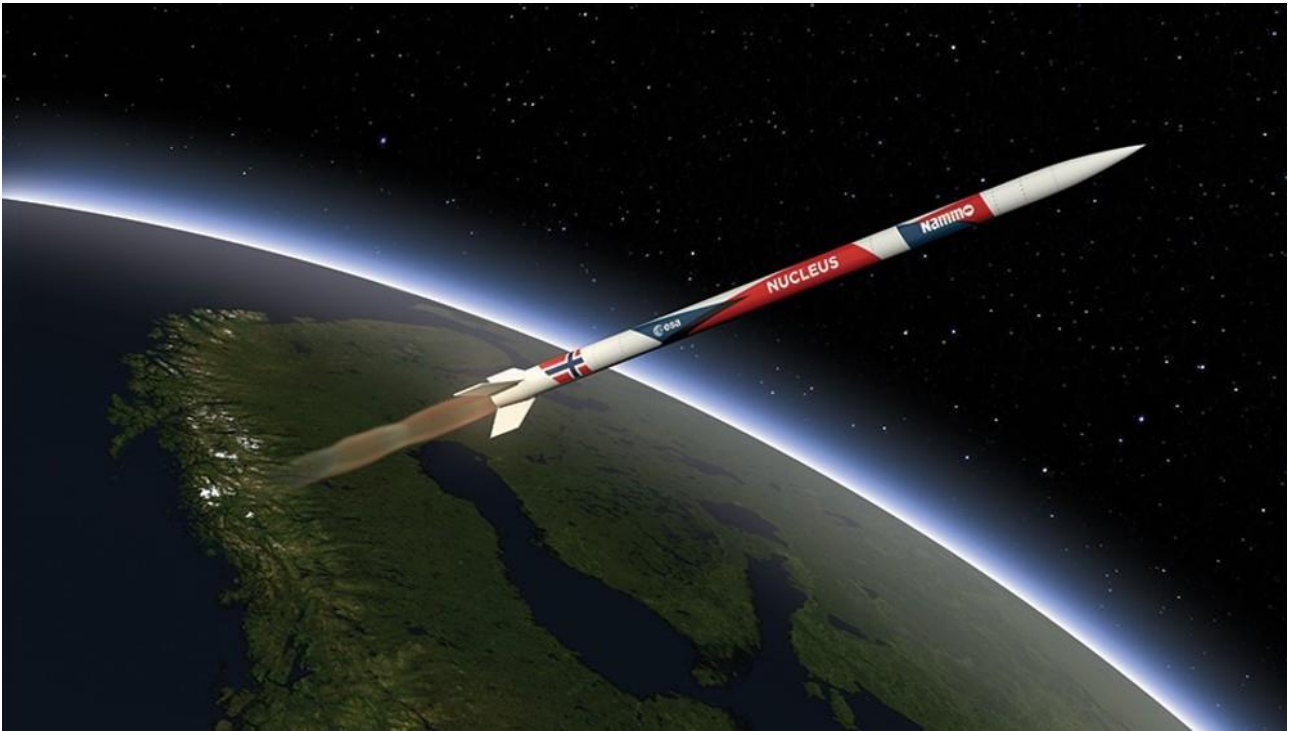


# Nucleus Sounding Rocket



**Nammo Space AS** has developed and flown the **NUCLEUS SOUNDING ROCKET**. The highly successful maiden flight was witnessed by many on 27<sup>th</sup> September 2018, from the Andøya Space Centre in northern Norway.

Starting from the baseline of a flight proven sounding rocket, the Nucleus product line is being developed to deliver experiments and spacecraft to an apogee of up to 1000 km. Each of the Nucleus products is planned to be a single stage delivery system.

Nucleus SC is the Standard Configuration

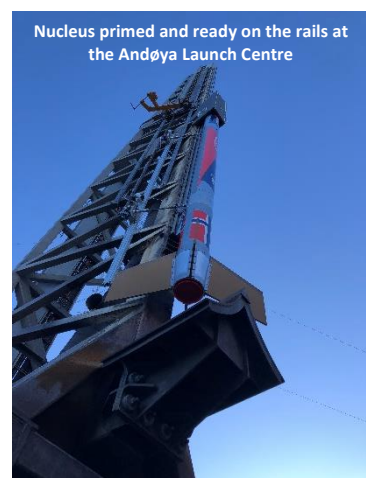
which is ready for procurement. At the core of this vehicle is the Unitary Motor 1 [UM1], which delivers 30 kN of thrust and a low energy environment when compared to the solid propulsion solution.

Nucleus NEO is currently in development and is being designed to give an additional 50% payload capacity, which can be delivered to a higher altitude.

The final version of this workhorse, Nucleus XL, will come on stream in 2027 and will be aimed at insertion into a 1000 km apogee, with 150 kg nominal payload mass.

This performance will be achieved with the upgraded UM2 engine, at 100 kN of thrust.

The UM2 engine will also be one of the building blocks for the NorthStar nano-Launcher.

