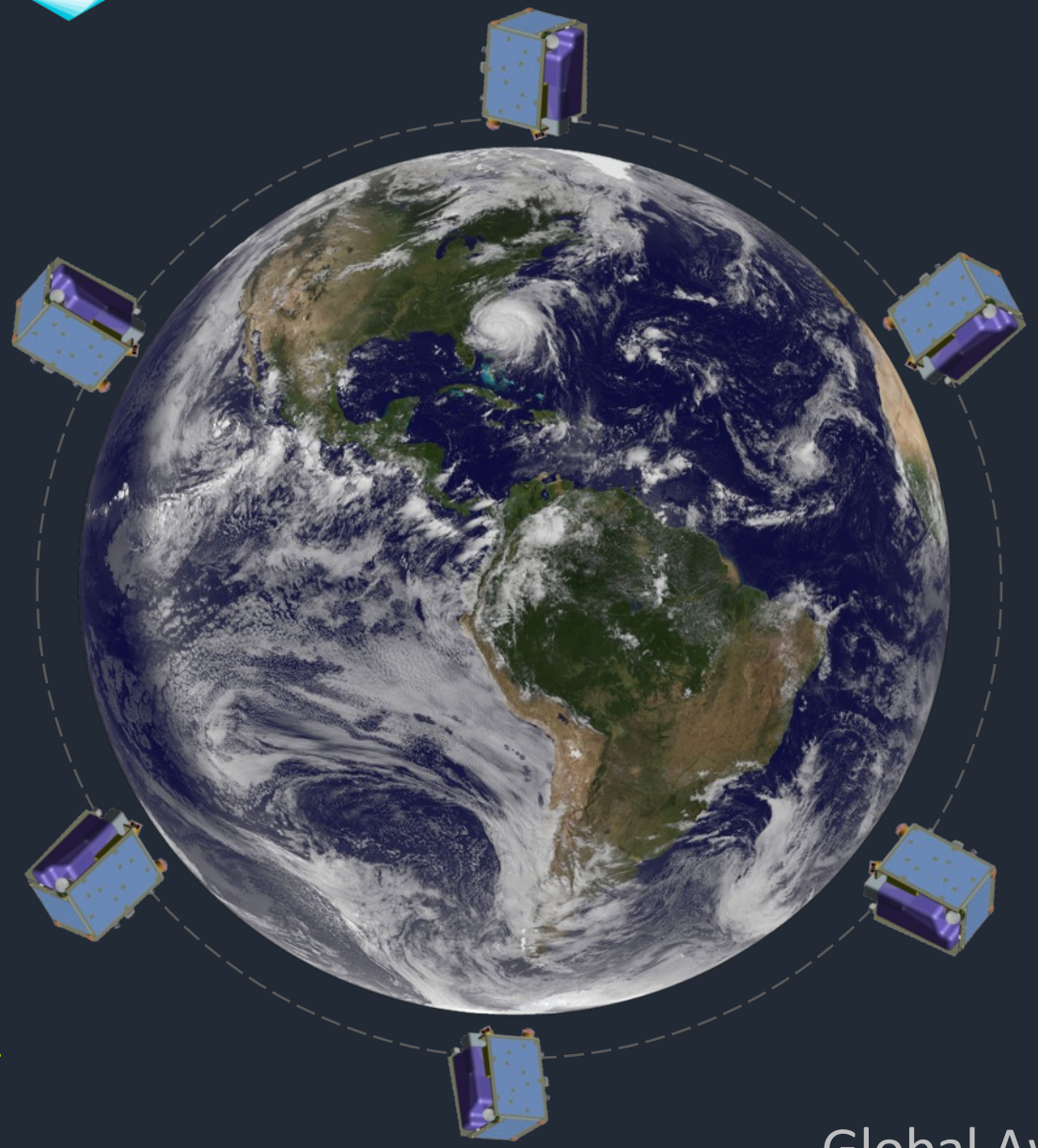
Global Imaging Systems Ltd



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Global Awareness for All

Global Imaging Systems company Status:

- GIS incorporated December 2021 by co-founders Liam Sills (CEO) and Richard Holdaway (Chairman).
- **Key USP is a 1m GSD, 200 km swath, multispectral payload to be accommodated on small or micro satellites (~200kg).**
- A patent has been awarded for the payload design concept.
- Teamed with In-Space Missions Ltd for satellite platform development.
- Seeking funds (Commercial seed funding & Government grants) to:
  - De-risk key subsystems in camera design.
  - Understand and create relationships with end users of data, secure LOI's and MoU's, find initial anchor customers.
  - Progress low level data processing pipeline and assess scale of cloud platform development required.

