THIS IS SINTEF

One of Europe’s largest independent research organisations

NOK 3.2 billion
Revenues

NOK 450 MILL
International sales

Applied research, technology and innovation

Expertise from ocean space to outer space:

Renewable energy

Ocean space

Industry

Buildings and infrastructure

Materials

Micro-, nano- and biotechnology

Climate and environment

Oil and gas

Health and welfare

Society

Digitalization

Transport

SINTEF

Societal mission and vision

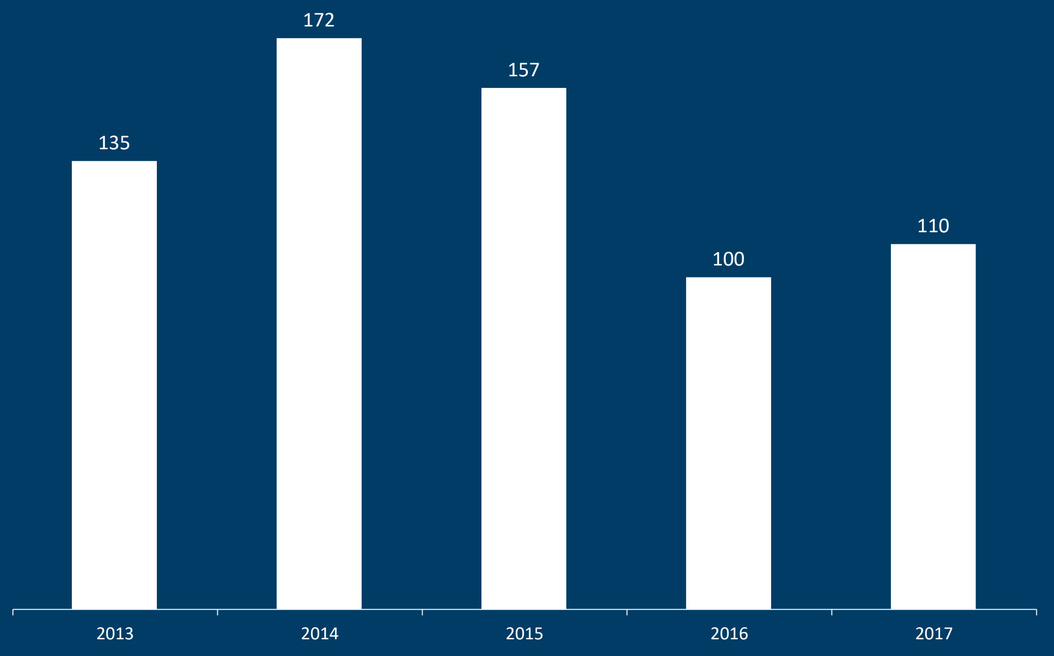
SINTEF develops society through research and innovation

- We create value and develop solutions to challenges faced by society
- We actively and boldly communicate our knowledge, solutions and recommendations

Our vision: **Technology for a better society**

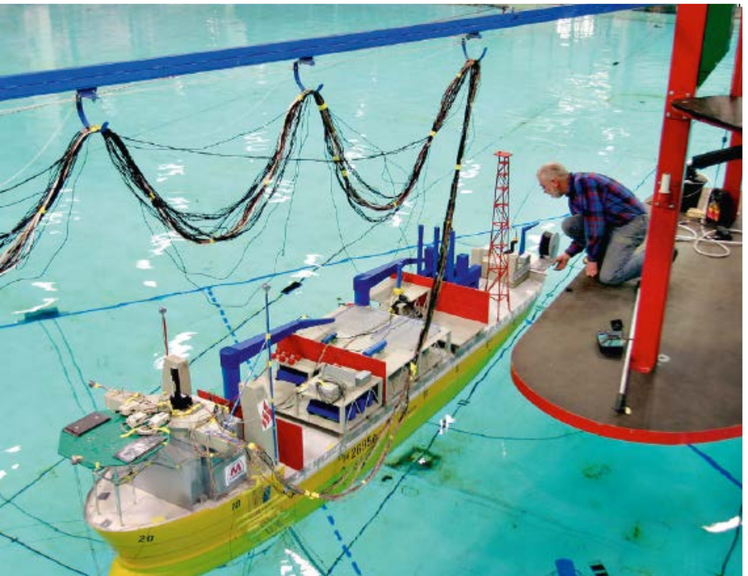
AN INDEPENDENT, NOT-FOR-PROFIT RESEARCH INSTITUTE

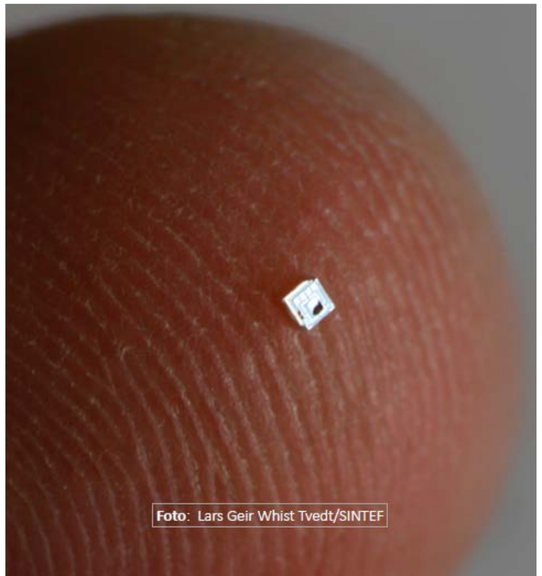
We invest our profits in laboratories and knowledge generation



Investments in laboratories, scientific equipment and buildings (NOK mill)

