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Transatlantic relations the role of nationalism in multinational space cooperation

Crooks, Heather R.

Monterey, California. Naval Postgraduate School

NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

TRANSATLANTIC RELATIONS: THE ROLE OF NATIONALISM IN MULTINATIONAL SPACE COOPERATION

by

Heather R. Crooks

June 2009

Thesis Advisor:	Donald Abenheim
Second Reader:	James C. Moltz

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Transatlantic partnerships are becoming integral to the success of modern-day aerospace programs. NASA and the European Space Agency have cooperated for decades on such programs. As with all such collaboration between nations, conflicts have and continue to arise between the U.S. and Europe concerning joint aerospace initiatives. This thesis investigates the hypothesis that nationalism has been the major driver within ESA, as well as between ESA and NASA, that hampers multinational cooperation; this thesis will also look to international space visions and the notion of joint space exploration as a partnership, not a competition. Additionally, multiple case studies of space cooperation between the European Union and the U.S. are analyzed, as well as what this could mean for future partnerships. This thesis concludes that cooperation within ESA's member states is hampered by nationalism; however, as a multinational organization, ESA rarely allows nationalism to interfere with international cooperation in space. Though NASA has participated in a range of successful international programs, it has allowed periodic shows of nationalistic actions to hamper some of these projects. The author recommends that future space policy allow for more international cooperation, taking heed of lessons learned from past programs.

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TRANSATLANTIC RELATIONS: THE ROLE OF NATIONALISM IN MULTINATIONAL SPACE COOPERATION

Heather R. Crooks
Captain, United States Air Force
S.B., Massachusetts Institute of Technology, 2000
M.S., Air Force Institute of Technology, 2003

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June 2009

Author: Heather R. Crooks

Approved by: Donald Abenheim
Thesis Advisor

James Clay Moltz
Second Reader

Harold A. Trinkunas, PhD
Chairman, Department of National Security Affairs

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ABSTRACT

Transatlantic partnerships are becoming integral to the success of modern-day aerospace programs. NASA and the European Space Agency have cooperated for decades on such programs. As with all such collaboration between nations, conflicts have and continue to arise between the U.S. and Europe concerning joint aerospace initiatives. This thesis investigates the hypothesis that nationalism has been the major driver within ESA, as well as between ESA and NASA, that hampers multinational cooperation; this thesis will also look to international space visions and the notion of joint space exploration as a partnership, not a competition. Additionally, multiple case studies of space cooperation between the European Union and the U.S. are analyzed, as well as what this could mean for future partnerships. This thesis concludes that cooperation within ESA's member states is hampered by nationalism; however, as a multinational organization, ESA rarely allows nationalism to interfere with international cooperation in space. Though NASA has participated in a range of successful international programs, it has allowed periodic shows of nationalistic actions to hamper some of these projects. The author recommends that future space policy allow for more international cooperation, taking heed of lessons learned from past programs.

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I. INTRODUCTION

A. MAJOR RESEARCH QUESTION

Transatlantic partnerships are quickly becoming integral to the success of modern-day aerospace programs. The United States (U.S.) and Europe have cooperated for decades on numerous aviation programs. Such programs grew out of security cooperation in the 1950s and 1960s, but their character changed as the nature of the transatlantic relationship matured. In the early 1980s, joint U.S.-European cooperation resulted in the widespread North Atlantic Treaty Organization (NATO) use of the U.S. Air Force's (USAF) Airborne Warning and Control System (AWACS). At the turn of the century, such joint projects include the Joint Strike Fighter (JSF) and possibly the KC-X tanker replacement for the aging USAF tanker fleet. This transatlantic partnership extends beyond aviation to include space exploration as well. As far back as 1973, the U.S.'s National Aeronautics and Space Administration (NASA) joined with the European Space Research Organization (ESRO) to create Spacelab, a modular scientific laboratory flown on the space shuttle.[1] Since then, the European Space Agency (ESA) and NASA have partnered on numerous programs including *Ulysses*, an initiative to study the space above the poles of the sun, and the *International Space Station* (*ISS*).

As with all such collaboration between nations about technology, conflicts have and continue to arise between the U.S. and Europe concerning joint aerospace initiatives. The most controversial example in the aviation industry has recently been the KC-X tanker bid, which in 2008 was awarded to Northrop Grumman and the European Aeronautic Defense and Space Company (EADS), but was being contested by Boeing as this thesis was being written in the fall of 2008. In the space exploration arena, the *ISS* has also proven rather controversial within transatlantic relations. The U.S. announced in June 2005 that it would pull out of the *ISS* project by the end of 2015. That announcement set off bickering between *ISS* funding nations within Europe about when to close the *ISS*, despite the fact that it had not yet been completed.[2] These are just two examples of the conflict experienced by transatlantic partners joining to further

[1] "History of the European Space Agency," European Space Agency (2000-2008), http://www.esa.int/SPECIALS/About_ESA/SEM7VFEVL2F_0.html (accessed 1 October 2008).

[2] "Space Station Partners Bicker Over Closure Date," Agence France-Presse, 26 September 2007, http://afp.google.com/article/ALeqM5gEDs2HT4Mza-aoefdTjPWQzrSsvg (accessed 1 October 2008).

space advancement, as well as their respective interests. This author is professionally concerned with these issues as a flight test engineer in the USAF and also as a scholar of U.S.-European security affairs. This thesis investigates multiple case studies of space cooperation between the European Union (EU) and the U.S., as well as what this could mean for future partnerships. Included in this analysis will be the politics of space in a multinational context, as well as the potential conflicts between multinational cooperation and nationalism. This thesis investigates the hypothesis that nationalism has been the major driver within ESA, as well as between ESA and NASA, that hampers multinational cooperation. In its conclusion, it will outline a set of policy recommendations on how the U.S. and its European partners might reduce these tensions in the future.

B. IMPORTANCE

Space power represents a vital aspect of U.S. security policy and defense strategy. The most recent U.S. National Space Policy, which was approved on 31 August 2006, states that "in order to increase knowledge, discovery, economic prosperity, and to enhance the national security, the United States must have robust, effective, and efficient space capabilities."[3] To achieve this, the policy of this government lays out seven principles, among which is that "the United States will seek to cooperate with other nations in the peaceful use of outer space to extend the benefits of space, enhance space exploration, and to protect and promote freedom around the world."[4] Along these lines, one of the seven fundamental goals of the renewed policy is to "encourage international cooperation with foreign nations and/or consortia on space activities that are of mutual benefit and that further the peaceful exploration and use of space, as well as to advance national security, homeland security, and foreign policy objectives."[5]

At the same time, the 1990s and the present decade have seen episodes of political acrimony across the Atlantic, which were anything but helpful to the declared ends of U.S. policy. One also knows that, despite the solemn and laudable writs of such policy, economic nationalism, as well as the special interests that are normal in pluralistic societies, complicate

[3] Office of Technology and Space Policy,"U.S. National Space Policy," August 2006, http://www.ostp.gov/galleries/default-file/Unclassified%20National%20Space%20Policy%20—%20FINAL.pdf (accessed 14 October 2008).

[4] Ibid.

[5] Ibid.

such policy. With the resurgence of the Russian space program in addition to the rise of the Chinese space program, transatlantic space cooperation is as important now as it has ever been. This thesis will look to international space visions and the notion of joint space exploration as a partnership, not a competition, as well as consider the conditions under which this might be possible.

C. PROBLEMS AND HYPOTHESES

This thesis investigates the hypothesis that nationalism has been the major driver within ESA, as well as between ESA and NASA, that hampers multinational cooperation. As mentioned previously, conflicts have and continue to arise between the U.S. and Europe concerning joint space initiatives. In March of 2005, British Aerospace Systems (BAE) Chief Executive Officer Michael Turner threatened to back out of the JSF program if it did not receive the technology transfer rights that BAE requested.[6] In March 2008, U.S. aerospace giant Boeing protested when the Northrop Grumman/EADS team was awarded the USAF's contract for replacement aerial refuelers.[7] While the U.S. and Europe have a notion of partnership, not competition, it is such bidding wars that turn a friendly relationship into an adversarial one. Adversarial relationships are also due to growing commercial turbulence, as well as greater interdependence and collaboration in a globalized world.

As concerns space systems, the aforementioned *ISS* problem is at the forefront. In 2005, NASA alluded to intentions to leave the *ISS* by 2015; this announcement resulted in conflict between NASA and ESA, as well as within ESA itself. Yet another source of contention was the *Ulysses* program, which was an ESA-produced spacecraft launched aboard a NASA space shuttle. This program dealt with almost seven years of delays from both sides before being launched. Galileo, Europe's precision navigation system that will be compatible with the U.S.'s

[6] Lisa Troshinsky, "No Tech Transfer, No JSF Cooperation, BAE Chief Warns," *Aviation Week and Space Technology*, 23 March 2005, https://npsbart.nps.edu/+CSCO+00756767633A2F2F6A6A6A2E6E69766E677662616A7272782E70627A++/aw/generic/story_generic.jsp?channel=aerospacedaily&id=news/JSFB_103235.xml (available with account access only; accessed 1 October 2008).

[7] Amy Butler and David Fulghum, "Boeing Leaning Toward Not Rebidding KC-X," *Aviation Week and Space Technology*, 11 August 2008, https://npsbart.nps.edu/+CSCO+00756767633A2F2F6A6A6A2E6E69766E677662616A7272782E70627A++/aw/generic/story_channel.jsp?channel=defense&id=news/BOEING081108.xml (available with account access only; accessed 1 October 2008).

Global Positioning System (GPS) and Russia's Global'naya Navigatsionnaya Sputnikovaya Sistema (GLONASS), is another program that has seen its share of conflict not only between ESA and NASA, but between ESA and Russia, as well as within ESA itself.

Another joint effort was the International Telecommunications Satellite Consortium (INTELSAT) in the 1960s and 1970s. Much to the dismay of Europeans, the U.S. held a majority (61%) of the shares, which led to a greater number of INTELSAT contracts awarded to the Communication Satellite Corporation (COMSAT), a U.S.-controlled company in exchange for use of U.S. technology.[8] To protect U.S. interests, INTELSAT resisted launching European commercial satellites, for instance, *Symphonie*. As a result of this, Europe became determined to achieve independence by developing its own launcher.[9]

The Stratospheric Observatory for Infrared Astronomy (SOFIA) is another example of transatlantic cooperation in space. SOFIA is a joint astronomy project between NASA and the German Aerospace Center.[10] According to Johnson-Freese, "with the program 85 percent complete, and more than $500 million in tax-payer dollars invested in it—plus another $100 million from Germany—U.S. funding was cut for fiscal year 2007, mere months before the first scheduled test flight."[11] While this certainly did not strengthen U.S.-European cooperation in space, the program did survive and is in operation as of this writing.

When one looks to the future, an observer who is less invested of the particular and special interests of commercial firms in the narrow sense can only reinforce the notion that the transatlantic relationship must strengthen in order for both sides to prosper. This statement is true not only for the future of the JSF, USAF tanker replacement, and the *ISS*, but it is also true for future missions to the Moon and Mars. With NASA's planned retirement of the shuttle, both sides must be committed to cooperation in order to keep a human presence in space. But how can this commitment to knowledge and the perfection of science and technology be squared with competition in the more rancorous political, economical, and industrial world? This thesis seeks to analyze the knotted problems of transatlantic relations and technology in search of answers.

[8] Kazuto Suzuki, *Policy Logistics and Institutions of European Space Collaboration* (Burlington, VT: Ashgate Publishing, 2003), 56.

[9] Ibid., 62.

[10] Johnson-Freese, *Space as a Strategic Asset* (New York: Columbia University Press, 2007), 78.

[11] Ibid.

D. LITERATURE REVIEW

A rich, complex literature exists concerning the transatlantic relations in aerospace endeavors. One of the main works to be analyzed is Army Captain David R. Perry's Master's Thesis, "Multi-National Cooperation in Space Operations;"[12] in addition, case studies to be researched include INTELSAT, the *Ulysses* mission, SOFIA, Galileo, and the *ISS* and future missions to the Moon and Mars. Both U.S. and European space policies will provide background regarding (and a basis for) transatlantic cooperation. In addition, books such as Joan Johnson-Freese's *Space as a Strategic Asset*,[13] Phillip Lawrence and Derek Braddon's *Strategic Issues in European Aerospace*,[14] Daphne Burleson's *Space Programs Outside the United States*,[15] Mark Lorell et al.'s *Going Global?*[16], and James Clay Moltz's *The Politics of Space Security*[17] will be referenced. Also, journals such as *Space Policy*, *Space News*, *Astro-politics*, *Aviation Week* and *Space Technology*, and the *ESA Bulletin* will be utilized. This thesis will also draw upon numerous internet sources, such as the NASA and ESA official Web pages, as well as public documents, such as Reports to Congress (CRS) and European Policy Papers written by authors such as Carl Behrens, Paul Belkin, Johan Lembke, Iraklis Oikonomou, and Marcia Smith.

In his Master's thesis, CPT Perry concludes that "politics has a tremendous effect on multinational endeavors,"[18] citing recent *ISS* issues. On the subject of multinational cooperation, he concludes that any partnership, be it space- or Earth-based, needs to have a full understanding of all the players involved and stresses the importance of liaisons.[19] Perry's thesis focuses on the *ISS* and Apollo-Soyuz missions; however, joint NASA-ESA endeavors are not mentioned. This

[12] David R. Perry, Captain, US Army, "Multi-National Cooperation in Space Operations," M.S. Thesis, Naval Postgraduate School, 2005.

[13] Johnson-Freese, *Space as a Strategic Asset.*

[14] Phillip Lawrence and Derek Braddon, *Strategic Issues in European Aerospace* (Brookfield, VT: Ashgate Publishing, 1999).

[15] Daphne Burleson, *Space Programs Outside the United States* (Jefferson, NC: McFarland & Company, Inc., Publishers, 2005).

[16] Mark A. Lorell, Julia Lowell, Richard M. Moore, Victoria Greenfield, and Katia Vlachos, *Going Global: US Government Policy and the Defense Aerospace Industry* (Santa Monica, CA: RAND Publishing, 2007).

[17] James Clay Moltz, *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests* (Stanford, CA: Stanford University Press, 2008).

[18] Perry, 30.

[19] Ibid., 31.

thesis will fill the gaps in this area to include the *Ulysses* and Galileo programs among others, such as future uses of ESA's Automated Transfer Vehicle (ATV).

Lawrence and Braddon's *Strategic Issues in European Aerospace* tackles many topics including "The European Response to Globalisation"[20] and "The Role of the EU as a Catalyser for the Integration of the Aerospace Industry in Europe."[21] These topics point out that Europe cannot keep pace with the U.S.'s aerospace industry without strong financial support, as well as multinational cooperation within Europe. In addition, they frankly state, "if we [Europe] are not cohesive, acting together, there is a good chance that the European aerospace industry will be severely weakened in the global marketplace."[22] This book will serve as the basis for researching the strategic issues that Europe faces in the aerospace industry; this thesis will extrapolate from these strategic issues and determine if/how multinational cooperation within Europe and between Europe and the U.S. can propel both the U.S. and Europe further toward the top of the increasingly globalized aerospace industry.

Yet another book that researches the globalization of the aerospace industry, Lorell, et al.'s *Going Global*, finds that as the U.S. collaborates with one country's firm, it increases the likelihood of collaboration with other countries' firms. This means that "it is increasingly unrealistic for U.S. government policy makers and industry leaders to think in terms of bilateral collaborative relationships between the United States and specific European or other foreign countries."[23] In addition, the authors conclude that a balance must be struck between competition and cooperation with Europe, as well as calling for increased research in the industrial, political, and military environments of Europe.[24] This author intends the thesis to cover these areas.

Suzuki's *Policy Logics and Institutions of European Space Collaboration* includes a study of INTELSAT. As previously mentioned, the U.S. had the majority of satellite contracts; Suzuki notes that "the lack of technological capability and expertise for application satellites

[20] Lawrence and Braddon, 91.

[21] Ibid., 99.

[22] Ibid., 97, 99.

[23] Lorell et al., 187.

[24] Ibid., 191.

seriously disadvantaged the position of European governments in the Intelsat negotiations, and therefore, they were urged to form a group under CETS [Conférence Européenne des Télécommunications par Satellite]."[25] He goes to report that the Europeans were resigned to rely on the U.S. to launch their telecommunications satellites; however, the U.S. agreed to allow the usage of their launcher technology if and only if it was not used to improve communication satellite capability (among other stipulations).[26] This clearly was not the solution the Europeans were seeking and led to competition with the U.S. instead of cooperation. Johnson-Freese also investigates the INTELSAT case and notes that the U.S.'s decision not to launch European satellites was purely economic.[27] In her book, she states that "the idea of the United States imposing such restrictions on Europe was the ammunition France needed to convince the other European spacefaring nations that Europe needed its own launch capability. The result was the Ariane launcher."[28] These two authors highlight how nationalism hindered U.S.-European space cooperation; this thesis will draw upon this case to support the hypothesis that nationalism plays a role in hampering multinational space cooperation.

Johnson-Freese also investigates the SOFIA project, a joint project between NASA and the German Aerospace Center. NASA cut the program in order to reroute money to the Space Shuttle and the ISS. In June 2006, however, Germany persuaded NASA to take another look at the funding for the program, which eventually proceeded.[29] Again, this thesis will investigate the role of nationalism in these negotiations.

In August 2006, President Bush authorized an updated national space policy that governs the conduct of U.S. space activity. Within this policy are seven principles and seven fundamental goals designed to keep the U.S. at the forefront of space exploration. In addition to the aforementioned principle and goal pertaining to international cooperation, it stated:

> The United States is committed to the exploration and use of outer space by all nations for peaceful purposes, and for the benefit of all humanity. Consistent with this principle, 'peaceful purposes' allow U.S. defense and intelligence-related

[25] Suzuki, 56.

[26] Ibid., 62.

[27] Johnson-Freese, *Space as a Strategic Asset*, 46.

[28] Ibid.

[29] Ibid., 78-79.

> activities in pursuit of national interests; also the United States considers space capabilities—including the ground and space segments and supporting links—vital to its national interests. Consistent with this policy, the United States will: preserve its rights, capabilities, and freedom of action in space; dissuade or deter others from either impeding those rights or developing capabilities intended to do so; take those actions necessary to protect its space capabilities; respond to interference; and deny, if necessary, adversaries the use of space capabilities hostile to U.S. national interests.[30]

An additional goal includes "strengthen[ing] the nation's space leadership and ensure[ing] that space capabilities are available in time to further U.S. national security, homeland security, and foreign policy objectives."[31]

The updated space policy expresses that the U.S. is committed to international cooperation in numerous areas of space exploration from Earth observation to the minimization of orbital debris. The policy includes an International Cooperation section that outlines not only transatlantic partnerships, but worldwide partnerships, as well:

> The United States Government will pursue, as appropriate, and consistent with U.S. national security interests, international cooperation with foreign nations and/or consortia on space activities that are of mutual benefit and that further the peaceful exploration and use of space, as well as to advance national security, homeland security, and foreign policy objectives. Areas for potential international cooperation include, but are not limited to: space exploration; providing space surveillance information consistent with security requirements and U.S. national security and foreign policy interests; [and] developing and operating Earth-observation-systems.[32]

Across the Atlantic, a European space policy was not agreed upon and implemented until 2007. This policy unified "the approach of the ESA with those of the individual European Union member states. Jointly drafted by the European Commission and ESA's Director General, Jean-Jacques Dordain, it creates for the first time a common political framework for space activities in Europe."[33] The strategic mission of the European space policy was also outlined and "based on

[30] Office of Science and Technology Policy, Presidential Decision Directive, "U.S. National Space Policy."

[31] Ibid.

[32] Ibid.

[33] "History of the European Space Agency," European Space Agency.

the peaceful exploitation of Outer Space by all states."[34] The European space policy also outlines how European countries will work together to implement the policy and subsequent goals. The members will:

> Develop and exploit space applications serving Europe's public policy objectives and the needs of European enterprises and citizens … to meet Europe's security and defence needs as regards space; to ensure a strong and competitive space industry…; to secure unrestricted access to new and critical technologies, systems and capabilities in order to ensure independent European space applications. To achieve this strategic mission will require the [European Union] EU, ESA and their Member States to improve the efficiency and effectiveness of their space activities by … developing a joint international relations strategy in space.[35]

This space policy clearly outlines the need (and the requirement) for collaborative efforts. The EU as a whole (not just the European Commission [EC]) must support and work with ESA in order to achieve international status in space science, as well as to better the lives of the people of Europe. By agreeing to this policy, ESA agrees to oversight by the EC, and the EC agrees to provide funding to ESA so that it can accomplish the EU's goals in space. According to the EC, this policy demonstrates the EU's ability to lead in areas of strategic importance.

