

May 12, 2014

# U.S.-Australian Partnership Could Help Hypersonics Take Off

&lt; ROBBIN LAIRD &gt;

The coming of the U.S. Marine Corps for a six-month rotation in the training areas of Northern Australia is a concrete manifestation of the United States and Australia deepening their working relationship in shaping 21st-century Pacific defense capabilities. The Aussies are engaged in significant defense modernization projects, such as the KC-30A Airbus tanker, the Wedgetail air battle management system and the F-35. Along with these projects, the Aussies are engaged in significant research in the field of hypersonics and have partnered with the U.S. on some of the basic research. However, going forward the United States should consider extending the excellent working relationship with Australia in this area.

Too often there tends to be an attitude in Washington of fiscal limits overcoming modernization. Yet when one looks at the Pacific, key allies are investing in defense modernization and in significant innovations as well. The opportunity is to shape convergent modernization to the benefit of the United States and its allies to deal with the challenges from China and North Korea. It is not us versus the Chinese; it is the allied engagement shaping deterrence in depth against a China with no strategic allies, other than Russia and North Korea.

Recent Chinese tests on hypersonics have underscored that several countries are working to be able to build operational hypersonics platforms, for a variety of purposes. You wouldn't want to be second to the table with a hypersonic strike missile.

Partnering with a solid ally like Australia can help ensure that does not happen to the United States. But this requires significant commitment to steady investment in the

hypersonics research area.

Australia has a small but cutting-edge team of hypersonic researchers, with the test ranges to play out the evolving technologies, and with significant global working relationships. Research in this field can clearly yield possible capabilities for space access as well, with an ability to launch rapidly intelligence, surveillance and reconnaissance and command-and-control capabilities for Australia and as part of the effort to overcome the tyranny of distance to deal with longer-range threats and challenges. In fact, hypersonic "air-breathing" engines may be the only solution for dramatic reductions in the cost

enterprise," he said. "We are not organized around a model of deep-pocket experts who stay within the confines of their specialty; we interact across the enterprise to push the research effort forward."

Dr. Paull emphasized that the hypersonic effort required progress in several technologies at the same time, materials, propulsion, computation, etc.

Visiting the workroom of the DSTO where two hypersonic vehicles are being assembled certainly reinforced the point that several moving parts are being worked toward the next hypersonic test.

The main takeaway from the discussion

flight with air-breathing propulsion, and to complete a horizontal flight of a scramjet-powered vehicle for a duration of 30 seconds.

An interesting aspect of the Aussie effort has been to build an engine that can reach hypersonic speeds but fits into the center of a vehicle, thus allowing for an axisymmetric configuration. The team is working on a number of innovations to achieve this result.

Such an engine, if proven, would be a major step forward in making practical use of scramjet technology. If this capability works effectively and can be replicated from a manufacturing point of view, then the path toward achieving hypersonic missiles seems open. HiFire is testing high angle of attack flight profiles as well, which adds a potential of maneuverability to speed.

Much has been achieved by Australia already, working in concert with its partners in hypersonic research in a period of less than a decade. But the importance of this effort, and the need to be on the cutting edge, is clear.

The basic hypersonics research effort is being worked for a baseline space system as well. This program, called Scramspace, is the first and largest project funded by the Australian Space Research Program. The program is working on a Mach 8 flight experiment that entails both ground and air tests, with the ground tests on the vehicles working at up to Mach 14 and the flight test focused on a free-flying scramjet at Mach 8.

The first free flight test for Scramspace was conducted in Norway but did not achieve the desired results. The first-stage rocket motor malfunctioned, which led to the test not being able to deliver the requisite hypersonic

**The main takeaway from the discussion with Dr. Paull was rather straightforward: "By 2015 we will have finished our current round of tests, and by that time there is little question but that the basic scramjet technology works and can be leveraged moving forward."**

of launching payloads to orbit.

During a recent visit to Australia, I had a chance to visit several defense installations, including a hypersonics research area. I visited with Dr. Allan Paull and members of the Defence Science and Technology Organization (DSTO) hypersonic team located close to Brisbane. Dr. Paull made it clear that the team was small but effective. "We combine the skills of several disciplines but each member of the team takes ownership of the entire effort and provides inputs to each and every aspect of the

with Dr. Paull was rather straightforward: "By 2015 we will have finished our current round of tests, and by that time there is little question but that the basic scramjet technology works and can be leveraged moving forward."

