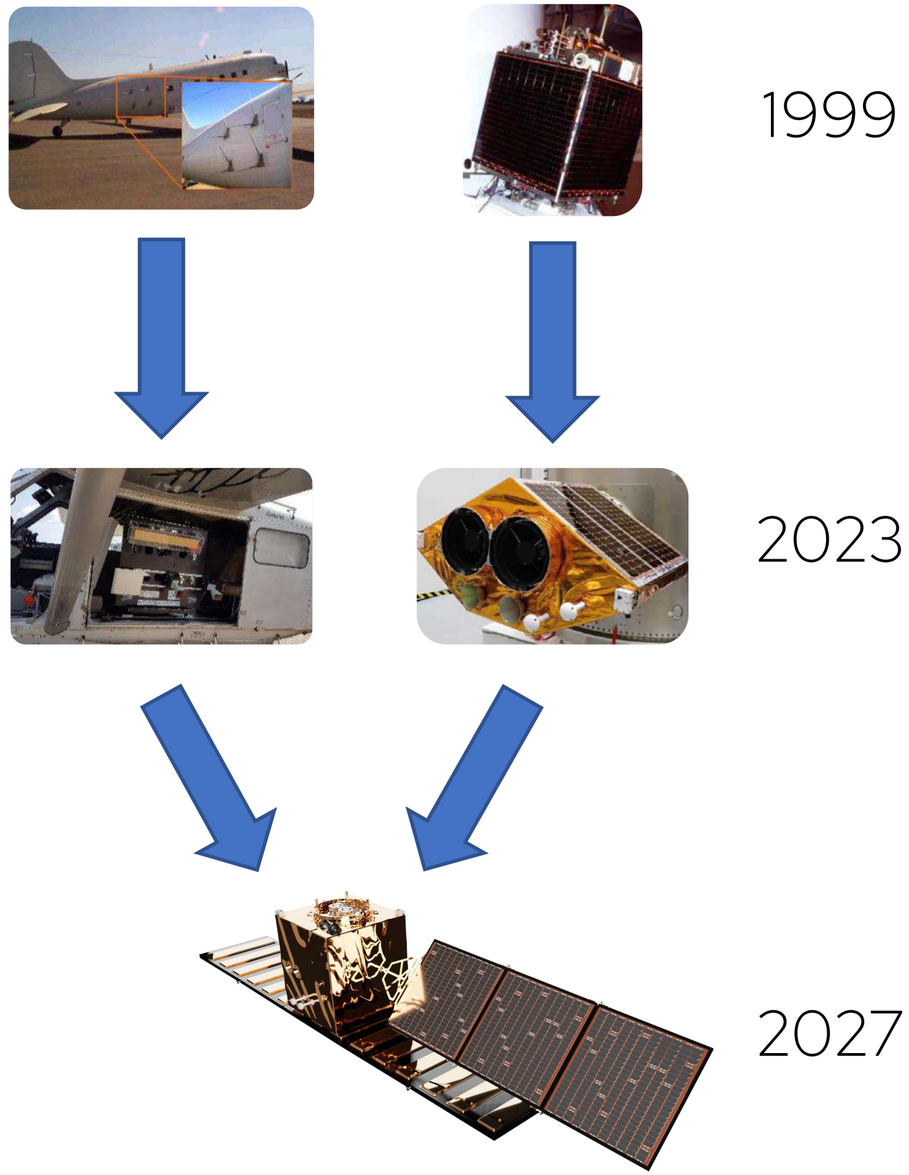
DRAGONFLY
aerospace

An Earth Observation SAR satellite solution for South Africa

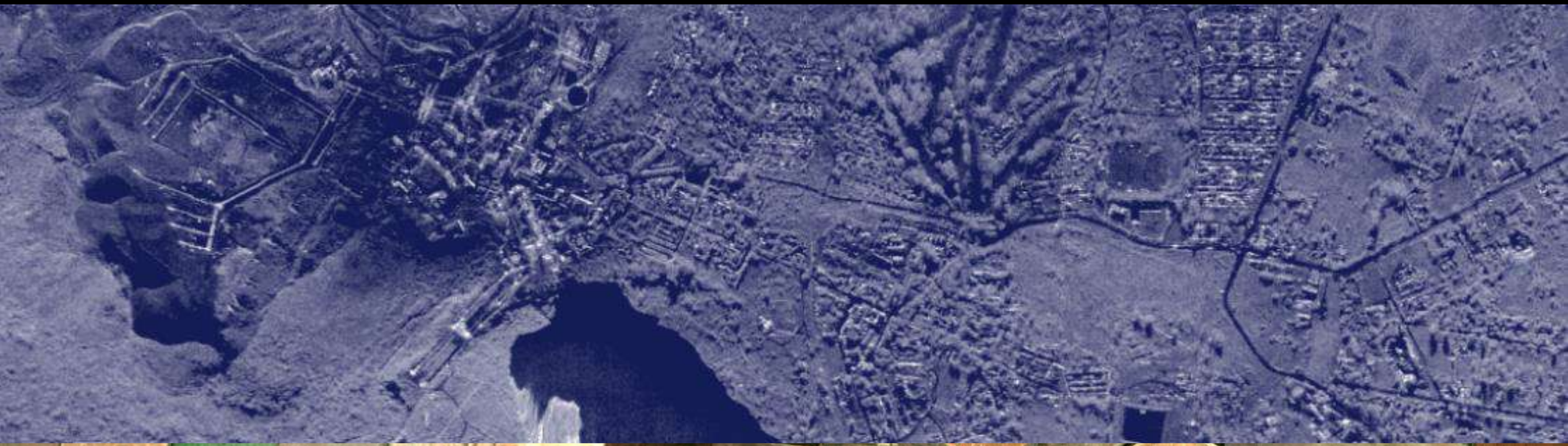
National Space Conference 2024

We are ready to build our first SAR satellite

- South Africa has been designing and building optical imaging satellites for 39 years and launched the first one 25 years ago
- We have launched 4 optical imaging satellites (1999, 2009, 2017, 2023)
- South Africa has been designing and building radar systems for 75 years and synthetic aperture radar (SAR) for 29 years
- The team at Dragonfly has been working with CSIR for over 5 years to define the SAR payload and the satellite bus needed to support it



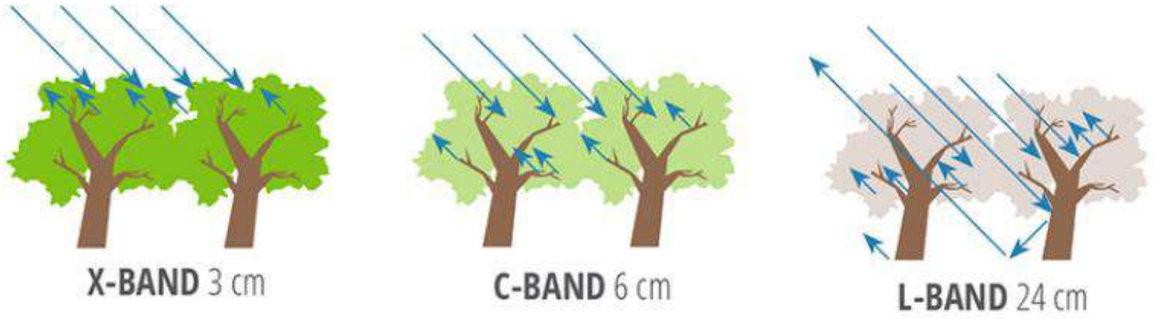
Benefits of SAR imaging from space



SAR imaging frequencies

- SAR can be done at almost any radio frequency but the following bands have been flown in space
- The lower the frequency or longer the wavelength, the better it can penetrate clouds, trees and even soil but the larger the antenna
- The higher the frequency the better the resolution and smaller the antenna but the less it can penetrate
- Bandwidth also affects the resolution and this is governed by regulations rather than engineering

Band	Frequency	Resolution	Antenna	Bandwidth
X-band	9.65 GHz	0.25m	3m	1200 MHz
C-band	5.5 GHz	1	5m	300 MHz
S-band	3.2 GHz	3m	5m	80 MHz
L-band	1.25 GHz	3m	10m	80 MHz



C-Band Advantages

Technical

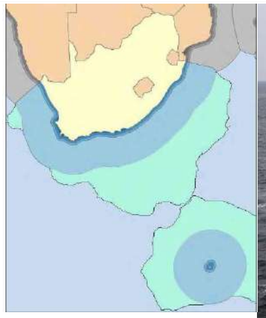
- C-band radar allows **access to large body of science** from RadarSat 1, 2 as well as Sentinel 1
- **600 MHz of spectrum** available allows for sub-metric resolution
- **Longer wavelength provides more stable phase coherence** for interferometry (less vegetation effects) and improved penetration foliage capabilities
- **Lower attenuation in severe weather** provides opportunities in context of climate change and severe storms, especially in MDA and DM
- **Improved characterization of ice** provides benefits in polar ice monitoring applications