Both the U.S. and European space policies show a commitment to multinational cooperation for the betterment of space exploration. The largest space-based cooperation project is the *ISS*. ESA is not only cooperating within its member-state construct and with the EC, but it is also part of the largest international space exploration endeavor ever undertaken. An initial member of the *ISS*, ESA continues to fund and contribute to the *ISS* through station modules and astronaut presence. Long-time space policy expert John Logsdon has written numerous publications concerning the *ISS*. He notes that in 1984, U.S. President Reagan commissioned NASA "to develop a permanently manned space station and to do it within the decade. … NASA will invite other countries to participate so we can strengthen peace, build prosperity, and expand

[34] "History of the European Space Agency," European Space Agency.

[35] Communication from the Commission to the Council and the European Parliament, European Space Policy, (2007), http://www.espi.or.at/images/documents/communication%20from%20the%20commission%20to%20the%20council%20and%20the%20european%20parliament%20com%282007%29212%20%93european%20space%20policy.pdf (accessed 14 October 2008).

freedom for all who share our goals."[36] Europe accepted the invitation in 1985 implying that a significant share of Europe's "space budgets over the coming decade would have to be channeled into a partnership with the United States."[37]

Such a large undertaking does not come without its disagreements, which were not only seen internationally, but within ESA, as well. During the year from invitation to acceptance, Europe was divided on whether or not to join such a venture. As noted by Logsdon, "political-level discussions among the leading European countries—particularly France, Germany, the United Kingdom, and Italy—were leading to agreement on how those elements could be combined in an acceptable fashion."[38] The biggest disagreement was split three ways: French desire for better launch vehicles and European autonomy, German and Italian desire for human spaceflight, and British desire for ESA to take on smaller, exploration-type projects.[39] After a year of discussions between the member states, ESA accepted President Reagan's invitation to join in the *ISS*.

Since its agreement to join in the *ISS* endeavor, ESA has contributed the Columbus laboratory, as well as two mission control centers, one for the operation of the Columbus laboratory and one for Europe's Automated Transfer Vehicle. These control centers are located at the German Space Operations Center near Munich, Germany, and French Space Agency in Toulouse, France, respectively.

Fast forward twenty years to the U.S.'s announcement that it will leave the ISS by the end of 2015. That announcement set off bickering between *ISS* funding nations about when to close the *ISS*, despite the fact that it had not yet been completed. NASA announced that it would utilize the space station no longer than five years after completion, Russia is pushing for a longer life, and ESA acknowledges that it cannot pick up NASA's share after NASA's departure from the *ISS*. In light of that, ESA chief Jean-Jacques Dordain stated at an astronautics congress in Hyderabad, India, that "If NASA is staying, we are ready to follow. If NASA is quitting, I shall

[36] John Logsdon, *Together in Orbit: The Origins of the International Space Station* (Washington, DC: The George Washington University, 1999), 1.

[37] Ibid., 26.

[38] Ibid., 31.

[39] Ibid.

not propose to ESA to pay part of the cost that NASA is covering today."[40] If the U.S. departs the *ISS* in 2015, ESA must decide how to proceed. Such a decision is sure to cause controversy not only within the ESA itself, but also between the ESA and the EC, as well as ESA and other international partners.

Other programs have witnessed conflict, as well, including Galileo and *Ulysses*. The Galileo program began in the late 1990s, and disagreements on funding began right away. In a European Policy Paper for the Center for West European Studies, "Transport Commissioner Loyola de Palacio argued that the EU Transport Council would be crucial for the future of Galileo."[41] Despite this warning, the Transport Council postponed a commitment to the development of Galileo. However, the European Commission continued to push for an agreement between the EU Council and the European Parliament by May of 2001.[42] Conflict also existed within the EU member countries, not just within the EU political structure. France, Italy, Norway, Spain, Portugal, and Switzerland felt that the construct and political drivers of Galileo fell under the umbrella of the EU. Germany, Netherlands, and the United Kingdom (UK) subscribed to a more commercial argument and pushed for immediate development.[43] In 2007, European finance ministers disagreed on funding for satellite navigation, putting Galileo in a holding pattern. Previously, the mission had been boosted when funds were diverted from the agricultural sector to the ESA's satellite navigation budget. Germany, however, wanted to see money specifically allotted for ESA to pay for the Galileo program. However, according to Portuguese Finance Minister Fernando Teixeira Dos Santos, "Germany put forward that point of view, but was alone in doing so. There was no support from the other member states."[44]

The *Ulysses* spacecraft, built in Europe and launched aboard a NASA shuttle in 1990, was the first spacecraft to fly over the poles of the sun.[45] *Ulysses* endured almost a decade of delay in part due to financial cutbacks in the early 1980s on the NASA side of the partnership.

[40] "Space Station Partners Bicker Over Closure Date," *Agence France-Presse*, 26 September 2007.

[41] Johan Lembke, The Politics of Galileo, European Policy Paper No 7 (April 2001), 8.

[42] Ibid., 9.

[43] Ibid., 11.

[44] "EU Agrees to Disagree," *The European Weekly*, 17 November 2007, http://www.neurope.eu/articles/79861.php (accessed 14 October 2008).

[45] Burleson, 79.

ESA continued with the mission, however, and was prepared to launch in 1986. Due to the *Challenger* disaster, however, the launch was further delayed until 1990.[46]

Looking to the future, there are numerous space programs affected by the U.S.-Europe transatlantic relationship. The *ISS* will continue to be a point of contention; however, ESA's ATV could serve as the bridge between ESA and NASA by allowing for cooperation and reducing both agencies' reliance on Russia to transfer cargo and potentially crews to and from the *ISS*. The ATV, however, is a currently a cargo ship only. In order to use the ATV to transport crews, it would have to be man-rated, which would incur additional costs not only to ESA, but potentially to NASA, as well, assuming ESA allows NASA to utilize the spacecraft. Future missions to the Moon and Mars will also require transatlantic cooperation including the Constellation Project, which encompasses the vehicles required for such endeavors.

This thesis will research nationalism conflicts within ESA, as well as between ESA and NASA. These drivers could include economic self interests, respective national security, and/or nationalism. This thesis investigates the hypothesis that nationalism has been the major point of contention within ESA, as well as between ESA and NASA, that hampers multinational cooperation. The findings will be contrasted with the growing pressures and need for international cooperation and globalization in order to further space exploration.

E. METHODS AND SOURCES

The methodology for conducting this project are historical and comparative case studies of joint space exploration projects undertaken by the U.S. and Europe. For the analysis, NASA and ESA (as well as its member states and their respective space agencies) will be evaluated. In addition to the aforementioned sources of books, journals, and policy papers, interviews will be conducted with NASA officials, as well as experts in the field of space security.

In seeking answers to the viability of continuing transatlantic relations pertaining to space cooperation, a study of the history of multinational agreements in space exploration will offer insight into the challenges the U.S. and Europe will face as they look to the future of space. In addition, two of the three the levels of analysis common to international relations will serve as an

[46] "Ulysses Overview," European Space Agency, 2000-2008, http://www.esa.int/esaSC/120395_index_0_m.html (accessed 15 October 2008).

outline for the methodology of this research. The international level will look at the distribution of power, economic conditions, and interdependence of one country on another, while the state level, will research the country's regime type, politics, and organizational theory, focusing on nationalism. These levels will be studied as they apply to the aforementioned case studies and historical references.

F. THESIS OVERVIEW

The rest of this thesis is organized as follows: Chapter II examines why states cooperate in high-tech ventures including space and will include specific factors relevant to the transatlantic relationship. Chapter III discusses the history of U.S.-European space cooperation and investigates projects within this construct. Chapter IV outlines current and emerging issues affected by the transatlantic cooperation, and finally, Chapter V concludes this thesis and offers policy recommendations.

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II. SPACE COOPERATION

A. WHY NATION-STATES COOPERATE IN HIGH-TECHNOLOGY VENTURES

Nation-states cooperate in high-technology ventures for such varied reasons as cost savings, a desire to increase the rate of technological research and development, risk sharing, and technology sharing and transfer, as well as strategic needs of alliance cohesion. Cooperation in these ventures also results in the generation of new products, processes, and services. As noted in a 2005 report to the United States (U.S.) Congress, "collaborative ventures are intended to accommodate the strengths and responsibilities of all sectors involved in innovation and technology development."[47] In 2008, officials in the White House noted that "the U.S.-European commercial relationship is the engine of the world economy."[48] To this end, the U.S. has joined with European countries to pursue advanced technology ventures in many areas. Academic, commercial, and military cooperation have resulted in noteworthy and diverse products including the structure of DNA, earthquake engineering,[49] the Joint Strike Fighter (JSF), and the *International Space Station* (*ISS*).

Cost savings are a substantial benefit of cooperation in general, but especially in high-technology ventures. While an effort to cooperate with other nation-states may be more expensive in the short term (for example, extra travel, interpreters, different measurement systems, etc), such effort can be more cost effective in the long run. For instance, the *ISS* would have been entirely too expensive for one nation-state to fund independently. With the help of five cooperating nation-states (Canada, European nations under the veil of the European Space Agency (ESA), Japan, Russia, and the U.S.), the construction and utilization of the *ISS* was much more feasible, since spreading research and development across numerous participants subsidizes the overall cost. Another example is the JSF; over $4.5B of the program have been

[47] Wendy H. Schacht, Cooperative R&D: Federal Effort to Promote Industrial Competitiveness, CRS Report for Congress, IB89056, (2005).

[48] "Fact Sheet: The United States and The European Union: Working Together to Advance Freedom and Prosperity Around the World," The White House (2008), http://www.whitehouse.gov/news/releases/2008/06/20080610-6.html (accessed 8 December 2008).

[49] "U.S.-EU Cooperation in Science and Technology," US Department of State (2005), http://www.state.gov/p/eur/rls/fs/42549.htm (accessed 8 December 2008).

funded through international cooperation.[50] Though the U.S. could have produced the JSF without this funding, the technological advances may not have been developed as quickly. The sum of $4.5B may be a small portion of the overall cost of the JSF program; however, this funding and technology transfer from cooperating nation-states do have an overall positive impact the program.

Another benefit of cooperation in high technology ventures is the sharing of risk and possibly the spreading of the penalty of associated failure. The risk associated with a project may be too much for one nation-state (for example, the risk could outweigh any potential benefits), but if the risk is spread across many nations and institutions, the project is much more feasible and the risk is more manageable. Again, an example of this is the *ISS*. If the *ISS* or its individual components had failed, the cost and failure would have been spread through five space agencies instead of completely crippling one nation's space agency.

B. FACTORS AFFECTING U.S.-EUROPEAN COOPERATION

Nationalism is an elusive term. Many have attempted to define nationalism; however, it is more a state of concept rather than a word to be defined. Kupchan notes that "in some parts of post communist Europe, nationalism is a critical source of cohesion, in others, a source of fragmentation and violence."[51] In *National Identity*, Anthony Smith defines national identity as "some sort of political community,"[52] while Craig Calhoun adds that "nationalism is not only a matter of politics, but of cultural and personal identity,"[53] as well. While these are excellent definitions and ideas, nationalism cannot truly be defined since it is more about the variations in the ideas/concepts of a nation. What is of benefit to this study is the idea of nationalists and how they shape the international relations of space cooperation as applied to the U.S. and Europe. Nationalistic particularism and parochial concerns of a national nature have been present in the area of space exploration since the beginning; for example, the space race of the 1950s and 1960s was deeply rooted in the Soviet-U.S. conflict of the era which, in turn, was a successor to competition in the then high technology of aviation and maritime weapons of the early 20th

[50] "Program," JSF (2008), http://www.jsf.mil/program/prog_intl.htm (accessed 8 December 2008).

[51] Charles A. Kupchan, *Nationalism and Nationalities in the New Europe* (Ithaca, NY: Cornell University Press, 1995), ix.

[52] Anthony D. Smith, *National Identity* (Reno, NV: University of Nevada Press, 1991), 9.

[53] Craig J. Calhoun, *Nationalism* (Minneapolis, MN: University of Minnesota Press, 1997), 3.

century. There was a tremendous amount of pride and prestige in the Soviet Union when *Sputnik* was launched in 1957. The same can be said for the U.S. when *Apollo 11* landed on the Moon in 1969. Had it not been for dictates of putative national and strategic interests fueling the space race, these feats may not have been accomplished for many, many years.

According to Lieven, post-9/11, the U.S. reverted back to its old pattern of nationalism, which in turn "alienated the United States from some of its closest allies in Europe."[54] Additionally, Lieven concludes that Europe has overcome its Eurocentric way of thinking and embraced the idea of international cooperation, as opposed to traditional nationalism.[55] This, however, is not entirely accurate in the area of space cooperation, be it within ESA itself or between ESA and other nation-states. This section will research nationalism in space cooperation and correlate the activities and policies of the U.S. and European governments, and their respective space agencies, to nationalism.

1. U.S. National Interest, Nationalism, and Space

In the 21st century, the U.S. is one of the world's major space powers (along with Russia) if not *the* major space power. How does this state of affairs fit within the international system of nation-states? Following the space race with the Soviet Union in the 1960s, the U.S. surged ahead in the development of a reusable launch vehicle, space science research, and military support technology. With the coming of the *ISS*, the U.S.'s National Aeronautics and Space Administration (NASA) and Russia found themselves once again working together for the progression of space exploration. In addition to Russia's partnership, NASA has also partnered in many areas with ESA and many of its member states, the Japan Aerospace Exploration Agency (JAXA), and the Canadian Space Agency (CSA). Though this policy is a multilateral endeavor, the pursuit of national interests, as well as outright nationalism as applied to industrial policy and space technology, plays a role in the politics and economics of the *ISS*. With such accomplishments and rich heritage in space exploration, the creators of U.S. space policy and the space industry feel a great pride that plays a key role in the international relations of space cooperation.

[54] Anatol Lieven, *America Right or Wrong: An Anatomy of American Nationalism* (New York, NY: Oxford University Press, 2004), 19.

[55] Ibid.

a. Brief History

The NASA of the early 21st century has a heritage that began in 1915 with the National Advisory Committee for Aeronautics (NACA), whose mission was to advance aeronautics research in its infancy and when aviation was scarcely a major issue of public policy in the new world. In the wake of the *Sputnik* shock in 1958, NACA acquired the additional mission of space research and exploration and was renamed to NASA. The agency's progress accelerated at a rapid pace; NASA was able to put a man in space, orbit the earth, and eventually land man on the Moon in a span of only eight years (from May 1961 to July 1969). Unfortunately, following the initial Moon landings, NASA's budget was drastically reduced in the difficult decade of the 1970s; this policy resulted in the cancellation of Apollo 18, 19, and 20.[56] In the years that followed the Apollo program, NASA turned its focus to space science programs, launching such probes as *Mariner, Pioneer,* and eventually, *Voyager.* *Skylab*, the U.S.'s first experimental space station, was also launched in 1973, serving as the platform for nearly 300 scientific experiments.[57]

NASA's next great accomplishment came with the launching of the Space Transport System, better known as the Space Shuttle. The Shuttle was first launched in 1981 and is scheduled to be retired in 2010. There have been five orbiters to serve the U.S.: *Columbia, Challenger, Discovery, Atlantis,* and *Endeavor.* As of this writing, only three orbiters remain: in 1986, the U.S. was faced with the loss of seven astronauts and the *Challenger*, which broke apart during launch; in 2003, another orbiter was lost when *Columbia* broke apart during re-entry, which also resulted in the loss of all seven crew members. Despite these losses, the U.S. has continued to forge ahead with the *ISS*, with the first two modules of the station being launched in 1998. Today, the *ISS* consists of more than ten modules resulting from more than thirty construction flights, has been home to more than 167 astronauts/cosmonauts,[58] and has been the

[56] Roger E. Bilstein, *Orders of Magnitude: A History of the NACA and NASA, 1915-1990* (Washington, DC: NASA SP-4406, 1989).

[57] "Skylab Mission Goals," NASA (2000), http://wwwpao.ksc.nasa.gov/history/skylab/skylab-goals.htm (accessed 25 November 2008).

[58] "Nations around the World Mark 10th Anniversary of International Space Station," NASA (2008), http://www.nasa.gov/mission_pages/station/main/10th_anniversary.html (accessed 25 November 2008).

platform for hundreds of scientific experiments. NASA continues to look to the future with plans for completing the space station, missions to the Moon and Mars, and a new program to accomplish this feat: Constellation.

b. Goals, Projects, and Nationalism

As previously mentioned, the most recent U.S. National Space Policy states that "in order to increase knowledge, discovery, economic prosperity, and to enhance the national security, the United States must have robust, effective, and efficient space capabilities."[59] The 2006 space policy greatly differs in one area from the previous policy in 1996; while still mentioning international cooperation in the 2006 policy, it focuses much more heavily on national security. In that vein, the U.S. government has lain out seven principles to achieve the aforementioned goals; among these principles, the U.S. is committed to "the exploration and use of outer space by all nations for peaceful purposes, and for the benefit of all humanity."[60] In addition, the principles call for the rejection of any claim over space by a nation and the deterrence of nations that may impede others from developing space capabilities. In the realm of national defense, the principles call for the denial of space capabilities if a nation threatens U.S. interests.[61] The U.S.'s unilateralism and nationalism are evident in these principles. Along these lines, the following goals set forth by the space policy also have a nationalistic flavor in terms of both attitude and self-determination:

> Strengthen the nation's space leadership and ensure that space capabilities are available in time to further U.S. national security, homeland security, and foreign policy objectives; enable unhindered U.S. operations in and through space to defend our interests there; enable a dynamic, globally competitive domestic commercial space sector in order to promote innovation, strengthen U.S. leadership, and protect national, homeland, and economic security; and enable a robust science and technology base supporting national security, homeland security, and civil space activities.[62]

These goals all have a common thread: to protect the U.S. and its interests; to meet these goals, the U.S. has many programs in progress. These programs include the Defense

[59] Office of Science and Technology Policy, Presidential Decision Directive, "U.S. National Space Policy."

[60] Ibid.

[61] Ibid.

[62] Ibid.

Support Program (DSP) (under United States Air Force [USAF] control), the Global Positioning System (GPS) constellation (under Department of Defense [DoD] control), the *ISS* (under NASA control), and many commercial space ventures. DSP satellites protect the U.S. with their ability to detect missile launches and nuclear detonations.[63] This capability will continue to exist for the U.S. as DSP is phased out and replaced by the Space Based Infrared System (SBIRS). The statement: "enable unhindered U.S. operations in and through space to defend our interests there,"[64] can be construed as having slight overtones of an anti-satellite system (ASAT).[65] While ASAT systems themselves are not banned, the test of such systems is proscribed via the Outer Space Treaty, which refers to the harmful contamination of space.[66] Recently, however, the U.S. shot down a rogue satellite (U.S. 193) using a sea-launched missile. While not a "test" of an ASAT system, this action clearly has important implications, which reconfirm the U.S.'s ability to shoot down a satellite. Finally, in meeting these goals, the U.S. commercial sector continues to succeed at its goal of being globally competitive via advances in telecommunications, Earth mapping satellites, and commercial space launch ventures.

Aside from the current space policy, nationalism can also be found in NASA projects. The *ISS* provides an excellent example of U.S. nationalism in practice in terms of attitude and self-identity. For instance, the original name of the *ISS* was *Freedom*. As the number of partners increased, the name of the station continued to change (*Alpha*, then eventually *ISS*) and contracts were "lost" by the U.S. in favor of money and technology from cooperative partners. On the economic side, the U.S. has put forth the largest sum of funding for the *ISS*, at a total of $40B by the end of 2008.[67] To that end, the U.S. lays claim to a majority of the station regardless of the "international" nature of the program. It is, after all, the

[63] Jeffrey T. Richelson, *America's Space Sentinels: DSP Satellites and National Security* (Lawrence, KS: University Press of Kansas, 1999), vix, 40.

