IAC 2017 Press Articles

Online


Le Gall reflects on successful International Astronautical Congress

by JMF Velvet -- October 27, 2017

Jean-Yves Le Gall, president of the International Astronautical Federation (IAF), speaking at the 68th International Astronautical Congress in Adelaide, Australia, in September. Credit: IAF

When the International Astronautical Federation (IAF) selected Adelaide, Australia, as the site of its 68th International Astronautical Congress (IAC), many feared the worst. They worried the location would depress attendance, particularly for the many attendees from Europe and North America who would need to spend the better part of a day to get there.

Those fears turned out to be unfounded. The IAC wrapped up a month ago with more than 4,500 attendees, a figure that the IAF’s president, Jean-Yves Le Gall, called “very outstanding.” The week-long event started with the announcement that Australia would, in 2022, launch a national space agency, and ended with a keynote by SpaceX founder Elon Musk giving an update about his Mars mission architecture.


https://room.eu.com/events/view/14-iac
Ahead of Elon Musk’s new Mars-voyage update, watch the insanely cool SpaceX simulation video


SpaceX CEO Elon Musk revealed that he “will be announcing something really special at today’s talk” and you can watch the live stream on YouTube. Musk is speaking at the 67th International Astronautical Congress (IAC) in Adelaide, Australia, where he’s going to explain more about his plans to make humanity multi-planetary by colonizing Mars. He recently highlighted an old SpaceX simulation of how rockets in an Instagram post, and has been posting glamorous shots of spacecrafts 4K over social media. The talk kicks off local time Friday at 2:30 PM, or 12:30 PM PT.

Update: Musk just posted this image to Instagram, showing a “Moon Base Alpha” concept, then followed it up with an image of “Mars City.” Notably, it’s appearing a day after Russia and US space agencies announced plans to team up on an effort, and of course, earlier this year SpaceX said it would send two people on a trip around the moon in late 2018. Surely we’ll find out more about more about this plan in just a few hours.

Insight - 68th International Astronautical Congress

Wednesday, October 4, 2017

by Victoria Ramson, Washington Office Director

On Sept. 25-29, 2017, the 68th International Astronautical Congress (IAC) was held in Adelaide, Australia. This event, with 4,500 delegates marked the annual gathering of the world’s space experts. The “Space 2017” conference (SWF) used this opportunity to get very involved in the discussions being held by hosting a session on panel presentations, supporting young professionals, and participating in planning committees.

A plenary session for the next generation of space leaders discussed “Innovative Methods for Assured and Secure Access to Space Resources.” Presented by SWF Executive Director Victoria Ramson, this session examined industry, academic, agency, national, and international efforts being taken to address the broad spectrum of human-made and environmental challenges which could interfere with assured and secure access to space assets. It also explored the need to properly manage the space environment and ensure that it is safe to all to operate in and use for the long term.

SWF Space Law Advisor Christopher Johnson was a panelist during the Global Networking Forum’s session on “Space Mining – Law, Politics, Perspectives.” This session examined the legal and policy challenges arising from plans to use the resources of extraterrestrial bodies. The issue of “whom” has many stakeholders, including the Hague Space Resources Governance Working Group, but Johnson spoke about “the Outer Space Treaty’s goal of coexistence, predictability, and not allowing the free and unregulated use of outer space.”

SWF staff presented a variety of papers in various technical sessions. Washington Office Director Victoria Ramson and Director of Program Planning Brian Wedden co-authored a paper with SWF advisory committee member Raymow Pihl on “Stability, sustainability, and disasters.” The paper explores the role of satellite dynamics in ensuring the long-term sustainability of space. Dr. Johnson and Dr. Simpson co-authored “Law and Science in International Space Law: A Hypothetical Advisory Opinion from the International Court of Justice.” SWF Project Manager Jan Christensen presented a paper on “Norms of Behavior for Small Satellite Operations – Basic Principles,” which was co-authored with Dr. Wedden. Staff Project Manager Akiyuki Nakatsuka presented a paper on “Distributing Benefits as a Pathway to the Valdostan Accepted Development of Extra-terrestrial Resources,” which was co-authored with Dr. Simpson and Jan Christensen.

In Brief

Earlier this week, Elon Musk teased news of “major improvements” and “unexpected applications” set to be delivered during his presentation at the International Astronautical Congress. Here’s how to stream his address as it happens.

Tonight, Elon Musk will take to the stage at the International Astronautical Congress in Adelaide, Australia to address attendees. Once he does, people around the world will be able to see what he has to say via the livestream below.

Making Life Multiplanetary


Elon Musk unveils lofty vision at International Astronautical Congress in Adelaide to pay his way to Mars

Tony Shepherd and Jamie Seidel, News Corp Australia Network
September 29, 2017 10:56am

- Bill Nye: Why we have a need to explore space
- The moon has become even more important
- Musk to detail plans to colonise Mars in Adelaide

A PLAN to have a Mars City of a million people has been outlined in Adelaide by billionaire entrepreneur Elon Musk as he also revealed his plans for a base on the moon.

