# THE EUROPEAN SPACE POLICY AND RESEARCH ACTIVITIES

*On the occasion of the Plenary Session "Space Agencies Forum", 11 September morning, Dietrich Knoerzer,replacing Jean-Jacques Dordain, Director General of ESA, obliged to attend a meeting in Paris at this date, presented the European Space Policy Key Messages.*


– The European Commission has adopted the European Policy Document,which reflects the key strategic importance that space systems and space applications have for Europe.
– It is a joint policy document of the European Commission and the European Space Agency.
– On 22 May 2007,it was presented to the Space Council,a joint meeting of EU and ESA Councils.The Resolution shows for the first time their strong political support at European level.

**Some key-points and figures concening Space in Framework Programme 7 (FP7)**


*Draft Annual Budget:Commitment profile 2007-2013*

- **€ 1.4 billion for FP7 Space theme;**
- **About 85 % for GMES(Global Monitoring for Environment and Security), i.e. € 1.2 billion , including for dedicated space infrastructures;**
- **About 15% for strenghtening space foundations and cross-cutting issues.**

## Some words about GMES

- GMES is the next EU flagship for space after Galileo. It is an EU-led initiative in which the Commission will manage actions for identifying and developing services relying both on *in situ* and remote sensing data whilst ESA will implement the space component.
- Successive actions:

– R and TD, aimed at supporting the development of new capacity where needed and at exploring condition for long-term sustainability;
– Development and validation of pre-operational GMES services, starting with the Fast Track Services, followed by other pilot and downstream services;
– Integrating Earth Observation with Satcom and Satnav technologies;
– Support to the coordinated provision of data (space and *in situ*) for related projects in FP7;
– Development of dedicated space infrastructure for GMES.

- Indicative breakdown of the total amount of resources (€1.2 billion): about 30% foreseen for projects on service development; about 10% foreseen for data procurement, both space-based (ESA)and in situ;about 45 % foreseen for developing space infrastructure (ESA).

## Some words about Strenghtening Space Foundations

- The objective of this budget chapter is to provide opportunities for those actors and activities which are currently not catered for yet at ESA or national level,thereby adding value to these: support to research in space science and exploration;new concepts in space transportation,space technologies and critical components;research into reducing the vulnerability of space-based systems.

Timing of the FP7-Space-2007-1(about 134M€):
- November 2007:start of negotiations;
- Early 2008:first set of grant agreements signed;

Future calls for proposals:
- Biannual Space research calls :2009,2011,2013.

• Potential topics: GMES; Space science and technology; cross-cutting activities (international cooperation, cross-border coooeration and ERA-NET).

## SPACE TECHNOLOGY FORUM

*During the Plenary Session "Space Technology Forum" which took place on Thursday 13 September morning, three speakers expressed their views concerning the future of space: François Auque – CEO, EADS Astrium Satellites ; Evert Dudok – CEO, Astrium Satellites, chairman of the managing Board, EADS Space Transportation ; Michel Fiat – CTO, THALES Alenia Space.*

### The keynote speech delivered by François Auque

*Among the main messages addressed to the audience, were the following :*

• **Space industry evolution**

« (...) evolutions for space industry will mostly be a direct consequence of Government's ambitions today. It is difficult to quantify the magnitude of space services that will be available from Galileo, GMES and Military space systems but infrastructures have to be built now if we want to deliver services in a near future. (...) I am concerned for Europe when I see the magnitude of efforts from the US and today from Russia as well, for developing space infrastructure, in particular in the field of Security and Defence, and in parallel the efforts of countries like China and India with similar space ambitions than Europe had 20 years ago. I am concerned when I see the growing gap between the range of key applications of space to support space policies in different domains like: Environment, Climate change, Information Society, Transport, Security and Defense, Research (in line with the Lisbon Agenda) and the difficulties from Member States to take decisions and to allocate the necessary support for putting in place the infrastructure neeed for such applications.
**One of our big challenge for the years to come in our space domain is to have our stakeholders (Governments, Parliamentarians, Armed Forces) to decide now for results which will be seen in ten years, or more, from now.**

• **The ASTRIUM Corporate approach to prepare the future**
Four ideas: Efficiency, Duality, Cooperation, Services.