Commercial

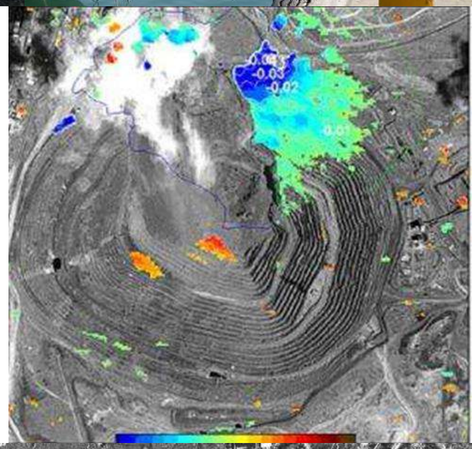
- Micro-satellite SAR at **X-band becoming crowded**
  - Many players and many more trying to enter
- **Sentinel 1 failures opening up opportunities at C-Band**
  - Potential for inter-agency collaboration with ESA & CSA
- **C-Band RF components being cheaper** leads to advantages in payload price once in production

Segment	Application	C-Band	X-Band
Military	IMINT (open areas)	+	++
	IMINT (forested)	**++**	+
	Mapping	++	++
	Terrain Analysis (DEMs)	**++**	+
Disaster Management	Flooding	**++**	+
	Earthquakes and Subsidence	**++**	+
Maritime Domain Awareness	Vessel Monitoring	++	+
	Search and Rescue	+	++
	Eco-system Monitoring	++	+
Natural Resources	Forestry	++	+
	Agriculture	++	++
	Mining	++	++
	Energy	+	+
Infrastructure Monitoring	For large infrastructure (dams, bridges, etc)	+	++
	Finance and Insurance	++	++

