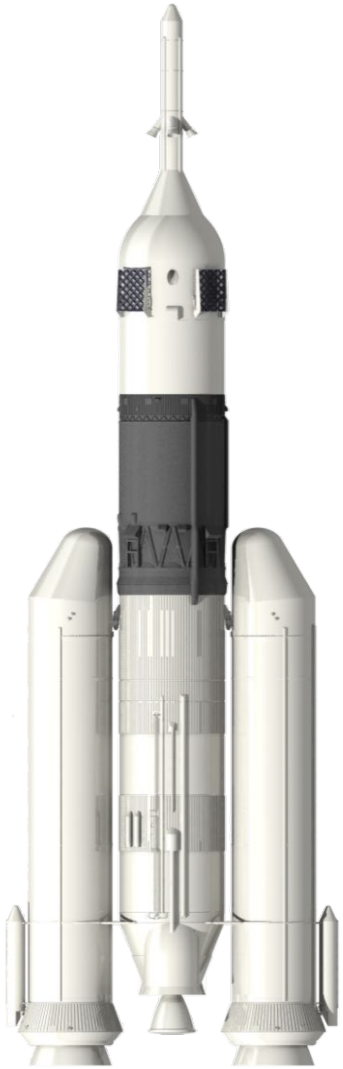


Human Space Exploration: Indian perspective

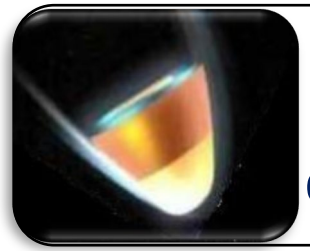
Imtiaz Ali Khan, Director, DHSP, ISRO, DOS

Date: 12/07/23

Early pursuit of Human Spaceflight Technologies in India

Conceptualized in last decade

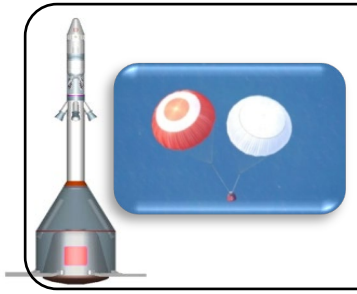
Reviewed by Eminent Expert committees



SRE
2007
Orbital re-entry

GSLV Mk-III
2017

10t to LEO



Technology Development
2009-18

Global trends in Space exploration

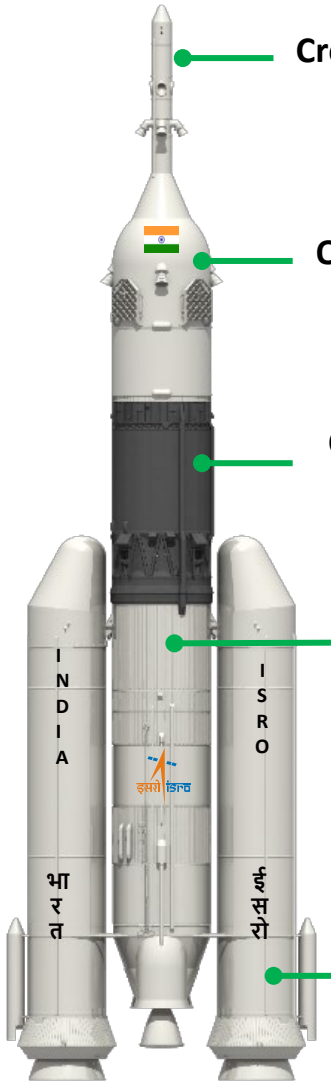
Vision, Scope
Execution strategy
Schedule & budget

2014 – CARE
2018 - PAT

Reviewed by Expert Committee

National Committee

Gaganyaan Configuration



Crew Escape System

Orbital Module (Inside)

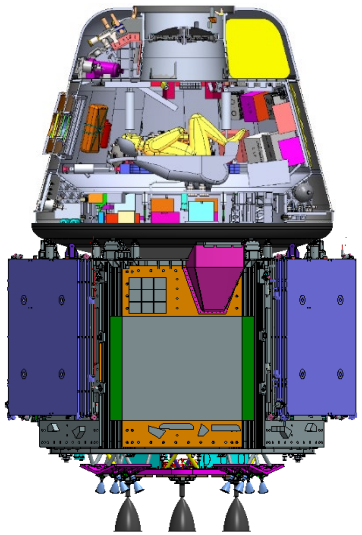
Cryogenic Stage (C25-G)

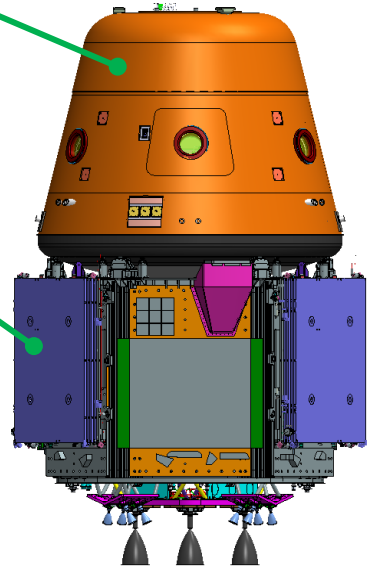
Liquid Stage (L110-G)