A key hypersonics program is the Hypersonic International Flight Research Experimentation, or HiFire. Australia has worked with the U.S. Air Force in building out a full set of HiFire test vehicles. The objectives of the program are twofold: to develop the science and technology for hypersonic

SEE LAIRD PAGE 21

## Commercial Crew Needs Competition

&lt; PAUL WERBOS and DALE SKRAN &gt;

The *SpaceNews* editorial "A Feckless Blame Game on ISS Crew Access" [April 14, page 18] defends NASA's Commercial Crew Program against disingenuous attacks by its congressional opponents. We support many of the points made in the editorial, especially the assertion that the failure of Congress to fully fund Commercial Crew as requested by the White House is the major reason for delays in the date Americans can start flying on American rockets to the international space station. However, we take issue with the suggestion that a down-select to a single Commercial Crew provider is desirable.

We strongly recommend that the following considerations guide the Commercial Crew Program:

- A minimum of two complete, technologically independent commercial crew systems should be brought to operational status. Commercial Crew can only be fully successful with real competition between multiple U.S.-based service providers.

- The value of Commercial Crew lies not just in providing the means of transporting astronauts to the ISS without relying on Russian spacecraft, but also in significantly strengthening the U.S. commercial orbital access industry.

There has long been a strain of criticism in Congress that calls for an immediate down-select in Commercial Crew to a single contractor in the name of saving money and moving forward more rapidly. Traditionally, NASA has run "competitive" procurement processes in which a number of proposals are considered, and then one is chosen to be developed into a flight article. This approach, although a reasonable one for experimental or some operational vehicles, is not the best approach for building a new industry.

The traditional NASA approach has the effect of the system or service ultimately being supplied by a single "monopoly" vehicle from a single vendor, and provides no competition that would work to lower costs over time. Commercial Crew, like the Commercial Resupply Services program, is intended to create a situation in which NASA has multiple, independent methods of transportation to and from the ISS. Two fully independent U.S.-based providers combined with occasional use of the Russian Soyuz would be the minimum system to put real competitive pressures on all vendors.

A highly desirable characteristic of a fully successful Commercial Crew Program is the operational availability of two technologically and financially independent solutions. For

example, selecting the Sierra Nevada Dream Chaser/Atlas 5 and the Boeing CST-100/Atlas 5 introduces a single point of failure, the Atlas 5. It would be equally risky to select as the two solutions the Dream Chaser/Falcon 9 and the SpaceX Dragon/Falcon 9 for the same reason.

In the approved 2014 budget, language exists holding back \$171 million of the allocated Commercial Crew funding until the NASA administrator certifies an independent cost-benefit analysis of the program. It should be noted that this level of scrutiny — an independent cost-benefit analysis — is not being applied to other NASA programs such as the Space Launch System rocket and Orion capsule.

It is possible to alter the outcome of a cost-benefit analysis via careful selection of underlying assumptions. In the case of a cost-benefit analysis of Commercial Crew, key areas to consider are the operational lifetime of the ISS, the probability that the ISS will be followed by a similar base in low Earth orbit, and the crew size of the ISS.

The Obama administration is proposing an ISS extension for an additional four years, meaning that the anticipated Commercial Crew operations would be extended to 2024. It is very likely, and indeed highly desirable, that the life of the ISS will be extended well

beyond this date. NASA has certified that an extension to 2028, an additional four years beyond that just proposed, is possible without major efforts.

The Chinese have announced that their large China Space Station will become operational in the 2020-2024 time frame, and they are currently seeking international partners. It is difficult to imagine that the United States will at just that moment deorbit the ISS, abandoning space research in low Earth orbit to the Chinese.

Thus all analysis of Commercial Crew value should be based on the realistic assumption that: the ISS lifetime is significantly extended beyond 2020; the ISS is replaced with a follow-on U.S./international/commercial station; and/or Commercial Crew vehicles will continue to be used to transport crew to low Earth orbit in support of other future NASA projects, such as assembly of a Mars ship from multiple launches. In all of these scenarios, low-cost, specialized and reliable transport of crew to low Earth orbit will be of continuing value to NASA.

The current size of the ISS crew is limited to six, since only two Soyuz "lifeboats" can dock to the ISS at the same time, and

SEE WERBOS PAGE 21

May 12, 2014

## LAIRD FROM PAGE 19

flight data.

The Aussies are building a number of hypersonic vehicles and doing ground tests on these vehicles and preparing for future flight tests as well. Tests for the HiFire program are performed on the extraordinary Woomera Test Range in South Australia. This is a very large area where the vehicles can be recovered and then fully examined to determine their performance parameters. It is not a well-instrumented range, but with proper funding could be.

The U.S. hypersonics program needs a practical focus, as well as a funding and priority boost. Partnering with Australia could boost the effort by providing for a best value partner, an effective test range, innovative thinking and capabilities from that partner, and an ability to provide that partner with capabilities that it may lack or would find prohibitively expensive to provide.

For example, if one wished to do a test replicating what the Chinese just did, it would cost three to five times more in the United States than in Australia. By building a solid working relationship and

joint development, access to the Australian range would make sense for both sides, and a more cost effective and capable result could be achieved in a more timely manner.

