

APL/NASM Space History & Policy Forum: Update on Russia, China & India

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APL/NASM Forum on Space History & Policy

- Following on great success of inaugural forum in September, goal is to stimulate two-way discussion, not listen to a “talking head”
- Three Topics For Today
 - Are we too dependent on Russia?
 - Should we cooperate with China?
 - Could regional rivalry between India and China spur a new arms race in space?

Russia

- Had to make hard choices when the USSR collapsed
- Retained core capabilities – like launch vehicles – but recent launch failures may suggest deteriorating industrial base/workforce issues
 - Dec. 2010 Proton/Block-DM loss of 3 GLONASS sats
 - Feb. 2011 Rokot/Briz left GEO-IK-2 in transfer orbit
 - Aug. 2011 Proton/Briz left Ekpress AM-4 in transfer orbit
 - Aug. 2011 Soyuz-U loss of Progress M-12 M (Progress 44) cargo spacecraft
 - Nov. 2011 Zenit/Fregat probable loss of Phobos-Grunt
 - Roscosmos head Perminov sacked in April; replacement (Popovkin) called before State Duma in October; Medvedev threats after Phobos-Grunt
- Meanwhile, U.S.-Russian relationship has shifted from primarily competition to primarily cooperation – even dependence
 - ISS crew rotation and lifeboats
 - Rocket engines: Atlas V RD-180 and Taurus II NK-33/AJ-26

Challenges of Interdependence

- Some in U.S. object to dependence on Russia because—
 - Undermines U.S. national pride and prestige
 - U.S. taxpayers are supporting jobs overseas instead of jobs at home
 - Risky to have only one way to get to/from the ISS – single point failure, as Aug. Soyuz launch failure demonstrated – especially when Russian industry under stress
 - Risky to be tied to ever-changing geopolitical relationships
- But we put ourselves in this position long ago
 - Killed Crew Return Vehicle, killed shuttle, little money for rocket engine development
 - More INKSNA waivers may be needed
- Are we too dependent on Russia and if so, what can be done?

China

- Hot button issue politically
- Chinese space program “mystery within a maze” run by PLA
- Steady step-by-step program since first launch in 1970
 - Launch vehicles and launch sites – new Long March 5 being built for launch from new Hainan Island launch site
 - Space science (lunar, Mars)
 - Human spaceflight – Tiangong-1 and Shenzhou
 - Dual use applications (communications, navigation, remote sensing/reconnaissance etc)
 - Space weapons – hit to kill ASAT test(s), allegation of hacking into U.S. Landsat-7 and Terra satellites

U.S. and China in Space

- Some space advocates want a “race to the Moon” with China like the 1960s US/Soviet space race to shore up support for NASA
- Others want U.S. to cooperate with China, even bring them into the International Space Station program
- Some influential members of Congress, however, strongly oppose the Chinese government and cite 1990’s commercial space “cooperation” as helping Chinese missile prowess
 - Led to ITAR changes
 - Strongly oppose any space cooperation with China until change in government
 - Rep. Frank Wolf (R-VA) and OSTP
- Others argue low level cooperation with USSR gave us insight into THAT program, paved way for closer relationship today and should be model
 - Bush Admin “NASA-China space science and earth science” working groups
 - Premised on transparency, reciprocity and mutual benefit
 - Currently on hold due to Wolf language
- Should we race China, cooperate with China, or isolate them?

India

- Aspires to be space leader in developing world
 - Launching satellites since 1980; two Indian/Indian-born astronauts (Sharma, Chawla); Moon probe (Chandrayaan-failed prematurely)
- U.S.-India space relationship waxes and wanes
 - Close in early days (Thumba sounding rocket range; ATS-F/SITE)
 - Strained as India embraced USSR; cryogenic engine controversy
 - Sanctions after 1998 Indian nuclear test, gradually relaxed
 - Closer today, latest space cooperation agreement in Nov. 2010
- If there's a space race, it's between India and China
 - China also aspires to be space leader in developing world
 - India announced plans to send people to the Moon after China said that it would
 - Indian space officials desire for antisatellite (ASAT) weapon following Chinese ASAT test (also BMD, like China)