SINTEF





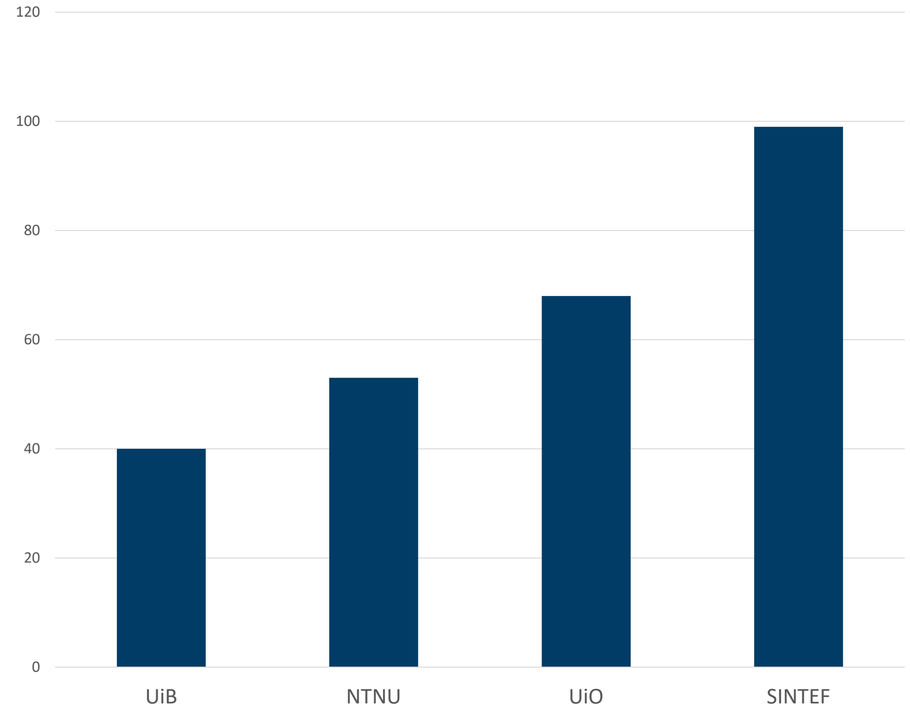
Laboratories and test facilities

- World-leading within a range of technology areas
- From nano and micro electronics to the world's largest multiphase flow laboratory and ocean laboratory

SINTEF

Major participant in EU research programs

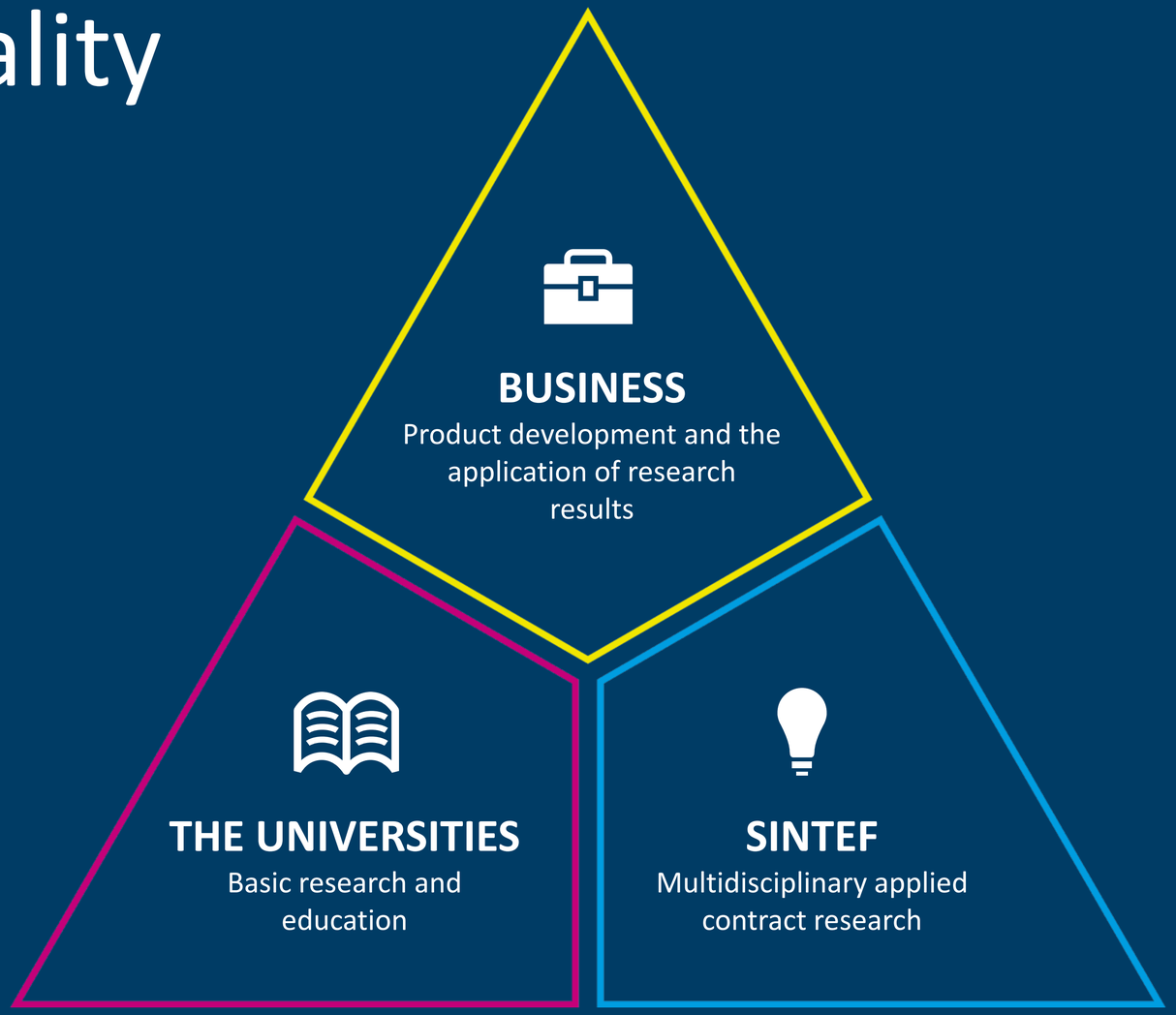
Mill. Euro



- Participate in 147 projects, with a project volume of € 1510 mill.
- Coordinate 40 projects with a project volume of € 228 mill.
- SINTEF research funding from EU: € 98,7 mill.

Participation in Horizon 2020, as of March 2018.
Source: RCN, EU's contract data base.