The problem we are aiming to solve

Global change is accelerating....Climate, resources, infrastructure

Requires a global awareness system that is affordable, accurate and fast.

Current imaging solutions are expensive, with poor coverage due to narrow swaths.

High data prices limit access, information flow is restricted.

GIS will provide the next generation Earth Observation (EO) system to address these issues.

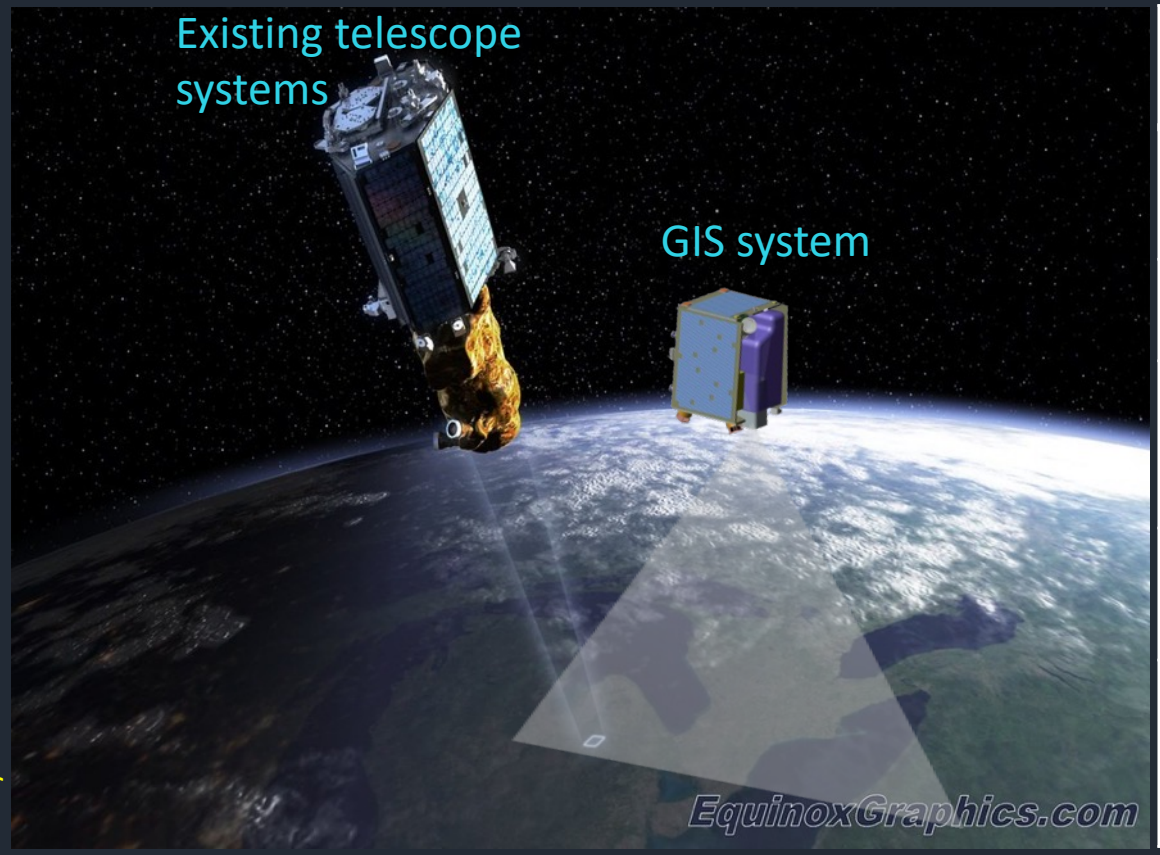
OODA LOOP

Global Awareness for All

Capability - High resolution, wide swath Camera

GIS camera design for **high resolution**, **wide swath** imaging, gives 10 X increase in data collection compared with telescope payloads.

The key USP is 1m MS GSD over a continuous 200 km swath, at low cost.



Parameter	Value	Comment
GSD	**1m**	GSD assumes a 375km VLEO orbit.
Swath width	**200 km**	Max angle of +/- 15°
MS bands	**Red, Green, Blue, + NIR**	Green band used to 'PAN' sharpen other bands.
SNR	**All bands >100:1**	@Sentinel 2 ref radiances
MTF	**>7%**	Lens based optics give better overall MTF than Cassegrain telescopes due to no central obstruction.

Vision for future commercial EO constellations

Using its unique camera design GIS will revolutionise Earth observation with high resolution global image coverage and unprecedented update rates at 1/10th the price of existing solutions.

