

# Norwegian ESA IOD mission

Industry Day – August 31 2017

# Agenda

## Plenary meeting with Norwegian industrial/scientific actors

<b>09:00</b>	Norwegian IOD mission – the programmatical context	NSC
<b>09:30</b>	GSTP program context	ESA
<b>10:00</b>	Phase A/B system study – Norwegian IOD initiative – Procedure and Schedule	ESA
<b>11:30</b>	SmallSat Technologies, Future Applications and IOD Mission Roadmap	ESA
<b>12:00</b>	Lunch and start of discussions	All

## II. Plenary and bilateral discussions

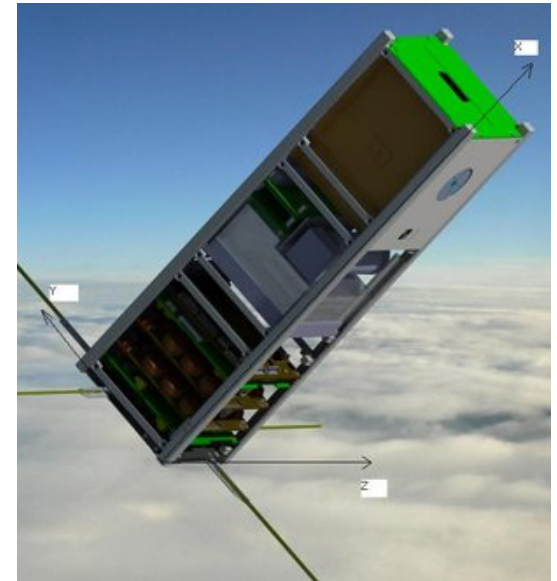
<b>12:00 - 15:00</b>	Plenary and bilateral discussions ESA, NSC with the Norwegian industrial/scientific actors	All
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## III. Wrap up and conclusion

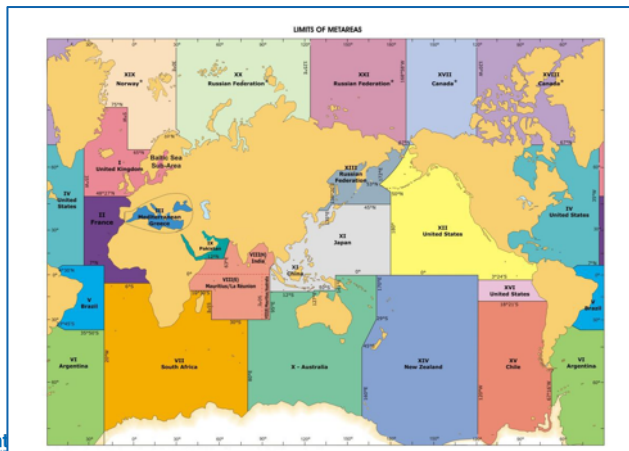
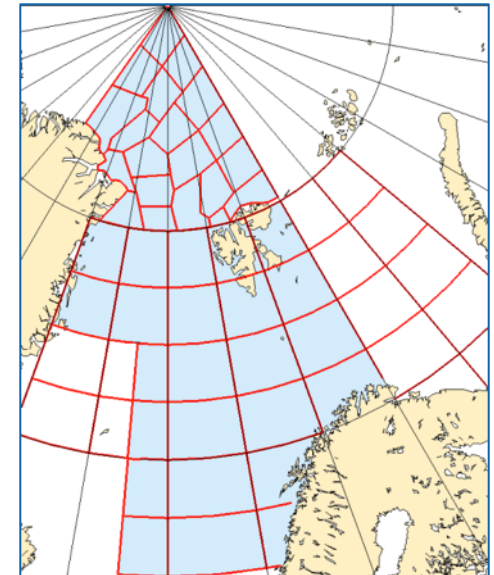
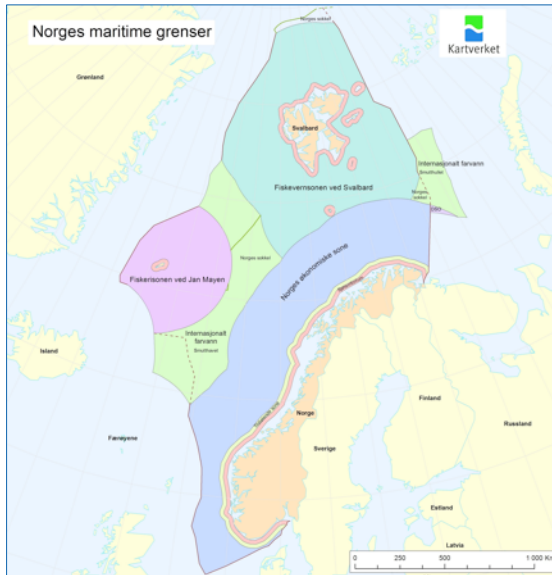
<b>15:00</b>	Conclusions	ESA, NSC
<b>15:30</b>	End of meeting	

# Meeting objectives

- › Inform Norwegian actors about a possible microsatellite Norwegian In Orbit Demonstration (IOD) mission, realized through ESA's GSTP :
  - Concept
  - Process
  - Objectives
- › Establish contact between ESA and the Norwegian actors
- › Allow actors to provide feedback early in the process
- › Answer questions