Solid Propulsion (HS200)

HRLV
(Human rated Launch Vehicle)

Orbit :
400 km
Circular
Inclination:
51.5°



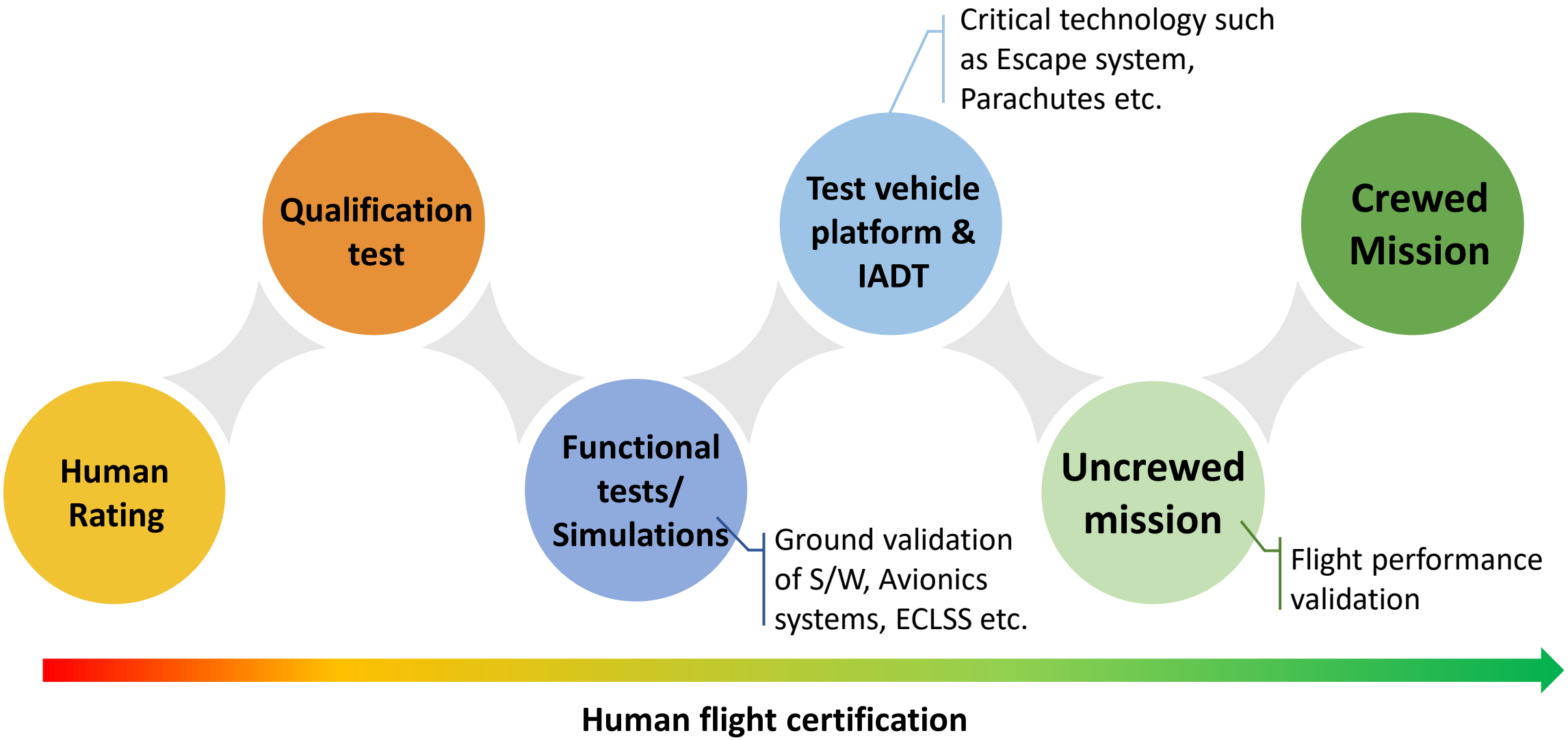


Orbital Module

- No. of Crew : 2 to 3
- No. of days in Orbit : Up to 3 days
- Orbit : 400 km Circular
- Launch Vehicle : Human Rated GSLV Mk-III
- Recovery : Arabian Sea / Bay of Bengal

