

Autonomy in Human Spaceflight Towards a Strategic Perspective for Europe

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After losing support in the early 1990s the idea of autonomy in human spaceflight is slowly entering the European agenda again. However, Europe is in dire need of a comprehensive discussion on the political merits and consequences of autonomy rather than responding to external factors alone. It is necessary to ask what values and benefits are associated with human spaceflight and what risks follow from dependency respectively. Also, a better understanding of the political relations autonomy enables (or complicates) is required. After examining past and present experience several conclusions can be drawn: Autonomy in human spaceflight serves important values, although of a quite intangible nature and with rather long-term impacts on society. Also, rather than impeding cooperation, autonomy will put Europe in a more favourable position for entering into cooperative activities.

Autonomy back on the European agenda

The question of whether Europe should become autonomous in human spaceflight is hardly a new one. It was raised and affirmatively answered more than two decades ago at the ESA ministerial councils of Rome and The Hague in 1985 and 1987 respectively. By contributing detachable modules to the American space station and by building the Hermes spaceship, autonomy and cooperation were pursued at the same time. However, geopolitical and economic conditions altered dramatically with the end of the Cold War, German reunification, and European monetary integration. Ultimately, Europe neither disposed of independently sustainable space modules nor did it build its own astronaut carrier.

Rather than considering autonomy as a last resort, sound strategy requires an idea of the political merits and risks of autonomy in the first place.

Circumstances have changed again now. Whereas the International Space Station (ISS) is finally nearing completion, the United States have committed themselves to the moon and perhaps even Mars without offering any foreign

contributions to the critical path of the capabilities concerned. Other space powers engage in explorative missions as well, although on a far less ambitious scale.¹ While coordination of these activities is foreseen and already institutionalised,² the schemes of future cooperation are hardly discernible yet. Human spaceflight is obviously entering a transition period. Through this situation the question of autonomy is back on the European agenda. Thus, there is the risk that European decision-making is driven by external circumstances alone. A comprehensive discussion of what autonomy is worth and what difference it will make in terms of international relations is indispensable for sound strategy though. The following analysis aims to contribute to that task.

¹ Nicolas Peter. "Space Exploration 2025: Global Perspectives and Options for Europe", ESPI Report 14 August 2008.
http://www.espi.or.at/images/stories/dokumente/studies/esp_i_report_14.pdf

² See the 'Global Exploration Strategy' signed by fourteen space agencies.
<http://esamultimedia.esa.int/docs/exploration/InternationalCoordination/Global%20ExplorationStrategyframeworkforcoordination.pdf>. In respect to the activities of the International Space Exploration Coordination Group (ISECG) see also:
http://esamultimedia.esa.int/docs/exploration/InternationalCoordination/ISECG_workplan%202008%20.pdf

Autonomy as a political asset

Autonomy is hardly a value by itself, but instead has an instrumental nature. Based on the assumption that all politics is about the distribution of values³, the following analysis refers to autonomy as a political asset enabling the partaking in certain values by performing essential tasks independently.

Considering the values at stake is therefore the most basic issue while discussing autonomous capabilities. Human spaceflight cannot and should not be an exception in this regard. Indeed, in whatever realm Europe achieved autonomy or is due to achieve it in the coming years a strong case could be made for allocating resources in favour of security, political or economic reasons. Thus, Europe developed its own launcher amongst other reasons to ensure its participation in the commercial satellite market.⁴ Several European states acquired their own reconnaissance and surveillance satellites after they experienced a shortage of critical information during international crises.⁵ Finally, Galileo will enable Europe to have its own control of an infrastructure, which is becoming ever more deeply entrenched in the daily life of European societies.

Autonomy should be considered instrumental, enabling to partake in certain values by performing essential tasks independently.

In order to structure the following discussion, it is assumed that values fall into one of the following basic categories: knowledge, welfare, security, and prestige/identity. In some of these dimensions human spaceflight makes a distinct and important contribution - in others, however, it has hardly any impact at all. Thus, the following sections try to assess how human spaceflight serves some of these values through the provision of significant benefits.