Benefits of C-band SAR to South Africa

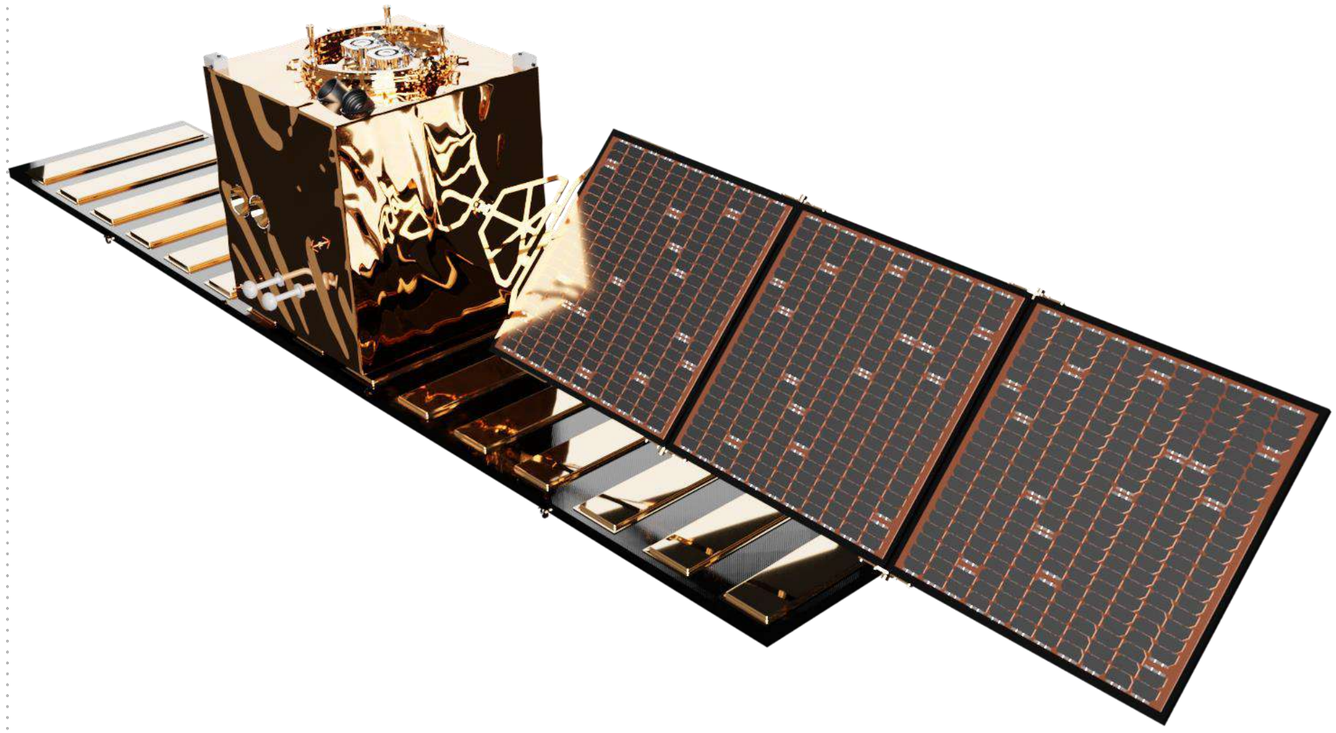


- Strategic capability – very few countries have it
- Internationally competitive industry – export revenue
- Maritime Domain Awareness - large EEZ and Search and Rescue zone
- Eradicate Illegal fishing – our local fisherman and fish populations are suffering!
- Mining – control subsidence of mines and tailings
- Manage linear Infrastructure – roads, rails, power lines, water pipes
- Precision Agriculture – biomass estimation and yield prediction (with Optical)
- Support our peacekeeping troops from space where aerial systems are not possible – through vegetation and even camouflage



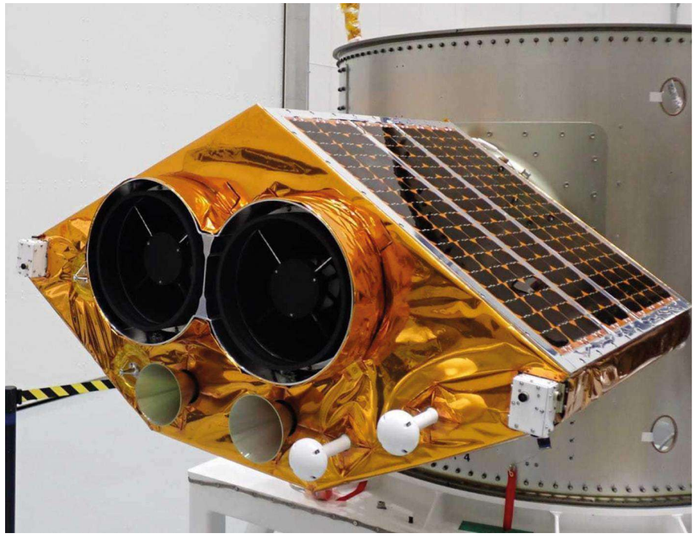
Dragonfly-C

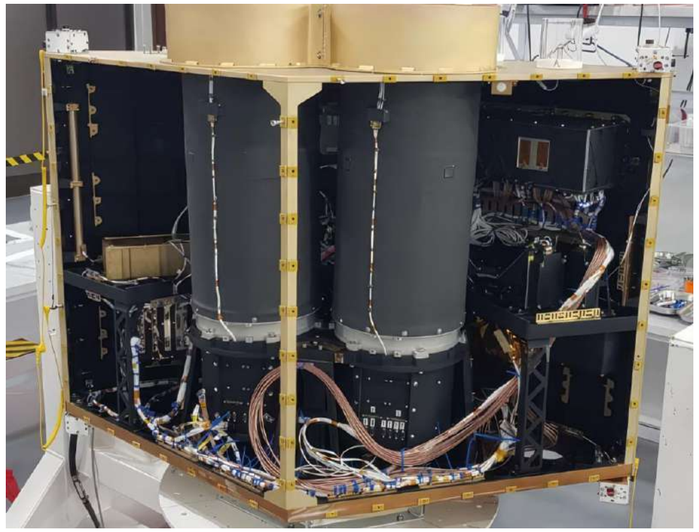
DRAGONFLY BUS + C-BAND SAR	
Mass	350 kg
Imaging Resolution	Spotlight: 1 m / Stripmap: 3 m
Imaging Swath	Spotlight: 10 km / Stripmap: 44 km
Spectral Bands	C-band 300-600 MHz HH or VV
Downlink	X-Band 2.5 Gbps (peak)
Data Storage	4 TB
Imaging Capacity	5-10 minutes per orbit
TMTC	S-Band 150 kbps up / 400 kbps down
Geolocation Accuracy	120 m (3-sigma)
Propulsion	Xenon 28 mN thrust, 1850s Isp
Lifetime	8 years

