i-Nord

An Integrated System for Surveillance of the Arctic Oceans

Monitor the marine security, environment and resources in the Arctic Ocean with the holistic i-Nord information system

Odd Kr. Ø. Pettersen
Research Director SINTEF ICT

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(Havforskningsinstituttet)

Outline

- Background
- *i-Nord* system description
- Fast Track Services
- Budget
- Related technology development projects

Background

- The *i-Nord* pre-project is initiated as part of the Norwegian Government's High North Strategy.
- The main objective of *i-Nord* pre-project is to prepare the background for the implementation and operation of a ***comprehensive monitoring and information system*** of the High North Ocean areas.
- The *i-Nord* pre-project is initiated and financed by the Norwegian Ministry of Foreign Affairs (UD) and the Ministry of Fisheries and Costal Affairs (FKD).

The pre-project mandate and objectives

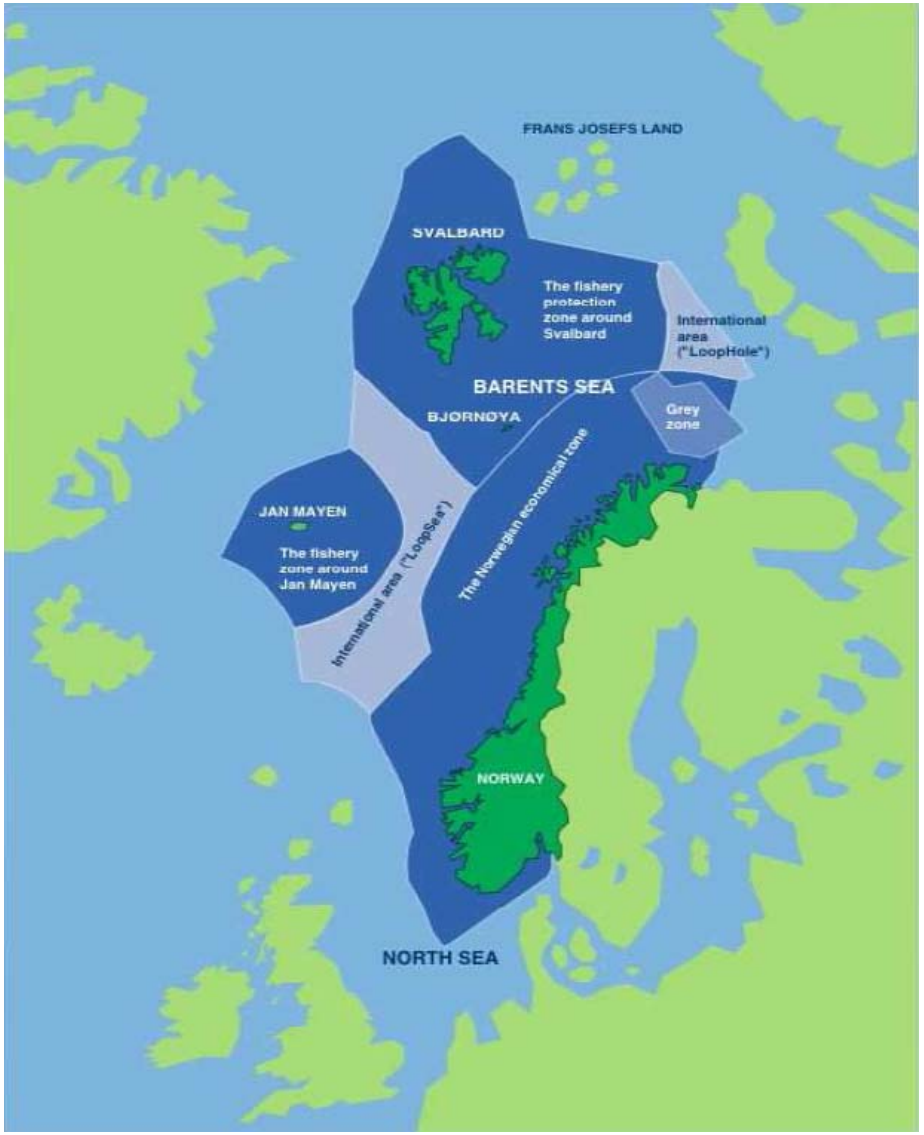
- Identify the primary stakeholders to such a system
- Describe the *i-Nord* concept and overall system structure
- Describe best practice for developing such a system
- Identify the need for research and development
- Produce a main project plan

Approach

i-Nord is **an ecosystem-based approach** to the management of human activities in the High North in order to:

- Ensure that the collective pressure of such activities is kept within levels compatible with the achievement of good environmental status
- Ensure that the capacity of the marine ecosystem's response to human induced changes is not compromised
- Enabling the sustainable use of marine goods and services by present and future generations

Norwegian Economic Zone



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Bilde: Olav Rune Godø
(Havforskningsinstituttet)


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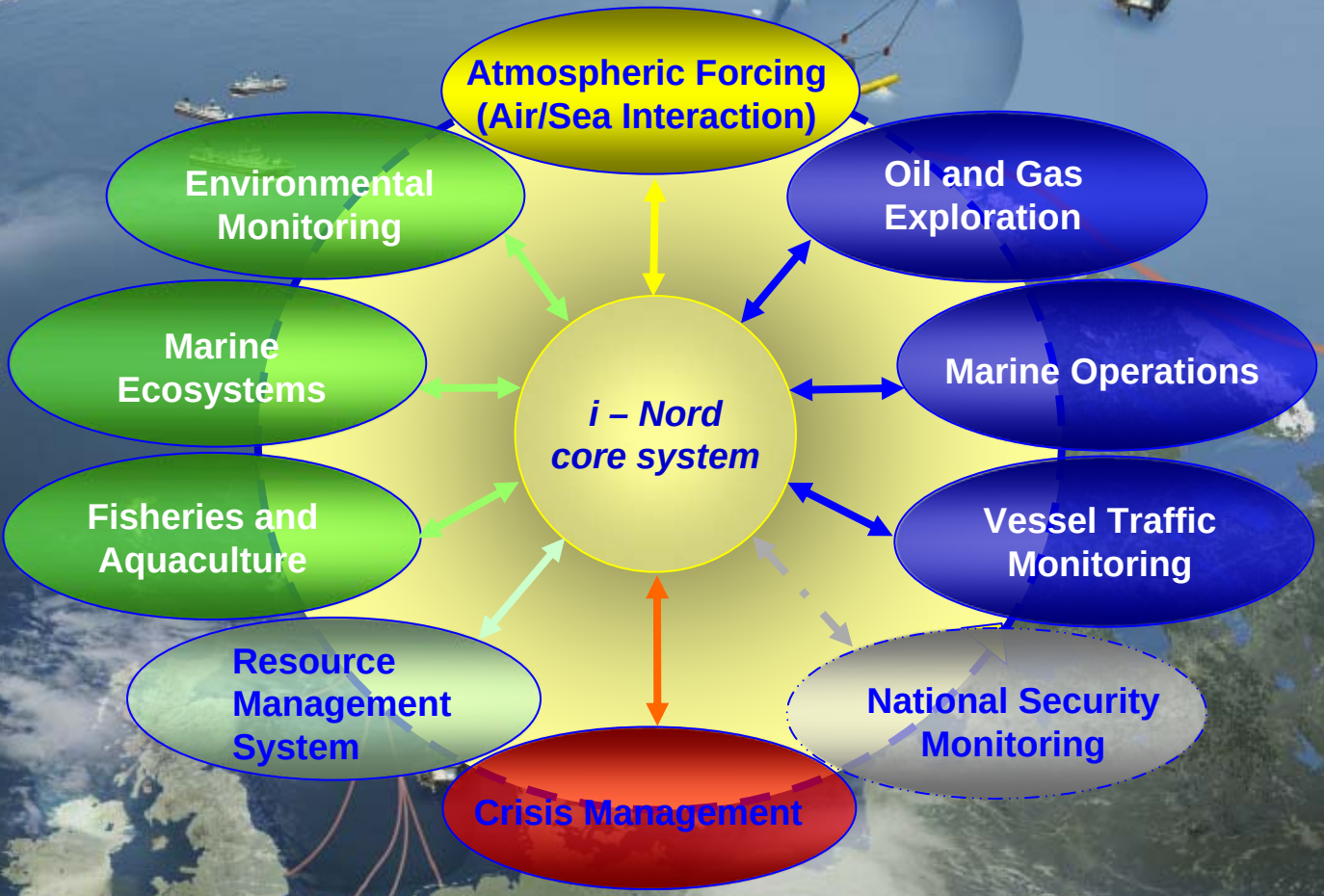