³ Czempiel, Ernst-Otto (1966): „Internationale Beziehungen: Begriff, Gegenstand und Forschungsabsicht“, in Manfred Knapp/Gert Krell (Ed.), *Einführung in die Internationale Politik*, Munich, 2-26, 6.

⁴ Sebesta, Lorenza (1996): *The Availability of American Launchers and Europe's Decision "To Go It Alone"*, ESA History Studies Report 18, Noordwijk.

⁵ Hansel, Mischa (2007): *'(Although) it's not Rocket Science': A Theoretical Concept for Assessing National Space Policies in Europe*, Arbeitspapiere für Internationale Politik und Außenpolitik, Cologne: University of Cologne.

Rationales for human spaceflight

From a scientific point of view the benefits of human spaceflight are highly questionable, and probably always will be. All in all, scientific reasons alone hardly justify large-scale investments in human spaceflight, but they can tip the balance in favour of them if other convincing reasons can also be found.

As to fundamental research on space stations, some experiments in biology and material science benefit from the presence of human beings, whereas for others they pose the risk of interference and biased results. Nevertheless, given the sheer number of applications, appreciation of the international space station by the scientific community should not be underestimated. As to exploration, most of the scientific work can be done cheaper and easier by robots. Exploring planets by extensive geology, however, as well as managing complex instruments and technological interfaces require the ability of human beings to deal with the unpredictable and to adapt to circumstances unforeseen. Therefore, the preparation of long-term bases on ground could only be achieved by astronauts.

Military considerations are certainly not among the reasons for human spaceflight, for there is no single military mission which cannot be more efficiently performed by satellites than by humans. However, and far from being intended to do so, some of the capabilities supporting human spaceflight infrastructures have security-related implications. The European and Canadian robotic arms at the space station as well as the autonomous rendezvous and docking technologies of the European space freighter ATV are prerequisites for potential anti-satellite missions.⁶ Acknowledging this, Europe has one reason more to play an active part in ongoing arms control efforts. However, the very same technologies may also enable the orbital repair and service of critical satellites and thereby increase their survivability. This could reduce the incentives for hostile behaviour against European space assets in the first place.

Except for the burgeoning market for space tourism, human spaceflight does not offer any commercial profits. There have been expectations of industrial activities making use of microgravity, but these have not materialised

⁶ Spacesecurity.org. Space Security 2007. Waterloo (Canada). 130-131: <http://www.spacesecurity.org/SSI2007.pdf>

so far. What has happened, though, is that industry has financed a considerable share of the experiments on the ISS, in anticipation of future applications. In contrast, mining of minerals on the moon or solar energy from space seem to be decades away from becoming viable options. Finally, spin-off from human space flight technology to terrestrial applications is hardly of the same value as the resources spent.

Human spaceflight delivers economic returns by serving as a showcase for industrial competences, accumulating unique expertise and inspiring new generations.

However, there are economic returns in a variety of more indirect ways: as human safety requirements pose enormous technical and managerial challenges, an industry meeting these criteria sends out a strong sign of technological prowess and reliability. Therefore, human spaceflight projects have an impact on industrial competitiveness by enhancing costumers' confidence in commercial space products. The complex task of developing human spaceflight capabilities and managing human spaceflight endeavours also improves managerial expertise. For instance, building the Columbus research laboratory required the integration of two million single pieces and the coordination of 41 major subcontractors delivering from 10 European countries.⁷ System engineers involved are now sought-after for enabling other large-scale projects like the construction of refineries or aircrafts. One should also not underestimate the inspirational qualities of human spaceflight and their educational impact by motivating people to strive for a career in high tech research and industrial facilities. This year, almost ten thousand people applied to be one of the ESA's next astronauts.⁸ This sort of inspiration is probably even the most important contribution which human spaceflight can offer to the Lisbon strategy of the European Union.⁹

Finally, human spaceflight provides a highly symbolic setting. Comparable to international sport events or emergency actions in case of disasters, human spaceflight seems to reveal society's mobilisation, innovation, and organisation skills in a single action chain: the

launch of a spaceship, docking manoeuvres, or even the posting of a flag on a celestial body. In other words: one gets the impression of an insight into the essential qualities of a society which are usually covered by the rather average and fragmented performance of its regular activities. Given these potentials human spaceflight was often framed and perceived as an indicator of societies' achievements or deficiencies in general. Symbolic policy considerations of this type spurred the 'space race' between the United States and the Soviet Union. They are currently driving prestigious space efforts by Asian countries, most notably China.