Close working relationships generate innovation and high quality



SINTEF TTO wins Investor of the Year award 2015
Photo: Astrid Bjerke Lund, Oslotech Oslotech

We create new businesses

- Commercialization of research results
  - Licensing
  - Spin-off companies
- We are active owners in our spin-off companies
- Profits from successful exits are invested in new knowledge generation

www.sintef.com/tto

SINTEF

SINTEF DIGITAL AVIATION ACTIVITIES

Agenda

1000 – 1045	**Welcome** **SINTEF mobility initiative** **Introduction**
1045 – 1115	Demo 1 Advanced Surface Routing and Safety Nets
1115 – 1145	Coffee
1145 – 1215	Presentations AIRM - ATM Information Reference Model IRIS - Satcom for Aviation
1215 – 1245	Demo 2 Remote Tower enhancements
1245 – 1330	Lunch
1330 – 1400	Demo 3 Enhanced Collaborative Airport Performance Management at Gardermoen
1400 – 1415	Presentation Helicopter safety studies
1415 – 1445	Demo 4 ANYWHERE - Risk based decision support
1445 – 1500	Future work SESAR 2020 Wave 2
1500 – 1530	Discussion

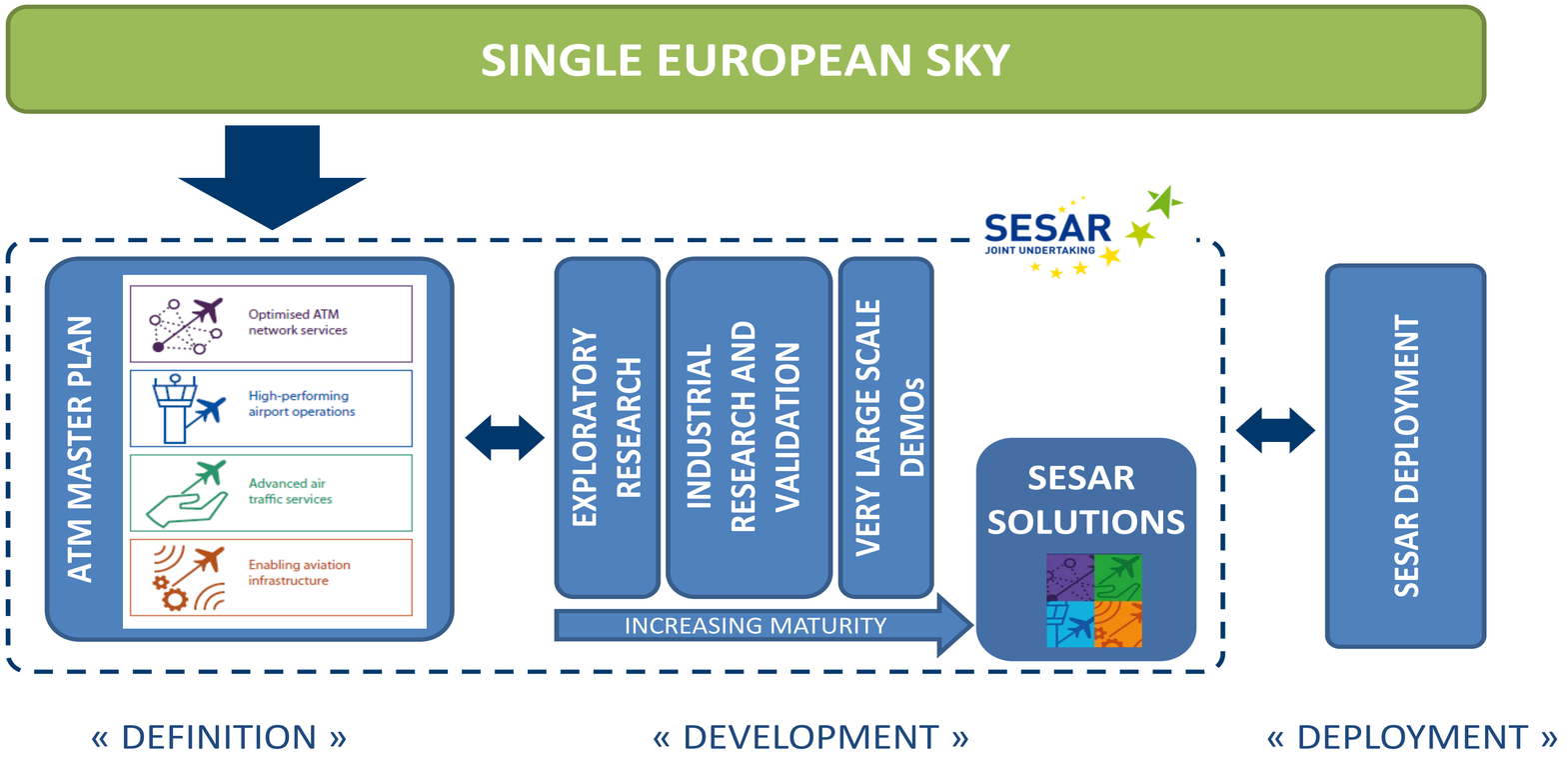
www.sintef.no/aviation

SINTEF in Aviation

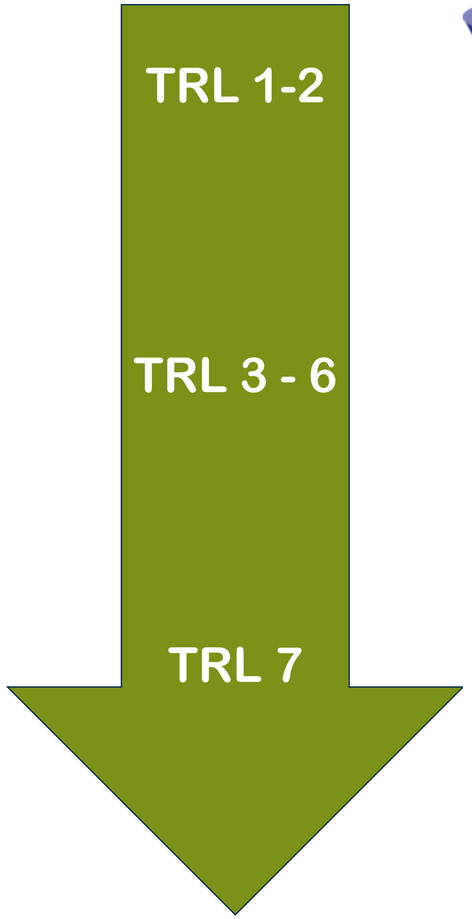
- SINTEF has broad competence and knowledge contributing to the development of the aviation and space industry
- Involved in different technology developments throughout the years
- Became a focus area when entering SESAR

