



OPNOP

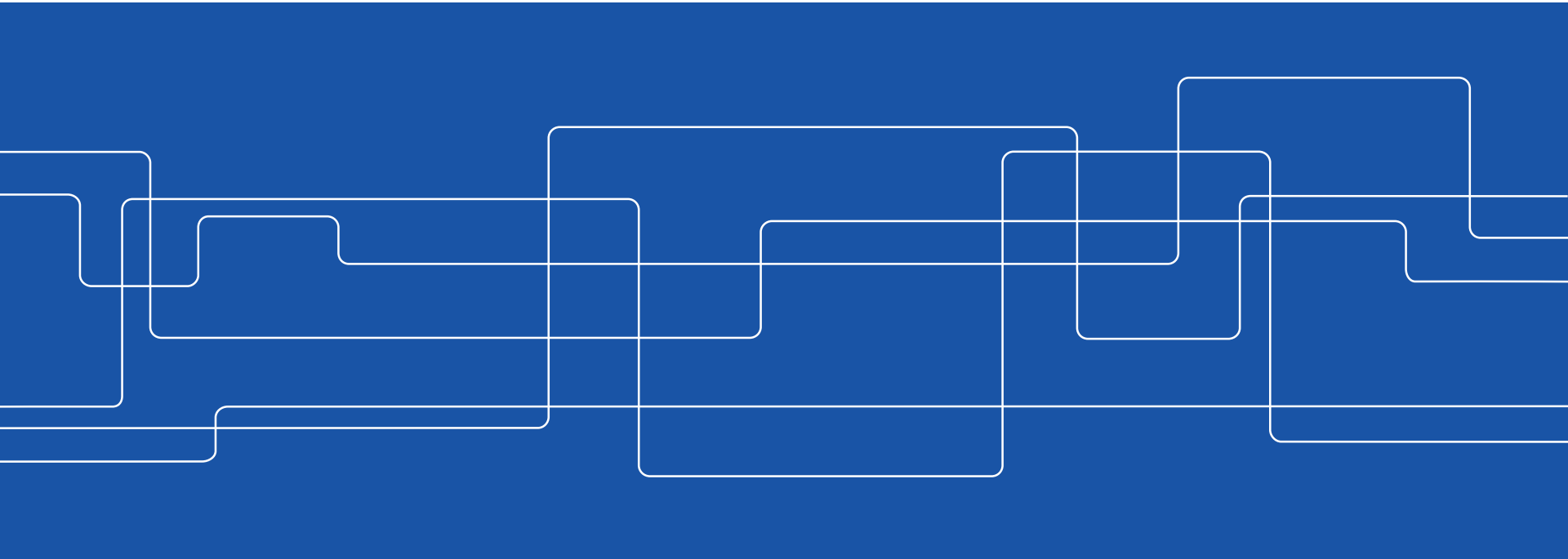
Operational Noise Optimisation

Status report at CSA Workshop 12 October 2020

Bengt Moberg, Vernamack AB



CSA
Centre for
Sustainable
Aviation





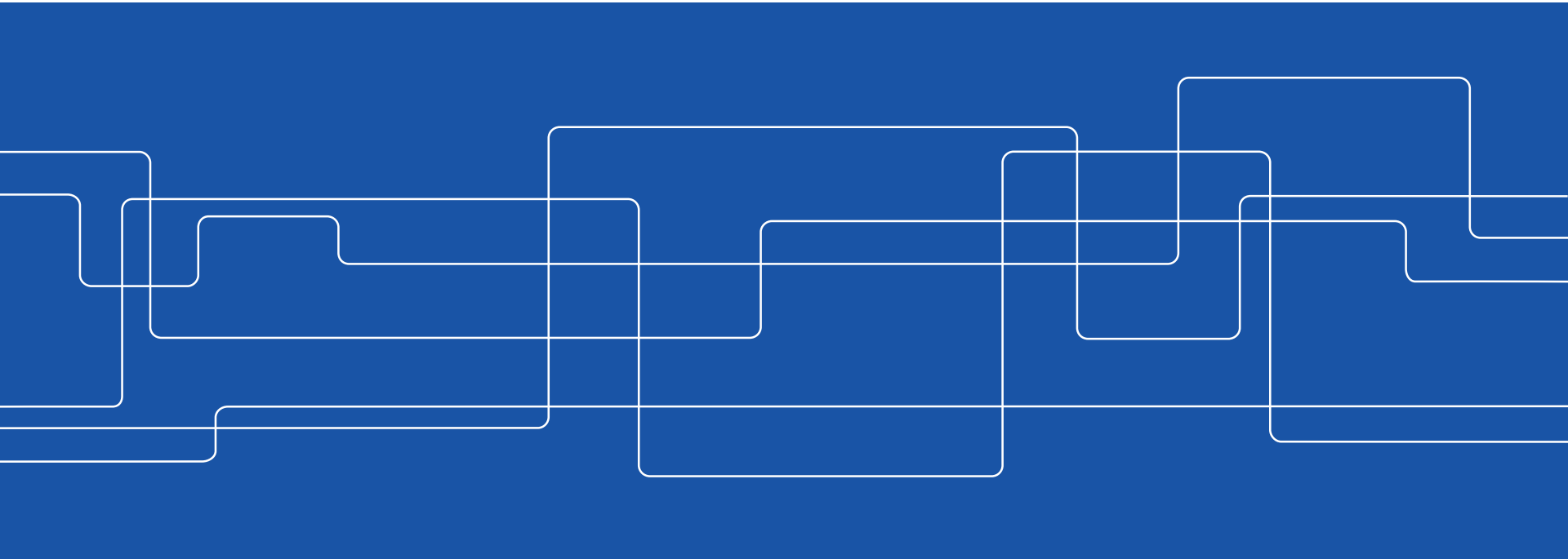
CSA
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Aviation