Amongst other aspects, China's human spaceflight programme is symbolizing the power transition from Japan to continental Asia. As a soft power tool¹⁰ it might even have a more comprehensive impact through shifting political expectations and loyalties on a global scale. It thereby poses political risks to Europe as well, which is already facing strong competition from China on the African continent. The impression of lagging behind China in spaceflight runs counter to the belief of Europe as a future world power. Given that India and perhaps also Japan are likely to reorient their space programmes in response to the Chinese achievements, Europe may even be perceived as a second-rank power in the future unless it takes bold actions towards a more visible space programme.

Providing a highly symbolic setting, human spaceflight could foster Europe's identity at home and support its credibility abroad.

There is yet another way in which human spaceflight serves symbolic politics. Cooperation or non-cooperation in human spaceflight is often perceived as a symbol of the relations between societies in general. This was a crucial factor in the United States' decision to include Russia in the International Space Station programme, thereby symbolizing the end of the Cold War. Nowadays, the European Union as an entity which is neither an international organisation nor a state could expect significant benefits from exploiting these potentials. There are no European sport teams but a single European astronaut corps, whose orbital activities - if properly represented in the media - could have an impact on European

⁷ Joint Press Conference by EADS Astrium and German

Aerospace Center, Washington, 3 December 2007.

⁸ http://www.esa.int/esaCP/SEMZQPQ4KKE/index_0.html

⁹ http://ec.europa.eu/growthandjobs/index_en.htm

¹⁰ Nye, Joseph S. (2004): *Soft Power: The Means to Success in World Politics*, Cambridge: Perseus Books.

cohesion and identity building. Furthermore, joint endeavours of European and foreign astronauts may give credibility to Europe's claim of taking on global responsibilities and being committed to multilateralism. However, reaping these benefits probably requires the European Union alongside ESA to underline these aspects of Europe's activities in space.

Autonomy in human spaceflight serves important values by providing significant benefits. While its impact on European societies is rather intangible, it could be also profound and long-lasting.

To sum up, the benefits identified are rather intangible and hard to measure in quantitative terms. Nevertheless, precisely the most intangible ones - particularly in the realms of symbolic politics and education - are likely to have a profound and long-standing impact on European welfare, identity, and soft power. If these values are considered worth engaging in human spaceflight, then limiting dependency is certainly one of the crucial lessons from the past.

Being dependent

On various occasions, the ESA had to face costly and unexpected decisions by its American partners, for instance during the Aerosat project, the International Solar Polar Mission (ISPM), and in respect of the Spacelab's utilisation. The process of planning and building the space station made even more apparent the risks of being critically dependent on cooperation partners.

In 1986 the Pentagon revealed its intention to use the space station for military purposes. For a brief period of time the space station partnership appeared in a bad light most notably from the perspective of the neutral ESA member states.¹¹ As early as 1989 NASA decided on the first redesign of the space station without consulting its European partners.¹² In the early 1990s the US Congress even threatened to cancel the space station project altogether. It survived the federal year 2004 budget considerations of the House by only one vote.¹³ All in all, from 1991 to 1997, 19

attempts were made to end the space station programme.¹⁴

Russia's inadequate and unreliable funding of its critical contributions caused further delays and insecurity.¹⁵ Furthermore, Europe's space station elements were completely reliant on the American Shuttle for being launched to their destination. Thus, Europe's prime contribution dangled on a string after the Shuttle fleet was grounded because of the Columbia catastrophe in 2003. Any further accident would have caused Columbus to end up unused in a museum. In the coming decade, sustaining the space station will further become a major problem after the planned retirement of the American Shuttles in 2010 and even the prospect of an American withdrawal from the ISS. One thing is certain: Europe's dependence on Russia's Soyuz vehicles is going to increase unless a major effort is made to access low earth orbit autonomously. However, for the purpose of this paper the path to autonomy is left aside in favour of looking at what the consequences of autonomy are in respect of international relations.