He plans to use a rocket bigger than an A380 plane to send 100 people at a time — with two or three people per cabin — to Mars. Ultimately he hopes to create a sustainable population of about a million.

Australia Rockets to Success with IAC 2017

October 17, 2017

Australia rocketed firmly into the space industry with the hosting of the 38th International Astronautical Congress (IAC) in Adelaide in September 2017 - the largest conference to be held in Adelaide to date and the first to be held at the newly expanded Adelaide Convention Centre.

The Paris-based International Astronautical Federation (IAF) is the world’s leading space advocacy body whose members include all major space agencies, companies, organisations and individuals across 90 countries.

The annual conference of the world’s space family is the largest gathering of the space industry in the world, each year the IAC changes country, theme and local organiser. The Adelaide Convention Bureau, in conjunction with the Space Industry Association of Australia, nominated Adelaide for its unique skills and infrastructure, which made the successful bid.


9 years ago SpaceX nearly failed itself out of existence: ‘It is a pretty emotional day,’ says Elon Musk

Dubai wins bid to host the 2020 International Astronautical Congress

An estimated 10,000 scholars are expected to attend the largest annual gathering of space professionals in 2020.

Dubai has won the bid to host the 2020 International Astronautical Congress (IAC), which will take place days after the UAE Mars Mission launches its rocket "Hera" to Mars.

International Astronautical Congress expands space frontiers in South Australia

SPACE INDUSTRY

When a convention begins with record numbers of delegates washing down 7,380 fresh Smoky Bay oysters with 2,248 bottles of fine South Australian wine and ends with Elon Musk outlining his Mars plans, the days in-between have much to live up to.

The International Astronautical Congress (IAC) at the Adelaide Convention Centre last week delivered on all counts, both to the 4,470 visiting delegates and to South Australia.

Australia Gets Serious About Space

Brett Biddington
68th International Astronautical Congress CEO and past Chair, Space Industry Association of Australia

The Australian government announced that it would create a national space agency at the 68th annual International Astronautical Congress in Adelaide. We'll talk with IAC 2017 CEO Brett Biddington about what this means for his country. Last week's IAC was also where Elon Musk provided more details about his ambitious plan to put hundreds of humans on Mars by the mid-2020s. Digital Editor Jason Dorfman has the scoop. A really easy space thinks contest question could win you space art and much more as you hear What's Up in the night sky.


Elon Musk wants to take you anywhere in the world in less than an hour

Imagine taking off from Los Angeles, and arriving at London in an hour and a half. On spending $8 billion on more than 800 of the Modern Skyscrapers spaceline from Tokyo to New York City. Here's how that'd work if it were actually happening from England to India.

Airbus held New Space and innovation competition at the International Astronautical Congress (IAC) 2017 in Adelaide, Australia

Winning Australian start-up to visit Toulouse to meet European space experts

AEDALE, Australia, 02-Oct-2017 — Europawire — Airbus and other industry players yesterday held a New Space and Innovation competition at the International Astronautical Congress (IAC) 2017 in Adelaide. The initiative demonstrates the commitment of Airbus and its partners to support the development of Australia’s space sector.

http://spacenews.com/united-arab-emirates-to-establish-human-spaceflight-program/
IAG SPACE CONFERENCE

Adelaide hosted a meeting of the world's top minds in the field of space - the International Astronautical Congress. During the week, some big announcements were made. We sent Rookie Reporter Ness along to give you a taste of the action.

http://www.abc.net.au/btn/story/s4748481.htm

NYSF 2016 ALUMNUS ... DINGLEY! REPORTS FROM THE INTERNATIONAL ASTRONAUTICAL CONGRESS (IAC)

The best thing I've seen Australia do since I attended the National Youth Science Forum (NYSF)

AELAIDE, Australia—Russia does not plan to launch its new science lab to the International Space Station (ISS) until late 2018, likely prolonging the country’s scaled-down staffing of the orbital base, which frees an extra seat aboard Soyuz capsules for NASA or U.S. partners ahead of upcoming commercial space ...

http://aviationweek.com/space/russian-iss-module-launch-delayed-until-late-2018

China is open to expansion of its planned space station in cooperation with foreign partners, says a senior official involved in the program. Discussions on use of the station by other countries are underway, says the official, Wei Chuanfeng of spacecraft builder CAST. Speaking at the International Astronautical Congress here, Wei did not say the negotiations specifically covered the possibility of enlarging the station; the idea has obviously not progressed as far as a definite plan. But ...

http://aviationweek.com/space/china-willing-consider-foreign-modules-space-station
Mohammed al-Ahbab, director general of the three-year-old United Arab Emirates (UAE) Space Agency, had some advice for Australia after this year’s International Astronautical Congress (IAC) host announced it would establish a national space agency. “It is important to focus on the future rather than going back to classic-era space programs,” he said. “And have a niche... because competition is very hard in space.” The UAE practices what it preaches. With ...

http://aviationweek.com/space/united-arab-emirates-sets-sights-mars

http://spacenews.com/australia-to-establish-national-space-agency/
SpaceX has published Elon Musk’s presentation about colonizing Mars — here's the full transcript and slides

In late September, billionaire and SpaceX founder Elon Musk debuted a fresh plan for colonizing Mars with 1 million people.