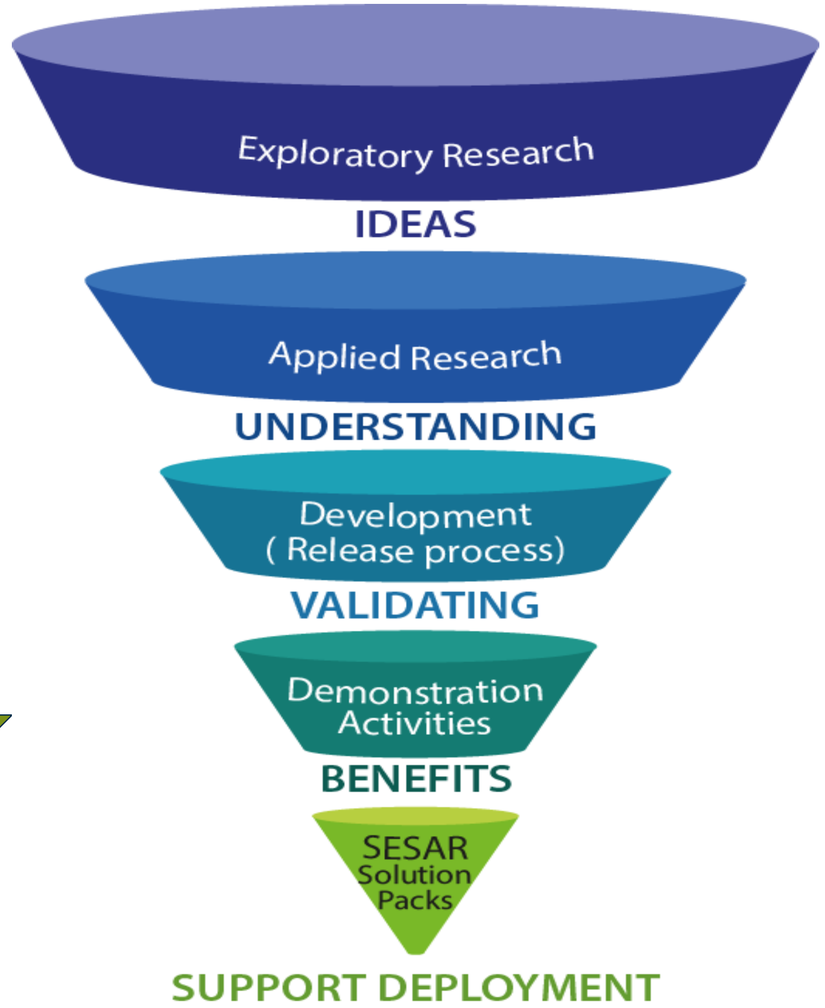
SINTEF

Aviation R&D


SINGLE EUROPEAN SKY
ATM MASTER PLAN
Optimised ATM network services
High-performing airport operations
Advanced air traffic services
Enabling aviation infrastructure
EXPLORATORY RESEARCH
INDUSTRIAL RESEARCH AND VALIDATION
VERY LARGE SCALE DEMOs
INCREASING MATURITY
SESAR JOINT UNDERTAKING
SESAR SOLUTIONS
SESAR DEPLOYMENT
« DEFINITION »
« DEVELOPMENT »
« DEPLOYMENT »

Aviation innovation path





SINTEF projects

BEST
PACAS
(5-6 proposals ER call 4)

PJ 02, 03a, 04, 05, 08, 09, 14, 16, 19
(W2 PJ04, 05, 09, 10, 14, 19, 20)

PJ 28
(W2 VLD 3)

SESAR 2020

PJ20 – Master Plan Maintenance

PJ19 – Content Integration

INTUIT

APACHE

AURORA

PACAS

PJ22 – Validation, Verification & Demo Infrastructure

Fundamental Scientific Research

ATM Application Oriented Research

Industrial Research & Validation

Very Large Scale Demonstration

Very Large Scale Demonstration Open Calls

BigData4ATM

DART

BEST

TaCo

TBO-MET

MINIMA

PNOWWA

AGENT

MALORCA

AUTOPACE

ATM4E

STRESS

COCTA

COMPAIR

Vista

High-performing airport operations

MOTO

RETINA

PJ02 – Increased Runway and Airport Throughput

PJ04 – Total Airport Management

PJ03a – Integrated Surface Management

PJ05 – Remote Tower for Multiple Airport

PJ03b – Airport Safety Nets

PJ28 – Integrated Airport Ops (incl. TBS)

Optimised ATM network services

PJ07 – Optimised Airspace Users Operations/UDPP

PJ09 – Advanced DCB

PJ08 – Advanced Airspace Management

PJ24 – Network Collaborative Management

Advanced air traffic services

SALSA

R-WAKE

OptiFrame

COPTRA

PARTAKE

PJ01 – Enhanced Arrivals & Departures

PJ10 – Separation Management en-route & TMA

PJ11 – Enhanced Air & Ground Safety Nets

PJ06 – Trajectory Based Free Routing

PJ25 – Arrival Management Extended to en-route Airspace

Enabling aviation infrastructure

NAVISAS

SAPIENT

PJ14 – CNS

PJ17 – SWIM Infrastructures

PJ15 – Common Services

PJ18 – 4D Trajectory Management

PJ16 – CWP/HMI

PJ31 – Initial Trajectory Information Sharing

PJ27 – Flight Information Exchange

SINTEF participation

SINTEF focus areas in SESAR 2020

- Optimisation
  - Traffic sequencing, routing, taxiing, dynamic airspace(DCB), Safety nets, A-CDM and more
- Human Computer Interface
- System architecture and development
- 3D modelling
- Safety and security
- Navigation (GBAS)
- Wake Vortex

SINTEF Contribution

PJ 02 EARTH Enhanced RWY Throughput

- **Methods and software for dynamic, coordinated arrival, departure, and surface management**
- Lead Partner: LFV(COOPANS) - Contributors: THALES Air Systems
- Q1 2019 Sturup (simulation of Arlanda)

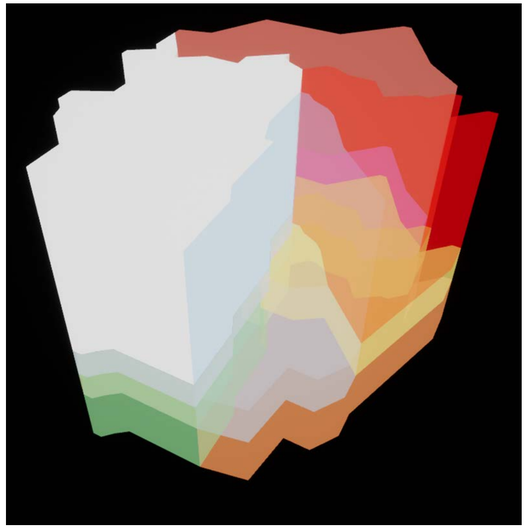
PJ 03a SUMO Integrated Surface Management

- **Methods and software for dynamic (continuous), deconflicting, surface routing and AGL-based guidance**
- Lead partner: Frequentis AG - Contributors: Eurocontrol, Hungarontrol, Austrocontrol
- April 2018, Eurocontrol Experimental Centre, V2 validation

PJ 04 TAM Total Airport Management (Demo today)

- **Focus on collaborative planning, scheduling of the different stakeholders who influence the airport throughput**
- Partners in validation; Avinor/OSL, Paris CDG, ATOS, EUROCONTROL, DLR, Thales, handling agents, airport operators and ATC.

