

TRANSFORMING LIFE FROM SPACE



ENVIRONMENTAL
RESPONSIBLE
LAUNCH

GNOSIS:
Sustainability in the
space environment

ENVIRONMENTAL RESPONSIBLE LAUNCH

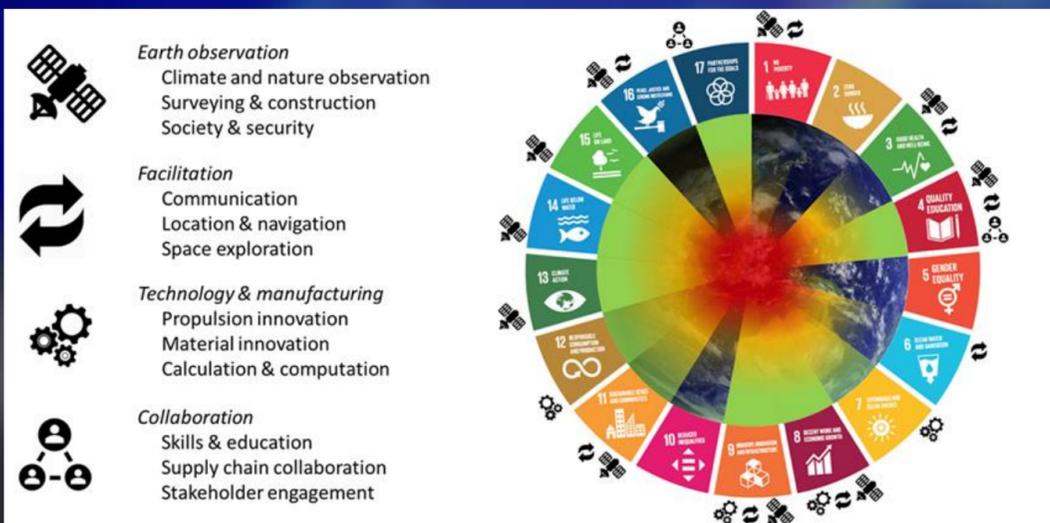
Overview:

- SUSTAINABILITY FROM SPACE
- SUSTAINABILITY OF SPACE
- SUSTAINABILITY IN SPACE
- Space as a Service: focusing on environmental launch and responsible ADR
- Taking responsibility for ourselves, and for others
- How to be nostalgic about tomorrow's Space?



ENVIRONMENTAL RESPONSIBILITY

SUSTAINABILITY FROM SPACE



From their unique vantage point, satellites provide key lines of scientific evidence to understand how our Earth is changing.

- Satellites are used to detect the smallest changes in key metrics – atmospheric concentration, sea temperature, sea level height, ocean currents, ocean winds, forestry.
- These are used to improve scientific models which form the basis for real action;
- Data from satellites reap the benefit of uniformity across borders, continuity across decades and rapid data collection – a matter of minutes.
- UNOOSA: “Earth Observation” to help achieve SDG’s
- More Sats = more environment data?

ENVIRONMENTAL RESPONSIBILITY

SUSTAINABILITY OF SPACE

Address and respond to the problems currently facing the continued safe use of space.

- An estimated 900,000 objects larger than 1cm in diameter, and 128m fragments larger than 1mm, are already in Earth's orbit.
- Active Debris Removal:
 - SSA/ SST/ SDA data- whose data is the best?
 - How to achieve uninterrupted (continuous) responsibility from launch through to end of life?
 - How to identify unknown unknowns?
 - How to achieve a rational sober understanding of the problem of ADR without hysteria?
 - 1 in 2 out principle...?
 - WHAT ARE WE DOING ABOUT IT- not just talking!
- *FINDING PROSPERO CHALLENGE*

ENVIRONMENTAL RESPONSIBILITY

SUSTAINABILITY IN SPACE

Minimising and offsetting environmental impacts of space activities.

