The VINGA project

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Introduction to the VINGA project

- Validation and Implementation of Next Generation Airspace
- A Single European Sky ATM Research (SESAR) project conducted in the frame of AIRE II (Atlantic Interoperability Initiative to Reduce Emissions), a joint program between SESAR and US FAA.
- The VINGA project consisted of the following partners:

AIRBUS

QUOVADIS

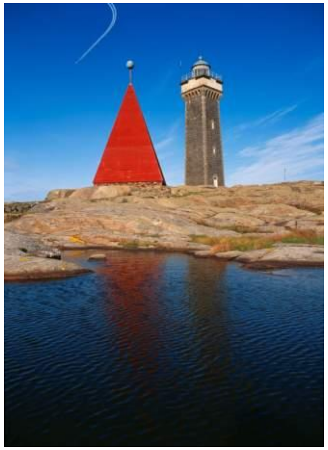
LFV

swedavia SWEDISH AIRPORTS

novair

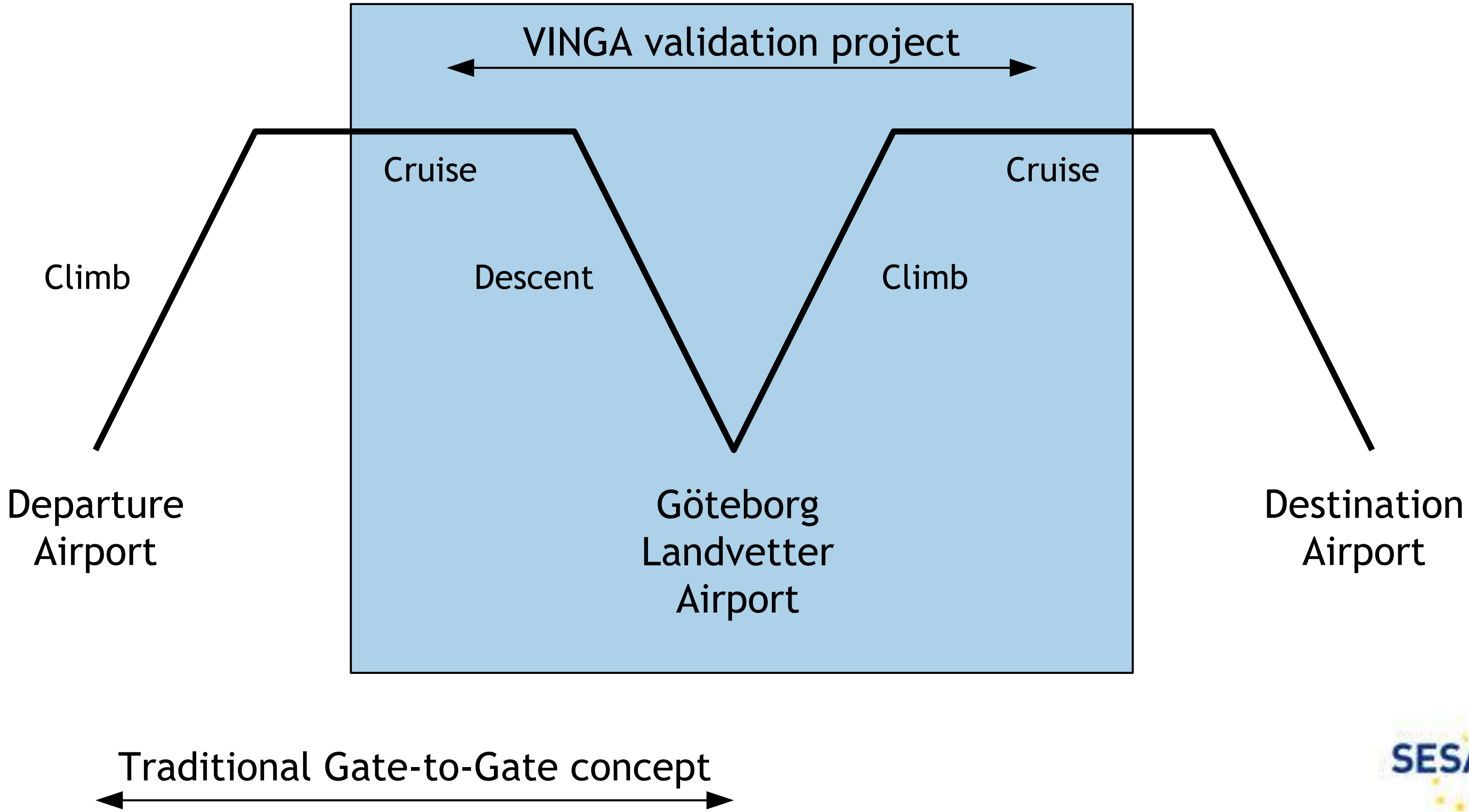
supported by:

CHALMERS



The VINGA validation project

The high level objective was to validate and implement new technique procedures in the day-to-day operation at Göteborg Landvetter Airport, to minimize the environmental footprint.



