Broadening the Base
Cooperation as a Springboard for New Participants in the Space Sector

Michael Simpson, Ph.D.
the Secure World Foundation

Introduction

Numerous examples of international cooperation among well-established spacefaring states have emerged over the last several decades. Although the prime example may be the International Space Station, other missions are similarly worthy of mention: Cassini-Huygens, Chandrayan 1, Hayabusa, and literally every mission launched by the European Space Agency. As a result of such cooperation our knowledge of our solar system, including our home planet, has been increased dramatically by missions whose success exceeded the capacity of single states, even large

and wealthy ones, to organize and fund alone.

Less attention has been paid to the role that cooperation within and between national states has played in helping boost countries with less space experience into a position where they could benefit economically from participation in space activity and also contribute materially to the success of space missions.

Among such national states several patterns of cooperation are evident.

First, there is the case of economically well-developed countries that have consciously adopted a policy of niche specialization designed to facilitate inclusion of strong national competencies into space missions organized by more powerful spacefaring countries.

Second, there is the situation of emerging space states that have benefited from the express policy of spacefaring countries to encourage their development as participants in the space sector.

Third, and often related to one or both of the above cases, there is the pattern of national pursuit of space participation as part of an overt strategy of national economic development and capacity building.

Fourth, there is the example of sub-national efforts at regional economic development that specifically emphasize space activity as a means for enhancing the diversity of the local economy and enhancing the market for high technology products and services.

Lastly, there may be another pattern emerging, as private entities collaborate to bring order to potentially chaotic situations where political authorities have failed to act either by design or neglect.

A number of examples will help make these patterns clearer.

Pattern 1: Economically Developed Countries and Niche Specialization: Looking at Canada and Australia

The best example of Pattern 1 is Canada. Active in the very early days of the space age with the development of the Alouette satellites first lofted into space on September 29, 1962, it chose the cooperative path from the beginning, electing to launch aboard an American Thor-Agena vehicle. Speaking about this program thirty years after its launch, C. A. Franklin noted that the cooperation was far from accidental, stating, “It was to be a cooperative undertaking between Canada and the US, with each country

paying its own costs in the project."[1] With the subsequent addition of the United Kingdom to the endeavor, it would become even more international.

In the years since the launching of Alouette 1, Canada has shown continued openness to cooperation, integrating the iconic Canadarm robotic assembly into both the American Space Shuttle program and the International Space Station and following these successes with the addition of the Dextre fine motor control capable robot, now part of the ISS advanced tool kit. In addition to a resumé of the Canadarm's early history, the Canadian Space Agency's website highlights the cooperative nature of the project: "The Canadarm project remains a sterling example of successful international space cooperation."[2]

Another physical example of the success of Canada's cooperative strategy is the presence of a Canadian LIDAR aboard the US Phoenix mission. This instrument played a central role in the detection of snow in the Martian atmosphere, confirming the role water continues to play in the ecology of that otherwise dry planet. Other technological examples include synthetic aperture radar applications, biomedical technologies, and specialized clothing for human spacefarers.

Canada's cooperative strategy also includes a political dimension, which has allowed it to be a privileged partner in the US space program while also being an active associate member of the European Space Agency. In an evaluation of Canada's relationship with ESA prepared for the Canadian Space Agency by management consultants Goss Gilroy Inc., the expected dividends of a cooperative strategy are expressed clearly and early:

"Generally speaking, the Agreement contributes to maintaining Canada's world leadership in its traditional niches (e.g., civilian radar technology for Earth observation, and advanced satellite communications services) and enhancing the international competitiveness of the Canadian manufacturing industry through the development of space technologies, innovative advanced systems, and terrestrial applications."[3]

One manifestation of this strategy has been the substantial investment

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1 Franklin, C. A., "Alouette/ISIS: How it all Began," a speech to the IEEE International Milestone in Engineering Ceremony, Shirley Bay, Ottawa, Canada, May 13, 1993, as viewed on May 30, 2011 accessible on-line at http://ewh.ieee.org/reg/7/millennium/alouette/alouette_franklin.html

2 "Canadarm," web page included in the Canadian Space Agency site as viewed on May 20, 2011, accessible online at http://www.asc-csa.gc.ca/eng/canadarm/default.asp

3 "Summative evaluation of the 2000-2009 Canada/ESA Cooperation Agreement, Final Report," February 22, 2010, Goss Gilroy Inc., Management Consultants, Suite 900, 150 Metcalfe Street, Ottawa, ON K2P 1P1.

in the development of human capital capable of supporting the space sector, and especially those elements that contribute to meeting terrestrial needs. In the nearly 25 year history of the International Space University, the number of Canadian graduates, numbering 410 as of early 2012, is second only to those of the United States (466) among that school's more than 3300 alumni from over 100 countries.

Focusing on what it does well, investing in innovation where new opportunities present themselves, and concentrating resources within centers of excellence, Canada has demonstrated the utility of the cooperative model not only for the development of space activity, but for its own development as well.

Australia has pursued a similar strategy, but with less consistency and breadth. From the earliest days of the space age, it recognized that it occupied a privileged geographical position as regards monitoring both natural radio frequency signals from space, and those produced by human-made spacecraft. This led it to play a central role in monitoring communication from the early days of the US human space flight program, and to establish critical components of the deep space network on its territory. The cooperative advantage of the latter has been important in the monitoring of the continuing faint signals of the two Voyager spacecraft, and was critical to the success of those missions during their encounters with the outer planets. This emphasis continues today, as it supports an active bid in cooperation with New Zealand to host the Square Kilometer Array, intended to dramatically enhance the ability of radio astronomy to increase our knowledge of deep space phenomena, continuing its substantial interest in space-based telecommunications technologies and the ground infrastructure necessary to support them.