The focus of Musk's new presentation, which updates a 2016 talk he gave at the International Astronautical Congress, was the "Big F---ing Rocket," or BFR.

Musk told a crowd at the 2017 IAC meeting in Adelaide, Australia, that he hopes to start building the 35-story space vehicle in early 2018, launch the first BFR to Mars in 2022, and use it to land


GhanaSat-1 Chef de projet honoré

M. Ben Bonsu (à gauche) reçoit un certificat de Mme Lyn D. Wigbels, agrégée supérieure et professeure adjointe au Centre de recherche sur les politiques aérospatiales de l'Université George Mason. Avec eux, Christophe Bonnal, expert senior de l'Agence spatiale française

La Fédération Internationale d’Astronautique (FIA) a décerné le Prix de la Meilleure Présentation Interactive 2017 à M. Benjamin Bonsu, le leader du projet GhanaSat-1 qui a lancé le premier satellite du Ghana dans l'espace le 7 juillet 2017.

Le prix a été décerné en reconnaissance de sa présentation sur GhanaSat-1 et des activités spatiales en cours au Ghana lors du 68e Congrès international d’astronautique qui s’est tenu à Adélaïde, en Australie, en septembre 2017.

https://blog.anusstl.com/ghanasat-1-project-leader-honored/
Two more cargo missions would follow in 2024 to provide more construction materials, along with two crewed flights. The window for launching to Mars occurs every two years.

For the approximately six-month, one-way trips to Mars, the SpaceX ships would have 40 cabins, ideally with two to three people per cabin for a grand total of about 100 passengers. Musk foresees this Mars city growing, and over time “making it really a nice place to be.”


ESPI AT IAC 2017 IN ADELAIDE, AUSTRALIA

06 October 2017. During the 2017 International Astronautical Congress, held in Adelaide from 25 to 29 September 2017, Dr. Serge Plattard, chair of the IAF Committee on Space Security, and former ESPI Resident Fellow Alessandra Vernile participated in various technical sessions where the outcomes of ESPI studies were presented. This year ESPI significantly contributed to IAC with a number of papers in various areas:


2. “Space and SATCOM for 5G European Transport and Connected Mobility” co-authored by Dr. Stefano Ferretti, Jean-Jacques Tortora and Hermann Ludwig Moeller and Nagatil Valissiere, European Space Agency.

3. “Space education for diplomatic circles” co-authored by Dr. Annette Froehlich and Patricia KHWAMBALA, Cape Peninsula University of Technology, South Africa.

4. “International cooperation on the margin of UNCOPUOS: GRULAC-European space activities” co-authored by Dr. Annette Froehlich and Ms. Ridith Maharaj, University of Cape Town, South Africa.

5. “The rise of the private actor” authored by Alessandra Vernile.


7. “Exploring Governance Frameworks for an Earthquake Early-Warning Future Space-Based System”, co-authored by Dr. Stefano Ferretti, Matteo Tognoli and Alessandra Vernile.

https://www.espi.or.at/News-Archive/espi-at-iac-2017-in-adelaide-australia
Ausztrál ürügenökség alakul

2017.09.27. 12:15

A komoly és időigényes munka, amely a kapcsolatot a Nemet és Ausztrál űrpolitikák között lehetőségére, és az Ausztrál űrpolitiikai konferencián, a 60. Nemzetközi Űrpolitikai Konferenciára (AIA) 2017. szeptember 25-én tartott sorukon türelmesen, hogy az Ausztrál űrpolitika szerződése és kapcsolata az Ausztrál űrpolitikai országokkal, az Ausztrál űrpolitika és az Ausztrál űrpolitika országokkal állomásai.”

http://www.urvilag.hu/urpolitika/20170927_ausztral_urugynokseg_alakul

Musk komolyan gondolja

2017.10.02. 08:15

A Space X alapítója elismeri, hogy a világban létezik valóban a lehetőség, hogy a Marsra tudjunk bejutni. A szóban forgó projektet már közeledik a napjainkba, és a Musk azt mondja, hogy a projektnél a legfontosabb dolog az, hogy a projekt-hitelek visszaadása a megvalósulásra hozzák hozzá. A projekt további fejlesztései ismeretlenek, de a Musk szerint a projektnek szerepe van az emberiségében és a világéban.

http://www.urvilag.hu/spacex/20171002_musk_komolyan_gondolja
Hogyan tovább, ISS?