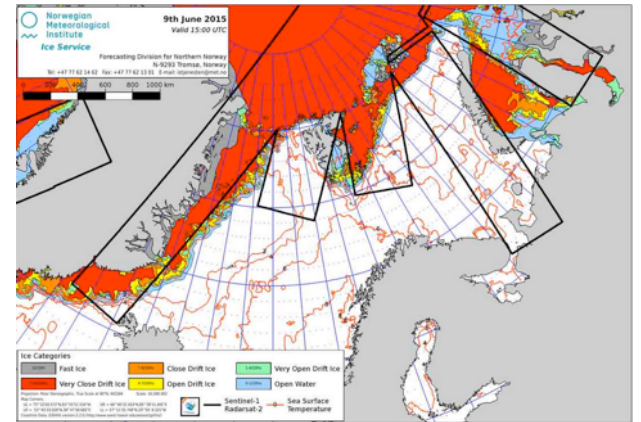
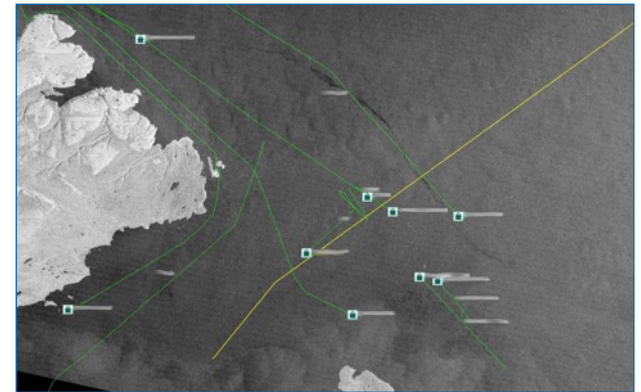
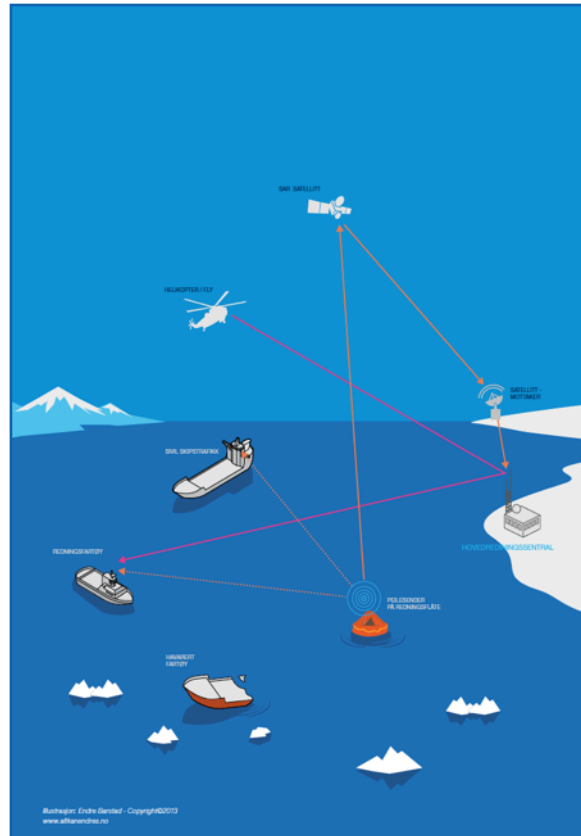
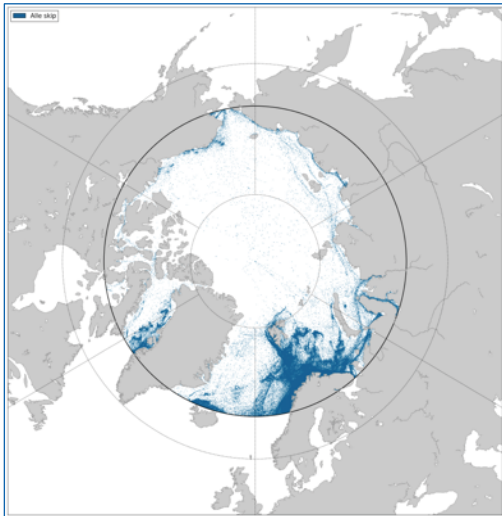


# Location, interests and responsibilities





# Need for an updated situational awareness



# Norway's maritime strategy

- Increasing activities in the North require improved infrastructure for ocean surveillance
- The use of space based systems are recognized by the Norwegian authorities as a cost effective complement to land, air and sea based means
- This is recognized in several government strategic white papers



# NewSpace



**Incumbent Space:**  
*Time of development:* Years  
*Price:* Hundreds of millions \$  
*Size and weight:* A mini-bus  
*Resolution:* - 30cm - 1m  
*Revisit:* once a day  
*Data Price:* > \$50/Km<sup>2</sup>

Vs.



**NewSpace:**  
*Time of development:*  
Months  
*Price:* Hundreds of thousands \$  
*Size and weight:* A mini-bar  
*Resolution:* - 1m - 2.5m  
*Revisit:* Many times a day  
*Data Price:* < \$0.25/Km<sup>2</sup>



Catapult Ltd 2015

# The precursors: AISSat 1,2 (3)

## > AISSat-1 : 12 July 2010

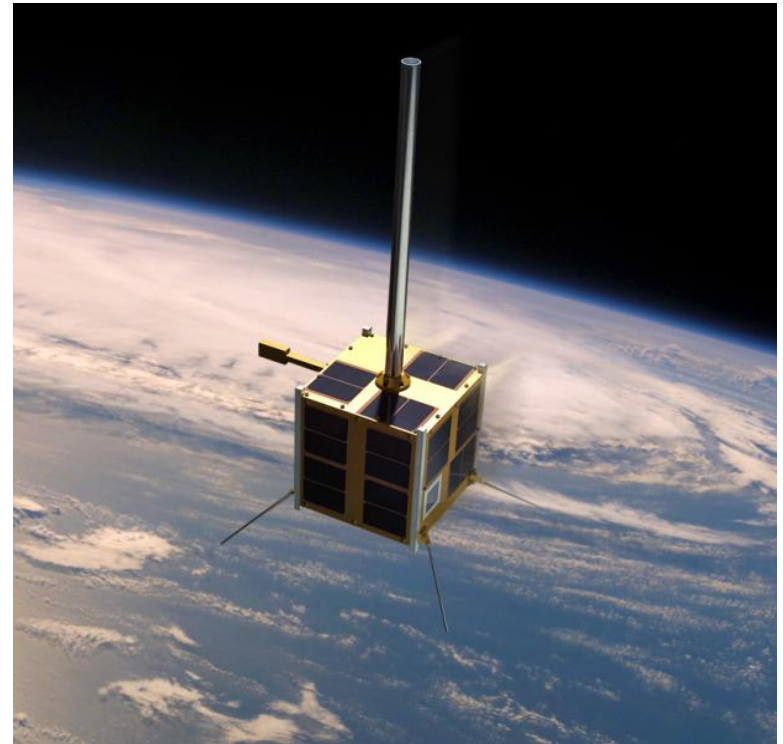
- Satish Dhawan Space Centre (SDSC) SHAR, Sriharikota
- PSLV-C15 rocket
- CARTOSAT-2B satellite

