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4 September 2006

Mr. Rémy DENOS
Scientific Officer, European Commission Research Directorate-General
Directorate H–Space and Transport, Aeronautics, 21 Rue du Champs de Mars
B-1050 Brussels

Dear Mr. Denos,

Subject: Revised USE HAAS WP4–D 9 Deliverable “D4, D7 and D8 regrouped and re-analyzed”

Attached please find the Revised D9 Deliverable report “D4, D7 and D8 regrouped and re-analyzed” of the WP4 work-package as required in the Technical Appendix of “USE HAAS” EC Contract No 516081 and including your comments of 24 August 2006.

The Analysis presented in this deliverable consists of:

WP 4.6

Objectives: Write a summary report on all the workshops and WG activities, endorsed by all the partners project, end-users and industry. ATG (or Zeppelin) will be helping and advising the Consortium

Description of work: Endorsed summary report of the past 16 months.

In practice the workshop 2 held on 7&8 June 2006 in RMA was the final event where D6 SRA–Strategic Research Agenda draft was also presented and discussed. Since ATG – Advanced Technology Group in UK did not participate in the USE HAAS activities, Dr. Bernd Straeter, the CEO of Zeppelin, advised very helpfully the USE HAAS Consortium and we would like to thank him for that. The presented D9 hereby includes the comments and recommendations presented by the participants in the 2 workshops and the Working Groups meetings and your comments presented to us on 24 August 2006.

I would appreciate your approval of the revised D9 including regroup of D4, D7 and D8.

With kind regards,

Prof. Dr. Arie Lavie
Project Coordinator



**FP6-2002-AERO-2 SSA Project - Contract No 516081
USE HAAS**

***WP4
Deliverable D9
Summary report of the WP 4***

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Abstract:

This report provides a summary and an analysis of activities organised within the USE HAAS framework of WP4 workpackage, **Consultation and Validation of a HAAS end-user and interested community**, i.e. of the two Workshops conducted during the project, the 1st Working Groups meeting and the Working Groups activities organized within the project. The workshops and the meetings were held at the Royal Military Academy of Belgium in Brussels. The analysis covers also the presentation in the second workshop of the USE HAAS SRA - Strategic Research Agenda draft, that was delivered as Deliverable D6, one of the most important deliverables of the USE HAAS study. The workshops, the working groups activities and D6 contributed to the creation of the High Altitude Aircraft and Airships sector and provided a policy prospective tool for the EC regarding the HAAS sector.



Document history

Date	Revision	Comment	Author / Editor	Affiliation
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30/08/06	v2	Draft version, for delivery to EC	P. Hendrick & C. Souris	RMA
3/09/06	final	Report for delivery to EC	A.Lavie	CTI

Final Document Approval (Deliverables only)

Date of approval	Revision	Role of approver	Approver	Affiliation
16/08/06	1	Editor (internal reviewer)	A. Lavie	CTI
3/09/06	2	On behalf of Scientific Board	A. Lavie	CTI

Important note

This Deliverable D9 is a collecting document of deliverables D4, D7 and D8 and supersedes them all.



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Introduction

This document intendeds to provide a quick view on the materials presented during the first and the second Workshops, and during the Working Groups meetings conducted in the USE HAAS SSA project, and to provide also an important analysis of the results obtained during these activities.

The first objective is to show a summary of each presentation given during these events, without adding any real critical comment.

The second objective is to present an analysis of these events, considering all the presentations and the subsequent comments and questions. Such analysis is also oriented towards the preparation of the important D6 deliverable of the SSA project, the HAAS SRA - Strategic Research Agenda, and towards the initiation to establish a framework of an organized HAAS sector.

In the Conclusions, some general comments and points-to-be-considered for the preparation of the SRA and setting up the HAAS sector are given or highlighted.

The Final Agendas of the 1st and the 2nd Workshops, and of the 1st Working Group Meeting are also given in the Appendices.

The lists of Participants and Contributors in these events, totaling more than 130 members, are also attached in the Appendices.



Summary of the WP4

Appendix A provides the summary of the 1st Workshop organized in July 2005 at the Royal Military Academy. This event was mainly intended to make the USE HAAS activities known to the largest possible number of interested people in the research community, potential stakeholders and prospective end-users, towards the launching of Working Groups meetings to involve important participants belonging to the prospective HAAS sector.

Appendix B gives a summary of the Working Groups work done after the 1st Workshop. The 1st Working Groups Meeting was organized in September 2005 at the Royal Military Academy. Five Working Groups were established in this meeting that intended to help the USE HAAS Consortium in getting as many comments as possible from potential stakeholders and prospective end-users, in order to obtain as largest as possible commitments from the HAAS sector in the preparation of the Strategic Research Agenda.

Appendix C gives the summary of the 2nd Workshop organized in May 2006 at the Royal Military Academy. In this workshop, which was the final event for the USE HAAS project activities, the 1st draft of the Strategic Research Agenda was presented to the HAAS sector, discussed, received comments from any participant in the workshop, and later comments by others through the USE HAAS web site. These comments, remarks and suggestions were used in producing the final version of the SRA and its technology roadmaps.

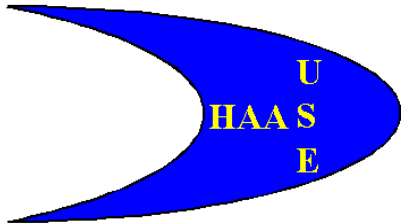


Conclusions and Recommendations

First, it can be concluded that the work done in the Work Package 4 of this USE HAAS Study, i.e. the works in the two Workshops and in the Working Groups, can be considered as highly successful when considering the large number of more than 130 participants and contributors, quality and variety of participants from the HAAS sector, who delivered a substantial number of inputs and guidelines to the USE HAAS Consortium, providing a feedback and acknowledgement to these events and activities. They helped a lot for the initial creation of the HAAS sector and for reviewing the three volumes of the Strategic Research Agenda (SRA) and the related Technology Roadmaps for the prospective R&D Needs for developing a HAAS platform and prospective launching of such platform for HAAS applications.

This presence of experts, of potential stakeholders from the industry and from authorities and potential end-users, has enlarged the accepted views and the credibility given to the USE HAAS Consortium and the documents and deliverables produced by the Consortium. These non-paid participants helped through the discussions and the comments received in structuring and writing the SRA but also provided a commitment to follow up in the future the implementation of the USE HAAS recommendations to be described in D10, the Executive Summary of the USE HAAS project. The accumulated list of participants during these events will also help in the creation of the HAAS sector, in addition to the information presented in the USE HAAS web site.

The main difficulty encountered throughout these meetings is certainly to maintain a HAAS group active when the largest number of its participants is not paid, since only the Consortium partners were financed. A real challenge was provided to have people involved, contributing beyond their working days for the success of the project. Some organizations have, from this point of view, to really be congratulated for their efforts and the man-hours they spent agreed to put in this task in the future.



The second difficulty is of course that the HAAS sector is not really an existing one. It is an emerging sector that still needs to be structured and to become more advanced, it is mandatory to invest in HAAS R&D and deploy HAAS platforms by end-users. The proposed applications are in fact generic ones and not yet existing, the market is still not yet defined. This has been an obstacle in getting people to be fully involved, but also in getting consensus on the various subjects discussed and considered while the HAAS SRA was prepared.



Appendix A

Deliverable D4

Summary of the 1st Workshop



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Introduction

This document is intended to have a quick view on the materials presented during the 1st Workshop of the USE HAAS SSA project and a first critical analysis of the results obtained during this Workshop.

In Chapter I, the purpose is to show a summary of each presentation given during the Workshop, without adding any real critical comment.

In Chapter II, the objective is to present an analysis of the whole workshop, considering the oral presentations and the subsequent comments and questions. This analysis is classified per Working Group as identified for the following work to do in preparation of the Strategic Research Agenda (SRA).

Finally, in the Conclusion, some general comments and points-to-be-considered for the following Working Groups and the SRA are highlighted.

The Final Agenda of the Workshop is attached as Appendix 1.

The List of Participants is also attached as Appendix 2.



Chapter I

First Workshop Summary

In this first chapter, one gives a one-page summary of each oral presentation given during the two days of the 1st Workshop. These presentations are normally all available under a pdf format on the website of the Consortium (www.usehaas.org).

This one-page summary is just intended to show the different points that were put forward by the different presenters and authors, without trying now to extract the highlights which are important for the work to be done by the Use HAAS Consortium in order to prepare the Strategic Research Agenda (SRA) for the future research in this field in Europe.

The second chapter will present those highlights for the Strategic Research Agenda to be prepared by the Consortium members.



Workshop objectives :

State of the art, Needs and Applications, Strategic Research Agenda

Prof. Dr. Arie Lavie – CTI - Project Coordinator

This presentation is a sort of monography on the subject. It presents what is happening in the different parts of the world, who are the main actors and what are the actual and prospective missions and applications.

The aim of the workshop is introduced: HAAS state-of-the-art, missions and preparation of a strategic agenda. Use HAAS is also introduced, with the partners of the Consortium. Focus is made on the following "description":

Vehicle: 20km altitude, stratospheric, either plane or airship (HAAS). Endurance: ideally, should be comparable to that of satellites.

Main objective is split into 5 sub-objectives: 1. Analyze the state-of-the-art, 2. To develop sensible research objective to outline future research programs, 3. To discuss among academics, industrials and EU & National/regional authorities (workshops and working groups). 4. To disseminate recommendations, 5. Issue a report (impact on regulations, recommendations, technological roadmap, general conclusions) and disseminate it.

The different research works under course are presented, the potential missions and applications are: Regional Earth Observations System, Communications, Crisis/Emergency Operations, monitoring, Security and Intelligence Missions, agricultural optimization/monitoring, intelligent transportation.... It needs a global market to develop.

What exists today? The Global observer (\Leftrightarrow Helios) with an endurance of 1 week. Goal: 6 month. 1 year, indefinite. Footprint = 600km.

The Sky Tower concept is also presented: compared to other systems, HAAS have (should have) low cost, high capacity, are rapidly deployable, etc. They have a larger footprint than towers and much higher capacity as well as lower latency than satellites.

A two step roadmap is outlined:

- 1) 1 week⁺ endurance (with H₂ lifting gas), regenerative fuel cells, stratospheric flight (airship or airplane)
- 2) 6 months⁺ endurance with (RFC) and improved accumulators, develop alternative propulsion (micro-wave beaming, etc.), develop multi use concept.

A winged airship schematics using microwave beaming is also presented.



The US High Altitude Airship Program

Ronald Browning
Lockheed Martin MS2 Akron

The US High Altitude Airship program is presented.

It is a military development with some hope for commercial applications. The HAA is one of the LM LTA products.

The missions could be : air and maritime surveillance (coastal patrol), boarder management, communication relay, ground reconnaissance and targeting.

Some characteristics of the prototype airship : speed of 22-25kts, payload of 500 lbs with a 3kw electricity supply for 30 days at 60 kft. The operational vehicle would be on station for more than 180 days at 65-70 kft with a payload of 2.000 lbs and 15 kW.

The HAA is compared for its size to other airships : the HAA prototype is 105.000 m³, L=131 m in Vectron-based fabric equipped with Li-Ion batteries. The USS AKRON was 184.000 m³ with L=239 m. The Zeppelin ZPG-3W only 41.500 m³ for a length of 123 m.

The motivators for this US study and application are :

- Near to mid term availability
- Relocatable / Recoverable
- Good sensor performance
- Multi mission capability
- High endurance and station keeping
- High survivability
- Large coverage with a few systems
- Low LCC

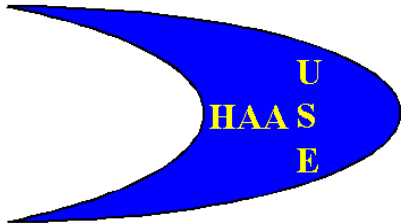
The final aim of this HAA is persistent observation/affordability (months/weeks vs. Hours/minutes) with a large footprint, a high survivability and enhanced sensor/mission performance.

The involved costs are mentioned (in \$/lb-month) : Space 1000-4000 ; UAV:300-1000 ; HAA 2-5 only.

