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USE HAAS**

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Deliverable D10
Final Technical Report
Executive Summary of the Project**

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Abstract:

This D10 Deliverable provides a summary of USE HAAS activities followed by an analysis of the Workshops and Working Groups contributions presented in Deliverable D9 organised within the framework of USE HAAS project. The analysis includes also the presentation and the submission of the Strategic Research Agenda (SRA) Deliverable D6 which is based on version and on criticism in the 2nd Workshop, the final event of the USE HAAS activities, contributing for the creation and the organization of the new HAAS “High Altitude Aircraft and Airships” sector, to be followed by recommendations to the EC presented in the hereby Deliverable D10 Executive Summary of the project.

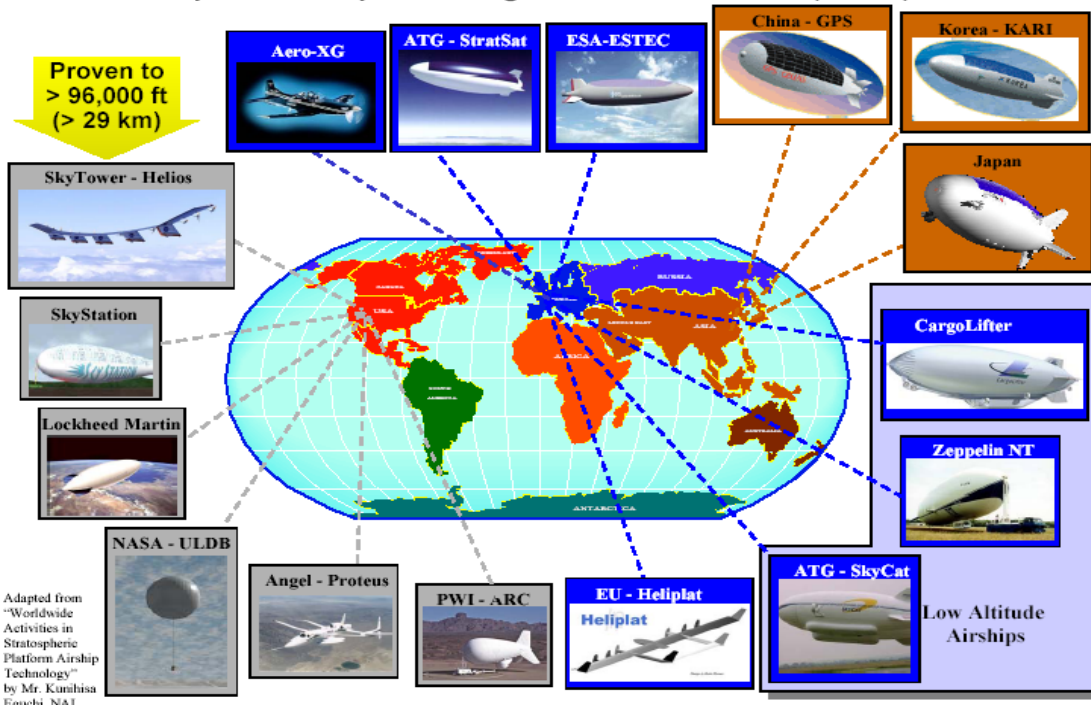


Developing a EU Research Strategy in the High Altitude Aircraft and Airships (HAAS) Sector

USE HAAS Project Contract No. ASA4-CT-2005-516081

World Map of Stratospheric HAAS

World Map of Stratospheric / High Altitude Platforms (HAPS) Activities



Final Report and Recommendations

EXECUTIVE SUMMARY



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2. The USE HAAS SSA project, the Consortium and next steps

Project Title: Study on High Altitude Aircraft and Airships (HAAS), deployed for specific aeronautical and space applications

Acronym: USE HAAS

USE HAAS Consortium members:

- 1. CTI** - Creative Technologies Israel - Israel
- 2. RMA** – Royal Military Academy - Belgium
- 3. DLR** - German Space Centre - Germany
- 4. UoY** – University of York – UK
- 5. IAI** – Israel Aircraft Industries – Israel
- 6. ULg (CSL)** – University of Liege (Centre Spatial de Liege) - Belgium

Project Work Plan Objectives

1. To analyse the world state-of-the-art including HAAS aeronautical uses.
2. To develop tentative research objectives for HAAS deployment.
3. To discuss in workshops and working groups, objectives and prepare a potential SRA – Strategic Research Agenda for the HAAS sector, including research and development needs programme in aeronautics.
4. To disseminate recommendations on the objectives, i.e. the aeronautical research agenda.
5. To issue the final report including the conclusions, and the impact on regulations.
6. To make recommendations for the coordination of activities in this sector and for defining and disseminating a technological roadmap and a SRA for the HAAS sector based upon the inputs given by the end-users and any potential industrial partner.