2017.10.24. 07:15

Az Őslakos és az Ősa. Az Őslakos és az Ősa.

Alig szállított meg minden partner,
döntése az ISS 2024-ig történt fentbirtásánál, mász százba került a további folytatás kérésére. Megosztoznak a véllemények, súgós-e a döntés.

A Hemszolczi Őslakos (ISS) üzemeltetésében részt vevő szervezetek három darab az Ősolakos-
ban megfelelően bővült. Nemzetközi Őslakoskongresszus (IAC) kongresszusán szepembre 26-án tartott
jövőhelyjelentésében bemutatott, hogy megosztásukat továbbra is az ISS 2024-ig tartás az
Iriny Lightbath, a NASA felügyeleti központjában megpróbálta, hogy eredetileg a Deep Space
Gateway (DSG) „kapu a távoli világúhöz” nem előrelépést terhessé és lényegét, de úgy
állították, hogy együttesen semmi sem szükséges, hogy a tűt hordza Bécsületében mitől
döntéseket hozzák.

Lightbath szátrával a tudományosra hivatkozott, amelyek szerint a működési lehetősége az ISS
2024-es ütemben tartalékos. Bejelentette, hogy az IAC idején további megoszlásokat tartanak,
viszont együttvevő nem szükséges háttérbeépítés szabálya vagy döntés menetrendet felülvévő. Utart
atra, hogy az Európai Őslakos (ESA) összességében tekintenek tekintetük és 2025-ig tartó teljes
végrehajtását háttérbeépítés magasítása 2024-ig tartó tekintetük. Így Karmos, az Opera,
Ügyfélként, a Roskoszmosz vezetője megjegyzett, hogy 2024-ig is szükség lesz arra,
 hogy az európai Föld körüli pályán lévőhelyesek nyilvánosság úgy bestételezését,
 bár ebben nem tekintnek szükséges a jelenlegi mozdulatokért. Közvetlenek azonban is
látogathatnak. Ugyanakkor Karmosz előszavá szerint az ISS és a kapcsolatokkal, ahol megpróbált
Országszerte 2024-ig továbbra is saját moduljuk az ISS-ül, bár ellenére, hogy
tanulmányozott ennek a technikai lehetőségeit. Hangsúlyozta, hogy az ISS módját két
jelenlegi partneren két téren jár a.

http://www.urvilag.hu/az_urallomas_es_az_usa/20171024_hogyan_tovabb_iss

Kapu a távoli világú felé

2017.10.27. 07:15

Györgyes, Örszívó Szemepályás

Körülönbatnád egy a Hadit körül megnyitott Ipolyút felé, nemzetközi
együttműködésben. A NASA reményei szerint azonosítása lehet a Mars útjára.

A Roskoszmosz, az ESA és a NASA közötti együttműködést követve az Őslakos-
ban a 2017.10.27. körül megnyitott, kettő a feltételek a távoli világú felével.

A Roskoszmosz, az ESA és a NASA közötti együttműködést követve az Őslakos-
ban a 2017.10.27. körül megnyitott, kettő a feltételek a távoli világú felével.

A Deep Space Gateway a jelenlegi 2017-es tervei szerint (DSG, NASA/WMAPs)

http://www.urvilag.hu/urpolitika/20171027_kapu_a_tavoli_vilagur_fele
「日本のJAXAはとても親切」とUAEの担当者

http://business.nikkeibp.co.jp/atcl/report/16/102400174/102400004/

http://business.nikkeibp.co.jp/atcl/report/16/102400174/102500005/
日本のロケットベンチャー、国際会議に見参！
世界最大の宇宙会議IAC探訪記・その3

2017年10月30日（木）

9月24日の午後、国際宇宙会議IACのワークショップの一つとして、"Small Launchers: Concepts and Operations"（小型ロケット打ち上げ、コンセプトとオペレーション）のセッションが開催された。

イーロン登壇で大熱狂、「ええもん見たなぁ！」
世界最大の宇宙会議IAC探訪記・その4

2017年10月31日（金）

アテロードで開催されたIAC（International Astronautical Congress、国際宇宙会議）2017で、昨年秋の9月28日の夜に、酒場からすべての参加者に対して音楽が流れました。
After the ISS

NASA pursues technology demonstrations to prepare for what comes next

Irene Klotz, Adelaide, Australia

Ask NASA when it plans to end the International Space Station (ISS), and the answer comes back not as a date but as a list of technology demonstrations that need running time in low Earth orbit so engineers can build a safe and reliable crew transport to Mars.

The flight tests cover the gamut of life support, logistics, environmental monitoring and human health technologies aboard the station today—everything from how to extract water from concentrated urine brines, build small but effective resistance exercise machines, and develop fire extinguishers to replace carbon dioxide systems.