For C4ISR military missions, a line-of-sight of up to 600 km is expected with low operating costs and long endurance. The optimal altitude for minimum wind speeds is between 60 and 70.000 ft.

The vehicle construction is proposed for the period 2005->2008. The DoD (in fact the Missile Defense Agency) has decided in June 05 to continue its support to the LM HAA effort.

Some technical challenging areas have been highlighted : fabrics, power systems, integration and flight test operations. The need to have a parallel technology development program is addressed.



A few answers to some questions during the discussion after the presentation are presented here :

What is the expected time schedule ? A prototype should be ready by 2008.

What is the filling gas used? He, for safety at TO.

What is the level of funding? 40 M\$ have been spend.

How long is the time limitation for the systems (rather than airship endurance) ?It is unclear at the moment.

What should be the acquisition costs for one system ? 10-100 M\$

What will be the problem solving methodology: separate qualification of key issues? No, tests will be done on the prototype.

What is the crew size to operate a HAA? The author does not remember.



The EADS/IAI HERON/EAGLE High Altitude UAV System

Dr. Drora Goshen – IAI Europe

High performance UAV are put on a "altitude vs. endurance vs. speed" space to compare their requirements/missions and performances. MALE (Medium Altitude Long Endurance), MALE+, tactical and HALE (High Altitude, Long Endurance UAV) are compared. MALE+ flies higher than MALE, but with a somewhat reduced endurance. The EAGLE 1 and 2 are presented. EAGLE 1, a MALE+ concept, is already operational LONG endurance ISR, Maritime Patrol, SIGINT and strategic long range vehicle. Vehicles are designed to be adaptive and accept modification (payload, airframe, etc.), they are payload oriented, while retaining good performance (range, endurance, clean aerodynamics). All vehicles use very similar hardware and are controlled/operated through the same Ground Segment. Operators can be trained in full scale simulators. Vehicles feature automated take off and landing. Navigation is based on GPS and DGPS. The system is reliable through computer-electro-mechanical redundancy and fail safe design (+built in auto test). All components are mature and off the shelf. Vehicles designed for convenient transport and payload space & access.

EAGLE 1 performance & characteristics are summarised here : max TO mass = 1.200kg. max payload mass > 250kg, max fuel < 400kg. 165HP. L9.3m, span 16.6m, height 2.3m alt=20kft+ (25kft max). Climb in <50min. Speed: cruise 80-110ktas, max 120ktas@max altitude. Mission time: 30 h. Loiter time: >12h@550NM. TO and landing distance: <1km.

EAGLE 2 performance & characteristics are summarised here : max TO mass = 3900kg. max payload mass > 450kg, max fuel 1750kg. 1200HP. L13.0m, span 26m, height 3.3m alt=41kft+ (>45kft max). Climb in <40min. Speed: cruise 180-200ktas, max 220ktas@45kft. Mission time: >24h. Loiter time: >16h@550NM. TO and landing distance: <1km.

A maximum endurance above 40h requires a special configuration.

Communication range: 20km UHF, 150km LOS, >1500km SATCOM.

Typical crew size: 20 +16(maintenance). Sufficient for continuous mission.

- What still lacks ?

Nothing vital. those vehicles will improve with time and available technology. Long endurance still lacks. Combination of high altitude and long endurance is yet harder to achieve (see eagle 1 and 2 performance).

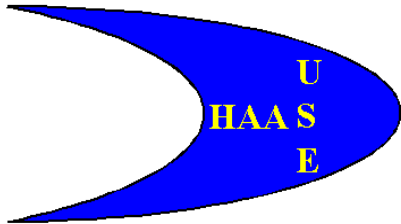
- Practical solutions to problems seem well studied and mastered for their objectives. For



long endurance/high altitude, specific solutions should be sought, leading to a deeply modified design.

- What is the practical use ?

Mainly military, but progressive improvement may very well lead to a widening of application through performance improvement and price decrease, possibly well within the civil range (earth observation, other proposed applications: military/intelligence).



The Japanese Stratospheric Platform Project

Masaaki Nakadate - JAXA & Aircraft Application Technology center

Great size tend to favour airship in large capacity. Key issues are manufacturing light and strong hull of very large size, controlling flight, buoyancy, managing thermal fluxes, and, managing energy supply to payload with the help of large lightweight solar panels and regenerative fuel cells. Japan has developed 2 flight test vehicles: SPF 1 & 2 (150m and 250m in length respectively), technology demonstrators. Development project spanned from 1998 to 2004 and both vehicles have flown. SPF 1 flew to 16.4km altitude and proved the ultra-light structure. It performed measurement and sampling of green house gases. Thermal management was also proven, then SPF1 was deflated and fell in the sea. SPF2 Has performed 8 flights, demonstrating full operation, from launch to land, (attitude, buoyancy & flight control, pressure control, thermal management, tracking, etc.). Solar cells were fitted on the hull with a 1kw reversible fuel cell to test electrical power system. Experimental missions were successful: earth and traffic observation, telecommunication and broadcasting.

- What still lacks ?

Technology is still maturing but yet mainly available. Practical solution come in time.

-What is the practical use ?

Airship can performs as pseudo satellites once they can be kept on station for long periods.

- What are the proposed applications ?

Earth observation , traffic observation, telecommunication, broadcasting

- Airship vs. Airplane ?

It is shown that big sizes favour airship.



The USA AeroVironment Helios, Path-Finder,

Global Observer Stratospheric UAV's

Yuichiro Nishi, Sky Tower, Japan

SkyTower Inc. is a company that has been established as a separate company to market HAP communications activities. SkyTower's business strategy is based on using AeroVironment's solar-powered aircraft based platforms, such as Helios (Figure 1) and Pathfinder (Figure 2), with the aim of delivering a range of applications such as:

- Fixed Broadband
- 3G-Mobile
- Narrowband
- Direct Broadcast
- Event servicing.

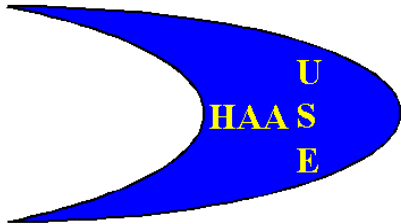
The strong point in their activities is that they are based on AeroVironment which is a subsidiary company of NASA whose objective is to exploit and commercialise NASA technology. They have specific interests in High Altitude Solar Electric UAV's and are currently developing the technology to provide around the clock solar powered flight, based on a combination of solar powered arrays and regenerative fuel cells. They have a full size fuel cell and electrolyser storage system for such an UAV operating in their test facilities. The craft themselves are aimed at telecommunications, remote sensing and atmospheric measurement.

Sky Tower has been pursuing market opportunities on a worldwide basis, specifically targeting developing countries, where there is an absence of infrastructure. In July 2002, they were jointly responsible for providing the successful tests of various communications for the Japanese project.



Figure 1 – The HELIOS High Altitude UAV

AeroVironment/SkyTower have detailed business models with excellent technical capabilities and proven to launch such missions and their on-going research programmes into energy storage could prove critical in the development of HAPs. The Helios mishap in July 03 has slowed down their marketing of this technology. The fuel cell critical to round the clock deployments was being tested when Helios crashed. Helios, Pathfinder and Pathfinder Plus are experimental vehicles, so AeroVironment/SkyTower could dependent on NASA proceeding with their development plans. The Pathfinder Plus is currently being upgraded and will be operational within the next few months, which will allow further testing of the technology, leading to mass market production. Also this delay has also allowed them to revise the business models towards shorter-range missions such as event servicing and disaster relief communications, which are less reliant on solar-powered flight and advanced energy storage, and as such providing a less risky initial exploitation path. It is expected that NASA's next generation of planes will further enhance opportunities.



NASA Dryden Flight Research Center Photo Collection
<http://www.dfrc.nasa.gov/gallery/photo/index.html>
NASA Photo: ED02-0161-2 Date: June 24, 2002 Photo by: Nick Galante

Pathfinder-Plus flight in Hawaii

Figure 2 – The Pathfinder High Altitude UAV



HALE Aerostatic platforms, Application, Maturity & Research Demand

Dr. Ingolf Schäfer - CEO LTA Technologie AG & Lindstrand Technologies

The project described is the result of internal funding, ESA funding, EU funding and contributions from customer projects. For long endurance missions at high altitude, only the unmanned option is practical. The aerostatic choice is based on physical arguments. Qualities of airships are endurance, payload capability, safety, however, their downfall is the wind sensitivity and the absence of infrastructures. They can also reach high altitudes, which increases their "footprint" (for a vehicle at 20km, the footprint width is 50km@40° and 110km@20°). Cruise speed is estimated at about 15m/s (approx. 1300km/day). The impact of altitude on airspeed requirement to maintain station keeping is studied. Power consumption for the payloads is also studied (1-10W/kg, remote sensing -> communication) as well as required mass. Maturity and technology availability is not clear. Identified critical technologies are thermal balancing, static lift control, energy systems (interest in fuel cells), hull/envelope/fin design and construction. Aerodynamics and flight mechanics modeling are also quoted as key technologies. Solar cells are evaluated with fuel cells as means of providing continuous power to systems and station keeping engines.

- What is still lacking ?

Probably mainly a strong initial funding and a clear market perspective although scientific interest is present. Some systems need maturing (energy storage, solar cells, overall technological challenge).

- What are the practical solution to the problems ?

Airship in itself answers many problems linked to very long endurance application. Energy source for payload and station keeping is from solar panels on the airship.

-What is the practical use ?

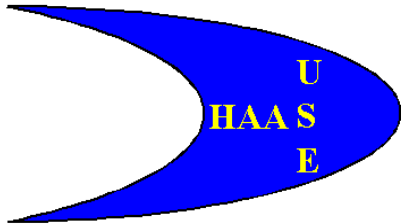
Mainly scientific and civilian (services), but also military. It is claimed to have long endurance, high reliability and to be rapid to deploy.

-Proposed applications are:

Communications (mobile phones, networks, digital broadcast), remote sensing/ observation, science, defence.

-Airship vs. Airplane:

It is shown that big sizes and long endurance favour airships.



The EU FP5 UAVNET program

D. Penn - Israel Aircraft Industries Ltd.

UAVNET was established under FP5. It is a thematic network with a "VISION". Its aim is to interconnect industry, universities, research institutes and potential users, to allow information to be exchanged and to coordinate activities and projects. UAVNET works at bringing the UAV's back in the interest of the EU (while USA massively invests) and defines critical technologies for the following areas. Two main project under course USICO (Improving Operational Capability & Safety of UAV's) & CAPECON (Definition of Civil UAV Configurations for UAV Applications, 5.14M€, 50%EU funding, IAI coordinates, 36months). Achievement are to date mainly theoretical and studies, including recommendations. Although use of UAV's is to date mainly military, UAVNET foresees a cost decrease and applications in the civilian field. This requires starting to attract potential users requiring public fund help.

-Proposed applications/services/missions:

communications (mobile phones, networks, digital broadcast), remote sensing/observation, science (meteorological, geologic), emergency/disaster management service (observation, monitoring, communication), communication (broadcasting, relay, etc.), surveillance/monitoring (border/maritime patrol, forest fire, powerlines, traffic), GPS/Galileo augmentation

-typical payloads considered:

EO/ IR camera, EO/ IR scanner, SAR (Synthetic Aperture Radar), MTI (Moving Target Indicator) Atmospheric sensors



HeliPlat and Capecon-Shampo Solar Powered Platform Projects

Giulio Romeo, Politecnico Torino

Professor G. Romeo presented his recently completed HAP project in HeliNet (IST-1999-11214), which ran between January 2000 and March 2003 under funding from the European FP5 programme. The project examined aeronautical issues and three prototype applications: broadband telecommunications; environmental monitoring; and vehicle localisation. A scale size prototype stratospheric aircraft, 'Heliplat', was designed as illustrated hereunder in Figure 3.

Politecnico di Torino played the role of the overall coordinator with the University of York that undertook the majority of the work in the broadband application. Other members of the consortium were CASA (Spain), Enigma Technology (UK), Carlo Gavazzi Space (Italy), Fastcom (Switzerland) and Ecole Polytechnique Federale de Lausanne (Switzerland).

