Another Indian multi-purpose satellite

by Ramtanu Maitra and Susan Maitra

On July 23, only seven days after the Russians cancelled the January 1991 contract to supply India with cryogenic rocket engine technologies, Ariane-4 took off from Kourou, French Guiana, carrying the Indian satellite Insat-2B and a Spanish satellite into a geostationary orbit. Last year, the Ariane rocket had put India's Insat-2A into the geostationary transfer orbit, from where the Master Control facility of the Indian Space Research Organization (ISRO), based in Hassan, Karnataka, put it into the designed slot in the geostationary orbit (GSO). The Insat-2B had also been lodged in the GSO by the Indian space scientists.

The Indian multi-purpose satellite Insat-2 series consists of two-ton class satellites. In the coming years, India will be putting Insat-2C, Insat-2D, and Insat-2E into orbit, before moving onto the Insat-3 series, consisting of three-ton class satellites. The Insat-2B, another fully indigenously built satellite, has proven India's mastery over the development of satellites.

The Insat-2 satellite series consists of 18 transponders, providing services for direct community television broadcasting, domestic telecommunications, data collection from remote unattended platforms, and meteorological earth observations. For a complete coverage of ground segments, 36 transponders are envisaged. Using two mutually orthogonal linear polarization signals, all 36 transponders get effectively used for a single ground segment. This can be achieved by co-locating two of the Insat-2 series satellites. Indian space scientists say that in view of the emerging global scenario, Insat-2C, the next in the Insat series, will carry additional Ku band transponders, beyond the use of advanced modulation and multiple access techniques such as TDMA, DAMA, and digital speech interpolation.

Accessing India's remote areas

In addition to moving on to the Insat-3 series, ISRO is in the process of developing dedicated Gramsat satellites which will carry six to eight high-powered C-Band transponders which, together with video compression techniques, can disseminate region- and culture-specific audiovisual programs in each of the many Indian regional languages through rebroadcast mode on ordinary TV sets. The high power in the C-Band will enable even viewers in remote areas outside the reach of TV transmitters or special groups of people to receive programs of their choice in a direct reception mode with only a 2-meter antenna. The addition of two or three high-power spot beam Ku band transponders to Gramsat will further enhance this capability by permitting direct reception with just an 0.8-meter antenna, which is particularly useful to provide continuing education for industrial workers in urban areas, said ISRO chief Prof. U.R. Rao at a recent seminar.

The ISRO is also carrying out feasibility studies on the optimal utilization of low-earth orbiting 400-800 kg class satellites to provide a variety of cost-effective services for messaging, mail distribution, disaster management, global position services, etc., with the availability of indigenous launch vehicles for realizing multiple launches.

In the area of remote sensing, ISRO is in the process of developing third-generation remote sensing as a followup to the IRS-1C and IRS-1D satellites, which will be launched in the 1990s. The IRS-1A and IRS-1B satellites have played a key role in developing India's agriculture. IRS-1A and IRS-1B which are providing multispectral imagery with a resolution of 36 meters and a repeat cycle of 11 days, thus providing essential inputs related to monitoring of forests, exploration of minerals, identification of underground and surface water sources, delineation of wasteland, agro-climatic regioning, soil mapping, and snow-melt runoff prediction.

The second-generation IRS-1C and IRS-1D satellites are now in the process of being designed to have better spectral and spatial resolution, more frequent revisits, stereo viewing, and onboard recording capabilities. They incorporate an improved camera system with a ground resolution of about 20 meters in three spectral bands, a middle infrared camera with a resolution of 70 meters, and a panchromatic camera with a resolution of better than 10 meters, in addition to a wide-angle camera covering a swath of over 700 km^2 with a resolution of 180 meters for rapid detection of changes in the vegetation canopy.

In addition to all the information supplied by the IRS-1A and IRS-1B, the new generation of remote sensing satellites will provide information on water stress and pest infestation. Together with dedicated satellites for ocean studies, advanced technologies like Digital Terrain Modeling and geographic information system, the Indian satellites will be in the technological forefront of all remote sensing satellite technology worldwide.

Launch vehicles

With the launching of the Polar Satellite Launch Vehicle (PSLV) scheduled later this year, India will also have a launch vehicle, using both liquid and solid propellants, which can put 100 kg class satellites into a 1,000 km-high polar orbit. Indian space scientists claim that given the unique location of the Indian launch complex close to the equator at

SHAR, Tamil Nadu, which gives a better payload weight advantage than any other site in the world for polar launches, the commercial potential of the PSLV itself is large. With PSLV services, India is in a position to contract a package deal of fabricating and launching satellites at a price most competitive compared to the West.

