expected to be research visits of typically a few weeks by personnel in the field to another member institution.

c) Dissemination, regulatory impact, public relations and promotion

Dissemination will be a key aspect of this Action, and will be pursued primarily using the Internet. A web-site will be established, and regularly and proactively maintained to serve as a resource to all Action members, as well as public promotion. Also, every opportunity will be taken to encourage and present the work of the members in international seminars and conferences. Researchers from the institutions involved will be expected to work in close co-operation, with mutual and continuous exchange of information.

The outputs of the Action will also serve to inform regulators, standards bodies, EC funders, other investors, and potential service providers concerning HAPs and their applications.

At the end of the Action, a summary of the work will be presented in the Final Report. This Report will be structured in accordance with best practice for COST Actions.

The Action will constantly monitor publicity and public perception relating to HAPs and HAP services, and will make representations as appropriate. The Action will identify opportunities to promote work on HAPs and HAP services where possible.

Please refer also to the Dissemination plan later in this document.

d) Outputs

The Outputs from the Action will be Reports, based upon, and mapped to, all the above specific research activities.

D. Organisation, Management and Responsibilities

The Management Committee (MC) will be responsible for co-ordinating all the activity within the Action and will take advice from the Technical Committee TIST to achieve liaison between this and other COST Actions. The Management Committee will meet at least twice a year. The Management Committee will comprise delegates from the signatory countries, and will elect a Chair and Vice-Chair. The Chair will report annually, to TC TIST, on the progress of the work, and on the short-term work-plan, in accordance with TC TIST procedures.

The Management Committee will appoint Working Group (WG) Co-ordinators responsible for the activities of each group. The technical activities of the Action will be organised into three WGs, which will interact with the MC, as indicated in Fig. 1. Each WG will elect a Chair, to co-ordinate the work within the Group, and to ensure the exchange of information with the other WGs and with the MC. The activities within each WG will be monitored carefully, and consideration will be given to the formation of one or more Sub-Working Groups dealing with specific topics, as and when these may become identified; this will enable a better and faster achievement of results within the time scale of the Action.

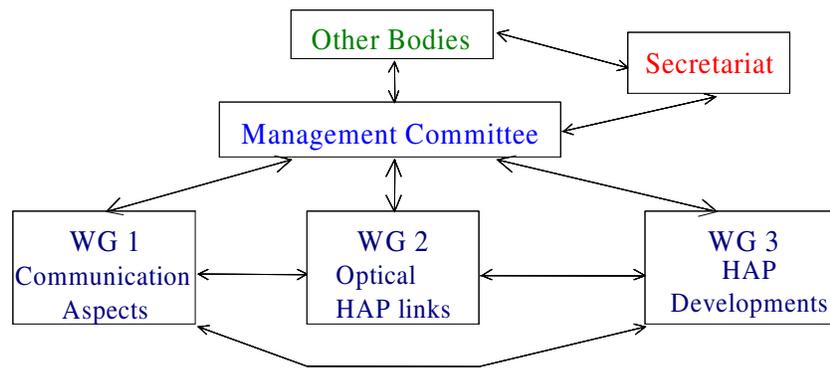


Fig. 1 – Diagram showing interaction between the WGs and other elements.

The Secretariat will be responsible for taking care of the administrative matters of the Action, for supporting the MC and the Chairperson in its activities, and for being in charge of documentation flow within the Action. For this purpose, the WWW server set up by the Secretariat will not only facilitate the exchange of documents within the Action, but also to promote a worldwide dissemination of results.

A competent and experienced body will be elected to undertake the Secretariat role.

Linkage with other Programmes and Activities

This COST Action will establish links with other appropriate COST Actions. These have been identified above. It is anticipated that there may be some overlap of individual or corporate members, and opportunity will be sought to combine meetings as appropriate. Early endeavours will be made to establish formal contact with these other Actions.

Potential members are involved in EU Research programmes; several with CAPANINA. Close contact and collaboration will be readily established. However, it should be emphasised that this COST Action is much broader than such programmes, and represents complementary activity rather than any direct support.

At the present time, there are no standardisation bodies established for HAPs. However, this Action will serve to inform any such activity, including any regulatory activity. It will be a key activity of

this Action to identify standardisation or regulatory bodies relevant to HAPs and their applications, to identify communications routes to such bodies and to proactively inform them, and to make direct representation on behalf of the Action where identified as appropriate.