Additionally, Australia has invested in launch infrastructure, recognizing that its favorable latitude and sparsely inhabited interior provide excellent conditions especially for sounding rocket launch and recovery operations. Although efforts to establish a launch facility on Christmas Island in support of orbital missions have not borne fruit, the central Australian facility at Woomera from which Australia successfully launched its only orbital flight in 1967, continues to be an attractive site for sounding rocket missions, and the wide open territory in its range proved an ideal landing site that Japan has used to bring its Hayabusa spacecraft safely back to Earth.

Unlike Canada, however, which has maintained a focused and consistent emphasis on space activity, Australia's interest has ebbed and flowed substantially over the years. With the tasking of the Australian

Space Research Program to overcome the sense of drift described in a 2008 report to the Australian Senate entitled "Lost in Space?," the country has embarked on an important initiative to build both intellectual and physical capacity.

As an example of cooperation, the joint effort between the University of South Australia and the International Space University to offer a space studies program focusing on the needs of states in the Southern Hemisphere is particularly interesting. The mandate for this program has been intentionally international from the beginning and its inaugural session at Mawson Lakes, Australia in 2011 attracted students from 10 countries and 5 continents. Tasked with identifying space activities and technologies that were of particular value and interest to the states of the southern hemisphere, the program reflected Australia's willingness to advance along a cooperative path and its readiness to play a leadership role.

This was particularly evident with the focus of the 2012 program. Working to produce a white paper entitled, "REACH2020: Tele-reach for the Global South," its mission was "to develop a sustainable framework under which states can collaborate on economic and social needs, and maximize Information and Communication Technology (ICT) to provide space and terrestrial tele-reach applications".[4]

The "Lost in Space?" report also made it clear that there is a big difference between cooperation and dependency. Noting the extent to which the country relied on non-Australian sources for critical satellite-based services, the report summarized the arguments in favor of increasing numbers of satellites being built and operated by Australia with the phrase, "while the risk of being denied access to satellite data is not necessarily large, it would have severe consequences if it eventuated."[5] The report also noted that Canada harbored enough of its own concerns to also be engaged in the development of independent capabilities.[6]

These concerns were balanced, however, by awareness of the advantages of collaboration. Cooperative opportunities with Japan, the United States, China, Korea, and Canada were specifically highlighted.[7]

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4 "Southern Hemisphere Summer Space Program," University of South Australia, Division of Information Technology, Engineering & the Environment, http://www.unisa.edu.au/itee/spaceprogram/whitepaper.asp

5 The Commonwealth of Australia, "Lost in Space? Setting a New Direction for Australia's Space Science and Industry Sector," The Senate, Standing Committee on Economics, PO Box 6100, Parliament House, Canberra, ACT 2600, November 2008, p. 16, paragraph 2.40. Online at asri.org/system/files/private/report.pdf

6 Ibid. p. 15, paragraph 2.36.

7 Ibid. pp. 16-17, paragraphs 2.41-2.44.

Special emphasis was placed on Australia's ability to provide mission critical support through its ground station network, thus emphasizing that Australia, like Canada, was conscious of its strengths, and intended to develop them in an environment where important technical capabilities became both centers of excellence and centers of economic return.

Pattern 2: Emerging Space States: Nigeria and the PECS Countries

Good examples of pattern 2 include Nigeria and the countries participating in ESA's Plan for European Cooperating States (PECS). Although possessed of a good technological infrastructure of its own, Nigeria has benefitted substantially from technical assistance, support, and resource development provided by several international partners. For their part, the PECS countries have benefitted from a close mentoring relationship with ESA that has enabled them to identify where they can contribute to space activity and to build capacity to be more involved in the future.

Like many countries new to space activity, Nigeria entered the space arena with high hopes of building capacity and encouraging technological development.[8] It has worked with China, the United Kingdom, Russia, and the international Disaster Monitoring Constellation (DMC) to increase its technical ability, develop independent satellite control capability, and advance toward a goal of acquiring indigenous technology in Earth observation and telecommunications.[9]

Nigeria's 2011 plans called for the launch of three satellites. NIGCOMSAT-1R, developed in cooperation with China Great Wall Corporation as a replacement for a satellite that failed in 2007, was launched in December 2011. NigeriaSat2, developed with Surrey Satellite Technology Ltd. (SSTL) and NigeriaSat-X were successfully launched in August 2011 from Kourou, French Guiana. Although the first two of these projects involve contracts with non-Nigerian firms, they were designed to increase technology transfer to Nigeria in preparation for increasing the country's domestic share of future projects. The NigeriaSat-X project, by contrast, was completed in country, and represents an important step

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8 "National Space Policy and Programs," Federal Ministry of Science and Technology, 2001, Abuja, Nigeria, p. 3.

9 "Paths to Progress: Space and the Southern Hemisphere," a white paper prepared by the students of the Southern Hemisphere Space Program (a joint academic venture of the University of South Australia and the International Space University) 2011, Mawson Lakes, Australia, p. 19.

forward in Nigeria's effort to build technical capacity in space applications and systems.