## > AISSat-2 : 8 July 2014

- Baikonour Cosmodrone
- Soyuz 2-1B rocket
- Meteor-M 2 satellite

## > AISSat 3 : Q4 2017

- Vostochny Cosmodrone
- Soyuz 2-1B rocket



# Benefits of national satellites

- Predictability on data access, coverage, reliability, quality and costs for users
- Industrial growth
- High socio-economic benefits
- Tool for international cooperation
- Tool for participation in international standardisation work (ITU, AIS, VDES, etc..)
- Development of system competences



# Opportunities

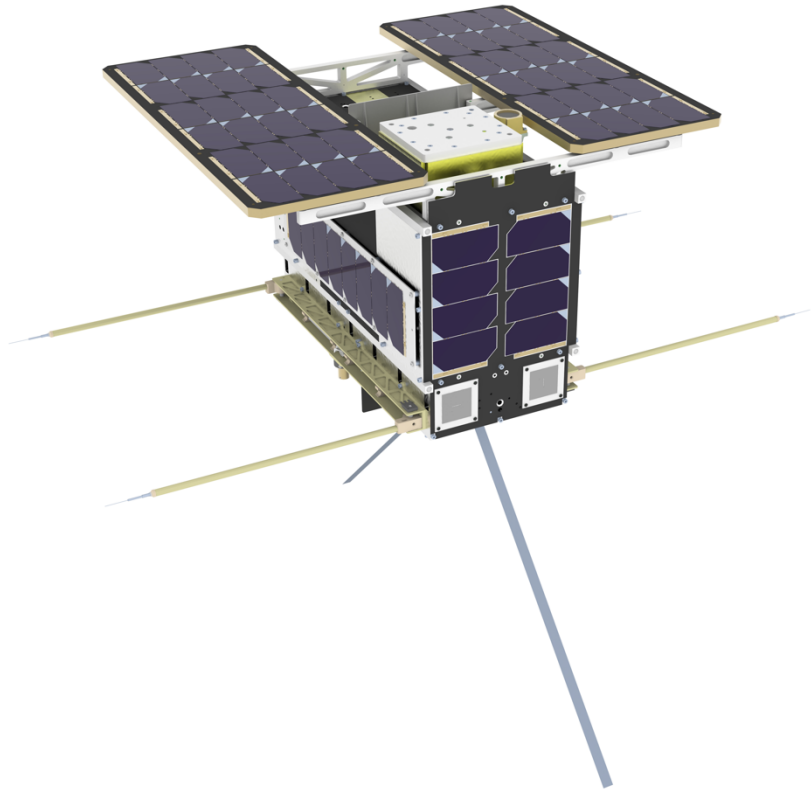
- › Increasing recognition of the benefits of microsat in Norwegian maritime administration
- › Increasing international attention and interest in using satellite data for maritime surveillance
- › Increasing number of providers of microsatellite platforms in different sizes and weights
- › Increasing number of programmes in ESA supporting industry in developing technology and business cases in the market for microsatellites
- › Increasing interest in Norwegian industry for microsat




# Challenges

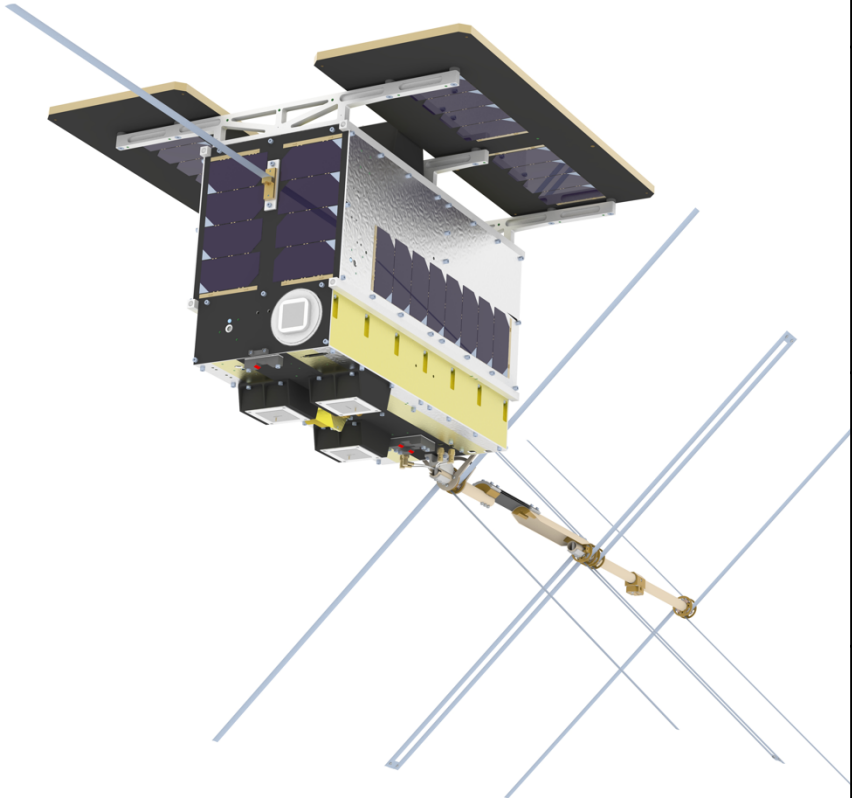
- › Launch services for appropriate orbits
- › Lack of funding from user groups in early stages of development
- › Lack of opportunities for industry to space qualify their microsat technology
- › Lack of cooperation among norwegian industry, research and academia
- › Lack of entrepreneurship, business development and private initiatives
- › Competition is hardening internationally