"If you try to put out a fire in the small Orion spacecraft with CO₂, you're going to asphyxiate the crew. The CO₂ level is going to be too high," Raphn Gatens, deputy director of the ISS Division at NASA headquarters, said during a presentation at the 68th International Astronautical Congress here.

The push forward in fire suppression—namely the development of nonflammable water-mist systems—also provides a glimpse into NASA's post-ISS operations in low Earth orbit (LEO), when the agency buys what services it needs from commercial companies. After delivering cargo to the station, for example, Orbital ATK's Cygnus capsules serve as host vessels for NASA experiments that test fire detection, suppression and safety gear. During future missions, Cygnus resupply vehicles also may be repurposed for microgravity science experiments away from the station. Before atmospheric reentry and incineration, the capsules would redeck at the station so the samples can be removed.

"That's a way to sneak into actions of the future without having to actually build a facility in space," says William Gerstenmaier, NASA associate administrator for Human Exploration and Operations. "The idea is to use the ISS to leverage all that, actually let companies see what they can do to generate revenue, see what markets can materialize.

"We're seeing early indications of that now," Gerstenmaier tells Aviation Week. "I don't know if it will be there by 2024...but that's some of the criteria that goes into how long we keep the ISS operational."

NASA is due to report to Congress in December on its post-ISS plans. Gerstenmaier says he would like a NASA and its partners are firming up plans for collaborative ventures beyond the International Space Station.

decision in 2018, or 2019 at the latest, about how long the ISS will fly. For now, "we're trying to stay a little bit out of the discussion of a date for when station ends, [focusing instead] to describe the transition criteria and what we need in the future."

The ISS may not end as all one piece, he adds. "We can look at deconstruction: taking some pieces off. Some things are still functional. They still have value...We're being very creative in that arena."

The U.S., Russia, European Space Agency (ESA), Japan and Canada, which jointly own and operate the station, have agreed to fund the orbiting laboratory until 2024, although some of the long-duration life-support, environmental monitoring and crew health systems being developed by NASA and the partners will need testing beyond that time frame.

Keeping the station in orbit beyond 2024 is one option. Flying on potential commercial spacecrafts another.

"There is not going to be the replacement for the ISS: There will be many
replacements for the ISS,” says David Parker, director of human spaceflight and robotic exploration at ESA.

“I am not a fan of extending the station to 2028,” adds former NASA Administrator Charles Bolden. “The private sector loves it. Those who are doing investigations on-station love free transportation to low Earth orbit. They love free room and board. That is not a viable, sustainable LEO environment. That’s a government environment,” he avers.

“We need to have multiple platforms. Some are human-tended, some are human habitats,” Bolden tells Aviation Week. “You want to be able to put modules at different places for whatever the type of research is that you want to do. They should be autonomous, be able to operate and sustain themselves for long periods of time. And that allows ISS to go away.”

NASA is testing an experimental expandable habitat developed by Las Vegas-based Bigelow Aerospace, which intends to parlay the prototype into free-flying and lunar-based stations staffed by its employees and occupied, on a timeshare and contract basis, by paying customers including government agencies, research organizations, companies and tourists.

Bigelow, Houston-based Axiom Aerospace and other companies also are eyeing an ISS docking port on the front end of Node 2 that NASA intends to make available for commercial use.

“We have one that we can provide a significant amount of power and data to,” Gerstenmaier says. “We’re thinking about how we best utilize that — what kind of competition we need, how we put that together to really leverage and expand commercial industries.”

While nurturing the nascent low-Earth-orbit industry, NASA’s primary focus is getting the equivalent of four racks’ worth of equipment up and running on-station for testing, so engineers can determine which systems to include in the planned Deep Space Gateway—a small outpost slated to be put into an elliptical lunar orbit beginning with the second flight of the Space Launch System (SLS) rocket in the 2025-26 timeframe. The first piece of the gateway to launch would be the power propulsion element. “Within one or two flights [of the SLS] it will be complete,” says station program director Samuel Schenimei.

The gateway, in turn, is intended as an assembly site and proving ground for a proposed Deep Space Transport, which NASA would like to have ready for a crewed, yearlong shakeout mission beginning in 2025. Completion of the demo run in 2020 could position NASA and partners to send astronauts into Mars orbit for the first time in 2033.

“That gateway is the stop along the way to the Moon, where we want to test things out,” acting NASA Administrator Robert Lightfoot says. He notes it is a vantage point that “gives you a lot of options, and there is a lot of opportunity for international partners to participate in that arena.” He says it has been the next logical step for a long time.
Elon's Big Gamble

Iconoclastic SpaceX CEO wants to scrap Falcon rocket line to fund his Mars dream

Irene Klotz Adelaide, Australia

SpaceX founder and CEO Elon Musk says he has fixed a fatal flaw in the interplanetary space transportation system unveiled during last year's International Astronautical Congress (IAC)—namely, how to pay for it.