Nigeria's commitment to international cooperation has been rooted in its National Space Policy document of 2001. Chapter 9 emphasizes the importance of multilateralism in Nigeria's space planning, and also underscores that economic development is the goal more than space development.[10]

The initial role in space development for many smaller countries will often come as a side effect of their pursuit of solutions to terrestrial problems, but as Nigeria's participation in the DMC shows, a major space asset can also be assembled through the participation of several like-minded and technologically advancing states.

Similar conclusions can be drawn about the PECS states, but with an interesting twist. All current members of this group were members of the Soviet Bloc during the formative days of the space exploration. While working in Poland and the Baltic States as part of a European Union initiative to increase the participation of these countries in the economic activity of the space sector, I was struck by the number of stories related by veteran engineers who worked on projects in the 1960s and 1970s, and whose end purpose they only understood years later. In all cases these had been projects related to Soviet space missions, but the information about their eventual use was so compartmentalized that no one working on them in the client states knew the ultimate applications. Even in this information vacuum, however, both capacity and interest grew. In general, both the veterans and their younger colleagues showed considerable interest in the developmental challenges and opportunities of space itself, even while never forgetting the objective of economic development as well.

They and their non-technical colleagues also showed considerable enthusiasm for the role ESA was willing to play in their capacity-building efforts through the PECS system. And they had good reason for their enthusiasm. Two former PECS countries, the Czech Republic and Romania, are now full members of ESA, and a third, Poland, has just initiated the process to accede to membership. For Hungary, Estonia, and Slovenia, there is ample evidence that close cooperation can lead to opportunities to participate not only in locally focused applications, but also in scientific and exploratory missions as well. Equally as important, countries including Latvia and Lithuania are showing a growing interest in the PECS, and may soon apply to participate.

Cooperation with ESA can mean contracts and cash flow of course,

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[10] "National Space Policy and Programs," section 9.2 (b), p. 33.

but the greatest boost to space activity often comes from the role the European agency plays in facilitating performance and capability audits. Enterprise Estonia, a national agency dedicated to supporting the country's entrepreneurial growth, devotes an entire page in its space business prospectus to the results of ESA's capability audit. With growing capabilities such as ground systems support, robotics, software, and advanced materials among many others, Estonian suppliers could now move with some confidence to market these capabilities in conjunction with documented advantages in turnaround time and workmanship.

The PECS countries also benefit from another source of mentorship as they seek to enter the space sector. Under the 2009 Treaty of Lisbon, the European Union acquired a so-called "shared competency" in space policy with its member states. This has led it to a more active pursuit of space issues not only as part of its foreign policy, but also in support of economic development objectives.

This conjunction of interests played a role in the establishment of the NordicBaltSat project, aimed at accelerating the entry of European Member States from the Baltic region into active participation in the space economy. In so doing it has placed a high priority on building human capital through training sessions, briefings, and workshops. During the NordicBaltSat sessions, presenters have often heard how participants had only recently discovered that a technology in which they had considerable expertise was of interest to the space sector. During one series of sessions in February 2011, representatives of several laser technology laboratories or enterprises expressed both surprise and delight that there were so many diverse applications for lasers in space missions, both on the ground and in flight. Although a commercial value cannot immediately be put on such an epiphany, it is evident that the team devoting some of their creative energies to the utility of laser technology in the space sector has increased in size. With that increase, the potential for innovations and even breakthroughs capable of advancing the development of space has also grown.

Although each country participating in the space sector has its own economic motives, even the newest arrivals are capable of advancing the broader and shared overall goal of pushing forward the frontiers of humanity's knowledge of the cosmos. What is especially true of the smaller, newer participants, is that if along the way the development of space provides insights to solving practical problems on Earth as well, those implications will be very welcome indeed.

Pattern 3: Space Cooperation and Economic Return

All countries in the space sector are well aware of the potential for economic return in the form of technology sales and/or economic stimulus. Many also place high priority on the use of space technology in support of domestic economic sectors that are critical to them politically or commercially. If there is a difference between the largest and most powerful spacefarers and the newcomers, it is in the absence of exploration or cosmic rhetoric in their expressions of space objectives. The objectives of the newcomers always include capacity building and economic benefit; they rarely include reference to a human imperative to explore.

A good example of space policy by a country with some historical experience of space activity but only just now rediscovering the sector is the Lithuanian statement of June 7, 2010. It gets to the economic goals without delay in paragraph 1.1, declaring an unambiguous objective:

"To create and develop competitive business and science sector of Lithuania acting in the field of space (hereinafter referred to as the space sector);"[11]

Of special significance here is that the statement was issued by the Ministry of Economy (MoE), which is given the specific mandate of coordinating space policy. Like many new or returning entrants to the sector, Lithuania is strongly attracted to the potential for both direct and indirect economic benefits, although its initial expression of interest in the arena was advanced under the aegis of the Ministry of Education and Science (MoES). The mandate for creating and executing space policy shifted in early 2010 to the Ministry of Economy. MoES continues to have an important role to play in research issues, but the focus of the Lithuanian government's interest in space clearly centers on economic development.

