NavIC Utilization in ISRO's Human Spaceflight Mission

GAGANYAAN

for Crew Module Tracking and Recovery

Speaker:

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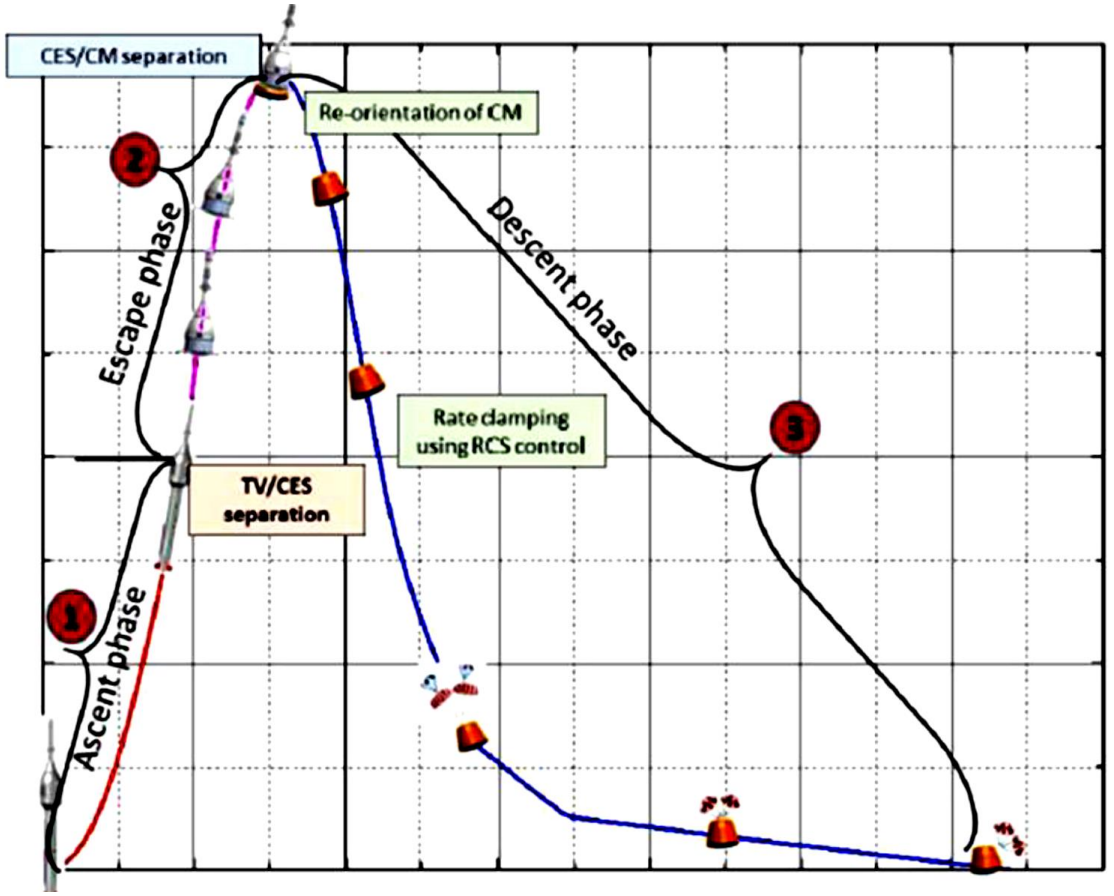
Use case: GAGANYAAN (Tracking & Recovery)

- **GAGANYAAN** consists of a **human-rated** *Launch Vehicle*, *Orbital Module* & *Crew Escape System*.

- **The Atmospheric Crew Escape System (ACES)** will ensure the crew safety in the event of emergency *(either at launch pad or during atmospheric flight regime of the vehicle)*

- *This presentation addresses the safety-of-life critical requirement to locate and track the position of Crew Module after splashdown*