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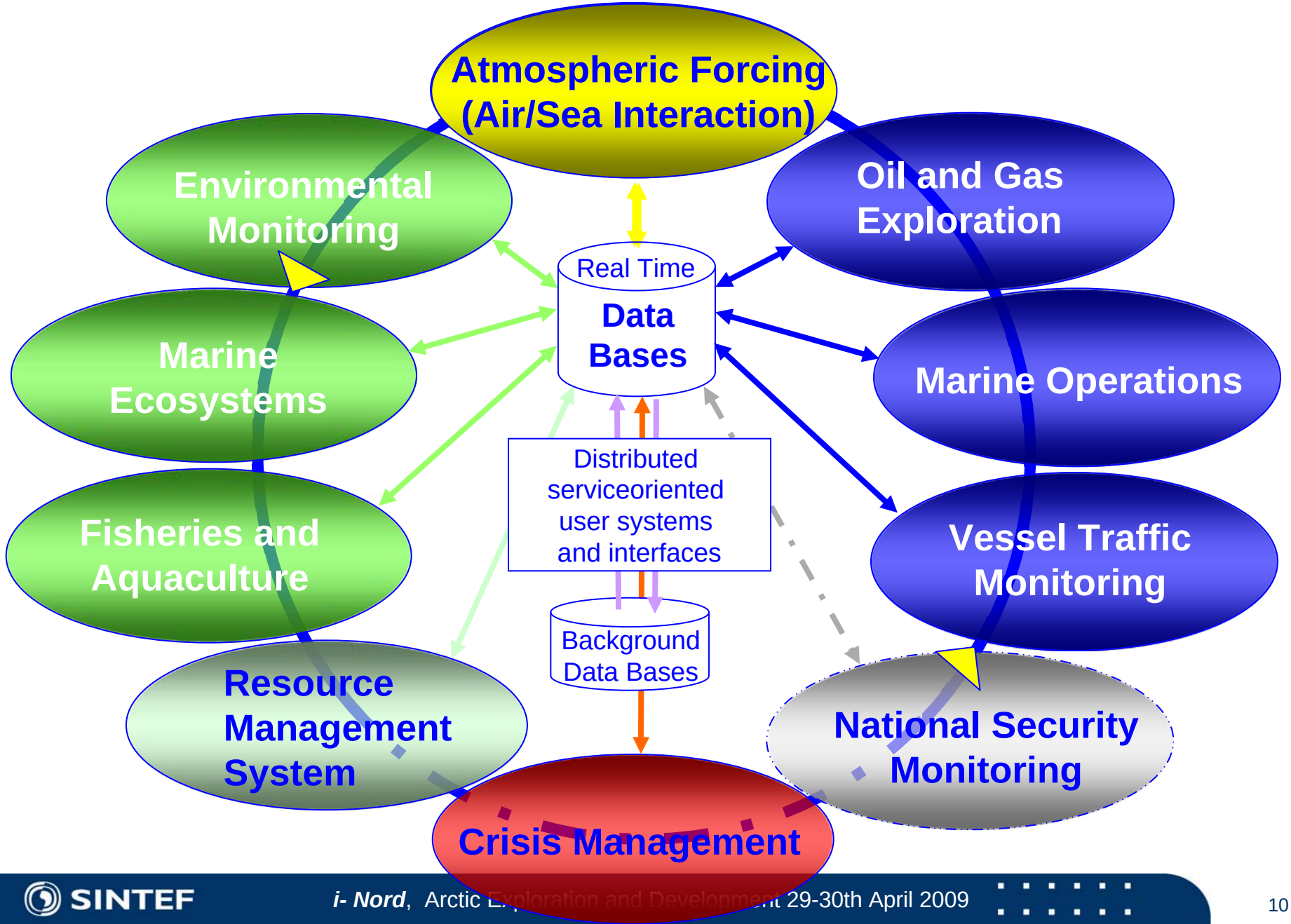
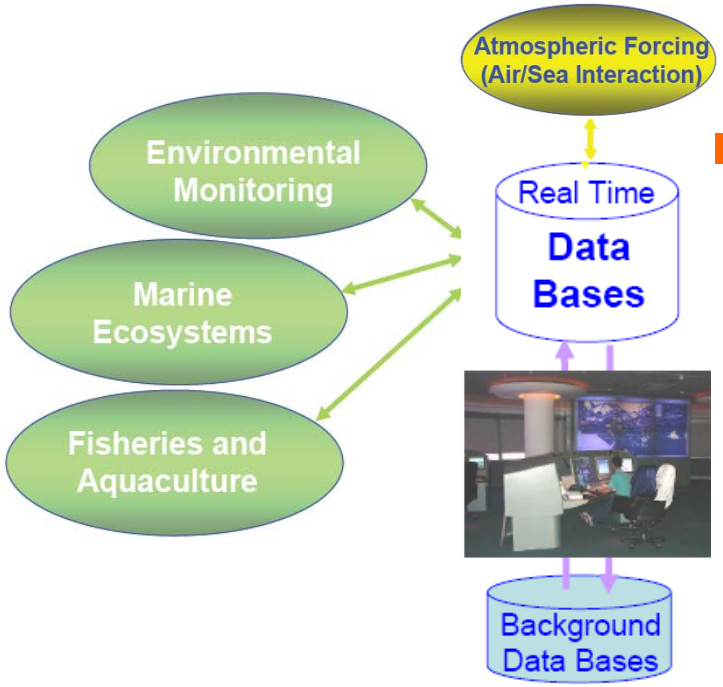
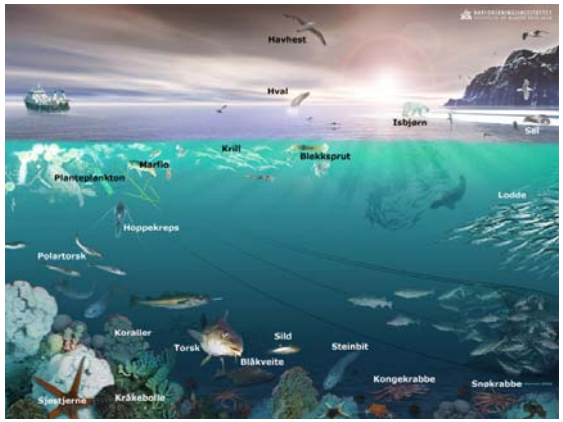