- Industry recognized need for an environmental impact assessment of space activities: NASA/ UNOOSA/ UKSA- Viasat vs FCC
- Few measurements exist for ozone depletion related to space activities;
- Move towards less damaging propellant or sustainable power sources;
- How to enforce responsible behaviour?
 - Code of responsible, environmentally committed behaviours

STRATEGIC VISION

*Skyrora's vision is to integrate the entire space-enabled value chain in one holistic **Space-as-a-Service (SPaaS)** provided to global end-users across a range of industries including defence, telecom, aviation, consumer, agriculture, scientific and climate management.*

An intelligent synthesis will enable Skyrora to utilize the economies of scale and synergies between different solutions and technologies to deliver high added value to end users and generate maximum ROI for investors



SKYRORA

We will contribute to securing the future of Earth by enabling environmentally conscious access to space



Skyrora is a New Space enterprise, manufacturing responsive, versatile and dedicated 3-stage satellite launch vehicles to make space more accessible



Aim to deploy payloads of 315kg to Polar and Sun-Synchronous orbits with launches from Scotland

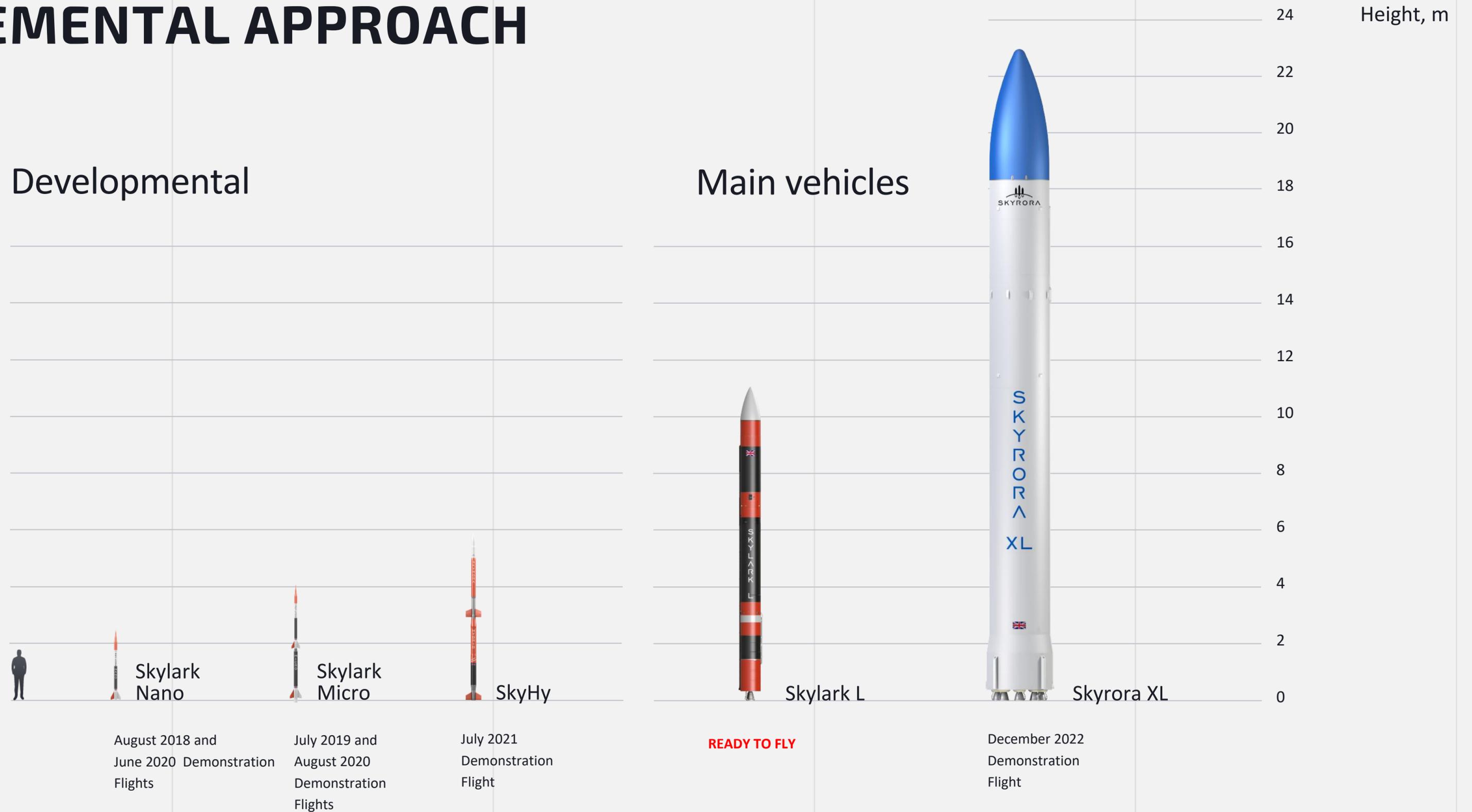


British space heritage, reinforced by R&D centers in Ukraine & EU



All-in-one service and associated support provider from satellite launch to its in-orbit management (refueling, relocation, de-orbiting, etc)

