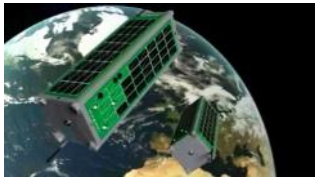

Q@TS study &
ArianeGroup way forward
ESA FLPP workshop
November 6, 2018

01
INTRODUCTION

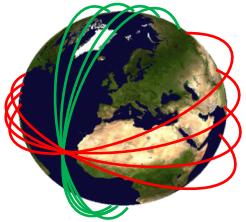
Q@TS INNOVATIVE MICRO-LAUNCHER IN A NUTSHELL

Launch Service
Payload 100 kg @ SSO orbit



Hybrid Propulsion
Green Propellant H_2O_2
Engines: NAMMO (Norway)

Orbits
SSO and LEO equatorial

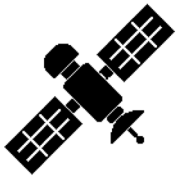


Competitive launcher
Launch price: 2 M$ for 100 kg

High launch rate
at least 22 launches per year
(Full exploitation phase)

Time to Market
4 year development time

MARKET DEMAND 2018-2028



450-500 satellites

8t – 10t

300 M$

Average Yearly forecast

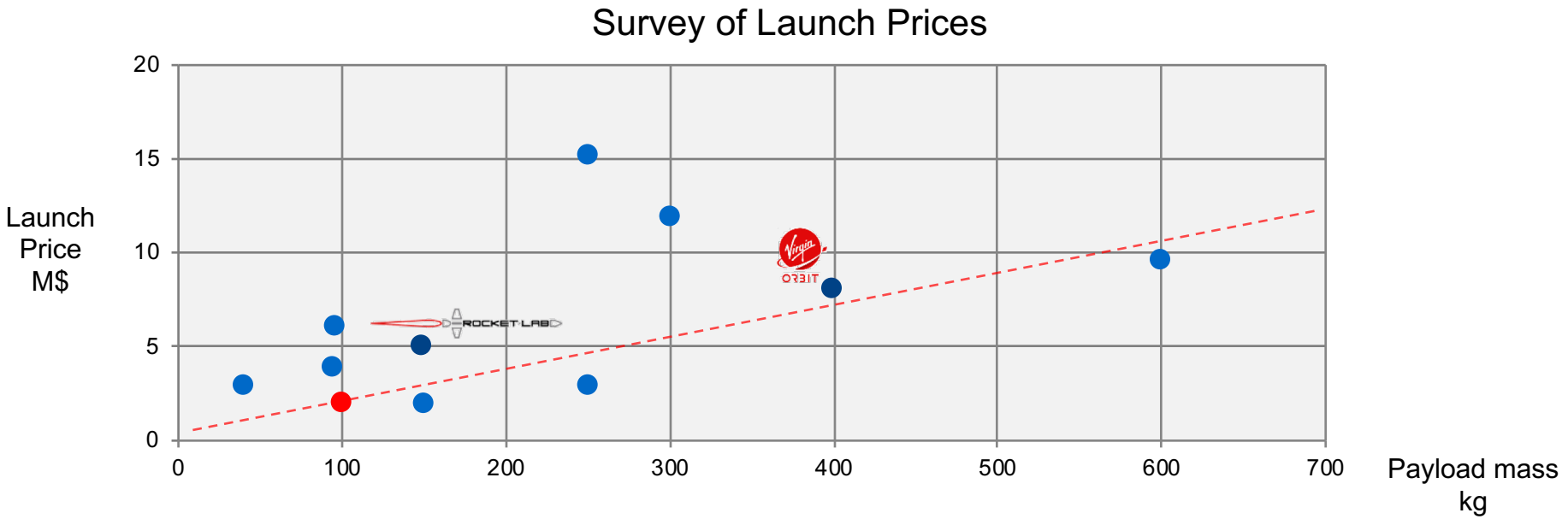
Class 4 1-25 kg	**Class 3** 25-60 kg	**Class 2** 60 kg-200 kg
40 %	40 %	20 %

% of financial volume

Standard	**Education**	**Constellations**
10 %	15 %	75 %

% of financial volume

MARKET OFFER



60+ micro-launchers announced
Various levels of credibility / flexibility
Price objective for Q@TS: 2 M$ for 100 kg – 20 k$/kg

BUSINESS PLAN

Dedicated entity, with strategic partners for propulsion and spaceport

Price: 2 M$ for a 100 kg payload

Partnership with several private or public investors to mitigate risks

Complementary to MLS/SSMS and building on Arianespace network

⇒ Ambitious but realistic hypotheses in order to secure a viable and profitable business plan on a 10 year project (development included)