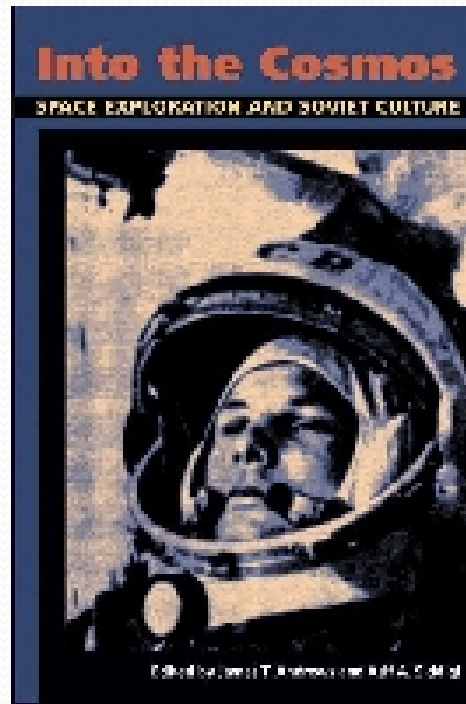
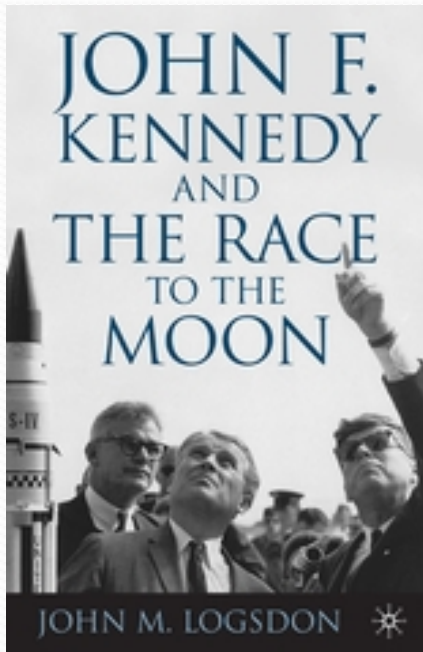
India's ASAT Aspirations

- Indian space officials have stated their interest in developing ASAT capabilities since 2007 Chinese ASAT test
 - No official policy, but government officials have made clear they want capability and could do through BMD program
- Chinese ASAT test and its 3,000 pieces of space debris led to current drive for “space sustainability” and SSA
 - Change in tone of U.S. National Space Policy
 - TCBMs, draft EU Code of Conduct, GGE at UN
- Anatoly Zak (RussianSpaceWeb.com) reports that in light of China and India's ASAT activities, Russia is considering reactivating its ASAT program
- Will India's ASAT plans spur an arms race in space, undercutting space sustainability?

Further Reading

- Lots of information available these days via the Internet, but one particularly good source is Secure World Foundation (<http://www.swfound.org>)
 - Holding seminars in-country and in Washington on India and China, plus Washington seminar on Russia
 - Particularly focused on space governance issues, esp at UN
 - Presentations and audio of seminars on its website
- Three new books out about US and Russia
 - How many times did JFK ask Khrushchev to join the US in going to the Moon?
 - Tsiolkovsky wanted to go the stars. What else did he want?
 - How did U.S./Russian space cooperation change post-USSR?

New Books of Interest



James T. Andrews and Asif A. Siddiqi, eds.

Your Turn!

- Are we too dependent on Russia?
- Should we cooperate with China?
- Could regional rivalry between India and China spur a new arms race in space?



BACKUP SLIDES

Soviet Space "Firsts"

- First satellite (Sputnik, Oct. 4, 1957)
- Human Spaceflight Firsts (examples)
 - Animal in space (Sputnik 2, Laika, Nov. 3, 1957)
 - Man in space (Vostok 1, Gagarin, Apr. 12, 1961)
 - Woman in space (Vostok 6, Tereshkova, 1963)
 - Extravehicular activity (Voskhod 2, Leonov, 1965)
 - **Space station (Salyut 1, 1971)**
 - **International crew** (Soyuz 28/Salyut 6, Remek-Czechoslovakia, **1978**)
 - Woman EVA (Soyuz T-12/Salyut 7, Savitskaya, 1984)
 - Modular space station (Mir, beginning in 1986)
 - **"Space tourist"** (Soyuz TM-11/Mir, Akiyama-Japan, **1990**)

... more ...

- Space Science and Applications Firsts (examples)
 - Return pictures from lunar farside (Luna 3, 1959)
 - Return pictures from lunar surface (Luna 9, 1966)
 - **Return lunar samples robotically** (Luna 16, 1970)
 - **Land robotic rover on Moon** (Luna 17/Lunokhod 1, 1970)
 - **Soft land on Venus** (Venera 7, 1970)
 - **Orbit Venus and images from surface** (Venera 9, 1975)
 - Soft land on Mars (Mars 3, 1971)
 - Domestic communications satellite system (Molniya, 1965)

...But Not All of Them Good

Examples:

- First death caused by spaceflight (Soyuz 1, Komarov, 1967)*
- First abort during launch phase (Soyuz 18A or “Apr. 5 Anomaly,” 1975)
- First launch abort using escape tower (Soyuz T-10A, 1983)
- First docking abort requiring ballistic return to Earth (Soyuz 33/Salyut 6, 1979)
- First collision between a spacecraft and a space station (Progress M-34 and Mir, 1997)
- First serious fire on a space station (Mir, 1997)

*The Apollo 204 fire that claimed the lives of the first Apollo crew occurred 3 months before this, but that was a ground test, not a spaceflight.