The different phases of the VINGA Flights

direct routing

ATC effective coordination

Curved approaches based on Satellite Navigation

Active time control of arriving aircraft

ATC effective coordination

Continuous Climb Operations

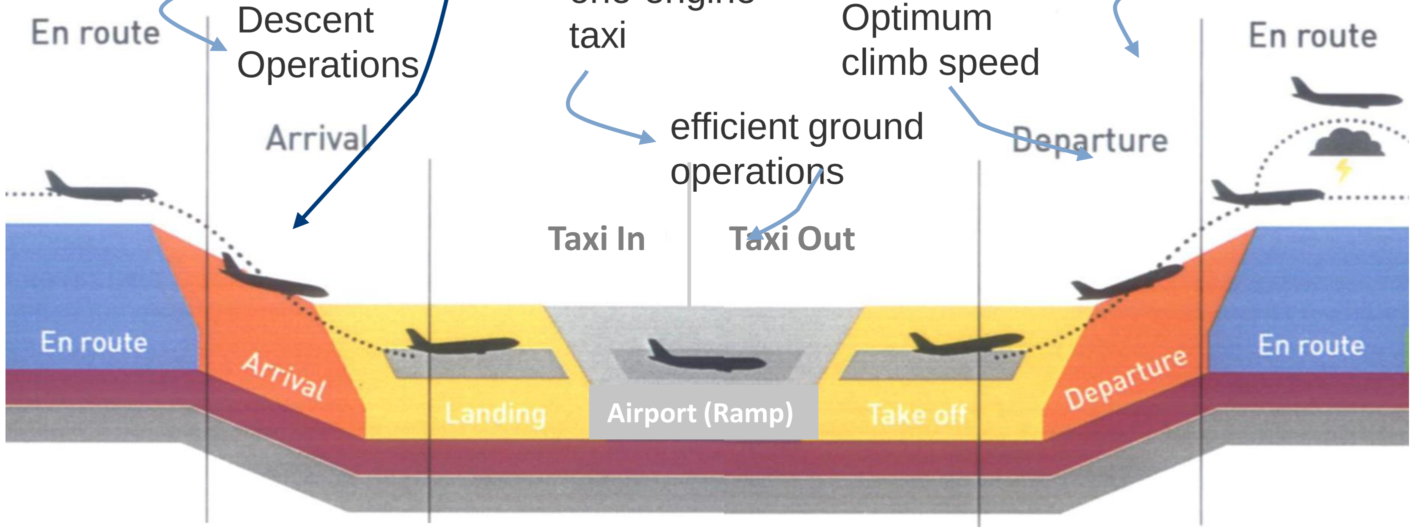
direct routing

Continuous Descent Operations

one-engine taxi

Optimum climb speed

efficient ground operations



VINGA approaches from an Air Traffic Control perspective

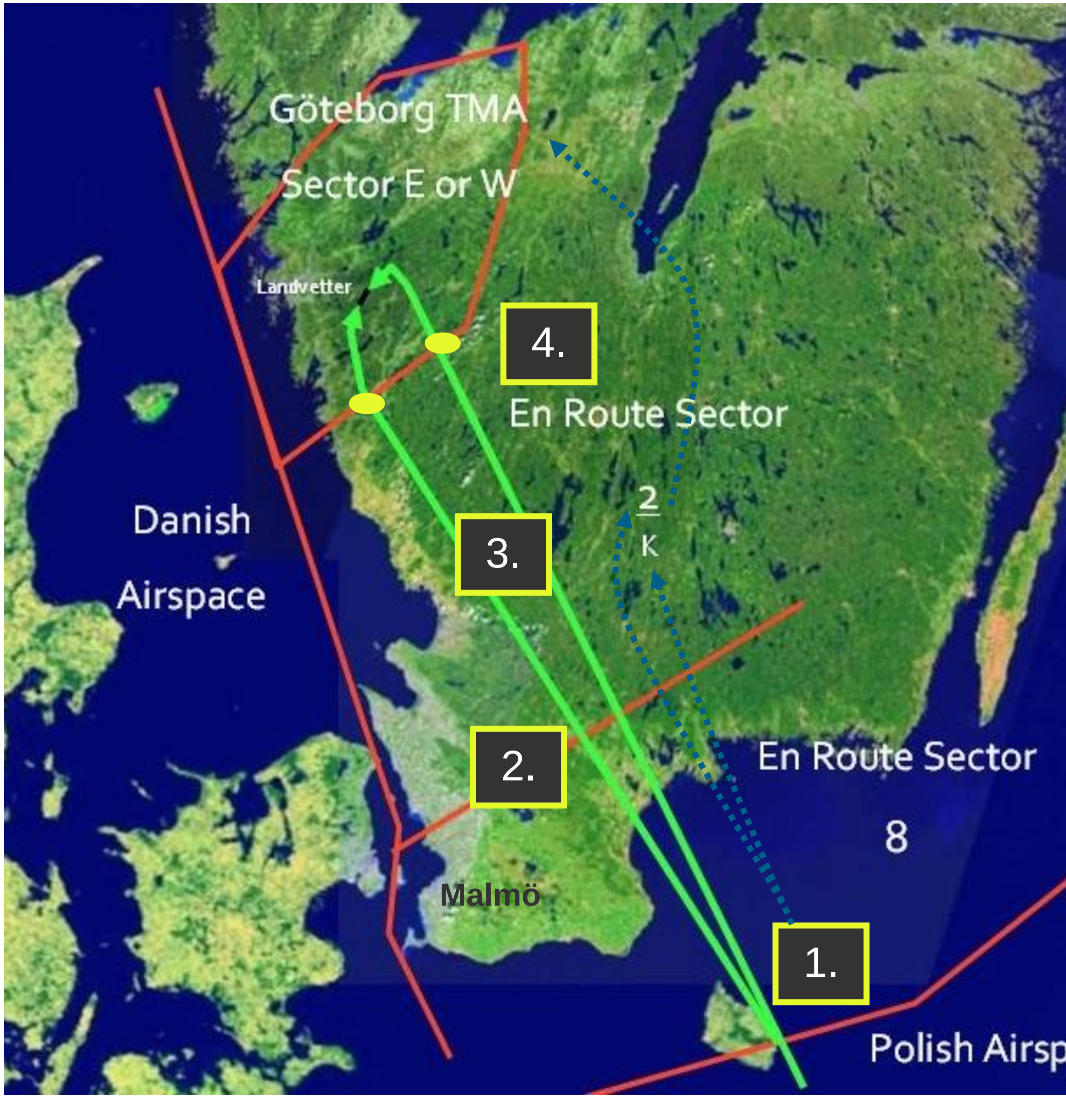
1. 300 km prior to landing.

   Initial contact between pilot and ATC in Malmö. Pilot request VINGA approach. ATC acknowledge the request and forward it via the internal system. ATC gives aircraft routing direct to OSNAK or KOVUX.