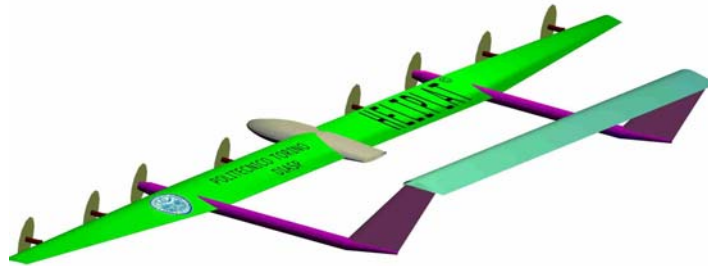


Figure 3 – The HELIPLAT HALE design

Some elements of the structure were also build and a wing statically and dynamically tested in Italy.

His work on HALE UAV's has been continued in the frame of the EU CAMPANINA project with the evolution of the Heliplat prototype called Shampo.



USE HAAS Research Agenda – Round Table introduction

Dr. Herbert Fox - Chief Scientist, CTI, Israel

M. Fox asks again the fundamental questions, trading between missions and technologies: altitude, endurance. Research issues are mainly in propulsion. Different concepts are presented showing challenging integration problems (fuel cell-structures, engine/airframe/lifting surfaces). Thin layer type of photovoltaic cells (15 μ m) offer best available power to weight. Photovoltaic cell issues: weight/P, efficiency, integration. For long endurance, it is required to make power available even when solar power is down. Fuel cells are presented as a solution, their main issues are: efficiency, weight of stack and electrolyser (tank for airplane??). Experimental data (on performance?) is also an issue. The air breathing propulsion with hydrogen as fuel is also shortly analysed. Issues are: engine availability, oxygen/air availability at altitude, need of available super-turbochargers, balance of plant, volume limitations. Hydrogen is a superior fuel in terms of specific energy and airships may carry it anyway. Do any engines exist for those altitude, jet engines? Are there alternate propulsion means? For example, power beaming, would that compromise the platform as an observation platform? Last but not least, practical issues: reliability, life, maintenance, crew, operability, logistics, etc.

This presentation does not really bring answers, but mainly poses the questions, some of which are quite sensible. The potential vehicles are only sketched and many options are open.



European and Global works in HAAS and Telecom applications

Tim Tozer – University of York

After a brief overview of the different platforms, it is highlighted that not only endurance but also reliability is an issue as, of course, the large payload requirement for an aircraft or airship.

New telecom services can be provided thanks to HAPS :

- Services to deprived or difficult areas
- Rapid and flexible deployment
- Low cost

HAPS could be an alternative to satellite communications.

HAPS advantages compared with terrestrial services are :

- Better propagation in many cases
- Rapid deployment
- Replace heavy ground-based infrastructure
- Large system capacity

Advantages compared with satellites :

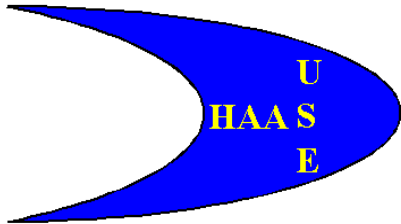
- Close range (low delay, high power budget)
- Lower cost
- Rapid deployment
- Larger overall capacity
- Incremental system deployment
- Environmentally friendly

The Japanese HAP program is explained as well as the Korean effort, the NASA works, the Aerovironment & SkyTower plans and the US DoD projects. The ATG, Sanswire, Lindstrand, University of Stuttgart, Zeppelin, Techsphere and other small company airship projects are also outlined. Manned aircraft HAP efforts are also on-going.

Finally, the Comms achievements of the Campanina project are explained : system design and definition, regulatory issues, link design, payload design, protocols, network configuration, etc.

Some issues are listed :

- For the platforms (patchy progress generally limited by investment ; Power storage as for most craft endurance is the requirement Large high-altitude airship yet to be funded and proven - may present unforeseen technical challenges? ; For applications, need to demonstrate endurance, reliability, station-keeping & attitude



stability, economic operation & through-life costing- For the comms applications : the benefits and applications need to be studied extensively, only a few concepts proven - incl. Trials with Skytower and with CAPANINA, needs detailed results in key areasmajor commercial developments await reliable & long endurance platforms, more practical trials needed to convince service providers (with the intermediate technology available now, e.g. tethered aerostats, manned airplanes); among the comms technical challenges: antenna technology, spectrum management and the regulatory issues (e.g. <48GHz for HAPS in Europe).

The benefits of HAPS is certainly not in doubt, especially for telecommunication applications.



Wireless system using high altitude platform R&D in Japan

Ryu Miura - NICT

It is explained that compared with satellites, the path loss with HAA is much lower (about 60 dB) as well as the path length leading to a much higher resolution (about 10 times).

For communications, satellites and HAA are in fact complimentary : Satellites for global services and HAA for high density regional services.

A wireless system concept based on HAA at 20 km is explained. This system could rely on Airships or/and on HALE UAV like an improved Global Observer.

Potential applications are :

- Fixed broadband access (wireless wide area network)
- Cellular phone systems
- Digital broadcasting
- Radiolocation
- High resolution and round-the-clock observation

Some trials are also explained : based on the Pathfinder Plus (IMT-2000 phone connection, digital TV broadcasting) with a first trial in July 2002 in Hawaii, multibeam antenna prototypes onboard helicopter, telecom flight test using a low altitude airship in November 2004 (digital broadcasting trials and radiolocation trials from a h = 4.000 m as well as optical link trials).

A short note is also given on the ITU spectrum identification works (31/28 GHz band for HAPS).

Future plans for NICT are given : smart antennas onboard a platform, large aperture array sensor, use of low altitude airship and/or UAV's for disaster relieves.



HAAS for improving risk management

Marc Acheroy – RMA

Earth-observing remote sensing systems can be powerful tools for observing :

- Economic activities
- Security activities (change detection – boundary enforcement, etc)
- Environment protection
- Disaster mitigation (rapid all-weather flood assessment – rapid earthquake damage assessment)
- Humanitarian operations

But their revisit time can be quite long (e.g. 15 days for the ERS2 for the Isabel hurricane).

Remote sensors characteristics are listed :

Application	Geology, soil	Volcanism	Soil monitoring	Atmosphere and risk	Atmosphere and risk	Risk management	Security
	Mineral composition	SO ₂ degassing	Organic matter	Gases molecules,	Aerosols Volcanic	Oil spills	Target identification
Spatial requirement							
GSD/spatial resolution	10-20 m	1-5 km	2-5 m	1-5 km	1-5 km	5-100m	0.5-5.0 m
Swath	1-10 km	100-200 km	1-10 km	50-150 km	100-500	30-300 km	0.5-5 km
Spectral requirement							
Spectral range	7.6-14 μm	2-4 μm, 11-12 μm	3-5 μm, 8-14 μm	3-14 μm	3-5 μm, 8-14 μm	2.5-14.0 μm	2.4-7.6 μm &
Numbers of	30-50	12-20	20-30	30-60	20-40	10-15	130-240
Spectral resolution	100-300 nm	100-300 nm	50-200 nm	20-100 nm	30-100 nm	100-300	20-40 nm
Radiometric requirement							
Radiometric resolution	0.05-0.1 K	0.05-0.2 K	0.05-0.1 K	0.05-0.1 K	0.1-0.3 K	0.05-0.01	>0.1 K
SNR	400-1000	600-800	400-1000	600-800	400-800	400-1000	500-2500
Temporal requirement							
Revisit period	Lava: 1-2 days Soils/geolog	15 min-2 hours	1-3 days	1.5-12.0 hours	Volcanic ash: 15-30 min	1.5-12 hours	1.5-24 hours

Table 1 – A summary of remote sensor characteristics



As well as the sensors needs and the system requirements (revisit time, resolution, etc.) in function of the application together with existing satellites characteristics.

- Spatial resolution: A spatial resolution range of 3 to 100m is needed.
- Revisit time: From hours to many days. But many items need to be observed one or twice a day.
- Multi-spectral band: Multi-spectral band with high spectral resolution is needed.
- All weather and all time observation: Microwave and infrared remote sensing are very useful.
- Large-scale: Wide swath is needed for most applications.
- Data storage capability: To get the image out of receiving area of ground stations.

A first but rather detailed comparison between satellites and HAAS is given :

Optical sensors	Satellites	HAAS
Revisit time	1-26 days	Continuous
Sensor system weight for a given	High	Low
Optical system quality For a given resolution	High (smaller IFOV)	Lower (larger IFOV)
Power requirements	Low power is required	Low power is required but
Possible navload	High	Limited (blims volume)
Stabilization	Low (stabilization on trajectory)	Motion compensation is mandatory (effect of wind)
Image cost	High (especially when priority is needed)	Low
Image availability	Difficult	Immediat
Flexibility	Very low	High
Possibility to recover the instruments	NO	YES
Possibility to adapt and/or enhance the instruments	NO	YES
Life time	Typically 5 years	Can be very long
Dedicate to specific application	Low	High
Earth coverage	Global	Local

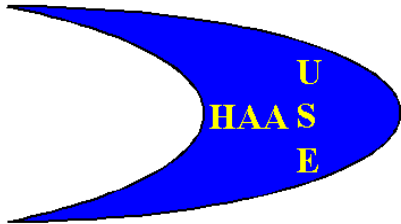
Table 2 – Comparison between satellites and HAAS systems



HAAS platforms and technology is certainly a good alternative to satellites with very clear advantages or characteristics :

- Revisit time and availability of data are drawbacks of current satellites
- Flexibility of HAAS (adapted sensors – evolution is possible)
- Relative low-cost
- Local coverage makes HAAS complementary to satellites (global earth coverage)
- Re-usability of HAAS sensors (sensor life-time is not linked to a satellite life-time)
- HAAS vs. limited satellite constellation (CNSA)
- All-weather capability (a key-issue in crisis management)

Standardization initiatives (data and metadata) are necessary if combined use of satellites and HAAS is envisaged (INSPIRE initiative by EC).



HAAS applications in integrated forest fire management

David Caballero – TYPESA Group

Objective : protect human lives, properties and the environment with a given budget.

Action must take place before, during and after the fire.

With spatial information systems, the problem is challenging from a spatial point of view but also from a time scale point of view.

Advantages of HAAS systems for forest fire management are :

- lower cost than space systems (but higher than airplanes)
- operations in day- and night time
- permanent overlook of a local zone
- permanent visible and IR feedback
- permanent system for communications and positioning

Some applications are explained :

- prevention planning and preparedness
- emergency management (advanced command post)
- post fire recovery management

A few recommendations are also given :

- cost should be shared (among different administrations, users, services)
- integrated information architecture needed
- to be coupled with ad-hoc information networks and in-ground sensors in inter-operable environments
- specific sensors should be developed for FF management



Remote sensing applications to monitor active volcanoes

Maria Fabrizia Buongiorno – Italian Institute of Geophysics and Vulcanology

The geohazards in Europe are introduced. The high density population poses in Europe particular problems and, in Italy, the volcanic activity is of course the matter of all attentions. Italian scientists have acquired a large experience on different volcano dangers over the years : lava flows, ash clouds, tsunamis, gas emissions, land slides, ... A permanent network of surveillance is existing on the Italian ground and islands.

This network is using ground based camera's but also spaceborne sensors (ground resolution between 15 m and 90 m, revisiting cycle 16-3 days for spectral and thermal analysis, ground resolution between 300 m and 4 km, revisiting cycle between 15 minutes to hours for plumes and clouds analysis) and airborne sensors (ground resolution between 20 m and 3 m depending on the flight elevation). For ground deformation analysis, satellites like Envisat or Radarsat are used with revisiting time of 20 days.

The objectives of the network are :

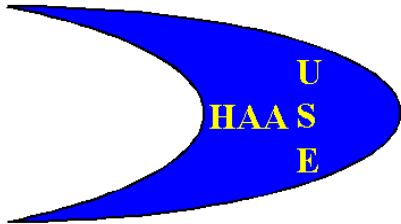
- to develop algorithms to retrieve volcanic materials properties
- to develop algorithms to analyse the surface thermal characteristics
- to develop algorithms to determine volcanic plumes parameters
- to analyse the ground deformation (e.g. with SAR interferometry)

A monitoring project based on UAV's has been started together with the University of Bologna (the project using one of their small UAV or RPV, the Butterfly) and Polytechnico di Torino. The following payloads are available onboard: V1 visible camera (for UAV flight control), V2 visible camera for monitoring, V3 thermal camera, a SO₂ sensor, a magnetometer, a micro-FTIR, an ash filter. The first flight has been made in October 2004.