**– Efficiency is a preliminary condition to prepare the future. This will be even more important in the years to come for Security and Defense**
(...) In 2000, european space industry had to face the end of the Internet dream, the technical difficulties of Ariane 5 and the emerging launchers competitors, mainly coming from Russian products (...). In less than 3 years, EADS has completely restructurd its space sector, with a heavy rationalisation of its competence centers in Europe. (...) As a result, Europe has regained market shares in the field of launches with Ariane 5 successes, in the field of Satcoms (...) and of our Astium E/O exports (Thailand, Algeria, Korea, ...).

**– Duality is a reality and a chance for end users**
The first duality is between Defence and Civil applications of space. (...). Duality exists as well in services. (...).
This brings us to another duality: the duality of the markets between institutional and commercial customers. Arianespace is a PPP, a Public Private Partnership. Interests and duties of institutional: I mean governments, and of private industries such as EADS are merged in Arianespace. Through this PPP, the government sharing the cost of autonomous access to space with private users/operators, we obtain a guaranted return of high value work in contributing countries, when industry provides a reliable and competitive launcher thanks to increased production rates to satisfy the commercial market (...).

**– Cooperation : space is a vehicle for international cooperation today and for the future**
(...) with the creation and development of Astrium, we integrate space activities in five countries: France, Germany, UK, Spain and Netherlands, completed with long lasting industrial partnerships in Italy, Sweden, Belgium, Switzerland... and the ability to combine national assets is a real chance for Europe. (...).
In Europe we have 3 challenges ahead of us, which will be key for the next twenty years: to enlarge the cooperation to European new comers and future partners; to develop the space european cooperation for security and defence; to remotivate our governments on the strategic and economic importance of space systems (...). Another aspect is the cooperation between Europe and other countries. I can mention of course the cooperation with US for the ISS. Missile Defence could be an area for transatlantic cooperation, at least through NATO. GMES as an element of GEOSS is another opportunity. Cooperation with Rusia is not new, in launchers through our subsidiaries Starsem, Eurockot, and EADS has enlarged the cooperation in satellites through a

subsidiary, Synertec with a Russian partner-RNII KP-. Our successful cooperation with ISRO for pooling our competnces for small satellites is already a success with two orders: Eutelsat-Hylas. Definitely Europe and the European industry will reinforce their cooperation with the rest of the world in the coming years. This is the only way to have access to institutional markets.

**– Services :the future of Space lies in a large extent and more and more with our ability to deliver services to the end user**
As existing examples: imagery, launchers, astronaut training, several exploitation activities associated with the ISS. But we had to go a step beyond to bring more added values to our customers.This is what Astrium is successfully doing with Paradigm (Paradigm mechanisms: international competition, negotiation on new parameters-service, finance, insurance, third parties, customer's satisfaction). As a result through Paradigm, we: contribute to public spending savings (best value for money); give the customer full benefit of "state of the art" systems;open the door to new services (Astel 5-Willfare); give our industry new market perspectives.

## The keynote speech delivered by Evert Dudok

« The approval of the European Space Policy in May 07 under the German EU-Presidency is a real step forward for the definition of the role of Europe in space, which is now in line with the European political and economic power.
Space is an important issue on the world market, and it will become even more important in the future because of new applications in the civil, environmental and security area.
With the 5.5 b€ per year for space, Europe is still keeping a strongposition in the world.