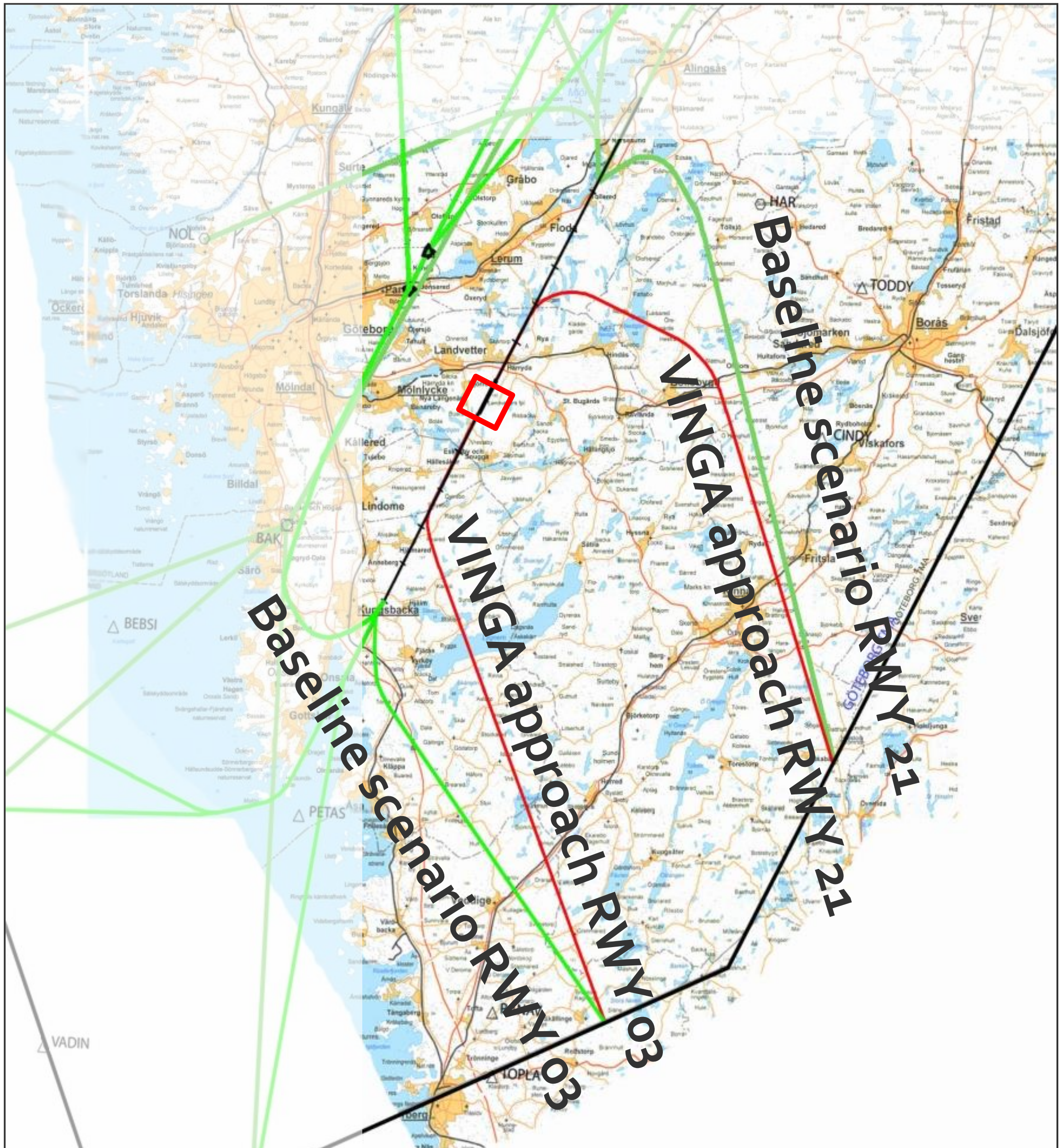
2. Aircraft leaves Top of Descent at optimum point.

3. Pilot receives inbound clearance. Information about flight to Göteborg ATC is handled in a silent manner..

4. Hand-over to approach sector – no verbal coordination.



VINGA approaches from an Air Traffic Control perspective



- Additional procedures to handle.
- Three different arrival scenarios, based on airborne capabilities and traffic intensity **Baseline**, **VINGA**, **tactical intervention** (radar vectoring).
- Similar ATC methods as pre-VINGA was decided to be used during the VINGA project.
- The main conclusion was that the “VINGA approach operation” worked well in the day-to-day operation for an airport, the size of Göteborg Landvetter Airport, and most likely at larger airports during off peak or night time.