INCREMENTAL APPROACH



SKYRORA XL USPs



Quick and simplified access to space



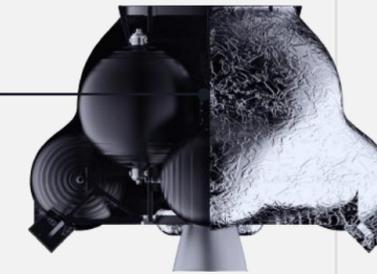
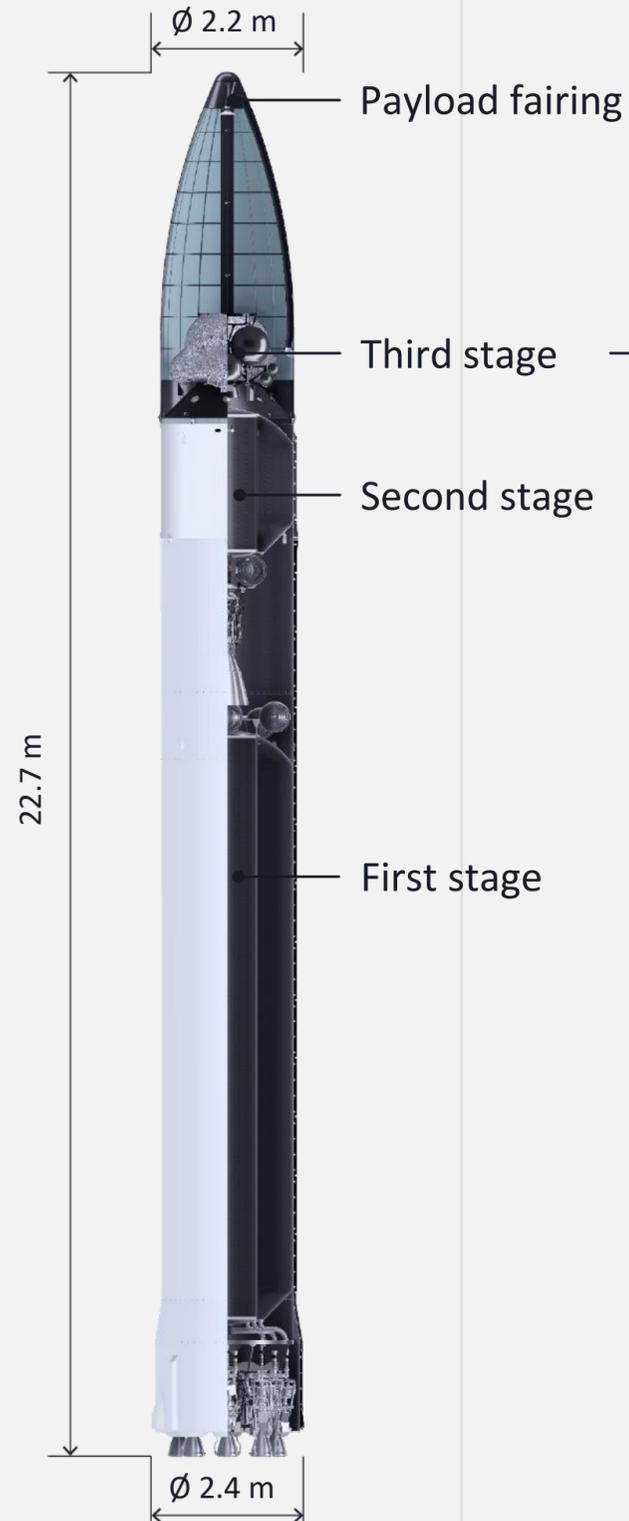
Eco-friendly launch