**It is "harvest time":**
– Columbus and ATV launch in the next months, start of scientific activities on the ISS ;
– The ESA science programme can be considered as a top extraterrestrial programme in the world (Titan Landing, Mars- and Venus-Express) ;
– Very good performing ARIANE 5, Soyuz in Kourou is coming 2008/09 ;
– Excellent meteorological capabilities with EUMESAT (Meteosat, Metop) ;
– Outstanding earth observation instruments like the radar Satellites TerraSar and Cosmo ;
– Competitive European satellites in the world telecom market.
– On the institutional side:
• "Space" in explicitly mentioned in the new treaty of the European Union!
• Increasing budgets in Germany

**The imperative tasks for the next 5 years:**
• Bring Galileo into orbit; based on the pre-development of the first 4 satellites.
• Further implementing the GMES-Missions: National Missions, ESA-mission and Eumetsat-mission with strong financialsupport from the EU; startingwith the core services in 2008 (I think that we have to be more explicit on the importance of having a permanent funding from EC to maintain the necessary infrastructures and another role for them is to act for better federating the public demand).

**The challenges for the next 10 – 20 years:**
The ESA-Ministerial conference in 2008 as well as the French EU presidency in the second half of 2008 will send out a strong momentum for this period:

**❶ The urgency of global action with regard to climate change. Space supports very effective**
– Weather forecast for 10 days.
– Global fire detection around the world (within a few minutes).
– Disaster warning (storm, flooding, earthquake, ...).
– Environmental monitoring (Kyoto).
– Detection of resources (natural resources).

Cooperation of all space nations is necessary!

**❷ The increasing threats to global security**
– In Europe we have started to built up reconnaissance capabilities on national level (SarLupe; TerraSar, Cosmo; Helios, Pleiades)
– After the step of multinational cooperation (Musis, optical/radar) Europe and the EU will have the necessary number of military satellites to play its role in the world. Already 2008 we will have 10 to 15 military satellites in orbit. (can we be more precise will it be 10 or 15?)
– What is at stake is to increase the European cooperation and to pool these capabilities in order to build a stonger service offer to our Armed forces. This has to be both as a tool for strategic intelligence to prevent crisis and a tool to support the operations during the crisis.

**❸ Exploration of the solar system**
– European robotic missions to moon and Mars, landing and sample return
– Moon will be the first step, scientific missions with landing on the moon brings:
• Excellent scientific outcome
• High technological spin offs
• Fascination of the young people (motivation)

**❹ Manned Space Transportation**
– Europe will have an autonomous access to space for man

space missions. Possibly ARIANE-5 as launcher can be fitted for that
– This will be a political decision from member states and EU and this could start with those countries which have already developed key competences in this domain.

**Within the next 20-50 years:**
- Space tourism (more than one week in orbit)
- European woman/man on the moon

## An adapted version of the keynote speech delivered by Michel Fiat

### Thales Alenia Space and the Satcom Market

« In 2007, two years after the merger with Finmeccanica. Thales replaced Alcatel as a shareholder. Thales Alenia Space is now a joint venture between Thales (67%) and Finmeccanica (33%), along with our "sister" company Telespazio, in which the ownership shares are reversed.

There has been no change in the organization of the former Alcatel Alenia Space; the new Thales Alenia Space is a business group of Thales.

Together, Thales Alenia Space and Telespazio form a space alliance that offers the space solutions expected by end-users, based on a comprehensive, well-coordinated approach. Telespazio focuses mainly on satellite infrastructure operations to support operators, as well as providing satellite services to end-users.

Thales Alenia Space is a major space systems manufacturer with extensive vertically-integrated expertise, from turnkey system prime contractor to strategic equipment supplier.

Our convergence plan is on track. We are in an excellent position to leverage dual civil/military market opportunities by drawing on the Thales group and coupling space and terrestrial solutions for telecom applications. From this standpoint, Alcatel-Lucent has significantly increased its stake in Thales, allowing to continue our cooperation, as reflected in our joint venture for mobile TV.

Our footprint is clearly European. We operate 11 industrial plants, with a major presence in France and Italy and very active subsidiaries in Spain and Belgium.