Radar tracks – arrivals Göteborg RWY21

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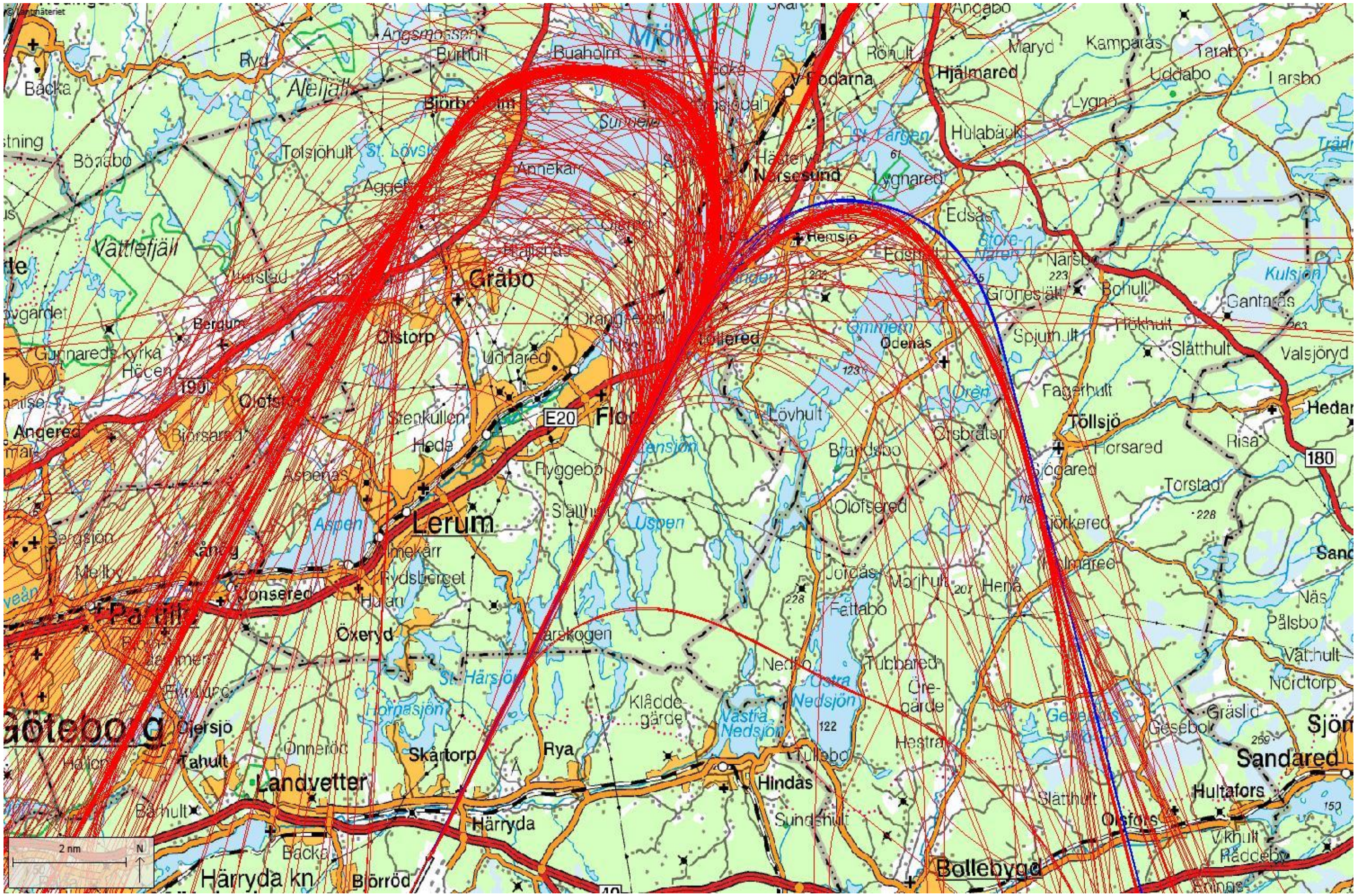
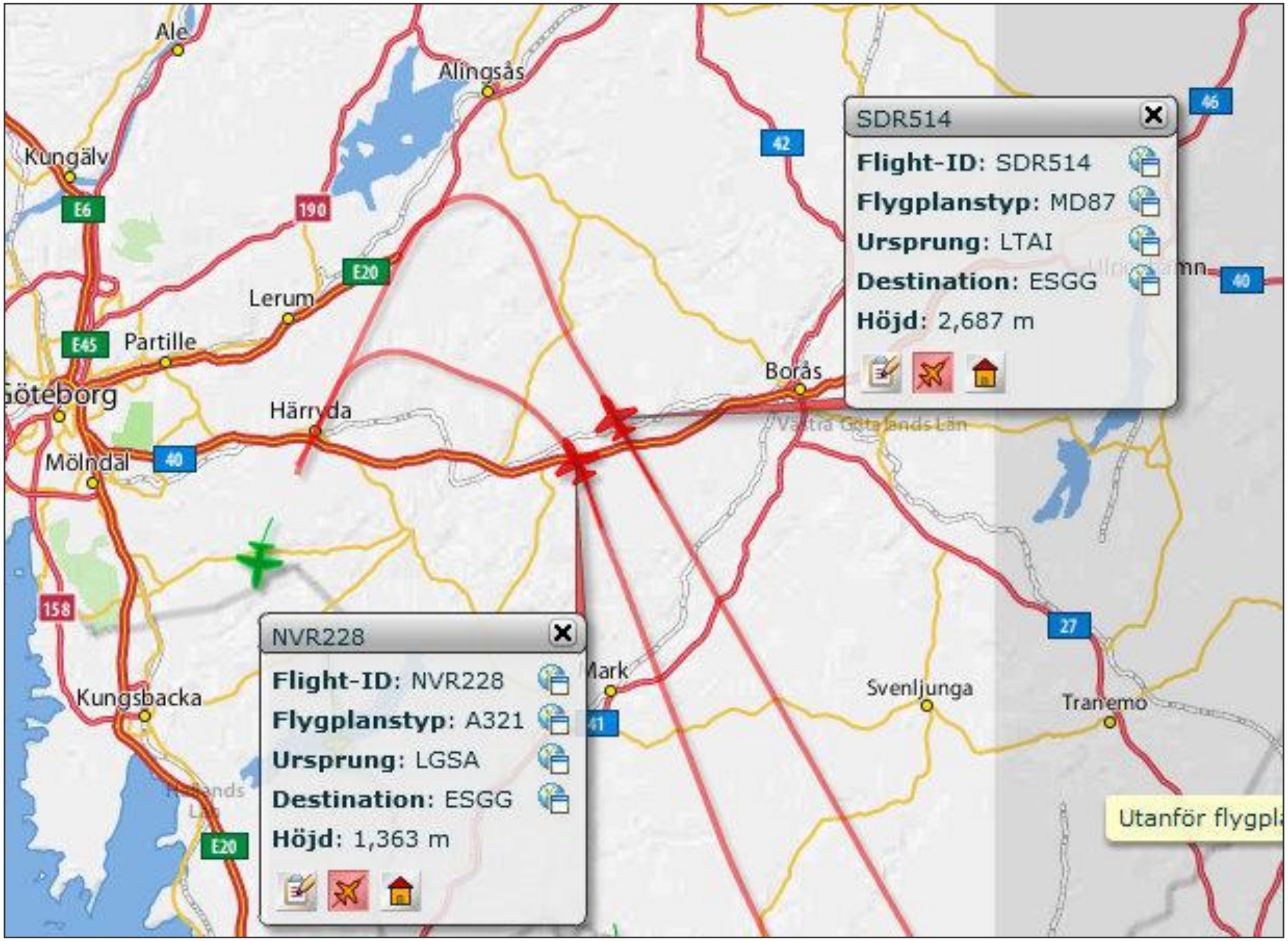