The Executive Summary of the Project

This document is intended to provide a quick view on the materials presented during the two Workshops of the USE HAAS SSA project and critical analysis of the results obtained during the Workshops and the Working Groups meetings. It brought together, perhaps for the first time, participants interested in the HAAS sector: industry, academia and research institutes, end-users and stakeholders from the EU, from the public and from the national and regional authorities to discuss the future of the HAAS new sector.

Next Steps

The surprisingly large number of active participants in the two workshops and working group meetings (136) represents an adequate spread from industry and potential end-users (69 people), research institutions (35 people), public authorities and stakeholders (32 people). Many of them encouraged us to develop an initiative for next steps to be taken towards the formalization of the HAAS sector. Such formalization is suggested to be the launching of a new partnership among the different organizations involved in the HAAS sector to follow up the implementation of the HAAS SRA Research and Development Needs and to develop a regulatory HAAS Air Traffic Management (ATM) for unmanned aircraft to be deployed for different civilian missions and applications. As suggested in the following paragraph 6 we



invited to meet on 16 October 2006 with all the interested HAAS organisations to set up the “HAAS Observation Platform” to be the “Watch Keeper” partnership with a mandate to follow up the implementation of the HAAS SRA Research and Development Needs and to promote the formalization of an ATM regulations for civilian HAAS unmanned aircraft to be deployed for important missions and applications that HAAS are designed for.

3. Existing and in development HAAS unmanned aircraft

Following is a short presentation of the existing and in development HAAS unmanned aircraft.

3.1 HAAS UAVs

- a) The **Global Observer** UAV (20 km altitude; one week + endurance; 400 kg payload)



In development by AeroVironment USA, solar and open loop Hydrogen fuel cell propelled aircraft. Full R&D tests are expected by end 2008. Possible commercial purchase by 2012

- b) The **Heron** High Altitude UAV (10-15km altitude;30-50 hours endurance;300 kg payload)



The 10 km altitude 30 hours endurance version is in current production in IAI – Israel Aircraft Industry for immediate delivery. The next generation of the Heron 2 version will be at up to 15 km altitude and for 50 hours endurance, probably available by end 2008.



c) The **HERMES 1500** High Altitude UAV (10 km altitude;26 hours endurance)



In current production by “Elbit UAV Systems” for immediate delivery, with 300 kg payload. The HERMES 450 UAV version of Elbit was selected to be the main UAV telecom tactical vehicle in the “Watch Keeper” project for the UK Army.

d) The **Mercator** High Altitude UAV (17 km altitude, 70 hours endurance; 5 kg payload)

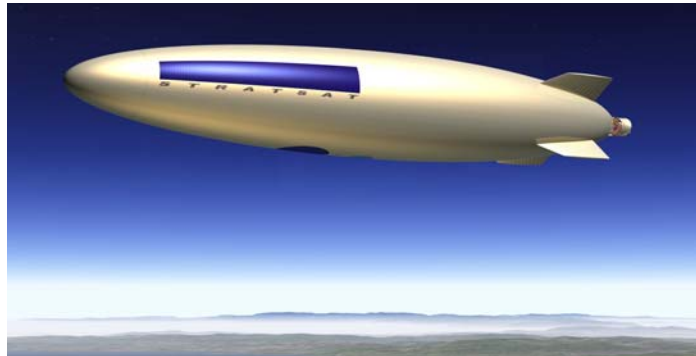


In current development by “QineriQ” UK for specific remote sensing applications. Presently R&D prototype was tested at 9 km altitude for 6 hours endurance. A full scale specified UAV is planned to be delivered to VITO Belgium by end 2007.

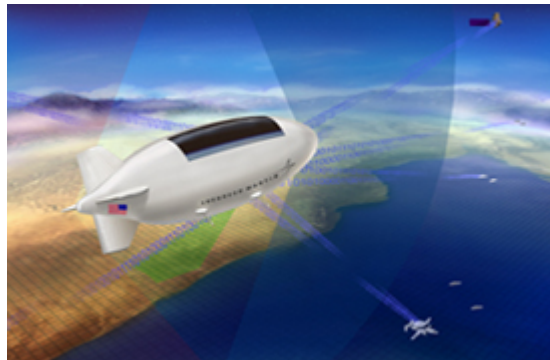
3.2 HAAS unmanned airships

a) The **ATG StratSat** Airship (20 km altitude;1month endurance; 400 kg payload)