But beyond that, India is seriously developing the capability to launch heavier satellites. It is this concern which had prompted ISRO to seek cryogenic rocket engine technology from the Russians, and all signals indicate that although it was blocked by the United States from obtaining the technology, ISRO is still in no mood to give up the development of this technology. Professor Rao said on July 26 that Russia's decision to withhold the supply of technology will merely delay the launching of the Geosynchronous Satellite Launch Vehicle (GSLV) by one and a half to two years, and that India will be ready with its own cryogenic rocket engines by 1997. With the Russian help, it had been estimated that India would be launching its Insat-2 series satellites to the GSO in 1995. The ISRO chairman said: "Our scientists have already tested an engine with one-ton thrust. This has proven our capability to build a high-power engine. What we need is a 12-ton thrust. And we have to understand the technology of handling fuels such as liquid hydrogen." These fuels are supercooled to temperatures close to −273°C.

Speeding up the program

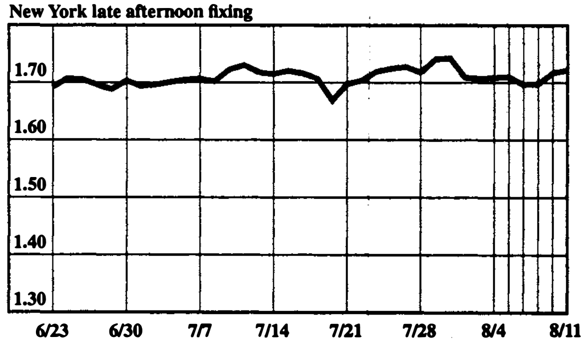
Professor Rao's projection about the development of cryogenic engines has been labelled "unrealistic" by some scientists. But there is no doubt that the cryo-project will be taken out of the back room where it has languished since 1988-89. The critics claim that Rao's projection is "unrealistic" because what India has achieved in this area is not substantial, and is only a necessary step for further development. They point out that the one-ton thrust test was carried out in 1988-89 using liquid oxygen as the oxidizer and gaseous hydrogen, instead of liquid hydrogen as the fuel. A fully cryo-fired engine has been test fired only after indigenous liquid plants were set up. However, the propellants in this were only pressure-fed, in contrast with turbo-pump feeding in a cryogenic engine.

But the impulse to speed up the cryogenic project has other sources. Indian space research has reached a point at which it could become a significant foreign exchange earner. The world market for space products and services at present, according to one estimate, is close to $7 billion. ISRO's current capability for export earning by the year 2000 is close to $300 million. However, the figure will be significantly higher if ISRO can provide launching of satellites into GSO. As it is, if the PSLV turns out to be a success, the ISRO can expect to earn another $20 million annually, from securing the polar launching contracts. It is this potential of the Indian space program, scientists here believe, that has led the West to pressure Russia to renege on the cryogenic contract.

Currency Rates

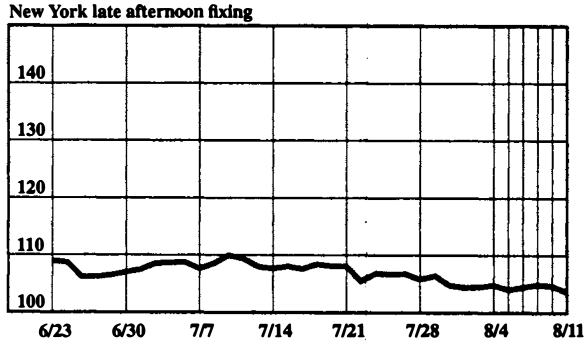
The dollar in deutschemarks

New York late afternoon fixing



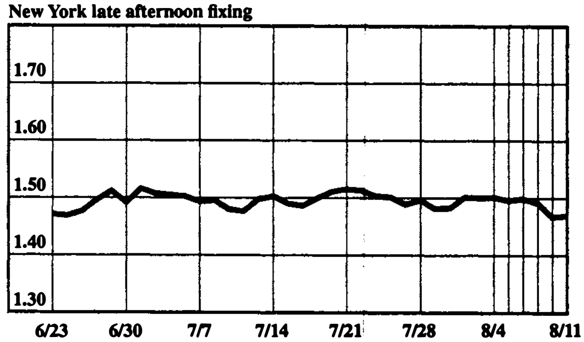
The dollar in yen

New York late afternoon fixing



The British pound in dollars

New York late afternoon fixing



The dollar in Swiss francs

New York late afternoon fixing