Even the young Lithuanian Space Association, a group of universities and research centers with a common interest in the usual broad range of academic subjects included in the field of space studies, chose to focus on the economics of the sector at its second International Space Conference at Vilnius in November 2011. Exploring the topic of "Space Economy in the Multipolar World," the association shows that it, too, has its eye on the

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11 "National Programme on Development of Research, Technologies and Innovation in the Space Sector for 2010-2015," Government of the Republic of Lithuania, Ministry of Economy, Dainius Kreivys, Minister, Vilnius, Lithuania, Order No 4-436, June 7, 2010, p. 2.

sector's economic prospects.[12]

With Lithuania's emerging interest in the space sector and Estonia's participation in the PECS already mentioned, it should come as no surprise that neighboring Latvia is also showing substantial interest. Like its neighbors, it has placed considerable emphasis on existing technology and expertise that can be adapted to meet the needs of space missions, identifying materials, components, equipment, infrastructure and R&D capabilities that could be "spun-in" to space projects undertaken by other countries.[13] As with other countries in the former Soviet Bloc, Latvia does have experience dating from the early days of space flight, and it is eager not only to resume active participation in the sector but also to participate at as advanced a technological level as possible. A recent informational brochure published by the Latvian Space Technology Cluster makes it clear that the country is aware that it had a significant role in the development of early liquid fuel rocket technology through the work of Friedrich Zander, and that awareness leads to a strong belief that it can be a key contributor to future developments as well.[14] Evidence of the political support enjoyed by this perspective was the participation of Dana Reizniece, a member of the Latvian Parliament in the International Space University's nine week long Space Studies Program held during the summer of 2011 in Graz, Austria.

Emphasizing its historical competencies in materials sciences, engineering, and astronomical observation, Latvia has highlighted recent accomplishments in scientific instrumentation, cryogenic insulators, radio astronomy, and printed circuitry as evidence that it has a current role to play in the space sector. Significantly, the country's first satellite Venta-1, is being developed as part of a cooperative project between the University of Latvia, Riga Technical University, and the University of Bremen, Germany, in cooperation with the German satellite manufacturer, OHB Systems. Of the four stated objectives for the Venta-1 project, acquiring practical skills in satellite design, studying theory of satellite design, developing satellite engineering in Latvia, and promoting the proficiency of

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12 "Call for Speakers: Space Economy in a Multipolar World," Lithuanian Space Association, accessible on line at http://www.space-lt.eu/pranesejams.htm?lid=4

13 Cf. Simpson, Michael K. "Spin-out and Spin-in in the Newest Space Age," Chapter 5 in Space Commerce: The Inside Story," Langdon Morris, ed., Aerospace Technology Working Group, International Space University, and the International Institute of Space Commerce, September 2010 for a discussion of the economic potential of "spin-in."

14 "Latvia and Space Technologies: History and Nowadays," Latvian Space Technologies Cluster supported by the Ministry of Economics of the Republic of Latvia.

high-technologies in Latvia, three are unabashedly economic in nature.

In addition to the numerous relationships Baltic countries are building with partners outside the region, the broad base of interest in the space sector has created a fertile field for intraregional cooperation as well. In the case of the NordicBaltSat program already mentioned, this kind of cooperation has been specifically sponsored and nurtured by outside partners such as The European Union, ESA, and ISU. Another such initiative, Baltic Sea Region Stars, although sponsored in part by the EU, is more homegrown.

Aimed broadly at stimulating innovation and not just at the space sector, it has nonetheless target strengths and attributes of considerable importance to the space sector: health sciences, energy, sustainable transportation systems and digital services.[15] Within this project, so-called StarDust clusters not only invoke the space mystique as an innovation stimulus, but look toward transnational linkages in the region that can support breakthroughs useful to the space sector. Interestingly, many participants at NordicBaltSat workshops saw immediate parallels between their growing interest in the space sector and the collaborative, pan-regional approach inherent in the BSR Stars model. This model also holds out the possibility of pursuing collaborative projects with experienced ESA member states such as Sweden, Norway, Denmark, Germany, and Finland, as well as with Poland, whose application to join ESA has now been submitted.

As 2011 drew to a close, Estonia demonstrated its determination to continue on the cooperative path in space activity by formally signing the accession agreement to become a full member of the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT). After five years as a cooperating state, Estonia's action will now enable it "to be fully involved in the strategic decisions of [EUMETSAT's] ruling Council."[16]

Elsewhere in Europe, Ireland provides another excellent example of how countries can contribute niche expertise to the space sector while aggressively pursuing economic growth and improved technical capacity. In a history of Irish space activity published by ESA in 2008, author Paul Clancy devotes an entire chapter to a chronicle of the role of international

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15 "BSR Stars Executive Summary," Lead Partner: Vinnova, Stockholm, Sweden, October 2010.

16 "Estonia signs accession agreement with EUMETSAT," EUMETSAT website, December 14, 2011, http://www.eumetsat.int/Home/Main/News/Press_Releases/814189

cooperation in Irish space activity.[17] Clancy identifies 44 separate partnerships, only two of which are governmental; both governmental partnerships are led by institutions focused on economic growth, Enterprise Ireland and the Department of Enterprise, Trade, and Employment.

Among the partnerships singled out for mention, EUMETSAT is a particularly interesting example of how a small, developed state like Ireland can benefit from cooperation while also contributing to an extremely successful space activity. One of twenty members of the organization, and contributing only a bit over 1% of its budget, Ireland nonetheless is able to help sustain one of the world's preeminent providers of space-based weather data.[18]

Ireland can cite numerous examples of participation in European space initiatives and technological development, and one particularly interesting example was cited in ESA's 2001 report on "everyday uses for European space technology."[19] Through research sponsored by ESA, the Irish firm Parthus Technologies, with substantial expertise in mobile device technologies, developed a suite of space applications for Bluetooth Technology. These applications permitted reliable application of wireless technology both for data transfer among spacecraft components and for crew communications. Through this cooperation, ESA gained technology that permitted significant reduction in launch weight, and Ireland gained technology with substantial terrestrial value under the brand name BlueStream. Along the way BlueStream also generated 35% of the revenue that ultimately enabled Parthus to employ 400 people, and eventually become acquired by CEVA, Inc.