[64] Office of Science and Technology Policy, Presidential Decision Directive, "U.S. National Space Policy."

[65] Anti-satellite systems have been a point of contention for decades and are considered space weapons. The US successfully tested an ASAT system in 1985, launching an ASM-135 missile from an F-15 and destroying the intended satellite; the USSR also conducted successful tests in the 1980s. In January of 2007, China demonstrated an ASAT system of their own when the Feng Yun 1C weather satellite was destroyed and thousands of pieces of space debris was scattered into orbit. This not only displayed China's arrival on the space weapon's stage, its debris created a hazardous environment to other satellites and potentially humans in space.

[66] "Outer Space Treaty," (1967), http://www.state.gov/t/ac/trt/5181.htm (accessed 12 January 2009).

[67] Carl Behrens, The International Space Station and the Space Shuttle, CRS Report for Congress, RL33568 (2008).

International Space Station, not the *U.S. Owns Controlling Interest Station*. Another example of U.S. nationalism in space programs is the International Telecommunications Satellite Consortium (INTELSAT) program. The Communication Satellite Corporation (COMSAT) was established via the Communications Satellite Act of 1962 and was U.S. government owned. When INTELSAT came online in 1964, COMSAT satellites were used. As noted by Johnson-Freese, the U.S. offered to "provide benefits to others in areas which did not negatively affect U.S. national interest as inducement for cooperation, while ensuring no technology transfer from the United States."[68] Thus the U.S. ensured its pivotal role in this international cooperation all the while keeping its technology close hold. As previously mentioned, INTELSAT resisted launching European commercial satellites in order to maintain the lion's share of the program,[69] yet another example of nationalism in play.

Nationalism in space has been evident for decades, from INTELSAT in the 1960s to the present-day *ISS.* Strong themes of nationalism can be found from the new U.S. National Space Policy to the means of achieving the goals set forth in the policy. While nationalism is something that will continue to be a factor in space decisions, cooperation is obviously not out of the question. The challenge is to understand the specific conditions under which it can be reduced successfully.

2. U.S. Space Policy and Transatlantic Relations

As previously mentioned, the most current (2006) U.S. National Space Policy focuses more on national security and less on international cooperation than the previous space policy (1996) had. This change of policy is obvious not only from its content, but also from the fact that there are only two short paragraphs covering international cooperation and almost two entire pages on national security. Regardless, the U.S. recognizes the value of international cooperation and still addresses such cooperation in the 2006 policy. As such, one of the policy goals set forth is the encouragement of "international cooperation with foreign nations and/or consortia on space activities that are of mutual benefit and that further the peaceful exploration and use of space."[70]

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[68] Johnson-Freese, *Space as a Strategic Asset,* 18.

[69] Suzuki, 62.

[70] Office of Science and Technology Policy, Presidential Decision Directive, "U.S. National Space Policy."

However, U.S. policy is very clear on its intention to pursue international cooperation if and only if it is consistent with national security interests. The policy states that international cooperation could occur in space exploration, Earth observation, and "providing space surveillance information consistent with security requirements and U.S. national security and foreign policy interests."[71] The policy goes on to say that the U.S. will encourage the use of its systems by friends and allies.[72] Almost the entire section on international cooperation is based on U.S. national security interests and the promotion of its own systems.

The U.S.'s concern for national security is evident throughout the entire document. One principle mentions that the U.S. supports the peaceful use of outer space by all nations; however, the next principle states that the U.S. "rejects any limitations on the fundamental right of the United States to operate in and acquire data from space."[73] Note that the principle discusses the fundamental right of the *United States,* not *all* countries as mentioned in the previous principle. In addition, treaty obligations are not mentioned in the 2006 document, as was mentioned in 1996. Instead, the 2006 policy states that "arms control agreements or restrictions must not impair the rights of the United States to conduct research, development, testing, and operations or other activities in space for U.S. national interests."[74]

It is evident that nationalism (in the form of national security, attitude, self-identity, *and* self determination) is at the forefront of U.S. space policy and will be a major driver in international cooperation not only with Europe, but other nation-states, as well. One could argue that nationalism could be a limiting factor in cooperation; a different perspective is that national security needs among allies could actually promote and even bolster international cooperation. Though the U.S. will undoubtedly continue with international cooperation, it appears as though national security will outweigh any cooperation if need be.

3. European Interest, Nationalism, and Space

ESA is Europe's gateway to space. "Its mission is to shape the development of Europe's space capability and ensure that investment in space continues to deliver benefits to the citizens

[71] Office of Science and Technology Policy, Presidential Decision Directive, "U.S. National Space Policy."

[72] Ibid.

[73] Ibid.

[74] Ibid.

of Europe and the world."[75] ESA is currently comprised of eighteen member states: Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. Four other states are also participating under various cooperative agreements: Canada, Hungary, Romania, and Poland.[76] With eighteen member states and four periphery members, common goals and cooperation between these twenty-two entities must supersede individual member's state goals and sense of nationalism. Not only must ESA exhibit cooperation within the agency, but cooperation between ESA and other European Union (EU) establishments must also exist. Throughout the last decade, ESA and the European Commission (EC) have disagreed on what ESA's priorities should be and how to implement these priorities.

a. Brief History

The roots of the ESA go back as far as 1945. Following World War II, European scientists realized that national programs would not receive the funding or support required to compete with the two superpowers: the U.S. and the Soviet Union. As a result, many of these scientists left Europe to work in one or the other of these countries, though very few went to the Soviet Union. The idea for a joint space research organization did not come about until 1958 after the foundation of the European common market. However, by 1960, ten European countries had formed a commission to determine European cooperation in space. From this commission, European Space Research Organization (ESRO) was established in 1961.[77] In 1964, the European Launch Development Organization (ELDO) was established separately from ESRO.[78]

Throughout the 1960s, ESRO established various divisions based in multiple European countries. The ESA Center for Earth Observation (ESRIN) was established in Rome, Italy; the European Space Operations Center (ESOC) was established in Darmstadt, Germany; and the European Space Research and Technology Center (ESTEC) was established in Noordwijk, the Netherlands. In 1973, ESRO and NASA joined to create *Spacelab*, a modular

[75] "European Space Agency," European Space Agency (2000-2008), http://www.esa.int/esaCP/index.html (accessed 1 October 2008).

[76] Ibid.

[77] "History of the European Space Agency," European Space Agency.

[78] Johnson-Freese, *Changing Patterns of International Cooperation in Space,* 26.

lab flown on the space shuttle. ESRO constructed and gave NASA the first module of *Spacelab* in exchange for slots on the space shuttle for European astronauts. In 1975, ELDO and ESRO merged to form the ESA. From 1975 to 1979, ESA grew by two member states and one cooperating state: Canada. The 1980s saw a continuance in unmanned scientific and commercial payloads, as well as the evolution of the Ariane launch system.[79]

During the last two decades, ESA and NASA increased their collaborative efforts and launched the *Solar and Heliospheric Observatory* (*SOHO*), *Ulysses* satellite (another solar satellite), the well-known *Hubble Space Telescope* (*HST*), and the *Cassini-Huygens* probe to Saturn. ESA's launch vehicle, the Ariane, continued to improve with successful flights of the Ariane-5 in the late 1990s. Most recently, the world has seen the success of the *Mars Express Orbiter* (though the *Beagle 2* rover was lost), which was the first fully European mission to another planet. In 2008, ESA launched the Columbus module for the *ISS;* with this contribution, the "ESA now becomes a fully responsible partner in the operations and utilisation of the *ISS*."[80] This action also entitles ESA to fly its own astronauts for long-duration missions on the *ISS*. Additionally, "ATV [Automated Transfer Vehicle] *Jules Verne*, ESA's first Automated Transfer Vehicle, [was] also launched to take vital supplies to the *ISS*."[81] This short history shows that without these contributions from the ESA, many projects (*HST*, *ISS*) would not be where they are today.

b. Goals, Projects, and Nationalism

ESA does not operate autonomously from the collective of national governments. It is tied to the EU through the EC via the 2004 Framework Agreement between the European Community and the European Space Agency. The EC and the ESA agreed to the following cooperative goals: securing Europe's access to space, ensuring that space policy includes and supports policies pursued by the EC, strengthening the ties between ESA and the EC, and optimizing European resources.[82] The same framework agreement also identified specific fields of cooperation to include science, technology, Earth observation, navigation, communication by

[79] Johnson-Freese, *Changing Patterns of International Cooperation in Space*, 25-26.

[80] "History of the European Space Agency," European Space Agency.

[81] Ibid.

[82] Framework Agreement between the European Community and the European Space Agency, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri= OJ:L:2004:261:0064:0068:EN:PDF (accessed 14 October 2008).

satellite, human space flight, micro-gravity, launchers, and spectrum policy related to space. The articles of the framework agreement also outline governance of joint initiatives, consultation, and information procedures.

While this framework agreement existed in 2004, a European Space Policy was not agreed upon and implemented until 2007. This policy unified "the approach of the ESA with those of the individual European Union member states."[83] Implementing this policy and continuing on ESA's successful path of space exploration requires billions of Euros. Funding for ESA is provided through both the EU and the member states themselves. The member states fund in two different categories: mandatory and optional. Figure 1 below shows ESA's use in 2006 of the billions of Euros it receives from the EC and member states. Figure 2 is a breakdown of member states' mandatory and optional contributions in 2007.

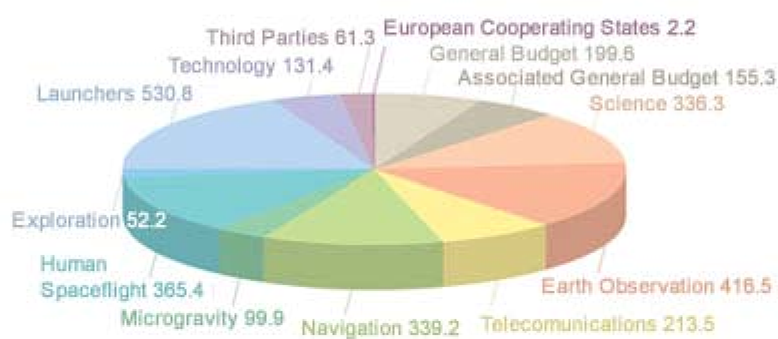

Figure 1. ESA's Budget Spending for 2006 in Millions of Euros[84]

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[83] "History of the European Space Agency," European Space Agency.

[84] Ibid.

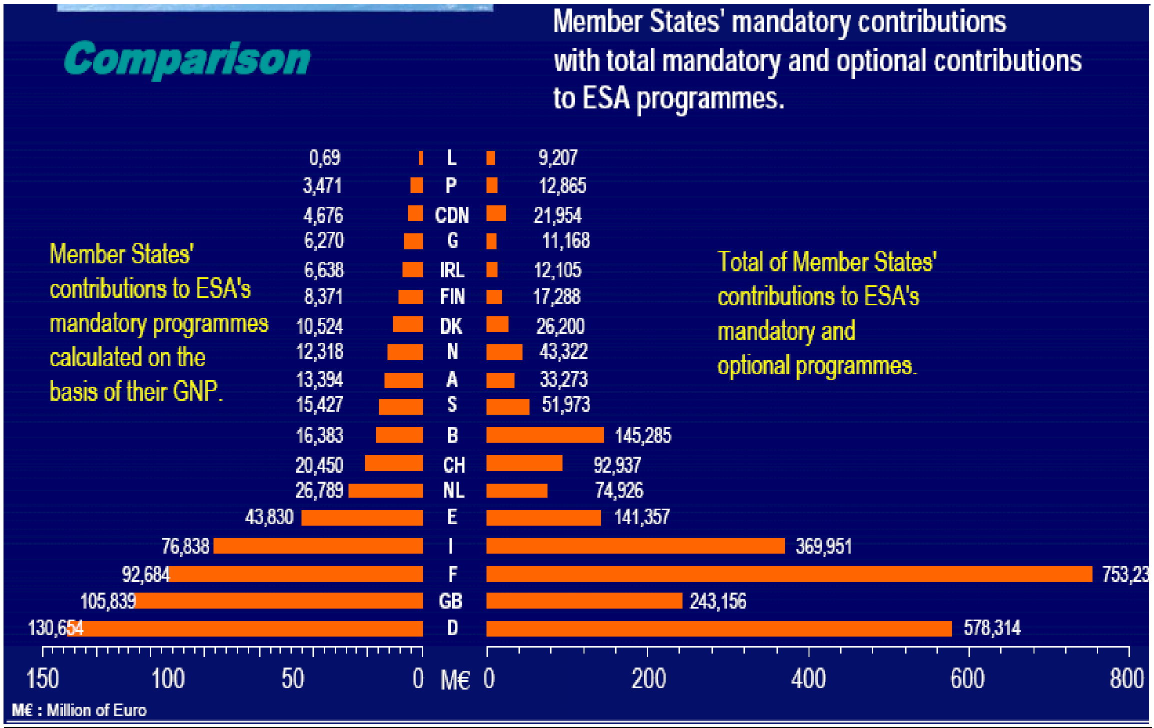

Figure 2. Member States' Contributions, 2007[85]

In line with the current space policy, ESA and the European Community collaborated to define goals for ESA. The first of these goals is satellite navigation, specifically Galileo, which would reside under the control of the EU. Another goal of the joint space effort is Earth observation, specifically, environment, climate change, and security. To accomplish this, ESA and the EC have implemented the Global Monitoring for Environment and Security (GMES) program. The two remaining goals outlined in the 2007 European Space Policy include satellite communications and security and defense. Satellite communications account for 40% of revenues for the European space sector and are "an integral part of the Information and Communication Technologies, such as the modernisation programme of the Air Traffic Management in Europe."[86] The final goal, security and defense, is important to the EC because it allows for monitoring of constantly evolving threats.

To meet these goals, ESA currently has numerous programs underway and in the planning stages. Within the area of Earth Observation are projects such as Envisat, European

[85] Luigi Fusco, Transferring ESA Space R&D to New Business Opportunities. Presentation given to Connect Research, May 8, 2008. http://ukinitaly.fco.gov.uk/resources/en/pdf/3662515/luigi-fusco.

[86] Fusco, Transferring ESA Space R&D, n.p.

Remote Sensing (ERS), Earth Explorers, Meteosat Second Generation (MSG), MetOp, and Project for On-Board Autonomy (Proba). All of these projects are geared toward environmental studies including climatology, meteorology, crop forecasting, and marine science. Finally, ESA is also looking to human space flight. Currently ESA relies on the U.S. and Russia to fly Europeans in space. This leads to discussion of the *ISS*, where "Europe, working through ESA, is exclusively responsible for two key Station elements: the European Columbus laboratory and the Automated Transfer Vehicle."[87]

With the elaborate policies, number of member states, amount of funding, and few human spaceflight opportunities, one must ask why the Europeans are committed to a unified space agency and how national interest, particularism, and nationalism affect this commitment. Are there winners and losers among the members of the respective European nation-states? How does each member state contribute? To answer the first question of why the Europeans are committed to ESA, such cooperation plainly increases Europe's political, economic, and technological clout. In the technology area, Europeans have realized that "space-based systems provide improved weather forecasts, satellite broadcasting and advanced navigation services; they open up new opportunities in tele-education and tele-medicine."[88] Economically, space-based systems allow for the growth of communication systems, electrical power grids, and financial networks.

With a set amount of mandatory funding required from each member state, no state can accuse the ESA of favoritism toward another member state. All states contribute the same amount of mandatory money, and all have the option of contributing in additional areas. With that in mind, each of the twenty-two member or cooperative states contributes through various means. France and Germany are the largest monetary contributors to the ESA, followed by Italy and the United Kingdom. In addition, France and Italy account for 50% of the current ESA astronaut core. An abbreviated table of member (and other) states' responsibilities and contributions is listed below in Table 1.

[87] "European Space Agency: Human Space Flight and Exploration," European Space Agency, 2000-2008, http://www.esa.int/esaHS/ESA6NE0VMOC_index_0.html (accessed 23 November 2008).

[88] Resolution of the European Space Policy, 2007, http://www.esa.int/esaMI/About_ESA/SEMO78B474F_0.html (accessed 23 November 2008).

Table 1. Contribution to ESA by Member

	Member	Responsibilities/Contributions
Member States	Austria	*Cassini/Huygens, Rosetta, Mars Express*[89]
	Belgium	ESA liaison office; one astronaut; multiple programs
	Czech Republic	Various projects including SOHO, GSE Land, and CLUSTER II[90]
	Denmark	*EARTHNET*, *Spacelab*, EOPP[91]
	Finland	Space weather observation, instrumentation for mission to Mercury[92]
	France	Provides launch facility in French Guiana; two astronauts; multiple programs
	Germany	European Astronaut Centre (EAC); ESOC; one astronaut; multiple programs
	Greece	Cross Scale, Tandem[93]
	Ireland	*ARTES*, *Galileo*, *Ariane 5*
	Italy	ESRIN; two astronauts; multiple programs
	Luxembourg	*ARTES*[94]
	The Netherlands	ESTEC; one astronaut; multiple programs

Table 1: Contribution to ESA by Member continued on page 29.

[89] Bruno P. Besser, Austria's History in Space, (2004). http://www.esa.int/esapub/hsr/HSR_34.pdf (accessed 25 November 2008).

[90] "Running PECS Projects," Czech Space Office, 2006-2008, http://www.czechspace.cz/en/cso/running-pecs-projects (accessed 23 November 2008).

[91] Preben Gudmandsen, ESRO/ESA and Demark: Participation by Research and Industry, History Study Reports, (2003), http://www.esa.int/esapub/hsr/HSR_33.pdf (accessed 23 November 2008).

[92] "European Space Agency: ESA Space Weather Server," European Space Agency, 2000-2008, http://www.esa-spaceweather.net/spweather/workshops/proceedings_w1/proceedings_w1.html (accessed 23 November 2008).

[93] National Observatory of Athens Institute for Space Applications and Remote Sensing Annual Report, (2007), http://www.iono.noa.gr/ (accessed 14 October 2008).

[94] "Luxembourg strengthens its ties with ESA," European Space Agency, (2000-2008), http://www.esa.int/esaCP/GGGJ5ZC3KCC_Benefits_0.html (accessed 23 November 2008).

Table 1: Contribution to ESA by Member continued from page 28.		
	Member	**Responsibilities/Contributions**
	Norway	*ISS, Ariane 5*[95]
	Portugal	*Egnos, Galileo, ARTES*[96]
	Spain	European Space Astronomy Center (ESAC); multiple programs
	Sweden	One astronaut; multiple programs
	Switzerland	EUTELSAT, ITSO (INTELSAT) and EUMETSAT[97]
	United Kingdom	*ARTES*, EO mission, *Galileo, GMES*, and *Aurora*[98]
Cooperation Agreement Member	Canada	*ERS-1, ERS-2, EOPP, OLYMPUS, Poem-1/ENVISAT-1, Artemis*[99]
Plan for European Cooperating States (PECS) Member	Hungary	*Rosetta, Mars Express, ISS*[100]
	Poland	*Ulysses, SOHO, Mars Express*[101]
	Romania	COSPAR, INTELSAT, INMARSAT[102]

95 "Norwegian Space Center – Industry," 2003, http://www.spacecentre.no/English/Areas_of_Focus/Industry/, (accessed 23 November 2008).

96 "German Spinoff to Target ESA Business in Portugal," Space News, 2007. http://www.space.com/spacenews/archive07/hps_0416.html (accessed 23 November 2008).

97 "ESA – National Galleries," European Space Agency, 2000-2008, http://esamultimedia.esa.int/multimedia/nationalgallery/switzerland/info_swi.html (accessed 23 November 2008).

98 "About BNSC." British National Space Center, (2006), http://www.bnsc.gov.uk/6185.aspx (accessed 01 October 2008).

99 "CSA – A Model of International Co-Operation," Canadian Space Agency, 2002, http://www.asc-csa.gc.ca/eng/programs/esa/info.asp (accessed 23 November 2008).

100 "Hungary and the Czech Republic Sign Cooperating State Agreements with ESA," European Space Agency, (2000-2008), http://www.esa.int/esaCP/SEMLTLUZJND_index_0.html (accessed 23 November 2008).