### Market position

Thales Alenia Space's market focus is clearly on integrated applications, or "systems of systems". We couple space-based solutions with new applications for mobile TV, high definition TV, digital audio broadcasting (DAB), advanced broadcasting, local services and low-cost universal rural telephony.

The commercial market is strategic for the company, although 60% of Thales Alenia Space sales are generated by government contracts. But unlike US industry, we cannot afford to rely solely on government programs. The commercial market is therefore of strategic importance to Thales Alenia Space, which will continue developing its business in this market.

### Number 1 in 2006

Thales Alenia Space led the world in satellite orders in 2006, signing contracts for eight geostationary satellites plus 48 second-generation Globalstar satellites. In fact, European industry won half of all orders worldwide in 2006, thanks to tremendous efforts to enhance competitiveness to overcome an ever-weaker dollar.

Thales Alenia Space is deeply involved in a number of European government missions. In space science and exploration, for instance, we are prime contractor for the ambitious Exomars mission design, Goce, Hershel-Planck and part of the Cassini/Huygens mission to Saturn and Titan. In satellite navigation systems, Thales Alenia Space is prime contractor for Egnos, and is playing a key role in Galileo.

Thales Alenia Space is also an acknowledged specialist in meteorological and oceanographic systems and satellites, through Meteosat / MSG and the Jason series, as well as radar and optical observation systems, including the first Cosmo SkyMed satellite launched successfully this past summer. In the defence sector, Thales Alenia Space is involved in a number of communications and observation satellites and systems, including major programs such as Syracuse 1, 2 and 3 in France, Sicral in Italy, and a participation in Germany's SarLupe satellites.

The other major business sector for Thales Alenia Space is orbital infrastructures and transportation, with a major role on the International Space Station. Our plant in Turin, Italy is supplying fully half of the pressurized volume on the ISS, including the MPLM, nodes 2 and 3 and Cupola. In addition, it is making a significant contribution to the Columbus laboratory and the ATV cargo vessel.

### Market trends

Market conditions today are robust, and the recovery that started in 2006 is continuing in 2007. We are expecting a steady stream of orders, which should stabilize at about 20 satellites a year for at least the next few years.

Looking beyond this short-term view, we can't just extrapolate from current trends. We must consider how changing conditions around the world will impact the development of space business, while assessing whether the requested applications are technologically feasible and affordable.

Many different approaches are possible, but there are certain key geopolitical factors.

Space has always involved cooperation, and this is not going to change. But there are two opposing trends – strictly national policies, versus international or regional cooperation – and this will certainly impact the development of space business.

Socio-economic factors should be considered in conjunction

with geopolitical factors. The expected growth will largely depend on the degree of liberalisation and international cooperation, more specifically with developing countries.
Last but not least, environmental and energy issues will have a direct impact on the level and focus of research investments. This in turn has a significant effect on technology development, especially in the following areas:

- space exploration & science
- civil space infrastructure
- commercial space
- military applications and commercial spin-offs.

However, we cannot afford to wait for a definitive answer to these questions. Given the uncertain situation, we have to maintain our flexibility.

### Driving flexibility

Operators today want to deploy a complete range of satellites to address a variety of markets across a variety of frequency bands. Thales Alenia Space of course offers a very large portfolio of solutions addressing all of these needs.
For the time being, we still consider that there are several main drivers to support this flexibility.
First, pursue Thales Alenia Space's "multi-market" approach, to be able to draw customers from three space sectors, namely commercial, civil and military.
Civil (government/state agency) and military markets are less sensitive to general economic conditions. They are characterized by national procurement policies with industrial "champions" and strong R&D policies with preparatory programs (conception, design preliminary developments). There are also certain constraints, especially with ESA rules on geographical "fair return", which imposes worksharing and does not always lend itself to optimizing industrial capabilities.