In current development by ATG -Advanced Technology Group UK. The company negotiates with a Government in the Pacific ocean to supply 6 StratSat airships for Communications to cover all the islands in the country lacking of telecom infrastructure. The company faced last year financial difficulty and stopped its business operation but recently it was announced that the development of the StratSat continues and they expect to deliver to their customer its first full scale prototype by end of 2008.




b) The **Lockheed-Martin** Airship (20 km altitude; 1 month endurance; 150 kg payload)





Lockheed-Martin USA signed a \$ 149 Million contract with the US MOD to develop HALE (High Altitude Long Endurance) airship for military surveillance mission. R&D prototype will be flown by year 2008 and operational system will be delivered by 2010.

3.3 HAAS long endurance aircraft

a) The **Helios AeroVironment** - NASA HALE UAV (20 km altitude; 6 months endurance)



AV Configuration Comparison

 AV Global Observer (1 st production configuration)	 AV Regen Configuration (future option)
<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)



In the above picture there are given the specifications of the future option for Helios aircraft (20 km altitude) with solar – regenerative fuel cell propulsion for 6 months endurance with compare to the Global Observer UAV previously described.

There is no definite time schedule for launching the first Helios R&D prototype, depending on the availability of an operational airborne regenerative fuel cell system.

b) The Japanese HALE Airship (years endurance)

JAXA the Japanese Space Authorities have developed in years 1998 till 2004 a stratospheric airship for communications missions and 2 flight test vehicles were launched and analyzed. Presently the development program is postponed until an operational regenerative fuel cell system will be available.

4. Project activities analysis and dissemination of HAAS results

4.1 Analysis of USE HAAS activities

This analysis is intended to have a quick view on the materials presented during the USE HAAS Workshops and the Working Groups (WGs) described in Deliverable D9, and provide a first critical analysis of the results obtained in this project. First, it can be concluded that the project results are highly successful when considering the large number of 136 participants in the workshops and taking active part in discussions and providing recommendations for the formalization of a HAAS sector. Second, we decided to involve in the USE HAAS activities groups of individuals representing potential HAAS stakeholders and end-users, perhaps for the really first time, all people interested in this sector, from industry, from academia, from research institutes and from public and national authorities. Third, that solution provided an important input when the HAAS SRA was prepared and draft of it presented and discussed in the final event of the project at the second USE HAAS workshop on 7&8 July 2006 in RMA.

Finally, the objective is to present an analysis of the whole project activities including the 2 Workshops and WGs meetings, by considering presentations and a subsequent comments not only from the EU participants, but also from world leaders in developing HAAS unmanned aircraft in USA, Japan and Korea. The following analysis can be modestly classified as world HAAS identified activities and preparation of the SRA - Strategic Research Agenda for the entire worldwide HAAS sector.

4.2 Analysis of Working Groups Meetings

The analysis of the Working Groups (WGs) meetings and activities are given in Deliverable D9 Appendix 2. Hereby it is intended to summarize the objectives, the discussions hold there regarding tasks imposed by the USE HAAS Consortium and expected inputs to be provided by the WGs.

Objectives



This summary is related to working groups objectives, structure and activities. It highlights the following points:

- 1) Preparation of HAAS Strategic Research Agenda (SRA)
- 2) Structure of the Working Groups
- 3) Terms of reference

Structure of the Working Groups (WGs) and Chairmen:

WG1: HAIRSHIPS-High Altitude Airships (Chairman Bernd Straeter /Zeppelin)

WG2: HAIRCRAFT-High Altitude Aircraft (Chairman Paul Davey /QinetiQ)

WG3: HAAS Communications (Chairman Patrice Bongibault /EADS)

WG4: HAAS Security (Chairman Stefan Axberg /FHS)

WG5: HAAS Remote Sensing (Chairman Bavo Delaure /VITO)

Terms of Reference

1. To conduct current consultation and recommend structure and content for HAAS SRA
2. To participate in intended USE HAAS PMB (Project Management Board) meetings.
3. To participate in USE HAAS second workshop and present WGs attitude.

4.3 Analysis of USE HAAS workshops

This analysis gives a short summary of presentations and Round Table discussions during the two USE HAAS Workshops, presentations and discussions that are described in Deliverable D9, in Appendix 1, the 1st workshop, and in Appendix 3, the 2nd workshop.

The 1st workshop was mainly intended to disseminate to the new HAAS sector the planned USE HAAS activities and to involve in these activities as many as possible participants from the new HAAS sector including EU stakeholders and HAAS platform developers from USA, from Russia, from Japan and from Korea. At the discussions in the workshop Round Table it was made very clear that the USE HAAS Consortium is willing to cooperate with all the present and future participants in completing the tasks that the Consortium undertook in this project.