SINTEF Contribution



PJ 05 Remote Tower (Demo today)

- SINTEF is creating **3D models** of Sundsvall airport in Sweden to support remote tower (RT) system, by improving situational awareness of air traffic controllers. This includes aspects of target tracking and augmenting information.
- Adapting the **Safety** Reference Material developed in SESAR 1, SINTEF is investigating the **resilience** of RT concept in the face of network issues related to availability, quality of service and security.
- Partners in validation: Saab (NATMIG), LFV

PJ 08 AAM Advanced Airspace Management

- Validation of acceptance of **Dynamic Airspace Configuration (DAC)** for ATCOs in simulated environment (Milano airspace)
- Leading evaluation exercise
  - In-house developed simulator and Controller Working Position (CWP)
- Partners in validation: ENAV and EUROCONTROL

PJ 09 DCB Advanced Demand and Capacity Balancing

- Supporting the development of the **Collaborative Planning Framework** in which coordination of decisions takes place between the different actors (Airports, Airspace Users, Network manager, Air Traffic Control Centers)
- **SINTEF's SIMADES** is used as a simulation tool to evaluate and fine-tune different Collaboration Framework alternatives
- Main partners are: EUROCONTROL, DLR, ATOS, NATS, DSNA, LFV and ENAIRE

SINTEF Contribution

PJ 14 EECNS Essential and Efficient Communication Navigation and Surveillance Integrated System

14-03-01: Ground Based Augmentation System (GBAS)

- Dual Constellation Dual Frequency (DCDF) GBAS concept development (GPS L1/L5+Galileo E1/E5a).
- Environment and integrity monitoring and **algorithm development** to support Indra Navia's and Indra Espacio's GBAS installations (Gardermoen, Frankfurt, Barcelona, Tenerife Norte airports). Major focus on anomalous **ionosphere and troposphere**, RFI, signal deformation, etc.

PJ 16 CWP Controller Working position

- 16-04: Multi-modal User Interface for ATCOs **– Multi-touch and speech, integration** with air traffic simulator
- 16-03: Virtualisation of CWPs - separating the CWP from the data center where the data is produced
- DSNA and Eurocontrol main partners in validation

PJ 19 CI Content Integration

- SINTEF is taking part in the development of the **Information Service Reference Model (ISRM)** of the European Air Traffic Management Architecture (EATMA) - Service architecture and service modelling
- **SINTEF chairs** the CCB (Change Control Board) for the **ATM Information Reference Model (AIRM)**
- Helps other SESAR projects to understand role & relevance of AIRM and ISRM
- Support SESAR 2020 on **Cyber Security** work across all projects

SINTEF Contribution

PJ28 IAO Integrated Airport Management Very Large scale Demonstration (VLD) (Demo today)

- Methods and software for dynamic, coordinated arrival, departure, and surface management
  - Pre-departure sequencing, conflict-free routing, conformance monitoring
- SINTEF ATC Optimization Library and services (MADMAN)
- Hamburg airport April 2019 (crossing runways), shadow mode
- Partners: DLR, DFS, Hamburg airport

