

## From New Delhi by Ramtanu Maitra and Susan Maitra

### Space program achieves key success

*The perfect launch of the Polar Satellite Launch Vehicle promises to make western missile-controllers fidget.*

India got a needed break from the creeping disillusionment over the much ballyhooed economic reforms and globalization of the Indian economy, not to mention the battering the country's image took with the breakout of plague in the garbage-infested streets of Surat and elsewhere. The break came in the form of a picture-perfect launching on Oct. 15 of the Polar Satellite Launch Vehicle (PSLV), which injected the indigenously developed remote sensing satellite, IRS-P2, into polar orbit.

This second demonstration rocket, PSLV-D2, was launched from Sriharikota, the operational satellite/launch vehicle range. The precision with which the rocket performed is an example of the maturity that the Indian space program has achieved.

The launching of the PSLV was watched carefully everywhere and it will doubtless bring little joy to the self-appointed controllers of missile programs. A poignant anecdote related by *Economic Times* science writer R. Ramachandran after the launch pointed to broader aspects of the success. Dr. Satish Dhawan, former chief of the Indian Space Research Organization (ISRO) and the man who gave teeth to the Indian space program at a difficult time, told scientists witnessing the launch that "some countries are going to be unhappy with our achievement and happiness," adding, "but that in no way should prevent us from feeling that we are now a space power."

There is no question that the successful launch of the PSLV, the 44-meter-tall, four-stage launch vehicle that weighed 283 tons at liftoff and carried an 870-kilogram remote sensing

satellite, has placed India on the front line of space-related technologies. PSLV can launch satellites weighing one ton at an altitude of 1,000 km, and probably can carry a bigger payload if launched from elsewhere. It is expected to be the future workhorse and is considered a technology-model for the much bigger Geostationary Satellite Launch Vehicle (GSLV), to be launched by the year 2000. The GSLV program was delayed because of the international fracas initiated by the United States in 1991 over the agreement by Russia to provide the Indian space program with cryogenic rocket engines and related technologies, for developing GSLV rocket engines indigenously.

However, with the PSLV India has a powerful rocket equipped with liquid propulsion engines. The first and third stages of the PSLV use solid motors, the second and fourth stages use liquid engines carrying about 40 tons of liquid propellant. PSLV's huge first stage carries 129 tons of indigenously produced solid propellant hydroxyl-terminated poly-butadiene (HTPB). The use of an unsymmetrical dimethyl hydrazine/nitrogen tetroxide combination for the liquid-propelled second stage is significant.

While the PSLV rockets will pave the way for the GSLV rockets, which in turn will send satellites to the geostationary orbits and thus become commercially attractive, the concern of the chanting gurus of the Missile Technology Control Regime (MTCR) is bound to increase after the PSLV's perfect launch. The Indian Army's Agni missile, among a few others, uses the first-generation SLV-3 rockets developed

by the ISRO and is the cynosure of Washington. The United States has reportedly pressured New Delhi to abandon the plan to deploy the missiles because, as Washington says (which is likely to be different from what it believes), that would destroy the arms balance in South Asia. The Indian government, of course, denies it has been subjected to bullying.

Besides the fact that the PSLV is a much more powerful rocket than the SLV-3, and with a little effort can be converted into an intercontinental ballistic missile (ICBM)—although it is altogether a different matter whether the Indian government has any intention to do so—what may worry the West is the long firing (4,000 sec) of the liquid apogee motor in the indigenously developed INSAT-2 series of satellites. The combined potential of the PSLV solid motor and the reported long firing satellite liquid motor have some awesome potentials from a military standpoint.

The United States has already reacted in advance by imposing an embargo on the ISRO and the Russian supplier of the cryogenic engines and related technologies. What Washington has noticed is not the cryogenic engines but the precision with which ISRO scientists have mastered the PSLV technology; those nations with missile capabilities will easily recognize the fact that just the first stage of the PSLV can be reconfigured into ICBMs. India's independence in developing the HTPB fuel is an added concern for the control-wallahs.

The main challenge before ISRO scientists is to make the space program a commercial success. ISRO will have to establish India as a major space launch nation. As one scribe here points out, it will be a focus of the budget-cutters, who are influenced by western missile controllers one way or the other.