Being autonomous

First, autonomy neither precludes nor impedes cooperation, but enables another structure of cooperation. Thus, "autonomy for enhanced cooperation"¹⁶ more aptly describes the relationship among both terms rather than regarding them as opposites. Indeed, European decision-makers aimed for a kind of enhanced cooperation through autonomous contributions in the 1980s. Although planned as being part of the space station constellation, the man-tended free flyer (MTFF), the Polar Platform (PPF), as well as the Hermes spaceship would have provided Europe with the capabilities for sustaining a human presence in low-earth orbit on its own. Rather than being just an element of a system like the Columbus orbital facility (COF), which is not viable without being permanently attached to the space station, the MTFF, the PPF, and Hermes would have formed an independent system and an

History of the European Space Agency: Volume II: The Story of ESA, 1973-1987, Nordwijk: European Space Agency, 633-637:

<http://www.esa.int/esapub/sp/sp1235/sp1235v2web.pdf>

¹⁴ Sadeh, Eligar (2004): „Technical, organizational and political dynamics of the International Space Station program“, *Space Policy*, 20 (3), 171-188, 176.

¹⁵ Sadeh (2004), 185.

¹⁶ Di Pippo, Simonetta (2008): „Celebrating the Accomplishments, Preparing the Future: New Challenges in Human Spaceflight and Exploration“, *ESA Bulletin*, 135 (August), 10-17, 17.

¹¹ Bonnet, Roger M. and Vittorio Manno (1994): *International Cooperation in Space: The Example of the European Space Agency*, Cambridge (MA)/London: Harvard University Press, 111.

¹² Harvey, Brian (2003): *Europe's Space Programme: To Ariane and Beyond*, Chichester: Springer/Praxis, 311-314.

¹³ Krige, John, Arturo Russo and Lorenza Sebesta (2000): *A*

augmentation to a more comprehensive system (space station Freedom) at the same time. Thus, a system-of-system approach, aiming for autonomous but complimentary capabilities was supposed to be implemented, which is certainly a viable option for exploration infrastructures as well. A recent study, jointly conducted by the ESA and NASA about compatible and mutually enhancing capabilities with respect to moon exploration, supports the idea of this kind of partnership.¹⁷

Far from impeding cooperation, autonomy enables Europe to enter in cooperative arrangements on more favourable conditions.

Europe is already following similar lines in other policy areas. The European Union has set itself the goal of being able to conduct autonomous crisis management operations in the framework of the European Security and Defence Policy (ESDP). In practice however, EU access to NATO assets and planning capabilities is assured through the Berlin Plus agreements¹⁸ in case the alliance as a whole is not engaged. Thus, the EU has taken over NATO missions in Macedonia and Bosnia-Herzegovina. It has, however, worked together with NATO also outside the Berlin Plus agreement, fulfilling complimentary functions, for instance in Darfur¹⁹, and more recently in Afghanistan²⁰ and Kosovo.²¹ All in all, EU-NATO relations are not without conflicts and ambiguities,²² but they nevertheless show that European steps towards autonomy qualify, but do not end, transatlantic cooperation.

Autonomy does not end economic, functional, or political incentives for coordinated actions.

Second, autonomy, although enabling independent actions, does not equal being independent on a political level, i.e. unaffected by other space powers' decisions. Usually there are market forces, functional requirements for

collective actions or political considerations, which are making decisions influencing each other. First, the physical characteristics of space and limited resources in earth orbits necessitate a minimum of joint management among space powers. Autonomous space powers need to maintain a common regulatory effort to allocate frequencies and orbital position and to avoid the creation of space debris. Of course, comparable necessities exist outside the realm of space policy as well. International air traffic requires common technical and procedural standards lest safety and efficiency are compromised. Turning to economic forces, interdependence and joint actions are characteristic of many fields. Although several states autonomously commercialized their earth observation satellites, each decision on permitting a better resolution of commercial space imagery exerted pressure on competitors to follow. Launch providers such as Arianespace are agreeing on mutual back-up contracts with their competitors in order to meet the expectations of their clients. Also responding to the interests of the user community, the European Commission and the United States established a framework for ensuring compatibility and interoperability between the GPS and Galileo systems.²³

