Opportunities for Atmospheric Studies through Sounding Rockets

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SOUNDING ROCKETS
A PLATFORM FOR YOUR EXPERIMENTS

Payload Capability (kg)

<table>
<thead>
<tr>
<th></th>
<th>RH 200</th>
<th>RH 300 MKII</th>
<th>RH 560 MKIII</th>
<th>ATV-EX</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>60</td>
<td>100</td>
<td>400</td>
<td></td>
</tr>
</tbody>
</table>

Altitude (km)

<table>
<thead>
<tr>
<th></th>
<th>RH 200 (65 km)</th>
<th>RH 300 MKII (150 km)</th>
<th>RH 560 MKIII (560 km)</th>
<th>ATV-EX (260 km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
<td>150</td>
<td>560</td>
<td>260</td>
<td></td>
</tr>
</tbody>
</table>

Launch Site

Thiruvananthapuram, Kerala & Sriharikota, Andhra Pradesh
Sriharikota, Andhra Pradesh

Give wings to your experiments

- Microgravity experiments upto 6 minutes
- Launch near Earth’s Magnetic equator
- Upper Atmospheric Studies
- Flight testing of new avionics
Origin Of Space Research Activities In India

- In 1963, Thumba Equatorial Rocket Launching Station (TERLS) was established
- Thumba at 8° 31’ 49” N and 76° 52’ 11” E is near the Geomagnetic Equator.
- Ideal launch site for meteorological and upper atmospheric research
- The first sounding rocket launched from TERLS on November 21, 1963 was Nike Apache
- Dedicated to the UN in 1968

- Indian: 2127,
- Other Nations: 1380
- Regular RH-200 fortnightly launches from TERLS

3507 launches so far..
# Major Sounding Rocket Campaigns

<table>
<thead>
<tr>
<th>Year</th>
<th>Name</th>
<th>Payloads</th>
<th>Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>Dynamics Of Indian Equatorial Ionosphere over SHAR (DEOS)</td>
<td>Resonance Cone, Impedance Probe Payload, Precision Magnetometer and RABER payload</td>
<td>RH560MkII</td>
</tr>
<tr>
<td>1999</td>
<td>Leonid Meteor Shower (LMS)</td>
<td>Langmuir Probe, Electric Field sensor and Radio Frequency Mass Spectrometer (RFMS)</td>
<td>RH300MkII</td>
</tr>
<tr>
<td>2000</td>
<td>Equatorial Wave Studies (EWS)</td>
<td>Chaff experiments</td>
<td>RH200</td>
</tr>
<tr>
<td>2002-2007</td>
<td>Middle Atmosphere Dynamics (MIDAS)</td>
<td>Chaff experiments</td>
<td>RH200</td>
</tr>
<tr>
<td>2004</td>
<td>Mesospheric Turbulence Studies (MTS)</td>
<td>Langmuir Probe (LP) Spherical Probe (SP)</td>
<td>RH300MkII, RH200</td>
</tr>
<tr>
<td>2008</td>
<td>Airglow Emission Studies (ABHA)</td>
<td>Multi wavelength photometer, Langmuir Probe</td>
<td>RH300MkII</td>
</tr>
<tr>
<td>2010</td>
<td>SOORYAGRAHAN (Solar Eclipse campaign)</td>
<td>EACE, ENWi, Langmuir Probe, Electric Field and Tri Methyl Aluminium</td>
<td>RH300MkII, RH560MkII, RH200</td>
</tr>
</tbody>
</table>
Sounding rockets offered for experiments