ECOSYSTEM AROUND Q@TS

Ecosystem Assessment
Space Policy
Market Intelligence

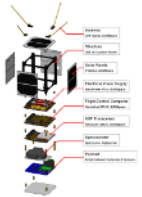
ADVISORY

START UP
Events/Conferences
Incubators/Accelerators
Fundings/Coaching

EDUCATION

Training
Mentoring, Internship

Space Ecosystem



CAPACITY BUILDING
CubeSats Design & Manufacture
Space Data Center/Applications

Up to 100 kg
SSO and equatorial orbits
Door-to-Space

LAUNCH SERVICES

INFRASTRUCTURES

Constellation CubeSats AITC
Training Center
Launch pads

02
TECHNICAL CHARACTERISTICS

MAIN CHARACTERISTICS

Mass: 25 t

Height: 17 m

Diameter:

- Rear skirt: 2500 mm
- Main body: 1800 mm

3 stages:

- 1st stage: 8 engines
- 2nd stage: 2 engines
- 3rd stage: 1 engine

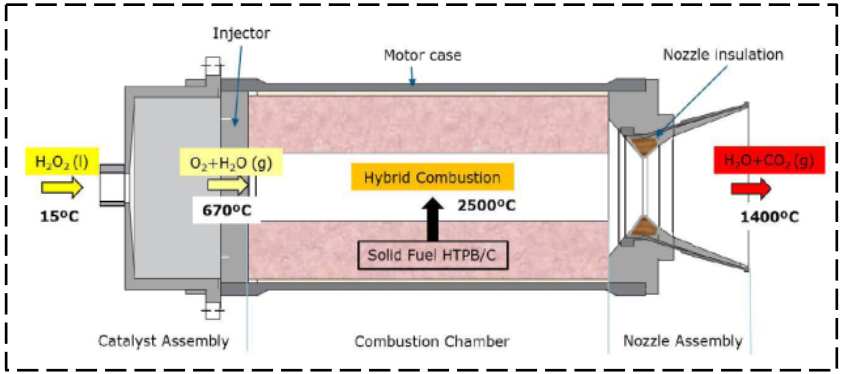
Oxidizer: H_2O_2 at 87.5% concentration

Fuel: HTPB

Turbo-pumps. Aluminium structures for tanks.

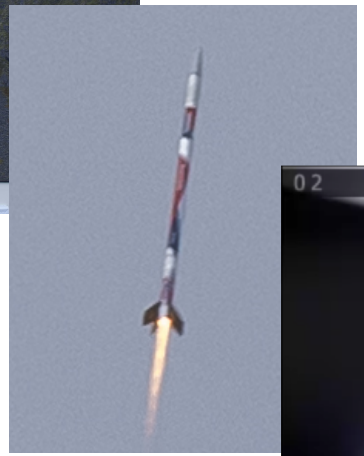
NAMMO HYBRID PROPULSION

- **High density, green and storable oxidizer**
- **Solid inert fuel** with high mechanical properties,
- **Self-ignition** without any ignition device,
- **Stop, re-start** and wide **throttling** capabilities,
- **Environment friendly**,
- **High** engine combustion **efficiency**, performance and stability,
- **Simplicity** of a single circular port and single feedline configuration,
- **Low** development and operational **costs**



IN-FLIGHT PROPULSION TEST

September 2018:
Successful launch of **Nucleus**, propelled by a 30 kN hybrid propulsion engine