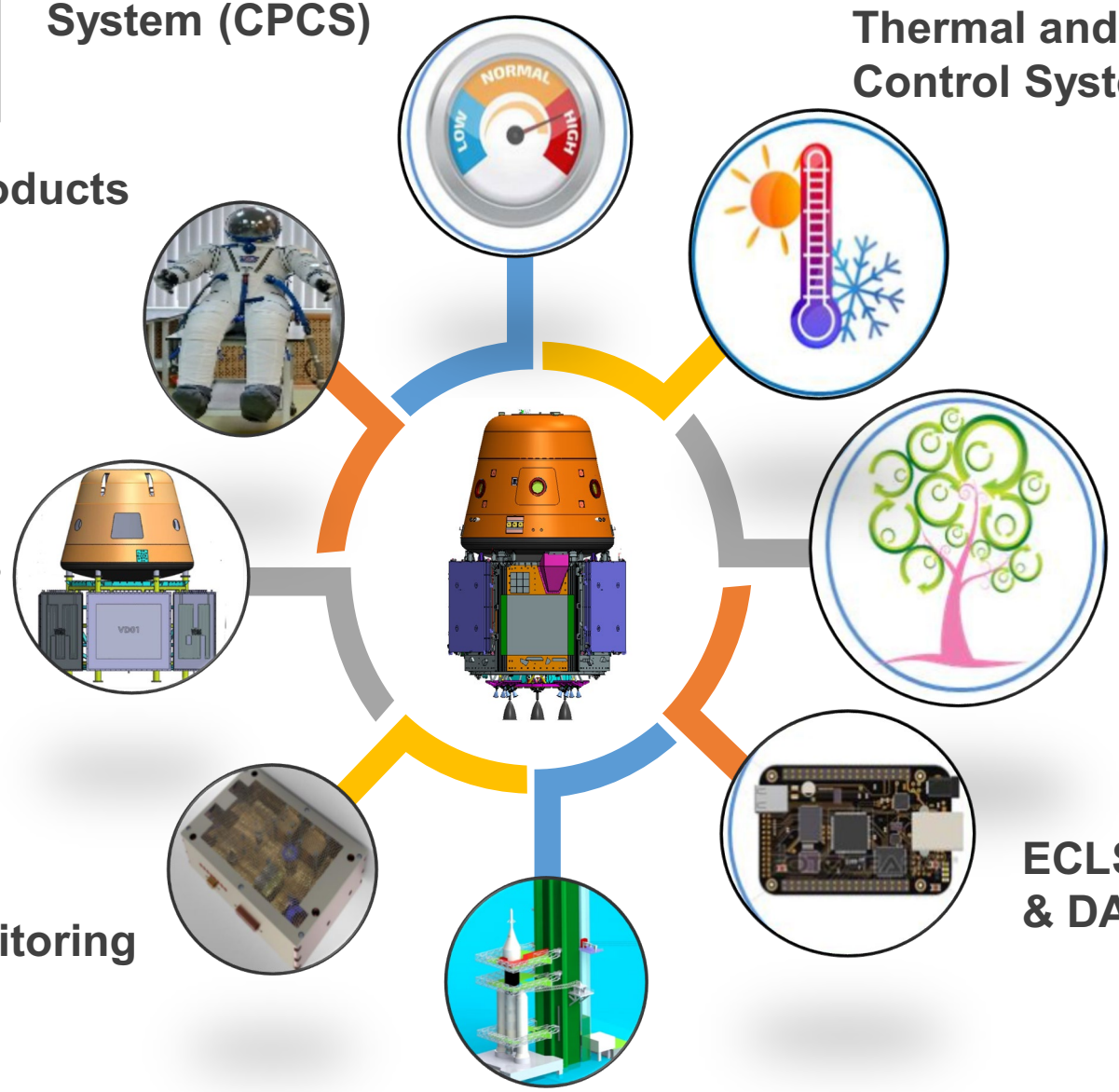
Programme Execution Strategy

1. **High priority on crew safety, step-by-step approach with extensive qualification & functional tests.**
2. **Crew escape system and deceleration systems to be fully validated before uncrewed mission.**



Environment Control and Life Support System

To provide shirt sleeve environment in Space



Design completed and Realization in progress

Bioastronautics - Impact of Microgravity on Human Body

Eyes
Some vision loss. May be due to increased pressure inside the head

Heart
May shrink, which can cause problems for astronauts after returning to earth

Muscles
Muscles aren't really needed to hold up the body. They become weaker.

Spinal cord
Astronauts are taller in space. The vertebrate in our spine is able to expand

Bones
Bones aren't needed in microgravity due to which they get weaker and brittle

Blood
The blood and fluid is pulled towards the head, giving astronauts puffy face

Future Space Habitats – A Need

- Survival of human civilization and biosphere, in case of a disaster on the Earth
- Huge resources in space for expansion of human society
- Space stations are a first step towards long duration space habitats
- **Life Support:** Air revitalization, water recovery, waste collection and processing
- **Environmental Monitoring:** Atmosphere, water, microbial, particulate, and acoustic monitors
- **Radiation Protection:** Low atomic number materials including polyethylene, water, or any hydrogen-containing materials
- **Extra Vehicular Activity (EVA):** Space suit for exploration
- And other human centric products

Thank You