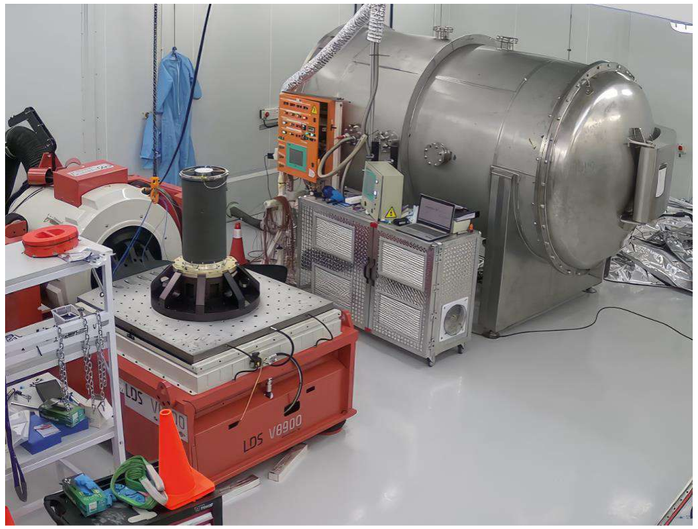


Already in place – Satellite Technology

- Imaging Satellites
- Satellite Buses
- Satellite Components
- Mission Planning and Control
- Manufacturing Facilities
- Environmental Testing Facilities
- Launch Campaign and Fueling

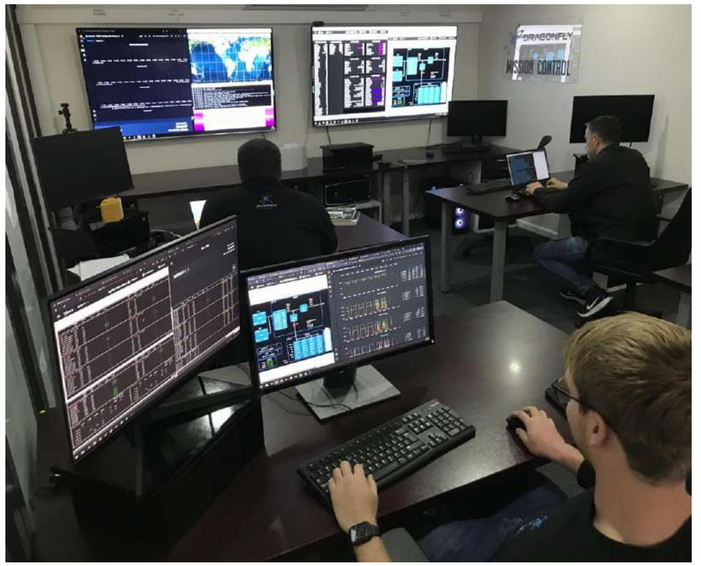


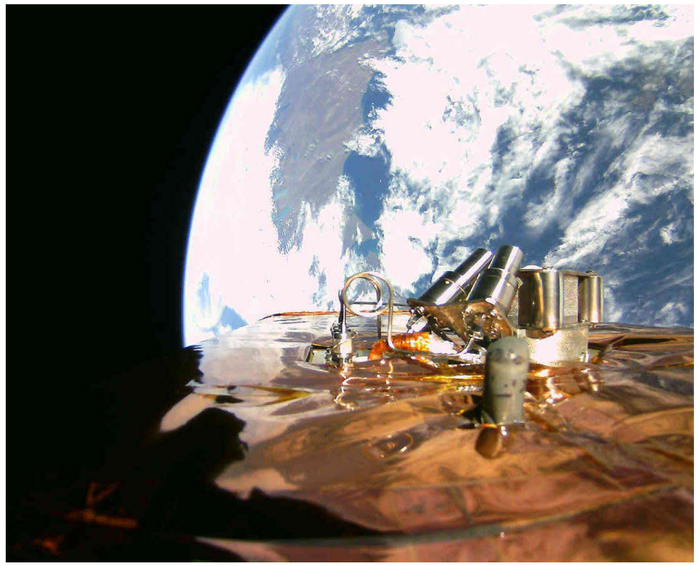




Already in place - Satellite Operations

- Launch and Early Operations (LEOP)
- Satellite and Payload Commissioning
- Payload Calibration and Validation
- In-Orbit Acceptance
- Satellite Operations and Maintenance
- Automated and API Tasking
- Image Processing and Cloud Delivery





Next steps to launch the first SAR satellite

- Complete qualification of CSIR Payload (already funded)
- Complete qualification of bus structure (Dragonfly internal)
- Allocate funds
- Kick-off project
- 2027 launch