Human spaceflight in contrast is certainly going to remain a non-routine and non-commercial activity for decades, but nevertheless there will be functional problems even among autonomous space powers. For example, without agreeing on a certain compatibility of their systems, space powers would find it difficult to pool their resources in cases of emergencies. Moreover, public opinion is providing for a certain degree of political interdependence among space powers. An excessive duplication of tasks, at least among western space powers, will not likely be accepted. Therefore, political incentives for a certain degree of coordination have to be taken into account. On the other hand, most notably in Asia, considerations of prestige and domestic legitimacy will push decision-makers towards space programmes which lead to comparable or even superior achievements than those of their foreign competitors. The two political incentives do not have to be mutual exclusive. For example, the existence of several independent moon probes does not make any information exchange invaluable, unless the same places are explored with the same instruments. To sum up, if Europe were

¹⁷ http://www.esa.int/esaCP/SEMBA0THKHF_index_0.html

¹⁸ http://www.nato.int/shape/news/2003/shape_eu/se030822a.htm

¹⁹ http://eurlex.europa.eu/LexUriServ/site/en/oj/2005/l_188/l_18820050720en00460051.pdf

²⁰ http://www.consilium.europa.eu/uedocs/cmsUpload/070514-factsheet_EUPOL_AFGH.pdf

²¹ <http://www.eulex-kosovo.eu/?id=1>

²² Hofmann, Stephanie and Reynolds, Christopher (2007): „EU-NATO Relations: Time to Thaw the ‚Frozen Conflict‘“, *SWP Comments*, 12: http://www.swpberlin.org/common/get_document.php?asset_id=4106

²³ <http://pnt.gov/public/docs/2004-US-EC-agreement.pdf>

autonomous in human spaceflight it would still be exposed to some political and functional pressures.

By disposing of autonomous means, Europe's influence on the establishment of rules and the exchange of goods will grow.

Third, achieving autonomy alters the structural conditions for rule-making and exchanging goods by ending monopolistic or duopolistic (the USA and Russia) structures. Whenever scarce resources have become exploitable, those able to access and control them have enjoyed the greatest influence on utilisation. However, the fewer suppliers, the less advantageous the terms of utilisation from the perspective of those on the demanding side. As supplying countries managed to control the majority of oil reserves by a single entity (the OPEC) prices soared and caused a global recession. Turning back to spaceflight, one of the reasons why Europe has built its own launcher was the American refusal to launch commercial satellites of its allies. Now, American decision-makers themselves are worried about a monopoly to their disadvantage. This is because of the Shuttle's retirement after 2010 and because neither the new Ares launcher nor the Orion spacecraft will be ready before 2015. The transport of American and European crews to the space station and back to earth will be dependent on Russia's Soyuz vehicles alone for a considerable time. Given the troubled relations among Russia and the West, as well as Russia's past behaviour of retaining critical resources for political reasons, there are certainly some risks associated with that monopoly. At least prices for tickets on Soyuz flights are likely to increase.

Europe's Choice

To conclude, autonomy in human spaceflight serves important values by providing considerable benefits, although of a quite intangible nature and with rather long-term impacts on society. Human spaceflight first and foremost provides opportunities for strengthening the image and skills of European industry, contributing to a highly-qualified workforce and fostering European identity and credibility. If European decision-makers hold these benefits in high regard, then they should limit the risks to them by reorienting the European space programme towards an independently sustainable infrastructure.

Rather than impeding cooperation, taking these steps will give cooperation a new quality. By enabling a system-of-system architecture European autonomy does not necessarily lead to duplication of efforts, but instead limits the impact of unexpected decisions of cooperation partners. Likewise, Europe will still feel pressure for international coordination due to safety requirements and will still have to respond to political dynamics. Finally, autonomy will foreclose any monopolistic or duopolistic structures, by which one or two space powers can set the terms of interaction according to its/their political and/or economic interests alone.



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