GIS camera system for high resolution, wide swath imaging, overcomes the ‘drinking straw’ problem. A 10 X increase in swath over competitors.

Use of VLEO limits lifetime on orbit to ~3.5 years. This is offset by the increase in data collection capability.

GIS cameras on Low Earth Orbit satellites produce 1m GSD data of land areas used by humanity every day (with 6 satellites), or every hour (with 60 satellites).

Use of more agile satellites could provide a ‘CCTV camera for the world’, using platform FMC and video capability of the payload.

Lenses rather than reflective telescopes.

- Before digital sensors, lenses were combined with large format film giving wide coverage.
- Digital sensors were too small to be used over wide fields. Telescopes were favoured and gave high resolution over small areas. Digital detectors are now much larger, and have smaller pixels, bringing lenses back into the game.
- Large detectors with small pixels are now available, lens technology is more advanced compared to decades ago, small satellites are more capable, and lower orbit heights affordable given the increased data collection capability.
- The GIS system, using lenses and multiple COTS detectors, can cover large fields of view at high resolution.

CEOI feasibility study.

- GIS, and partners In-space missions (ISM), have successfully completed a feasibility study for the GIS payload and ISM satellite platform funded by CEOI.

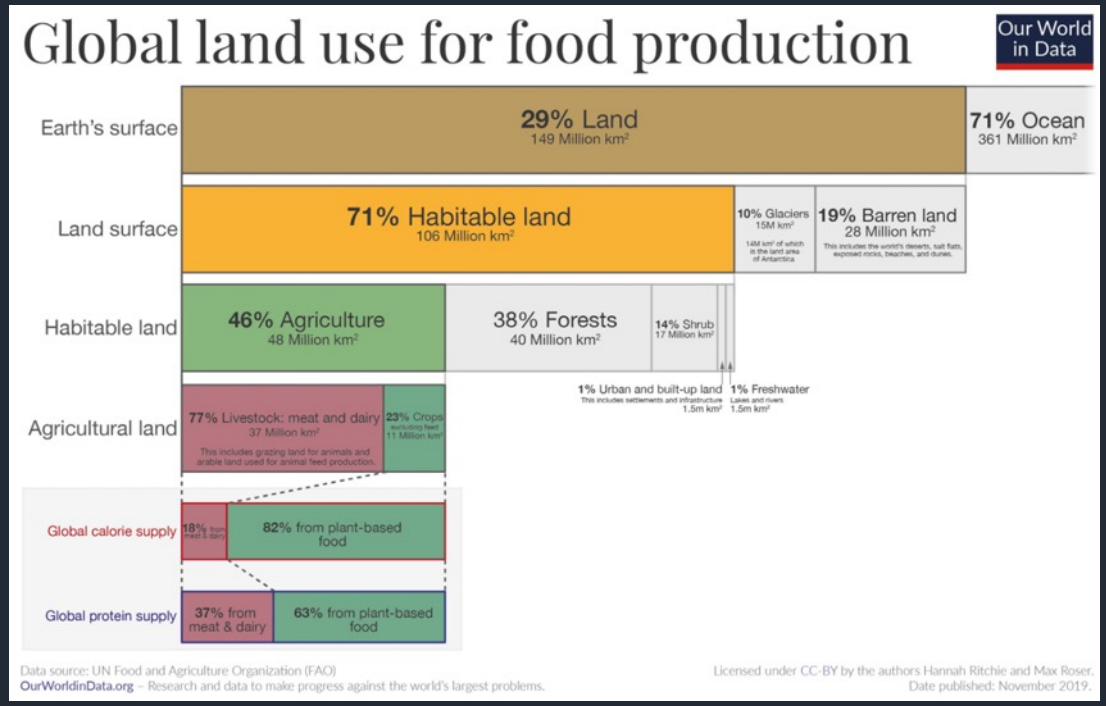
- The study covered the following areas of payload and mission design:

  - Optical systems design and requirements derivation.
  - Baseline optical design against requirements.
  - Electronics feasibility and baseline architecture.
  - Satellite conceptual design including CONOPS and key budget analysis.
- All study work packages were completed successfully.

CEOI feasibility study.

- Image coverage assumptions for data volume reduction.
- With such a wide swath and small GSD, the GIS payload can generate vast amounts of data. We will only download commercially valuable data using the following assumptions:

- 50% average cloud cover and that cloudy data is not downlinked.
- No data to be recorded of seas or oceans.
- Only image ‘Built up’ and ‘Agricultural’ areas, as these are commercially valuable.
- Agricultural areas are imaged at a lower GSD by selectively binning pixel data.
- A compression factor of 4 is assumed as an average lossless ratio given all land types.