Ireland's pathway to such a result was a bumpy one. Starting with a firm resolve in December 1976 that the benefits that Ireland stood to gain from joining ESA were "potentially, very considerable," Ireland eventually ratified its membership in the agency in March 1979. Just over a decade later, however, the Irish Ministry of Finance recommended withdrawal as a means of saving £3.2 Million in annual fees. In the ensuing debate, the utility of space cooperation as an economic engine was the critical issue.[20]

For several years the Ministry of Finance and the Ministry for

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17 Clancy, Paul, A Short History of Irish Space Activities, European Space Agency Publication HSR-40, September 2008, distributed by ESA Communications Production Office, ESTEC, Nordwijk, The Netherlands, pp. 47-50.

18 Ibid., p. 50.

19 Brisson, P. and J. Rootes, "Look No Wires, Down to Earth: Everyday Uses for European Space Technology," European Space Agency Publication BR-175, June 2001, pp. 100-101.

20 Clancy, op. cit., p. 37-40.

Enterprise and Employment argued opposite sides of the membership issue, until finally the question of withdrawal was abandoned in 1993. By 2001, the economic benefit arguments fully mated with the sense of participation in a major international undertaking worthy of Ireland had gained the upper hand as Mr. Noel Treacy, Minister for Science, Technology and Commerce made clear in a news release following an ESA ministerial meeting:

"[Ireland's] expenditure [for ESA membership] will not only assist Europe to build on its considerable strengths in Space, but will ensure that high technology Irish companies, and researchers, will continue to play a key role in European and global space activities, and enhance the growing capacity of Irish companies to exploit leading edge technologies in global aerospace and telecommunications markets."[21]

Two elements of that debate are important to us here. First, Ireland ultimately recognized that its involvement in space activity was not only part of its strategy of economic development, but also part of its partnership in a cooperative program of European dimensions in which its part, though small, was important. In short it was prepared to be a mission partner and not just a vendor state. Second, economic serendipity in the form of the advent of prosperous times and the era of the "Celtic Tiger" provided the political lubricant to get beyond the voices of austerity claiming that expenditures close to home were more important than investments in space. It didn't hurt that the Irish Government's resolve to stay within ESA in spite of the economic difficulties of the 1990s had bought the country the time it needed to discover the "down to Earth" qualities that the Parthus story and its many parallels were revealing by the beginning of the new millennium. Sustaining cooperative partnerships will likely always require a combination of political commitment and economic return, and both should be cultivated and managed carefully.

Ironically, Mr. Treacy's statement also shows that part of the political commitment necessary to sustain space activity in the emerging countries seems to be rooted in a desire of medium powers to improve their competitiveness with the major space actors. Ultimately this will lend notes of both cooperative participation and competitive zeal to the environment of commercial space, not only for Ireland but for many other states as well. To see the breadth of this phenomenon, it is worth looking at Futron Corporation's recently released fourth edition of its Space Competitiveness Index. Announcing the publication in a press release on August 15, 2011, Futron's Space and Telecommunications Director, Jay Gullish, is quoted as saying, "The 2011 results show that even as countries

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[21] Ibid., p. 38-39.

collaborate in space, competition has intensified."[22] As the Irish Minister's remarks make clear, this is not a new phenomenon, but is accelerating as more and more countries discover their capacity to participate. At the very least we will need to keep in mind that no matter how much they may be facilitated by cooperation, space-based endeavors of the future are as likely to see intense competition as have those of the past. One difference, certainly, is that the number of potential collaborators and competitors is increasing rapidly.

Pattern 4: Space Cooperation and Sub-national entities

The next pattern of interest in our review of cooperation opportunities, beyond those between the marquee actors among Earth's spacefaring states, addresses cooperation by political entities and associations that are not at the national level. The world's countries are composed of a dizzying array of sub-units, including states, provinces, regions, departments, territories, and the list goes on. Many of these entities have developed their own offices or agencies with mandates to pursue space opportunities for the benefit of more local populations and interests. Others have simply added a space portfolio or two to already existing bodies that were pursuing research, technology development, or economic growth.

The United States, with its traditions of decentralization and constitutional empowerment of states, has given rise to a large number of such activities. Recent observations at American space conferences have revealed organizations including Space Florida, the Virginia Commercial Spaceflight Authority, Spaceport America (and the New Mexico Spaceport Authority), and the Colorado Space Coalition.

All of them seek to maximize local benefit through partnerships with the national space efforts of the United States federal government, and thus NASA, the Department of Defense (DOD), the National Oceanographic and Atmospheric Administration (NOAA), and the Federal Aviation Administration (FAA) are on all their priority contact lists. All of them also cultivate important business partnerships, although the size of their target audiences differs with local priorities and objectives.