EXPLORATORY RESEARCH

PACAS

Participatory Architectural Change MAnagement in ATM Systems

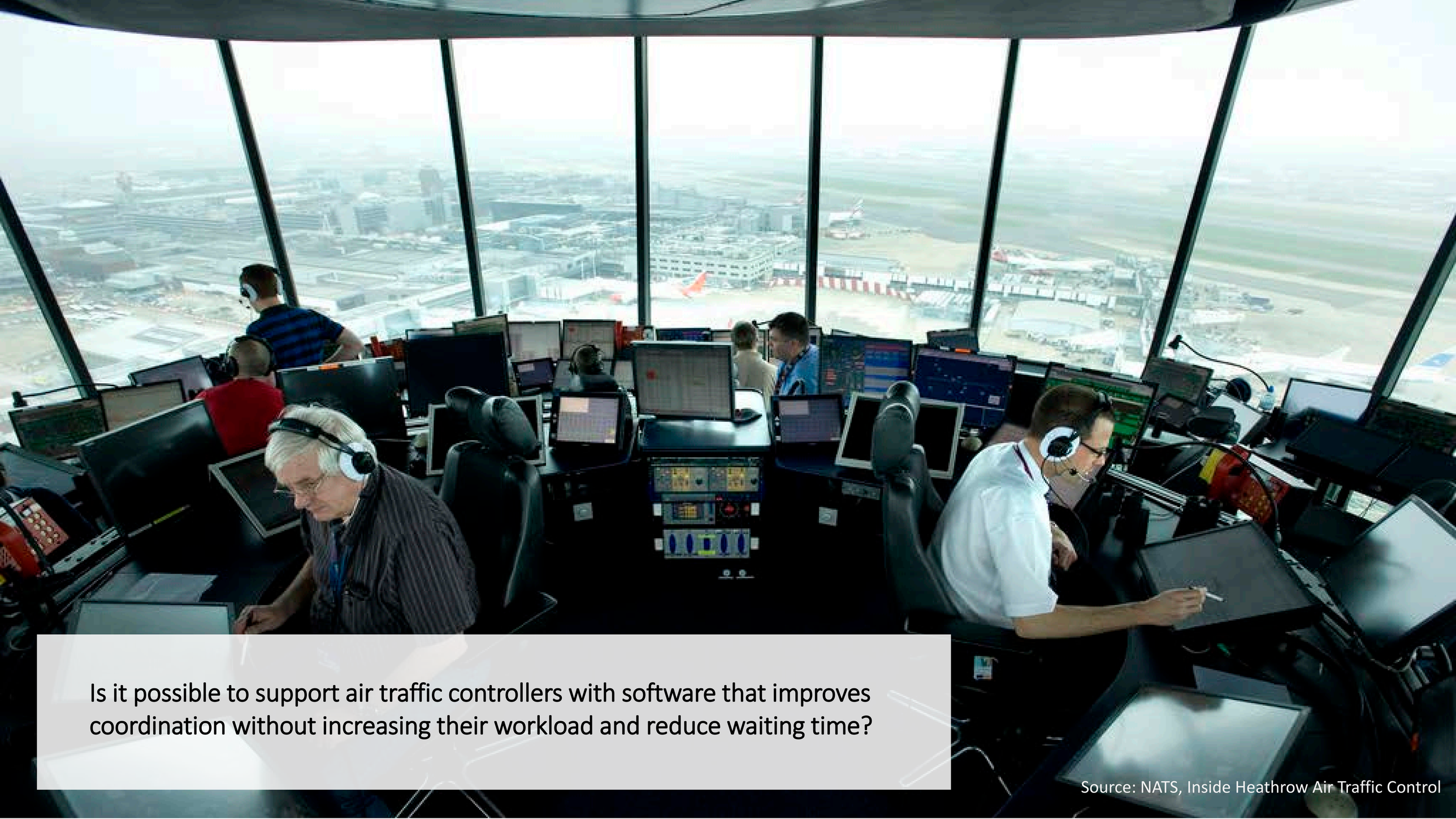
BEST

Achieving the Benefits of SWIM by making use of Semantic Technologies

SINTEF

AUDIO

- Increasing the flight crew’s situational awareness while the aircraft is taxiing.
- AUDIO will demonstrate the viability of an innovative advanced and connected moving map application.
- The application provides the cockpit with local airport data such as the on-ground traffic situation and planned taxi routes



Is it possible to support air traffic controllers with software that improves coordination without increasing their workload and reduce waiting time?

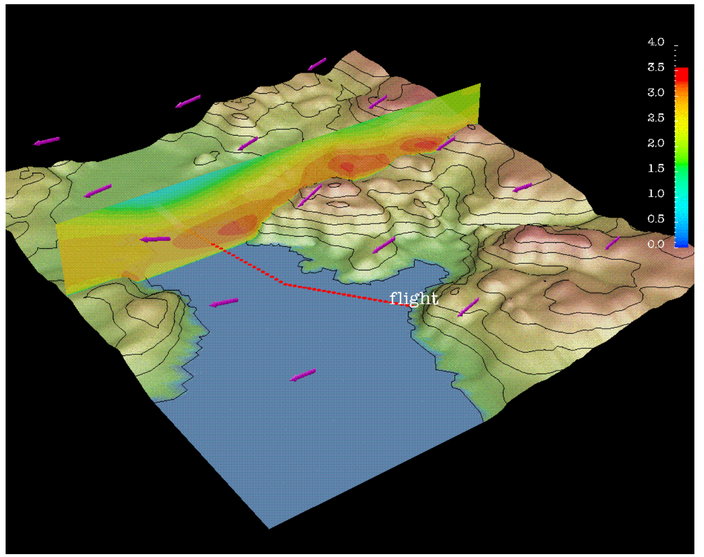
Source: NATS, Inside Heathrow Air Traffic Control

Some other aviation projects

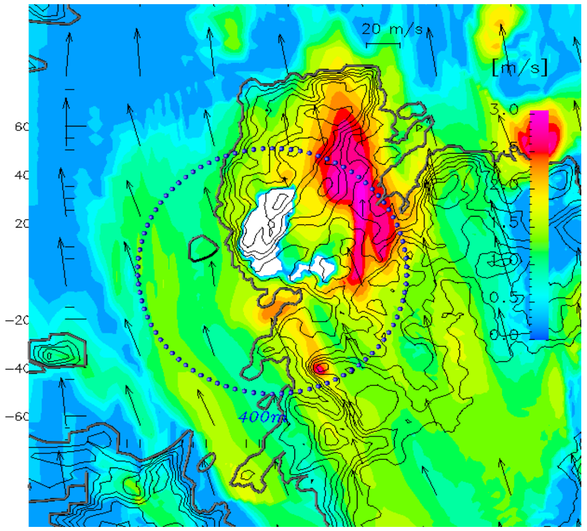
Clean Sky or similar projects

- Voici
  - Aims to develop an intelligent **"natural crew assistant"** in a cockpit environment
  - Sound recording, speech recognition and artificial intelligence.
  - Clean Sky project
- Production of altimeter sensor elements for Memscap ASA
- MUPIA
  - "Silicon Very High Performances MEMS Gyrometers Technology"
  - Bringing the manufacturing process for the gyrometer up to a manufacturing readiness level of 5
- Production of high-pressure sensor elements for engine management

SIMRA
– Local wind and turbulence forecast



- SIMRA developed by SINTEF for Avinor
- Bundle several **WX** forecast models driven by the Norwegian Met institute
- In use at 20 airports
- Forecast every hour
- Certified by NCAA for improving air safety