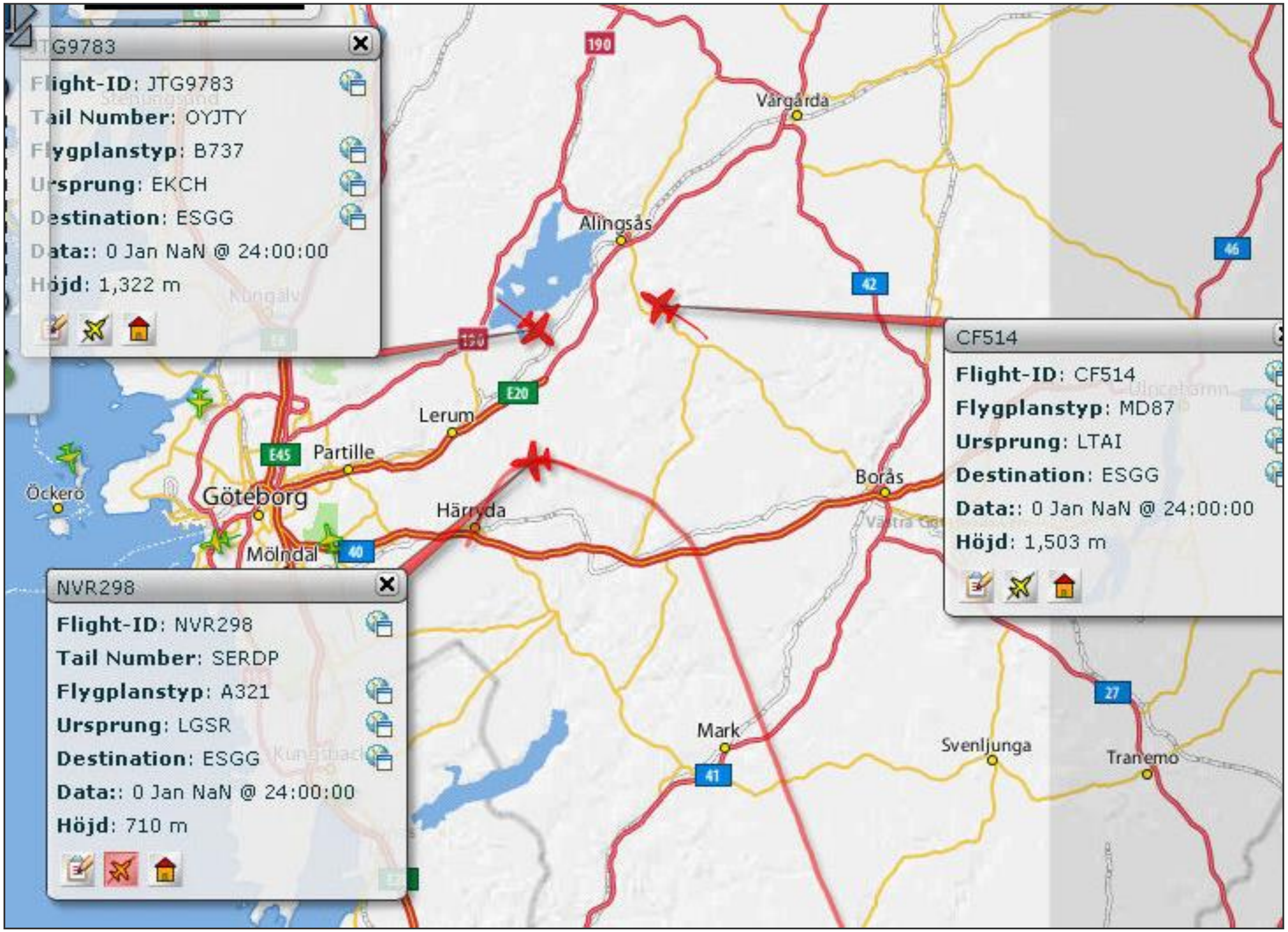
Airport

SESAR

VINGA from an Air Traffic Control perspective



VINGA from an Air Traffic Control perspective

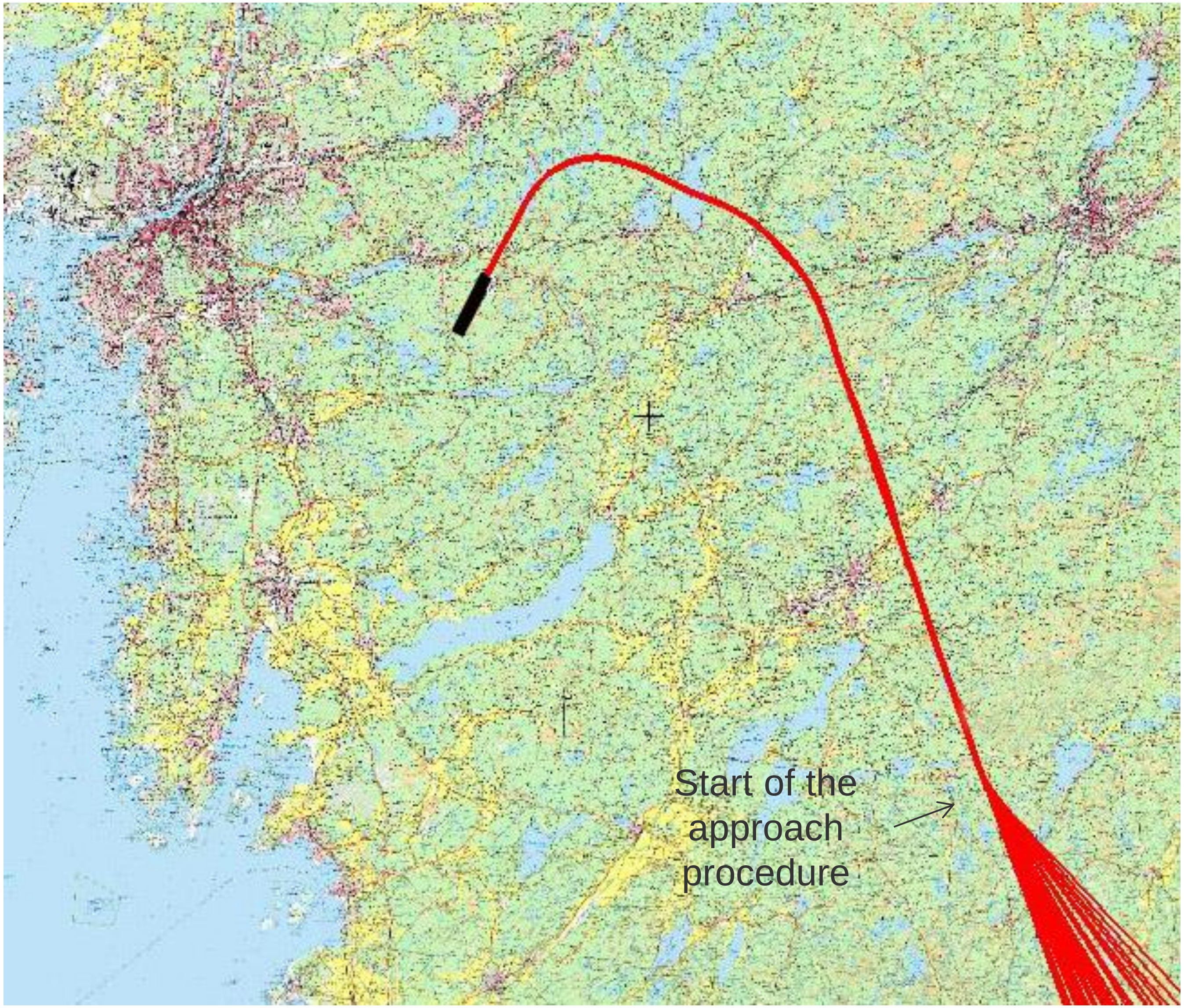