The 2nd Workshop was also the final important event of the USE HAAS project and intended mainly to: 1) to summarize the current HAAS state-of-the-art of unmanned aircraft and trends of the sector in future developments; 2) to introduce and present the draft version of the SRA -Strategic Research Agenda prepared by the Consortium and by the five Working Groups during their meetings under the leadership of the WG's Chairmen.

Professor Arie Lavie presented the HAAS SRA draft Summary (Volume 1), highlighting the technology needs for long endurance flying platforms, but also the end-users missions, their needs and specific applications which are the key objectives of the SRA activities for future mission deployment of HAAS unmanned aircraft: for Regional Earth System Observations,



for Communications services, for Emergency Operation, for Traffic Monitoring applications, for Security & Intelligence Missions, etc.

David Penn of IAI and Prof. Patrick Hendrick of RMA presented the HAAS SRA draft R&D Needs (Volume 2) regarding the flight platform with a summary of the technology roadmap.

Dr. Helmut Sues (DLR), Dr. Christian Barbier (CSL) and Prof. Tim Tozer (UoY) presented HAAS SRA draft Missions and Applications (Volume 3), with requirements for the payload and end-users requirements for variety of HAAS applications.

An important presentation was given by Geoff Bowker of the UK CAA on ATM- Air Traffic Management challenge for integrating Unmanned Aircraft into the civil airspace. Finally was a summary of recommendations concluded for the final SRA version.

4.4 Dissemination of HAAS project results

First, it can be concluded that the USE HAAS project has been considered as highly successful when looking at the number, the quality and the variety of the participants who took part in the Consortium activities, and when considering the amount of comments, discussions and feedback the Consortium has received thanks to its activities. It also helped to prepare and to review the HAAS Strategic Research Agenda (SRA) presented at the last important event in the second workshop.

Second we can conclude that the main results of USE HAAS project and of the Consortium activities are in 3 aspects:

1. The involvement of relevant HAAS sector members in the Consortium activities and the beginning of the formalization of this new sector.
2. The preparation and the acceptance of the HAAS SRA as basic document aiming to follow up and promote future implementation of R&D Needs analyzed in the SRA and to follow up implementation of conclusions and recommendations as described in paragraph 6 thereafter.
3. Analysis of the HAAS state-of-the-art by having real presentations of the worldwide ongoing HAAS projects in USA (Lockheed-Martin; AeroVironment, NASA), in Japan (JAXA, NICT), in Korea (ETRI, KARI) and in Europe (QinetiQ, IAI, Elbit and others).

Third, regarding the dissemination of the USE HAAS results, we are currently publishing in our website www.usehaas.org all the project important events, workshops and WGs activities and analysis, including the second version of the 3 volumes of the HAAS SRA. The next step in disseminating the USE HAAS results will be to publish there the final version of a HAAS SRA, to disseminate to all the participants the typed D10 Deliverable



and to invite them to participate in the HAAS Observation Platform on 16 October 2006 as described in paragraph 6 thereafter.

5. HAAS SRA “Executive Summary”

The European Aeronautical industry, including the air transport industry, is large, important and complex. It makes a huge contribution to the prosperity of Europe, both in terms of a globally competitive manufacturing sector providing goods and services, and also in terms of promoting the effective transfer of people and goods within Europe. Employment related to this industry is also very significant in Europe. It is, therefore, entirely appropriate that the work done in the USE HAAS project to develop new options for this industry by developing the *High Altitude Aircraft and Airships (HAAS) Strategic Research Agenda (SRA)* be considered, taken forward and implemented in future R&D programmes and applications in the EU.

The HAAS SRA consists of 3 volumes: Volume 1 - *HAAS SRA Summary*, Volume 2 - *HAAS SRA Research and Development Needs*, Volume 3 - *HAAS SRA Missions and Applications*. Preliminary analysis of the needs of the HAAS sector and associated applications indicate that an estimate of up to €billion will be required for investment in relevant research in the next 15 years fully to fulfil European HAAS sector needs. This investment is envisaged as being provided by institutional organisations like the EC, national governments, regional authorities and by industrial stakeholders. It is expected that annual incomes derived from deployed HAAS systems providing communications, security, civil monitoring and Earth system observation services will exceed the €billion level and this estimated revenue justify the cost effectiveness of the required investments.