Request are listed for monitoring active volcanoes :

- Accuracy of the retrieved parameters(temperature, gas concentration, deformation velocity...ecc.)
- Systematic acquisition with a suitable observation frequency for different activity level (quiescence, crisis, post crisis).
- Image sensors need to furnish suitable spatial resolution in order to give to the end users operative informations.
- Combine remote sensing retrieved parameters with ground based measurement in order to construct more accurate prevision models

These requirements could be met by the combination of spaceborne systems and High Altitude UAV equipped with the appropriate payloads whereas low altitude UAV could be used during crisis to monitor lava flow or measure gas and ash with no risks for operators. A high altitude platform could also help in improving the telecom links for data transfer.



HAAS needs regarding the EU PASR program

Dr. Helmut Süß - DLR

This presentation deals with the optimization of remote sensing methods and systems for security and surveillance applications using HAAS.

Different platforms are available for remote sensing (airplanes, satellites and HAAS) and they all differ from the operating standpoint (operating altitude, time to first image, revisit time, speed...). None of them can be used in any circumstances: satellites, for example, represent the only platform allowing global observation, and HAAS are the optimal platforms for surveillance purposes and allow highly flexible mission profile for many potential users.

Different types of sensors with different bands of the spectrum are used for data acquisition (visual sensors, IR sensors and Multi-/Hyperspectral sensors and Synthetic Aperture Radar (SAR)). Depending on the type of application, one sensor or another will be used:

- Visual sensors achieve good resolution and the images they give are very easy to interpret, but they require daylight or artificial illumination.
- IR sensors are passive systems (i.e. no illumination is needed) and can be used in any weather conditions (during night and light fog/smoke).
- SARs require platform motion, are weather and time independent, are active systems (provide their own illumination) and their resolution is independent of distance sensor-target.

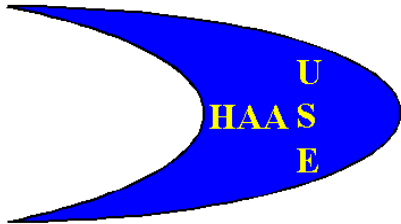
A multi-sensor combination on one of the platforms mentioned here above is thus needed in function of the type of application, the dimension of the area to be covered, the observation frequency and the covered area.

Examples of applications are: fire detection, observation of floodings, traffic monitoring...

For security applications, airships should be equipped with several sensors to guarantee efficient 24 hour operation, they need reliable positioning system for exact geolocation, they need to be designed for stationary or moving operation, and they also need a short positioning time.

Airplanes are not usable for long term observation and satellites are not usable for permanent observation (orbit, revisit time).

HAAS can overcome these drawbacks and allow stationary positioning for permanent long term observation; they can substitute expensive satellite systems for many applications and can optimize applications compared to use of satellites or airplanes.



HAAS can be interesting for many end-users as police, traffic information providers, organizers of mass events, transport and logistic companies, civil protection authorities, fire brigades...



Pegasus : Improving remote sensing capability with a HALE-UAV

Jurgen Everaerts - VITO

PEGASUS is a solar HALE UAV and is presented as a low cost, high precision remote sensing solution. It is a local geostationary s(tr)atellite allowing:

- Permanent availability if solar powered
- Flexibility if at high altitude (not confined to an orbit, not hindered by increasing air traffic, in stable environment).
- Carrying a high resolution remote sensing payload (still very much closer to the earth than satellites, modest downlink power requirements)
- Direct downlink (SATCOM only from ground reception station, data processing centralized at PAF).

Compared to airborne and spaceborne systems, it improves RS capability (see the table in the presentation).

It can be equipped with innovative instruments as Multispectral Digital camera, Laser Altimeter (LIDAR), Synthetic Aperture Radar (SAR) or Thermal Digital Camera to provide data acquisition for different types of applications.

Examples of applications for aerial images are photogrammetric mapping, change detection (damages from natural disasters, mobility), security and classification (crop forecast, ground pollution and sanitation). Applications for elevation models are inundations, coastal zone management, city models, sound propagation, 3D information for images, biomass estimation.

It is intended to be used in three strategies:

1. Baseline program (area coverage, 150000 km² per 8 months flying season, base mapping or imaging).
2. Specific application programs (E.g. agriculture monitoring, revisit time ~2 weeks).
3. Crisis situations (fly to the area in hours, revisit time: hours, even minutes).

Test and demo flights intended to prove airworthiness and integration ability in the airspace as well as to demonstrate the RS concept are expected for 2006.

Operational service is expected from 2007 (main focus on Flanders, Definite interest from other European partners).



HAAS Remote Sensing Applications

Dr. Christian Barbier - CSL

The CSL acts as adviser for space applications to

- Analyze and investigate existing space systems for early warning and alarming applications in risk management, telecom and security services.
- Analyze their possible replacement by or in combination with HAAS
- Identify potential HAAS users.

Three users requests are identified for evaluating RS systems:

1. spatial resolution → determined by altitude and beamwidth (optical sensors) → larger when altitude higher
2. Coverage/revisit time → coverage is determined by beam footprint, thus larger when altitude is higher; revisit time is determined by orbit repetitivity.
3. Weather independence / 24h service → weather independence is determined by atmospheric transparence (no clouds (VIS/NIR) or radar); continuous service is determined by, e.g., platform endurance and sensor reliance (VIS/NIR) or independence (radars) on sunlight.

Different types of platforms can be used and have different characteristics:

Satellites are very stable platforms, allow global coverage, have typical revisit time of a few days (which is far too long for quick reaction and frequent information update) and cloud cover adds further inefficiency for optical payloads.

Low-altitude aircrafts are subject to atmospheric turbulences, allow only local observations, allow quick reaction and frequent information update, have better spatial resolution, but are limited by traffic constraints, expensive to operate and have a limited endurance.

HAAS can be seen as a missing link between satellites and aircraft because:

- They fly at high altitude but still much lower than satellites, their type of observation is local in nature and the spatial resolution is better.
- Solar-powered HAAS can stay aloft for very long periods, thus enabling continuous monitoring of the region of interest.

Potential HAAS applications are **Generic applications** (coastal erosion, desertification, 3D city modeling, urban mapping, agricultural monitoring), **Dedicated applications** (pipeline monitoring, oil spills, forest fire detection, flooding, humanitarian aid) and **Disaster management and monitoring** (potential missions are fire, hurricane tracking, tornado earthquake, volcanic eruption plume sampling, terrorist or military disaster, loss of communications).

Different projects exist for fire monitoring:

The ERAST FIRE Pilot Project which intends to:



- Integrate a thermal imaging payload and telemetry equipment on a high performance UAV.
- Operate the payload remotely from a ground station.
- Telemeter payload data from the UAV to a communications satellite and over the horizon (OTH) to a computer server.
- Provide automated geo-rectification of the data.
- Globally disseminate the collected data to the Internet and disaster managers.

The FLAMES project has been proposed by CTI to examine the use of HAAS as a stratospheric platform integrated in a multi-sensor permanent surveillance network. It intends to improve forest fire risk assessment and to better understand the processes leading to fire eruption.

Different relevant HAAS are considered to be used for Fire Monitoring, as the **Heron UAV** (which can fly up to 10 km for more than 52 hours with a payload of 250 kg), the stratospheric **Helios UAV** (which can fly for 17 hours at 20 km with a payload of 35 kg), the **Stratsat geostationary airship** (which will be tested in 2006 at 20 km altitude and with a payload of 1000 kg) and the Man-piloted **Skycat and Zeppelin-NT** (which have available altitudes of 6000 and 3000 m respectively and with payloads of more than 1000 kg).

HAAS fill a niche between spaceborne and airborne RS platforms. They are complementary to satellites due to their potentially higher resolution, shorter revisit time and lower cost → ideal for disaster management and monitoring. They offer test-bench for demonstration activities.



EU security research and potential UAV application

For security related missions

K. Liem – European Commission Enterprise

The European research effort on research remains too fragmented, too compartmentalized and insufficiently connected to international cooperation.

There are 4 specific programs corresponding to 4 major objectives of European research policy:

1. Cooperation (support from collaborative projects and networks to the coordination of research programs)
2. Ideas (creation of an autonomous European Research Council to support investigator-driven “frontier research” in all scientific and technological fields)
3. People (activities supporting training and career development of researchers)
4. Capacities (support for key aspects of European research and innovation capacities)

The EU has determined 9 themes where research must be supported and strengthened to address European social, economic, environmental and industrial challenges. Communication, Aeronautics and security are among the most important.

Security research is very important in order to:

- Achieve a high level of security within the EU wide area of Justice, freedom and Security
- Contribute to develop technologies and capabilities in supporting other EU policies
- Contribute, through technology and innovation, to reinforcing the competitiveness of European security industry
- Exploit synergies and dualities between civil / security / defence sectors and between public / private research sectors
- Coordinate efforts and reduce fragmentation and duplication
- Stimulate investment in technology and contribute to Lisbon objective

The **GoP (Group of Personalities)** is an EC initiative with 27 Personalities which has the following major recommendations: coordinate national, intergovernmental and community RTD efforts, bridge the gap between civil, defense and security research, establish a security Research Advisory Board, launch a European Security Research Program while respecting individual rights, democratic values, ethic and liberties.

Different information about PASR 2004 – 2006 are given in the presentation (see transparencies 8 to10).

The General principles for Security Research are that the research activities must:



- Be mission-oriented to develop technologies necessary to meet capability requirements
- Complement and integrate technology and system-oriented research carried out in other theme
- Be flexible enough to accommodate future security threats and policy requirements
- Lead to cooperation between industry and public authorities
- Take into account individual rights, public liberties and democratic values.

The 4 main missions of security research are:

1. protection against terrorism and crime
2. security of infrastructures and utilities
3. border security
4. restoring security in case of crisis

The 3 cross-cutting areas are:

1. Security Systems Integration & Interoperability
2. Security and Society
3. Security Research Coordination & Structuring

Commission funding for UAV:

- Civil use of UAV
- 20 M€ has been invested under FP5 and 6 for different projects as UAVnet, USICO, CAPECON, HELIPLAT, AIRSCAN, USE-HAAS, FAST-WING, IFATS.

Arguments for future Community UAV Activities:

- Civil use of UAV-technologies / non-military application of UAV
- Civil UAV relevant technologies can be a driver innovation for future large aircraft, a Pan-European cohesion force, bringing together academia research institutes industries.
- UAV application in non-military public procurement, particularly Security missions.



High Altitude Systems

M. Bobbio Palavacini – Carlo Gavazzi Space

The presentation starts with an overview of the Carlo Gavazzi Space S.p.A (locations, staff, financial facts and figures, main customers and membership...).

The business mission is to provide solutions to lower the cost of first class science and application projects in the field of:

- The exploitation of small and medium size satellite missions
- The exploitation of new orbital and transportation systems
- Turning technologies into products for scientific and application projects
- Developing new technologies for earth observation services
- Realizing reliable systems for ground segment applications
- Developing feasible and cheap solution targeted to HIGH ALTITUDE PLATFORMS & SYSTEMS

An overview of the High Altitude Platforms & Systems is then given with among other:

- HELINET (2000-2003)
- CAPECON (2002-2005)
- UAV stratospheric Carrier (2004)
- EPS Systems for Stratospheric platforms (2002-2006)
- COVACH (2006-2008)
- **CAPANINA (allows broadband communications using balloon flight at high altitude)**
- GMESH? (2006-2008)

Then a detailed description of the CAPANINA scenario and test campaign is given (Trial 1, 2 and 3) (see transparencies for more details).