VINGA from an airline perspective

VINGA Approach vs. baseline operation RWY 21

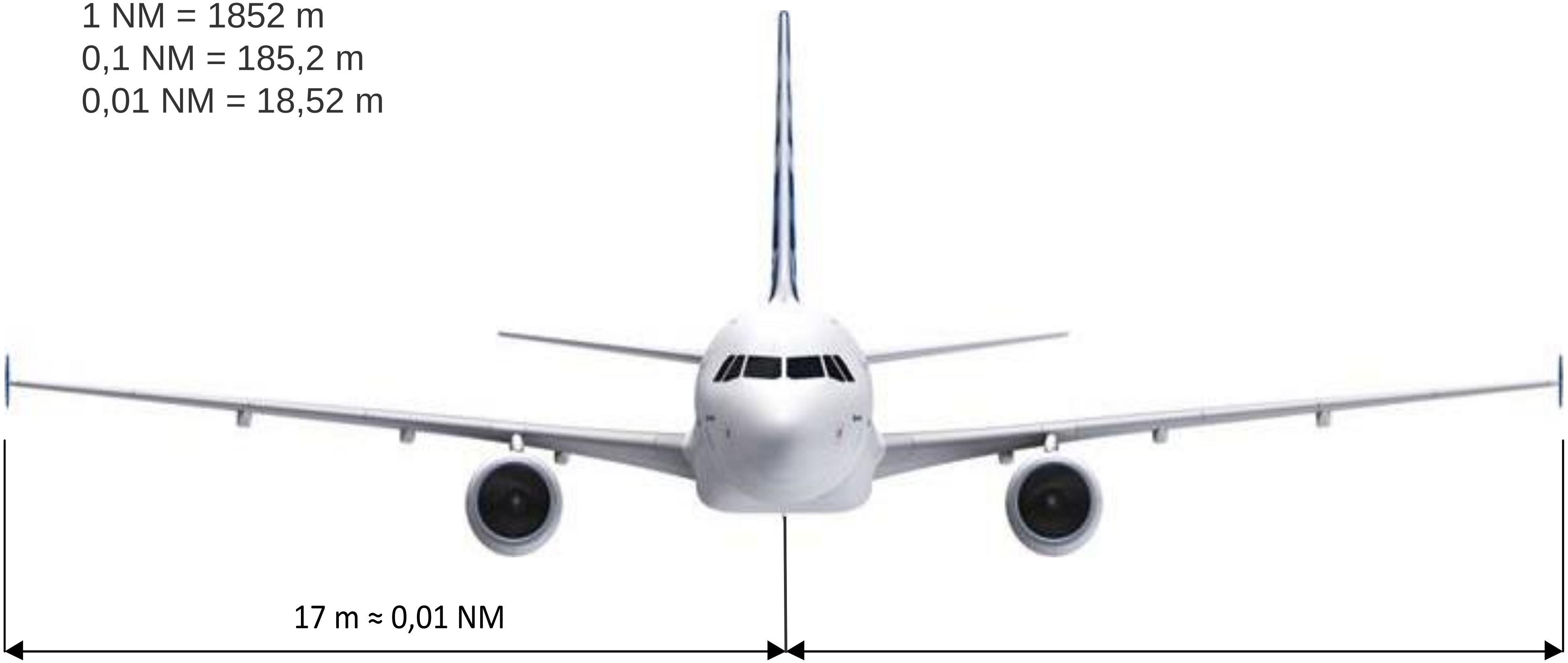
The VINGA Approach is 11 NM ≈ 20 km shorter than the baseline scenario.