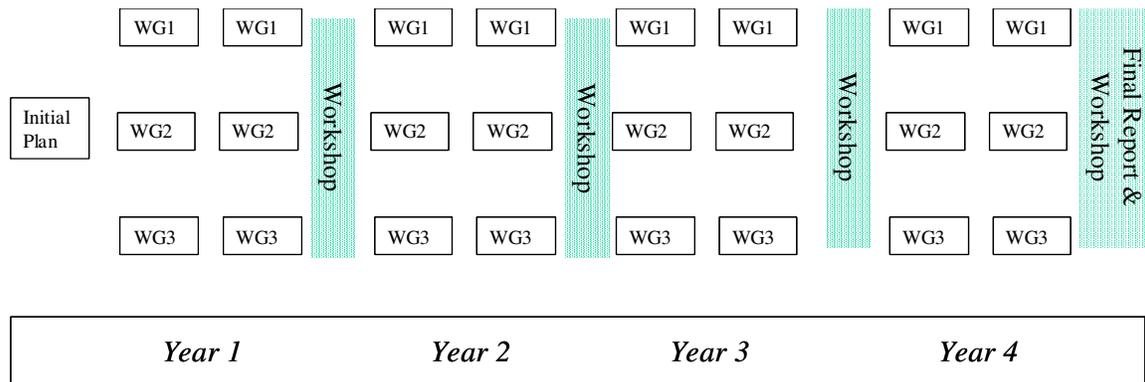
E. Timetable

The duration of the Action is four years. The activities associated with each WG and meeting will be phased so as to lead to a productive coherent and comprehensive Final Report by the end of the Action period. Additionally, Annual Progress Reports will be published at the end of each year, and a detailed schedule for the preparation of these reports will be decided upon in the kick-off meeting of the Action.

The three WGs will each meet regularly every 1 or 2 months. This will result in about 6 meetings per year, although some of these may be directly consecutive or concurrent where possible and as appropriate, in order to save costs and maximise interaction.

Each year there will be one additional comprehensive Workshop, which will consolidate and present results from the WGs.

The following represents the overall outline plan for the Action; further details of the schedule will be decided by the Action partners at the kick-off meeting.



F. Economic dimension

The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest.

COST Countries

Austria
 France
 Germany
 Hungary
 Italy
 Ireland
 Slovenia
 Spain
 Switzerland
 United Kingdom

COST Co-operating country

Israel

Other Countries

Japan
 Canada
 Korea
 Russia

On the basis of national estimates provided by the representatives of these countries, the economic dimension of the activities to be carried out under the Action has been estimated, in 2004 prices, at roughly Euro 11 Million.

This estimate is valid under the assumption that all the countries mentioned above but no other countries will participate in the Action. Any departure from this will change the total cost accordingly.

G. Dissemination plan

The outcomes of the Action will be disseminated to the following target audiences;

- Other workers and researchers in the field of HAPs and HAP communications.
- Other fraternities and networks such as Earth Observation and Remote Sensing, which may be served by HAPs.
- The wireless communications fraternity in general, including those in free-space optical communications.
- Service providers.
- Other potential users of HAP communications and services, e.g. national emergency services.
- Manufacturing industry concerned with aerial platforms.
- Regulatory and Standards bodies (national, European, and international)

- Related networks representing UAV activity and interest (viz. UAVNET and UCARE).

The primary means of reaching the first three in the list (and to some extent the other parties) is through **academic journals** and **conference publications** and by participation in the **Workshops** organised by the Action. Every opportunity will be taken to promote the findings of the Action through such activities, including special sessions at international conferences. **COST Action events** will be organised at selected conferences to report on the Action and to publicise COST in general. Presentations and Workshops will be co-ordinated with other networks (such as UAVNET) as appropriate.

Where appropriate, **articles in the technical press** will be encouraged. Agreed mechanisms for **Press Releases** will be established within the Action. National delegates will be tasked with communication directly with appropriate industrial concerns if these are not participating directly in the Action.

Individual researchers will be delegated to liaise with Standards-making bodies by the Management Committee.

An **Action website** will be developed, comprising both public and members' sections. Responsibility for this web-site will be clearly defined, and will lie with the Co-ordinator, or other appointed partner. It will be linked to others as appropriate. This Internet Site activity will involve the following:

- Selection and procurement of a relevant domain name (e.g. org)
- Development of an appropriate graphic design style and identity for the project
- Identification of appropriate site structure and content to communicate information about the project
- Development of website templates for relevant sections of the website
- Incorporation of content from team members, including document control and handling
- Hosting and support services associated with the website
- Maintenance of the website content, as required by partners
- Design of the site to aid search engines
- Monitoring and reporting site visitor statistics, as required by partners
- Coordination and dissemination of site enquiries to partners
- Provision of Newsletter and Document components of the web-site.

COST Action 297

“HAPCOS”

**‘High Altitude Platforms for Communications and Other
Services’**

ADDITIONAL INFORMATION

NOT PART OF THE MoU

a) History and background of the Proposal

HAPs, and the delivery of communications services from HAPs, first emerged as topics of widespread interest around 1998/9. At that time there had been some activity in the USA and in Japan, but little in Europe. The 5th Framework HeliNet programme commenced in 2000, representing the major European activity in this field, and cost M€ 4.3. HeliNet was based upon earlier work at Politecnico di Torino on a solar-powered airplane, linking with communications activity there, and thence to a European consortium of some 10 partners. Emphasis was on broadband communications services, as well as remote sensing and localisation services. During the three years of the HeliNet programme, a number of concepts were evaluated, and the consortium members strengthened their expertise and interest in these areas.

Public and media interest in HAP services has been considerable, and European members of the HeliNet consortium have developed numerous international links. Members have interacted with other HAP programmes worldwide (notably Aerovironment in the USA, and SkyNet in Japan), as well as participating in numerous other project proposals and bids, workshops, conferences, lectures etc. International interest was firmly established by the Airship Convention in Friedrichshafen in summer 2000, representing something of a pivotal turning point. Since then, HAPs and HAP services have been strongly represented in international conferences and publications. HeliNet alone has engendered 57 open-literature publications.