Nevertheless, in Europe the civil and military markets alone are not enough; we are far from a US model where major companies can stick to this market. In consequence, the commercial market continues to play a strategic role, and the two markets must co-exist. The commercial market is characterized by open competition on price and performance (and track record), and there is obviously no R&D support from customers.
Second , Thales Alenia Space believe that the increasing civil demand for security, improved environmental monitoring, traffic management and responses to natural or man-made disasters can and should be anticipated through a multifaceted approach:

- coordination at government level;
- increasing expertise in systems of systems and embedded security (software applications);
- investing in basic technology to support this increased need for security.

Thales as a group has strong assets in these areas and will actively support these initiatives.

In short, a dual approach should be key for Thales Alenia Space, based on the management of different objectives and drivers to foster fruitful cross-fertilisation: civil / military, commercial / governmental, national / export, fixed/mobile and sat / terrestrial, as reflected in our recent joint initiative with Alcatel on mobile TV.
This dual approach will help grow the market, identify innovative project funding methods, and support the spread of technologies.

### Current market for satellite systems

The open market for satellite systems in 2007 is estimated at slightly over ?12 billion, with a product mix very similar to Thales Alenia Space's own sales distribution. In term of growth, we expect the following over the next 10 years:
- an almost flat commercial market:

- with replacement of existing satellites in a smarter (more flexible) way;
- mobile and HDTV development.

– 5% average growth in the civil and military markets, driven by:

- US exploration programs;
- higher ESA/EU contribution;
- ambitious space programs in China, Russia, India and Japan;
- milsatcom systems
- surveillance & reconnaissance and navigation programs.

However this expected growth will only be realized if European governments are willing to invest more in space.
Recent launcher losses will certainly increase insurance premiums, launch prices and launch manifest congestion, as well as shaking industry confidence. Even though insurance brokers remain optimistic that the market can absorb these losses, we do need to offer a complete value chain competitive with terrestrial solutions – but these solutions keep boosting their own performance and innovation.
To maintain and develop its business, space has no choice. We must:

- reduce costs
- add value to services
- create and develop new applications.

Cost reduction has to be a shared effort among all players. On the satellite side, Thales Alenia Space believes in the need for strategic partnerships to provide components or subsystems. The aim is to develop these as increasingly interoperable commodities, while focusing our efforts on key differentiators.
The recent Globalstar II contract awarded to Thales Alenia Space proved the effectiveness of a design-to-cost approach. This was based on a concurrent design phase involving the end-customer and prime, all the way down to low-tier suppliers, combined with an aggressive global selection of best-in-class suppliers.
In this quest for competitiveness, we must not forget the need for plug and play user terminals, offering high performance at low cost.

**Applications**

Before addressing technology issues, we should take a closer look at the applications that will shape the future of space. In my view, besides specific military needs in the short/medium term, space applications will remain focused on the following:

1) Navigation, since the increasing mobility of people and goods demands major infrastructure upgrades for air transport, road transport and public transport. Space will undoubtedly play a key role in several critical areas:
– fleet & traffic management (air, road, sea, space);
– location based services (information and navigation services, tracking services and network-related services to improve communications access);
– search & rescue (for emergency assistance).

2) Earth observation: space still offers unrivalled "big picture" capability, even as it is challenged by alternative technologies (unmanned vehicles in particular), in addition to its traditional role in military C3I systems, (communication, command and control, intelligence). A wide range of civil applications are called on by public organisations:
– environment (meteorology, natural disaster prevention, oceanography, etc.);
– land services (farming, urban planning);
– exploration and management of natural resources.

3) Telecommunications, undoubtedly the market segment most challenged by terrestrial alternatives. But demand for mobile and remote area communications should remain high and space can capitalize on excellent assets.

The growing cost of transportation should also open several application markets to space systems, including distance learning, telemedicine and bridging the digital divide.
An increase in broadband demand will certainly spill over into space applications, for multimedia entertainment or e-commerce.