# NorSat-1



<p>Hoved oppdrags-giver</p>		
<p>Plattform</p>	<p>NEMO</p>	
<p>Hoved nyttelast</p>	<p>AIS mottaker</p>	
<p>Sekundære nyttelaster</p>	<p>CLARA solinnstråling</p> <p>m-NLP plasma /romvær</p>	

# NorSat-2



Hoved oppdrags-giver	 KYSTVERKET	
Plattform	NEMO	UTIAS 
Hoved nyttelast	AIS mottaker	 KONGSBERG seatex
Sekundær nyttelast	VDES sender/ mottaker	  FFI Forsvarets forskningsinstitutt  KONGSBERG 



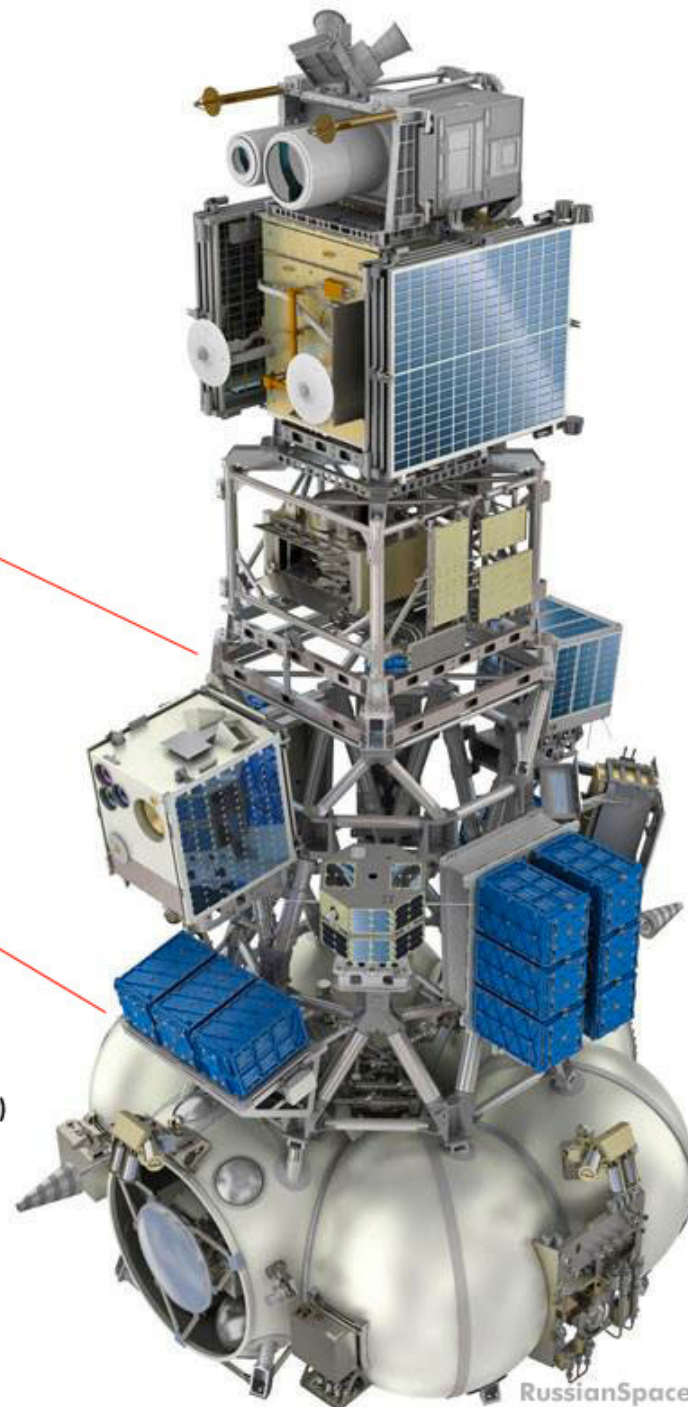




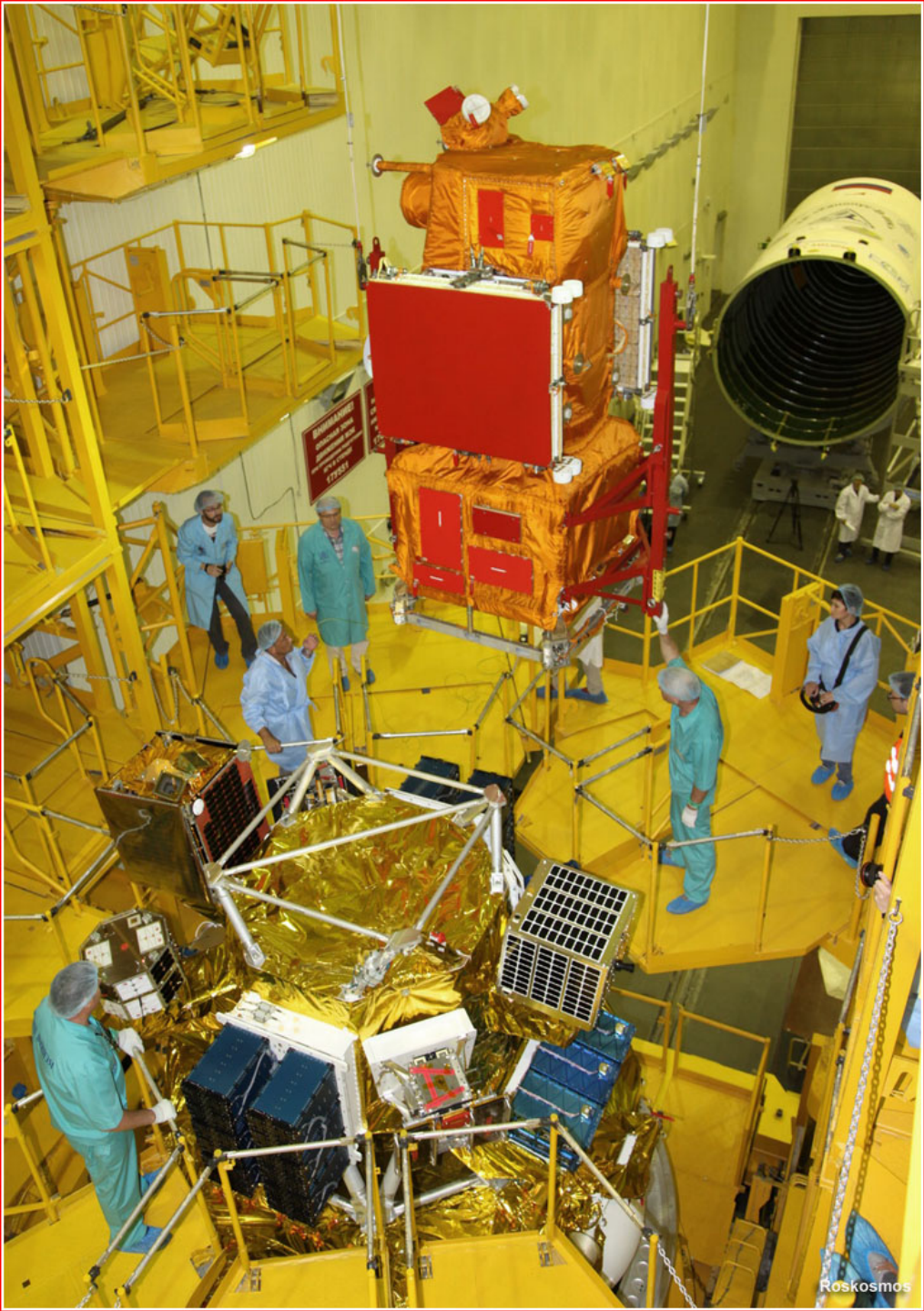
**Kanopus-V-1K**

**Secondary payloads**

**Fregat upper stage (space tug)**











**Lift off July 14th 2017,  
at 08:36:51 CET**





# First contact with ground station

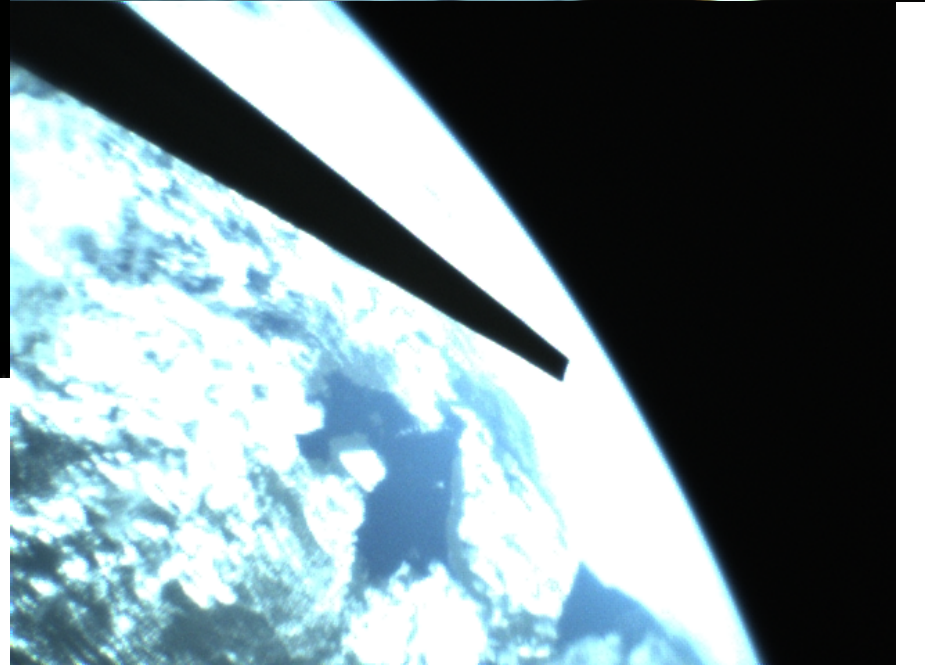
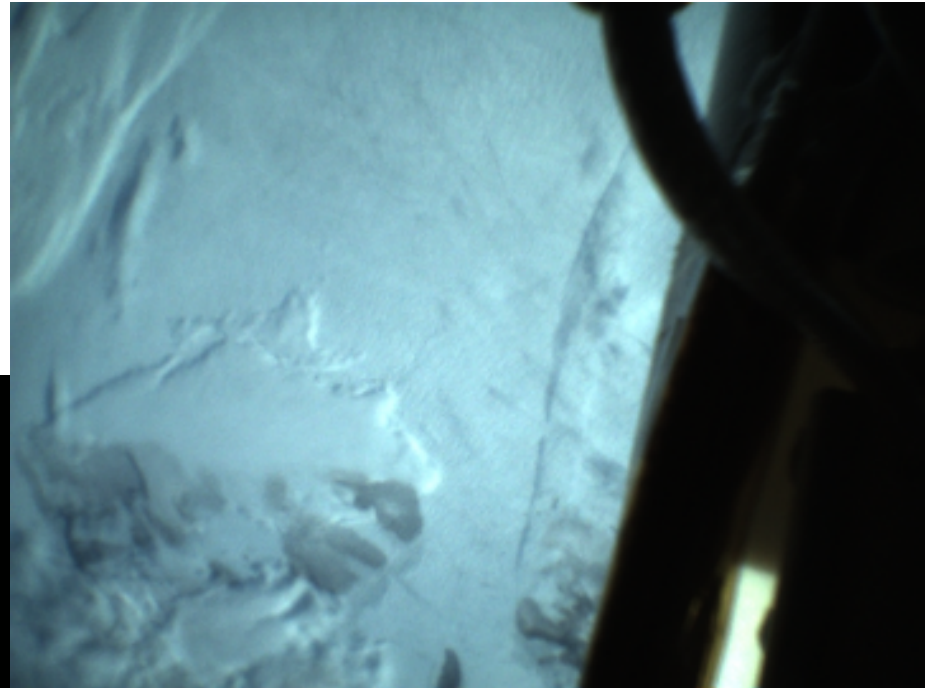
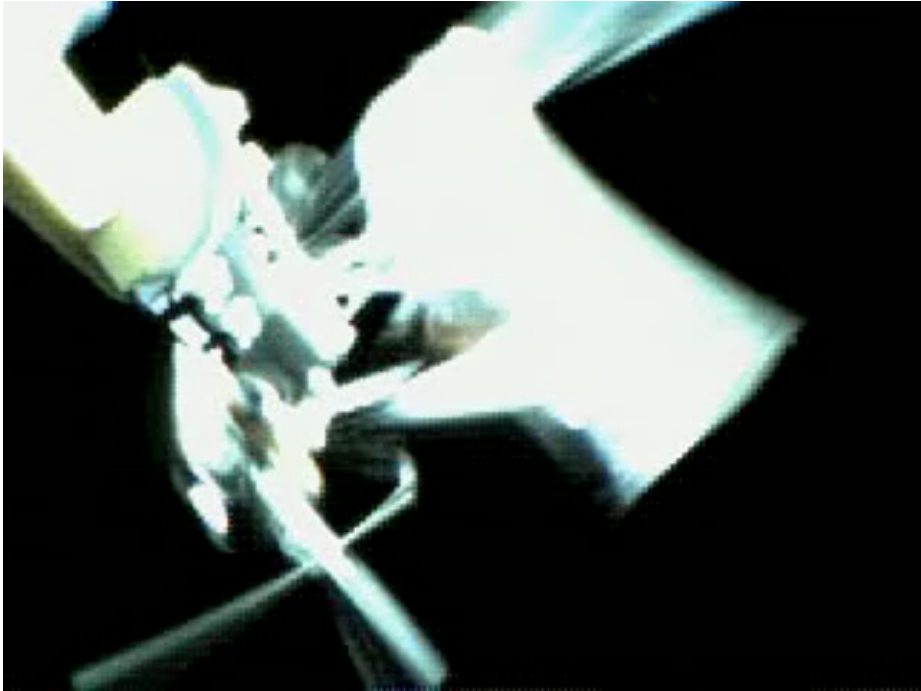
NorSat-1: kl. 11:54