Track adherence-VINGA approaches

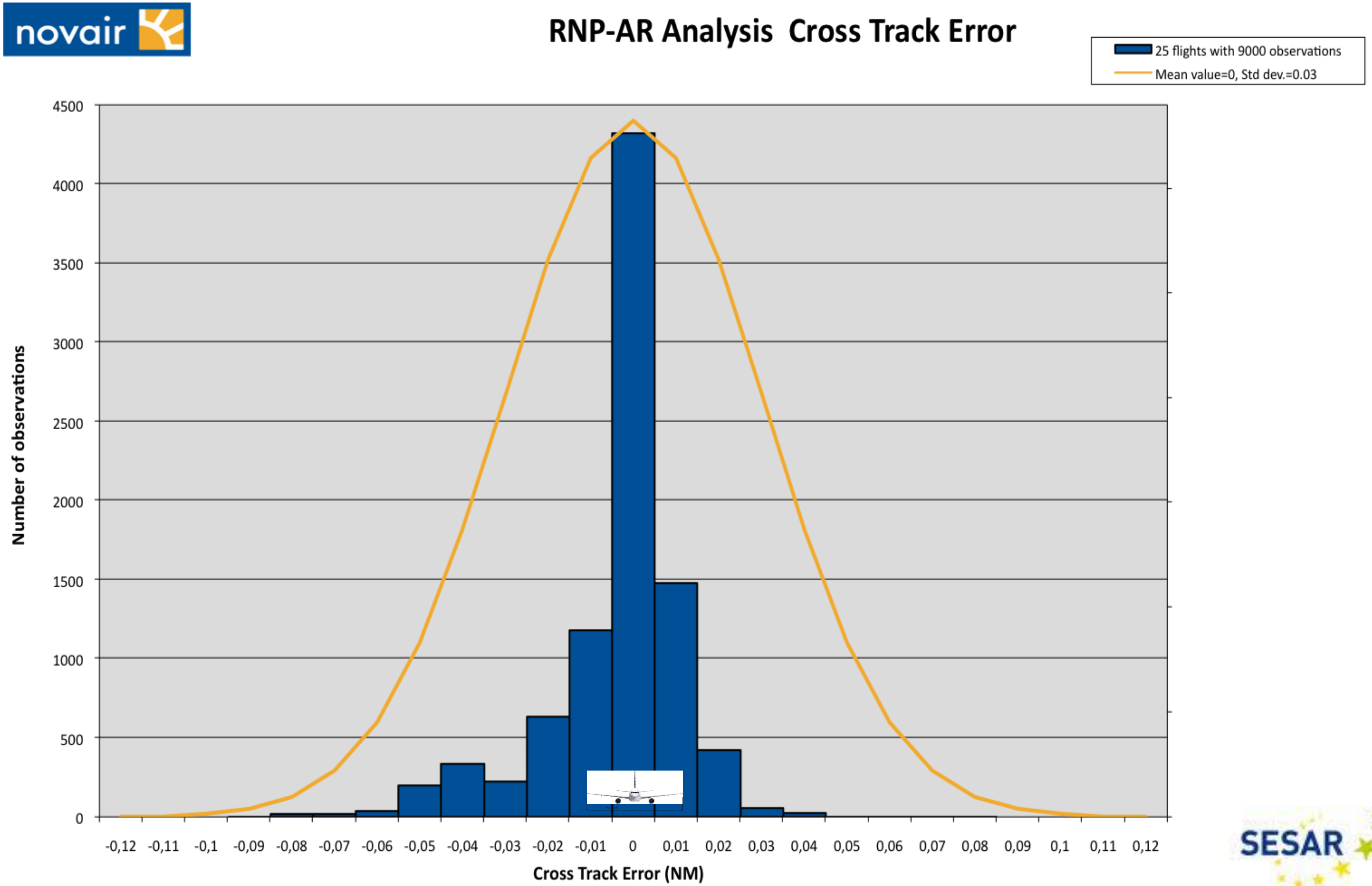


Track adherence-VINGA approaches

1 NM = 1852 m
0,1 NM = 185,2 m
0,01 NM = 18,52 m



Track adherence-VINGA approaches



Environmental analysis of VINGA

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- A conference paper was written by Novair and Chalmers University and accepted by ISABE on the subject of measuring energy intensity.
- A major literature survey was conducted blended with operational experience.
- This method is nowadays considered the ideal way of measuring fuel efficiency during flight validation in the frame of SESAR.

ISABE-2011-1403

A new method for measuring energy intensity during commercial flight missions

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Abstract
All parts of a flight mission have to be improved to minimize fuel consumptions. Here the final part of the flight mission for ordinary commercial flights is studied. A new energy intensity parameter is proposed that could be suitable to make comparisons between different final flight procedures. It is shown that energy efficiency improvements can be gained via the implementation of new navigation technologies in the order of 30%, but is highly affected by the number of passengers on board.

