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Augustine Committee : Review of U.S. Space Flight Plans Committee

**Statement by Jean-Jacques Dordain, Director General of
the European Space Agency**

Mr Chairman and Members of the Committee,

Thank you very much for giving me an opportunity to make a contribution to your Committee.

This hearing is timely, since for the first time in the history of the ISS, we have on board a crew of six made of five nationalities = the five partners are together in orbit, not only with hardware but also with astronauts living and working together in orbit, as we are working together on ground since 20 years.

This is just a fact which should inspire our reflexions = there is not anymore, for any of the five partners, a separate human space flight programme. We have all together one human space flight programme shared among five partners. Obviously, ESA cannot have a separate human space flight programme since we are dependent on USA and on Russia for transporting our astronauts, but even though NASA and Roskosmos could have a separate programme, they have not.

And this is the reason why I am attaching a great importance to the hearing of today because your conclusions may have an impact on our own plans, but also, I hope, our inputs might have an impact on your conclusions.

I thank Mike O'Brien to have sent me four questions of interest for you and I shall start by answering your questions, it being understood that I am ready to answer any further question you may raise, either today or at a later stage.

I have not prepared a presentation of the European Space Agency, its programmes and activities.

However, I would like to underline three characteristics of ESA which could explain the common aspects of my answers and remarks of today:

The European Space Agency has today 18 Member States which, according to the ESA Convention, pool their resources for developing space systems for both science and applications to the citizens. This means that the overall ESA activities range from Science of the Solar System and of the Universe, Science of the Earth and its environment, Life Sciences, Physical Sciences to operational meteorology,

operational services for Environment and Security, operational navigation systems with Galileo, without forgetting the activities related to the guaranty of access to space and the development of competitive technologies, in particular for telecommunications. As a result, human space flight activities in ESA represent a maximum of 15% of the total ESA activities. And Member States have never decided to increase their contribution to human space flight activities to the detriment of science and services to the citizens.

This balance between different type of activities = science, applications, innovation, launchers, human space flights is organised and even protected by the fact that there is not one ESA programme and one ESA budget, but as many programmes as type of activities. And each development programme is subject to one legal decision through which the Member States participating to that programme are committed up to completion of that programme (within the limit of 120% of the planned budget). This process makes the decision difficult, but provides a robust basis to all individual programmes of ESA once the decision is taken. This is the reason why ESA is the most reliable partner in the world.

If there is one topic on which ESA can teach the worlds, it is about international cooperation. International cooperation is our daily life: 18 countries of Europe cooperating within ESA and cooperating with all space powers in the world, starting with NASA which has been a partner since the start of the mother organisation of ESA (ESRO born in 1964), with Canada which is not only an international partner but also associated to ESA, i.e. contributing to some ESA programmes, with Russia, with Japan, with India, China... We know how much cooperation is difficult, but we know how much cooperation is successful. It is always easier not to cooperate, but always more difficult to succeed alone.

With this background, let's move on to your questions.

1. **What has ESA learned from the ISS partnership?**

The partnership is the most important asset of the ISS, which will live much longer than the hardware in orbit.

The ISS partnership is an operational "G5" working everyday to reach common objectives.

This is a very solid partnership because it has been built-up through a long list of problems (technical and financial) that we had to overcome together and even drama (the worst being the loss of Columbia) that we had to face together to reach a common objective = completing the assembly of the ISS and maintaining a permanent human presence in orbit.

ISS today is already a success, a technical, operational and management success, a fantastic success based on partnership.

The first lesson of this partnership is the interest of keeping a partnership open to new partners = the partnership has moved from the original four of Space Station Freedom to five in 1993, when the four partners: USA, Canada, Japan and ESA sent a collective invitation to Russia for joining the partnership. 15 years later, we know that, without Russia after the Columbia tragedy, the ISS would have collapsed.

Now, and just because the partnership is so solid, we can and we have to draw together the lessons learned coming from our common experience onboard ISS, in particular on what we could do better in future endeavours. I was the one among the ISS Heads of Agencies to propose to share the lessons learned and the exercise is on-going.

I would have preferred therefore to present today an already collective set of lessons learned, but I can tell you which points must, in my view, be investigated for improvements:

- a) Need for redundancy in key functions, in particular transportation functions. The US Space Shuttle has been a single point failure, in particular for transporting modules of ISS during the assembly phase and for downloading significant masses from the ISS to the ground. When the Shuttle was grounded, all elements of ISS were grounded. Interdependency should not mean therefore lack of redundancy.
- b) Need for full standardisation = interdependency requires standardisation of interfaces, which could not be fully achieved for ISS operation.
- c) Need for balancing utilisation, assembly and maintenance activities from the start of the programme. The choice which has been made (which was maybe the only possible scenario after the Columbia tragedy), to concentrate all operations towards assembly, postponing therefore utilisation after completion of assembly, has pushed the benefits very late in the programme and created a gap with the user communities.
- d) The evolution of partnership from Freedom to ISS, as well as the sequence: assembly first, then utilisation, has extended the programme into a very long period, with no intermediate, concrete and visible, milestones which could have focused the teams on shorter term objectives and could have attracted the attention and interest of governments and public. The only significant milestone is assembly complete which has moved continuously for a long time.
- e) The last improvement that we could bring for future endeavours is to associate the public from all partners to such programmes.

