India's Space Ambitions Soar

A lunar mission and a reusable launch vehicle are planned.

By Mark Williams Pontin

July 30, 2007

As China's star has risen, there's been speculation about whether its expanding space progra
with the United States. After all, Shenzhou spacecraft have twice carried taikonauts to orl
in principle support the manned moon mission that the Chinese claim they'll carry out by

2017, one year before NASA now foresees a return to the lunar surface. Still, the next-gen launchers necessary for a manned moon mission by China remain unfunded, and, in gene far only repeated decades-old American and Russian achievements.

Blastoff: An Indian geosynchronous satellite launch vehicle taking off.

Meanwhile, attracting far less attention and operating on a far smaller budget, that other r
also been ramping up its space program–and it is developing some novel, promising appr
then president, A.P.J. Abdul Kalam–a colorful scientist-technologist who loomed large fro
country's early satellite launch missions, and then led its guided-missile program–laid ou
ambitious vision of India's future space efforts during his speech at a Boston University s

Kalam told the international audience of space experts in Boston that, besides expanding
program, India now plans lunar missions and a reusable launch vehicle (RLV) that takes a
a scramjet "hyperplane." Kalam said that India understands that global civilization will de
the 21st century. Hence, he said, a "space industrial revolution" will be necessary to explo
resources. Kalam predicted that India will construct giant solar collectors in orbit and on
helium-3–an incredibly rare fuel on Earth, but one whose unique atomic structure makes
nuclear fusion potentially feasible–from the lunar surface. India's scramjet RLV, Kalam as
cost, fully reusable space transportation" that has previously "denied mankind the benefit
stations in geostationary and other orbits."

Talk of grand futuristic projects comes cheap, of course. Nevertheless, the Indian Space R
(ISRO) performed its first commercial launch in April, lofting an Italian gamma-ray obser
Satellite Launch Vehicle. Next, in early 2008, the Chandraayan-1, India's first lunar orbite
projects to search the moon's surface for sites suitable for the proposed U.S. Moon Base. A
first flight of the Hypersonic Technology Demonstrator Vehicle (HTDV), a demo for the s

While this current spate of activity brings the country greater prominence, India's space p
development. In 1975, ISRO launched its first satellite, *Aryabhata*, on a Soviet rocket, and
built launcher, the SLV-3, successfully put a satellite into orbit. ISRO has continued with a
and rockets in the succeeding years. Rather than national prestige, the Indian focus has u
pragmatic applications that gave the most bang for its limited rupees: communications sa
far-flung regions of a vast country with little existing communications infrastructure, met
carried on the same geosynchronous satellites that perform communications missions), a
to map India's natural resources.

Now ISRO is moving beyond that focus on immediately practical space applications. In N
Kumar, counselor for space at India's Washington, DC, embassy, told a forum on U.S.-Ind
Center for Strategic and International studies, "The time has come when you do have the

accomplished a lot." Following much discussion within India's space-science community, basically demanded that we go forward and do these exploration missions."

Setting aside the more science-fictional objectives described by President Kalam–whose in the near future, the most technologically innovative of ISRO's projects is its scramjet R launch costs via an RLV has, of course, been theunattainable holy grail for both the Unite programs. Avatar would weigh only 25 metric tons, with 60 percent of that the liquid hyd turbo-ramjet engines that would power its initial aircraft-style takeoff from an airstrip anc altitude. Thereafter, Avatar's scramjet propulsion system would cut in to accelerate it fron an onboard system would collect air from which liquid oxygen would be separated. That l used in Avatar's final flight phase, as its rocket engine burned the collected liquid oxygen to enter a 100-kilometer-high orbit. ISRO claims that Avatar's design would enable it to a reentries into the atmosphere. Theoretically, given ISRO's plans for it to carry a payload v ton, Avatar could thus deliver a 500-to-1,000-kilogram payload into orbit for about $67 pe

Current launch prices range from about $4,300 per kilogram via a Russian Proton launch kilogram via a Pegasus launch. Conceivably, Avatar could give India a radical advantage ir Gregory Benford, an astrophysicist at the University of California, Irvine, and an advisor t

House Council on Space Policy, is enthusiastic: “The Avatar RLV project will enable the I of the Chinese nostalgia trip. Once low cost to orbit comes alive, it will drive cheaper met unmanned activities in space.”

Still, Avatar’s potentially radical advantage comes with significant restraints, given both tl payloads and that very low 100-kilometer orbit. That latter factor, indeed, is something of released at such a height will find its orbit degrading quickly. Do the Indians intend to us launcher, in effect, from which they will fire their satellites further up into secure orbits? I hard not to notice that Avatar, in fact, makes more sense as a missile-launch platform. Aft also working on the scramjet concept but in the context of an unmanned global cruise mi Waverider.

Could Avatar be just another military application upon which India’s space scientists are develop a radical RLV prototype? The Indians do seem to be serious enough about Avatar that they’ve taken out patents internationally on the design. ISRO has, relatively, a very lo happen, Indians need to bring in international partners and funding. But if it turns out th another military application that India’s space scientists have used to secure funding from aspirations, they will hardly be the first ones in the history of spaceflight to do so.