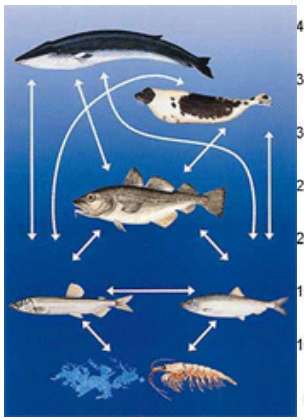

Atmospheric Forcing (Air/Sea Interaction)
Environmental Monitoring
Oil and Gas Exploration
Marine Ecosystems
Marine Operations
i – Nord core system
Fisheries and Aquaculture
Vessel Traffic Monitoring
Resource Management System
National Security Monitoring
Crisis Management

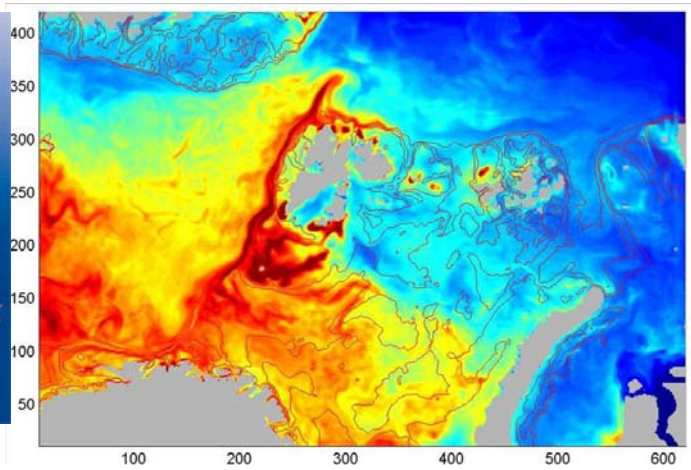
Ecosystem modelling, simulations og updating



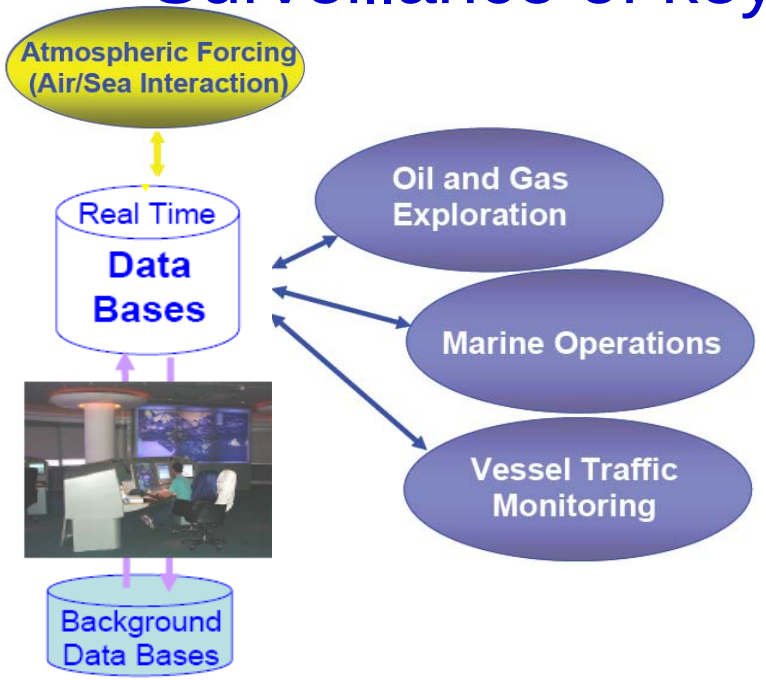
- Extensive use of mathematical modeling and simulation
  - 4D hydrodynamic models with scaleable grid
  - Dynamic ecosystem models
  - Coupling of physical and biological models
  - 4D drifts models and models for decomposition of different "oils and oil spills"