Space Florida, with a massive space infrastructure economically

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22 "U.S. Space Lead Erodes for Fourth Straight Year As Middle-Tier Nations Ascend," Press Release, Futron Corporation, Bethesda, MD, August 15, 2011. http://www.futron.com/1254.xml?id=1045

threatened by the end of the Space Shuttle Program, has devoted particular attention to job creation possibilities surrounding the reprogramming of former shuttle support assets at Kennedy Space Center. To this end, it has brought non-Federal assets to the table, especially with partners that are able to reciprocate with investments of their own, and/or with job creation. Further north, as the operating authority for the Mid-Atlantic Regional Spaceport and with a smaller and more specialized facility to promote, the Virginia Commercial Spaceflight Authority has signaled its interest in partnering with other states in pursuing space missions to be launched out of its Wallops Island site. As the Authority's website makes clear, neighboring Maryland is well represented.[23]

Spaceport America, and the New Mexico Spaceport Authority which oversees its financial bonding capabilities, has an unusually international focus. Its prime tenant, Virgin Galactic, is rooted in the British corporate constellation of Sir Richard Branson, and the flight paths of planned sub-orbital flights may extend into nearby Mexican airspace, either as part of an eventual agreement, or as the result of an emergency scenario. Like the Mid-Atlantic Regional Spaceport, Spaceport America intends to signal with its very name an openness to participation with other states. At the annual International Symposium on Personal and Commercial Spaceflight held in Las Cruces, New Mexico it has even suggested that the term "America" be interpreted it is broadest context to cover potential cooperation with other countries in the Americas.

A particularly interesting aspect of Spaceport America's cooperative model is the integration of two New Mexico counties, Doña Ana and Sierra, into the project. Citizens of both municipalities voted sales tax increases in support of the spaceport project, thus demonstrating that the cooperative model can be manifested by countries that are new to the space sector, and is applicable to sub-national units as well. As various space sector participants look for funds to underwrite their expensive start-up costs, they should not overlook possibilities within countries as well as between them.

The Colorado Space Coalition uses the structure of a not-for-profit organization to assemble a wide-ranging collection of space companies that are working across the full spectrum of sector markets, including military, civil, and commercial space into a coherent voice on behalf of the Colorado's space potential. Without a launch site to promote, its focus is industrial, research, and technological capacity. While acknowledging on

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[23] Home page, Mid-Atlantic Regional Spaceport Web Site. http://www.marsspaceport.com/about-mid-atlantic-spaceport, June 2011

its web site that Colorado is the fourth largest beneficiary of NASA contract awards, it also highlights the concern that the state's capabilities in the space field are as "top secret" as some of the highly classified projects being pursued in the state for government clients.[24]

While the not-for-profit association model seems to be working well for Colorado, an even bigger space participant among US states has had less success with it. On June 10, the California Space Authority, which in spite of its official sounding name is in fact a private association of space sector participants, announced that it intended to dissolve and was ceasing operations immediately. Recently focused on a major project to create a 500,000 sq. ft. (44,000 sq. m.) California Space Park connected to Vandenburg Air Force Base, the major DOD launch site on the US West Coast, the Authority stated in its announcement that it believed that it faced a prolonged environmental approval process with the local government holding jurisdiction over the proposed site.[25] Given the panoply of motivations and priorities affecting political units and human organizations, it obviously pays to pick your potential partners carefully before entering arrangements that can only succeed through cooperation.

Looking beyond the United States, there are several more interesting examples of space cooperation organized by and around sub-national entities including the Catalonia region of eastern Spain, several sites in northern Scandinavia, and the Association of Ariane Cities.

Two Catalan organizations, CTAE (Centre de Tecnologia Aeroespacial) and BAIE (Barcelona Aeronàutica i de l'Espai [Barcelona Aeronautics and Space Association]), have labored to transform the region's centennial aeronautical history into a growing tradition in space activity as well. While CTAE has been particularly focused on developing regional technology and capacity in cooperation with Spain's ESA partners, and in fostering international cooperation among universities and research centers,[26] BAIE has asserted its goal of building partnerships throughout the space community, even while being attracted to the special opportunities presented to the city of Barcelona by its relative proximity to

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24 Home page, Colorado Space Coalition Web Site, http://www.spacecolorado.org/ June 2011.

25 "Space group disbands after failed Vandenberg project ," Pacific Coast Business Times online edition. June 10, 2011. http://pacbiztimes.com/index.php?option=com_content&task=view&id=2402&Itemid=1

26 "Mission and Objectives," Centre de Technologia Aerospatial Web Site, http://www.ctae.org/mission-objectives, June 2011

France's considerable aerospace infrastructure in Toulouse.[27] Understanding the Catalan focus on space activity provides some clues as to why some local communities are prepared to make significant organizational investments in space development and participation.

As BAIE's website reveals, the space sector in Catalonia has a definite sense of its historical roots. With clear reference to its cooperative history, the site describes Barcelona's role as the first city in Western Europe to publicly capture Sputnik 1's signal, and as a contributor to the soil-sample analysis instrumentation on NASA's Viking Mars Lander. It also notes with pride that it was a Catalan astronomer, Josep Comas I Solà, who was the first to describe the atmosphere of the Saturnian moon Titan. In addition to historical roots, the sector also is aware of its technical capacity, reporting that Catalonia handles 9% of Spain's ESA contracts, and that its ratio of aeronautic to space activity is 76% / 24%, compared to the European mean ratio of 91% / 9%. One means of generating the energy needed to sustain institutional commitment to space activity at the local level is thus to combine a sense of historical roots with the hard realities of an engaged economic infrastructure. Supporting a capacity already in place can thus be as important as reaching out to generate new business through attracting outside firms.