Aerospace technologies in the security context

Manuel Mulero - INTA

The objectives of the European Security program are:

- The investigations on safety as support to the European politics
- To contribute to the general growth and competitiveness

The “life cycle” of an incident is characterized by different steps:

Identify / Notify / Protect / Prepare / Answer / Recuperate

The missions are essentially:

- The protection against terrorism and criminality
- Security of the infrastructures
- Security of the borders
- Recovery of security in case of crisis
- The integration and operation on safety systems

The aerospace technologies used concern:

1. communications (satellite & on board of an airship)
2. observation (from satellite / from aeronautical platforms (manned and unmanned))
3. humanitarian missions (transport of help material and personnel / rescue)

For the protection against terrorism and crime:

Intelligence: notify and identify using

- AWACS airplanes (communications, movement on surface)
- UAVs
- Airplanes and helicopters patrol (detection, follow, identification)
- Observation satellites

Detection: prevent, prepare

For the security of infrastructures and complex:

Observation: protection with:

- Airplanes and UAVs (proximity vigilance, following incidents)
- Satellites (big areas, evolution of the incidents, communication relay)

For the security of the borders:

Observation: identification, prevention, protection with:

- Airplanes, helicopters and UAVs equipped with observation sensors
- Satellites

For the Recovery of security in case of crisis:

Communications: recuperation (with satellites, airplanes, UAVs)



Humanitarian: airplanes and helicopters (rescue, evacuation, medical assistance)

But there are some limitations to these applications:

1. Communication: limited capacity of the traffic volume, coverage and useful time; land stations vulnerable
2. Detection and observation: limited by the meteorology (to achieve flight missions and for the sensor efficiency – i.e. optical and infrared sensors are ineffective with cloud coverage, in these condition, only SAR can be used)
3. Other factors: integration of UAVs in the general airspace is not resolved yet, scanty level of system operability (civilian-military, interdepartmental, international)



Chapter II

Workshop analysis for the Working Groups

This analysis is presented per subject as they have been identified and classified for the follow-up Working Groups intended for the preparatory work on the establishment on the SRA.

It has been decided by the Use HAAS Consortium to organise five Working Groups on the following subjects : High Altitude Airships, High Altitude UAV's, Applications in Telecommunications, Applications in Security and Applications in Remote Sensing.

The following highlights or critical questions have been identified per subject.

1. High Altitude Airships

There is a quite large US effort running at the moment, which is military oriented (funded by the US MDA) but with (mainly) homeland security applications like boarder control.

The following challenges / points of discussion can only be identified :

- Selection of the flight altitude
- Problem of the wind conditions (design for the maximum forces ?)
- Size /shape
- Identification of the Missions / Applications / Market / Capabilities
- Is the required endurance the key factor for the market
- Payload / sensors
- Type of structure (mass) / filling gas / power source
- Any possibility of refueling during the mission ?
- Environmental protections – e.g. against lightening

A good example of power requirements for the payload are the ones mentioned for the US programme : for the airship prototype : a payload of 500 lbs with a 3kW electricity supply for 30 days at 60 kft / For the operational vehicle on station for more than 180 days at 65-70 kft, a payload of 2.000 lbs and 15 kW of required power.

2. High Altitude UAV's

No real HALE UAV is available at the moment, even if the solar-powered Helios prototype has flown a few times before his fatal crash two years ago. The first one to be tested will be the Aerovironment hydrogen-fueled Global Observer (7 days @ 65 kft). Other designs have been also proposed, like the Heliplat or the Shampo projects of Politecnico de Torino.



There is a more reasonable UAV, approaching a kind of HALE/MALE requirement which is the IAI Eagle 1 and Eagle 2 with a maximum endurance of 40 hours @ 40-45 kft.

The real challenges are the almost mandatory combination of photovoltaic arrays and fuel cells with a question arising for the fuel storage of the fuel cell : regeneration of the produced water into hydrogen during the day flight or not and with which mass for the reversable electro-chemical system. Is there a short term solution and a longer term one ? Other questions are : the ATC open sky integration, the advantages of excellent station-keeping vs. Airships, advantage of being, practically more limited in payload than airships.

3. Applications in telecommunications

The following points have been highlighted during the Workshop :

- Short term = communications for emergency & remote sensing only ?
- Longer term = competition against classical communication systems ?
- Challenge is the platform (Availability ? When ? On station ? Endurance ?)
- HAPS advantages vs. terrestrial systems & satellites are surely :
 - the rapid deployment
 - the low cost (to be proven at a global integrated level)
 - the better quality propagation
- The radio-communication regulations needs to be well established and fixed
- The integration into existing or future networks
- We need a good market analysis & a business plan !

4. Applications in security

Security is a new topic and a emerging priority for the world but, perhaps mainly, for Europe. It is related somewhere to Defence and to police operations with some not-always-clear overlap. It is certainly a field with a high synergy/duality needed between civil, security and defense.

The research for this type of use of HALE Airships and UAV's must be mission oriented & system oriented with a clear identification of the future security needs & threads.

The four main missions of security research have been listed :

- Protection against terrorism and crime
- Security of infrastructures and utilities
- Border security
- Restoring security in case of crisis.

The mission could be oriented to either intelligence or detection or observation.

5. Applications in remote sensing



HAPS could be the missing link between satellites and aircraft with an all weather capacity, a short revisit time and a high resolution.

A lot of applications and sensors could be imagined. One of them being disaster management and monitoring with an almost immediate use.

An exhaustive comparison of remote sensors has been given during the presentations.

The listed problems are : the integration into the airspace, the costs (they could be shared between different applications and/or users, the coupling with other networks.



Conclusions and Recommendations

As underlined in the Introduction, this summary and this analysis of the 1st Workshop is intended to help starting the brainstorming per Working Group, as they have been identified for the follow-up work to do in preparation of the Strategic Research Agenda (SRA) on High Altitude Aircraft and Airships.

We should discuss the trade-off options of all possibilities in order to be able to distinguish the best applications for airplanes, UAV's, airships and satellites. Make a sketchy analysis based on simple arguments, practice or based on the physics, the available technology and plausible improvements, then make up our own mind on potentials.

The complementary application side is quite unclear as the time schedule/prospective for the development of civilian applications. A market analysis seems to be required (see also for our activity the analysis made for UAV NET by Frost ?) and predicting costs seems to be quite difficult and dangerous. The way of developing the activity is also probably tricky. But there is no doubt that unmanned flying machines will develop with their market in the civilian field.

A HAAS platform is the only platform with the capability to fulfil the requirements for surveillance (surveillance being the capability to image a certain region of interest for a continuous time). This key feature has to be kept in mind permanently and presented as THE key factor to invest in HAAS.

Having a reliable, robust, although non optimal, existing flight vehicle available – i.e. already supported by, for example, military applications - is a major asset, probably a most decisive factor. The support of the US DoD for the Lockheed Martin HAA concept and project is, from that point of view, essential and should induce more interest in Europe, from the civil and military sides.

It must be underlined that the potentially emerging economy based on hydrogen is fully in line with the HALE UAV's and airships. The technology roadmap to be written for Europe in this sector needs definitely to take that into account from both sides.



USE-HAAS Workshop # 1
FP6-2002-AERO-2 SSA Project Contract No 516081
High Altitude Aircraft and Airships (HAAS)

11th & 12th of July 2005 at the Royal Military Academy
Entrance gate : rue Hobbema, 30 - Brussels 1000

Final Agenda

July 11th, 2005

Registration & Coffee : from 09:00 at the RMA Conference Centre

Session 1: HAAS Objectives and State-of-the-Art

From 10:00 to 12:45

Chairman: Jean-Pierre Lentz, Scientific Officer, EU RDG Directorate H

Co-chairman: Prof. Dr. Arie Lavie, USE HAAS Project Coordinator

1. Colonel BAM Jean Marsia, Director of Academics: Royal Military Academy Welcome Word
2. Jean-Pierre Lentz: The EC "USE HAAS" Objectives
3. Arie Lavie: Workshop Objectives: State-of-the-Art, Needs and Applications, Strategic Research Agenda
4. Ronald Browning: The USA Lockheed-Martin High Altitude Airship Program
5. Drora Goshen: The EADS/IAI "HERON" High Altitude UAV
6. Patrick Hendrick: Next : The Working Groups in the USE HAAS Program
7. Larry Camacho: The USA NASA High Altitude Aircraft and Airships Program

Lunch : 12:45 to 14:00 at RMA

Session 2: HAAS State-of-the-Art

From 14:00 to 16:30

Chairman: Jean-Pierre Lentz, Scientific Officer, EU RDG Directorate H

Co-chairman: Dr. Masaaki Nakadate, Aeronautical Application Technology Centre, JAXA

1. Masaaki Nakadate: The Japan Stratospheric Platform Project
2. Yuichiro Nishi: The USA AeroVironment Helios, Path-Finder, Global Observer Stratospheric UAV's
3. Ingolf Schäfer: HALE Airships : applications, technical maturity and research demands
4. David Penn: The EU FP5 "UAV-NET" Program
5. Giulio Romeo, Politecnico Torino: HeliPlat and Capecon-Shampo Solar Powered Platform Projects



Coffee : 16:30 to 17:00

Round Table 1: Strategic Research Agenda for HAAS

From 17:00 to 18:30

Chairmen : J-P. Lentz, M. Nakadate, D. Fransaer (VITO) and A. Lavie

1. Herbert Fox, CTI: Outline of a Research Agenda for HAAS
2. Participants presentations and discussions :
 - a) B. Sträter, Zeppelin
 - b) J. Everaerts, VITO
 - c) B-J. Ku, ETRI, Korea
 - d) F. Marchand, Dassault-Aviation
 - e) A. Ollero, University of Sevilla

Evening cocktail : Reception at the Royal Air Museum, from 19:00 to 20:30

July 12th, 2005

Session 3: HAAS Applications in Telecommunications

From 09:00 to 10:45

Chairman: Augusto de Albuquerque, Scientific Officer , EU DG INFSO Unit D1

Co-chairman: Mr. Yuichiro Nishi, President, Japan Stratospheric Communications Inc.

1. Tim Tozer: European and Global Works in HAAS and Telecom Applications
2. Ryu Miura: The NICT Telecom Program (National Institute of Information & Communications Technology)
3. Harold G. Kimball: Telecom High Altitude Platforms Applications and ITU Regulations

Coffee : **from 10:45 to 11:15**

Session 4: HAAS Applications in Risk Management

From 11:15 to 12:45

Chairman: Guy Weets, Director, EC RDG IST Directorate

1. Guy Weets: ICT for Environmental Risk Management
2. Marc Acheroy: HAAS for Improving Risk Management in Air Pollution
3. David Caballero: HAAS Applications in Integrated Forest Fire Risk Management
4. Fabrizia Buongiorno: HAAS Remote Sensing Application to Monitor Active Volcanoes

Lunch : 12:45 to 14:00 at RMA



Session 5: HAAS Applications in Security and Science

From 14:00 to 16:30

Chairman: Tjien-Khoen Liem, EU PASR RDG Scientific Officer

1. Khoen Liem: EU Security Research and Potential UAV application for security related missions
2. Helmut Süß: HAAS Needs regarding the EU PASR Security Program
3. Christian Barbier: HAAS Remote Sensing Applications
4. Bernd Kröplin: HAAS – Comparison of Technologies for Stratospheric Flight
5. Gordon Taylor: The UK ATG “StratSat” High Altitude Airship

Coffee : from 16:30 to 17:00

Round Table 2: HAAS Needs and Applications

From 17:00 to 18:30

Chairmen : A. de Albuquerque, G. Weets, T-K. Liem, Y. Nishi, H. Süß

1. Herbert Fox, CTI: Outline of HAAS Needs and Applications
2. Participants presentations and discussions :
 - a) M. Pallavicini, Carlo Gavazzi Space b) H. Patel, GEOSCAN c) D. Dornbusch, Sofema
 - d) M. Mulero, INTA e) L. Baufay, Alcatel ETCA f) S. Thompson, EU DG FISH

Close : Prof. Arie Lavie and Jean-Pierre Lentz



1st USE HAAS WORKSHOP – JULY 11 & 12, 2005
List of Participants

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Appendix B

Deliverable D7

Summary of the WG's discussions



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Introduction

This document is intended to summarize the work made and the discussions held in Working Groups organized during the Use HAAS project. It provides also a view on the materials presented during the 1st Meeting of those Working Groups in September 2005.