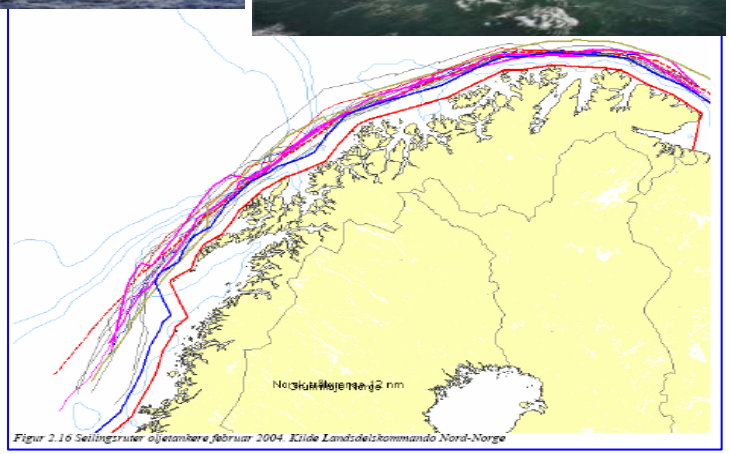




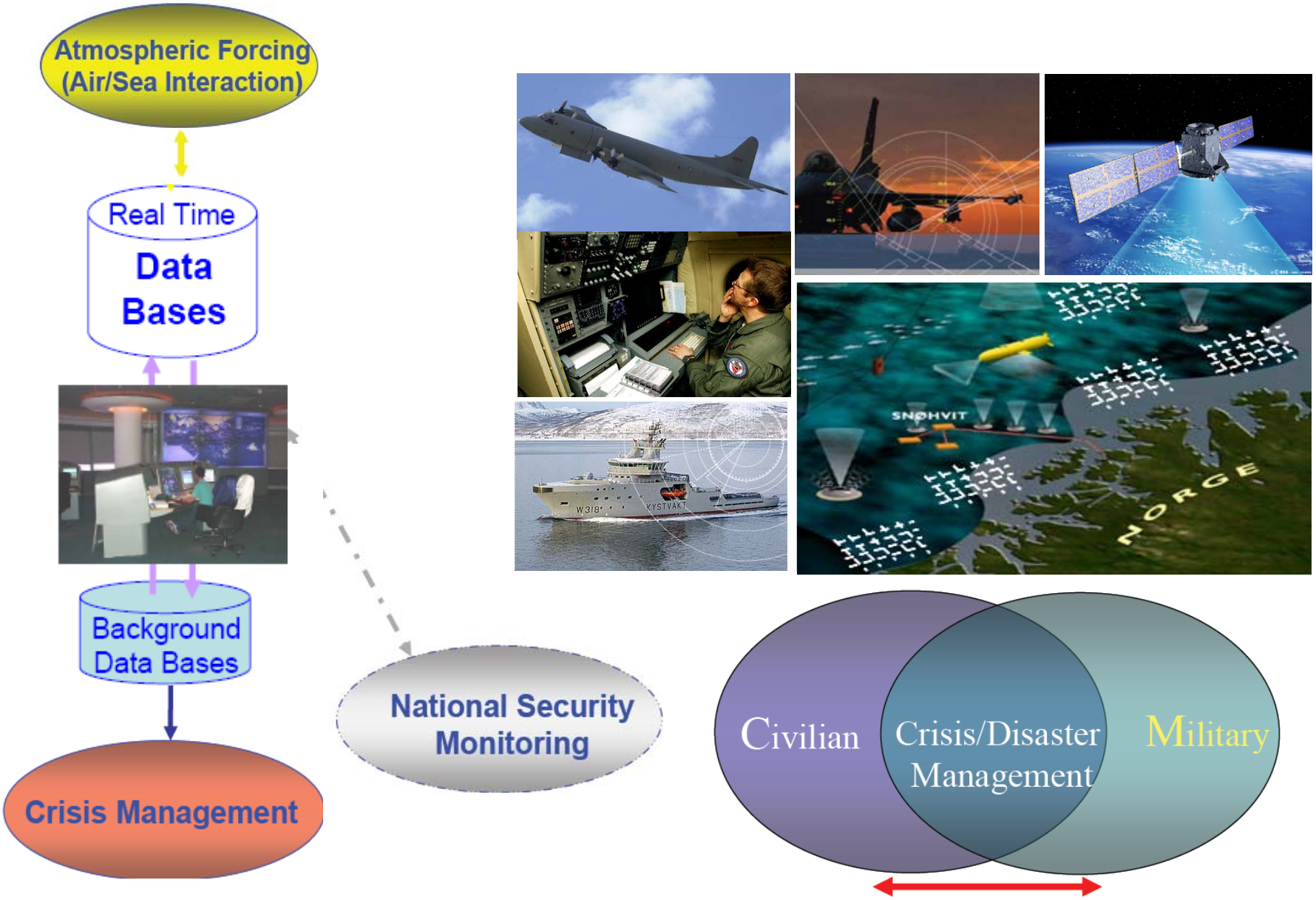


Surveillance of key activities in Artic waters

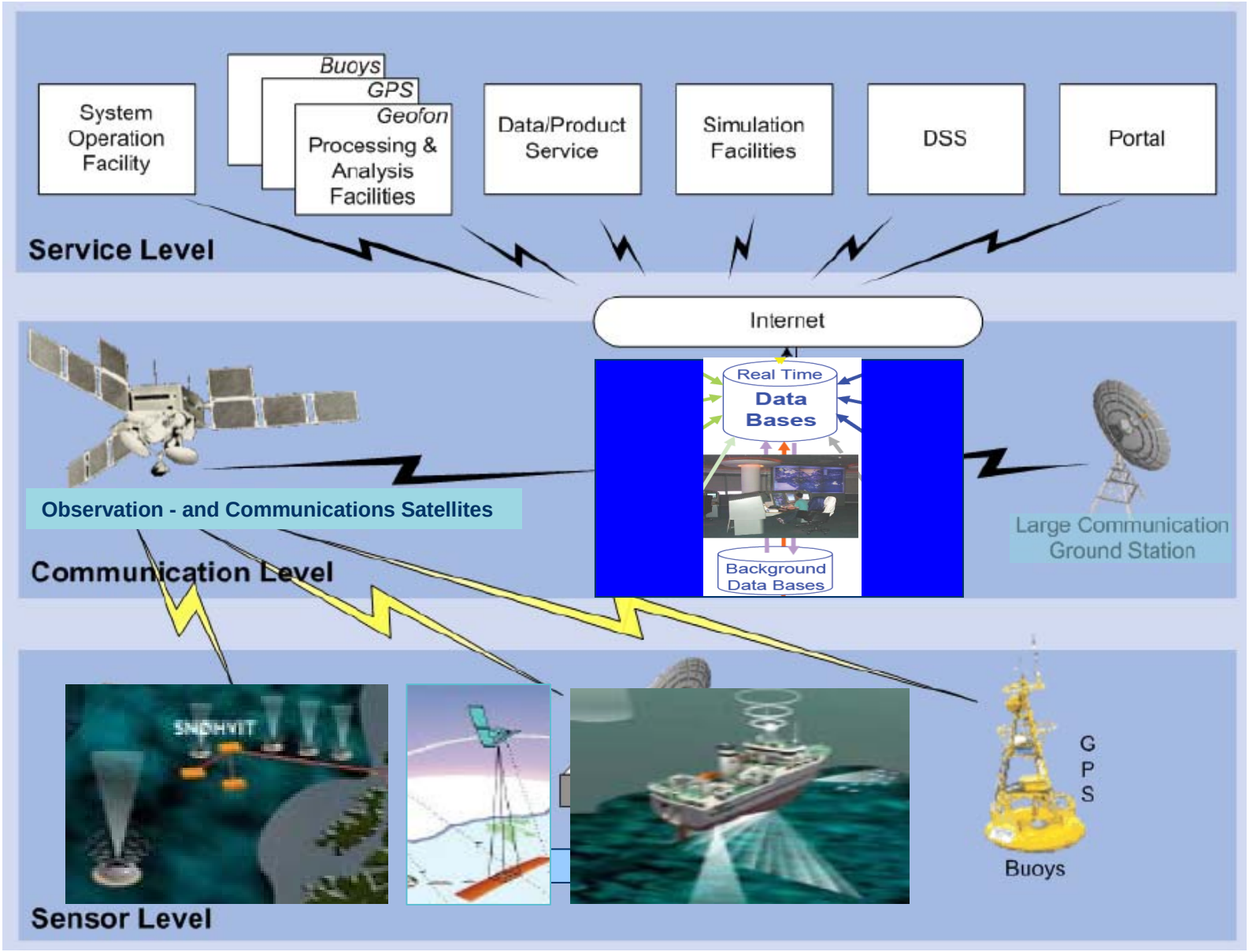




Crisis Management and National Security



Overall System Structure



Overall system requirements

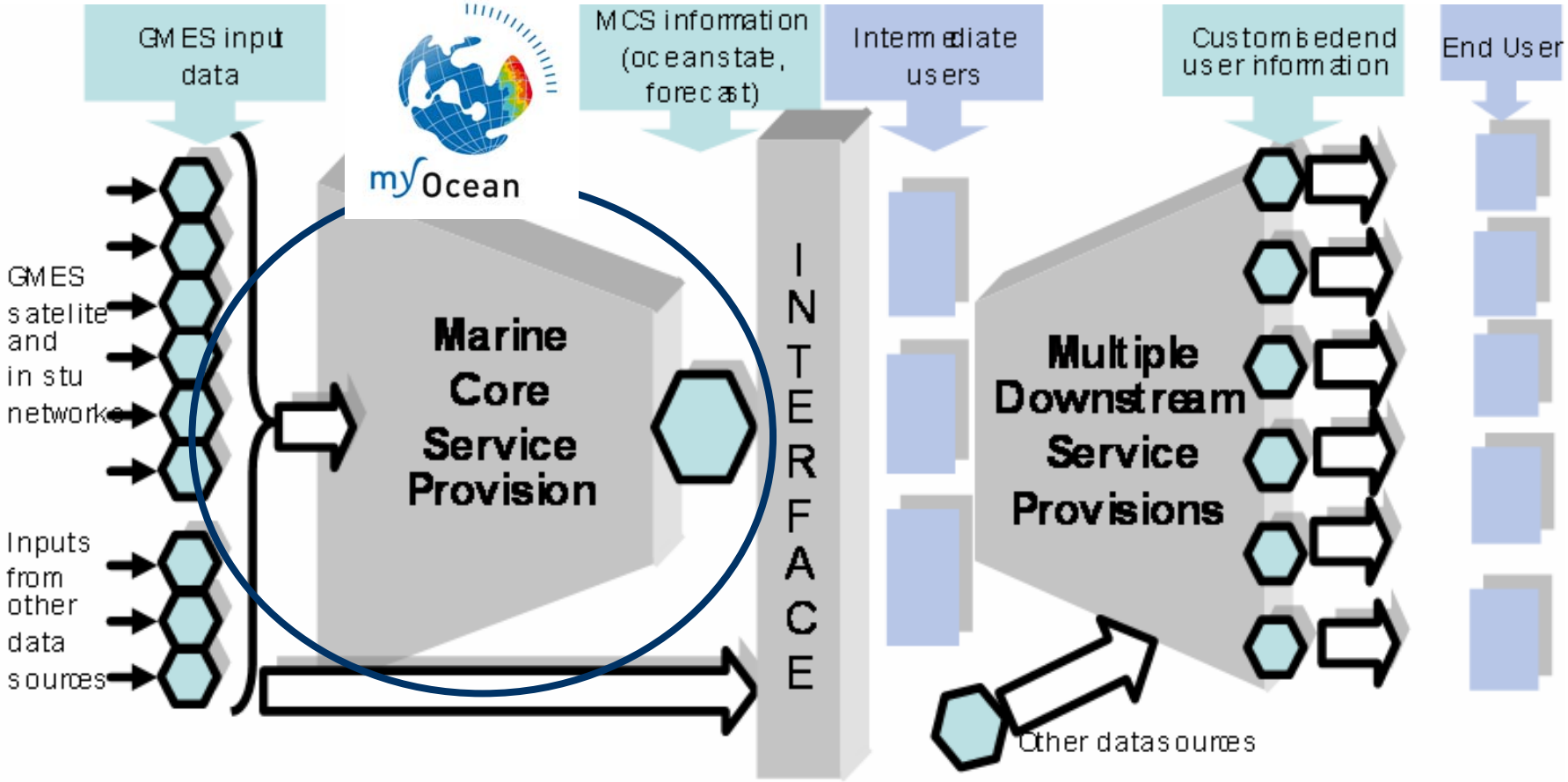
- A higher degree of integration of data and information that already exist in separate systems.
- More detailed observations of relevant parameters by means of new and more plentiful sensors and sensor networks. This will enhance the quality of existing models.
- A more flexible support for new services and new models that cannot be achieved by today's infrastructures and systems, e.g. real time systems.
- A more flexible interface for a variety of end users. This will make the system more attractive than a dedicated system for specialized users.

