DMC3 and Carbonite-1: Two Sides of Small Satellites

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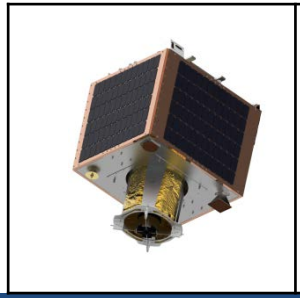
Launch of Two Different Classes of Spacecraft

- July 2015 saw the launch of two different classes of small satellites from SSTL:
  - High fidelity performance SSTL S1 spacecraft as used on the Disaster Monitoring Constellation 3 (DMC)
  - High utility spacecraft designed for very low cost and rapid schedule missions as demonstrated on Carbonite-1
- Both classes of spacecraft provide high resolution imagery and have been fully operational for over a year
- The satellites were all launched on-board a PSLV from Sriharikota, India into a SSO with an altitude of 651 km and an LTAN of 10:30


Courtesy of Antrix

Comparison of S1 and Carbonite



Spacecraft	Carbonite-1	S1
Design Lifetime	1 year	7 years
Mass	86 kg	447 kg
Envelope	0.6 × 0.7 × 0.9 m	3 x 1.35 x 0.65 m
Payload Data Storage		
Storage Volume	16 GBytes	554 GBytes
Imager Overview		
GSD	1.5 m Colour imagery and video	1 m PAN 4 m Multispectral
Swath	~5 km	22.5 km
Payload Data Downlink		
Frequency Band	X-Band	X-band
Data Rate	80 Mbits/s	500 Mbits/s
Schedule		
KO-FRR	8 months	24 months

SSTL S1

- DMC3 uses the SSTL S1 platform based on the tried and tested basic layout of the SSTL-300 (as on NigeriaSat-2), adding a new high resolution payload and more advanced avionics.
- SSTL S1 spacecraft is fully redundant and designed for triple-launch configuration on most popular small launcher fairings

Carbonite-1

- Carbonite-1 platform is similar in size to the heritage SSTL-100 platform but the main difference is the structure is built around the telescope using central shear walls made of milled aluminum.
- Utilizes single string (except for receivers) architecture based on reliable heritage equipment
- Carbonite Series also allows video imaging

S1: Imaging Capability

- S1's high agility not only supports off-axis imaging up to 45° from nadir, it also supports multiple imaging modes including:
  - Along-track stereo
  - Across-track stereo
  - Mosaic mode

S1: Imaging Capability (London)

Image over cloudy London, UK (courtesy of 21AT) from DMC3

S1: Current Status and Future Evolution

Current Status

- From Launch to May 2016, a total of 36139 scenes have been successfully captured and downlinked across the constellation.
  - This equates to 18.5 million km^2 captured in 10 months since launch; this is approximately twice the area of the US or nearly 76 times the area of the UK.
  - A total of 44.5 TBytes of imager data has been generated. As of

- For June 2016 alone, a total of 15617 scenes have been captured and downloaded across the constellation in 1 month
  - Approximate 7.98 million km^2 (~80% of the area of US) and generated 19.2 TBytes of data

Future Evolution

- SSTL has enhanced the design of the S1 imager so that for future missions it will be possible to achieve sub-meter imagery down to a native (i.e. without processing) GSD of 0.7m.

- The imager was designed to be modified to achieve this while still maintaining the agility of the SSTL-300 platform.

Carbonite-1: Imaging Capability

First image captured over Dallas, Texas in July, 2015

Carbonite-1: Imaging Capability

- Nadir Imaging mode is a simple “point and click” mode where images are captured in rapid succession over a target
- Images can be stitched together to show a film strip
- ~5 km swath coverage provided and 40 km strip image made

Carbonite-1: Imaging Capability (FMC)

- Forward Motion Compensation (FMC) mode allows for satellite to stare at one location as it moves over
- Images captured are stacked to create a video
- Motion of objects on ground can be tracked

Carbonite-1: Current Status and Future Evolution

Current Status

- As of June 2016, Carbonite-1 has captured and downloaded more than 975 GBytes of raw data; equivalent to more than 65000 images.

- As a prototype, the main objectives of the mission were to demonstrate the rapid build capability and the low cost of the final product. The mission has been a complete success and has in many cases surpassed the original expectations.

Future Evolution

- The satellite is the first in a series of demonstrators that will have increasing performance while bringing down cost and time to build.