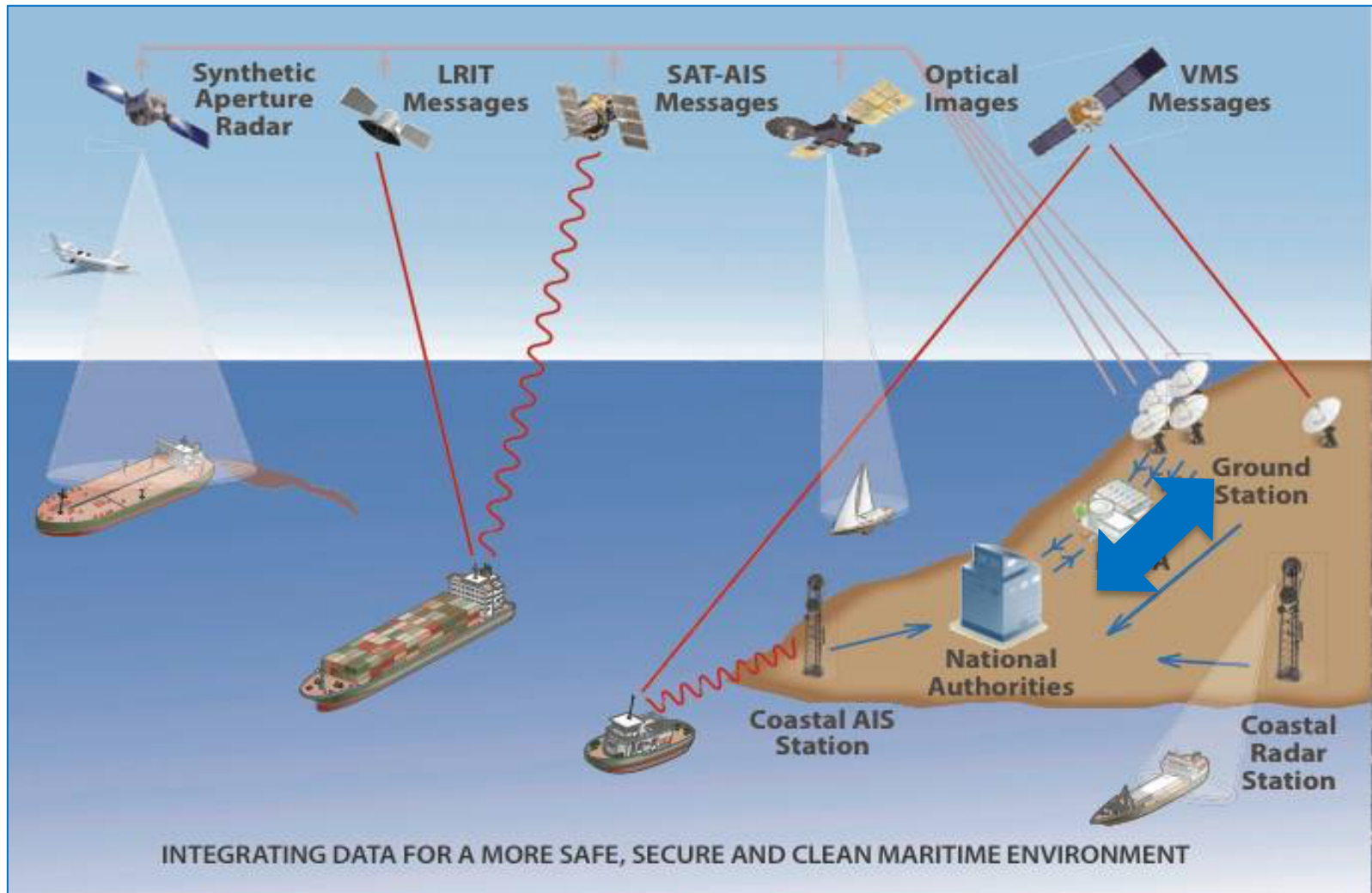
NorSat-2: kl. 11:52



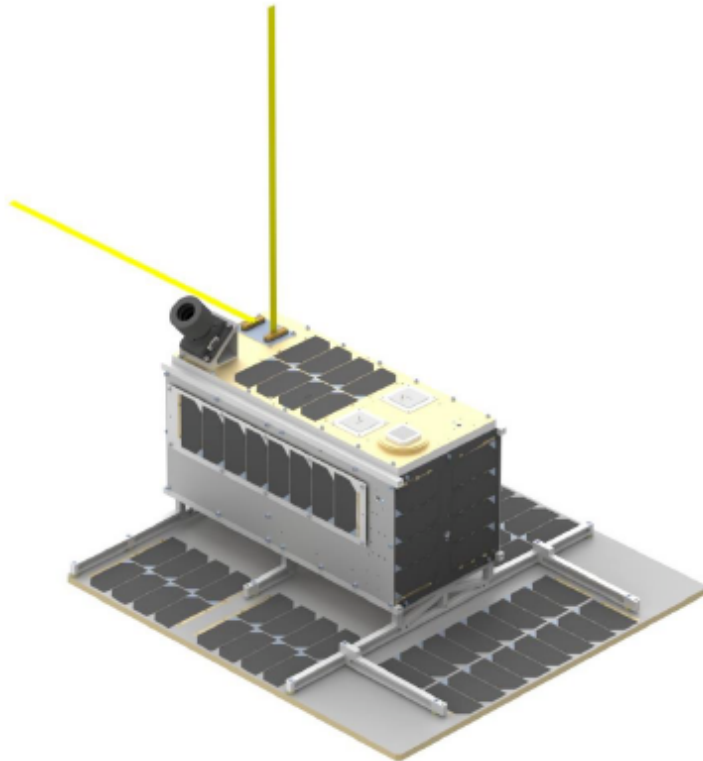
# Commissioning is going well