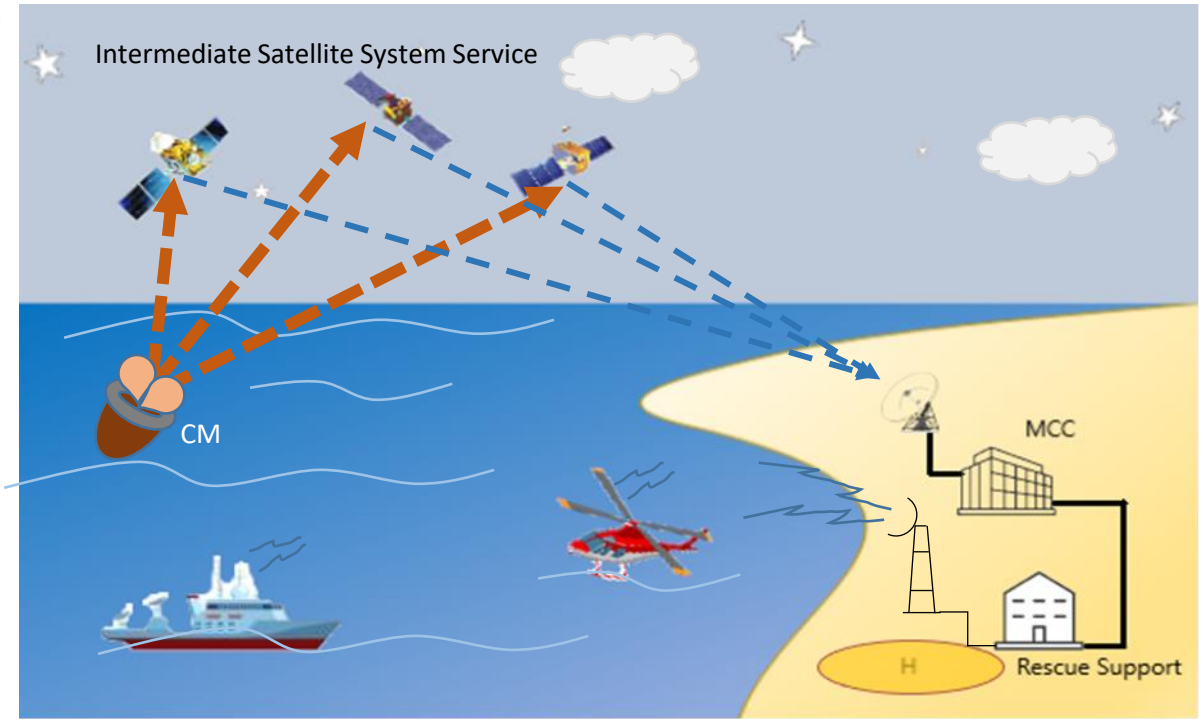
*Profile Courtesy: GYTV Project SAC, Ahmedabad

Location Transmitter System Requirements

- **Operational Scenario:**

  After splashdown it is required to transmit the accurate location of the Crew Module (CM) to the Mission Control Centre (MCC) via an *Intermediate Satellite System Service*.

- **Operational time** : 6 - 24 hrs.
- **Constellations** : GPS L1C/A + NavIC L5
- **Position accuracy** : < 20m (1-σ)
- **Update Rate** : 1- 30 sec
- **Output Format** : NMEA 0183