101 "Poland becomes fourth ESA European Cooperating State," European Space Agency, (2000-2008), http://www.esa.int/esaCP/SEMVKSU681F_index_0.html (accessed 23 November 2008).

102 "Romania becomes third ESA European Cooperating State," European Space Agency, (2000-2008), http://www.esa.int/esaCP/SEMI2HMVGJE_Benefits_0.html (accessed 23 November 2008).

As with all collaborative efforts, there are conflicts between ESA and the EC, as well as between member states. Many of these disagreements within ESA can be attributed to nationalism. For example, disagreements can come in the form of some member states not seeing the need for a certain system, while there are a handful of member states on the opposite side of the argument. One example of disagreement among member states is the Galileo program, which began in the late 1990's. Disagreements on funding began right away. In a European Policy Paper for the Center for West European Studies, "Transport Commissioner Loyola de Palacio argued that the EU Transport Council would be crucial for the future of Galileo and she argued for an unequivocal commitment by the Community. In fact, Palacio threatened to withdraw support for Galileo if the EU transport ministers did not firmly commit to invest public funds in a timely manner."[103] Despite this warning, the Transport Council postponed a commitment to the development of Galileo. However, the European Commission continued to push for an agreement between the EU Council and the European Parliament by May of 2001.[104] Conflict also existed within the EU member countries, not just within the EU political structure. Ministries and interest groups in France, Italy, Norway, Spain, Portugal, and Switzerland believed that the political forces in favor of and the structure of Galileo should fall under the umbrella of the EU. Germany, the Netherlands, and the United Kingdom (UK) subscribed to a more commercial argument and pushed for immediate development.[105]

Yet another nationalistic/political issue that arose in the early stages of Galileo was whether "satellite navigation should be offered through a publicly funded market or through a privately funded service market."[106] The share of development funding was linked closely to the forecasts of future market value. Private investors were leery of heavily investing upfront with no guarantees of the future of the program. In addition, "industry has been concerned to make a heavy investment early on in a system that would be on the market at the same time as GPS."[107] Other factors to consider are the timing of the commercial operation, as well as the

[103] Lembke, 8.

[104] Ibid., 9.

[105] Ibid., 11.

[106] Ibid., 12.

[107] Ibid., 14.

interest of industry and its ability "to make a profit from the system from the start."[108] The previous two arguments boil down to whether Galileo should be publicly funded and fall under the EU or if Galileo should be privately funded and managed, which may speed commitments, production, and completion times. The former countries mentioned (France, Italy, Norway, Spain, Portugal, and Switzerland) see the strategic purpose and value of Galileo, which fuels their desire for Galileo to be managed by the EU. The latter countries mentioned (Germany, Netherlands, and the UK) see "a more commercial argument, holding that the development of Galileo is urgent because of the need to compete in the satellite applications market."[109]

In 2007, European finance ministers disagreed on funding for satellite navigation, putting Galileo on hold. Previously, the mission had been elevated when EU authorities diverted funds from the agriculture sector to ESA's satellite navigation budget. Germany, however, wanted to see money specifically allotted for ESA to pay for the Galileo program. However, according to Portuguese Finance Minister Fernando Teixeira Dos Santos, "Germany put forward that point of view, but was alone in doing so. There was no support from the other member states."[110]

In an interview via *Satellite Today*, two defense contractors expounded upon the political situation surrounding the EU, EC, and ESA. Ian Reid, president of space operations at QinetiQ, a defense and security technology company, stated that "Among the challenges that ESA faces (in 2008) are its relationship with the EU, its role as [a research and development] organization and its relationship with the European Commission."[111] He also stressed that with the enlargement of the EU, there would be pressures on the budget. In the same vein, Antoine Bouvier, the Chief Executive Officer (CEO) of European Aeronautic and Defense Space Company (EADS) Astrium states, "We have in Europe, a political setup which is more complex than and not as straightforward as the political organization in the U.S. .… *It is more difficult here than in the U.S. due to this specific political situation in Europe.*"[112] In the U.S., only one

[108] Lembke, 14

[109] Ibid., 11.

[110] "EU Agrees to Disagree," The European Weekly.

[111] Mark Holmes, "Critical Year for European Space Programs," *Satellite Today*, 2007. http://www.satellitetoday.com/civilspace/geolocation/17299.html (accessed 23 November 2008).

[112] Ibid.

country is arguing over where funding should go, which projects should survive, and who has priority; however, in Europe, you have multiple countries' nationalism coming to light and providing input and arguing over funding, projects, and priorities ultimately vying for jobs for their respective country.

4. European Space Policy and Transatlantic Relations

ESA is not only cooperating within its own realm and with the EC, but it is also part of the largest international space endeavor ever undertaken. An initial member of the *ISS*, ESA continues to fund and contribute to the *ISS* through station modules and astronaut presence. Europe was invited by the U.S. to join in this endeavor in 1984; after a year of discussions between the member states, ESA accepted President Reagan's invitation to join. Logsdon notes that "European acceptance of the U.S. invitation was an important achievement for those within the United States advocating the station partnership. Without European involvement, the partnership they had in mind would have been much different in character." [113] Even after accepting the invitation, however, there was still opposition to cooperation in Europe, much of which was due to nationalism. France wanted to take the lead and push for European autonomy, while smaller member states remained skeptical; "however, the political strength of an invitation from the U.S. President kept this opposition muted in character."[114]

Recently, NASA announced that it would utilize the space station no longer than five years after completion; Russia is pushing for a longer life; and ESA acknowledges that it cannot pick up NASA's share (approximately 70%) after NASA's departure from the *ISS*. As mentioned previously, if the U.S. departs the *ISS* in 2015, ESA must decide how to proceed; controversy is sure to arise, nationalism could very well be at the forefront of this controversy.

Despite all of these issues, Europe's space policy clearly outlines the need for and benefits of international cooperation from science and technology research to launchers to human space flight. To that end, the European space policy mandates that the EU, ESA, and their member states will "develop a joint strategy for international relations in space by the end of

[113] Logsdon, 36.

[114] Ibid.

2008."[115] Though nationalism will continue to play a role with (and within) ESA, Europe is committed to international cooperation for the greater good of space exploration.

C. CHAPTER CONCLUSION

Nation-states cooperate in high technology ventures to reduce costs, share risks, and increase technological advances. These joint efforts result in new products, processes, and services,[116] and positively affect relations among those nation-states. Since the 1960s, NASA has partnered with Europe to further space research and exploration for all mankind. These partnerships, however, have not come without growing pains. The INTELSAT program is an excellent example of such pains. Nationalism pushed the U.S. to expect (and the U.S. eventually did receive) a majority of the contracts for this program. In addition, the U.S. refused to launch French satellites in support of INTELSAT in favor of its own satellites. More recently, nationalism is evident in *ISS* funding and resulting operations.

Of greatest note is the change in U.S. space policy from 1996 to 2006. The most recent space policy focuses much more on national security and much less on international cooperation than the previous policy. International cooperation is scarcely mentioned, and when it is, only in conjunction with national security and protecting U.S. interests. In addition, the updated policy states than even arms control treaty obligations would not hinder the U.S.'s pursuit of national security in and through the use of space.

Since its inception as a collaborative entity in Europe in 1960, ESA has faced many challenges. In contrast to NASA, which only deals internally with one country, ESA is comprised of twenty-two member or cooperative states and is subject to oversight by the EC; it is easy to see that disagreements will abound within ESA and between ESA and the EC, many of which are fueled by political and economic nationalism. Along those lines, it took until 2007 for ESA and the EC to agree upon and implement a European Space Policy. Not only were policies a source of contention, but individual programs such as Galileo, GMES, and the *ISS* caused consternation, as well.

[115] European Commission: European Space Policy, (2008), http://ec.europa.eu/enterprise/space/doc_pdf/esp_comm7_0212_en.pdf (accessed 14 October 2008).

[116] Wendy H. Schacht, Cooperative R&D: Federal Effort to Promote Industrial Competitiveness.

Despite internal disagreements fueled by nationalism, Europeans remain committed to ESA and space exploration. Many political, economic, and technological advances take root in ESA, and Europeans are not willing to lose their foothold in these areas. By supporting ESA, Europeans are advancing communications systems, financial networks, satellite communications and broadcasts, and increasing environmental awareness. While disagreements are destined to continue, Europe as a whole is aware of the benefits of ESA and will continue to support this agency well into the future. The next chapter focuses on five case studies of cooperative projects between the U.S. and ESA and delves more into the question of how nationalism affects such projects.

III. CASE STUDIES

This chapter analyzes historical and comparative case studies of joint space exploration projects undertaken by the United States (U.S.) and Europe. These case studies include the following: International Telecommunications Satellite Consortium (INTELSAT), *Ulysses*, Galileo, Stratosphereic Observatory for Infrared Astronomy (SOFIA), and the *International Space Station* (*ISS*). Within these case studies, two of the three levels of analysis common to international relations will serve as an outline for the methodology of this research. Among the areas studied will be the distribution of power, economic conditions, and interdependence of one country on another, as well as regime type, politics, and organizational theory.

A. JOINT NASA/ESA PROJECTS

Many reasons drove the initial National Aeronautics and Space Administration (NASA)-European Space Agency (ESA) partnerships including the U.S.'s "genuine desire to involve other countries in exploring the new frontier of space."[117] Early on, this involvement came in the form of providing ground stations for U.S. communication satellite programs. As noted by Johnson-Freese, "having a local ground station became something of a status symbol in other countries. European countries competed with each other."[118] Throughout the last five decades, this cooperation with Europe has evolved from ground stations for satellite communications to the *ISS.* This section reviews five cases that display this evolution of cooperation.

1. INTELSAT

The first case study focuses on INTELSAT, which, in the 1960s and 1970s, was one of the earliest cases of cooperation between the U.S. and Europe. As Johnson-Freese notes, cooperation enables the allocation of resources, for example, satellite slots in geostationary orbit. One of the first programs to fall under such cooperation was INTELSAT, which reflected "the early recognized need to coordinate telecommunication satellite activities."[119] INTELSAT is a

[117] Marcia S. Smith, "America's International Space Activities," *Society* (January/February 1984), 18.

[118] Johnson-Freese, *Changing Patterns of International Cooperation in Space*, 3.

[119] Ibid., 4.

global telecommunications network open to members of the International Telecommunications Union (ITU), "a specialized agency of the U.N. [United Nations]."[120]

In the U.S., satellite research and development (R&D) had traditionally been conducted by the government; however, as INTELSAT progressed, private industry realized the importance of gaining a foothold in satellite R&D, as well. Johnson-Freese notes that companies such as "RCA, AT&T, GE, Hughes Aircraft, and Bell Laboratories were heavily involved with basic communication satellite research."[121] At the same time, NASA informed the White House of the importance of handling international communication satellites in accordance with national interests. In addition, President Kennedy requested an additional $50 million in funding for R&D of communication satellites in 1961; it was this funding and the backing of NASA that led to U.S. industry's "capability to build operational telecommunication satellites."[122]

To represent U.S. interests in international telecommunications, the Communication Satellite Corporation (COMSAT) was established under the Satellite Act of 1962. Because of the technological advantage of the U.S., many other countries were relegated to either joining with the U.S. or being left out of the international endeavor all together. Because of this strategic position, and much to the dismay of the Europeans, the U.S. held the majority (61%) of the shares of INTELSAT. Additionally, many of the INTELSAT contracts were awarded to the U.S. in exchange for use of U.S. technology.[123] COMSAT's influence, however, was eventually reduced over time, and by 1988, the U.S. investment share was down to 26.4%.[124]

In the early 1970s, U.S. nationalism was very apparent. As previously mentioned, in order to protect U.S. interests, INTELSAT resisted the launching of *Symphonie*, a European commercial satellite. Since *Symphonie* was seen as competition to INTELSAT, the U.S. mandated that *Symphonie* could only be used for experimental purposes. Johnson-Freese notes that the U.S.'s decision not to launch European satellites was purely economic.[125] The French perceived this act as the U.S. attempting to "dictate the direction of future European programs

[120] Johnson-Freese, *Changing Patterns of International Cooperation in Space*, 17.

[121] Ibid., 18.

[122] Ibid.

[123] Suzuki, 56.

[124] Johnson-Freese, *Changing Patterns of International Cooperation in Space*, 18.

[125] Johnson-Freese, Joan, *Space as a Strategic Asset*, 46.

through launch restrictions."[126] This clearly was not the solution the Europeans were seeking and led to competition with the U.S. instead of cooperation, which subsequently resulted in Europe's determination to develop their own launcher.[127]

This international endeavor should have ensured an equitable distribution of power; however, the U.S. was able to control the majority of INTELSAT. Not only did the U.S. hold the majority of the shares, but it also was the sole launch provider for the INTELSAT member nations. This is just one example of the interdependence of one country on another in this international cooperation program. Despite this early competition between countries and the obvious show of nationalistic policy, INTELSAT has become a success story for international cooperation in space. Before privatization in 2001, INTELSAT brought together "116 countries of every imaginable size, economic structure, and political system to work together in a peaceful, purposeful, and profitable venture."[128] As Johnson-Freese explains, one of the reasons INTELSAT was so successful in bringing together various countries was because the system was using technology for the benefit of all, not just a single entity. Additionally, she lays out two valuable lessons learned from INTELSAT in regards to international cooperation: returns should be comparable to investment and the return must be greater through cooperation than on an individual basis.[129]

2. Ulysses

Ulysses began as the International Solar Polar Mission (ISPM), where the goal was to better understand how Earth's environment is effected by the Sun. Two spacecraft, one built by NASA, the other built by ESA, were to be launched aboard the space shuttle in 1983; however, it was not until 1990 that the ESA spacecraft was actually launched to fly over the poles of the

[126] Johnson-Freese, *Changing Patterns of International Cooperation in Space*, 26.

[127] Suzuki, 62.

[128] Johnson-Freese, *Changing Patterns of International Cooperation in Space*, 19.

[129] Ibid.

Sun.[130] Unfortunately, seven years of delays was a difficult way for the Europeans to learn that "the U.S. budget process makes it impossible for NASA to guarantee the continuation of an international project beyond a yearly basis."[131]

Troubles began in the late 1970s, when NASA diverted $5M from the ISPM budget to the test and evaluation budget for the space shuttle. This prompted the chairman of the Senate Appropriations Subcommittee to request that NASA delay ISPM by two years; this was the first step in a "series of problems … which culminated with the cancellation of the U.S. spacecraft."[132] The cancellation of the U.S. spacecraft for the joint *Ulysses* mission "was an exception to an otherwise steady norm and clearly international participation was still seen as politically beneficial in both receiving and maintaining Congressional and administrative support for a program."[133] While nationalistic behavior is not typically thought of in this manner, this is an example of just that. NASA deemed other national programs (including the space shuttle) more important than ISPM (possibly indicating that it was even more important than international cooperation), thus the cancellation of the spacecraft. Nationalism can also been seen in the early 1981 telex from Alan Lovelace, acting NASA administrator, to Director-General Erik Quistgaard of ESA. The telex states:

> In view of the scientific importance of the solar polar research, we hope that ESA will continue with the mission which can now be launched in 1986 on a shuttle/centaur and that we will be able to maintain its cooperative nature. As I indicated to you yesterday, the NASA budget will permit support of the remaining spacecraft, including U.S. experiments previously planned for the ESA spacecraft.[134]

The nationalistic flavor could be seen not only in the fact that the U.S. still wanted to be responsible for the launcher, but also that the previously planned U.S. experiments would still be included aboard the ESA spacecraft.

After the cancellation of the U.S. spacecraft, NASA and ESA met to discuss further action. ESA stated that the cancellation was a breach of the ISPM Memorandum of

[130] Burleson, 79.

[131] Johnson-Freese, *Changing Patterns of International Cooperation in Space*, 35.

[132] Ibid., 36.

[133] Ibid., 24.

[134] Ibid., 37.

Understanding (MOU) and requested full restoration of the program to the level outlined in the aforementioned MOU. ESA also specifically pointed out that the NASA was chosen over other European partners "because of the value ESA attached to transatlantic cooperation."[135] This has been one example of international cooperation outweighing nationalistic policies. ESA's response to this meeting was to ask each Member State to protest NASA's decision through their embassy in Washington. This would allow for multiple protests to be heard, rather than one European protest. Unfortunately, this action did not produce ESA's desired results. Instead, NASA pointed to a statement in the MOU that clearly stated each member's ability to carry out the agreement was predicated on available funding.[136]

ESA continued to favor international cooperation over nationalism; in a memorandum presented to the U.S. State Department on behalf of ESA's member states, ESA urged the U.S. to reinstate full funding and participation in ISPM *without* affecting other international space projects. The U.S., however, maintained its nationalistic stance and did not allow for provisions to fund ISPM in the 1981 NASA budget sent to Congress.[137] NASA's response continued to be noncommittal throughout negotiations, yet ESA kept a positive outlook. When the idea of developing a lower cost spacecraft was once again dismissed, ESA finally made the decision to press ahead with only one spacecraft. The mission was subsequently renamed *Ulysses*.

Johnson-Freese points out the biggest mistake made by the U.S. was not to consult with ESA prior to the budget reallocation and resulting cancellation of ISPM.[138] NASA exhibited strong nationalism when it cancelled an international program in favor of national interests. It could be argued that this funding was required for the testing and employment of the space shuttle (without which ISPM would never have launched) since many space science missions were being canceled at that time for just that reason. ESA was aware of this, as well as their dependence on NASA to get ISPM off the ground. Regardless, it is the author's opinion that cutting the funds for a program that required international cooperation was an unfortunate show of nationalistic interests. This, coupled with the overall handling of the cancellation, led Quistgaard to ask "the European scientific and technological community not to express too much

[135] Johnson-Freese, *Changing Patterns of International Cooperation in Space*, 38.

[136] Ibid., 38-39.

[137] Ibid., 39.

[138] Ibid., 42.

eagerness for cooperative ventures with the U.S. until the ISPM problem has been solved."[139] Clearly the only resolution they came to was to launch the ESA spacecraft on the space shuttle in 1990. Though this was not the outcome ESA was hoping for, ISPM was eventually launched and proved continually successful. In addition, cooperation between the two organizations continues to this day.

3. Galileo

The third case study is Galileo, Europe's precision navigation system that will be compatible with the U.S.'s Global Positioning System (GPS) and Russia's Global'naya Navigatsionnaya Sputnikovaya Sistema (GLONASS). It is the first large program jointly funded by the EU and ESA and is also the first major public/private partnership at the EU level;[140] the EU handles strategic issues, while ESA handles research and development.[141] In the *Communication from the Commission to the Council and the European Parliament [concerning the] European Space Policy*, Galileo was categorized as one of two European flagship projects (along with the Global Monitoring for Environment and Security (GMES) program).[142] The idea of this flagship program came about when the U.S. made GPS available to the civilian sector, prompting Europe to justify the need to enter the satellite navigation community. The U.S.'s GPS constellation was managed by the Department of Defense (DoD), which allowed civilians to access the capabilities albeit at a degraded accuracy. Europe was fearful that the DoD would cut off all non-DoD capabilities, leaving Europe at a loss for navigation. This was one of the drivers behind the implementation of Galileo. As noted by Lembke, "a race [then] developed for market share and strategic independence."[143] In 1994, "the European Commission

[139] Johnson-Freese, *Changing Patterns of International Cooperation in Space*, 38.

[140] European Commission: White Paper, Space: A New European Frontier for an Expanding Union: An Action Plan for Implementing the European Space Policy, (2003), http://eur-lex.europa.eu/LexUriServ/site/en/com/2003/com2003_0673en01.pdf (accessed 14 October 2008).

[141] Stefano Silvestri, "Space and Security Policy in Europe," Occasional Paper No. 48 (December 2003).

142 Communication from the Commission to the Council and the European Parliament, European Space Policy, (2007), http://www.espi.or.at/images/documents/communication%20from%20the%20commission%20to%20the%20council%20and%20the%20european%20parliament%20com%282007%29212%20%93european%20space%20policy.pdf (accessed 14 October 2008).

[143] Lembke, 4.

launched a proposal for Europe to engage in satellite navigation."[144] This led to the development of the Global Navigation Satellite System (GNSS), which was to be the predecessor of the second-generation constellation, Galileo.