# User needs : identification of all ships



# NorSat-3

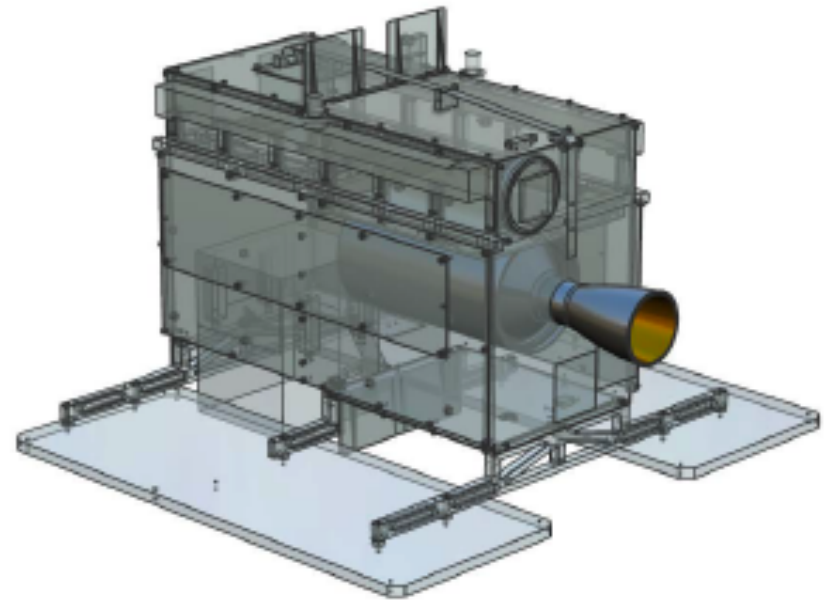
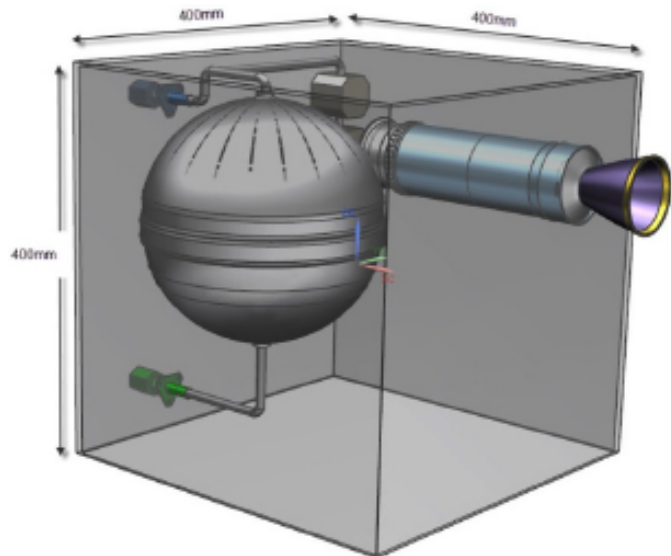