Northern Scandinavia presents us with another model where local interests have sought to take advantage of high latitudes suitable for polar research and data collection from polar orbiting satellites. Above the Arctic Circle in the city of Kiruna, Spaceport Sweden has assembled a coalition of local business, public infrastructure, and the Swedish Space Corporation to develop and promote its far northern location for commercial space flight. Although the city has been a center for sounding rocket launches for over 40 years, it attracted broader media attention when it announced an agreement with Virgin Galactic to provide an eventual European launch site for personal spaceflight trips aboard Spaceship 2. Here the local investment is driven by an evolution away from the singular mining focus of the city's creation, with the objective of optimizing the area's long but modest participation in the launch business. Given that Arctic tourism has been a big factor in the area's economic diversification, the conjunction of launch experience with the emerging business of personal spaceflight has been a strong factor in stimulating local interest in the spaceport.

Not far away across the spine of Norway, Kiruna faces launch

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[27] "About BAIE," Barcelona Aeronautics and Space Association Web Site, http://www.bcnaerospace.org/public/who.php, June 2011.

competition from the Andoya Rocket Range. The institutional model there is quite different, however, with the major partner being the Norwegian Ministry of Trade and Industry with the participation of the Kongsberg Defense and Aerospace Company. The business model is also quite different, with less emphasis on tourism and more on research and education. The model provides for substantial cooperative opportunities both within ESA and beyond, and fits quite comfortably into Pattern 3 as described above.

Before ending our discussion of Pattern 4, a few words about the Community of Ariane Cities (CVA) are in order. This organization assembles its 36 members, consisting of cities in France, Germany, Spain, Switzerland, Belgium, and French Guiana, in a not for profit association with a specific mandate to encourage collaboration and cooperation not only among the members, but also with the Caribbean and South American countries whose geographical proximity to the Ariane launch site in Kourou, French Guiana creates the foundation for a natural partnership. With a structure that includes both cities and institutional partners, the CVA provides a forum for space policy discussions at a sub-national level while also providing a forum for industrial and political actors to consult and cooperate as they seek to optimize the favorable impact of space activity on their operations.

Of particular note in the activity of the CVA has been the organization's heavy emphasis on outreach, public communication and education. Recognizing the importance of an informed public and a supportive constituency, the CVA has sponsored programs for such diverse groups as school children, teachers, and young engineers as it seeks to increase the mix and diversity of talent available to the future of the launcher industry.

Pattern 5: Private Cooperation for Space Sustainability

With only one clear example, it may be too early to elevate this activity to the level of a pattern, but the Space Data Association (SDA) may well provide a model for structured cooperation in space where political regulation is lacking.[28] The purpose of this cooperative endeavor is to ensure safe satellite operations through the exchange of space situational awareness data. Formed as a not for profit corporation on the Isle of Man

[28] For more information, refer to the SDA's website: http://www.space-data.org/sda/

in 2009, the SDA is a response to the growing concern that orbits are becoming increasingly crowded with operational satellites, derelicts, and loose debris.

Using automated systems operated by Analytical Graphics Corporation, the Association benefits from the support of the Isle of Man Government, which while unable to legislate for space due to its relationship with Great Britain has at least been able to provide a safe harbor in which the new association could be legally established. In this cooperative environment, the SDA seeks to reduce the likelihood of on-orbit collisions or broadcast interference, in an environment where international public regulation has not been established. Here, then, the principle that cooperation permits a favorable result which was otherwise beyond the means of the cooperating parties is extended to the private sector. Whether this model will survive the competitive impulses of the members themselves or the anti-trust fears of potential regulators remains to be seen, but in the growing number of areas where countries have been unable to create agreed upon rules of order, it seems likely that private operators, like pioneers on the old frontiers, will have a strong incentive to organize their environment as best they may, at least until the law arrives.

Some Lessons from the Examples

Cooperation is too common in the space sector to be a random occurrence, but our examples also show that it needs several pre-conditions to flourish. Ideally these conditions include as many of the following elements as possible:

A reasonable prospect of economic return to all partners

Even the most established spacefaring countries justify their space missions in terms of jobs created and economic development expected. All the new entrants are unabashed in their emphasis on expected economic returns. Increasingly commercial participants also anticipate profit and return on investment.

Political support and resolve rooted in more than just economic return

When economies go into down cycles there must be something more than short term returns to sustain them. The European Idea pulled Ireland out of its withdrawal crisis in the 1990s, and a sense that Australia should

not be left behind helped revive interest in space activity down under in the new millennium. Frequently, the impact of space activity as an inspiration to the young, or in maintaining a technical infrastructure, are advanced where economic returns fall short or face protracted delays. Similar non-economic arguments reinforce space initiatives almost everywhere that they persist. That part of this resolve may originate in the desire of previously less active space players to compete with the well-established spacefaring states, may ultimately prove to be both an incentive to cooperation and an inducement to commercial competition. In either case the opportunities for synergy should increase substantially, and the need for creative procedures to provide structure to cooperation will become more urgent.

Support from partners with experience or niche expertise

The hardest part of this element to deliver is the awareness that the assistance of others can be useful. Slowly, even the well-established spacefaring countries are coming to accept that building a market for space-based applications and extended space operations is beyond the resources of even the most powerful and wealthy players. The principle of "spin-in" is moving beyond national frontiers and increasingly will lead to acquisition of mission critical skills, equipment, and materials wherever they can most easily and economically be found.[29] Interestingly, even in the emerging pattern represented by the SDA, the niche expertise of Analytical Graphics and the opportunity to share its cost across several partners is a key feature of the association's recruitment message to potential members.

A sense of historic connection to the space sector or its antecedents.