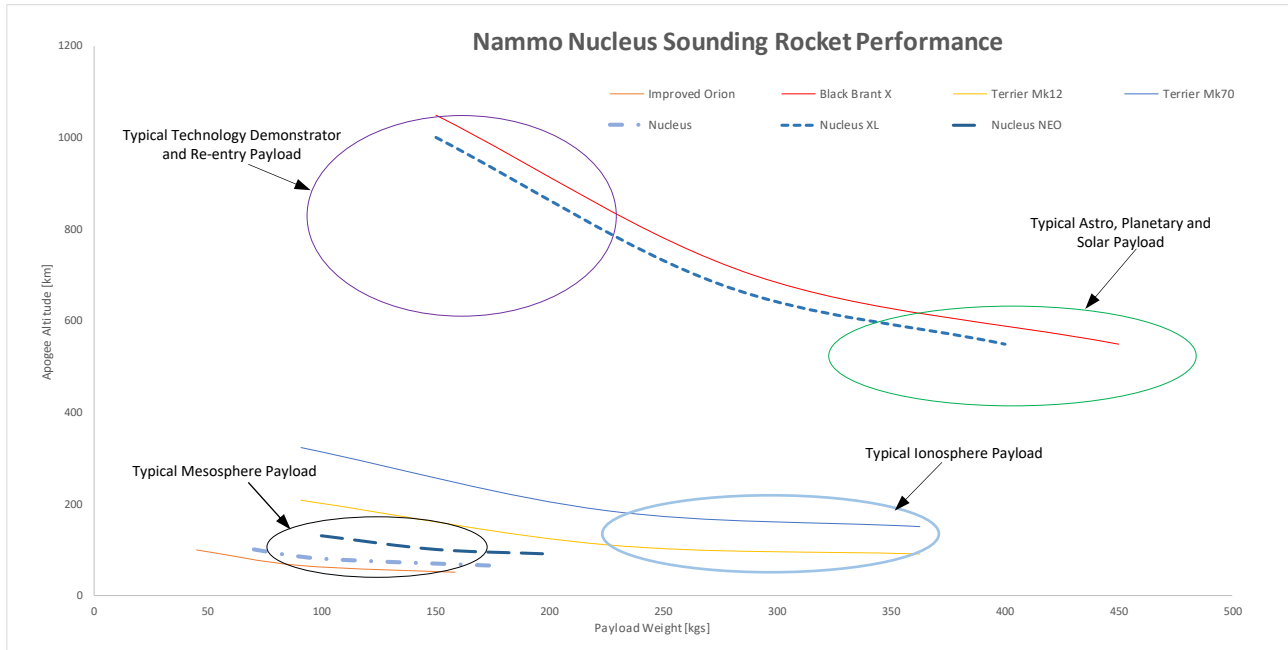


# Nucleus Sounding Rocket

Parameter	Nucleus SC	Nucleus NEO	Nucleus XL
Total lift-off mass (wet)	820 kg	820 kg	4 t
Overall Vehicle Length	9.5 m	9.5 m	12 m
Payload Diameter	360 mm	360 mm	410mm
Nominal Payload Length	2 m	2 m	2 m
Rocket Diameter	360 mm	360 mm	650 mm
Total Payload Module Mass (inc service module+fairing)	70 kg	100 kg	150 kg
Apogee	100 km	130 km	1000 km
Microgravity Level	Not Applicable	Not Applicable	High quality
Microgravity Duration	Not Applicable	Not Applicable	13 min
Guidance System Details	Not Applicable	Per customer request	Per customer request
Recovery System Details	Not Applicable	Per customer request	Per customer request
Land Recovery	Not Applicable	Per customer request	Per customer request
Water Recovery	Not Applicable	Per customer request	Per customer request
Number of Stages	1	1	1
1 <sup>st</sup> Stage Detail	1 x UM1	1 x UM1-NEO	1 x UM2
Engine Thrust	30 kN	30 kN	100 kN
Engine Type	H <sub>2</sub> O <sub>2</sub> -HTPB hybrid	H <sub>2</sub> O <sub>2</sub> -HTPB hybrid	H <sub>2</sub> O <sub>2</sub> -HTPB hybrid
Stage Propellant Feed	Pressure fed	Pressure fed	Turbopump fed
Stage Thrust	30 kN	30 kN	100 kN
Stage Peak Acceleration	< 7 g	< 7 g	< 20 g
Stage burn time	40 s	40 s	100 s
Spin Rate	< 4.6 Hz	< 4.6 Hz	Not applicable
Spin Stabilisation	Yes	Yes	No
Video Channels	4	Per customer request	Per customer request
Downlink System	2x 5W S-Band RF links 3,3Mbit PCM data stream Analog video stream	Per customer request	Per customer request
Instruments On-board	Magnetometers, accelerometers, Camera, IMU, Baroswitches, Temperature, Pressure	Per customer request	Per customer request
Technology Readiness Level	TRL7	In development	Next Nammo Development
Timeframe for Availability	2020	2022	2027

Nammo is ready to take account of customer needs and requests for tailored specifications and unique performance needs.

# Nucleus Sounding Rocket



Typical uses for the Nucleus product are as follows, but not limited to:

**Nucleus SC and Nucleus NEO**

- Mesosphere research
- Technology Demonstrator Platform
- Missile Defense Systems Target Practice
- Student outreach

**Nucleus XL**

- Ionosphere research
- Student outreach
- Microgravity Experiment
- CubeSAT demo platform
- Missile Defense Systems Target Practice
- Re-entry Demonstrator Flight

Here you can see the development testing of the UM1 engine, which is ready and available for flight. Nammo has extensive production and test facilities located in Raufoss, Norway.



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