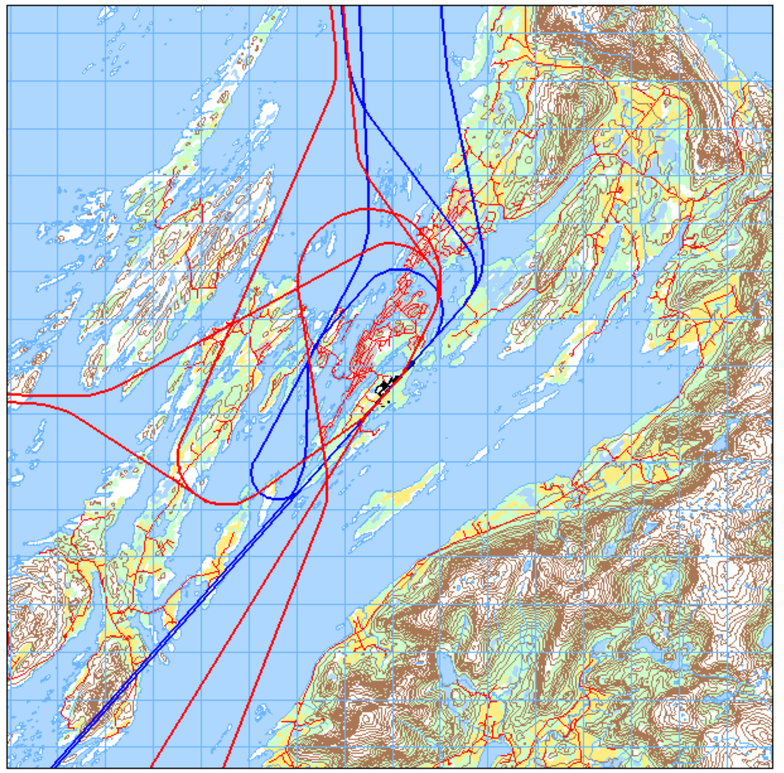


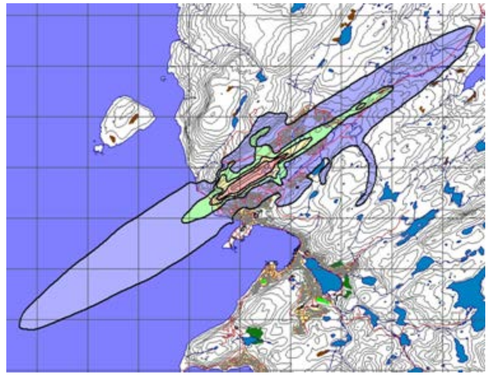
https://www.ippc.no/ippc/index.jsp

SINTEF

Aircraft noise

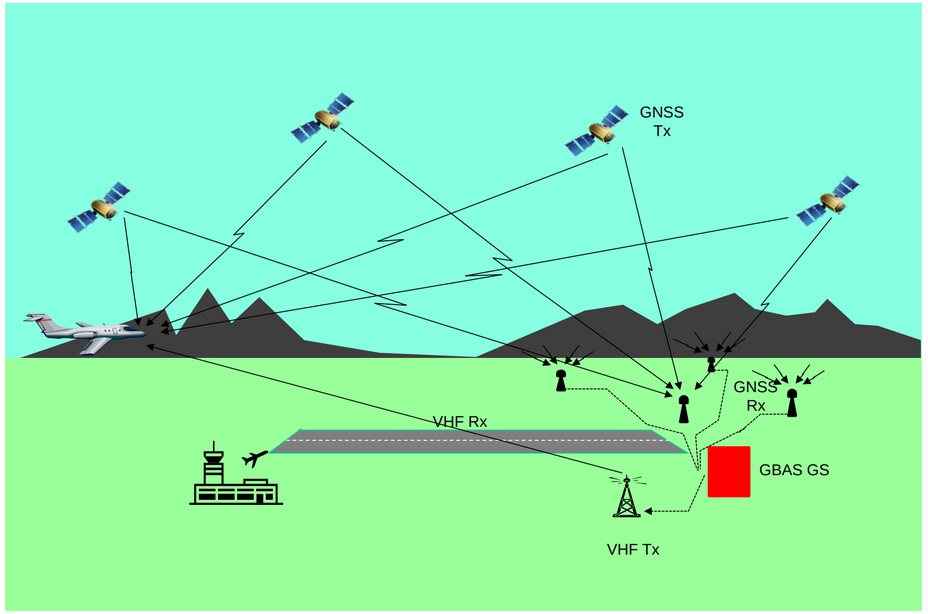
- Charts
  - 30 years of research and development
  - Methods
  - Software
- Cooperation with
  - Civil aviation
  - FAA
  - Eurocontrol
  - Air Force / NATO





NORGAL

- Development of a resilient ground station for satellite based landing systems for aviation (GBAS)
  - Replacing ILS
  - Focus on polar areas
  - National funded project

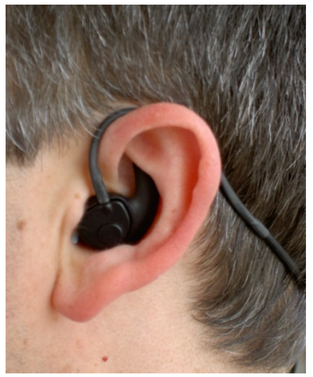


SINTEF

QUIETPRO(R)

- Digital hearing protection and communication earplug

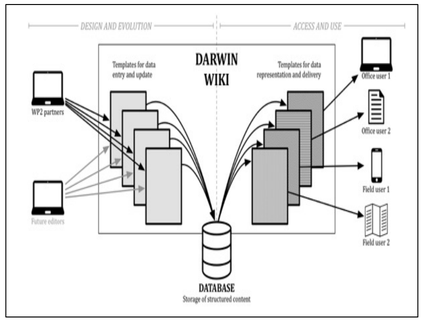
- Adaptive talk through (listening to surrounding sounds)
- Protection against continuous noise
- Protection against impulse noise
- Verification of hearing protection
- ANR – Active Noise Reduction



SINTEF

Aviation safety and resilience

Development of concepts, methods and techniques to design and operated complex socio-technical systems to improve the ability to manage expected and unexpected events



Scientific focus

- Aviation system safety
- Resilience Engineering
- Modelling and assessment
- Advance studies – aviation - avionics

Multiple Remote Tower Center
for Røst and Værøy at Bodø, Norway.
Ref.: AVINOR, SESAR

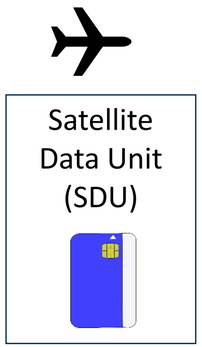
Projects examples

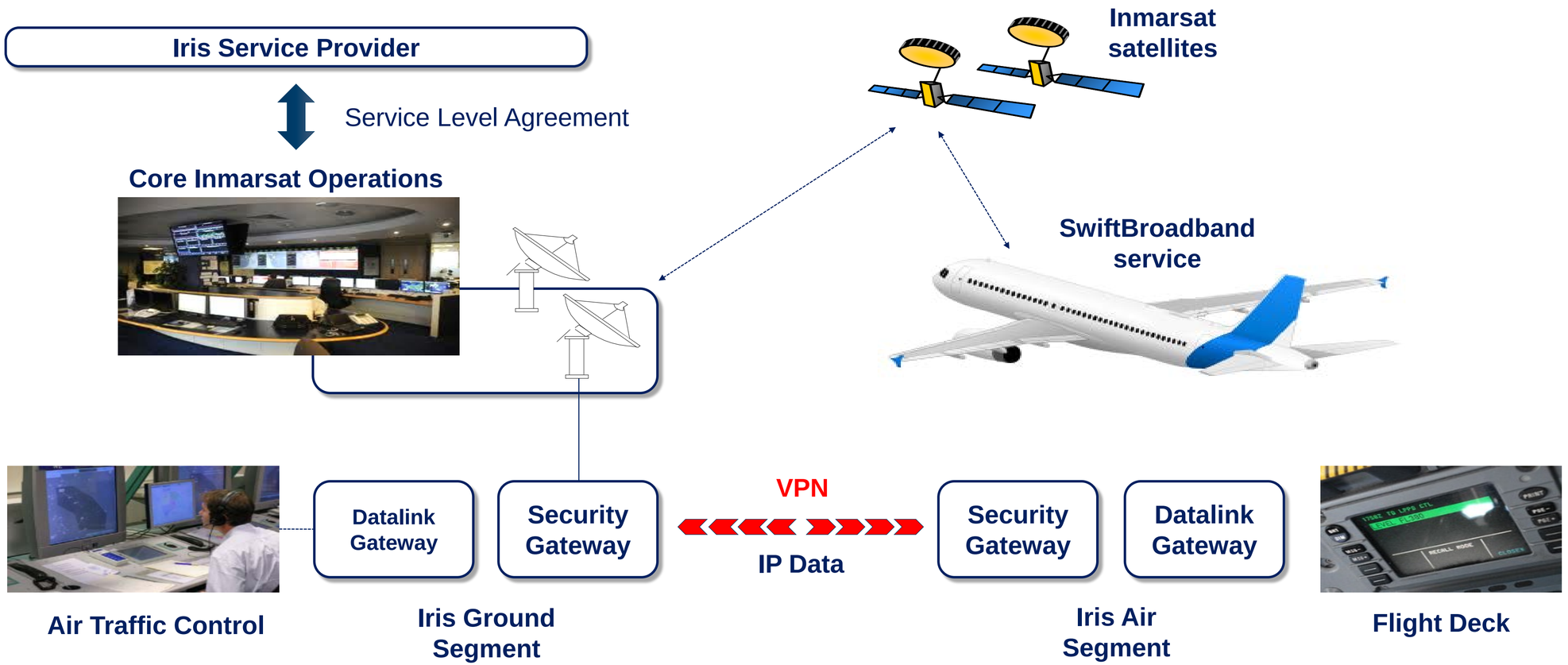
- Helicopter safety studies
- EC FP7 ASHLEY project (avionics)
- EC H2020 Secure societies DARWIN project (aviation, health care), (demo today)
- SESAR WPE SCALES resilient performance: combining enterprise architecture and resilience engineering
- SESAR Designing resilient ATM systems: multiple remote towers