flpp

03
GROUND INFRASTRUCTURES

SPACEPORT

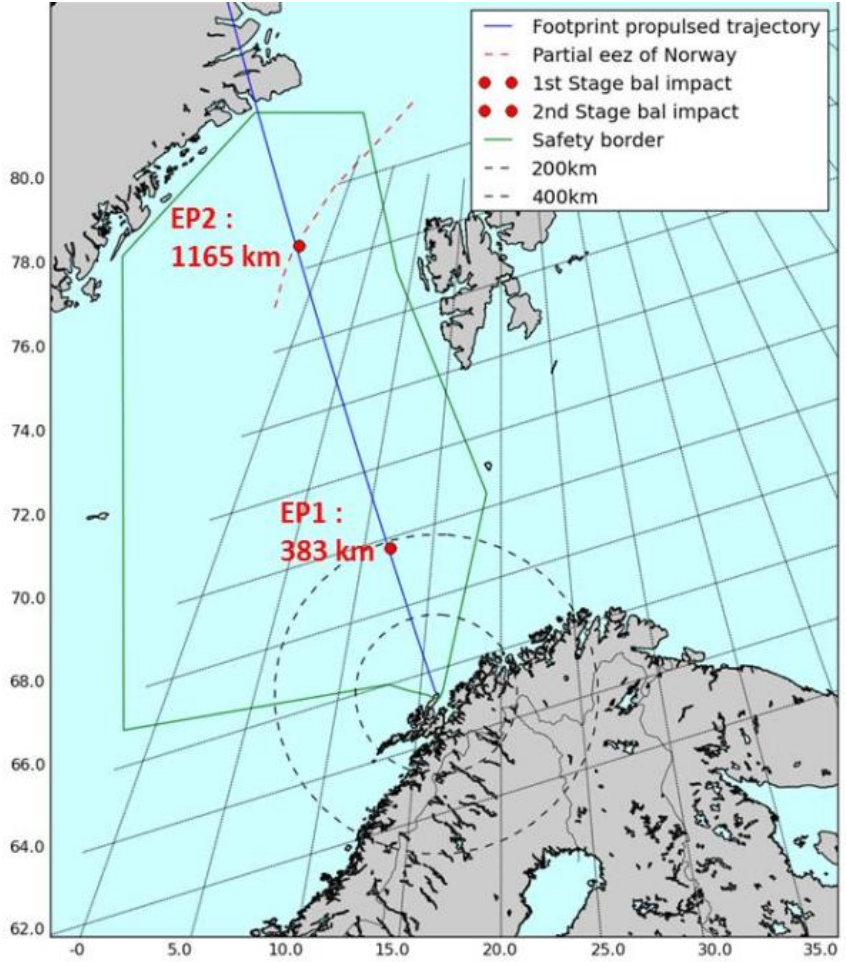
ANDØYA SPACE CENTER

Reference spaceport: Andøya

- Very active launch site for sounding rockets average of 25 launches per year
- Ideal location (latitude 69.3°N) for SSO missions

Opportunity for multiple spaceports

- Increase SSO launch rate
- Allow LEO equatorial missions




Q@TS
Q@TS

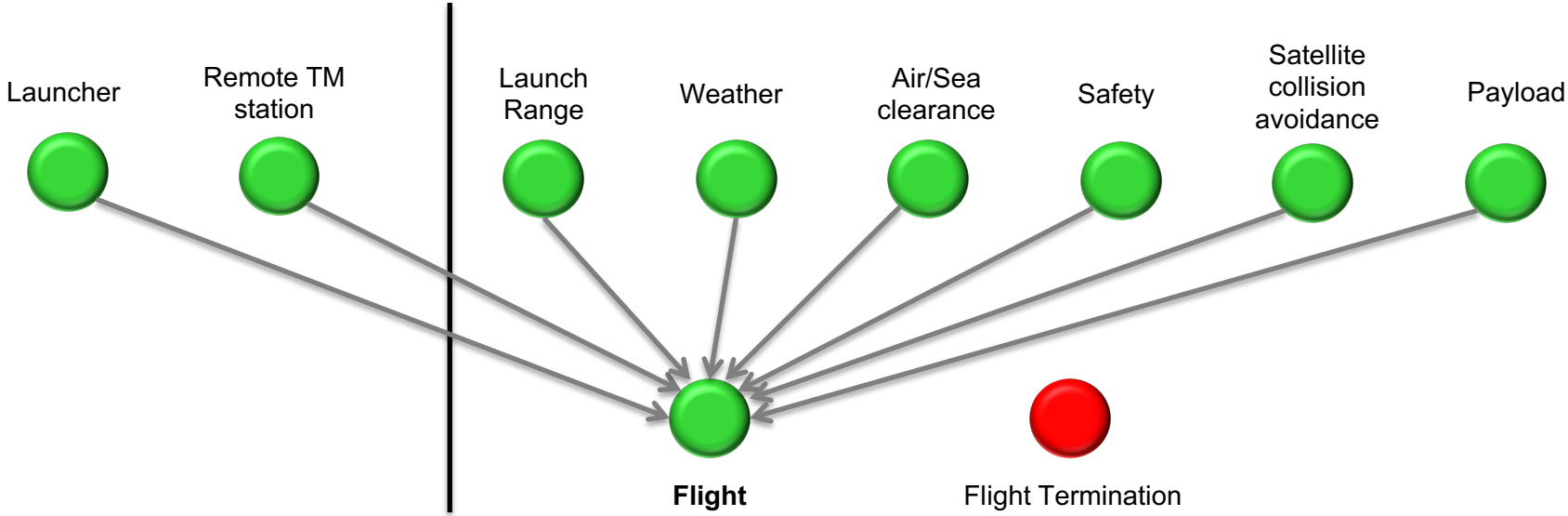
REMOTE CONTROL CENTER

ArianeGroup
Launch Operator

Remote Launcher Control Center

Spaceport – Launch Authority

Spaceport (Launch Complex + Launch Range)



Thank you!