Looking further ahead, the trendy new market of space tourism will depend to a great extent on economic growth and the ability to reduce the cost of access to space while guaranteeing high reliability.
Scientists will continue experiments in space, but space borne production remains a highly hypothetical proposition.
In short, the outlook is positive, but nothing can be taken for granted! »

# THE ESA IXV PROJECT

PAVING THE WAY TO FUTURE SPACE TRANSPORTATION

## Backround

The industrial activities related to the Intermediate eXperimental Vehicle (IXV) started in early 2005, when the co-existence of several ESA and national activities on re-entry and the sensitivity of the re-entry subject in Europe necessitated special effort to allow the creation of one single ESA project able to federate the consensus of the largest number of Member States.
A thorough trade-off was performed among several ESA and national existing concepts for re-entry in-flight experimentation with respect to shared requirements, including: experimentation (i.e. technology and system related), programmatic (i.e. technology readiness levels, development schedule and development cost) and risk mitigation (i.e. design feasibility, maturity, robustness and growth potential). The result of the trade-off led to the down-selection of the lifting body concept based on the extensive national (CNES: PRE-X) and ESA (AREV: Atmospheric Reentry Experimental Vehicle) efforts done and results available.
Therefore, the very early phases of the IXV project were structured to allow the utilization of data coming from national programmes but still ensuring one single ESA project file coherent with ESA technical and programmatic objectives and in line with ESA standards for project implementation (i.e. project phasing, reviews, documentation, design and development methodologies).

## Mission and System Aspects

The IXV is a lifting body hypersonic experimental vehicle, to be launched and injected on a reentry path by the ESA VEGA Launcher via a suborbital equatorial trajectory, landing on the Pacific Ocean.
The primary objective of the IXV project is to serve as a system demonstrator for re-entry missions, covering all project phases, from requirements derivation to design, to manufacturing and integration, to flight. Furthermore, it provides a key opportunity to verify in flight critical reentry technologies performance, to collect precious aerodynamics and aerothermodynamics data and to derive flight dynamic data via specific vehicle model identification (VMI).
For this reason the IXV will be equipped with various instrumentations addressing the main experimentation objectives including:

- Thermal protections and hot structures in-flight performance verification;
- Aerodynamics and aerothermodynamics in-flight data collection;
- Innovative technology in-flight experimentation (i.e. thermal protection and techniques for health monitoring and GNC).

With respect to the overall project, one of the major driving requirements is the adoption of the design-to-cost approach, leading to several constraints such as:

- Proto-flight approach with dedicated qualification models for critical S/S;
- Maximum use of COTS for all technologies not part of the IXV experimentation objectives;
- Simple architecture, but guaranteeing the necessary mission success requirements;
- Possible re-use of existing Software.

## Reference Mission Scenario

The IXV reference trajectory was selected as the result of extensive trade-offs performed for several sea and ground landing options and the following main constraints for the re-entry leg:

- De-orbit maneuvers to be performed by last launcher stage with debris fall-out occurring in ocean or safe area;
- Safety of whole trajectory, with re-entry flight not over populated landmasses and probability of loss of human life (population flown over) less than $10^{-7}$;
- Representative aero-thermal-mechanical re-entry environment for technologies verification and experimentation.

The trade-off led to the selection of the sea landing equatorial trajectory to minimize risks on safety (flight over non-populated areas) and to maximize launcher performance and, therefore, budgets for on-board experiments.