**RH200**
- Payload: 14 kg
- Altitude: 60 km
- Appln: Meteorological

**RH300MkII**
- Payload: 80 kg
- Altitude: 110 km
- Appln: D & E region

**RH560MkIII**
- Payload: 120 kg
- Altitude: 510 km
- Appln: E & F region

**ATV EX**
- Payload: 300 kg
- Altitude: 260 km
- Appln: Microgravity
### Sounding Rocket Launch Stations

<table>
<thead>
<tr>
<th></th>
<th>TERLS / VSSC Trivandrum</th>
<th>SDSC SHAR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Latitude</strong></td>
<td>8° 32’N</td>
<td>13° 43’ N</td>
</tr>
<tr>
<td><strong>Longitude</strong></td>
<td>76° 52’E</td>
<td>80° 13’ E</td>
</tr>
<tr>
<td><strong>Launchers</strong></td>
<td>RH 200 &amp; RH 300 MKII</td>
<td>RH 200, RH 300 MKII, &amp; RH 560 MKIII</td>
</tr>
<tr>
<td><strong>Telemetry Stations</strong></td>
<td>S-Band Telemetry Station</td>
<td>Two S-Band Telemetry Stations</td>
</tr>
<tr>
<td><strong>Tracking Stations</strong></td>
<td>C-Band &amp; S-Band Radars</td>
<td>PCMC Radars, C-Band &amp; S-Band Radars</td>
</tr>
<tr>
<td><strong>Telecommand Station</strong></td>
<td>-</td>
<td>Tele-command (S-band)</td>
</tr>
<tr>
<td><strong>Real Time Systems</strong></td>
<td>Real Time Data Processing</td>
<td>Real Time Data Processing</td>
</tr>
<tr>
<td></td>
<td>Real Time Display</td>
<td>Real Time Display</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Real Time Tracking Aids</td>
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<tr>
<td><strong>Meteorology</strong></td>
<td>Met Observatory</td>
<td>Met Observatory</td>
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<td></td>
<td>Met Towers</td>
<td>Met Towers</td>
</tr>
<tr>
<td></td>
<td>Balloon Launch Facility</td>
<td>Balloon Launch Facility</td>
</tr>
<tr>
<td></td>
<td>Data Bank</td>
<td>Data Bank</td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td>Iono Sonde</td>
<td>Iono Sonde</td>
</tr>
<tr>
<td></td>
<td>Radio Sonde</td>
<td>Radio Sonde</td>
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<tr>
<td></td>
<td>Range Timing Count Down</td>
<td>Range Timing Count Down</td>
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<tr>
<td></td>
<td>Range Timing UT CC TV System</td>
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</tbody>
</table>
RH 200

➢ Two stage vehicle
➢ Capable of lifting 14 kg payload (scientific payload 5 kg) to 60 km altitude
➢ Payload volume F115 x 100 mm
➢ Capable to reach very high acceleration ~45 g
➢ Technology demonstrator for flight qualifying space vehicle avionics
➢ Mainly used for meteorological studies

First launch: 1971

159 successively successful launches
RH 300 MkII

- Single stage vehicle
- Capable of lifting 80 kg payload (scientific payload 20 kg) to 110 km altitude
- Payload volume F280 x 500 mm
- Mainly used for experiments in D & E regions of atmosphere
- Capable to experiment multiple payloads in single flight

First launch: 1983
RH 560 MkIII

- Two stage vehicle
- Capable of lifting 120 kg (scientific payload 40 kg) to 510 km altitude
- Payload volume 280 x 900 mm
- Mainly used for experiments in E & F regions of atmosphere
- A work horse vehicle to qualify various launch vehicle systems

First launch: 1973
Sounding Rockets: The Ideal Platform for Space Science Experiments

- Probe high altitude regions inaccessible by balloons and satellites
- Test bed for technologies for space systems
- Low cost tool for scientific experiments
- Payload capability up to 300 kg
- Less turn around time
- Simple and versatile
Features available

Suitable for experiments D, E and F region of the Atmosphere

Qualified and reliable telemetry and tracking system

Payload deployment mechanisms - nosecone ejection, boom deployment, door ejection, chemical release

Real time data processing and data uplink

Vehicle attitude measurements

Near simultaneous launching from TERLS & SHAR

Multiple scientific experiments in a single flight
Research avenues.

- Aerosol experiments
- Plasma, solar and astrophysics
- Auroral and non-auroral phenomenon
- Airglow and electro glows of outer planets
- Solar flare emissions
- Plasma bubble studies
- Radio propagation studies
- Microgravity experiments
- Vapor / Tri Methyl Aluminum (TMA)
Thank You

For any additional information/query contact us : isroic@isro.gov.in