Low G-loading



In-orbit maneuvering



Reignitable third stage

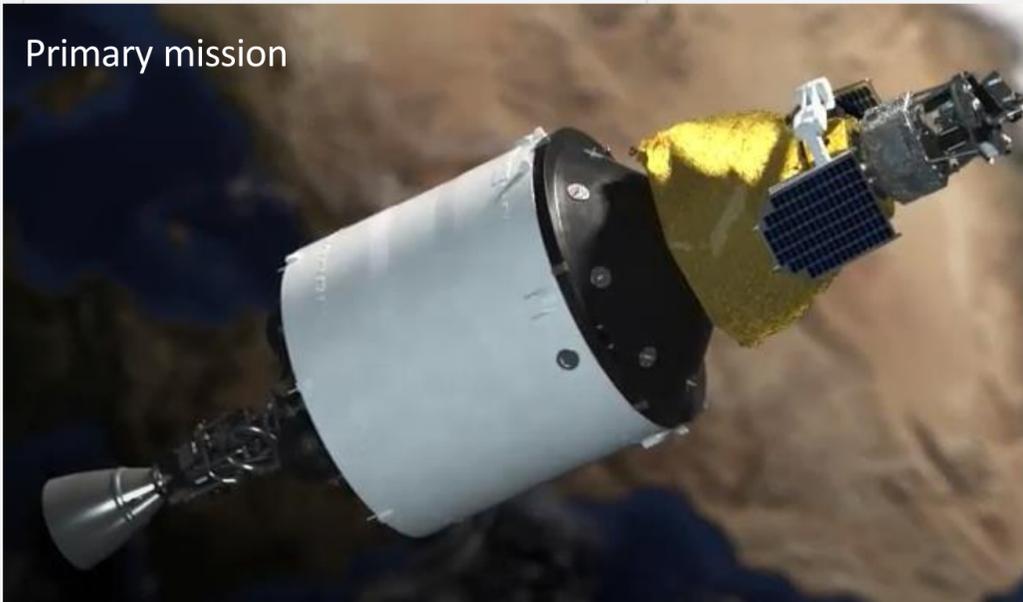
Propellant components:
HTP and Kerosene

Thrust (in vacuum):
3.5 kN

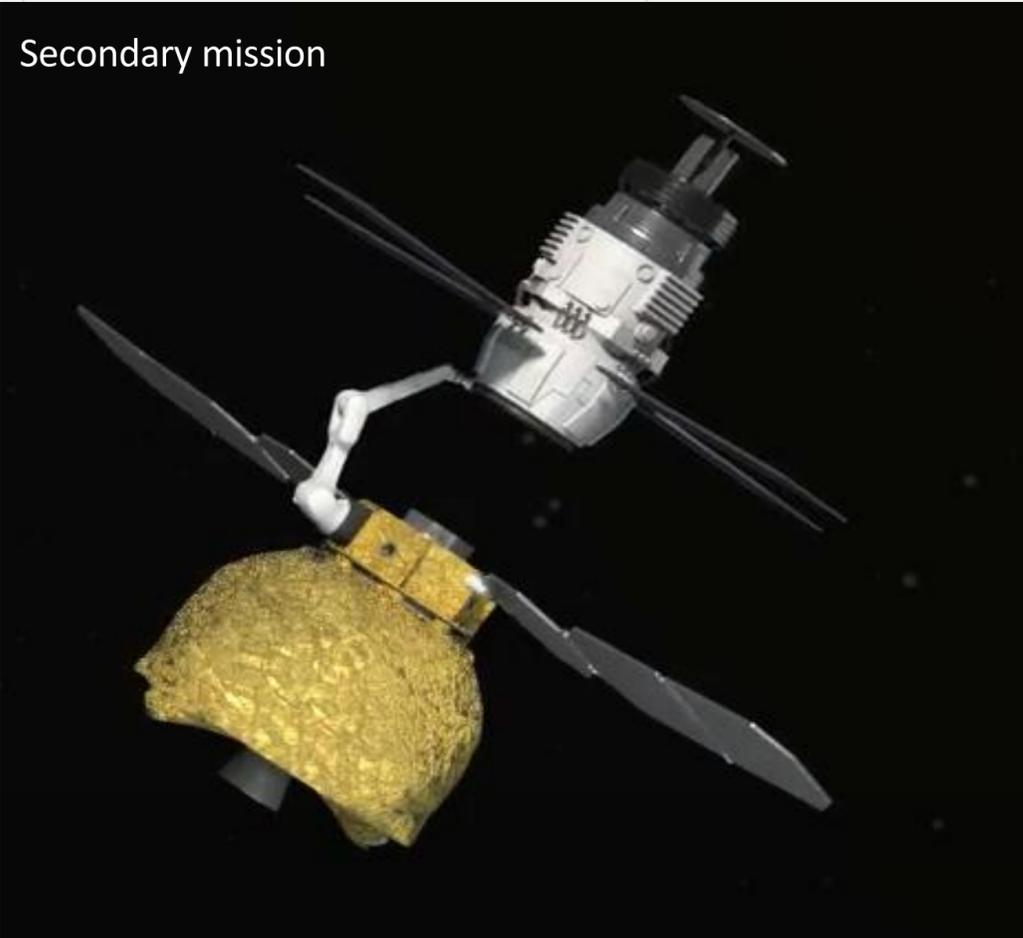
Exhaust velocity (in vacuum):
3,004 m/s

Payload mass
315 kg

THIRD STAGE / SPACE TUG



Primary mission



Secondary mission

December
2020

Full mission duration static fire test (450 second burn over 3 firings) has been successfully accomplished at our engine development complex in Fife, Scotland

The test verified propellants and compressed gas filling technology, operation of propulsion system, fuel system, pressurisation system, telemetry recordings

Primary
mission

Delivering the payload in LEO orbit from a wide range of altitude and orbit inclination

Secondary
missions

Correcting satellite or spacecraft orbit

De-orbiting space debris

Refueling satellites or spacecrafts

Lunar orbits or interplanetary missions

GROUND SEGMENT

Mobile launch

Easy storage