As mentioned previously, disagreements on leadership and funding began right away. In addition, conflict also existed among the EU member countries, not just within the EU political structure. Germany, Italy, France, and the UK were all competing for the prime contract and operational leadership. As recently as 2007, European finance ministers disagreed on funding for satellite navigation, putting Galileo in a holding pattern. (Previously, the mission had been boosted when funds were diverted from the agricultural sector to the ESA's satellite navigation budget.) Suzuki points out that the competition for leadership in the Galileo program could result in two negative impacts: first, if one member state took responsibility for the system, it would diminish the "European" aspect of it; second, it could undercut funding for other programs if funding could not be spread across all of the member states.[145] As a result of this competition, as well as numerous budget and schedule slips, Galileo's thirty-satellite constellation is now not expected to be fully operational until 2013.

Not only were funding and leadership of concern from the beginning, but so was the possibility of allowing commercial and private industry participation. Suzuki found that Britain, Germany, and the Netherlands expressed a concern for the commercial possibilities of Galileo and demanded participation of private industry."[146] In addition "to Sweden, Denmark, and Austria, the opposing countries—Britain, Germany, and the Netherlands—further demanded an explanation as to whether Galileo would show financial benefits beyond its costs."[147] This is important, as pointed out by Suzuki, because there is limited funding in the ESA framework for Galileo, and it would be "crucial to have financial support from industry."[148] There were also European countries in favor of commercial and private industry participation, namely France, Italy, and Spain. Lembke points out that these countries "wanted to strengthen Europe's commercial and strategic independence and viewed Galileo more as a public service than as a

[144] Lembke, 4.

[145] Suzuki, 196.

[146] Ibid., 196-197.

[147] Ibid.

[148] Ibid., 139.

solely commercial enterprise."[149] To that end, British company Surrey Satellite Technology, LTD, built and launched the first Galileo satellite in 2005 (and currently have a project with Mississippi State and NASA Stennis)[150] and has been awarded a contract by ESA to design another Galileo satellite.[151]

Disagreement abounds between Member States in other areas, as well, including the speed and scale of commitment. As noted by Lembke, "some countries want a lasting commitment at the earliest date, while others want to obtain more information before deciding at a later date on the entire project."[152] Those countries that are looking for a lasting commitment at an earlier date include: France, Italy, Spain, and Finland, as well as the European Commission and ESA. On the other hand, "Germany, the Netherlands, the UK [United Kingdom] and Sweden want a clear role for and commitment by the private sector at an early stage. Moreover, [they] opposed the idea of using Galileo for military purposes." [153] France, Norway, Portugal, Spain, and Switzerland all stress that "Europe should not subject the Galileo project to detailed cost analyses and to the promise of a public-private partnership." [154] These countries argue that a detailed cost analyses and delays in promises of public-private partnership would cause Europe to miss its window of opportunity. Germany, the Netherlands, and the UK agree on the urgency, however, they cite "a more commercial argument, holding that the development of Galileo is urgent because of the need to compete in the satellite applications market."[155]

In the international arena, the European Union (EU) has been in constant contact with the U.S. concerning the compatibility of GPS and Galileo. The U.S.'s major concern has been that "Galileo's open signal would be too close to the upgraded GPS military signal."[156] If that is the case, this could potentially interfere with the military's use of the system in the event that the

[149] Lembke, 7.

[150] "SSTL 900," Surrey Satellite Technology, LTD, 2008, http://www.sstl.co.uk/Missions/Platforms/SSTL_900 (accessed 4 February 2009).

[151] "UK Space Activities 2007," British National Space Center, http://www.bnsc.gov.uk/7042.aspx (accessed 4 September 2008).

[152] Lembke, 10.

[153] Ibid.

[154] Ibid.

[155] Ibid., 10-11.

[156] "Space Security 2008," http://www.spacesecurity.org/SSI2008MediaRelease.pdf (accessed 4 February 2009),41-42.

U.S. attempted to jam open signals during a conflict. However, in mid-2007, "the two agreed to a common GPS-Galileo civilian signal to allow for interoperability of the two systems, while also maintaining the integrity of the U.S. military signal."[157] In an additional outreach for international cooperation, the "project has been opened to international partners … these included Israel, Ukraine, India, Morocco, Saudi Arabia, and South Korea. Russia has agreed to launch Galileo satellites."[158]

The distribution of power between the EU and ESA was outlined in the *Communication from the Commission to the Council and the European Parliament* concerning the European Space Policy. The EU would "take the lead in overall representation of applications programmes for its policies." [159] ESA, on the other hand, would "take the lead in the overall representation of Europe on programmes in the areas of science, launchers, technology and human spaceflight."[160] In addition, the document (and its accompaniments) states that the European Commission (EC) will conduct the following activities with technical support from ESA: "cooperation with the United States (Galileo/GPS-Agreement of July 2004), Russia (GLONASS, negotiations ongoing) and other countries relating to interoperability and compatibility of Galileo with existing and coming GNSS Systems."[161] In addition, the document outlines that new governance structures will be adapted "to ensure the best value for money in the deployment and operation of GALILEO, and the most effective involvement of both public and private partners." [162] Also of note is how the document outlines non-EU partners and their participation, stating that "collaboration will be based on the principles of non-discrimination and loyal cooperation."[163]

While this case study deals more with EU Member State than trans-Atlantic cooperation, it is still a strong case for international cooperation. Though this cooperation seems to be only a small part of the politics involved in *Galileo*, it is nonetheless a very important part.

[157] "Space Security 2008," 41-42.

[158] Ibid.

[159] Communication from the Commission to the Council and the European Parliament, European Space Policy.

[160] Ibid.

[161] Commission Staff Working Document: "European Space Programme - Preliminary Elements Accompanying Document to the Communication from the Commission to the Council and the European Parliament, European Space Policy (April 2007).

[162] Communication from the Commission to the Council and the European Parliament, European Space Policy.

[163] Ibid.

Compatibility with the U.S.'s GPS system could turn out to be crucial for Europe, as well as the U.S.. As previously mentioned deconfliction of frequencies is of the upmost importance and will serve everyone well in the event of another conflict on European soil.

4. SOFIA

The Stratospheric Observatory for Infrared Astronomy is another example of transatlantic cooperation in space. SOFIA is a joint astronomy project between NASA and the German Aerospace Center.[164] The idea for SOFIA came about in 1985 when the NASA Ames Research Center was looking for a replacement for the Kuiper Airborne Observatory (KAO), which was a Lockheed C-141 equipped with a 91-cm.-aperture infrared telescope. At the time, NASA Ames was "negotiating a sole-source contract with Boeing Military Airplane Co. to determine the feasibility of installing such a telescope in a 747SP [Special Performance]."[165] Initial cost estimates were set at $60M, and in 1991, NASA released a request for a source to provide the telescope assembly to be flown aboard SOFIA. The winning bid went to the German Aerospace Center. With the German telescope and a projected date of first flight set around 2000 or 2001,[166] SOFIA promised "to see stars more than ten times fainter, with ten times greater clarity [than KAO]."[167]

In the last decade, SOFIA has dodged the chopping block, but has had numerous budget cuts with which to contend. In his statement to Congress in 1995, Dr. Daniel F. Lester (a research scientist at the McDonald Observatory at the University of Texas Austin) pointed out that:

> SOFIA is a collaborative effort between NASA and the German Space Agency DARA [German Agency for Space Flight Affairs]. In this effort, Germany would bear approximately 20% of the development and operations costs and, in exchange, German space astronomers would receive that fraction of the flight

[164] Johnson-Freese, *Space as a Strategic Asset*, 78.

[165] John T. Merrifield, "NASA Proposes Use of 747SP As Platform for Infrared Telescope," *Aviation Week and Space Technology* (May 1985).

[166] Ibid.

[167] Dan Lester, Statement for the Hearing "NASA: The Outside Opinion," March 16, 1995, 81.

> time. We have been given strong indications that this agreement may be perishable, in that postponement of SOFIA development may cost their financial support.[168]

Despite this warning, funds were only partially restored in 1995[169] even though projected costs had soared to $250M.

Not only did budgetary issues plague SOFIA, technical interface issues did, as well. In 1998, interface problems between the German-built telescope and the U.S.-modified 747 arose that put SOFIA behind schedule, yet again.[170] By the year 2000, the first flight was still projected to be three years away, but 2003 came and went, plagued by cost and schedule overruns. In 2007, NASA deleted SOFIA from its budget while it determined whether or not to continue with the program. Yet, again, NASA made a decision independent of its international partner. DLR (German Research Institute for Aviation and Space Flight), "which had spent 80 million of its own funds to develop and build the 2.7-meter Sofia telescope, pleaded with NASA to reinstate the funding, arguing, among other things, that transatlantic space cooperation could suffer if the project was stopped."[171] Fortunately, the program was saved when an MOU was signed between NASA and DLR; the cost, however, had risen to $600M, ten times the initial cost estimate.

Despite numerous setbacks, the SOFIA project continues. Initial flight tests were conducted in Waco, Texas, in early 2007, and full flight testing began at NASA Dryden (Edwards Air Force Base [AFB], CA) later that year. In October 2008, the first three astronomers to conduct research aboard SOFIA were announced, and these observation flights are projected for later in 2009. SOFIA is yet another example of NASA deleting international programs in favor of national ones, in this case, routing money intended for SOFIA to the shuttle and *ISS*. Once again, NASA made this decision unilaterally without consulting international partners. Apparently some lessons are more difficult to learn than others.

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[168] Lester, Statement for the Hearing, 81.

[169] "House Appropriations Restores NASA Field Centers, Cassini; Chops EOS," *Aerospace Daily*, July 19, 1995, 81.

[170] "Sofia Slip Section: What's Ahead in Aerospace," *Aerospace Daily*, March 30, 1998, 468.

[171] Michael A. Taverna, "Germany Resurrect Sofia," *Aviation Week and Space Technology*, February 5, 2007.

5. ISS

The foundation of the *ISS* began in the early 1980s when President Reagan commissioned NASA "to develop a permanently manned space station and to do it within the decade. … NASA will invite other countries to participate so we can strengthen peace, build prosperity, and expand freedom for all who share our goals."[172] Europe accepted the invitation in 1985 implying that a significant share of Europe's "space budgets over the coming decade would have to be channeled into a partnership with the United States."[173] Thus began the largest and most well known international space endeavor ever undertaken.

As previously mentioned in the ISPM study, and as noted by Logsdon, "NASA's international partners during the preceding two decades had been critical of the organization for deciding by itself on the objectives and design of projects and only then inviting foreign involvement, on terms largely dictated by NASA."[174] Because of this, NASA approached the *ISS* differently and included international partners in the early planning stages. Along these lines, NASA's Office of International Affairs was tasked with creating the guidelines of international partnerships. Though NASA was off to a good start, there were plenty of obstacles to cooperation. In 1982, technology transfer requests between NASA and ESA "required the issuance of a Technical Data Exchange Agreement under the provisions of the Munitions Control Act, which was administered by the Department of State."[175] Approval for these technology transfers was not forthcoming, and in late 1982, NASA appealed to Under Secretary of State for Security Assistance and Science and Technology. Ultimately, however, NASA was instructed that technology transfers should not occur since the space station had "not been given a new start."[176]

ESA's first big step came in June 1982 when Quistgaard stated "ESA will fund, manage, and conduct a first study entitled 'European Utilization Aspects of a U.S. Manned Space Station.' "[177] Not long after, competition within Europe began. Independent of ESA, both a

[172] Logsdon, 1.

[173] Ibid., 26.

[174] Ibid., 8.

[175] Ibid., 9, 15.

[176] Ibid., 16.

[177] Ibid., 11.

French and a German-Italian team were studying hardware products for the *ISS*. Not only did this spur competition within Europe, but it also diverted valuable funds into independent rather than cooperative efforts. Throughout this early planning phase, NASA was hopeful that Europe would cooperate under the umbrella of ESA, removing the need to interact with multiple European countries.[178]

According to Logsdon, Britain was the most skeptical among the larger ESA Member States. ESA required additional funding from its Member States at the same time the UK was cutting its own space budget. In addition, there was nothing about the space station that particularly sparked the interest of the UK in the early stages of planning. However, by late 1984, British Aerospace became increasingly interested in supplying automated platforms to carry specific instrumentation. In fact, "Germany and Italy agreed to allocate to Britain and to British Aerospace the lead role in the platform aspects of the Columbus program, [which] provided the incentive the British government needed to go along with the proposed ESA long-range plan and European participation in the U.S. space station program."[179]

While Italian support had never been in question, the French were a different story entirely. The French strongly backed Europeanization and were of the opinion that this could not happen if Europe did not have its own launch capability. France strongly pushed for further development of Hermes, a spaceplane, but because of the cost associated with a spaceplane, this idea was not well received by larger Member States, such as Germany and the UK. Germany had always supported the space station from a space flight and aerospace industry perspective; however, support was not as forthcoming from the political sector. Internal conflicts over funding for the Ariane 5 and Columbus programs versus the space station were putting the German government in a deadlock. This controversy, however, was settled in early 1985 when funding was split between the two.[180] Regardless of all of these aforementioned setbacks, the Member States came together, and in 1985, ESA officially joined with NASA on the *ISS*.

Although NASA was now partnered with ESA and not individual European countries, disputes remained between ESA Member States concerning funding and industry involvement.

[178] Logsdon, 27.

[179] Ibid., 32.

[180] Ibid., 33, 34.

In addition, Member States had their own views of what ESA should focus on. The French wanted to focus on improved launch systems and European autonomy; Germany and Italy pushed for human space flight and close cooperation with the U.S.; the British wanted ESA to focus more on tangible benefits and less on research; finally, smaller Member States wanted programs that allowed for their participation.[181] Finally, in 1989, all members of the space station signed an Intergovernmental Agreement (IGA) and an MOU. Within these agreements, "the partners agreed to provide hardware for the space station at their own expense, a total of $8 billion at the time."[182]

Over the years, the funding and schedule have changed numerous times. In addition, there are currently only eight shuttle flights to the *ISS* remaining before the shuttle's projected retirement in 2010. If the shuttle retires in 2010, it leaves only the Russian Soyuz as the means of crew transportation to and from the *ISS*. At the same time as the shuttle's retirement was announced, "the President said the United States would fulfill its commitments to its space station partners."[183] Additionally, however, a Congressional Research Service (CRS) report noted that "NASA plans to complete its utilization of *ISS* in 2016 (though the other partners may continue to use it after that time)."[184] NASA can only continue to fulfill its commitments via funding, station presence, and scientific research; it cannot fulfill its original commitment of being one of two partners to transport crews.

Though NASA plans on leaving the *ISS*, ESA continues to forge ahead in its contribution. ESA's most recent contributions include the Columbus laboratory, Harmony (which connects the Columbus, Destiny, and Kibo laboratories), and the Automated Transfer Vehicle (ATV). In February 2008, the Columbus laboratory was successfully launched and attached to the *ISS*, thus increasing the scientific capability of the station. In April of 2008, ATV *Jules Verne* was launched. The ATV is an automated cargo ship that visits the *ISS* about every twelve months with experimental equipment, food, air, and water. It stays docked to the *ISS* for up to six

[181] Logsdon, 31.

[182] Marcia Smith, Space Stations, CRS Report for Congress, IB93017 (2006), 3.

[183] Behrens, 2.

[184] Ibid.

months, offloads up to 6.4 tons of waste, and burns up in the Earth's atmosphere.[185] Future possibilities of the ATV include man-rating the system in order to transport crews, not just cargo, the addition of a cargo re-entry capsule to return scientific experiments, and even an advanced version of the ATV to be used for exploring the Moon and Mars.[186]

The *ISS* is the furthest-reaching example to date of international cooperation in space. Not only does this cooperation reach from Europe to the U.S. and other countries (including Japan, Canada, and Russia), but cooperation occurs within Europe as well. As an organization with multiple nations as members, ESA deals with unique problems that NASA does not face. Regardless, cooperation on this endeavor has succeeded, albeit not totally void of nationalism. In the early stages, NASA had a difficult time with technology transfer and European nations were at odds over what their role and involvement in the station should be. More recently, the U.S. put forth a large display of nationalism when it announced it would be leaving the *ISS* by 2015 in favor of funding missions to the Moon and Mars. This unexpected decision by the U.S. will force the other international partners to deal with upkeep and continuing station costs after the U.S. departs the *ISS*.

B. LESSONS LEARNED

Many lessons learned can be gleaned from these five case studies. From studying the INTELSAT case, an obvious conclusion is that strong nationalism hinders international cooperation. If a program is to be truly international, one partner cannot hold 50% of the shares. While it is true that someone will hold a larger percentage of shares, one partner having controlling interest is not conducive to international cooperation. In the case of INTELSAT, this led France to push for development of a European launcher. At the time, this took funding and development time away from INTELSAT. On the other side of the argument, having the Ariane launcher is of great benefit now, not only to Europe, but to the rest of the world. The ATV *Jules Verne*, which helps supply and remove waste from the *ISS*, is launched atop an Ariane rocket.

The second case study, *Ulysses*, proves that prior consultation with partners concerning major decisions is imperative. The U.S.'s decision to cancel its spacecraft intended for ISPM

[185] "ESA Jules Verne ATV," European Space Agency, 2000-2008, http://www.esa.int/SPECIALS/ATV/SEMOP432VBF_0.html, (accessed 15 February 2009).

[186] Leonard David, ATV's On Orbit, *Aerospace America* (October 2008), 31.

was not only a strong show of nationalism (clearly national programs were more important that international ones), but it proved to the international community that U.S. funding is never a guarantee. That alone could prevent another nation from entering into any type of agreement with the U.S.

The Galileo program also displays lessons learned. While the international cooperation between Europe and the U.S. has been very beneficial, the national cooperation within Europe over contentious issues like funding has been less than commendable. Europe has worked with the U.S. (and Russia) to make the Galileo constellation compatible with GPS (and GLONASS). The U.S. and Europe have successfully deconflicted Europe's open signal with the U.S.'s upgraded military signal to ensure adequate coverage and jamming capabilities, if required. On the other hand, disagreements within Europe have continually delayed Galileo. In order for programs like this to come to fruition, decisions that impact everyone should be made as early as possible, from the role of industry to the funding required to long-term applications of the project. This will not only save time, but it will ultimately cut down on costs.

The case study concerning SOFIA proves that NASA has a difficult time learning from its mistakes. As in the case of *Ulysses*, NASA not only cut funding for an international program, but it also made the grave mistake of not keeping the international partner informed of funding issues or even that the program could be cancelled. German DLR had invested millions in the program, yet was blindsided by the announcement that SOFIA would not be funded in 2007. Had it not been for Germany's persistence and willingness to sacrifice even more, SOFIA may never have seen its first flight.

The final case study of the *ISS*, however, proves that international cooperation is taking a step in the right direction. NASA realized up front that international guidelines had to be established and that all partners or potential partners had to remain abreast of changes or problems they might face. As mentioned previously, technology transfer was an issue in the early planning stages, as were the disagreements between European countries on the role in the endeavor. These issues were overcome, and the station flourishes today. However, not all lessons learned have been applied. The most recent announcement by the U.S. to pull out of the *ISS* by 2015 came as a surprise to other *ISS* members, not unlike NASA's decision to cancel the U.S. spacecraft component of the ISPM mission. While NASA seemed to understand during the early stages of *ISS* planning that communication with partners was important, the U.S. did not take that into account when it unexpectedly announced its withdrawal.

C. CHAPTER CONCLUSION

Conducting an historical analysis is important to understanding how to improve cooperation in the future. In the case of international cooperation in space, the historical analysis is best conducted via case studies. Of particular note to international cooperation in space, these five cases were explored: INTELSAT, *Ulysses*, Galileo, SOFIA, and the *ISS*. While each case was very different in mission, the goal of international cooperation was the same.

Numerous lessons learned were gleaned from these case studies, with many lessons appearing in more than one case. INTELSAT proved the need for a comparable distribution of power among nations. In the beginning, the U.S. had 61% of the shares and was favoring U.S. made satellites, while refusing to launch other's satellites. By 2001, however, 116 countries had come together to ensure success of the global communications system. The *Ulysses* program proved the need for open communication between international partners. When NASA blindsided ESA with the cancellation of the U.S. spacecraft, ESA put aside nationalism and fought to find a way to make it work with NASA. In the end, however, ESA resigned itself to using only one spacecraft to complete the mission. The Galileo program has worked well in the international arena, with cooperation evident between ESA and the U.S., as well as Russia. However, cooperation within ESA has been difficult. Numerous countries are battling over funding, industry involvement, and timelines, leading to multiple disagreements and delaying the program by years. Like *Ulysses*, SOFIA proved the need for open communication between international partners. In this case, however, it was Germany's nationalism, not lack thereof, which pushed NASA to continue funding and enter into the flight testing phase.