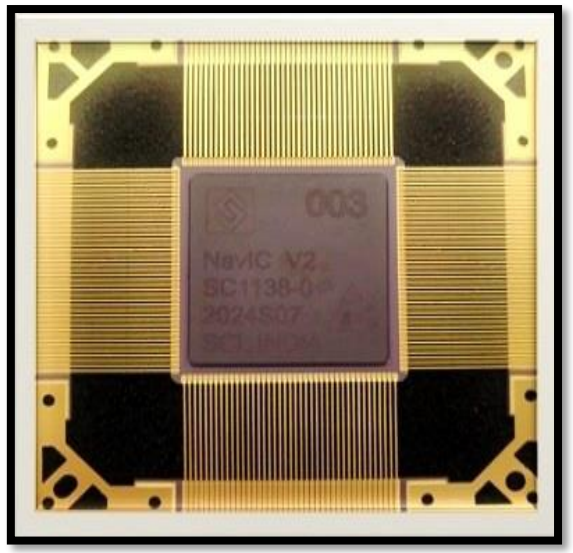


*SatLink Courtesy: SCTD Team SAC, Ahmedabad

In-House GNSS Receiver Specifications

DVM Ver. 1

DVM Ver. 2

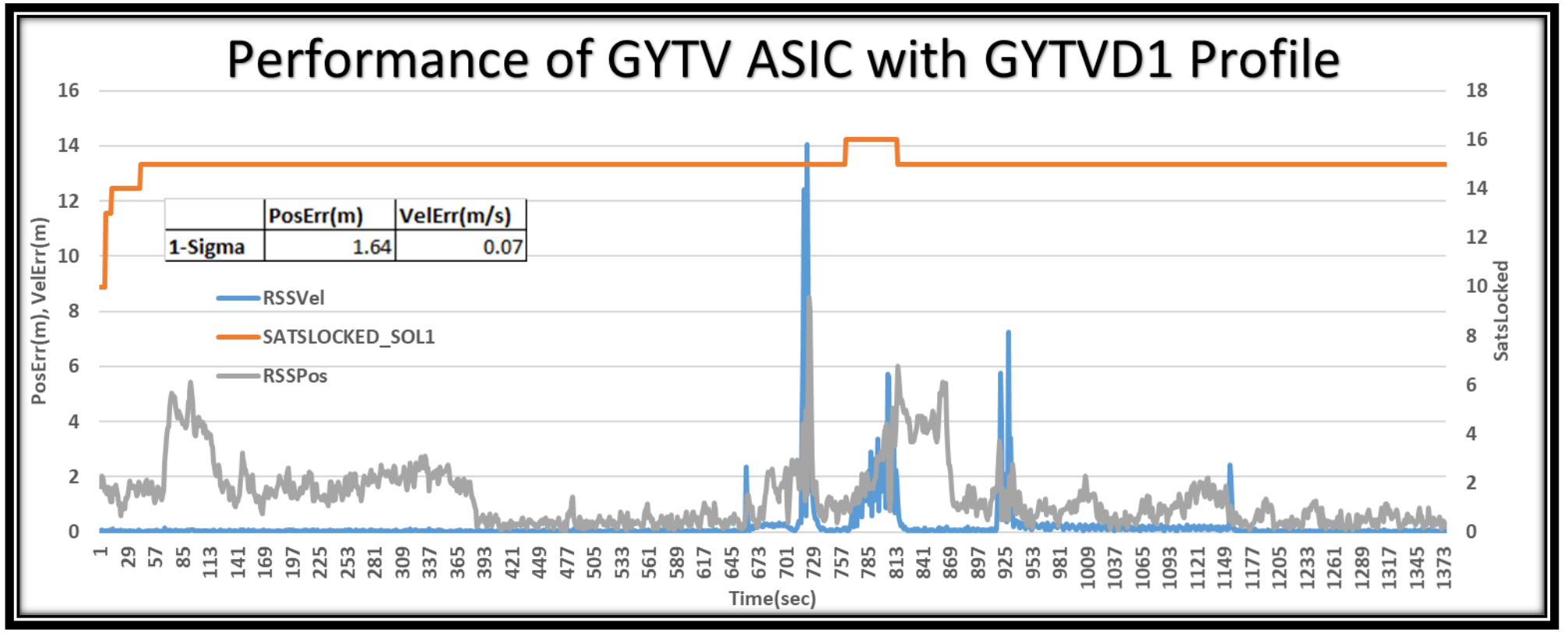


NavASIC V2

*Courtesy: NRD Team SAC, Ahmedabad

Parameter	Specification
Supported Constellations	GPS L1 C/A, IRNSS-SPS L5,S, GAL E1B, GLO L1, SBAS L1
Sensitivity	
Acquisition	≥36 dBHz
Tracking	≥24 dBHz
Time to first Fix (TTFF)	< 120 sec
Reacquisition Time (complete RF blockage < 6sec)	< 6 sec
Accuracy	
1σ Position	< 10 m (±1.5m stdev.)
Velocity Accuracy	±0.3 m/s
Tested Dynamics	
Velocity	11 km/s
Acceleration	5g
Jerk	20g/s
Refresh Rate	Up to 5Hz
Output	MIL1553, NMEA 0183 4.11

Testing and Validation



The above performance is validated with actual mission profile with following max motion parameters

	Acc(m/s*s)	Vel(m/s)	Jerk(m/s*s*s)
Max	22.40	390.64	120.91

Summary

- Keeping the multi-constellation positioning mode is ensuring continuous availability of the position.

- Advantages of using NavIC for Search & Rescue operations:
  - Better position accuracy in the defined Indian mainland due to better control on SIS errors. The constellation is providing better single frequency Ionospheric corrections and faster ephemeris and clock parameter update rate.
  - Removing the dependency on the ALMANAC in case of low dynamic/static mission; reduces memory & power requirement of the hardware.

Thank You