The objectives of these Working Groups were to try to involve as many as possible actors of the HAAS community and to gather all ideas present in this community in order to produce the best possible ultimate document of this study, the Strategic Research Agenda (SRA). By organizing these Working Groups jointly with industry, stakeholders and end-users, it was clearly intended to get as soon as possible a SRA which would be naturally endorsed by a largest part of the sector.

In Chapter I, the purpose is to show a short summary of each presentation given during the 1st Meeting of the Working Groups on 29 September 2005, without adding any real critical comment.

In Chapter II, the objective is to present a feedback on the inputs received from the participants in the Working Groups in preparation of the Strategic Research Agenda (SRA).

Finally, in the Conclusion, some general comments and points-to-be-considered for the following 2nd Workshop and the SRA are highlighted.

The Final Agenda of the 1st Meeting of the Working Groups is attached as Appendix 1.

The List of Participants is also attached as Appendix 2. A large number of active participants (more than 60) has been noted in the Working Groups. They are rather adequately spread among industry, academia and research institutions, public authorities and others.



Chapter I

1st Working Group Meeting summary

This first chapter gives an one-page summary of each presentation submitted during this 1st Meeting of the Working Groups (WG). These presentations are normally available under a pdf format on the open website of the Use HAAS Consortium (<http://www.usehaas.org>).

The presentations organized for this Working Group Meeting were intended to :

- Present the state-of-the-art of the sector that could not be presented at the 1st Workshop in July
- Introduce the five Working Groups and the work intended to be done inside each of these Working Groups under the leadership of the WG Chairmen and Secretaries

This one page is just a summary showing the different points forwarded by the different authors, without trying to extract the highlights which are important for the work to be done by the Use HAAS Consortium in order to prepare the Strategic Research Agenda (SRA) for prospective research in this field in Europe.

The second chapter presents the first analysis of the inputs received by the Consortium from the Working Groups discussions for the Strategic Research Agenda.



USE HAAS Working Groups Objectives, Structure and Terms of Reference

Prof. Dr. Arie Lavie – CTI - Project Co-ordinator

This presentation is a sort of monography for the Working Groups (WG). This presentation is highlighting the following points :

1. The preparation of the HAAS Strategic Research Agenda (SRA) to be prepared for the EC
2. The structure of the WGs :
 - WG1 : HAIRSHIPS - High Altitude Airships
 - WG2 : HAIRCRAFT - High Altitude Aircraft
 - WG3 : HAAS Communications
 - WG4 : HAAS Security
 - WG5 : HAAS Remote Sensing
3. The WG Terms of Reference

The aims of the 1st WG Meeting are presented :

1. To discuss the analysis of the USE HAAS Workshop # 1
2. To structure the USE HAAS Working Groups Work
3. To launch the preparation of the Strategic Research Agenda

It is highlighted that the end-users with their missions, their needs and specific applications are the key players for the development of the high altitude activities. The different currently running research works are presented, while the potential missions and applications are also given : Regional Earth System Observations, Communications, Crisis/Emergency Operations, Monitoring, Security and Intelligence Missions, Agricultural optimization/monitoring, Intelligent Transportation, etc. It needs also a global market to be developed.

A two step possible roadmap for the development of HALE UAVs is outlined :

- 1) A 1 week⁺ endurance (with H₂ as a propellant), (regenerative) fuel cells, mainly for stratospheric flight (airship or airplane);
- 2) A 6 months⁺ endurance with Regenerative Fuel Cells and improved accumulators, to-be-developed alternative propulsion (including micro-wave beaming, etc.), to-be-developed multi use concept. A winged airship schematics using microwave beaming could be a future (futuristic ?) solution.

A picture of the Global Observer UAV including its performance specifications is presented in Figure 1 and a picture of a prospective mission as oil pipeline surveillance and monitoring is schematized in Figure 2.

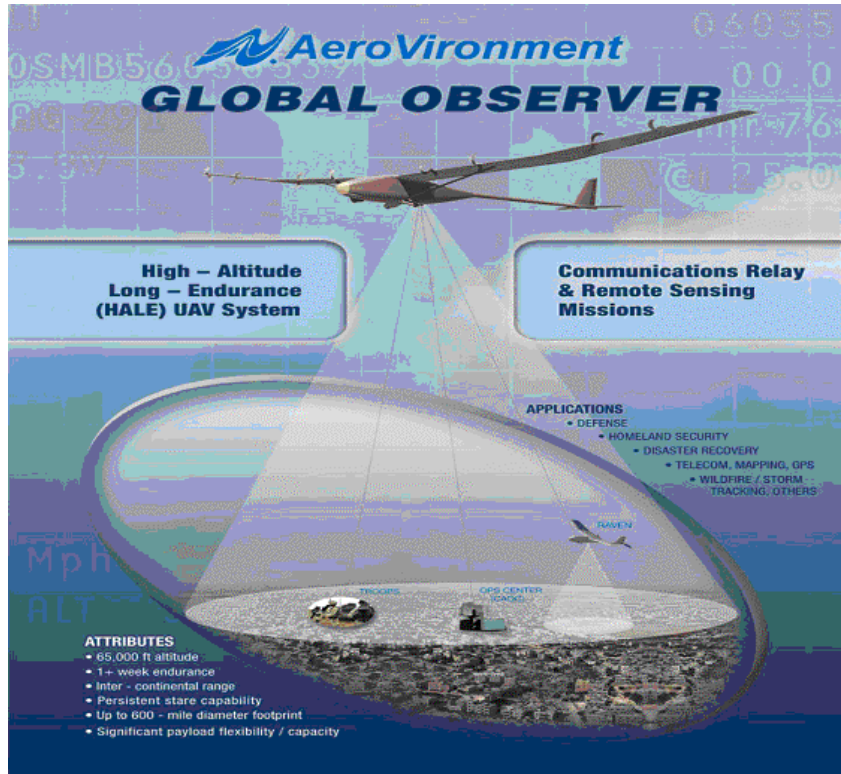


Figure 1 – The AeroVironment Global Observer high altitude UAV

Deployment of 4 platforms (+ backups) across Alaska:



- Provides multiple uses
 - Broadband local access at fraction of satellite cost (\$/bps)
 - Trans-Alaska aerial backbone
 - Pipeline & port monitoring
 - Distance learning/telemedicine
 - Weather tracking/disaster mgmt
 - Wildfire detection
- First station deployed ties Barrow into Prudhoe fiber
- Fourth enables complete aerial backbone alternative

Figure 2 – Global Observer pipeline monitoring mission



The French know-how in stratospheric airships - The Pegasus experience

David Dornbusch
SOFEMA

This French presentation is oriented towards High Altitude airship development with :

1. The characteristic features due to the stratospheric environment
2. The pre-dimensioning of a Stratospheric Airship: the PEGASE works
3. The interest of the LENTICULAR form and its background.

The mean wind velocity profile with altitude is reviewed (Figure 3).

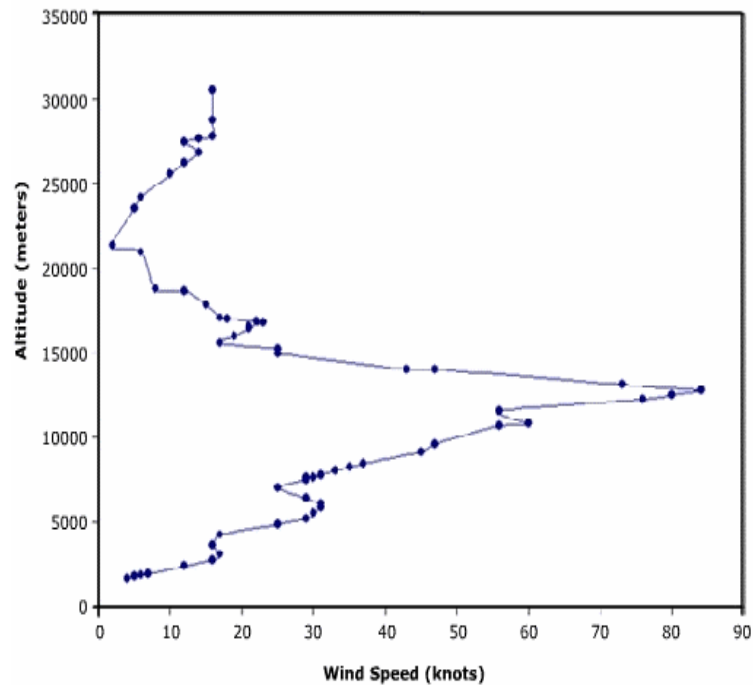


Figure 3 – Wind velocities with altitude

The challenges of high altitude long endurance airships are explained : shortage of energy on-board and loss of buoyancy with time. Six months a bit more seems to be a critical duration.



The tested Global Observer HALE UAV

Stuart Hindle – AeroVironment

The first real High Altitude Long Endurance (HALE) UAV is presented. The Global Observer (GO) developed by AeroVironment (USA) flew a continuous one week flight in July 2005. It was propelled by a proton exchange membrane fuel cell (PEMFC) using hydrogen as a fuel stored on-board under a liquid condition (at about 20 K).

A lot of possible applications are presented. The objective is to extend the flight duration to a few weeks pretty soon. The endurance is in fact limited by the internal available volume to store the hydrogen fuel as well as the PEMFC consumption.

Two slides presented in Figures 4 and 5 are showing :

- The comparison between the Global Observer (with an endurance of a few weeks) and the Helios (with an objective of a few months endurance);
- A typical telecommunication possible application of HALE systems.

AV Configuration Comparison

<p>AV Global Observer (1st production configuration)</p>	<p>AV Regen Configuration (future option)</p>
<p>Consumable Fuel Configuration</p> <ul style="list-style-type: none"> ▪ 20-km operating altitude ▪ Liquid H₂ propulsion system (open cycle) ▪ Over 1-week flight duration (limited by liquid H₂ tank capacity) ▪ Up to 450+ kg., 6+ kW payload ▪ Year-round global operation 	<p>Regenerative Configuration</p> <ul style="list-style-type: none"> ▪ 20-km operating altitude ▪ Regenerative solar/fuel cell system (closed cycle) ▪ Up to 6+ months flight duration (limited only by need for servicing) ▪ Up to 100+ kg., several kW payload ▪ Latitude-limited for winter operation

Initial production choice driven by increased latitude/payload flexibility of Consumable Fuel option (though operational cost higher than for Regen, offset by lower capital acquisition cost)

4

Figure 4 – GO/Helios comparison

World's First Telecom Tests from 20 km in Stratosphere (2002)

- 1) High Definition (HDTV) Broadcast tests using UHF channel
 - 19 Mbps data rate achieved using under 100 Watts of power
- 2) IMT-2000 (3G Mobile) tests using 2 GHz bands
 - Voice/video/data relay using off-the-shelf NTT DoCoMo 3G mobile handset

- **Multinational government / industry collaboration**
 - AV/SkyTower, Japan Ministry of Post & Telecom (CRL/TAO), NASA
- **HDTV broadcast & 3G mobile payloads developed by Toshiba & NEC**
 - Toshiba/Mits. broadband payloads also developed for future testing (47/28 GHz)

9

Figure 5 – Telecom HALE UAV mission



The ITU Telecom Regulations for HAAS

Harold Kimball – Consultant

The structural and regulatory issues of using high altitude communication systems are presented from an ITU view point. The different World Radiocommunication Conference (WRC) and their decisions concerning or impacting HAAS systems are explained.

From an ITU point, a high altitude platform station is defined as follows : A station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth (RR 1.66A).

The allocation to the fixed service in the bands 47.2-47.5 GHz and 47.9-48.2 is designated for use by high altitude platform stations (Resolution 122 – WRC 97) but some changes took place in 2000 (WRC 00) with added provisions in recognition of the HAPS related regulatory changes at 28 and 31 GHz with a final refocus solely on the 47 – 48 GHz band at the WRC 03.

During the last WRC in 2003, it was emphasized clearly on the technical and operational constraints on HAPS operations. More specific studies should be launched before the next WRC in 2007. Specific problems like cross border interference should be tackled with a lot of attention.



**Analysis of 1st USE HAAS Workshop and
methodology for preparing the SRA**

Patrick Hendrick, Royal Military Academy of Belgium

A short analysis of the 1st Workshop is presented. It clearly indicates a lot of interest from very different applications and communities. The applications appear clearly but the problem are the high development costs of the aerial platform that nobody wants to support neither the aircraft or airships companies and national and European agencies nor the application companies or groups of individuals. HALE systems are a really nice example of the chicken and the egg problem.