Hoved oppdrags-giver	 KYSTVERKET	
Plattform	NEMO	UTIAS <b>SFL</b>
Hoved nyttelast	AIS mottaker	 KONGSBERG seatex
Sekundær nyttelast	Passiv skips-detektor	 FORSVARET <b>FFI</b> Forsvarets forskningsinstitutt  KONGSBERG seatex



# Nammo's GSTP study

- TRP activity on propulsion system is defining high level requirements
- 18 months GSTP activity will start soon -> TRL 6



# Norwegian IOD mission under consideration

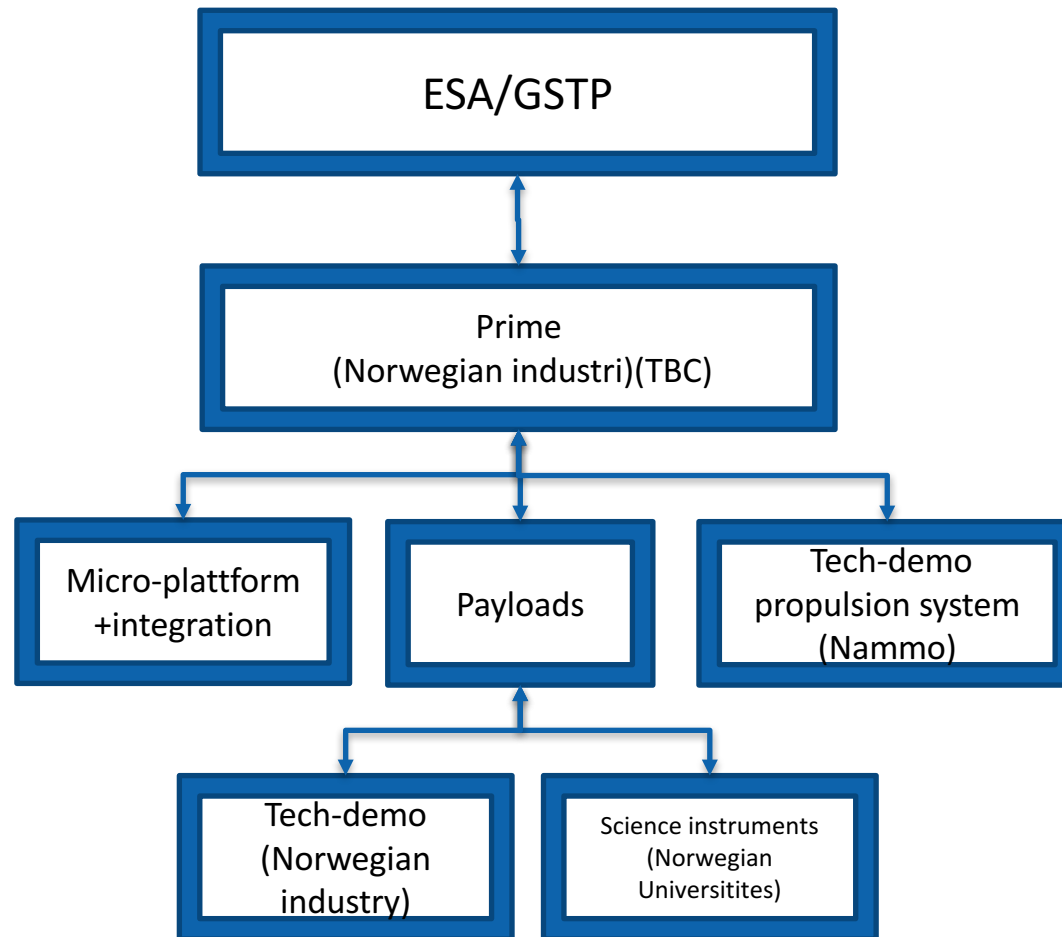
## > Mission objectives :

- In-orbit demonstration of Nammo's propulsion system for reorbiting /orbit control of micro satellites
- In-orbit demonstration of payload technology to be space qualified and/or instruments from Norwegian industry and universities
- Develop industrial system-engineering competences in Norway for future national and ESA micro-satellite missions
- Strengthen competitiveness of Norwegian space industry (good business case)

## > Proposed preliminary step:

- Conduct system study in parallel with Nammo's reorbiting propulsion GSTP activity
- Funding through GSTP
- Prime in-kind contribution through internal investment is encouraged
- Orbit : LEO
- 2 platform sizes (phase A) :
  - <50 kg with Nammo's system
  - Smaller version without Nammo's system

# Definition phase



# Operations

- >Private ?
- >Public ?
- >Public/Privat ?



# Potential selection criteria (TBC)

- Industrial spin off potential
- Potential utility of data for Norwegian users and/or business case
- Financial contribution from bidder in system study and realisation
- Company experience, competencies and estimated capacity to conduct the system study
- Flight heritage of technology and components
- Choice of platform provider, and his ability to deliver flight proven technology with acceptable performance on time and within a reasonable budget. In kind contributions would be a plus.
- Capability to federate and involve multiple Norwegian actors (commercial and non commercial), including the user community, in the design process
- Etc...

# Conclusions

- › Norway has on-going an AIS micro-satellite program to support the national interest in the high north
- › Norwegian industry has shown an interest in exploring industrial opportunities in national, international, public and commercial microsatellite missions
- › Nammo has the intention to develop in ESA GSTP a propulsion system for reorbiting/orbit control of micro satellites which needs to be validated in orbit
- › Norwegian actors are developing payloads that need space qualification in order to be commercially attractive
- › Norwegian industry sees a growth potential in developing system competences (design, integration, testing)
  
- › A system study for a potential Norwegian IOD through GSTP would be a good way to lift microsatellite development to a new level in Norway
- › The study will be limited to phases 0/A/B and accommodate secondary payloads :
  - 2 options until end of phase A (with/without Nammo's propulsion system)
  - 1 option continue with a phase B
- › A good business case is important
- › Internal contribution of at least 20 % is expected
  
- › **Looking forward to good proposals from Norwegian industry!**