As mentioned previously, the case of the *ISS* shows that international cooperation is taking a step in the right direction. International partners were brought into the early planning stages and were kept abreast of changes. Numerous nations worked together, sorted through issues, and developed quite possibly the greatest international cooperation endeavor ever undertaken in space. This was tainted, however, by NASA's unexpected announcement of withdrawal by 2016. While progress is noted throughout these five case studies, there is still room for improvement when it comes to international cooperation in space.

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IV. CURRENT AND EMERGING ISSUES

The previous chapter studied cases from an historical standpoint. This chapter focuses on the issues of current and future space cooperation. First and foremost is the *International Space Station* (*ISS*), in which there are currently five partners: Canada, the European Space Agency (ESA), Japan, Russia, and the United States (U.S.). The next step in future exploration is returning to the Moon. Numerous countries have their eyes turned toward lunar exploration including the U.S., Germany, China, Japan, and most recently, India. Finally, the ultimate goal of President Bush's Vision for Space Exploration (VSE) is to conduct "human missions to Mars and to worlds beyond."[187]

In January 2004, President Bush presented his VSE speech, which called on the National Aeronautics and Space Administration (NASA) to "gain a new foothold on the moon and to prepare for new journeys to the worlds beyond our own."[188] In the VSE, the president outlined three goals: to complete the *ISS* by 2010, to design a new crew exploration vehicle and conduct the first manned flight by 2014, and to return to the Moon by 2020. The U.S. cannot do this alone, however, and the President called on international partners to join in the exploration.[189]

With such lofty goals and need for international cooperation, the VSE set off a series of meetings, debates, controversy, and even agreements among international partners. The International Cooperation for Sustainable Space Exploration was organized in 2005 by ESA and the Italian Space Agency (ASI), which conducted workshops and facilitated meetings of "over 50 senior executives with responsibility in the field of space exploration from major space agencies world-wide."[190] During the 2005 session, ESA noted that while the VSE placed the U.S. as the primary player, "several nations can play an active role as partners in an international

[187] "President Bush Announces New Vision for Space Exploration Program," NASA (2008), http://history.nasa.gov/Bush%20SEP.htm (accessed 26 February 09).

[188] Ibid.

[189] Ibid.

[190] "International Cooperation for Sustainable Space Exploration," European Space Agency (21 February 2007), http://www.esa.int/SPECIALS/Global_Space_Exploration/SEMC5OBE8YE_0.html (accessed 21 May 2009).

endeavour for space exploration."[191] ESA is clearly stressing the need for international cooperation and further strengthens itself by stating that an objective is to "establish a reasonable autonomy for Europe whilst exploiting international cooperation opportunities as appropriate."[192] NASA's stance during this time was to foster cooperation in robotic and manned missions (particularly robotic missions to the Moon) and research and technology, including technology exchange.[193] In 2005, it seemed as though ESA and NASA were still in agreement on the future of international cooperation.

These meetings were again held in 2006, and the push by ESA for international cooperation continued. ESA stated three main reasons for international cooperation: "exploration of space is a global programme for the benefit of humankind by its very nature, a cooperative approach including several major spacefaring nations will achieve sustainability, and cooperation grants access to enabling capabilities, which are otherwise not affordable to develop for Europe alone."[194] International cooperation was still at the top of ESA's agenda. For NASA, however, international cooperation seemed to be struggling. While it was an objective of the VSE to promote international participation in space exploration, NASA still placed itself as the primary lead in numerous areas. As of 2006, the Science Mission Directorate had 43 missions on orbit, was the lead on 24 of those missions with international partners, and contributed to only 14 foreign-led missions. While this single directorate contributed to only 14 foreign-led missions, it was a step in the direction of international cooperation. Of note was the conclusion to NASA's International Cooperation briefing, in which it was stated that international cooperation would be present in numerous Moon and Mars missions. Additionally, it was noted "NASA anticipates significant opportunities for international participation in the Vision for U.S. Space Exploration."[195]

[191] Daniel Sacotte, European Strategy for Exploration, ESA presentation given at the International Cooperation for Sustainable Space Exploration Conference, 2005.

[192] Sacotte.

[193] Terri Lomax, The Vision for U.S. Space Exploration, NASA presentation given at the International Cooperation for Sustainable Space Exploration Conference, 2005.

[194] Status, Future Plans, and Rationale for Cooperation, ESA presentation given at the International Cooperation for Sustainable Space Exploration Conference, 2006.

[195] Status of NASA's Programs, NASA presentation given at the International Cooperation for Sustainable Space Exploration Conference, 2006.

Earlier in 2006, however, Taylor Dinerman of *The Space Review* noted that at ESA's ministerial meeting, "ESA is becoming less and less a civilian space agency dedicated to science, technology, and exploration and more and more an institution dedicated to enhancing the power and prestige of the European Union [EU], which leaves the non-EU members and associates of ESA, such as Switzerland and Canada, in an increasingly uncomfortable situation."[196] He noted that this is directly tied to France's desire to make Europe into a superpower while ignoring that "other Europeans want ESA to help provide them with a better standard of living, a cleaner environment, and more productive economy."[197] ESA as a whole, however, wants to contribute to many different projects and continues to push for international cooperation whenever possible. It is the author's opinion that this push comes from many aspects, one being ESA's lack of comparable funding to more established space programs such as those of the U.S. and Russia. Another aspect would be to participate in technology exchange. With greater international cooperation, ESA has a greater chance of accomplishing its own goals.

In May 2007, The Global Exploration Strategy: The Framework for Coordination was released. It was the result of discussions amongst fourteen space agencies concerning global interests in space exploration. Within this document, it was determined that there needed to be a medium through which space agencies could "exchange information regarding interests, objectives and plans in space exploration with the goal of strengthening both individual exploration programs as well as the collective effort."[198] This medium was created and named the International Space Exploration Coordination Group (ISECG), which was not intended to replace, or compete with, the International Lunar Exploration Working Group (ILEWG) and/or the International Mars Exploration Working Group (IMEWG), both of which will be discussed later in this chapter. This group continues to promote cooperation and technology sharing, as well as set standards for the space agencies to follow, for example, a common lunar reference system to ease cooperation.

These are but a few meetings that have occurred concerning the future of space exploration in an international context. The following sections address international cooperation

[196] Taylor Dinerman, "NASA and ESA: A Parting of Ways?" *The Space Review*, 2006, http://www.thespacereview.com/article/539/1 (accessed 21 May 2009).

[197] Ibid.

[198] International Space Exploration Coordination Group Annual Report: 2007, 14 March 2008.

concerning the *ISS*, as well as missions to the Moon and Mars. These sections also discuss possible technology sharing and coordination between NASA and ESA.

A. ISS

As previously mentioned, there are five main international partners participating in the *ISS* (see Figure 3) and many more individual countries. Not all member states of ESA are participating, however. Those eleven that are include the following: Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom (UK). The concept of numerous partners grants ample opportunity for cooperation, as well as for disagreement. As the *ISS* continues to orbit, all partners must commit to cooperation for the betterment of the station and crews themselves.

As noted, President Bush addressed the future of the *ISS* in his VSE speech, stating, "our first goal is to complete the International Space Station by 2010. We will finish what we have started; we will meet our obligations to our 15 international partners on this project."[199] It was also during this speech that President Bush announced the chief purpose of the Shuttle (to finish assembly of the *ISS*), as well as its projected retirement date of 2010.[200]

[199] "President Bush Announces New Vision for Space Exploration Program," Website of NASA.

[200] Ibid.

Figure 3. *ISS* in May 2006[201]

The Constellation program is NASA's answer to not only the Shuttle replacement for flights to the *ISS*, but also for the larger goals of reaching the Moon, Mars, and beyond. Constellation is comprised of the Ares launch vehicles (I and V), the *Orion* crew capsule, and the lunar lander, *Altair*. NASA projects an initial operating capability for *Orion* of 2015, with missions to the Moon by 2020. Fortunately, the U.S. has already landed twelve men on the Moon and has numerous technologies and historical aspects on which to build. The Saturn V (see Figure 4) was and remains the largest rocket ever built. This three-stage rocket had thirteen successful launches to its credit and zero losses of crew or payload; "nine of the missions it launched traveled to the moon, and six landed there. The final Saturn V launch in 1973 put *Skylab*, America's first space station, in orbit."[202] According to *Aviation Week and Space Technology*, "NASA plans to reuse human-rated hardware wherever possible … [which is] perhaps best illustrated in the decision to use the [Saturn V] J2 engine [for the Ares I second stage]."[203] The decision was made to use the same rocket that powered the upper stages of the

[201] "Astronomy Picture of the Day (16 May 2006): The International Space Station From Above," http://apod.nasa.gov/apod/ap060516.html (accessed 3 March 09).

[202] "Grand Opening for Restored Saturn V Rocket," NASA, (2008), http://www.nasa.gov/centers/johnson/home/jsc_grand_opening.html (accessed 2 March 09).

[203] Frank Morring Jr., "Starting Over; Despite Saturn V Heritage, J2-X is Like a New Engine," *Aviation Week and Space Technology*, 167 (23): 61.

Saturn V stack in order to save development time and money on Ares; however, there will be major modifications to this 1960s technology. NASA has warned that the J-2X development is approximately a year ahead of the Ares I overall development, which could mean a major redesign if problems were found elsewhere in the stack. However, this lead allows for more engine development and testing, which can result in a better design.[204] In November 2008, the J-2X passed the Critical Design Review stage and moved into full-scale testing.[205] Yet another carryover from proven technologies is the use of a solid rocket booster, "derived from the Space Shuttle Program's reusable solid rocket motor,"[206] on the Ares I first stage. In January 2009, an Ares I-X completed testing in Promontory, Utah, conducting "a full-scale separation test of the forward skirt extension."[207] The full-scale Ares I test launch is projected for launch from Kennedy Space Center, Florida, later in 2009.[208]

While Ares I will be the "people-lifter," Ares V will be the "cargo lifter," which "will serve as NASA's primary vessel for safe, reliable delivery of large-scale hardware to space—from the lunar landing craft and materials for establishing a moon base, to food, fresh water and other staples needed to extend a human presence beyond Earth orbit."[209] As with Ares I, Ares V's first stage will rely on solid rocket boosters derived from the Space Shuttle. The center tank, which is liquid fuel, is derived from the Saturn V; this tank will fuel engines that are upgraded versions of those currently used on the Delta IV. Also, Ares V will use the J-2X engines used in Ares I, derived from the Saturn V upper stage.[210]

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[204] Morring Jr., "Starting Over," 61.

[205] Frank Morring Jr, "Lunar Rocket Engine Passes CDR," *Aviation Week and Space Technology*, 228 (34): 5.

[206] "Overview: Ares I Crew Launch Vehicle," NASA, (2008), http://www.nasa.gov/mission_pages/constellation/ares/aresl/index.html (accessed 02 March 09).

[207] "Test in Development of NASA's New Crew Rocket is Successful," NASA, (2008), http://www.nasa.gov/mission_pages/constellation/ares/flighttests/aresIx/index.html (accessed 2 March 09).

[208] Ibid.

[209] "Overview: Ares V Cargo Launch Vehicle," NASA, (2008), http://www.nasa.gov/mission_pages/constellation/ares/aresV/index. html (accessed 2 March 09).

[210] Ibid.

Figure 4. Saturn V (During Apollo 11 Launch)[211]

Also in development for returning to the Moon is the *Orion* crew capsule, which will also serve as the shuttle between the U.S. and the *ISS* for both crew and cargo. Though similar in appearance to the Apollo capsule, *Orion* will be much larger and capable of carrying up to six crew members to the *ISS*. *Orion's* first flight to the *ISS* is projected for 2014 with Moon missions by 2020. In addition, *Orion* can be docked to the *ISS* for up to six months and serve as a lifeboat for crew members aboard the *ISS*.[212] Figure 5 depicts the components of Constellation.

Constellation has not been without controversy, however. As early as December 2008, then President-elect Obama requested a study be conducted on how much money could be saved by cancelling Ares I and scaling back *Orion*. Additionally, Obama's NASA transition team inquired about the cost savings and feasibility of man-rating an Atlas V or Delta IV rocket to serve as the launcher in lieu of Ares.[213] As recently as January 2009, President Obama

[211] Image of Saturn V, http://www.spaceshots.com/Merchant2/graphics/00000001/f2169.jpg (accessed 3 March 09).

[212] "Constellation Program: America's Spacecraft for a New Generation of Explorers: The Orion Crew Exploration Vehicle," NASAfacts, (2008), http://www.nasa.gov/mission_pages/constellation/Orion/index.html (accessed 2 March 09).

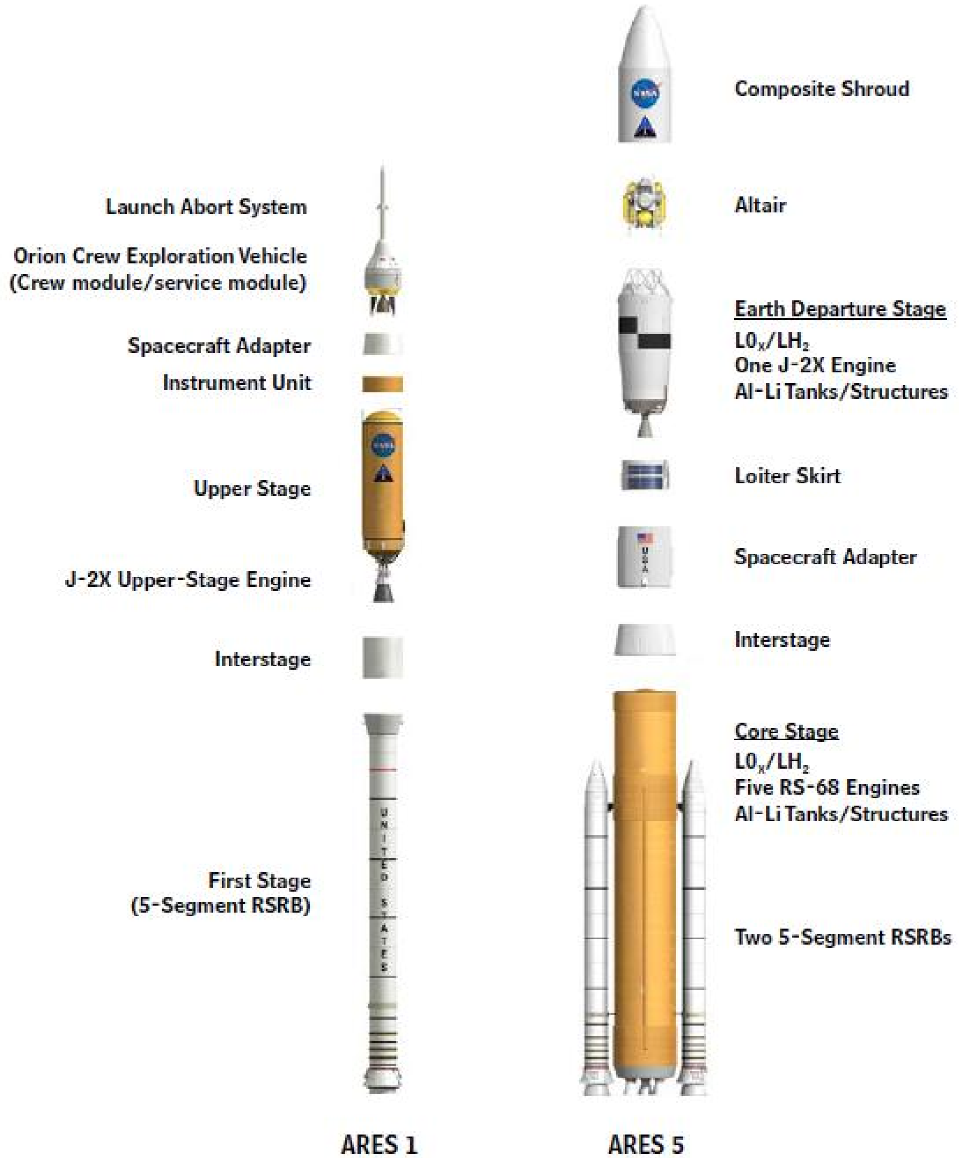
[213] Brian Berger, "Obama May Cancel Space Shuttle Replacement," Foxnews, 01 December 2008, http://www.foxnews.com/story/0,2933,459465,00.html (accessed 21 May 2009).

advocated collaboration between the Department of Defense (DoD) and NASA. President Obama envisions the collaboration reducing the time-gap between the retirement of the Shuttle and operation of *Orion*.[214] In an article released April 20, 2009, NASAspaceflight.com reported that "a study by the Aerospace Corporation … has found both the Atlas V Heavy and Delta IV Heavy are capable of launching Orion."[215] However, Mike Griffin, former NASA administrator, dismissed the finding as unviable. Of concern is the additional pad and vehicle assembly building requirements if an Atlas or Delta rocket is used. As stated in the article, "a new, dedicated launch pad (LC-37A) for Delta IV-H—if required—would cost around $750M, although sources claim it would be a lower dollar figure. An alternative Vehicle Integration Building (VIB) and Mobile Launch Platform (MLP) for Atlas V-H on LC-41 would cost around $350M."[216] Final decisions have yet to be made.

[214] Eric Blair, "Obama Considers NASA-DoD Collaboration." Eflux Media, 05 January 2009, http://www.efluxmedia.com/news_Obama_Considers_NASA_DoD_Collaboration_32548.html (accessed 21 May 2009).

[215] Chris Bergin, "Study Finds EELV Capable of Orion Role - Griffin Claims Alternatives are Fiction." NASAspaceflight.com, 20 April 2009. http://www.nasaspaceflight.com/2009/04/study-eelv-capable-orion-role-griffin-claims-alternatives-fiction/ (accessed 21 May 2009).

[216] Ibid.



Source: National Aeronautics and Space Administration.
Notes: The architecture for the vehicles is as of February 2008.
Al-Li = aluminum-lithium; LO_x = liquid oxygen; LH_2 = liquid hydrogen;
RSRB = reusable solid rocket booster.

Figure 5. Constellation[217]

Numerous countries are affected by the retirement of the Space Shuttle including those member states in ESA. In the VSE, President Bush outlined the goals of "promot[ing] international and commercial participation in exploration to further U.S. scientific, security, and

[217] Peter Orszag, "An Analysis of NASA's Plans for Continuing Human Spaceflight After Retiring the Shuttle," Congressional Budget Office Analysis (November 2008), 4.

economic interests,"[218] as well as "pursu[ing] opportunities for international participation to support U.S. space exploration goals."[219] The VSE clearly promotes international cooperation and directs NASA to "actively seek international partners and work with the space agencies of these partners in executing future exploration activities."[220]

With the retirement of the Shuttle comes a reliance on the Russian Soyuz to transport crews to and from the *ISS* for not only NASA's astronauts, but ESA's astronauts, as well. In addition, contracting with Russia for the use of Soyuz requires "an exemption from the Iran Nonproliferation Act (INA), which banned U.S. payments to Russia in connection with the International Space Station (ISS) unless the U.S. President determined that Russia was taking steps to halt proliferation of nuclear weapons and missile technology to Iran."[221] Congress exempted the *ISS* flights through … 2016.[222] According to *An Analysis of NASA's Plans for Continuing Human Spaceflight After Retiring the Space Shuttle*, the projected five-year gap (between the Space Shuttle and *Orion*) could increase if problems arise in completion of the *ISS*, not unlike the recent delay of STS-119, whose mission was to ferry the final set of solar panels to the *ISS*. Not only would this create a delay based on schedule slips, but it would also create a delay due to funding. If money is rerouted for Shuttle maintenance and flights, it decreases the amount of funding available for development of Constellation.