After launch from Kourou, the last stage of VEGA, will inject IXV on an equatorial (5 deg inclination) suborbital path (apogee about 500 km) towards the following targeted re-entry gate interface conditions:

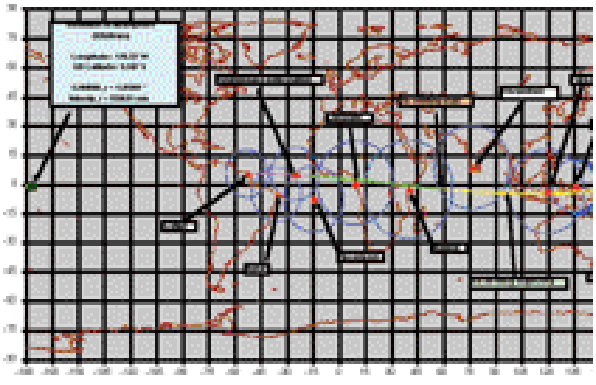

*Figure 1. VEGA reference trajectory - ground track*

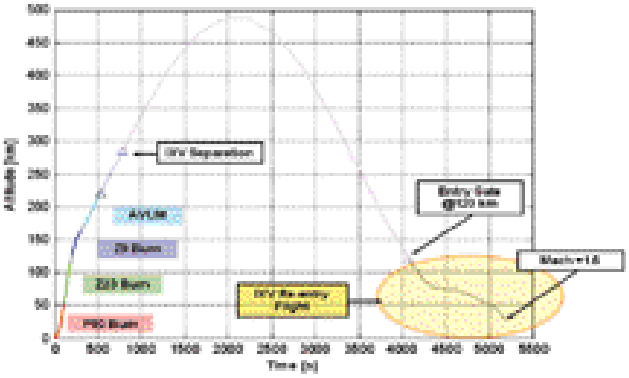

*Figure 2. IXV reference trajectory-height profile*

- Altitude h = 120 km;
- Relative velocity = 7.5 km/s;
- Flight Path Angle = -1.5°.

Once in the atmosphere, the IXV will be autonomously controlled by the combination of aerodynamic surfaces (FLAPS) and reaction control system jets (RCS), employing a hybridized inertial/GPS system for the determination of its state (position, velocity, attitude and rate).

It will take about 20 minutes and 7500 km of down-range from the re-entry gate to reach Mach 1.6 point (end of experimentation).

Once the Mach 1.6 interface is reached at 30 km altitude, a supersonic ribbon drogue chute will be deployed to slow down the IXV while ensuring flight stability through the transonic regime. Then, at Mach 0.3 at an altitude of 10 km, first a subsonic ribbon drogue chute and subsequently, at 3.2 km altitude, the main parachute are deployed to slow down the IXV to the final landing touch-down velocity of 6 m/sec.

The IXV will be able to float by itself; however two flotation devices will be deployed for backup purposes. The IXV will then be recovered and transported back to Europe to ground AIV facilities for post-flight inspection and analysis.

During the whole trajectory (ascent, coast, re-entry and landing) the IXV will be continuously tracked from various ground stations which will also provide the means to download the important vital and experimentation data in real-time.

## Vehicle Performance and Subsystems

The consolidated 4.4 m long IXV aerodynamic shape with lift/drag = 0.7 results from a detailed management of several design requirements, including maximization of the internal volume to ensure the vehicle layout feasibility and compliance with MCI constraints.

Detailed and accurate aerodynamics and aerothermodynamics databases are essential to perform key design and analysis tasks at system and subsystem level, such as flying qualities analysis, TPS sizing activities, and so on. For this purpose extensive computational fluid dynamics (CFD) computations (Euler and Navier Stokes) have been performed and will be perfor-