2. What is the European Space Agency's interest in continuing the ISS programme and why?

First of all, as I said above, the ISS programme has been sequenced in two successive periods: the assembly and then the utilisation. The assembly is going to be completed

next year, but the utilisation is just starting. The ISS is therefore already a technical success but is still far to be an overall success since the success of utilisation is still to be demonstrated. If the utilisation is not a success, the overall ISS programme will be assessed as a failure.

There are therefore two basic reasons to continue the ISS programme:

1. To reap the benefits of the investments made, by utilising the resources on board. The ISS is a unique laboratory offering resources which cannot be found on Earth. As for any laboratory, significant results will come from a repetition of experiments which require years rather than months.

The costs of utilising such laboratory are well defined and known by all partners. The only answer to the question: "How long should we use the ISS as a laboratory?" is: "as long as the benefits are worth the costs."

As far as the utilisation of ISS is concerned, my proposal is therefore the following: to organise every three years a joint (all partners) assessment of the benefits drawn from the utilisation of ISS and to jointly decide on that basis to continue for another period of 4 to 5 years, up to the end of the technical duration of life of ISS. This means that, if the benefits are worthwhile, new laboratories in LEO should be developed in order to keep the continuity of utilisation beyond ISS.

2. To be part of the human exploration programme. The ISS is the place for testing hardware and operations before they are used for lunar exploration and even more for Mars exploration which is the end objective of human exploration. There should not be any gap between ISS operations and lunar operations, since any discontinuity would lead to a loss of expertise, because expertise is with the people who operate.

As far as the role of ISS within the human exploration programme is concerned, my proposal is therefore to continue the ISS operations up to the start of a human lunar base operation.

In conclusion, there are two rationales for continuing the ISS programme exploitation, one related to utilisation, one related to human exploration, which may lead to two different dates for the end of exploitation. The best is therefore to define a rationale and not a date.

3. How would you characterize the ESA obligation and that of the US to the ISS in terms of its operational life?

As I said above, it is more a question of rationale than a question of obligation: if there is a common rationale to continue, it constitutes, in my view, an obligation to continue together. On the other hand, no obligation can replace a lack of rationale.

For what concerns each partner's obligations, they are defined in the multilateral IGA at Government level and in the bilateral MOU's at Agency level.

First, the obligation of each partner is to maintain its own flight elements in order and to pay its share of common operations costs, i.e. for ESA to maintain the Columbus laboratory in order and to compensate for 8.3% of the common operation costs. Against such obligation, each partner gets a right of utilisation of a percentage of available resources proportional to its obligations. Second, there is no termination date in the different agreements, meaning that operational life continues if no decision is taken. Third, each partner has the right to withdraw unilaterally at any time. But there is a difference among partners: if ESA withdrew, the other partners could continue on their own; if NASA withdrew, the ISS operations would stop, which makes a significant difference.

However, I do not think that a unilateral decision could happen, first thanks to the solidity demonstrated in the partnership, second because the rationale is the same for all partners. As I said above, the duration of operational life of ISS should rely on solid rationale and should be a joint decision by all partners.

At the end, the only obligation of each Partner, is to match their budget with the objectives. But this is true for any programme, including non space programmes.

4. How does ISS and its extension past 2015 connect to the European Space Agency's future plans for human and robotic exploration beyond low-Earth orbit?

The future plans of ESA for human and robotic exploration will be defined in several steps, the next step being planned in 2011..

A first step has been defined in November 2008, with the decisions by Member States:

- to embark into an ambitious programme of robotic exploration of Mars: a first mission, Exomars, is under detailed definition, planning a launch in early 2016 with an objective for ESA to demonstrate landing, moving at the surface and drilling capabilities. Follow-on missions are being prepared. These missions are subject to a lot of discussions with NASA for a long term cooperation, starting by a significant contribution of NASA to Exomars, based on the model of our common success Cassini Huygens. Discussions with Russia are also on-going, including an ESA contribution to the Russian Phobos Grunt mission.
- to start the preparation of a potential contribution of ESA to a human lunar exploration programmes. It is clear that for human exploration:
 - Europe is dependent upon other partners, in particular USA and cannot take decisions on its own.
 - Europe needs a high level political decision, because any significant contribution of Europe to human exploration requires significant additional budget, since human exploration should not be developed to the detriment of

science and applications for the citizens. A first high level political conference on the subject is planned in October this year.

At the end, the most important connection between ISS duration of life and future human exploration is the budget competition : can we afford to finance ISS continuation and the development of future human exploration?

This is the reason why, one important rationale to continue ISS is to make it an integral part of the exploration programme.

This the reason why also, additional resources are necessary because you can always transfer budgets between operations and development activities, but you cannot transfer the expertise because operations require very different industrial capabilities than development.

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Before closing my statement, Mister Chairman, I would like to come back to a very important characteristic for a partnership to be sustainable = it must be open to new partners. And we, the five partner of the ISS, we must address an important question = shall we invite other partners, China, India, South Korea (which are today contributing to the elaboration of a Global Exploration Strategy) to join our current partnership, under “terms and conditions” that we could jointly agree (as we have done in 1993 when inviting Russia to join the four Freedom partners)?

I do not want to anticipate the answer, but not raising the question among the five partners would be, in my view, the worst option.

You will receive soon a typed version of my remarks and I thank you for your attention.

Jean-Jacques Dordain