This HAAS Strategic Research Agenda intends to be similar to the ACARE SRA prepared for the air transport industry, but it also tries to extend it in important ways that include the relevant applications. It widens the range of situations that are considered by recognising the need to identify a number of scenarios. Their technical implications are considered through a series of focused High Level Target Concepts (HLTC) that emphasise a variety of aspects to create pools of technology for deployment to whichever future scenario actually develops. Some of these technologies will need to establish a breakthrough in their ability to provide substantially increased performance that cannot come from evolutionary progress. With so much to do, all of these features underline how the sense of challenge and excitement of the potential HAAS industry will extend well into the 21st century.

The HLTC deal with a wide variety of issues each related to the overall objectives of the HAAS SRA initiative which are to meet society’s needs and to establish a world leadership position in competition in the global HAAS sector. These twin objectives are inseparable and are both fed by such issues as competitive responses to the problems of congestion and environment.

To achieve the economic and social aspirations of Europe requires that success in world markets be achieved. Each of the situations considered needs a development and acquisition of suitable technology for the new HAAS sector and its exploitation to deliver its benefits.



However, not all of the required technologies will be new. Much of the work will be devoted to bringing together existing technologies in the USA and elsewhere to achieve new solutions that deliver new experiences to the ultimate stakeholders in the HAAS industry and end-users of Europe. This will require extensive demonstration and validation in operating conditions to meet the demanding safety and environmental constraints on the HAAS sector, and to reduce commercial development risk. Technologies will need to be provided not only from the aeronautical sector but from other sectors of importance as well, such as the ICT, the Space and other relevant to the HAAS sector industry. This will present new challenges.

Not all that needs to be done lies within the grasp of the industry. Some issues are really fundamentally public in nature (disaster management, security, safety etc) and deserve both attention and funding from the public sector. Matters of regulations for HAAS civilian deployment and policy depend on governments. The establishment of new mechanisms for collaboration, for sharing public funding and for HAAS research works to be stimulated also depends on government action in the member states and in Brussels. These mechanisms and priority actions are identified in this HAAS Research Agenda.

The HAAS Research Agenda describes in outline a set of technical activities that is essential to sustain and extend the vast high altitude and stratospheric flight transport and missions industry. The challenges in deploying HAAS are increasing in number and in scale. Some of the issues are of fundamental public and government concern, such as environmental hazards and disaster, homeland security, safety and social impact. The social needs of citizens are, in their broadest sense, matters for government. But there are also matters that are wholly or mainly for the industry to solve: sustaining competitive abilities, increasing the efficiency of collaboration and improving the end-users experience. All of these matters, both public and private in origin, need to be taken forward more forcefully.

In identifying the next steps the HAAS Strategic Research Agenda is aiming to promote the establishment of an organized HAAS sector equipped with respectable SRA and to facilitate greater European HAAS stakeholders efficiency in research&development of HAAS aircraft and encourage better links between industry and a collaboration with end-users, by analysing the market potential on matters of HAAS missions and applications. Finally it is proposing actions that will lead to the establishment of important European repository of HAAS know how and prospective applications, and act as a centre for new research and development of the issues involved in the HAAS SRA.

This HAAS SRA makes more concrete some of the recommendations and considers their wider implications. There is some urgency to begin the implementation of the proposed R&D activities and associated HAAS applications recommended in this SRA, in order to provide future monitoring progress and further recommendation to be developed in the HAAS sector.



6. Conclusions and Recommendations

6.1 Conclusions

The main achievement of the USE HAAS project is that it succeeded to determine and to initiate the launching of the HAAS sector equipped with the HAAS SRA-Strategic Research Agenda proposed in Deliverable D6 that includes the Research and Development Needs for developing the HAAS platform, and the determination of prospective HAAS Missions and Applications.

The main conclusion derived of the USE HAAS study is the need for establishing a Forum to follow up the activities in the HAAS sector to implement the recommendations of the HAAS SRA and to promote the legalization of necessary regulations for current deployment of HAAS unmanned aircraft for civilian applications. As recommended following such a Forum is an HAAS Observation Platform (HAASOP) to include major HAAS stakeholders, relevant industries, research institutes and end-users.

Following are the related recommendations.

6.2 Recommendations

In the following Appendix are listed the main recommendations of the USE HAAS study:

1) Proposing projects to be included in FP7–Aero-1 related to the HAAS sector members:

- Alternative Energy Hybrid Propulsion for Air Transport
- Improving Air Traffic Management by using HAAS
- Coordination Action USE HAAS follow up projects

2) Invitations for the first HAASOP meeting on 16 October 2006 in RMA with a Preliminary Agenda. In this meeting the participants will discuss the objectives for creating a partnership of members of the HAAS sector to follow up the conclusions of the USE HAAS study.