CEOI feasibility study.

- Optical systems: Key study activities.
  - Payload CONOPS definition
  - Detector selection
  - Focal plane array concept and optimisation
  - SWaP estimates
  - Radiometric model analysis (SNR feasibility etc).
  - System level MTF budget analysis
  - Payload subsystem requirement derivation.
  - Satellite level requirement derivation for satellite feasibility assessment.

- Optical systems top level results:
  - Swath of 200 km is achievable
  - SNR >100:1 is achieved in blue red and NIR bands, Green band SNR is >70:1 at saturation albedo = 0.7
  - System MTF >7% @ 1m GSD
  - Payload mass = 50 kg with 20% margin
  - Payload peak power use = 110 W.

CEOI feasibility study.

- Optical design:

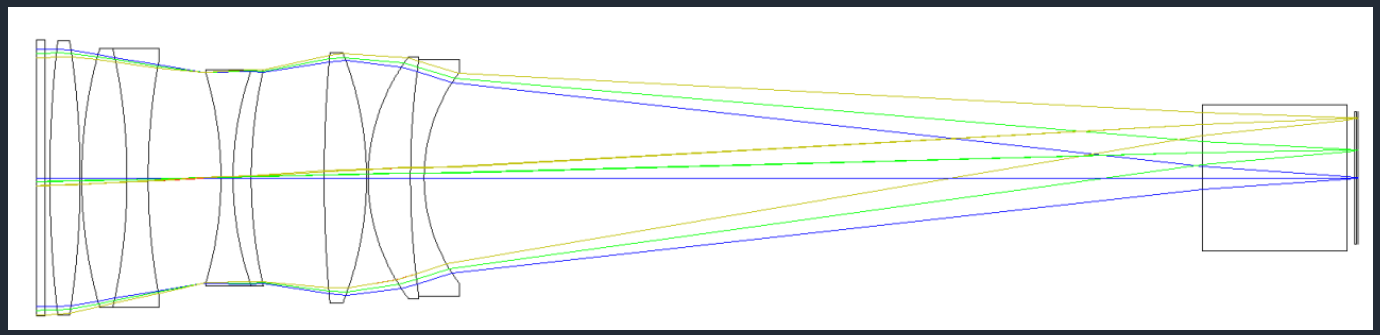
- Produced a baseline geometric design that meets derived requirements.

- Confirmed the lens design is buildable using existing assembly and alignment methods via tolerance analysis.

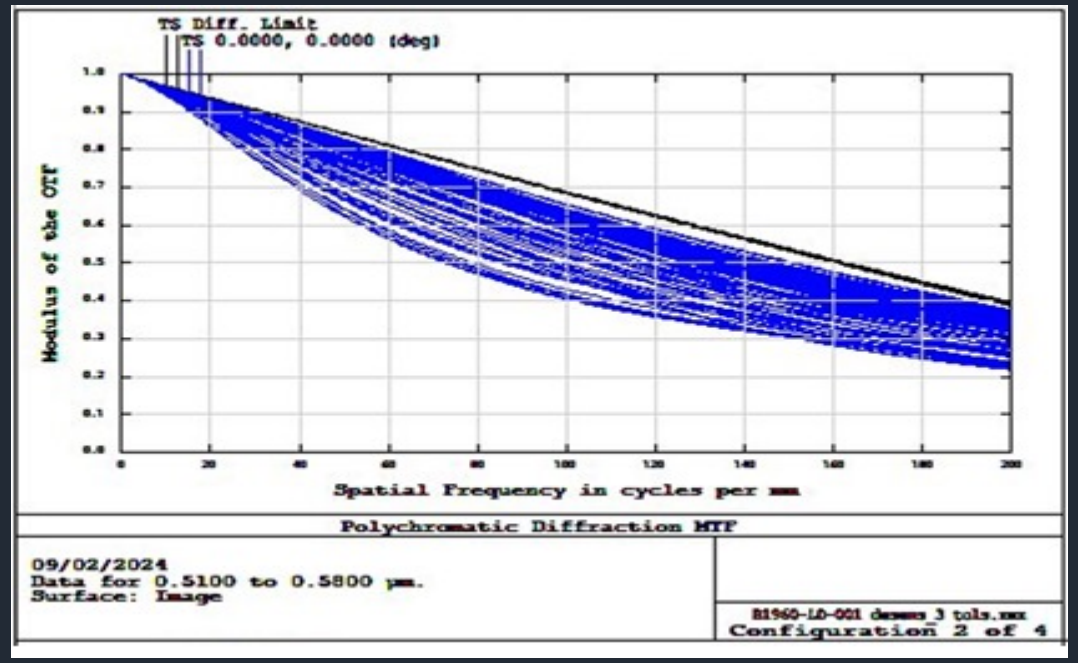
- Confirmed the lens design is athermal over a 10 ^{o}C operational temperature range.