In the event that Constellation is delayed, another option for cargo travel to the *ISS* is the SpaceX *Dragon* (see Figure 6) and/or the Orbital Sciences Corporation *Cygnus* (see Figure 6), civilian equivalents to the Russian *Progress* (see Figure 6) and the European Automated Transfer Vehicle (ATV) (see Figure 6), currently the only *ISS* cargo transports in operation (aside from the Shuttle). Both SpaceX and Orbital Sciences won the Commercial Orbital Transportation

[218] "President Bush Announces New Vision for Space Exploration Program," NASA.

[219] Ibid.

[220] Ibid.

[221] Behrens, 3.

[222] Ibid.

Services (COTS) / Commercial Resupply Service (CRS) contract let by NASA. First flights are projected for the last quarter of 2010, but that could be further delayed if the Space Shuttle's retirement is postponed.[223]

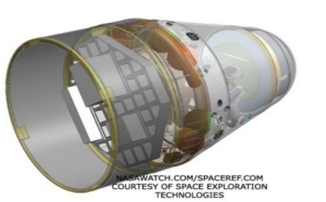
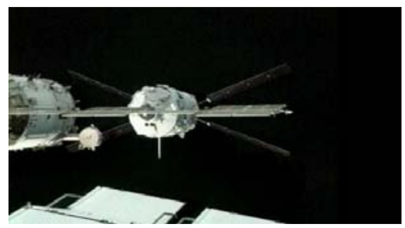
SpaceX *Dragon* Concept[224]  	Orbital Sciences *Cygnus* Concept[225] 
Russian *Progress*[226] 	ESA's ATV *Jules Verne*[227] 

Figure 6. Various Cargo Resupply Ships to the *ISS*

The ATV is an automated vehicle, which was developed in the spirit of international cooperation "for ESA by prime contractor Astrium, along with dozens of subcontractors in 10 European nations—and even eight companies in Russia and the U.S."[228] The ATV is designed to ferry supplies to the *ISS,* dock for up to six months, off-load up to 6.4 tons of waste, and burn

[223] Chris Bergin, "SpaceX and Orbital Win Huge CRS Contract from NASA," NasaSpacelfight.com 23 December 2008), http://www.nasaspaceflight.com/2008/12/spacex-and-orbital-win-huge-crs-contract-from-nasa/ (accessed 3 March 09).

[224] Image of SpaceX Dragon Concept, http://images.spaceref.com/news/2006/space.x.1.m.jpg (accessed 3 March 09).

[225] Image of Orbital Sciences Concept http://www.globalsecurity.org/space/systems/images/cygnus-image01.jpg (accessed 3 March 09).

[226] Image of Russian Progress, http://www.cnes.fr/automne_modules_files/standard/public/p7019_c9f8d7e109f354b7034390e225d241c3Progress.jpeg (accessed 3 March 09).

[227] Image of ESA's ATV Jules Verne, http://www.allamericanpatriots.com/files/images/2008-04-nasa-atv-jules-verne-docks-with-international-space-station.jpg (accessed 3 March 09).

[228] Michael Klesius, "ATV: Unmanned, but Everyone's Onboard," *Aerospace America* (June 2007), 40.

up in the Earth's atmosphere during re-entry.[229] In addition, the ATV can perform altitude re-boosts of the *ISS*. The ATV will continue to resupply the *ISS*, most notably, "it will help fill the gap between the end of NASA's space shuttle operations in 2010 and the start of cargo deliveries to the ISS by NASA's Orion crew exploration vehicle, which may not fly operationally until 2015."[230] The first ATV, the *Jules Verne*, successfully docked with the *ISS* in April 2008 and delivered more than 7,500 pounds of supplies including food, water, fuel, and spare parts. In addition, the ATV executed a critical altitude re-boost for the *ISS* before detaching and burning up on re-entry in September 2008. In February 2009, the second ATV was dubbed *Johannes Kepler*, which is to be launched in mid-2010 to execute a mission similar to *Jules Verne.* As mentioned previously, future possibilities of the ATV include man-rating the system in order to transport crews (not merely cargo), the addition of a cargo re-entry capsule to return scientific experiments, and even an advanced version of the ATV to be used for exploring the Moon and Mars.[231]

ESA's future in the *ISS* includes a total of five ATV flights, Node 3, Cupola, and the European Robotic Arm (ERA). Node 3 is scheduled to launch in 2009 with the life support equipment necessary to sustain a crew of six. Additionally, it will accommodate the Cupola observation module, which will also be the control center for the Canadarm 2.[232] Finally, the ERA will be "a robotic servicing system, which will be used in the assembly and servicing of the Russian segment of the International Space Station."[233] The purpose of the ERA is to reduce the EVA [extra vehicular activity] preparation time by allowing easier transfer of small payloads.[234] Yet another possibility for ESA is the Advanced Re-entry Vehicle (ARV), a follow-on to the ATV. When the Shuttle retires, not only is the world losing a crew transportation vehicle, it is also losing a heavy equipment return capability. The ARV could fill this gap by building on the

[229] "ESA Jules Verne ATV," European Space Agency.

[230] Klesius, 40.

[231] David, 26, 31.

[232] "Node 3: Connecting Module," European Space Agency (2009), http://www.esa.int/esaHS/ESAFQL0VMOC_iss_0.html (accessed 3 March 09).

[233] "ERA: European Robotic Arm," European Space Agency (2009), http://www.esa.int/esaHS/ESAQEI0VMOC_iss_0.html (accessed 3 March 09).

[234] Ibid.

ATV technology and allowing for a safe return to Earth vice burning up on re-entry. ESA predicts this spacecraft, which would launch atop an Ariane 5, could be operational by 2015.[235]

Ariane 5 (see Figure 7) is the current heavy lifter for ESA and launches satellites "into geostationary transfer orbit, medium and low Earth orbits, Sun-synchronous orbits and Earth-escape trajectories." There are different versions of the Ariane 5, but most aspects remain the same; upper stages, however, vary depending on payload. The Ariane 5 ES ATV version has been modified to place the ATV into a circular, low-Earth orbit.[236] The Ariane 5 launcher is not only the heavy lifter for ESA, it has also been viewed as an alternative to Ares I. Such an alternative could be quite the international initiative. Michael Griffin had previously proposed "man-rating" satellite launchers (such as the Atlas and Delta rockets) for use in launching humans into space. In 2008, Griffin "told French lawmakers that it would be a 'small step' from today's French Ariane 5 rocket, which has launched a cargo craft to the International Space Station, to 'an independent European human spaceflight capability.'"[237] More recently, however, Griffin opposed the use of the Atlas or Delta rockets citing an increase in delays and cost, as well as risking safety.[238]

Concerning international cooperation, ESA has contracted with Russia to launch a Soyuz spacecraft (see Figure 8) from the European Spaceport in French Guiana in late 2009. This not only marks an historic event in cooperation between Russia and ESA, but it is also historic in that a Soyuz has never launched outside of Baikonur or Plesetsk. While this launch will be unmanned, the infrastructure put in place by ESA allows for transition to manned launches in the future if need be.[239] International cooperation is critical to the future of the *ISS*. With the retirement of the Shuttle comes the loss of a crew transportation vehicle, as well as a heavy/large cargo transporter to and from the station. Only with international cooperation, in terms of funding and transportation, will crews continue to occupy the *ISS*. However, as recently as April

[235] "ATV Evolution: Advanced Re-entry Vehicle," European Space Agency(2008), http://www.esa.int/esaMI/ATV/SEMNFZOR4CF_0.html (accessed 3 March 09).

[236] "ATV Evolution: Advanced Re-entry Vehicle," European Space Agency,

[237] John Schwartz, "The Fight Over NASA's Future," *The New York Times* (29 December 2008), http://www.nytimes.com/2008/12/30/science/30spac.html?_r=2&hp=&pagewanted=all (accessed 3 March 09).

[238] Ibid.

[239] "Soyuz," European Space Agency (2000-2009), http://www.esa.int/SPECIALS/Launchers_Access_to_Space/SEM6JRS4LZE_0.html (accessed 3 March 09).

11, 2009, the *Wall Street Journal* reported that “the U.S. and major foreign partners on the International Space Station have agreed in principle to keep it operating through 2020, at least five years beyond the current deadline, according to government and industry officials.”[240]

Figure 7. Ariane 5 Launcher[241]

[240] Andy Pasztor, “Space Station Nears an Extension: Plan to Operate Through 2020 Offers Lift for Science; NASA May Feel a Budget Pinch,” *The Wall Street Journal*, 10 April 2009. http://online.wsj.com/article/SB123940596771109777.html (accessed 21 May 2009).

[241] Image of Ariane 5 Launcher, http://www.fluent.com/about/news/newsletters/05v14i3/img/s2_2lg.jpg (accessed 03 March 09).

Figure 8. Soyuz Launcher[242]

B. MOON

President Bush also addressed future exploration of the Moon in his VSE speech. He stated that "our third goal is to return to the moon by 2020, as the launching point for missions beyond. . . . We will undertake extended human missions to the moon as early as 2015, with the goal of living and working there for increasingly extended periods."[243] The President realized the importance of returning to the Moon, not only to increase technologies and further space exploration, but also to utilize the Moon as a launching station for missions to Mars and beyond. Cost is a driver in all launches; as stated by the President, "Spacecraft assembled and

[242] Image of Soyuz Launcher, http://www.spaceflight.esa.int/users/images/foton/highres/soyuz_u_launcher.jpg (accessed 03 March 09).

[243] "President Bush Announces New Vision for Space Exploration Program," NASA.

provisioned on the moon could escape its far lower gravity using far less energy, and thus, far less cost."[244] His final statement drove home that "the moon is a logical step toward further progress and achievement."[245]

As previously mentioned, *Orion* is being developed not only for the *ISS*, but also for the Moon missions. *Altair*, the lunar lander, is also in development. Currently, NASA "is seeking input from industry experts and is developing conceptual designs."[246] Project assembly and testing is projected for 2009 to 2011, with a mission to the Moon no later than 2020. Prior to sending humans back to the Moon, NASA has a series of landers and robotic probes that will orbit and land on the Moon to collect data for future missions. One such probe, the Lunar Reconnaissance Orbiter (LRO), is scheduled to launch in June 2009, when it will begin its journey to the Moon. During its first year, LRO will be in a low polar orbit "on its primary exploration mission, with the possibility of three more years to collect additional detailed scientific information about the moon and its environment."[247] Among its missions is to create a detailed lunar map, which will help in our understanding of such areas as lunar topography and resources.[248] In the spirit of international cooperation and technology exchange, the information yielded from this mission will supplement data already obtained by ESA and Japanese probes. As stated in *Aviation Week and Space Technology*, "The international constellation of robotic spacecraft at the Moon may herald an era of human exploration there in which the nations fielding them and others, including Russia, cooperate on an open-ended endeavor to build what former NASA Administrator Michael Griffin called a spacefaring civilization beyond low Earth orbit."[249]

[244] "President Bush Announces New Vision for Space Exploration Program," NASA.

[245] Ibid.

[246] "NASA Chooses "Altair" as Name for Astronauts' Lunar Lander," NASA, (2008), http://www.nasa.gov/mission_pages/constellation/altair/altair.html (accessed 2 March 09).

[247] "NASA Lunar Spacecraft Ships South in Preparation for Launch," NASA (2009), http://www.nasa.gov/mission_pages/LRO/news/lro_ship.html (accessed 5 March 09).

[248] Ibid.

[249] Frank Morring Jr, "NASA Lunar Orbiter to Join International Constellation Gathering Exploration Data," *Aviation Week and Space Technology* 170 (10): 44-46.

As noted, NASA is not the only organization interested in lunar exploration; ESA is forging ahead with plans of robotic and human missions with first launch in 2018. As stated by the *ESA First Lunar Lander: Request for Information (RFI),*

> Coordinated by the Directorate of Human Spaceflight (D-HSF), the overarching goal of the European Human Exploration Programme with regards to the Moon is: '*to prepare for and conduct exploration of the Moon, focusing on those elements key to a future European contribution to international human lunar exploration, and to progressively advance our understanding of the Moon itself.'*[250]

Also outlined in the RFI are three mission goals for the first lunar landing mission. These goals are as follows: "to advance European technological capabilities for future human exploration of the Moon, to characterize the lunar environment and potential in situ resources to identify their implications for future human exploration, and to increase our understanding of the formation, history and evolution of the Moon."[251]

Like NASA, ESA has plans to send probes to the Moon, including Small Missions for Advanced Research in Technology (SMART-1), which was launched in September 2003 and completed its mission in September 2006; SMART-1 was Europe's first trip to the Moon. According to ESA, SMART-1's mission was to test "test solar electric propulsion and other deep-space technologies, while performing scientific observations of the Moon."[252] Other objectives included determining the origin of the Moon and searching for ice at the south pole of the Moon.[253] As previously mentioned, these respective lunar missions will yield data to be incorporated with other agencies' lunar data.

These agencies, however, must work together; in that spirit, what eventually became ILEWG was formed in 1994 to foster international cooperation in lunar exploration. In 2005, the annual ILEWG conference attendees determined that we need to accelerate our exploration of the Moon and that "[the ILEWG] vision is one of expanding humanity into space on an endless

[250] Lunar Exploration Team, ESA First Lunar Lander: Request for Information, 1.

[251] Ibid., 2-3.

[252] "SMART-1," European Space Agency (2000-2009), http://sci.esa.int/science-e/www/area/index.cfm?fareaid=10 (accessed 5 March 09).

[253] Ibid.

journey of exploration and discovery."[254] They also recommended "coordinated spacecraft operations and the exchange and integration of data between space agencies … [and] the formation of an interagency task group to formulate standardisation of lunar data archives."[255] Since then, the organization has been championing international cooperation in as many areas as possible. For example, in 2008, the conference addressed international lunar surface operations. It is the author's view that discussions such as these are imperative to ensuring international cooperation. While exact duties and infrastructures cannot be determined quite yet, a reliance upon one another can be built such that no one agency can go it alone. This view is also shared by Anatoly N. Perminov, head of Russia's Federal Space Agency, who was quoted as saying, "the possibility of a U.S. withdrawal from ISS suggests the need for 'more strict rules and conditions for participation from the very beginning' of lunar collaboration to avoid a 'situation when some of the participants will try to leave without taking into consideration the interests of other parties.'"[256] Along those lines, under the Global Exploration Strategy, NASA developed a lunar plan with input from 14 space agencies, including ESA. Among other themes, the resulting strategy included seeking international collaborations. As quoted in *Aerospace America*, Shana Dale (then deputy administrator of NASA) states, "'We are completely open' to new ways that NASA and their partners could strike arrangements."[257]

As pointed out by ESA director-general Jean-Jacques Dordain, "Co-operation is hard. ESA is all about co-operation. We have 17 states co-operating. It requires transparency and trust."[258] NASA understands this all too well considering its history of international cooperation; in response, Griffin stated, "We consider the ISS a significant testbed for the future exploration of the Moon and Mars, which we wish to jointly undertake with our international partners."[259] In that spirit and in a tremendous show of international cooperation, NASA and

[254] "Seventh International Conference on the Exploration and Utilization of the Moon: Toronto Declaration," European Space Agency, 22 August 2008, http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=38178 (accessed 21 May 2009).

[255] Ibid.

[256] Frank Morring Jr., Michael A. Taverna, and Neelam Mathews. "As Coming Lunar Collaboration Takes Shape, Nations Scramble for a Piece of the Action," *Aviation Week and Space Technology* 167 (13): 24-26.

[257] Frank Sietzen Jr., "Home on the Moon," *Aerospace America* (July 2007).

[258] Rob Coppinger, "International Lunar Cooperation is Advancing, but Faces Obstacles of its Own," *Flight International* (August 2006).

[259] Ibid.

ESA joined in the first half of 2008 to complete a comparative exploration architecture study. This study included the "assessment of potential programs and technologies that when conducted cooperatively could one day support a human outpost on the Moon."[260] It focused on ESA's predicted capabilities, as well as NASA's Ares program. Per the Global Exploration Strategy, NASA is working under an open architecture system that intends to maximize international cooperation opportunities.[261] While NASA is focusing on the Constellation program, ESA is studying the use of an Ariane 5 lunar landing system to autonomously deliver cargo to the surface of the Moon, as well as Moon habitation and mobility systems.[262]

The comparative study found "a significant mutual interest in the potential development of lunar cargo landing systems, communication and navigation systems, lunar orbital infrastructures, and lunar surface systems such as habitats or mobility systems."[263] In addition, the benefit of redundant human crew transportation capability was reiterated. In response to the findings, Geoff Yoder, the NASA Directorate Integration Office Director, stated:

> Since the announcement of the U.S. Space Exploration Policy, NASA has sought and welcomed input from its international partners. …. As future exploration plans mature around the world, it is becoming increasingly important that we seek compatibilities between NASA's plans and those of its potential future partners. The work we did with ESA will serve as a useful model for discussions with other potential partners.[264]

Additionally, Bruno Gardini, ESA Exploration Programme Manager remarked:

> ESA is preparing itself to [sic] a round of decisions that will mark Europe's role in human spaceflight and exploration for the decades to come. … The Moon is surely a [sic] important case study and an [sic] useful test bed to thoroughly prepare for more distant destinations.[265]

[260] "NASA and ESA Complete Comparative Exploration Architecture Study," European Space Agency (2000-2009), http://www.esa.int/esaHS/SEMBA0THKHF_index_0.html (accessed 3 March 09).

[261] "NASA Unveils Global Exploration Strategy and Lunar Architecture," NASA Release 06-361 (4 December 2006), http://www.nasa.gov/home/hqnews/2006/dec/HQ_06361_ESMD_Lunar_Architecture.html (accessed 3 March 09).

[262] "NASA and ESA Complete Comparative Exploration Architecture Study," European Space Agency.

[263] Ibid.

[264] Ibid.

[265] Ibid.

While there has been much talk of international cooperation, it is the author's opinion that the actual implementation is still in the early stages. It is true that lunar probe missions and the data they collect are being coordinated and shared between nations. This, however, is a small, albeit important, step toward the bigger goal of returning humans to the Moon. True international cooperation may be seen when NASA subcontracts components of the Constellation program to international partners, or when ESA man-rates the ATV and Ariane 5 in order to ferry humans to the space station. If nationalism is put aside, true international cooperation could be realized.

C. MARS

The final issue addressed in this chapter is human missions to Mars. Again, President Bush's VSE mentions these missions, which are to be preceded by robotic missions such as probes, landers, and rovers. He points out the need for a human presence: "Yet the human thirst for knowledge ultimately cannot be satisfied by even the most vivid pictures, or the most detailed measurements. We need to see and examine and touch for ourselves. And only human beings are capable of adapting to the inevitable uncertainties posed by space travel."[266]

The world has had a fascination with Mars since the red planet was discovered and has spent billions of dollars to learn more about Earth's neighbor. According to Dan Vergano, "since July 4, 1997, when the Mars Pathfinder rover riveted the nation with Martian vistas, the space agency has spent about $5 billion on Mars exploration."[267] To this end, NASA sent five probes to the red planet following *Pathfinder*: *Odyssey, Spirit, Opportunity, Mars Reconnaissance,* and *Phoenix*, all of which are still operating and transmitting vast amounts of Martian data back to Earth. *Odyssey* is mapping Mars' mineralogy and morphology, while *Spirit* and *Opportunity* continue to explore the Martian landscape (five years longer than their expected lifetimes). The mission of the *Mars Reconnaissance* project is to determine if long-standing

[266] "President Bush Announces New Vision for Space Exploration Program," NASA.

[267] Dan Vergano, "Imagination Takes a Flight to Mars; But Economics Could Chill Warm Feelings over Success of Phoenix Lander," *USA Today* (21 July 2008).

bodies of water existed, while *Phoenix* is focused on the geology and biology of the arctic regions.[268] Recently, the *Phoenix* lander found ice at Mars' north pole.[269]

In 2006, Michael Griffin proposed the use of the *ISS* and a lunar base to serve as an experiment for a mission to Mars. The idea was based on the time it would take for crews to get to Mars, spend time on the surface, and return to Earth. He proposed "stay[ing] on the Moon for nine months to a year, and then go back to the station for another six or seven months before landing to simulate the return from the red planet." This would all occur without assistance from NASA "other than what we originally sent them with"[270] in order to prove that astronauts can successfully complete a Mars expedition. This would have to be an international effort if not in the crew sense, then in the planning and coordination of such a mission and utilization of the *ISS*.