After my visit I had a chance to discuss my findings with Dr. Mark Lewis, former chief scientist of the U.S. Air Force and a leading researcher in hypersonics. He underscored the importance of boosting the partnership going forward for a number of reasons.

"This is an important relationship because the Australians bring significant intellectual contributions to the table," he said. "They also have important practical flight experience; we can even argue that they flew the very first flying scramjet under their HyShot program, which was a precursor to HiFire. They have an extraordinary test range."

Much like the global F-35 would not exist without allies and partners, the effort to work with core partners on other 21st century capabilities is crucial as well. There is none more so than a steadily and fully funded Australian-U.S. partnership in hypersonics.

*Robbin Laird is co-founder of Second Line of Defense and an analyst of defense, space and security issues, based in Paris and Washington.*

## WERBOS FROM PAGE 19

each Soyuz can carry only three astronauts. The introduction of Commercial Crew vehicles that can carry up to seven astronauts allows for expansion of the ISS capabilities to support a crew of up to 14.

Even the use of a single Commercial Crew vehicle would allow for an expansion from six to seven, something that would significantly increase the scientific return from the ISS. The ISS can accommodate one additional long-term crew member with minimal effort.

The ISS also can accommodate multiweek "surges" of additional crew members, as was demonstrated during the shuttle program. Thus, Commercial Crew vehicles could expand the output of the ISS by periodically allowing teams of, for example, five scientists accompanied by two crew members, to live on the ISS for weeks at a time. It is expected that expansion to a permanent crew of 14 might require additional facilities to be added to the ISS. Finally, it should be noted that the number of astronauts on the Commercial Crew vehicles significantly affects the cost per seat. Arbitrary limits of, for example, four astronauts per vehicle artificially increase the cost per seat by a large factor.

The Commercial Crew Program offers the potential to build the foundation for a true private crewed orbital access industry. In the past, the U.S. government has supported the development of new industries in various ways, ranging from federal airmail contracts supporting early aviation to current nanotechnology research centers. The crewed orbital access industry involves not just space tourism but also satellite repair and refueling, industrial research and private commercial space stations. Commercial Crew is a key enabler

of this new industry, and can significantly contribute to strengthening the larger U.S. space access industry, which has vast potential for the creation of large numbers of well-paying American jobs.

Strong industries must have competition. A major advantage of the nature of the Commercial Crew Program is that the competitive environment keeps costs low and forces each competitor to seek other markets for its solution. But the development of alternative markets is also related to the timely success of the Commercial Crew Program. Companies such as Bigelow Aerospace have flown multiple orbital test vehicles to demonstrate some of the technologies that they are planning to deploy to create inflatable private space stations. At one point, delays in the readiness of Commercial Crew vehicles led Bigelow to lay off a substantial portion of its workforce to conserve capital. Although Bigelow has since won a contract to attach an inflatable module to the ISS, its commercial space station plans remain in a holding pattern until the Commercial Crew Program moves to operational status.

We strongly endorse the \$848 million 2015 NASA budget request for Commercial Crew, along with the \$250 million supplemental request. At a time when the availability of the Russian-supplied Soyuz is being increasingly questioned, we need to move Commercial Crew to the top of NASA's priority list.

*Dr. Paul Werbos is executive vice president and chairman of the National Space Society's Policy Committee, and Dale Skran is deputy chairman of the committee. A longer version of this article is at [http://www.nss.org/legislative/positions/NSS\\_Position\\_Paper\\_Commercial\\_Crew\\_2014.pdf](http://www.nss.org/legislative/positions/NSS_Position_Paper_Commercial_Crew_2014.pdf).*

## SPACENEWS

www.spaceneews.com

## PRESIDENT &amp; PUBLISHER

William A. Klanke  
Tel: +1-571-385-0234

Email: bklanke@spaceneews.com

## BUSINESS MANAGER

John H. Dawson  
Tel: +1-571-385-1509

Email: jdawson@spaceneews.com

## REPRESENTATIVES

## NORTH AMERICA

## ASSOCIATE PUBLISHER, STRATEGIC PRODUCTS &amp; MANAGER, ADVERTISING SALES

Candace "Candy" Maness  
Cell: +1-318-550-1727

Email: cmaness@spaceneews.com

## DISTRICT MANAGER

Tiina Neifert  
Tel: +1-517-788-6913  
Cell: +1-571-723-3259

Email: tkneifert.spaceneews@comcast.net

## OUTSIDE NORTH AMERICA

CHINA, GERMANY, INDONESIA, ISRAEL, KOREA, MALAYSIA, RUSSIA, TAIWAN, SINGAPORE, AUSTRIA, DENMARK, FINLAND, INDIA, NETHERLANDS, BELGIUM, LUXEMBURG, NORWAY, SOUTH AFRICA, SWEDEN, SWITZERLAND, UNITED KINGDOM