The 46-year-old tech entrepreneur now plans to phase out his company's successful Falcon rockets and Dragon capsules in favor of a reusable, two-stage, multipurpose super-heavy-lift launcher that not only can take on the distance transportation," commented U.S. Transportation Secretary Elaine Chao, a member of the council.

Ultimately, Musk intends for the BFR to render its current line of rockets and spaceships obsolete. "This was really quite a profound realization that if we can build a system that cannibalizes our own products... then all the resources—which are quite enormous—used for Falcon 9, Heavy and Dragon can be applied to one system," Musk said during a 45-min. presentation at this year's satellite delivery and station resupply flights that keep SpaceX financially viable but also fly crews and cargo to the Moon and Mars. The system, called the BFR (originally an acronym for big f***ing rocket), but recently renamed to the more politically palatable "Big Falcon Rocket") also could be used for suborbital, point-to-point travel between destinations on Earth.

"Historically, the launch industry has done this," said SpaceX President Gwynne Shotwell during the Oct. 5 debut meeting of the reconstituted National Space Council, which is staffed by members of the Trump administration Cabinet and headed by Vice President Mike Pence.

"I know at first glance this may seem ridiculous," says Musk. "But it is not. The same is true of aircraft. If you bought a small, single-engine turboprop aircraft, that would be $15-2 million. To charter a [Boeing] 747 from California to Australia is half a million dollars, there and back. The single-engine turboprop cannot even get to Australia. So a fully reusable, giant aircraft like the 747 costs a third as much as an expendable tiny aircraft. In one case, you have to build an entire aircraft; in the other, you just have to refuel something.

"It is really crazy that we build these sophisticated rockets and then crash them every time we fly," he adds. "Often I'll be told, 'but you could get more payload if you made it expendable.' I said yes, you could also get more payload from an aircraft if you got rid of the landing gear and the flaps and just parachute out when you got to your destination. But that would be crazy, and you would sell zero aircraft."

Luxembourg-based SES, the first commercial satellite operator to fly on a Falcon 9, and the first customer for a SpaceX's planned super-heavy-lift, multipurpose replacement for Falcon rocket and Dragon capsule at the International Space Station.

previously flown booster, said it would assess the BFR for future launch services, as it would any rocket. "SES's position is to constantly review the various launch systems available to us," says Martin Halliwell, SES chief technology officer. "The SpaceX Falcon 9 has proven itself in both expendable and flight-proven modes. The BFR is a completely new system with completely different levels of capability, so we will have to assess the fit once again for our requirements."

With 29,135 ft³ (825 m³) of pressurized volume for cargo and a vehicle diameter of nearly 30 ft. (9 m), the BFR could be a game changer for satellite design, Musk notes. "You could send a mirror that has 10 times the surface area of the current Hubble [telescope] as a single unit—doesn't have to unfold or anything. You do whatever you like," he says.

The BFR, powered by 31 methane-fueled Raptor engines, is a scaled-down design of the 42-engine Interplanetary Transit System (ITS) Musk unveiled last year. "We were really
Simple, Robust
Japan’s LE-9 space launch engine
has passed a first series of tests

Bradley Perrett Adelaide, Australia

Japan climbed a technological mountain in developing the main propulsion system for its H-IIA space launcher series in the 1980s and '90s, producing an engine of difficult configuration that was comparable with the best that had been achieved for NASA.

Then Japan climbed down from that mountain. Launching development of an engine for the H-II successor in 2014, the Japan Aerospace Exploration Agency (JAXA) decided that the remarkable efficiency of the old launcher's first-stage propulsion technology, also used by the space shuttle, was not worth its production cost. So JAXA and prime contractor Mitsubishi Heavy Industries (MHI) are now clambering up another technological peak, developing the largest engine so far of a configuration that offers simplicity and low cost but was previously regarded as suited only to small sizes.

This engine, the LE-9, has performed successfully in a first series of hot-fire tests. JAXA and MHI reported to the International Astronautical Congress, held here on Sept. 25-29. It is intended to power the first stage of the forthcoming H3 launcher.

Two more series of tests for the hydrogen-burning LE-9 engine are planned: one for qualification and one for verifying modifications to cut costs. The LE-9 and H3 launcher, successor to the current H-IIA and H-HII, are due to fly in the fiscal year beginning in April 2020.

"The engine characteristics are mostly within predicted variations," says Akishide Kurosaki, a senior engineer of the H3 project at JAXA, reporting on the first series of tests.

The LE-9 features the expandable bleed process for pumping propellant into its combustion chamber. Engines of that type use heat from the main combustion chamber to expand a little of their hydrogen fuel and use it not for burning but to drive the propellant turbopumps. This fraction of the fuel, also a coolant, is essentially bled—dumped overboard.