- The baseline design was found to meet all derived requirements.

Lens design ray trace

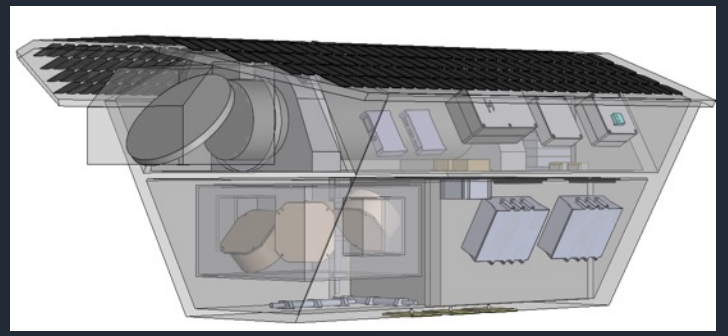


Montecarlo tolerance analysis, MTF plots.

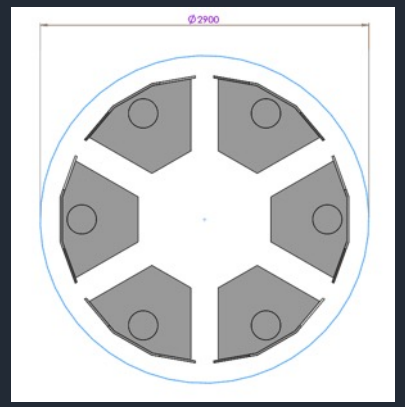


CEOI feasibility study.

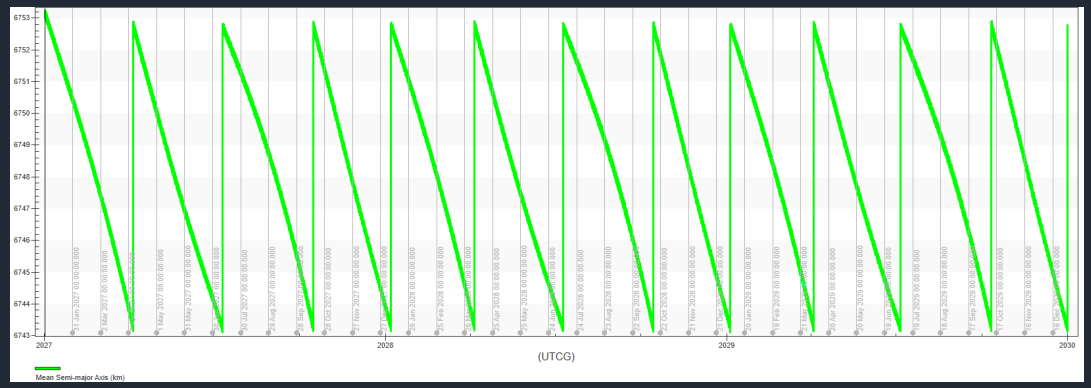
- Satellite design: Performed by In-space Missions.
- Baseline design completed successfully against derived requirements.
- Mass = 270 kg.
- Satellite dimensions are 1.7m (l) x1.1m (w) x 0.7m (h).
- Power and data budgets close for the satellite lifetime. Svalbard and Troll GSNs were assumed.
- Significant delta V is required to maintain orbit for 3.5 years. Drag analysis and propulsion system design show this is feasible.
- Future work will look to reduce cross-section area further to reduce delta V required or increase lifetime.



ISM platform CAD



6 sats on PSLV



Altitude raising over lifetime.

Next steps.

- With mission feasibility confirmed, the next steps will focus on Detailed design activities.

- These include:
  - Elegant breadboards or EM's of key payload subsystems.
  - Payload optical and opto-mechanical design to a PDR level.
  - Payload electronics design to a PDR level.
  - Maturation of the satellite design including:
    - Subsystem location optmisation and reduction of cross-sectional area.
    - Mechanical and thermal analyses.
    - Possible improvements to AOCS control loop algorithms.

Thank you for your attention.

- **GIS USP 1m GSD over 200 km swath from small satellites!**

- For further information please contact:

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  - GIS and ISM would like to thank CEOI for funding our study and for their help throughout the project.

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