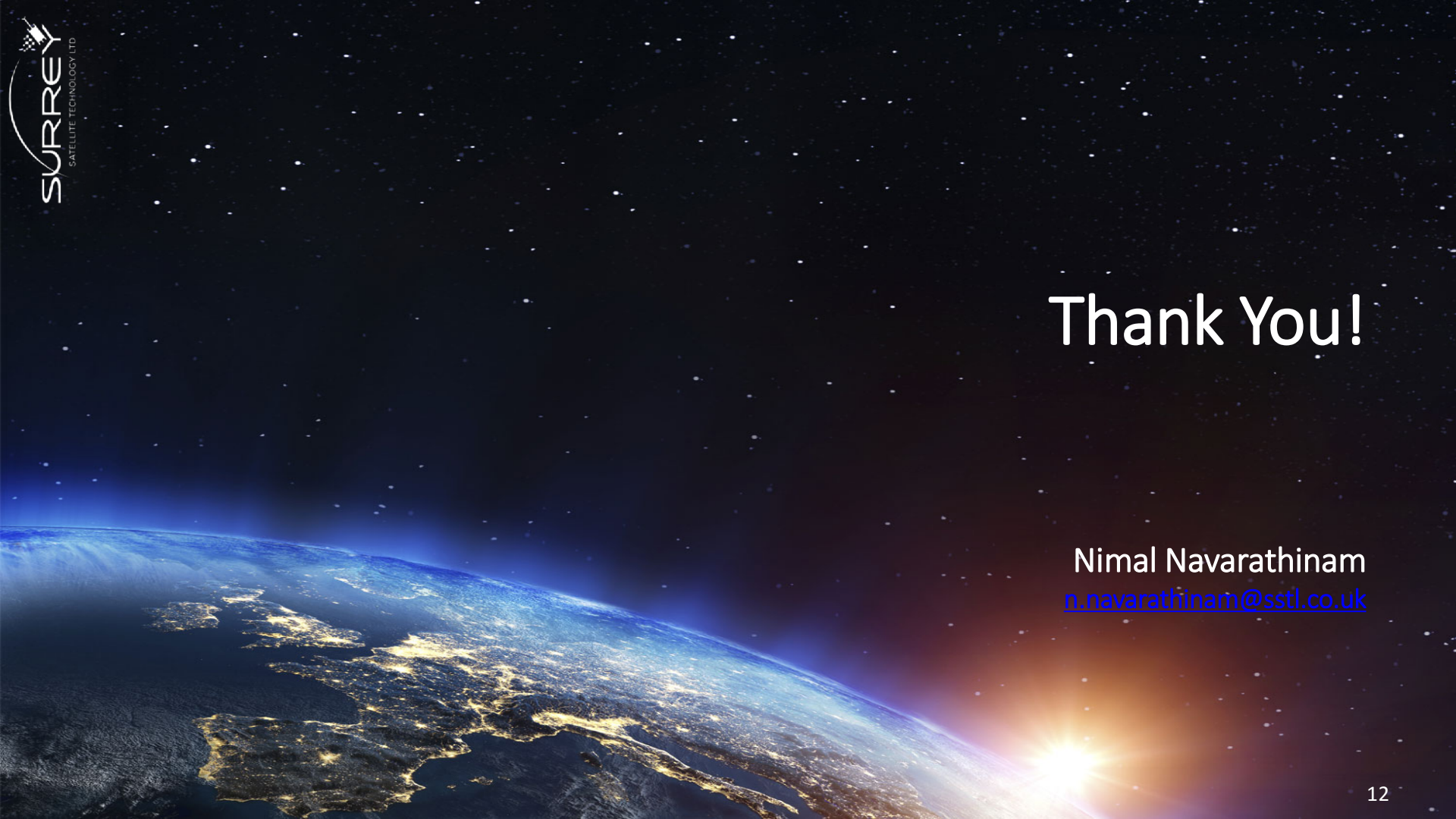
- The next satellite will incorporate new on-board data processing capability and demonstrate several new material technologies, including additive layer manufactured parts and new deployment systems.

Concluding Remarks

- The S1 and Carbonite Series of spacecraft are two sides of the same coin: one provides high fidelity imagery and the other provides high utility; but they both provide high resolution imagery.

- S1 provides high precision pointing in order to acquire images with a high degree of fidelity with respect to the scene being captured.

- The Carbonite Series of spacecraft provide high utility by reducing the cost of entry for new and existing business models which includes the deployment of super-constellations. In addition, it includes video capture capability.



Thank You!

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Carbonite-1: Walnut Ridge, USA


Burj Al Arab
Wild Wadi Water Park
Jumeirah Beach
Beach Umbrellas
Google Maps
Carbonite-1: Dubai, UAE