Overall system requirements

- *i-Nord* should be public, very flexible, and very dynamic; facilitating integration, interoperability and scalability
- *i-Nord* should not be regional, i.e. only the Barents Sea, but also include the Nordic Seas and the Arctic Ocean, etc.
- *i-Nord* must be able to communicate and interact with other similar national and international systems, e.g. AIS (Automatic Identification System), GMES (Global monitoring for environment and safety), and projects like MyOCEAN, etc.
- The *i-Nord* system should be able to operate in different modes so that both large open ocean areas, costal waters, and even fjords can be included in a seamless way.
- The *i-Nord* system must be based on internationally accepted standards, including the relevant application domains and reliability, security, and safety requirements.
- *i-Nord* should function on a 24-7 basis.
- *i-Nord* must be service oriented and must be universally accessible.

A European Marine “core” service

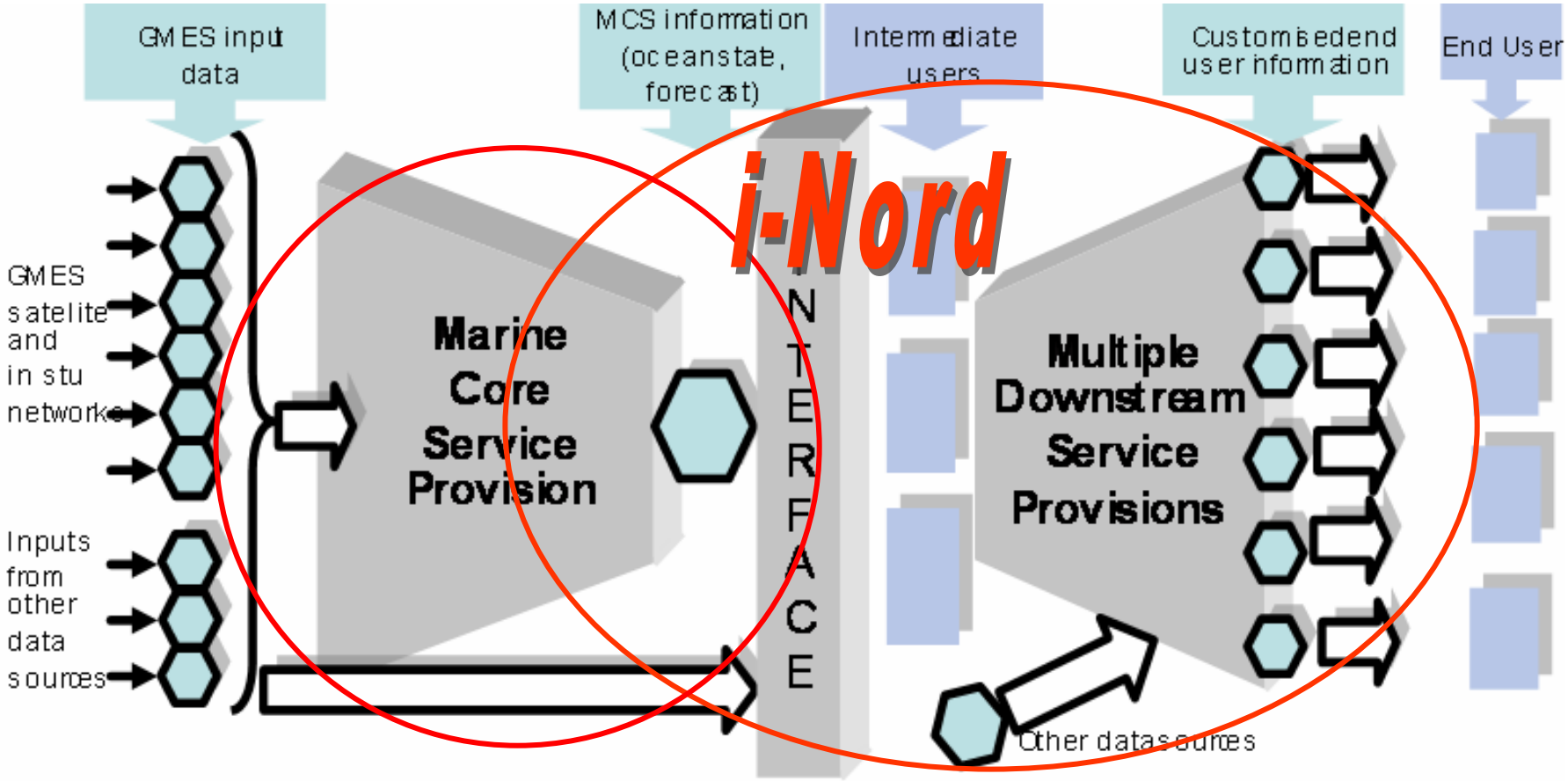
clearly defined by the EC GMES Implementation Group



GMES – Global Monitoring for Environment and Security
From GMES MCS Implementation Group report by P.Ryder & al

A European Marine “core” service

clearly defined by the EC GMES Implementation Group



From GMES MCS Implementation Group report by P.Ryder & al

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Key partners:

SINTEF

Meteorologisk institutt met.no

HAVFORSKNINGSINSTITUTTET INSTITUTE OF MARINE RESEARCH

Forsvarets forskningsinstitutt

KYSTVERKET

NERSC

NORSK POLARINSTITUTT

UNIVERSITETET I TROMSØ

norut NORTHERN RESEARCH INSTITUTE TROMSØ

NTNU

KONGSBERG

FUGRO

SAAB TECHNOLOGIES

SAAB

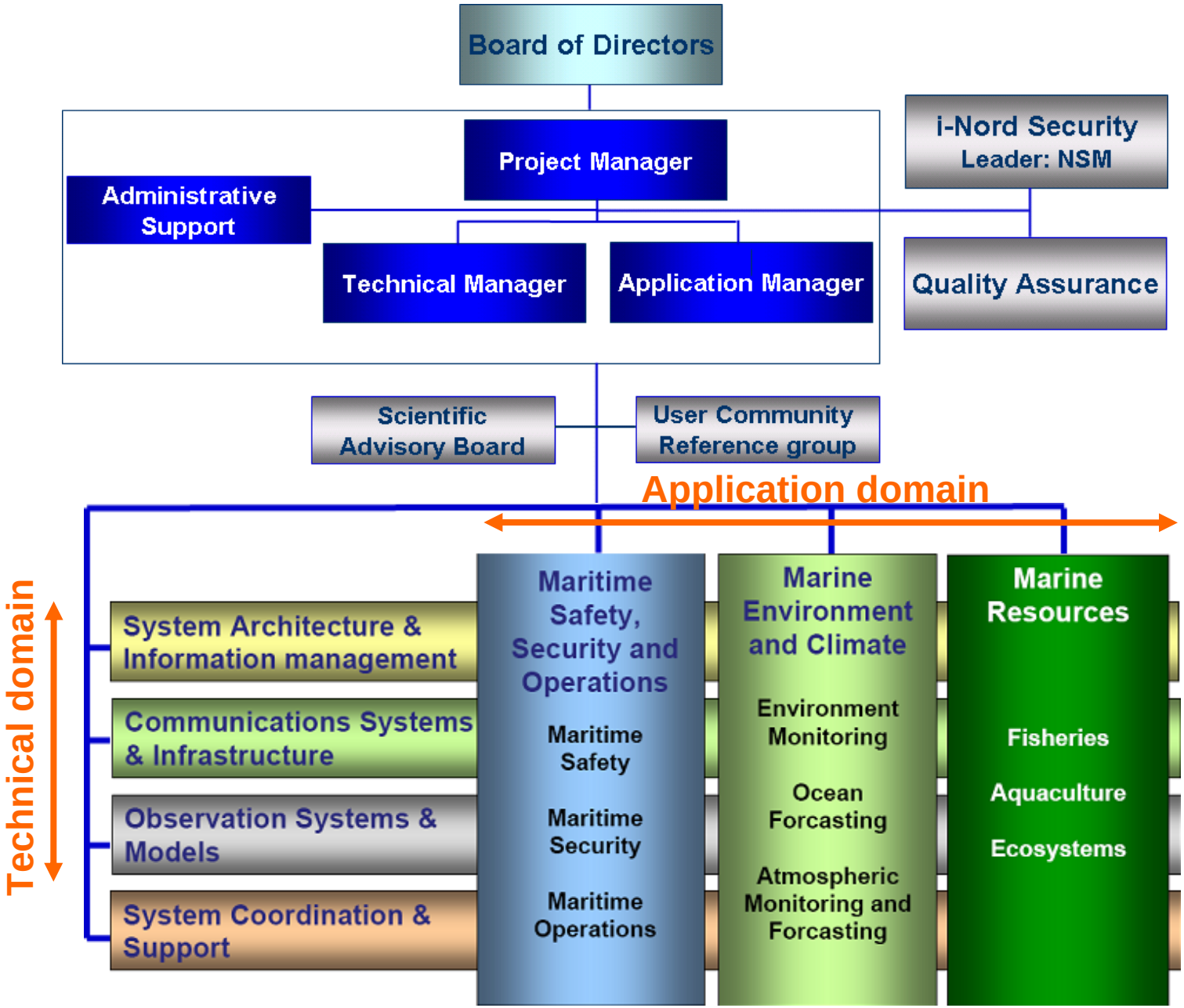
Customers:

UTENRIKSDEPARTEMENTET

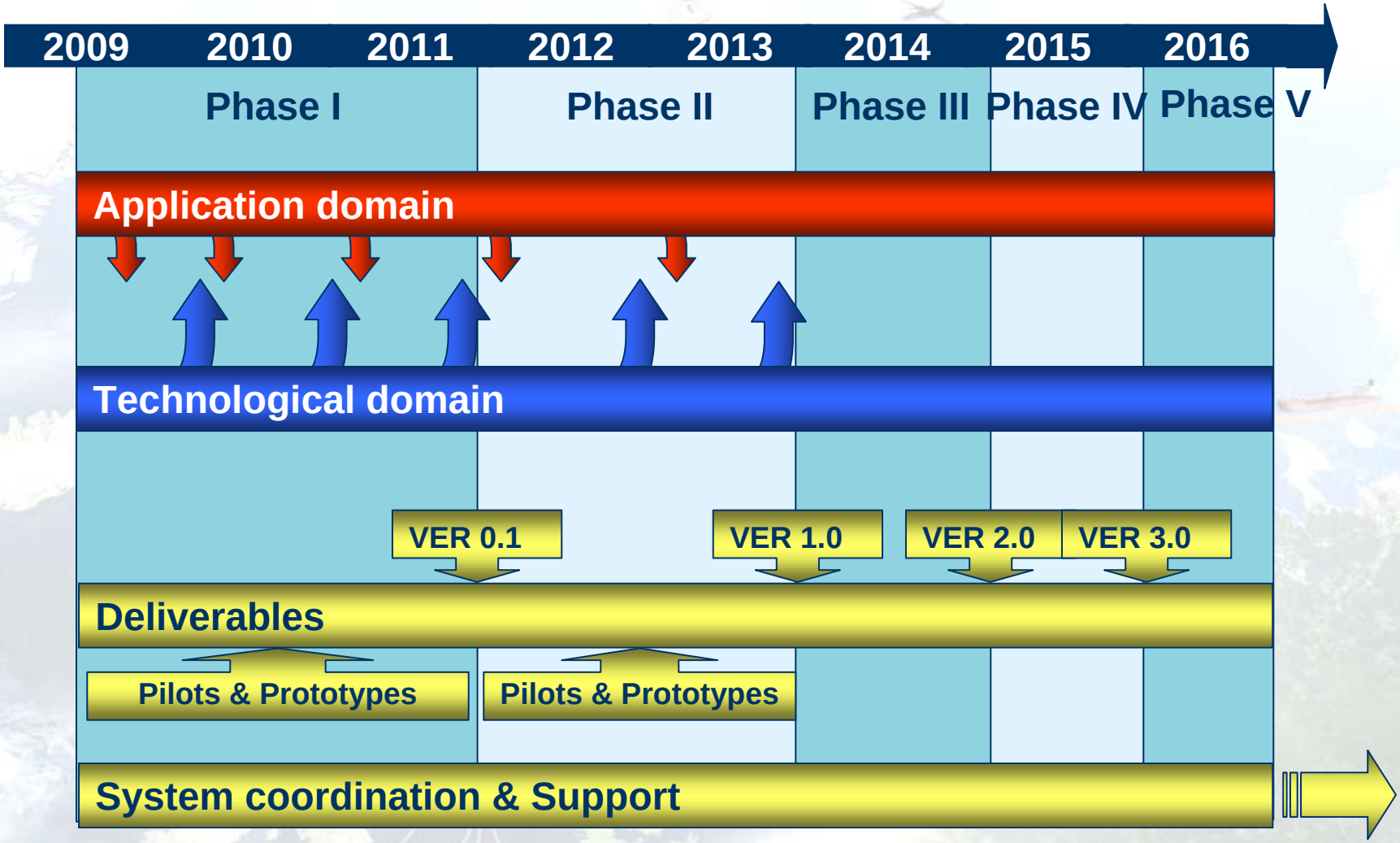
FISKERI- OG KYSTDEPARTEMENTET

”Fast track services”