End of the Soviet Union-1991

- Soviet space program was broadly based and robust, with bold plans for the future; collapse of Soviet Union in 1991 changed its fortunes dramatically
- Russian space program had to make hard choices
 - First to go was their space shuttle (Buran) which flew only once w/o crew and almost-Saturn V-class booster (Energia) which flew only twice
 - Space science withered; remaining “flagship” – Mars ’96 – failed to leave Earth orbit
 - Major Soviet launch site, Baikonur, now in a different country, Kazakhstan
 - Quick to appreciate appeal of commercial launches and cooperation in human spaceflight

Russian Launch Vehicles/Engines

- Range of reliable launch vehicles – leveraging for commercial use
 - Proton is largest: 21 tons to LEO; 5.5 tons to geostationary transfer orbit (GTO)
- Attempts to build Saturn V-equivalent (N1) in 1960s and 1970s failed
 - Failed four times in four attempts (1969-1972)
 - NK-33 engines, however, being used for U.S. Taurus II rocket
- Energiya booster in 1980s only flew twice (1987 with Polyus and 1988 with Buran). Abandoned for financial reasons.
 - Was 100 tons to LEO; 18-20 tons to GTO; 32 tons to lunar trajectory.
 - RD-170 engines for Energiya's strap-ons live on today in other forms for Zenit, Atlas V (RD-180), and Angara (under development)

“No China” Language in P.L. 112-55

SEC. 539. (a) None of the funds made available by this Act may be used for the National Aeronautics and Space Administration (NASA) or the Office of Science and Technology Policy (OSTP) to develop, design, plan, promulgate, implement, or execute a bilateral policy, program, order, or contract of any kind to participate, collaborate, or coordinate bilaterally in any way with China or any Chinese-owned company unless such activities are specifically authorized by a law enacted after the date of enactment of this Act.

(b) The limitation in subsection (a) shall also apply to any funds used to effectuate the hosting of official Chinese visitors at facilities belonging to or utilized by NASA.

(c) The limitations described in subsections (a) and (b) shall not apply to activities which NASA or OSTP have certified pose no risk of resulting in the transfer of technology, data, or other information with national security or economic security implications to China or a Chinese-owned company.

(d) Any certification made under subsection (c) shall be submitted to the Committees on Appropriations of the House of Representatives and the Senate no later than 14 days prior to the activity in question and shall include a description of the purpose of the activity, its major participants, and its location and timing.

Examples of Statements of Indian Officials on ASAT

- Science Adviser to India's Defense Minister Saraswat:
 - “India is putting together building blocks of technology that could be used to neutralize enemy satellites.” Jan. 2010
 - But, “there is no program to do a direct hit to the satellite.” Feb. 2010
 - But, “...as part of Ballistic Missile Defense Program, we have all the technology elements [to]...defend our satellites...” Feb. 2011
 - “Space security [includes]...protection of satellites ... and denying the enemy the use of his own space systems. These technologies would be developed as part of Ballistic Missile Defense Program.” Jan. 2011
- Air Chief Marshall Naik: “Our satellites are vulnerable to ASAT weapon systems because our neighborhood possesses one.” Feb. 2010
- Former ISRO Director Kasturirangan: “China's ASAT capabilities displayed a few years ago was to show the world that they too can do it. ... Obviously we start worrying. We cannot overlook this aspect.” Sept. 2009

Quotes are taken from an article by Victoria Samson, Secure World Foundation.
[India and Space Security](#). The Space Review. May 9, 2011.

Largest Launch Vehicles

- U.S.
 - Existing: Delta IV Heavy (22.5 tons to LEO; 13 tons to GTO)
 - Planned: NASA's Space Launch System (70-130 tons to LEO)
 - Announced: SpaceX's Falcon Heavy (53 tons to LEO)
- Russia
 - Existing: Proton M (21 tons to LEO; 5.5 tons to GTO)
- China
 - Existing: Long March 3A (7.2 tons to LEO; 2.5 tons to GTO)
 - Planned: Long March 5, first launch in 2014? (25 tons to LEO)
- India
 - Existing: GSLV (5 tons to LEO; 2.5 tons to GTO)
 - Planned: GSLV Mark III (4 tons to GTO)
- By comparison
 - Europe's Ariane 5 (17 tons to LEO; 10.5 tons to GTO)
 - Japan's HII-B (16.5 tons to LEO; 8 tons to GTO)

Data on existing vehicles from FAA's [Commercial Space Transportation: 2010 Year in Review](#) and JAXA website for Japan's HII-B.

BRIC Countries

- Russia, India and China are three of the four “BRIC” countries (Brazil is the B, which also has a modest space program, but is outside the scope of this talk)
- Defined in economics as countries with emerging economies -- at similar stage of economic development -- and expected to play a growing role in the world’s economy (collectively have 42% of world’s population)
- One more reason for the U.S. to pay close attention to these countries ... and their space programs