

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  $-273^{\circ}\text{C}$ .

### Speeding up the program

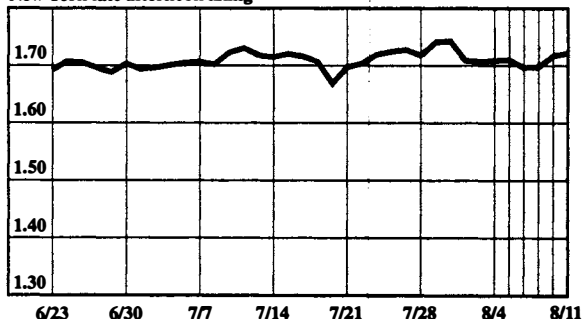
Professor Rao's projection about the development of cryogenic engines has been labelled "unrealistic" by some scientists. But there is no doubt that the cryo-project will be taken out of the back room where it has languished since 1988-89. The critics claim that Rao's projection is "unrealistic" because 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

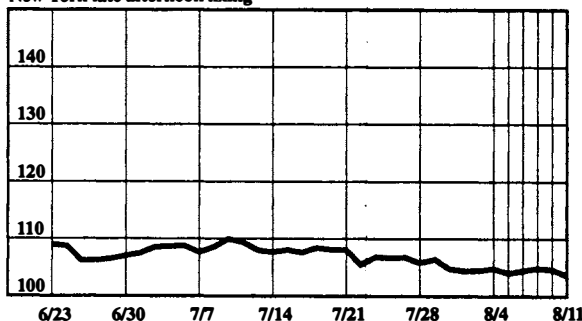
### The dollar in deutschemarks

New York late afternoon fixing



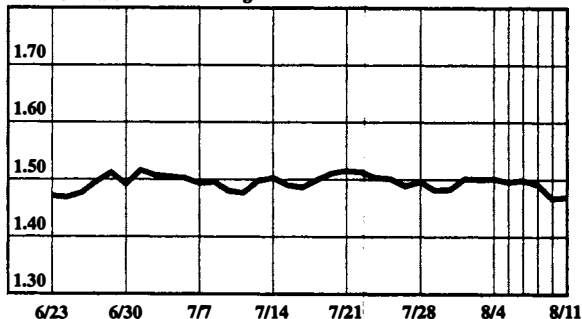
### The dollar in yen

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