Not only has ESA put its sights toward the Moon, it has also invested in Mars exploration via *Mars Express* and the Aurora Program. *Mars Express* (with its lander, *Beagle 2*) was launched in June 2003 and was Europe's first mission to the red planet. While the orbiter (*Mars Express*) continues to operate, *Beagle 2* was lost during its descent to the surface. Recently ESA announced the extension of *Mars Express* to the end of 2009. Throughout its mission, *Mars Express* has provided high-resolution, color, three-dimensional images of the surface of Mars, as well as evidence of underground water-ice deposits via sub-surface sounding measurements. In addition, *Mars Express* has detected the former presence of liquid water on the surface and methane in the atmosphere, as well as Marian aurorae.[271]

The objective of the Aurora Program is to become a space leader in the future and to formulate and implement a "long-term plan for the robotic and human exploration of solar system bodies holding promise for traces of life."[272] Additionally, the purpose of the program is to explore the universe and solar system, stimulate new technology, and inspire the youth of

[268] "Current Missions," Website of NASA (2009), http://www.nasa.gov/missions/current/index.html (accessed 5 March 2009).

[269] Vergano.

[270] Frank Morring, Jr, "Redundant Systems," *Aviation Week and Space Technology* (6 October 2008), 169 (13): 38.

[271] "ESA Extends Missions Studying Mars, Venus and Earth's Magnetosphere," European Space Agency (2000-2009), http://www.esa.int/SPECIALS/Mars_Express/SEMACI05VQF_0.html (accessed 5 March 09).

[272] "The European Space Exploration Programme Aurora," European Space Agency (2000-2009), http://www.esa.int/SPECIALS/Aurora/ESA9LZPV16D_0.html (accessed 3 March 09).

Europe to take an interest in science and technology. International cooperation is a goal of the Aurora Program, as well; not only will the program rely on European nations, but it will also collaborate with Canada and the U.S.[273] To that end, NASA has become an important partner to the ESA in terms of its Aurora Program, funding instrumentation for the ExoMars mission.[274] As stated on ESA's Aurora website, "the Aurora Programme can be seen as a road map for human exploration, from which a large number of scientific as well technology spin-offs will emerge, driven by the goal of exploration."[275] Such information would be invaluable to not only ESA, but to NASA and the rest of the world, as well. With appropriate funding and cooperation, the U.S. and ESA (and possibly Russia, Canada, or Japan) could collaborate on the largest human expedition ever and land mankind on another planet.

Missions to Mars allow for ample international cooperation. Such a large undertaking could only be possible with contributions from many nations. To that end, the IMEWG was established in 1993 and continues to meet twice a year. The charter of IMWEG includes the following goals: "produce and maintain an international strategy for the exploration of Mars, provide a forum for the co-ordination of Mars exploration missions, and examine the possibilities for the next steps beyond the currently defined missions."[276] The aforementioned *Mars Express* program falls under IMWEG collaboration. In 2004, arrangements were made between NASA and ESA "to use each other's orbiters as back-up for each other in relaying data and other communications from the landers to Earth."[277] Additionally, ESA intends "to use NASA's Deep Space Network for communications with Earth during parts of the mission. US scientists are playing a major role in one of Mars Express's payload instruments, MARSIS, and participate as co-investigators in most other instruments."[278] These actions are crossing the nationalism divide and furthering Mars exploration for all partners involved. In 2006, the International Mars

[273] "Aurora's Origins," European Space Agency (2006), http://www.esa.int/SPECIALS/Aurora/SEMZOS39ZAD_0.html (accessed 3 March 09).

[274] Rob Coppinger, "Science and Robotic Exploration are Winners in ESA Budget Round, but Manned Mission Plans Suffer Cutback," *Flight International* (9 December 2008).

[275] "The European Space Exploration Programme Aurora," European Space Agency.

[276] "Towards Mars: International Strategy for the Exploration of Mars," University of Washington: Department of Atmospheric Science, 2007, http://www.atmos.washington.edu/~mars/IMEWG_strategy.html (accessed 21 May 2009).

[277] "International Cooperation," European Space Agency, 2 November 2004, http://www.esa.int/esaMI/Mars_Express/SEMVQ95V9ED_0.html (accessed 21 May 2009).

[278] Ibid.

Architecture for Return of Samples (iMARS) Working Group was established to develop a possible international Mars sample return mission intended for 2018–2023. This would be a fully international mission, in which partners would share not only the costs and risks, but also the rewards.[279] ESA's Exploration Program Manager, Bruno Gardini, states, "For Europe this is a major step to shape the future of the ESA Aurora Exploration Programme in 2008."[280] Additionally, a sample return mission (and how well partners cooperate) will serve the international community well when human missions to Mars are undertaken.

Again, however, difficulties with international cooperation may arise. Ironically, the cooperation of NASA and ESA on outer planet missions is coming at the expense of Mars rover missions. As the cost of the outer planet missions increase, funding for Mars missions is redirected. This leads to "NASA and European Mars managers and scientists [being] concerned that … NASA's Mars robotic sample return mission … will be done on the cheap."[281] At a time when Europe's Institute for Scientific and Technical Information is trying to sell Mars to Europeans, members of the Institute feel as though they have been undercut. "Mars remains the ultimate goal of …. the VSE,"[282] a goal which is strongly supported by both a Stanford University study and the National Academy of Sciences.[283] This appears to be a Catch-22 for both NASA and ESA. In order to foster greater international cooperation for Mars missions, partnerships must be built to sustain less visible missions. While this is occurring on outer planet missions, the redirection of funds from Mars exploration negatively impacts such partnerships.

In order for NASA and ESA to cooperate, however, ESA members must agree to cooperate amongst themselves. In October 2008, *Aviation Week and Space Technology* reported, "A last-minute about-face by Italy could scuttle Europe's ambitions to take a lead role in Mars and Moon exploration, just as planners are beginning to define a coordinated international exploration road map."[284] Enrico Saggese, head of ASI, said "a shift in space priorities ordered

[279] "Preliminary Planning for an International Mars Sample Return Mission," Report of the International Mars Architecture for the Return of Samples (iMARS) Working Group, 1 June 2008.

[280] "International Group Plans Strategy for Mars Sample Return Mission," Lunar and Planetary Institute, 11 December 2007, http://www.lpi.usra.edu/features/mars_sample/ (accessed 21 May 2009).

[281] Craig Covault, "The Outer Limits," *Aviation Week and Space Technology* 168 (15): 30-32.

[282] Ibid.

[283] Ibid.

[284] Ibid.

by Prime Minister Silvio Berlusconi [would] reduce Italy's ESA contributions far beyond levels initially expected."[285] As one of ESA's top three contributors, this could mean the severe crippling, if not the end, of programs such as ExoMars. In an enormous display of nationalism, Saggese states, "The primary reason for the shift is philosophical: [Prime Minister] Berlusconi wants to balance out Italy's spending between ESA programs …. in order to leave more money for national programs."[286] Further he notes that Italy will not increase its funding for the ExoMars program, even if it results in forfeiture of ASI's status as prime contractor.[287] If this came to fruition, NASA could respond by offering up an increased partnership in the program to help ease financial strains and the loss of prime contractor.

The future of manned Mars missions is still unknown; however, international cooperation has afforded NASA and ESA numerous probe, lander, and rover missions to the red planet, though many still remain fully NASA or fully ESA programs. The basis for a Mars mission collaboration has already been established with the partnerships on the *ISS* and the intended partnerships on the return to the Moon. It is the author's opinion that a manned mission to Mars could most efficiently be accomplished through international cooperation. However, such cooperation must be fully established and tested via continuation of cooperation on the *ISS*, as well as manned missions to the Moon.

D. CHAPTER CONCLUSION

President Bush noted the need for "other nations to share the challenges and opportunities of this new era of discovery," and he invited these nations to "join us on this journey, in a spirit of cooperation and friendship."[288] This not only applies to the *ISS*, but to missions to the Moon and Mars, as well. His 2004 VSE speech outlined three distinct goals to accomplish this. First he directed the U.S. to complete the *ISS* and meet the obligations to our international partners. The second goal was for the U.S. to return to the Moon, and finally, the VSE called for a human presence on Mars.[289]

[285] Craig Covault, "The Outer Limits," 30-32.

[286] Ibid.

[287] Ibid., 30-32.

[288] "President Bush Announces New Vision for Space Exploration Program," NASA.

[289] Ibid.

The future of the *ISS* is somewhat uncertain. With the retirement of the Shuttle, projected for 2010, and the departure of the U.S. from the *ISS*, projected for 2015/2016, what occurs to and on the *ISS* beyond that time is questionable. The most apparent issue is the retirement of the Space Shuttle, the cargo and people hauler to and from the *ISS*. Without the Shuttle, the U.S. must rely on Russia to transport U.S. crews. Also without the Shuttle, the world loses the only large/heavy cargo return capability from the *ISS*. To mitigate these issues, as well as to commence the quest of travel to the Moon and Mars, the U.S. is developing Constellation, which will be comprised of an Ares I crew launcher, an Ares V cargo launcher, and the *Orion* crew capsule. ESA is capitalizing on the retirement of the Shuttle by developing the ARV. The ARV will be a follow on to the ATV, modified and human rated in order to carry crews. Currently, however, this capability is not projected to be operational until 2015, the same timeframe as Ares I and *Orion*. Unfortunately, this still leaves a gap for the U.S. between Space Shuttle retirement and *Orion* operation during which the U.S. will rely on Russia for crew transportation.

The second goal of returning to the Moon is in motion. Testing of the lunar lander, *Altair,* is projected to begin this year (2009). To pave the way for returning to the Moon, NASA and ESA have both launched probes to the Moon, and ESA has also released an RFI for a lunar lander. Most importantly, however, is the recent comparative exploration architecture study, which included an "assessment of potential programs and technologies that when conducted cooperatively could one day support a human outpost on the Moon."[290] This study found a significant interest in development of lunar landers, communications, navigation, infrastructures, and habitats, as well as re-iterating the need for redundant crew transportation capabilities.[291]

Building on the technology and lessons learned from returning to the Moon, the U.S. will set its sights to Mars. The U.S. and Europe have conducted extensive missions to Mars, including five U.S. rovers and orbiters that are currently exploring the red planet. ESA is also orbiting Mars with the *Mars Express* and has plans for further exploration via the Aurora Program. The opportunities for international cooperation abound. With a collaboration of technologies, funding, and motivation, landing humankind on Mars is well within our reach.

[290] "NASA and ESA Complete Comparative Exploration Architecture Study," European Space Agency.

[291] Ibid.

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V. CONCLUSIONS AND POLICY RECOMMENDATIONS

Transatlantic partnerships have become integral to the success of modern-day aerospace programs. As with all such collaboration between nations concerning high-technology, conflicts have and continue to arise between the United States (U.S.) and Europe concerning joint space initiatives. This thesis investigated multiple case studies of space cooperation between the European Union (EU) and the U.S., as well as what this could mean for future partnerships. Included in this analysis was the politics of space in a multinational context, as well as the potential conflicts between multinational cooperation and nationalism. This thesis investigated the hypothesis that nationalism has been the major driver within the European Space Agency (ESA), as well as between ESA and the National Aeronautics and Space Administration (NASA), hampering multinational cooperation.

To understand the effects of nationalism on multinational space cooperation, one must understand why these states cooperate in the first place. Nation-states cooperate in high-technology ventures for such varied reasons as cost savings, a desire to increase the rate of technological research and development, risk sharing, and technology sharing and transfer, as well as strategic needs for alliance cohesion. Cooperation in these ventures also results in the generation of new products, processes, and services. If cooperation in high-technology ventures is so advantageous to all partners, why does nationalism come into play? As previously mentioned, nationalistic particularism and parochial concerns have been present in the area of space exploration since the beginning; for example, the space race of the 1950s and 1960s was deeply rooted in the Soviet-U.S. political conflict of the era.

Since the 1960s, NASA has partnered with Europe to further space research and exploration for all mankind. The most notable case of nationalism can be seen in the change in U.S. space policy from 1996 to 2006. As previously mentioned, the most recent U.S. space policy focuses much more on national security and much less on international cooperation than the previous policy. International cooperation is scarcely mentioned, and when it is, only in conjunction with national security and protecting U.S. interests. In addition, the updated policy states than even arms control treaty obligations would not hinder the U.S.'s pursuit of national security in and through the use of space. Nationalism can also be seen within ESA, which is comprised of twenty-two member or cooperative states and is subject to oversight by the European Commission (EC); it is easy to see that disagreements will abound within ESA and between ESA and the EC, many of which are fueled by political and economic nationalism.

To further investigate multinational space cooperation, five case studies were conducted on varying degrees of cooperation in space exploration. These case studies included the following: International Telecommunications Satellite Consortium (INTELSAT), *Ulysses*, Galileo, Stratospheric Observatory for Infrared Astronomy (SOFIA), and the *International Space Station* (*ISS*). Within these case studies, two of the three levels of analysis common to international relations were researched, to include the distribution of power, economic conditions, and interdependence of one country on another, as well as regime type, politics, and organizational theory. It was determined that numerous aspects drove the initial NASA-ESA partnerships including the U.S.'s "genuine desire to involve other countries in exploring the new frontier of space."[292] Over the last five decades, this cooperation with Europe has evolved from ground stations for satellite communications to the *ISS.*

Many lessons learned were gleaned from these five case studies, with numerous lessons appearing in more than one case. INTELSAT proved the need for a comparable distribution of power between nations, while the *Ulysses* program proved the need for open communication between international partners. The Galileo program has worked well in the international arena, with cooperation evident between ESA and the U.S., as well as Russia. However, cooperation within ESA has been difficult to find. Numerous countries are battling over funding, industry involvement, and timelines leading to multiple disagreements and delaying the program by years. Like *Ulysses*, SOFIA proved the need for open communication between international partners. In this case, however, it was Germany's nationalism, not lack thereof, which pushed NASA to continue funding and enter into the flight testing phase. As concerns the *ISS*, international partners were brought into the early planning stages and were kept abreast of changes. Numerous nations cooperated and developed the greatest international cooperative endeavor ever undertaken in space. This was tainted, however, by NASA's unexpected announcement of withdrawal by 2015.

[292] Smith, "America's International Space Activities," 18.

In his 2004 Vision for Space Exploration (VSE) speech, President Bush noted the need for "other nations to share the challenges and opportunities of this new era of discovery," and he invited these nations to "join us on this journey, in a spirit of cooperation and friendship."[293] This concept is vital to the survival of the *ISS* and potentially very important to returning to the Moon and continuing on to Mars. The future of the *ISS* is uncertain due to the retirement of the Space Shuttle (both a people and heavy/large cargo hauler to and from the station) and the announcement by the U.S. to pull out of the *ISS* by 2015. This has left station partners without a large cargo return vehicle, one less crew transport, and significantly less funding for *ISS* operations. To this end, it is important for the station partners to collaborate where possible on crew transportation and funding, while maintaining the cooperation present in research and crew operations.

The U.S. is currently developing Constellation, which consists of an Ares I launcher, an Ares V launcher, an *Orion* crew capsule, and the *Altair* lunar lander. The combination of Ares I and *Orion* can serve as a crew transport to the *ISS*; however, it is not projected to be operational until 2015, which is precisely when the U.S. has announced it will leave the station. ESA is also in the process of developing the Automated Return Vehicle (ARV), a man-rated follow on to the Automated Transfer Vehicle (ATV); however, the ARV is not projected to be operational until 2015, the same timeframe as Ares I and *Orion*. This leaves Russia as the sole *ISS* crew transporter during the gap between Shuttle retirement and *Orion* operation. Not only does this put Russia in a very powerful position, it also encourages other space-faring nations to focus their cooperative activities away from the U.S. and toward Russia.

The final two goals of the President's VSE are to return mankind to the Moon and eventually have a human presence on Mars. To that end, both the U.S. and ESA have sent probes to the Moon to pave the way for mankind's return. Constellation will not only serve the *ISS*, but will also serve as the heavy launcher that returns the U.S. to the Moon and eventually land the first humans on Mars. As mentioned previously, the U.S. and ESA participated in a comparative exploration architecture study. This study concluded that both the U.S. and ESA had significant interest in development of lunar landers, communications, navigation, infrastructures, and habitats, as well as reiterating the need for redundant crew transportation

[293] "President Bush Announces New Vision for Space Exploration Program," NASA.

capabilities.[294] It is certainly apparent in ESA's recent request for information for a lunar lander and in NASA's plan to begin testing of *Altair* this year. Following its return to the Moon, the U.S. will build on that technology and lessons learned to venture to the red planet. Both the U.S. and Europe have conducted extensive missions to Mars, including five US rovers and orbiters. With the cooperation of the U.S., ESA plans to launch the first segment of its Aurora Program, ExoMars in 2013. In that spirit, continued cooperation could greatly increase the chances of humans landing on Mars in this century.

Nationalism has been an underlying theme throughout this thesis. This research has shown that cooperation within ESA's member states is hampered by nationalistic views and ideas, which is most recently apparent in Italy's redistribution of funds away from ESA's optional programs. As an agency as a whole, however, ESA rarely allows nationalism to interfere with international cooperation in space, even sacrificing national interests in favor of cooperation. By contrast, though it has engaged in some successful international programs, NASA has allowed numerous shows of nationalism to hamper some of these projects including *Ulysses* and even the *ISS*.

ESA faces a more complex challenge in terms of international players. ESA itself is comprised of twenty-two international partners that must agree before proceeding as a single European entity. Cooperation amongst these partners is not a simple task and has hampered many projects within Europe. The most recent example is Italy's intent to refocus space funding into national programs, thereby compromising ESA's ability to take a lead role in Moon and Mars exploration. However, the case studies examined in this thesis have shown that once ESA comes to an agreement within its construct, it is more than willing to put European nationalism aside in favor of international space cooperation.

On the other hand, the U.S. has allowed nationalistic views to determine the course of action in numerous international space exploration ventures; the first being INTELSAT, and the most recent being the *ISS*. Additionally, the 2006 U.S. National Space Policy is drastically different from the previous (1996) policy. While the 1996 policy mentioned international cooperation numerous times, the 2006 policy dedicated only two short paragraphs to the topic. In stark contrast, the topic of national security was afforded two entire pages in the 2006 policy,

[294] "NASA and ESA Complete Comparative Exploration Architecture Study," European Space Agency.

with emphasis on international cooperation only in conjunction with U.S. national security interests and the promotion of its own systems. It is evident that nationalism is at the forefront of the 2006 policy and will be a major driver in international cooperation not only with Europe, but other nation-states, as well. The case studies discussed in this thesis have shown that NASA has placed nationalistic ideals and goals ahead of international cooperation numerous times, most recently with the announcement to withdraw from the *ISS* in the 2015 timeframe.

This thesis has not been an all-inconclusive study of international cooperation between NASA and ESA. It is recommended that more studies be conducted before a final determination can be formed. However, the author clearly recommends that future space policies allow for more international cooperation, taking heed of lessons learned from past programs. A future space policy can still be focused on national security and the measures required to protect the U.S.; however, a more amenable approach to international cooperation would not only aid in national security, but also allow for greater space exploration than would be possible by a single national agency. In the future, lessons learned must be reiterated and applied to the maximum extent possible, especially those that have occurred in more than one program. While an overarching framework should be established for cooperative space exploration programs, no one agency should control the majority of the operation/contracts. Additionally, the U.S. should be more receptive to including international partners when making programmatic decisions that affect other agencies/partners.

While the U.S. was able to land man on the Moon forty years ago, no one has returned in over three decades. However, nations around the world continue to join the U.S. as space-faring countries. These partners can offer each other significant contributions in space exploration if international cooperation is allowed to come to fruition. With tightening space exploration budgets and the need for technology exchange, it is the author's opinion that the ultimate goal of landing humans on Mars could be more efficiently realized through international cooperation. With international cooperation can come international success on a large scale. As stated by space expert Eligar Sadeh, "Today and in the future, it is hard to imagine that a major governmental or commercial space program could be undertaken without international space cooperation."[295] If respective space agencies lay aside nationalistic views, the greatest space endeavor of landing humans on another planet can be realized. Such an accomplishment would not be just a single nation's victory, but a victory for all mankind.

[295] Eligar Sadeh, *Space Politics and Policy: An Evolutionary Perspective* (Dordrect, The Netherlands: Kluwer Academic Publishers, 2002).

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