Nomenclature

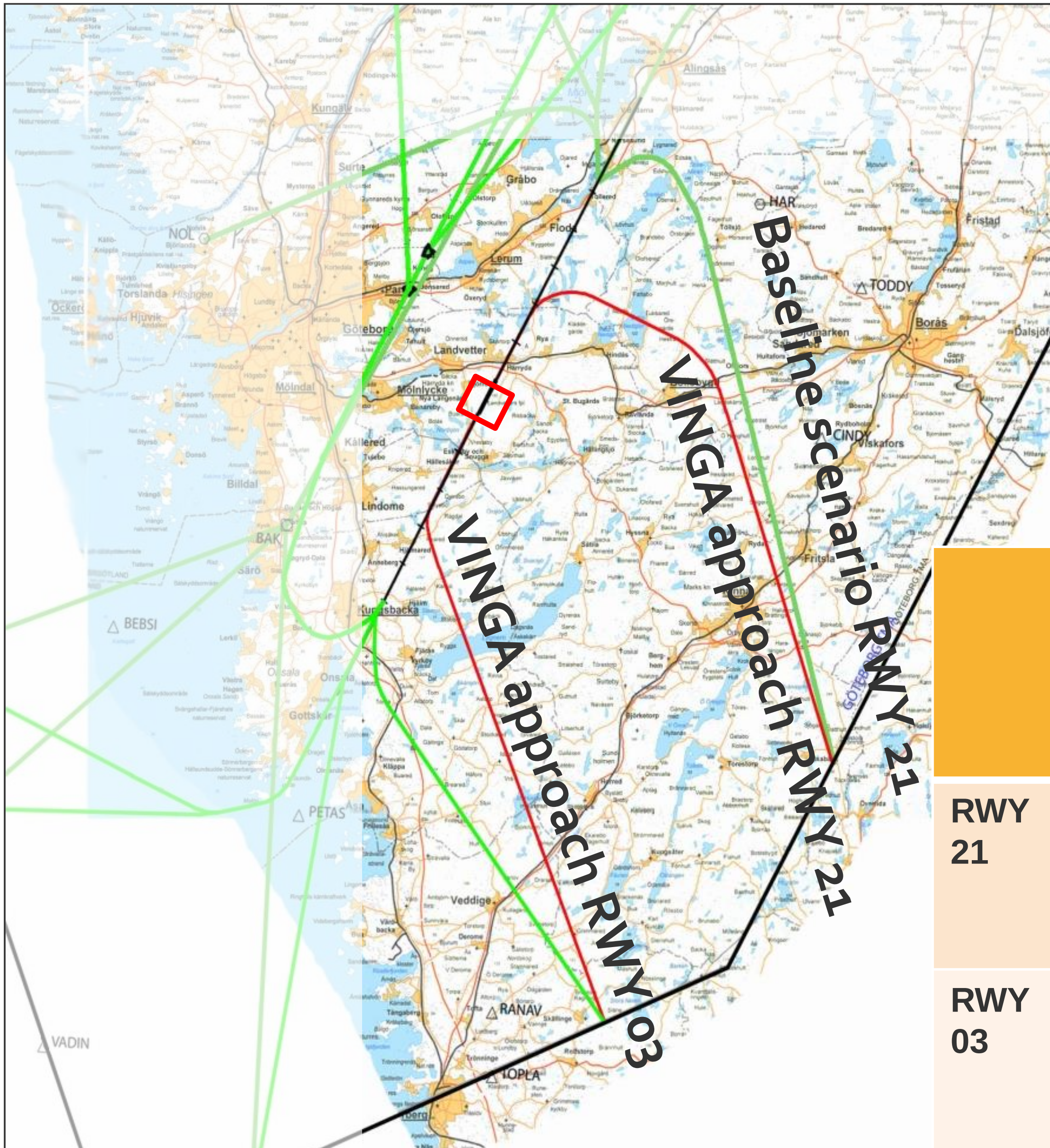
a_{SL}	Speed of sound at sea level
D	Drag
FH	Flight Hours
FIR	Flight Information Region
FL	Flight Level (altitude in feet/100)
F_N	Net thrust
g	Gravity constant
KCAS	Knots Calibrated Air Speed
L	Lift
M	Mach number
m	Mass
m_{FUEL}	Mass of fuel
NM	Nautical Mile (1852 m)
RNAV	Area Navigation
RNP	Required Navigation Performance
RNP AR	RNP Authorization Required
SFC	Specific Fuel Consumption
T	Ambient static temperature
T_{SL}	Temperature at sea level
W	Weight (mg)
θ	Temperature Ratio (T/T_{SL})

Introduction
Air traffic contributes to approximately 2% of the global anthropogenic carbon dioxide (CO_2) generation[1] and is now perceived as one of the fastest growing transport sectors[2]. Passenger traffic is expected to grow by 4,6% per year until 2036[3]. The aviation sector thus threatens to become a substantial and ever increasing contributor to Greenhouse Gas (GHG) emissions. Pollutant emissions from combustion processes have become of great public concern due to their impact on health and the environment. The past decade has witnessed rapid changes both in the regulations for controlling aero engine emissions and in the technologies used to meet these regulations.

The very stringent environmental goals introduced by the Advisory Council for Aeronautics Research in Europe (ACARE)[4] in their vision for the year 2020 have been widely accepted by the aviation industry. This includes the European Commission in their "Clean Sky" project[5] and the European Air Traffic Management (ATM) modernization program SESAR[6], which strives for further improvements in energy efficiency. In parallel, some airlines, airports and Air Navigation Service Providers (ANSPs) are actively working with fuel saving initiatives throughout the world, to minimize their environmental impact[7].

From a high level perspective, there is interest within, for example, SESAR and the International Civil Aviation Organization (ICAO) and its technical bodies, to develop CO_2 or GHG emissions standards for commercial aviation[8]. However, to date there have been no widely accepted solutions for how to develop such emissions standards. This is because of

VINGA fuel efficiency analysis



	Distance vs. baseline	Total Fuel saving	Lateral Fuel saving	Vertical Fuel saving
RWY 21	-11 NM	-90 kg	-71 kg	-19 kg
RWY 03	-3 NM	-22 kg	-16 kg	-6 kg

VINGA main conclusions

- The project showed that it is possible to implement new procedures in parallel with the existing procedures.
- Working in partnership amongst all stakeholders is essential.
- The operation was well received by the pilots and by the Air traffic Controllers.
- The curved procedures are published in the Swedish Aeronautical Information Publication and available in todays operation.

The VINGA report

09 Dec 2011

Edition 02.00

Project ID: VINGA Final Report

D2011-019555

The VINGA Project
Final Report

www.sesarju.eu/news-press/documents/aire-2-reports-1034