Scalable

Personnel safety – used propellant are not-toxic, not-cryogenic, not self-ignition

Full-autonomous (can be operated independently)

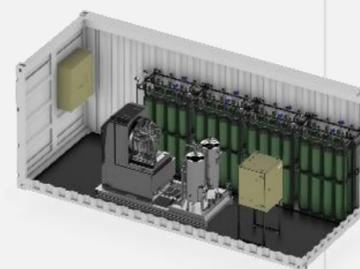
Fuel filling system



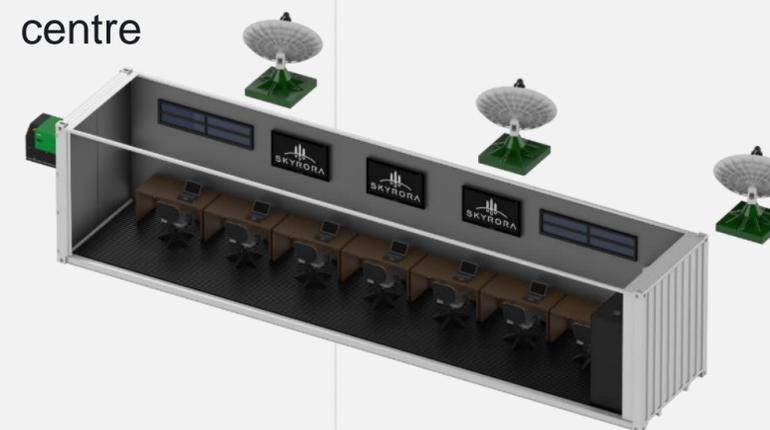
Oxidiser filling system



Compressed gas supply system



Command centre



Mobile power station



Transporter erector launcher



SKYRORA TECH IN-HOUSE



LV and spacecraft assembly, integration and test building



Skyrora Test Stand — Across, Scotland 2020



- High pressure tanks
- Avionics
- Fly termination systems
- Recovery programs
- Procurement
- Software programs
- Telemetry systems
- Safety and security management
- Antennas
- Propulsion subsystems
- Carbon Wrapping
- HTP distillation

TECH IN-HOUSE. ECOSENE. ECO FUEL

Ecosene is innovative kerosene made of waste plastics and upgraded to be used as rocket fuel

Using Ecosene over traditional Kerosene for 16 launches per year saves up to 720 tonnes of unrecyclable plastic every year