The SRA is shortly explained with its objectives and preliminary content. The SRA must be a vision for the whole sector, from the end-user side as well as from the platform side. It is intended to give a clear view of the HAAS uses and needs to raise interest of all stakeholders. In order to reach this objective, a common view of « all » potential European actors must be given through this SRA.

The best tool that has been identified to reach the objective of writing a common SRA is the creation of Working Groups, assembling as many actors as possible from the sector.



Chapter II

Working Groups inputs and analysis

After the 1st Workshop of July 2005, five Working Groups have been identified and organised :

- WG 1 : Airship platforms
- WG 2 : UAV platforms
- WG 3 : Communication applications
- WG 4 : Security applications
- WG 5 : Remote Sensing applications

They have been established during the first meeting of 29 September 2005 and manned with all the possible candidates. A list of the Working participants is given in Appendix 2.

An important aspect of the Working Groups is that a good integrated work between the Working Groups is mandatory as applications are imposing some constraints on the flying vehicles and vice versa (Figure 6). The problem of the requirements on the payload and on the platform is therefore a key concern.

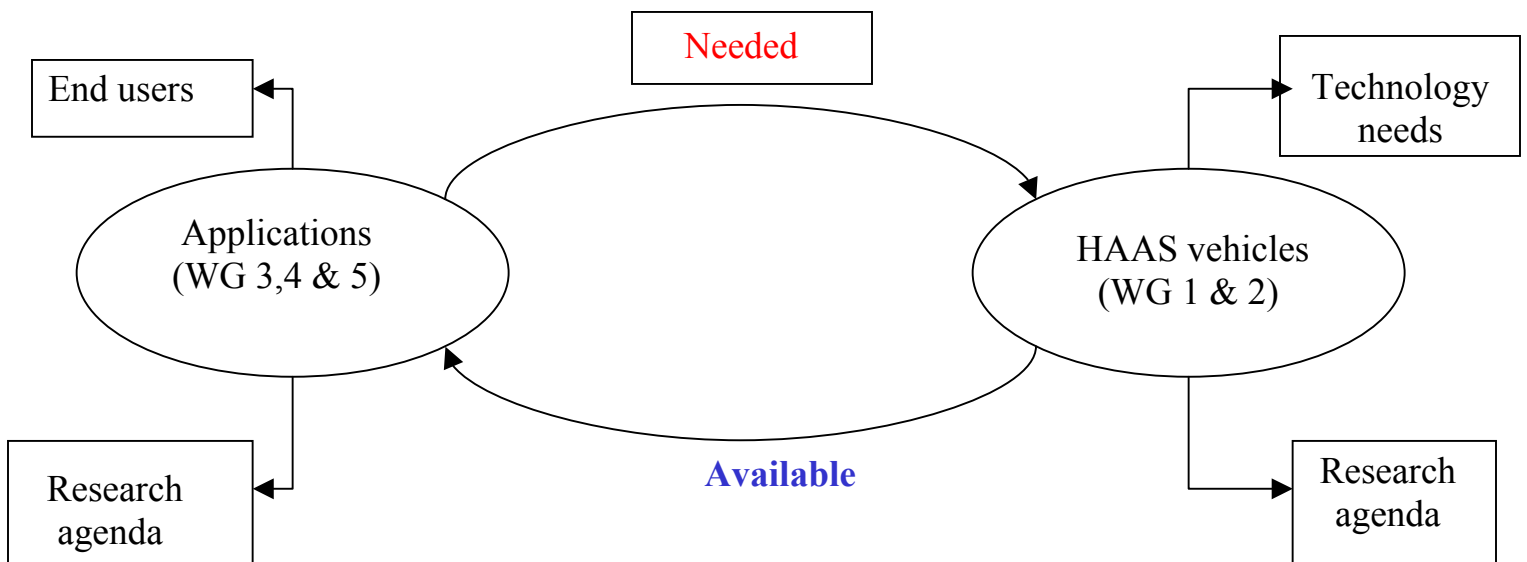


Figure 6 : The required integration between the applications and the vehicles



Each WG is chaired by an expert from the industry who is assisted by a secretary coming from the Use HAAS Consortium. One of the reasons of having someone from the Consortium in each Working Group at that position is to assure a cross link between the five WGs. Another is to maintain a good reporting to the Consortium and thus a good know-how to write the SRA afterwards.

The tasks listed for the WGs are :

- Encourage and create a broad discussion with a brainstorming on HAAS sub-activities 1, 2, 3, 4 & 5.

- Provide specialist's inputs for the SRA :
 - identify the potential short term & long term applications
 - identify the end-users
 - list the technology needs
 - list the technology enablers in other fields
 - provide time constraints for non-available technology
 - propose a preliminary agenda.

- Establish a list of contact points inside the industry and research institutions.

The Working Groups discussions resulted in building the architecture of the three volumes of the SRA, the final product of the Use HAAS Specific Support Action, by integrating as much as possible the comments made by the participants. The selected architecture for this SRA document is as follows :

- A Volume 1 that is the Executive Summary
- A Volume 2 on the High Altitude Long Endurance Aircraft and Airships
- A Volume 3 on the HAAS Missions and Applications

The discussions with the WG participants and their comments and materials helped the Consortium to fill in the different sections of these volumes with the necessary and adapted content. Of course that exercise has not been an easy task as the participants were not receiving any financial retribution but it is important to note that it has been essential for the success of the study, particularly thanks to the presence, the inputs and the efforts of some key European players in this sector and related matters.

This activity was finalised with the organization of the 2nd Workshop where the SRA draft was presented to the public and where final comments from the audience and other actors were asked. The Working Groups final inputs have been delivered and incorporated through the comments received from the participants after they had received access to the full three SRA volumes through the web site of the Use HAAS organization.



Conclusions and Recommendations

First, it can be concluded that the 1st Meeting of the Working Groups has been considered as highly successful when looking at the number and the quality of the participants and when considering the amounts of contacts the Consortium has established thanks to this event. It helped a lot for the organization of the following Working Groups.

As underlined in the Introduction, this 1st Working Group meeting was intended to help starting the brainstorming per Working Group, as they have been identified for the follow-up work to do in preparation of the Strategic Research Agenda (SRA) on High Altitude Aircraft and Airships.

Five Working Groups have been created. They helped through the discussions and the comments received in structuring and writing the Strategic Research Agenda with also the Technology Roadmap included in this SRA. The presence, the inputs and the efforts of the participants to these WGs and mainly of a few key European players and industrials in this sector, have been an essential factor for the success of this Use HAAS activity.



USE-HAAS Working Groups Meeting # 1
FP6-2002-AERO-2 SSA Project - Contract No 516081
“High Altitude Aircraft and Airships (HAAS)”
29th of September 2005 at the Royal Military Academy
Avenue de la Renaissance, 30 – Brussels, Belgium

Final Agenda

Registration and Coffee: starts at 09H00

Session 1: from 10H00 until 12H30

Chairman: Lt-Col ir J-P. Salmon, Scientific Officer, Royal Military Academy
Co-chairman: Prof. Dr. Arie Lavie, Project Coordinator

1. J-P. Salmon: RMA welcomes the “USE HAAS” Working Groups
2. Arie Lavie: USE-HAAS Working Groups Objectives, Structure and Terms of Reference: 1) Preparation of HAAS Strategic Research Agenda (SRA); 2) Structure of Working Groups (WG): WG1-HAIRSHIPS-High Altitude Airships; WG2-HAIRCRAFT-High Altitude Aircraft; WG3-HAAS Communications; WG4-HAAS Security; WG5-HAAS Remote Sensing; 3) WG Terms of Reference
3. David Dornbusch: The French know-how in stratospheric airships - The Pegasus experience
4. Stuart Hindle: The tested Global Observer HALE UAV
5. Harold Kimball: The ITU Telecom Regulations for HAAS
6. Patrick Hendrick: Analysis of 1st USE HAAS Workshop and methodology for preparing the SRA

Standing lunch: from 12H30 until 13H30

Session 2: from 13H30 until 15H30

Five brainstorming WG discussions in five separate meeting rooms :

Sub-Session WG1: HAIRSHIP program for preparation of the Strategic Research Agenda

Chairman: Bernd Sträter - Zeppelin

Secretary: Patrick Hendrick – RMA: WG1 SRA items extracted from the USE HAAS workshop

Discussions: Arie Lavie - CTI: Use of hydrogen as lifting gas and propellant in a HALE airship;
WG1 participants discussions



Sub-Session WG2: HAIRCRAFT program for preparation of the Strategic Research Agenda

Chairman: Paul Davey - Qinetiq

Secretary: David Penn – IAI: WG2 SRA items extracted from the USE HAAS workshop

Discussions: Drora Goshen-IAI; Bruce Robb – EADS Defense and Security; Arie Lavie – CTI :
Solar/Electric/Hydrogen HALE UAV; WG2 participants discussions

Sub-Session WG3: HAAS Telecom program for preparation of the Strategic Research Agenda

Chairman: Patrice Bongibault – EADS Defense and Security Systems

Secretary: Tim Tozer – UoY: WG3 SRA items extracted from the USE HAAS workshop

Discussions: Augusto De Albuquerque – EU Commission INFISO; Phil Charlesworth – EADS
WG3 participants discussions

Sub-Session WG4: HAAS Security program for preparation of the Strategic Research Agenda

Chairman: Prof. Stefan Axberg - FHS

Secretary: Reinhard Schröder – DLR: WG4 SRA items extracted from the USE HAAS workshop

Discussions: Tjien-Khoen Liem - EU Commission ENTR ; FHS : Project Baltic Watch

Arie Lavie : Security aspects in risk management - WG4 participants discussions

Sub-Session WG5: HAAS Remote Sensing program for preparation of the Strategic Research Agenda

Chairman: Bavo Delaure - VITO

Secretary: Christian Barbier – ULg: WG5 SRA items extracted from the USE HAAS workshop

Discussions: Guy Weets - EU Commission ICT ; Martin Sauerbier – ETH; WG5 participants discussions

Coffee break: from 15H30 until 16H00

Round Table: from 16:00 until 17:30

Chairmen: J-P. Salmon - Scientific Officer, RMA and Arie Lavie - Project Coordinator

Objective: The preparation of the entire Strategic Research Agenda for HAAS

1. Summary by the 5 WG Chairmen
2. Participants comments
3. Arie Lavie: Summary, time schedule and logistics for preparatory work of the 5 WG's

Adjournment



Appendix 2

1st USE HAAS Working Group Meeting – Sept 29, 2005

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Appendix C

Deliverable D8

Summary of the 2nd Workshop



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Introduction

This document is intended to summarize the presentations made and the discussions held during the 2nd Workshop organized during the second year of the Use HAAS project. It provides thus a quick view on the materials presented during the 2nd Workshop organized on 08 and 09 May 2006 at the Royal Military Academy of Belgium.

The main objective of this 2nd Workshop was to present the first draft of the ultimate purpose of this study, the Strategic Research Agenda (SRA) and its Technology Roadmap. By organizing this Workshop with industry and potential end-users, it was clearly intended to get as soon as possible a lot of comments on this draft SRA and then include them in the final version of this document. An indirect objective was also to obtain a SRA that is naturally or automatically endorsed by the largest part of the HAAS sector and stakeholders.

In the Conclusions and Recommendations, some general comments and points-to-be-considered for the closure of the activities of the Use HAAS Consortium and the finalization of the SRA are highlighted.

The Final Agenda of the 2nd Workshop is attached as Appendix 1.

The List of Participants is also attached as Appendix 2. A large number of active participants has been noted. They are rather adequately spread among industry, academia and research institutions, public authorities and others.



Summary of the 2nd Workshop presentations

This section gives a short summary of each presentation submitted during this 2nd Use HAAS Workshop. These presentations are normally available under a pdf format on the open website of the Use HAAS Consortium (<http://www.usehaas.org>).

The presentations organized for this 2nd Workshop were intended to :

- Present the state-of-the-art of the sector that could not be presented at the 1st Workshop in July and at the 1st Working Group Meeting in September;
- Introduce and present the draft version of the Strategic Research Agenda prepared by the Consortium and resulting from the five Working Groups under the leadership of the WG Chairmen and Secretaries.