We wish to thank

- **ESA** for the opportunity of completing this study
- Our study partner **Nammo** for the outstanding work and great collaboration

04

ARIANEGROUP WAY FORWARD

ARIANEGROUP SMALL LAUNCHER CONCEPTS

Several projects explored by ArianeGroup with few main guiding objectives

- **Disruptive and scalable** to find positive business case
- **Participative / open-innovation** approach with European partners
- **Innovative organization and financing** to reinvent ways of working

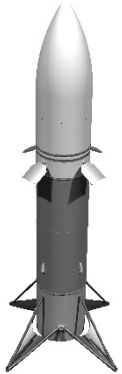
Reusable

Bavaria One
20kg -> 200 kg

Low cost

Q@TS
100 kg

Themis derivative

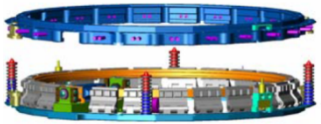


Commercial market

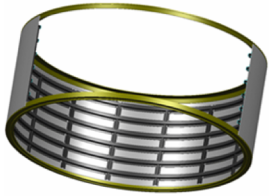
Bring technology maturation

TECHNOLOGY MATURATION PLAN

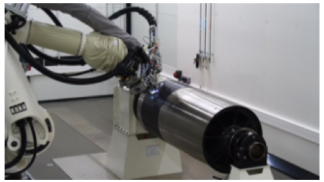
AG small launchers projects shall support maturation of key technologies for European launchers



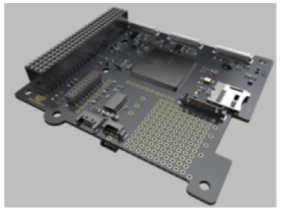
Non-pyrotechnic release and distancing devices



Composite inter-stage structures

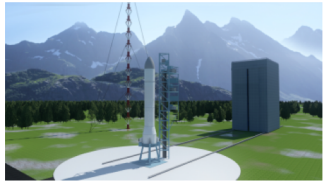


High-pressure composite tanks 50 bars



Low cost / low weight avionics

Secured Remote Control Center



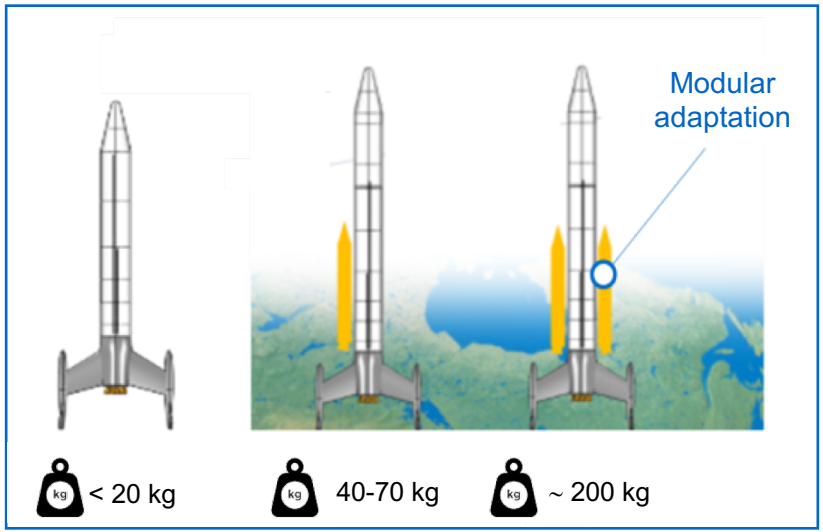
Generic Spaceport

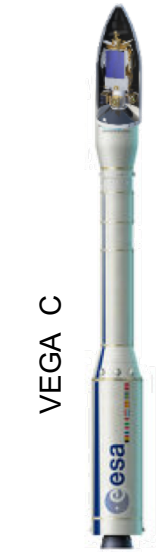
BAVARIA ONE – MINI LAUNCHER „MADE IN BAVARIA“

Lighthouse project „Mini-Launcher“

Development of mini launcher for cubesat missions → Feasibility of payload increase → Completion of the European launcher family

- Launch of mini satellites
- Orbital and sub-orbital payload strategy
- Involvement of industry, start-up and universities
- Modular launcher concept
- Maiden flight < 3 years
- Reinforcement of infrastructure with valuable jobs





2,300 kg SSO

> 20 t LEO

KEY FINDINGS

Difficult to find a sustainable business case on a purely private basis

- Microlauncher market still not confirmed for profitable dedicated flights
- Need for anchor customer (e.g. Vector / USAF in the US)

ArianeGroup is building cooperative approach in Europe to foster emergence of a disruptive and federative concept

- Instruct disruptive concepts which can bring profitable business case and benefit to Ariane evolutions, including reusability
- Embark partners in a cooperative / open-innovation approach across Europe and reinvent ways of working

#spaceenablers