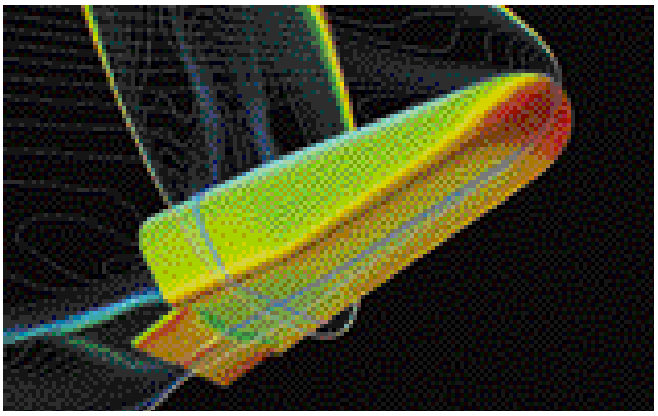

*Figure 3. CFD Flowfield around the IXV aero-shape*

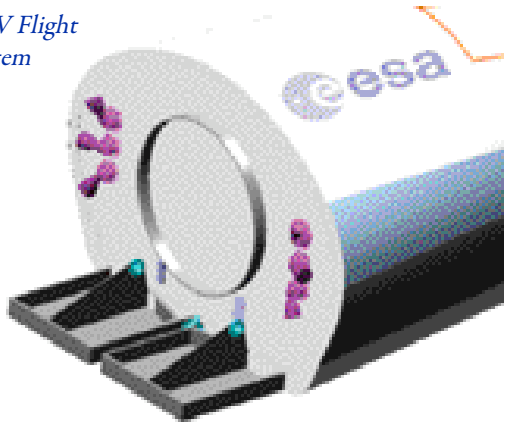


*Figure 4. IXV Flight Control System*

med continuously along the project development phases to support the different design loops, as well as extensive wind tunnel testing campaigns in a variety of European wind tunnel test facilities. The flow regimes cover hypersonic down to transonic speeds.

The In-Flight Measurement System will be responsible for collecting and distributing the various measurements needed to fly the vehicle and to meet the experimentation objectives.

## Conclusions

The development and flight experience of such an integrated system will provide Europe with relevant know-how applicable to several space fields in addition to reusable launchers, such as sample return missions, crew transportation, atmospheric planetary entry missions (Mars, Venus, ...), non-atmospheric planetary and interplanetary entry missions (Mercury, Moon, NEO, ...), space tourism.

With the objective to identify to which extent the IXV flight experience is contributing to the increase of European know-how for space applications other than future launchers, a detailed exercise was carried out by ESA with its results presented in the table hereafter.

Although the level of compliances might appear subjective, the strategic importance for Europe to advance in such critical re-entry domain is evident.

On the industry side, activities are running at full speed and heading towards key review milestones, such as System Requirements Review in December 2007 and Preliminary Design Review in August 2008.

On the agencies side, while the industrial activities are running, the highest priority is given to the successful completion of the harmonization process with national programmes, targeting:

- the integration of the CNES / PRE-X national data into the IXV project file for the mission similarities, ensuring consistency in the IXV design loops, with the objective to have a more consolidated IXV phase-B end design file leading to a potential reduction of phase-C/D cost for development and risk provision;
- the integration of national technical expertise from ASI / CIRA, CNES, DLR in the current IXV project team, with the objective to set-up a solid European team ensuring proper project implementation and follow-up to flight.

| | SPACE APPLICATIONS | | | | | |
|---|---|---|---|---|---|---|
| | Reusable Launch Vehicles | Sample Return Missions | Spaceplanes/Space Tourism | Crew Transportation Vehicles | Atmospheric Planetary Entry Missions (Mars, Venus,..) | Non-Atmospheric Planetary Entry Missions (Moon, Mercury, NEO,..) |
| GNC | X | x | X | x | x | x |
| VMI | X | X | X | X | X | x |
| HWD experiments | X | X | X | X | X | x |
| TPS | X | x | X | X | x | |
| HSD - ATD | X | X | X | X | X | |
| HOT STRUCTURES | X | x | X | X | x | |
| RCS | X | X | X | X | X | X |
| PARACHUTE | x | X | x | x | X | |
| AVTECHNIQUES | X | X | X | X | X | x |
| OPERATIONS | X | X | X | X | | |
| SAFETY | X | X | X | X | | |
| STANDARDS | X | X | X | X | | |

LEGEND:
X = Fully Compliant
x = Partially Compliant

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