- **Decision Support System Coast Guard**
  - Provide a best possible common recognized maritime picture for on-site resources, governmental agencies and the Joint Rescue Coordination Centre in search and rescue operations
- **Iceberg detection and warning system**
  - Services include maritime traffic information and extended ice information services in particular detection of ice bergs, and discrimination between ice bergs and other surface targets.
- **Oil spill detection and warning system**
  - Environmental service including an oil spill detection system, pollution detection, potential source identification, drift modelling and environmental impact assessment.
- **Harmful algal bloom detection and warning system**
  - Potential harmful algal bloom detection and monitoring system based on in situ observations and optical satellite data. The information on the environmental impact on aquacultures industry will be provided.
- **Marine Ecosystem Monitoring**
  - Operational system to quantify fish larval growth and distribution, for early prediction of recruitment and potential mortality from pollution. Support new information to the fisheries management advice process.


Board of Directors
Project Manager
Administrative Support
Technical Manager
Application Manager
i-Nord Security
Leader: NSM
Quality Assurance
Scientific Advisory Board
User Community Reference group
Application domain
Technical domain
System Architecture & Information management
Communications Systems & Infrastructure
Observation Systems & Models
System Coordination & Support
Maritime Safety, Security and Operations
Maritime Safety
Maritime Security
Maritime Operations
Marine Environment and Climate
Environment Monitoring
Ocean Forcasting
Atmospheric Monitoring and Forcasting
Marine Resources
Fisheries
Aquaculture
Ecosystems

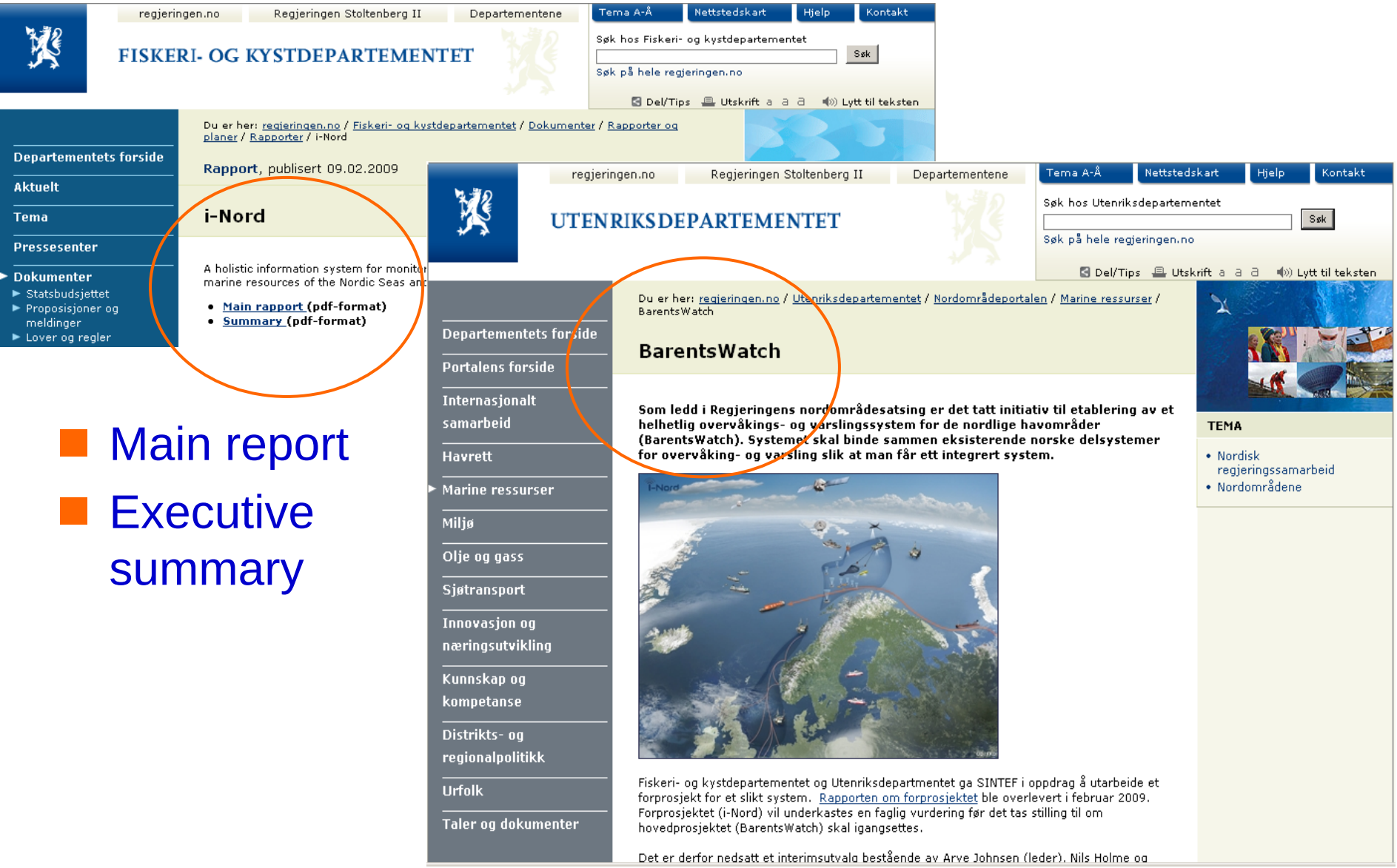
Stepwise development



Funding Strategy

i-Nord Funding Strategy					
	2009	2010	2011	2012	2013
Norwegian Governmental Funding	27.500	49.500	56.000	60.000	60.000
International Governmental Funding	0	0	5.000	8.500	17.500
Esimated Gross Governmental Funding	27.500	49.500	61.000	68.500	77.500
Framework Program Funding (FP 7)	10.000	10.000	10.000	TBD	TBD
Project Partner Funding	5.900	5.900	5.900	5.800	TBD
Esimated Gross Partner Generated Funding	15.900	15.900	15.900	5.800	0
Gross *i-Nord* related Funding	43.400	65.400	76.900	74.300	77.500