SINTEF

Iris - A SATCOM system for 4D trajectory management

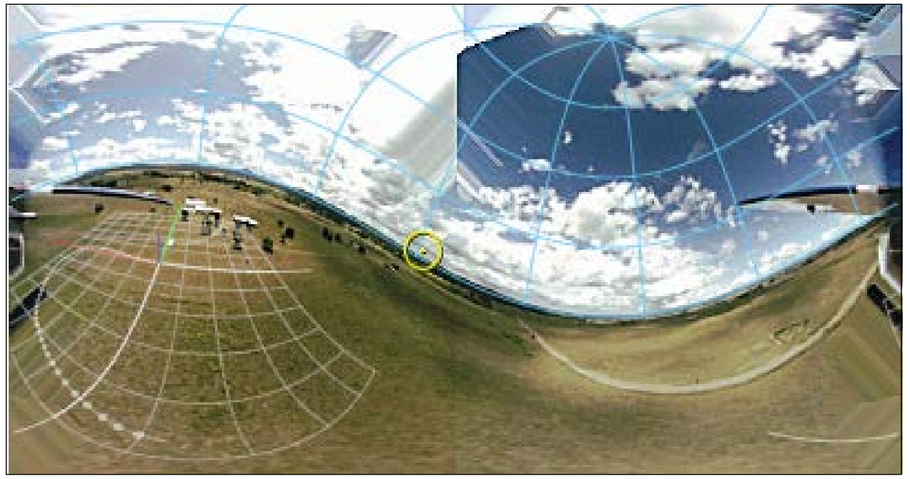
- SINTEF delivered PKI* SIM to the IRIS project 30000 aircraft



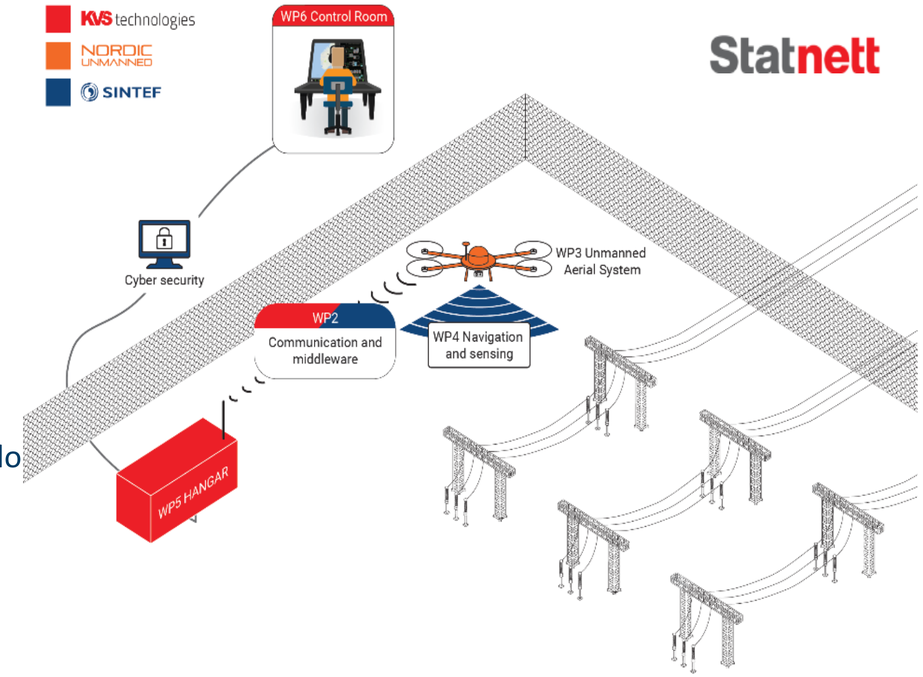


*Public Key Infrastructure

SINTEF technologies and competence enables drones to **sense & avoid, communicate, navigate, and inspect the environment**



- Inspection on electrical substations with resident drones (2018-19)
  - SINTEF: Sense & avoid, path planning, localization, EMI
  - Partners: Statnett, KVS Technologies, Nordic Unmanned
- Drone-based transportation of biological material
  - SINTEF: Drone operation safety
  - Partners: Oslo Universitetssykehus, Sykehuset Innlandet, FFI, Meterologisk Institutt, Dronebud
- Follow-me drone
  - SINTEF: Sense & avoid. Partner: Staaker
- Mobile and autonomous sensor platforms (2015-2017)
  - SINTEF Digital strategic effort on drone technologies incl. Sense & avoid, path planning, indoor-outdo localization, acoustic source detection, ++
- Technology and possibility studies
  - Automatic net condition monitoring by drones (SFI CINELDI project)
  - UAS technology for the petroleum industry (Equinor)
  - UAS for natural hazards and infrastructure (NVE, Bane NOR, Nor. Public Roads Administration)



SINTEF

New business models and increased value creation with drones

- The SINTEF-led RINVE network targets to increase value-creation within automation and robotics in inspection and maintenance

- SFI-initiative on drones and small satellites for the northern regions

SINTEF

Teknologi for et bedre samfunn