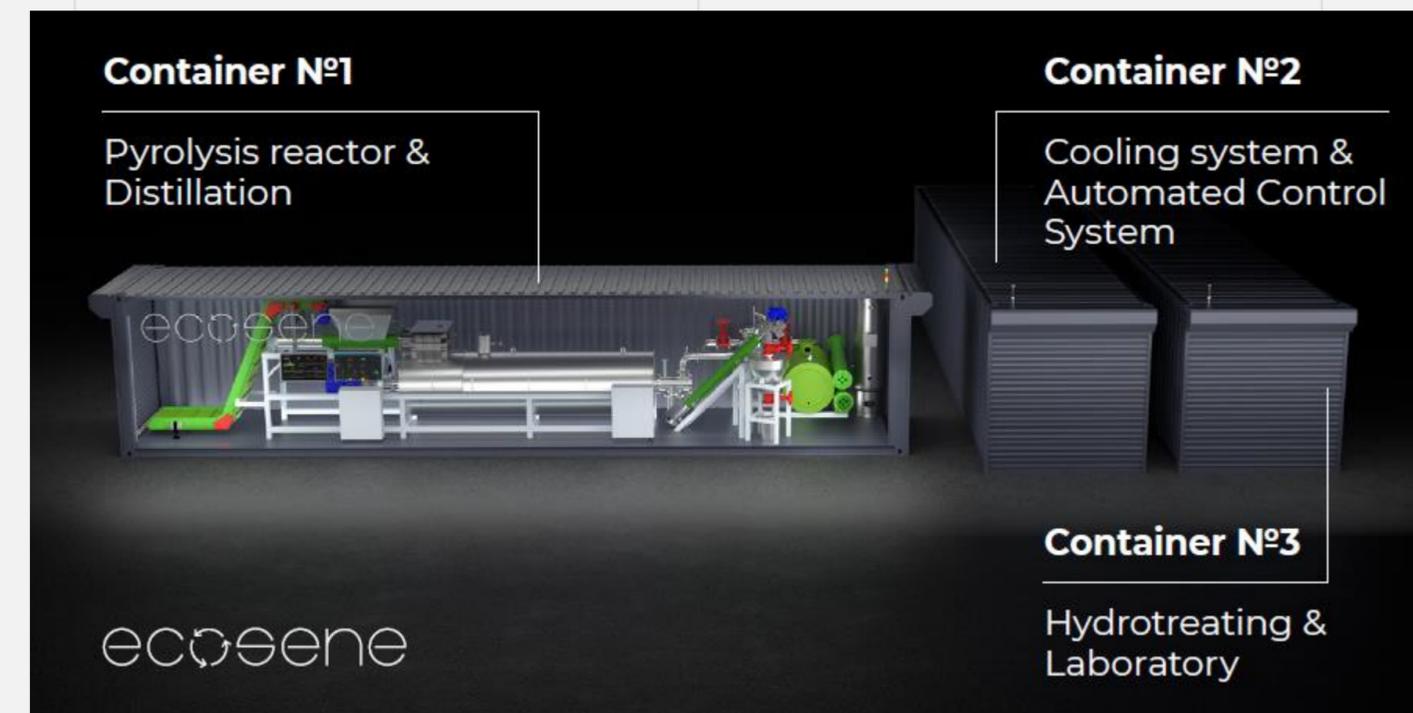
720+ Metric tonnes of plastic recycled per year

96X Lorries per year

Successful test firing have been held for 350 kg (Leo) to compare kerosene and Ecosene. Result: Ecosene is 1% - 3% better than kerosene by its energy characteristics

ecoseene

	Ecosene	RG-1	RP-1	Jet A-1
Density at 15, °C	775.1	833±3 (20C)	801...815 (20C)	775-840 (15C)
Sulphur, %	0.0001	0.01	≤0.05	≤0.25
Freezing point, °C	-58.9	-60	-37.8	-47



TECH IN-HOUSE ADDITIVE TECHNOLOGY

Scottish spaceports

5-axis hybrid 3D printer capabilities include:

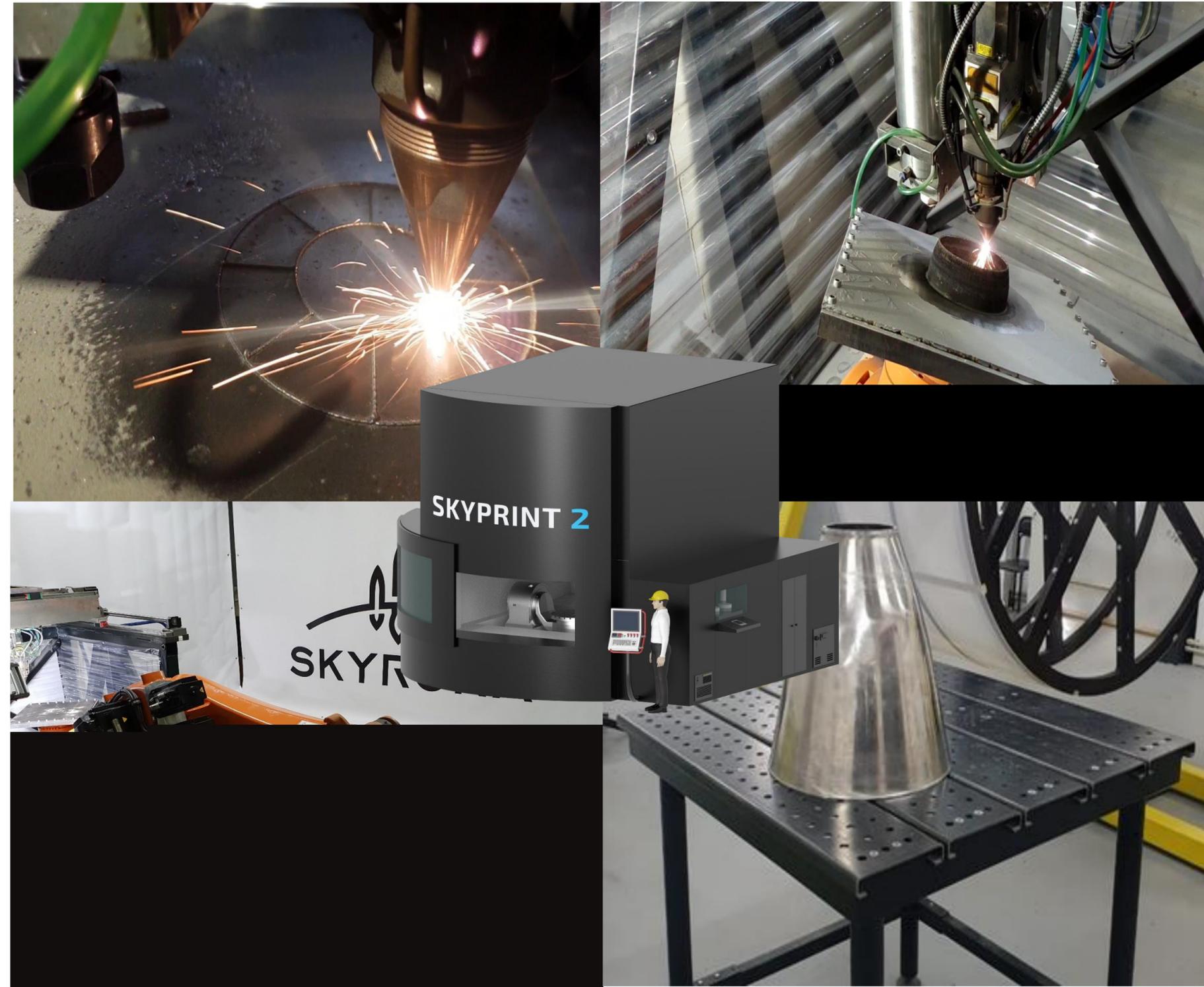
All products are printed from superalloy

CNC Machine head + 3D DED printing technology parts manufacturing and post-machining

Print accuracy 0.1 mm

Printable area size 2100×2370×1270 mm

Printing speed 125 cm³/h



TAKING RESPONSIBILITY FOR OURSELVES & FOR OTHERS

The Black Arrow projectile had lain at its crash landing site in the South Australian outback for 48 years. Skyrora recovered and transported the artefact over the 10,000 mile journey.

It's now displayed at FAST Museum where it inspires a new generation of scientists and engineers.

FINDING PROSPERO – is a challenge we are looking to coordinate, with the UK industry demonstrating responsibility, and environmental sustainability through collaboration



HOW TO BE NOSTALGIC ABOUT TOMORROW'S SPACE? THE FIRST 50!

Celebrating 50 years of UK being in SPACE, with the Black Arrow R3 Launch on 28th October 1971, the UK Space Industry has a unique opportunity:

- to celebrate our collective Space heritage;
- to come together to collaborate and demonstrate the UK as a responsible launch nation;
- to establish the principles of sustainable, responsible and environmentally acceptable behaviours
- And demonstrate a commitment to **DOING SPACE BETTER**

To be allowed to enable access to SPACE (launch) for the United Kingdom in 2021/ 2022



SKYRORA TODAY

The first UK static fire test in 50 years completed successfully in May, 2020



Supported by:



The strongest team

Full tech in-house

Mobile modular launch pad

LOIs and launch contracts for £500m

Privately funded company

Dedicated Versatile Responsive

Environmental & Sustainable



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