The first part of the Workshop highlights some state-of-the-art concepts which were not presented before in the Use HAAS meetings, after a general introduction made by Colonel Marsia, Director of Academics at RMA, Professor Lavie, Co-ordinator of the Use HAAS Consortium and Ir Lentz, Scientific Officer of this EC study.

A first presentation is given on the Global Observer HALE UAV developed by AeroVironment (USA). This is the first High Altitude Long Endurance (HALE) UAV that flew. The Global Observer flew a continuous one week flight in July 2005, propelled by a fuel cell (PEMFC) using hydrogen as a fuel stored on-board under a liquid condition (at 20 K). Possible applications are also presented. The objective is to extend the flight duration to a few weeks pretty soon. The endurance is in fact limited by the internal available volume to store the hydrogen fuel as well as the PEMFC consumption.

Two slides are presented here in Figures 1 and 2.

AV Configuration Comparison

<p>AV Global Observer (1st production configuration)</p>	<p>AV Regen Configuration (future option)</p>
<p>Consumable Fuel Configuration</p> <ul style="list-style-type: none"> ▪ 20-km operating altitude ▪ Liquid H₂ propulsion system (open cycle) ▪ Over 1-week flight duration (limited by liquid H₂ tank capacity) ▪ Up to 450+ kg., 6+ kW payload ▪ Year-round global operation 	<p>Regenerative Configuration</p> <ul style="list-style-type: none"> ▪ 20-km operating altitude ▪ Regenerative solar/fuel cell system (closed cycle) ▪ Up to 6+ months flight duration (limited only by need for servicing) ▪ Up to 100+ kg., several kW payload ▪ Latitude-limited for winter operation

Initial production choice driven by increased latitude/payload flexibility of Consumable Fuel option (though operational cost higher than for Regen, offset by lower capital acquisition cost)

4

Figure 1 – GO/Helios comparison

AV Global Observer: Multi-Use Platform High-Altitude, Long-Endurance (HALE) UAV System

<p>SkyTower Telecommunications</p> <p>urban & rural infrastructure at fraction of conventional cost</p>	<p>Homeland Security</p> <p>border/coastal/site monitoring & emergency communications</p>	<p>Other Services</p> <p>disaster management, wildfire detection, etc.</p>
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- Production aircraft being developed by parent company, AeroVironment (AV)
- Multiple, high-value commercial & civilian services can be delivered by each platform, complementing military communications/remote sensing capabilities

2

Figure 2 – Some typical HALE applications



These two figures are showing :

- The comparison between the Global Observer (with a few weeks endurance) and the Helios (with a few months endurance objective);
- A few typical possible applications of HALE UAV systems.

The freshly tested Zephyr UAV (also called Mercator) developed by QinetiQ and to be used for the Pegasus project of the VITO (Belgium) is also presented with a few video's (Figure 3). The Zephyr is a lightweight, high-altitude, long endurance design, which is solar-powered using lithium based batteries. It has a wingspan of 12 meters (39.3 ft.), but weighs only 27 kg (59.5 lb.).



Figure 3 – The Zephyr HALE UAV

At White Sands, the Zephyr flew at an altitude of up to 27,000 ft., and its longest flight lasted 6.5 hr., says Paul Davey, business development director for the program. The venue for the next set of trials has yet to be determined. Altitude and endurance during the White Sands trials were limited by range availability. The Zephyr is designed to operate at altitudes of 50,000-100,000 ft, a production-standard version of the UAV could fly on station for up to three months at a time.

Professor Romeo (Politecnico di Torino) presented afterwards his projects and developments. He presented particularly the Heliplat concept, the Shampo concept and, finally, the ENFICA – Fuel Cell project just accepted by the EC for the FP6 in Aeronautics.

The Heliplat, developed during the EC FP5 HELINET project is presented on Figure 4. A scaled prototype manufacturing was even done in Italy.

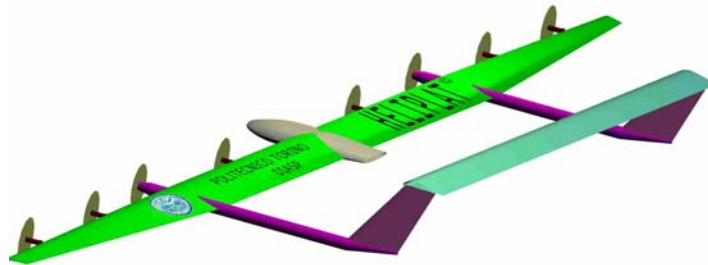


Figure 4 – The HELIPLAT concept

In the EC FP5 CAPECON study, Professor Romeo proposed the Shampo concept (Solar Hale Aircraft Multi Payload and Operation) which is a blended wing body configuration UAV.

The National HAAS program of Korea was also shortly presented. It was mainly based on the development of an airship but is now more concentrated on the development of some critical technologies as lightweight fuel cells and regenerative fuel cells.

The second part of the Workshop highlights the work done by the Use HAAS Consortium in order to prepare the Strategic Research Agenda (SRA) for prospective research in this field in Europe.

Professor Lavie presents first the Executive Summary (Volume 1 of the SRA), highlighting the technology needs for the flying platforms but also the end-users with their missions, their needs and specific applications who are the key players for the development of the activity. The different research works under course are presented, while the potential missions and applications are also given : Regional Earth System Observations, Communications, Crisis/ Emergency Operations, Monitoring, Security and Intelligence Missions, Agricultural optimization/monitoring, Intelligent Transportation, etc. It needs also a global market to develop.

IAI and RMA presented then the research and development needs on the platform side with a summary of the technology roadmap that has been prepared for the UAVs and the airships. DLR, CSL and University of York presented afterwards the missions and applications, with their requirements from the payload side.

An important presentation was given by Geoff Bowker from the British CAA on the Air Traffic Management challenge for the integration of UAV into the civil airspace.

The end of the first day was used for a round table with interested end-users and developers. The new project developed in Switzerland called Stratex intended to develop a new airship attracted a lot of attention. Bernd Sträter, former CEO of Zeppelin,



highlighted the importance of lightweight technology for HALE systems, for all elements used on-board, the structure, the propulsion system, the energy storage, the payload, etc.

The second day was oriented towards end-users and possible applications and missions in order to highlight the importance of identifying as many as possible applications as possible and thus attract investors to develop the necessary platforms to support those applications. Three quite attractive missions are certainly forest fire monitoring (which become more and more important with the climate change), traffic monitoring and pipeline monitoring.

High resolution imaging radar systems (SAR) combined with moving target detection (MTI) are indeed capable of monitoring traffic using sensors on airborne and space-borne platforms, independent of atmospheric condition, independent of sun's illumination and with a high spatial resolution at large stand-off distances.

Pipeline monitoring missions could include pipeline observation but also, or even, gas leakage detection and monitoring of soil subsidence. Figure 5 shows the observation by four different means of an external threat, i.e. an excavator working on the pipeline site.



Figure 5 – Pipeline monitoring (photo, airborne optical, airborne IR, airborne SAR)



It is clear that a given UAV or a given airship could be used or should be used at different moment of the year for different applications and thus to the service of different end-users, perhaps even in different countries.

The workshop is concluded with a round table mainly oriented towards the SRA.

Conclusions and Recommendations

First, it can be concluded that the 2nd Workshop has been considered as highly successful when looking at the number, the quality and the variety of the participants and when considering the amounts of comments and feedback the Consortium has received thanks to this event. It helped a lot for the review of the Strategic Research Agenda (SRA), volumes 1 to 3.

As underlined in the Introduction, this 2nd Workshop was intended to help reviewing the Strategic Research Agenda on High Altitude Aircraft and Airships thanks to the presence of experts and end-users who were not directly involved with the write-up of the three SRA volumes as these were compiled by the Consortium Partners only. They helped through the discussions and the comments received in structuring and writing the second draft of the Strategic Research Agenda together with the reviewed Technology Roadmap included in this SRA.

The second objective of this Workshop was a first dissemination of the draft SRA volumes to the HAAS community. This has been realised by distributing the Executive Summary to the participants of the Workshop and publishing the three draft volumes on the web site of the study just after the Workshop.



USE-HAAS Workshop # 2

FP6-2002-AERO-2 SSA Project Contract No 516081

High Altitude Aircraft and Airships (HAAS)

8th & 9th of May 2006 at the Royal Military Academy, Brussels

Final Agenda

May 8th, 2006

Registration & Coffee : from 09:00 at the RMA Conference Centre

Session 1: HAAS State-of-the-Art and SRA – Strategic Research Agenda

From 10:00 to 13:00

Chairman: Jean-Pierre Lentz, Scientific Officer, EU RDG Directorate H

Co-chairman: Prof. Dr. Arie Lavie, USE HAAS Project Coordinator

1. Colonel BAM Jean Marsia, Director of Academics: Royal Military Academy Welcome Word
2. Arie Lavie: HAAS State-of-the-Art and the Vision for a Stratospheric Long Endurance Flight
3. Jean-Pierre Lentz: The EC HAAS SRA Objectives
4. Patrick Hendrick: The “Global Observer” HALE Aircraft
5. Paul Davey: The “Mercator” HALE UAV
6. Giulio Romeo: Application of Solar Cells on HALE UAV
7. Park Jongmin: The Korean HAAS National Program

Lunch : 13:00 to 14:00 at RMA

Session 2: Presentation of HAAS draft SRA

From 14:00 to 16:00

Chairman: Jorge Pereira, Scientific Officer, EU RDG Directorate

1. Arie Lavie: The HAAS SRA draft: SUMMARY
2. David Penn & Patrick Hendrick: The HAAS SRA draft: Research and Development Needs
3. Helmut Suess & Tim Tozer & Christian Barbier: The HAAS SRA draft: Missions and Applications
4. Bowker Geoff: The HAAS Air Traffic Management (ATM) challenge

Coffee: 16:00 to 16:30

Round Table: The HAAS Strategic Research Agenda

From 16:30 to 18:00

Chairmen: Bernd Sträter and A. Lavie

Participants presentations and discussions :



B. Straeter, Zeppelin; I.Schäfer, Lindstrand Tech and LTA Tech.AG.; F. Marchand, Dassault-Aviation; A. Ollero, University of Sevilla; B.Delaure, VITO; S.Axberg, FHS; P.Davey, QinetiQ; P.Bongibault, EADS; B.Geoff, CAA; D. Goshen, EAT; H.Patel, Geo-Scan; J.A.Delgado, UPC; A.Grimm, IGI; G.Naldi, S-C

Evening cocktail : Reception at the Royal Military Academy, from 18:15 to 20:00

May 9th, 2006

Session 3: HAAS SRA Applications in Telecommunications

From 09:00 to 10:30

Chairman: Ryu Miura: The NICT Telecom Program

- 1) Ryu Miura: Demonstration test plan of wireless applications in 2006 using Zeppelin NT and Global Observer prototype
- 2) Ernesto Deprieri: Selex-Comms approach to HAAS Communications services
- 3) Masaaki Nakadate: Japan's Stratospheric Platform Project Updated
- 4) David Grace and participants discussions

Coffee : from 10:30 to 11:00

Session 4: HAAS SRA Missions in Security and Remote Sensing

From 11:00 to 12:30

Chairmen: Stefan Axberg, FHS; Bavo Delaure, VITO

- 1) Helmut Süß: HAAS Traffic Monitoring
- 2) Anibal Ollero: HAAS Fire Monitoring
- 3) Andre Jadot: BS-UAV Border Security PASR project
- 4) Reinhard Schröder & Christian Barbier and participants discussions

Lunch : 12:30 to 13:30 at RMA

Session 5: The HAAS SRA draft conclusions

From 13:30 to 14:30

Chairmen: Arie Lavie and Bernd Sträter

1. Patrick Hendrick and Ingolf Shaefer
2. David Penn and Paul Davey
3. Helmut Suess and Stefan Axberg
4. Christian Barbier and Bavo Delaure
5. Tim Tozer and Patrice Bongibault

Close : Prof. Arie Lavie – Final word



Appendix 2

2nd USE HAAS Workshop – May 08 & 09, 2006

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