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But the configuration is difficult to scale up, notably because transferring enough energy into the coolant hydrogen demands a long, almost pipe-like combustion chamber with a large surface area. To get the most out of the extracted energy that can be drawn from that surface, the turbine needs to be highly efficient. Conducted in April-July, the first series of tests was intended to assess the LE-9 in static and transient conditions, the latter covering startup, throttling and cutoff. Engineers also used the test series to initially verify a system of feedback, or closed-loop, control that should cut unit costs. Eleven firings were done at JAXA's Tanegashima facility, which also will be the launch site.

"There is no problem about combustion stability," program engineer Masaki Adachi of MHI told the International Astronautical Congress. Achieving combustion stability was the biggest concern before the tests, he says. The second-biggest was achieving a satisfactory starting sequence, according to Kurosu. There was success there as well.

The LE-9 has been tested to above 225,000 lb. thrust. Designed output is 330,920 lb. JAXA and MHI plan that four versions of the H3 will vary from two to three LE-9s in their core first stages and zero, two or four solid-propellant boosters derived from the first stage of the Epsilon space launcher.

The duration of firings of the LE-9 this year worked up to 78 sec from the initial 2.6 sec. The engine was throttled down in three of those tests, including the final one, in which feedback control was demonstrated. The tested degree of throttling was from 90% thrust to 70%. Cutoff also was stable, with no continued burning, Adachi says.

A key objective of the H3 program is to deliver launch services at half the cost achieved with the H-IIA. The cost of an H-IIA launch is undisclosed but is probably at least ¥10 billion ($88 million). The LE-9 engine should cost only a little more than half as much as the LE-7A main engine of the H-IIA and H-IIB.

The LE-7A was the previous but overly expensive technical masterpiece of JAXA and MHI, featuring the unusually difficult combination of hydrogen fuel and the staged-combustion arrangement for driving propellant pumps. The result was a vacuum specific impulse—comparing thrust with the rate of fuel consumption—of 440 sec., comparable to the 452 sec. of the similarly configured space shuttle main engine. The LE-9’s specific impulse should be 425 sec., still far higher than can be achieved with the most common space launcher fuel, kerosene.

Feedback control is intended to contribute to savings by eliminating a process of adjustment that would otherwise have to be made on each unit during acceptance trials. It will do so by automatically meeting the specification for mixture ratio at various thrust settings, Kurosu says.

The first series of tests confirmed this function only by using sensors in the test facility, rather than with the onboard sensors that production engines will use. Each production unit, and two intended for qualification testing, will incorporate not just the usual pressure sensor in the combustion chamber for determining thrust; there also will be a sensor in the propellant lines that determines whether pressure is above, below or at the value that corresponds to the correct mixture. If the level is wrong, the engine automatically adjusts.

This should eliminate the usual lengthy acceptance process of testing each engine for mixture at various thrust levels, changing orifices as a physical adjustment, and repeating the cycle, perhaps many times, until the unit meets the specification. Space launcher engines go through that process because of variations in manufacture.

The H3’s second-stage engine is the LE-5, also used on the H-IIA and H-IIB but slightly improved. It is also an expander-bled engine.

The technology is becoming something of a Japanese specialty, one that JAXA and MHI engineers see as highly suitable for reusable space launchers. Lacking the troublesome complication of upstream combustion to drive the turbopumps, an expander-bled engine is inherently robust.

So an engine of this type will be used in a testbed reusable sounding rocket that is due to fly in the fiscal year beginning April 2018, with the aim of demonstrating vertical landings and 24-hr. turnarounds. These capabilities could later be applied to the first stage of a space launcher. The testbed, RV-X, is 7 m (23 ft.) long and has a liftoff weight of 3 metric tons (6,600 lb.). Its single engine is designed to be used 100 times.

The tests will focus on fault-tolerance, vertical takeoff and landing and aerodynamic guidance and control, MHI researcher Kotaro Aoki told the conference, which was organized by the International Astronautical Federation.

An initial round of tests, including at least five flights, is intended to take the RV-X to an altitude of 100 m and show that it can fly again within 24 hr. using only simple ground facilities and make an emergency landing in case of fault. Higher altitudes will be attempted in a second series of tests. The evaluations should be completed in fiscal 2019.

A team of 10 to 20 people has been looking at conceptual design of a reusable launcher, says Akibiro Sato and Yusuke Suzuki, the heads of H3 development at MHI and JAXA, respectively.
Damage Limitation

Long March 5’s problems do not extend to other Chinese launchers

Bradley Perrett Beijing and Adelaide, Australia

Chinese space engineers have identified the fault that caused the failure of the second flight of their country’s largest space launcher, Long March 5, a problem that appears to be pushing back the mission schedule by about a year.

The cause of the failure was simply a manufacturing defect in one of the two YF-77 hydrogen-burning engines of the core first stage, says a source close to the Chinese industry. The fault was quickly pinned down, says that source, who adds there was nothing wrong with the design and the problem should be easily addressed.

