THIS IS SINTEF
One of Europe’s largest independent research organisations

- 2000 Employees
- 75 Nationalities
- 3700 Customers
- 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 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)

<table>
<thead>
<tr>
<th>Year</th>
<th>Investment (NOK mill)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>135</td>
</tr>
<tr>
<td>2014</td>
<td>172</td>
</tr>
<tr>
<td>2015</td>
<td>157</td>
</tr>
<tr>
<td>2016</td>
<td>100</td>
</tr>
<tr>
<td>2017</td>
<td>110</td>
</tr>
</tbody>
</table>
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
Major participant in EU research programs

- 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

- **BUSINESS**
  - Product development and the application of research results

- **THE UNIVERSITIES**
  - Basic research and education

- **SINTEF**
  - Multidisciplinary applied contract research
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

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

www.sintef.com/tto
SINTEF DIGITAL AVIATION ACTIVITIES
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 – 1045</td>
<td>Welcome</td>
</tr>
<tr>
<td></td>
<td>SINTEF mobility initiative</td>
</tr>
<tr>
<td></td>
<td>Introduction</td>
</tr>
<tr>
<td>1045 – 1115</td>
<td>Demo 1</td>
</tr>
<tr>
<td></td>
<td>Advanced Surface Routing and Safety Nets</td>
</tr>
<tr>
<td>1115 – 1145</td>
<td>Coffee</td>
</tr>
<tr>
<td>1145 – 1215</td>
<td>Presentations</td>
</tr>
<tr>
<td></td>
<td>AIRM - ATM Information Reference Model</td>
</tr>
<tr>
<td></td>
<td>IRIS - Satcom for Aviation</td>
</tr>
<tr>
<td>1215 – 1245</td>
<td>Demo 2</td>
</tr>
<tr>
<td></td>
<td>Remote Tower enhancements</td>
</tr>
<tr>
<td>1245 – 1330</td>
<td>Lunch</td>
</tr>
<tr>
<td>1330 – 1400</td>
<td>Demo 3</td>
</tr>
<tr>
<td></td>
<td>Enhanced Collaborative Airport Performance Management at Gardermoen</td>
</tr>
<tr>
<td>1400 – 1415</td>
<td>Presentation</td>
</tr>
<tr>
<td></td>
<td>Helicopter safety studies</td>
</tr>
<tr>
<td>1415 – 1445</td>
<td>Demo 4</td>
</tr>
<tr>
<td></td>
<td>ANYWHERE - Risk based decision support</td>
</tr>
<tr>
<td>1445 – 1500</td>
<td>Future work SESAR 2020 Wave 2</td>
</tr>
<tr>
<td>1500 – 1530</td>
<td>Discussion</td>
</tr>
</tbody>
</table>
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

www.sintef.no/aviation
Aviation R&D

SINGLE EUROPEAN SKY

ATM MASTER PLAN
- Optimised ATM network services
- High-performing airport operations
- Advanced air traffic services
- Enabling aviation infrastructures

« DEFINITION »

EXPLORATORY RESEARCH

INDUSTRIAL RESEARCH AND VALIDATION

VERY LARGE SCALE DEMOS

INCREASING MATURITY

SESAR SOLUTIONS

SESAR DEPLOYMENT

« DEVELOPMENT »

« DEPLOYMENT »
Aviation innovation path

TRL 1-2
TRL 3 - 6
TRL 7

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)
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
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.
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
SJINTEF 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
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
• 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?
Some other aviation 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
Aircraft noise

• Charts
  • 30 years of research and development
  • Methods
  • Software

• Cooperation with
  • Civil aviation
  • FAA
  • Eurocontrol
  • Air Force / NATO
• Development of a resilient ground station for satellite based landing systems for aviation (GBAS)
  • Replacing ILS
  • Focus on polar areas
  • National funded project
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
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

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
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-outdoor 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)
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.
Teknologi for et bedre samfunn