The Indian Space Research Organisation (ISRO) has successfully implemented the INSAT program of communications satellites. Today, there are 10 INSAT satellites in service, making INSAT one of the largest domestic communication satellite systems.

However, the INSAT fleet is now ageing. The last INSAT bird - the INSAT-4CR was launched almost 2 years ago. The 2 oldest INSAT operational satellites are the INSAT-2E and the INSAT-3B, both operating from the 83 degrees East orbital slot. These satellites are now 10 and 9 years old, respectively, and the Indian Government has released budgets to develop replacement satellites for the 2E & 3B satellite. Infact the budget sanctions were made by a cabinet committee headed by the Prime minister, recently.

**GSAT-10**

On August 7, 2009, the Union Cabinet has approved a communication satellite, GSAT 10. The satellite will be designed and developed at a cost of Rs 735 Crores, with a foreign exchange component of Rs 634 Crores.

The satellite will have 12 high power Ku-band transponders, 12 C-band and 12 Extended C band India coverage transponders and a navigation payload. It will also carry the second GPS aided Geo Augmented Navigation (GAGAN) payload. The GAGAN payload will be an in-orbit backup.

The communications capacity is urgently required, and GSAT-10 will be ready for launch in 20 months, ie by March 2011.

By today’s standards, GSAT-10 is of modest size and capacity. The Spacecraft employs ISRO’s proven 1-3K structure used on the INSAT 4A and 4B satellites. Its solar panels will generate around 6 KW of DC power.

The GSAT-10 will be located at 83 degrees
East, and will provide replacement capacity for the ageing INSAT-2E & 3B currently operational at this orbital slot.

**GSAT-11**

Unlike the GSAT-10 which is a routine capacity replacement satellite, the G-11 will be a true trail-blazer for ISRO. It will be ISRO’s largest and most ambitious project. A sense of this satellite’s size and capability can be gleaned from the fact that the GSAT-11 will have more than twice the communications transponder capacity than all the existing INSATS put together.

**GSAT-11 Will Have More Than Double The Capacity Than All INSATs Put Together**

The ambitious GSAT-11 project actually received its budgetary allocation 2 weeks before the GSAT-10. The cabinet approved the GSAT-11 development budget on July 23, and the satellite will be ready for launch in 30 months.

The GSAT-11 will be an advanced communication satellite which will be a high capacity multi-team Ku/Ka transponders. The giant 4.5 tonne satellite, GSAT-11, will carry capacity equivalent to 40 transponders in the Ku-band and Ka-band. All these transponders will be 3 to 6 times more powerful than those on existing INSAT Ku Band satellites.

The GSAT-11 will be ISRO’s first Ka Band commercial satellite. The Ka band beams will be regional spot beams and not necessarily cover all of India. As an example, there could be a spot beam for the South Indian states only, and another covering East India. “This would help us address growing demand from users,” said S. Satish, spokesman for Indian Space Research Organisation, or ISRO, the country’s space agency.

The satellite will be launched by ISRO’s own launch vehicle which is currently under development - the GSLV Mk3. This larger launcher will be able to loft satellites of up to 4.5 tonnes weight, into Geo transfer orbit. The launch site will be Sriharikota, about 80 km north-east of Chennai.

The GSAT-11 will employ ISRO’s completely new Kailasa cryogenic launcher, which will be ready for launch in 2010.

**Jayaswal**

This achievement is a new milestone for ISRO, which has so far focused on sending scientific payloads into space. The GSAT-11 will be a true commercial satellite, with a dollar-and-rupee-based pricing model.

**Jayaswal**

The GSAT-11 will be a trail-blazer for ISRO, providing more than double the capacity of all existing INSATs put together. This project, received its budgetary allocation 2 weeks before the GSAT-10. The cabinet approved the GSAT-11 development budget on July 23, and the satellite will be ready for launch in 30 months.

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new 1-4K Bus. This craft is configured with two sided large solar array panels generating around 11 KW of DC power. The craft structure is designed for a lift-off mass of about 4,500 kgs with a dry mass of 2100 kg.

SMALLER GSAT-4 FIRST

In the run-up to GSAT-11, ISRO will launch of other communications satellites in the GSAT series over the next 2 years.

ISRO will test the Ka-band technology in its forthcoming experimental satellite GSAT-4, to be launched later this year.

"The two-tonne GSAT-4, slated for launch by this year on board GSLV-Mark II, will have a communication payload comprising multi-beam Ka-band pipe and regenerative transponder and navigation payload in C, L1 and L5 bands," Satish said.

GSAT-4 will also carry a scientific payload, Tauvex, consisting of three ultra violet (UV) band telescopes developed by Tel Aviv University and Israel space agency for surveying a large part of the sky.

Propulsion with 4 stationary plasma thrusters, Bus Management Unit (BMU), miniaturised dynamically tuned gyro, 36 AH Lithium ion battery, 70 V bus for Ka-band and on board structural dynamic vibration beam accelerometer are some of the new technologies developed for GSAT-4.

"GSAT-4 spacecraft will have a power generation capability of 2,500 watts and will be positioned at 82 degrees east longitude in a geostationary orbit," the official said.

HUGE UPGRADE IN SAT CAPACITY

India aims to increase its transponder capacity to 500 during the 11th Plan, which ends in March 2012. The country plans to launch six satellites by then, some to replace its ageing satellites in orbit.

Globally, there are more than 6,000 communication transponders in space. A 50% growth of transponder capacity is projected for the next 5 years. This is ofcourse in addition to the replacement for end-of-life transponders. However, the Indian sub-continent and the Asia Pacific region will see huge growth, far above the global average.

The GSAT-11 will catapult ISRO and India, to become a force to reckon with, in the global satellite

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market. However, ISRO will have to overcome significant challenges in not only satellite design and execution, but also in developing a launch vehicle cable of orbiting such a giant satellite. So much depends on the GSAT-11 that failure is just not an acceptable possibility.

### ISRO SATELLITES
- **INSAT-4CR** launched on September 2, 2007
- **INSAT-4B** launched on March 12, 2007
- **INSAT-4A** launched on December 22, 2005
- **INSAT-4C** launch Failed
- **EDUSAT** launched on September 20, 2004
- **INSAT-3E** launched on September 28, 2003
- **GSAT-2** launched on May 8, 2003
- **INSAT-3A** launched on April 10, 2003
- **INSAT-3C** launched on January 24, 2002
- **INSAT-3B** launched on March 22, 2000
- **INSAT-2E** launched on April 3, 1999

### Standard Frequency Bands (IEEE Standard 521-1984)

<table>
<thead>
<tr>
<th>Band Designator</th>
<th>Frequency (GHz)</th>
<th>Wavelength (centimeters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L band</td>
<td>1 to 2</td>
<td>30.0 to 15.0</td>
</tr>
<tr>
<td>S band</td>
<td>2 to 4</td>
<td>15 to 7.5</td>
</tr>
<tr>
<td>C band</td>
<td>4 to 8</td>
<td>7.5 to 3.8</td>
</tr>
<tr>
<td>X band</td>
<td>8 to 12</td>
<td>3.8 to 2.5</td>
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<tr>
<td>Ku band</td>
<td>12 to 18</td>
<td>2.5 to 1.7</td>
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<tr>
<td>K band</td>
<td>18 to 27</td>
<td>1.7 to 1.1</td>
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<td>Ka band</td>
<td>27 to 40</td>
<td>1.1 to 0.75</td>
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<td>V band</td>
<td>40 to 75</td>
<td>0.75 to 0.40</td>
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<tr>
<td>W band</td>
<td>75 to 110</td>
<td>0.40 to 0.27</td>
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