Potential Members of this Action have engaged in numerous other studies, bids, and potential project activities. These included possible projects in South Africa and Malaysia; many such projects have not proceeded due to the universal downturn in high-tech investment. However, several are still being actively pursued.

The European Commission has taken a strong interest in HAP applications, in particular under the 'Broadband for All' action line, and under action lines relating to Risk Management (i.e. emergency communications). In 2002 the CAPANINA FP6 STREP bid was successful: this is building upon work in broadband communications undertaken within HeliNet, and includes up to three practical trials. CAPANINA has 14 international partners (including the Japanese NICT), and an overall budget of c. M€ 5.6.

Despite the general investment downturn in communications, interest in HAP projects remains strong, with major initiatives in Korea (KARI / ETRI), Japan, and the US, while many other projects are being planned or proposed. It is anticipated that this field will continue to grow steadily, with escalating R&D leading towards commercial services c. 2010.

Other applications of HAPs, such as Remote Sensing, are attracting increasing interest. There is also potential for synergy with localisation / navigation interests such as GALILEO. There is also a growing consensus that for HAPs to prove truly economically viable to operate, a bundle of mixed services /applications will need to be offered. Part of the purpose of this Action is to bring together such interested parties with those already addressing HAPs for communications services.

Also in recent years, there has been an upsurge of interest and activity in UAVs – Unmanned Aerial Vehicles – which operate generally at much lower altitudes and for shorter durations than HAPs. However, there are a number of common interests between UAVs and HAPs, including 'barriers to entry' for commercial services and regulatory hurdles. Activity is required to help bridge the gap between these two fraternities. The Action will link in with UAVNET – an industry group representing UAV interests.

Encouragement to submit this Proposal has been very strong from those within established programmes such as HeliNet and CAPANINA, but also from others seeking to extend into HAP application areas and to exploit HAPs. There is a strong consensus within academic and industrial spheres that the time is right for such a COST Action.

b) List of Experts / Potential Partners

The following partners have contributed to the preparation of this Proposal or have recently and actively expressed interest in participation in this Action; it is anticipated that they will sign up to the Action.

<u>Country</u>	<u>Organisation</u>	<u>Lead expert</u>	<u>e-mail</u>
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<i>COST Cooperating Country</i>		
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	Creative Technologies Israel.	Arie Lavie <i>arlavie@zahav.net.il</i> <hr/> CTI 49 Dagan Street Jerusalem 93856 ISRAEL Tel: +972 2 645 2086 Fax: +972 2 645 2489
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Korea	KARI (Korean Aerospace Research Institute)	Dr. Yung-Gyo <i>lyg@kari.re.kr</i> Lee <hr/> Airship Group Aviation System Department Aviation Division Korean Aerospace Research Institute Eoeun-Dong 45 Yusong-Gu, Daejeon, Korea Tel: +82 (42)860-2353 Fax +82 (42)850-2006
Canada	ALCATEL	Zlatko <i>zlatko.krstulich@alcatel.com</i> Krstlich <hr/> ALCATEL Research & Development Kanata Campus Kanata Ont. CANADA Tel:- +1 613 784-4690 Fax:- +1 613 784-4690
Russia	GEOSCAN	Vitaly <i>geoscan1@ttk.ru</i> Chmyrev <hr/> (postal address not available at time of printing)

Several other experts and organisations, not listed above, may also be considered as likely candidates for participation.

The following is a list of some other organisations or people with whom the Proposers and/or the above partners have been in contact or had recent dealings, and who are believed to be both likely and valuable candidates for involvement in this Action. However, they may not have signified their intentions directly to date as regards this Proposal.

<u>Country</u>	<u>Organisation</u>	<u>Lead expert</u>
(Europe)	ESA	
Finland	Helsinki University of Technology	
France	Alcatel-Espace	Nicolas Chuberre (Nicolas.Chuberre@space.alcatel.fr)
Germany	University of Stuttgart	Bernard Kroeplin
Italy	CERCOM	Fabio DAVIS
Greece	National Technical University of Athens / ICCS	Nikolaos Uzunoglu
	Aristotle University of Thessaloniki	Stelios Karapantazis
Switzerland	Contraves	
	EPFL	Jean-Philippe Thiran
UK	ATG	Roger Munk
	SkyLINC	Neil Daly

Others		
Canada	21 st Airships Inc.	Hokan Colting
USA	SkyTower	Stuart Hindle

The above list is by no means exhaustive, and the proposed Action would also be open to other potential partners as it evolves.

(Co-ordination of this Action will be undertaken by a competent body elected by the MC. A potential candidate has been identified as the York Electronics Centre (YEC) -a wholly owned commercial subsidiary of the University of York, UK. YEC also act as Co-ordinators for the FP6 CAPANINA programme, and have particular experience in dissemination within the HAP community).

c) Recent publications

The following is selected list of some publications concerning HAPs and HAP services.

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