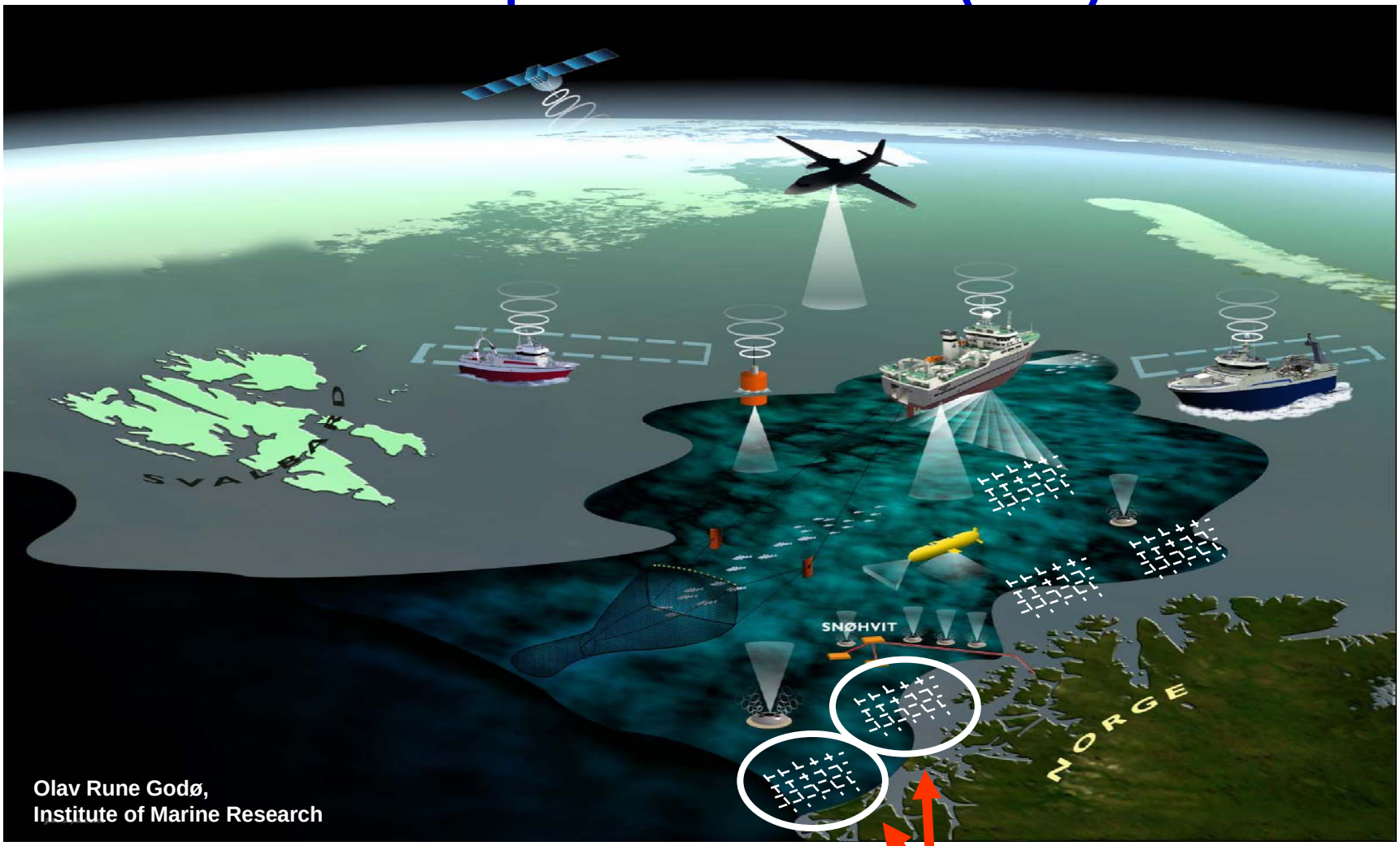
i-Nord reports



- Main report
- Executive summary

New technology development

Ocean Space Surveillance (OSS)

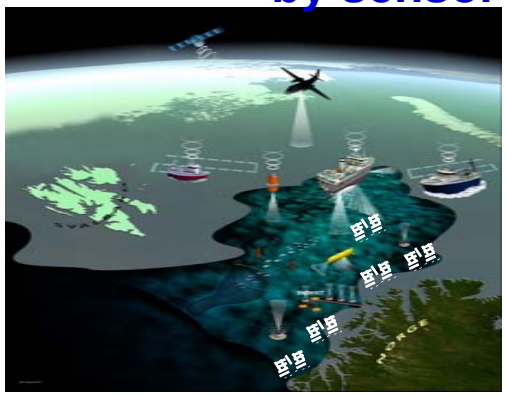


Olav Rune Godø,
Institute of Marine Research

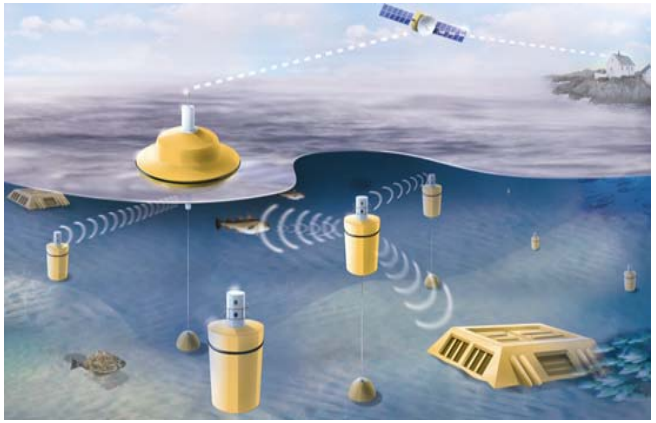
Underwater wireless sensor networks

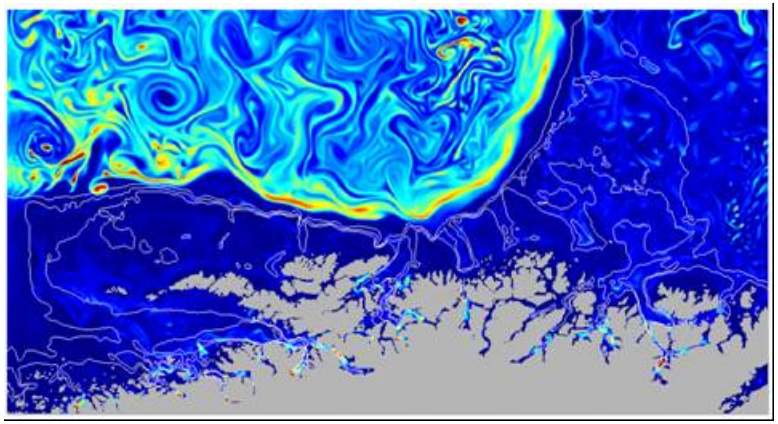
Ocean Space Surveillance (OSS)

Supervision of the marine environment by sensor networks, models and data assimilation



- Wireless sensor networks
- Advanced ocean modelling
- Assimilation of sensor data into models



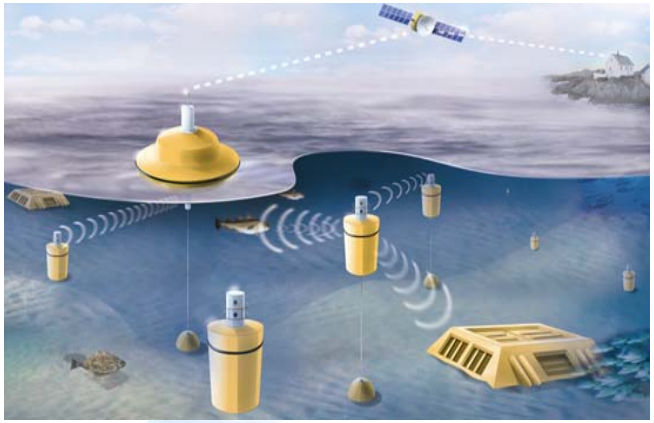


Ocean Space Surveillance (OSS)

concept demonstration

OSS demonstration

- Wireless sensors
- Ocean modeling including assimilation of sensor data



Valsneset aquaculture research facility

Running projects

- Ocean Space Surveillance (OSS)
  - SINTEF group strategic research project
- Underwater Wireless Sensor Network (NNN-UTS)
  - Norwegian JIP supported by the Norwegian Research Council 2006 - 2009
- Underwater Acoustic Network (UAN)
  - EU 7th Framework Programme. ICT-Security joint call. Underwater acoustic sensor network for protection of critical infrastructure 2008-2011
  - http://www.ua-net.eu/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Thank you!
UD / FKD