Just as countries of the former Soviet bloc are energized by the knowledge that they played important roles in the earliest days of the space age, so, too, will the beneficiaries of today's mentorship efforts come to view the missions that they contribute to as part of their space traditions in the future. As that tradition grows in more and more countries, the prospect for a well-rooted expansion of space commerce also grows. Thus efforts such as ESA's PECS system, China's outreach to the states of the

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[29] Please see "Spin-Out and Spin-In in the Newest Space Age" by Michael Simpson in the previous volume in this series, Space Commerce: The Inside Story by the People Who Are Making it Happen. Aerospace Technology Working Group, 2010.

emerging space sector, and the CVA's effort to include Caribbean and South American representatives under the growing Ariane tent, all hold the promise of enhancing the size and value of tomorrow's commercial activity for the space sector.

Leadership with vision

Cooperation seems to generate many enemies among those who prefer the ease of protected markets or the convenience of familiar commercial patterns. Leadership, political and commercial, will need to see beyond the "threats" of including participants from "outside" their national or economic networks. They will need to see that rapidly expanding markets can create opportunities enough to permit spreading benefits widely. The visionary Space Data Association is a solid example of what can be accomplished when leaders cooperate to address a problem beyond the capacity of any one of their institutions to resolve.

Like the vision shown by the SDA, those of governments will need to be focused as well as ambitious. Promises of economic benefit will need to be tempered with an understanding of the potentially long time scales required for infrastructure development and to achieve mission milestones. Ultimately vision will be measured by the skill that leaders show in seeing what is achievable, not in the rhetoric they pronounce about potentially exciting destinations. President Kennedy's challenge to go to the Moon and back was based after all on a hard-headed study about what objectives could reasonably be obtained in the context of a space race that had caught the USA by surprise.[30]

Effective public communication

The public is hungry for space-based information, but is also skeptical about the beneficial results of space activity. The hunger and the skepticism both need to be addressed. And in both cases the cooperation theme itself is broadly appealing and is emphasized increasingly in communications from the major space agencies.

For those of us who have followed the websites of major space participants over that last couple of decades, there is an understanding that we have come a very long way in our ability to communicate with the public. In the process, to the chagrin of some, space information, especially images, have become something of an entertainment industry.

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[30] Logsdon, John, John F. Kennedy and the Race to the Moon, New York, Palgrave MacMillan, 2010. [This is by far the most thoughtful treatment of John Kennedy's historical challenge to the American People and his ultimate willingness to have made the voyage one of international cooperation.]

Given the cash flows in entertainment this may not be altogether such a bad thing. It may even be one more incentive for us to cooperate as we seek to keep the relationship between science, applications, exploration, and storyline in balance.

Conclusion

Looking at five distinct but combinable patterns, we have seen just how deeply rooted and widely sown cooperation has become in the space sector. Whether crossing national lines or enriching development within the diverse regions of a single country, cooperation is releasing synergy and enabling collaboration on a scale that permits even those coming late to space activity to hope reasonably for political, economic, and social rewards.

From the examples defining these patterns we have also been able to infer important lessons about what makes the soil fertile for cooperation, and how to keep it that way. In a sector increasingly interested in the challenges and importance of sustainable activity in space, it will be useful to keep a close eye on the role cooperation will play not only in developing creative new solutions to such problems as debris, traffic management, RF interference, access, and shared participation in economic benefits, but also in increasing the number of people, institutions, and countries with a reason to care.

Ultimately by broadening the base we will have provided the entire space sector, from the first participants to the most recent, with the foundation we need to make the future of space activity exceed even the wildest dreams of its greatest visionaries. This should more than adequately compensate us for the hard work ahead.

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Dr. Michael K. Simpson

Dr. Michael K. Simpson joined the staff of the Secure World Foundation in September 2011 following seven and one half years as President of the International Space University (ISU). He became the Foundation's Executive Director on January 1, 2012

Simpson's academic career extends over 36 years and five continents. In addition to his tenure at ISU, he has been president of Utica College and the American University of Paris with a combined total of twenty-two years of experience as an academic chief executive officer.

Simpson has taught courses in political science, international relations, business management, leadership and economics at Universities in both the United States and France and holds a post as Professor of Space Policy and International Law at ISU. He received his Bachelors Degree magna cum laude from Fordham University in 1970 where he was elected to Phi Beta Kappa. He has also been elected to academic honor societies in the fields of political science and business management. He is a corresponding member of the International Academy of Astronautics.

After graduating from Fordham University, Simpson accepted a commission as an officer in the US Navy, retiring from the Naval Reserve in 1993 with the rank of Commander. He completed his Ph.D. at Tufts University, The Fletcher School of Law and Diplomacy, holds the Master of Business Administration from Syracuse University; and two Master of Arts degrees from The Fletcher School. He has also completed two prestigious one year courses in Europe: the French advanced defense institute (Institut des Hautes Études de Défense Nationale) and the General Course of the London School of Economics.

He is the author of numerous scholarly papers, presentations, articles and book contributions and his practical experience includes service as a Political Military Action Officer, observer representative to the UN Committee on the Peaceful Uses of Outer Space, and member of the Association of Space Explorers International Panel on Asteroid Threat Mitigation. He currently serves on the Commercial Spaceflight Safety Committee of the IAF, the Executive Committee and Board of Directors of the World Space Week Association, and the Board of Governors of the National Space Society in the United States. He is a founding Trustee of Singularity University and an emeritus director of the Utica College Foundation.

Past board service includes over ten years as a trustee of a large mutual savings bank and eight years as a director of a billion dollar retirement fund.