Tony Kingham  
KNM PR and Publishing  
4a High Street,  
Edenbridge,  
Kent, TN8 5AG, UK  
Tel: +44 (0) 20 8144 5934  
E-mail: tony.kingham@worldsecurity-index.com

## FRANCE, ITALY, SPAIN

Defense & Communication  
Fabio Lancellotti  
Emmanuel Archambeaud  
Melanie Villard  
48 Boulevard Jean-Jaures,  
92110 Clichy, France  
Tel: +(331) 47307180  
Fax: +(331) 47300189  
E-mail: earchambeaud@defcommunication.com

## JAPAN

Kazuhiko Tanaka  
Shinono International, Inc.  
Akasaka Kyowa Building 2F  
1-6-14, Akasaka, Minato-ku  
Tokyo 107-0052 Japan  
Tel: 81 03 (3584) 6420  
Fax: 81 03 (3505) 5628  
Email: kazuji@bunkoh.com

## SUBSCRIBER SERVICE

Tel: Toll free in U.S.  
+1-866-429-2199  
Fax: 1-845-267-3478  
Outside North America  
01-845-267-3023  
Fax: 01-845-267-3478  
Email: spaceneews@  
cambeywest.com

## AUDIENCE DEVELOPMENT

Mark Rosen  
Tel: +1-203-822-7789  
Email: mrosen@  
circulationspecialists.com

## SEND ADVERTISING MATERIAL TO:

Christine Frazee  
Marketing Manager  
Tel: +1-571-356-9618  
Email: cfrazee@spaceneews.com

## SpaceNews

1414 Prince Street, Suite 300  
Alexandria, Va. 22314 USA

## On The Horizon

ADVERTISEMENTS

## MAY

May 14-19  
International Space Development  
Conference (ISDC)  
Los Angeles, CA  
<http://isdc.nss.org/2014>

## May 15

Abstracts Deadline extended to May 15  
The Ka and Broadband Communications,  
Navigation and Earth Observation  
Conference  
[www.kaconf.org](http://www.kaconf.org)

## May 18-19

Space Generation Fusion Forum  
The Broadmoor Hotel  
Colorado Springs, Colorado, USA  
<http://spacegenerationfusionforum.org/>

A space event geared towards university students and young professionals across government, industry, and academia. Intense and interactive panel discussions moderated by international space sector leaders.

## May 19

Cyber 1.4  
Colorado Springs, CO  
[www.spacesymposium.org](http://www.spacesymposium.org)

## May 19-22

30th Space Symposium  
Colorado Springs, CO  
[www.spacesymposium.org](http://www.spacesymposium.org)

## May 20-21

SATCOM Africa 2014  
Johannesburg, South Africa  
[www.terrapinn.com/exhibition/satcom-africa/](http://www.terrapinn.com/exhibition/satcom-africa/)

## May 20-25

ILA Berlin Air Show  
Berlin, Germany  
[www.ila-berlin.com](http://www.ila-berlin.com)

## May 26-30

The 4S Symposium, Small Satellites  
Systems and Services  
Majorca, Spain

## JUNE

June 4-5  
LATSAT – Latin America Satellite Communication and Broadcasting Summit  
Mexico City, Mexico  
[www.latsat-congreso.com](http://www.latsat-congreso.com)

Join 100+ executive-level participants representing the entire Latin American satellite communications value chain for two days of intense debates, top-level social events, networking and business deal making. The summit is organized by Euroconsult with the support of the Secretaría de Comunicaciones y Transportes, Mexico and leading industry actors.

## June 16

CASBAA Satellite Industry Forum  
Shangri-La, Singapore  
[www.casbaa.com](http://www.casbaa.com)

## June 17-19

AAS ISS Research and Development  
Conference  
Chicago, IL  
[www.astronautical.org](http://www.astronautical.org)

## JULY

## July 14-20

Farnborough International Air Show  
Farnborough, UK  
[www.farnborough.com](http://www.farnborough.com)

## July 28-30

AIAA/ASME/SAE/ASEE Propulsion & Energy Forum & Expo  
Cleveland, OH  
[www.aiaa.org](http://www.aiaa.org)

## AUGUST

## August 2-7

AIAA/USU Small Satellite Conference  
Logan, UT  
[www.smallsat.org](http://www.smallsat.org)

## August 4-7

AIAA Space Conference & Expo  
San Diego, CA  
[www.aiaa.org/space2014/](http://www.aiaa.org/space2014/)

## On the Horizon

The Space Community's Bulletin Board

Let the Space Industry know about your

- Conferences • Symposiums • Training Courses
- Trade Shows • Professional Development Courses •
- Employment Opportunities • Consulting Services

For more information contact:

Christine Frazee

Tel: 571-356-9618 • Email: cfrazee@spaceneews.com