Although the cause of the failure has been found, several months of verification work will be needed, says another source familiar with the program. That suggests that Long March 5, which first flew in November 2016, cannot be used again this year.

Isolating the fault to the YF-77 is particularly important because it means the failure has no implications for other Chinese space launchers; Long March 5 is the only launcher to use the YF-77. The national space program would be facing a far greater problem if one of eight YF-100 kerosene-burning engines in the rocket’s boosters had caused the launch failure, and especially if some inherent shortcoming in the design of those powerplants were to blame. Both possibilities were conceivable when the state media tersely announced on the day of the flight that the mission had not succeeded (AVIATION July 10-23, p. 20).

The YF-100 is the main engine of two other Chinese rockets that have entered service in the past two years, Long March 6 and 7, both smaller than Long March 5. The beginning of full-scale development of another, Long March 8, is imminent; it will also use the YF-100 as its main engine. Under-scoring the blamelessness of the kerosene engine, another flight for Long March 6, its second, is scheduled for this year, says a third source.

Regardless of the serviceability of other launchers, Long March 5’s unavailability is enough to cause considerable delays for the national space program, because no other rockets can undertake some of its missions. The next lunar mission, Chang’e 5, will be pushed back a year, for example. It will be flown at the end of 2018, Tian Yulong, secretary general of the China National Space Administration, said at the International Astronautical Congress, held in Adelaide, Australia, Sept. 25–29.

Chang’e 5, planned to bring a lunar sample back to Earth, was previously scheduled for the end of 2017. Because the spacecraft is larger than those that China has previously sent to the Moon, it requires a Long March 5.

Describing the Long March 5 failure as a major challenge to the space agency, Tian says the timing of the Chang’e 4 mission will also be adjusted. The reason is not clear. The spacecraft for that mission, smaller than Chang’e 5’s and developed from the one used for the Chang’e 3 mission of 2013, will presumably be carried by a Long March 2F to the Moon. Long March 2F is a long-established launcher used by previous Chinese lunar probes, quite unrelated to the technology in Long March 5 and therefore never under suspicion following the July launch failure.
Launching Martian Hope

Nascent United Arab Emirates space program aims to launch orbiter to red planet in 2020

Irene Klotz, Adelaide, Australia, and Cape Canaveral

Mohammed al-Ahbabi, director general of the three-year-old United Arab Emirates (UAE) Space Agency, had some advice for Australia after this year's International Astronautical Congress (IAC) host announced it would establish a national space agency.

"It is important to focus on the future rather than going back to classics space programs," he said. "And conference, is to have a sustainable presence. "We are not looking at launching an astronaut for a week or launching a tourist flight," he said. "We are looking at a program that is based on science."

As a first step, the UAE is building a satellite to study the Martian climate and atmosphere. The orbiter, known as Hope, is scheduled to launch in the summer of 2020 aboard a Mitsubishi

Emirates Mars Mission Hope Spacecraft

**DIMENSIONS**
- Width: 2.4 m (2.6 ft.)
- Height: 2.9 m (3.2 ft.)
- Launch mass: 1,500 kg (3,306 lb.)

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Heavy Industries II-IIA rocket and arrive at Mars in 2021.

The UAE has ample opportunities to build space partnerships. Hope is among a half-dozen or so spacecraft aiming to launch during the 30-day 2020 period when Earth and Mars are favorably aligned for interplanetary flight. NASA and the European Space Agency are both planning rovers to look for signs of past life. China plans to fly an orbiter, lander and rover to study the Martian environment, topography, atmosphere and internal structure. India intends to follow up its pioneering and ongoing Mars Orbiter Mission with a second orbiter and perhaps a lander and rover as well. Japan is looking to fly a microsatellite outfitted with a terahertz sensor to study molecules in Mars' atmosphere.

By the time Hope reaches Mars, the UAE expects its first group of astronauts to be well along with training for flight. A call for astronauts will be going out by the first quarter of 2018, and the agency anticipates selecting four to six astronauts by early 2019. The first would fly before the end of 2021, aboard other countries' rockets. By then at least two U.S. companies, SpaceX and Boeing, expect to be offering commercial low-Earth-orbit flights, along with Russia and China.

The UAE's first government-backed

have a niche... because competition is very hard in space."

The UAE practices what it preaches. With the founding of its own space agency in 2014, the country unveiled plans for a Mars orbiter, scheduled to launch in 2020. In September, it took its first step toward a 100-year goal of being part of a Mars colony by putting aspiring young pilots, engineers and scientists on notice that the agency would begin staffing an astronaut corps next year.

The goal, Salem Hamad al Marri, assistant director general of the Mohammed Bin Rashid Space Center in Dubai, said during an IAC panel discussion on Sept. 28 at the Adelaide

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