ERAS

Evaluation of Realistic Approach Scenarios

Status report at CSA Workshop 12 October 2020

Bengt Moberg, Vernamack AB





OPNOP – Project members



- KTH (Project lead)
- Novair
- Natmer AB
- Vernamack AB

OPNOP – The project idea

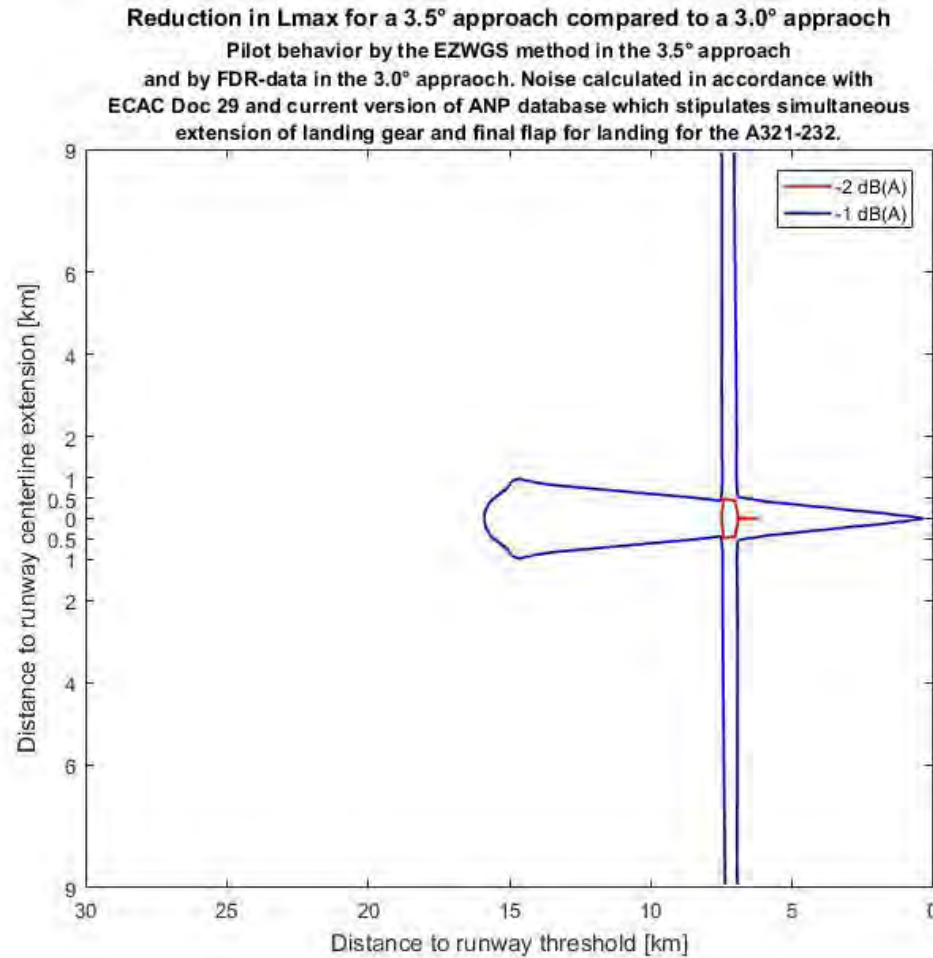
Is it possible to move noise from one area to another by operational recommendations or limitations?



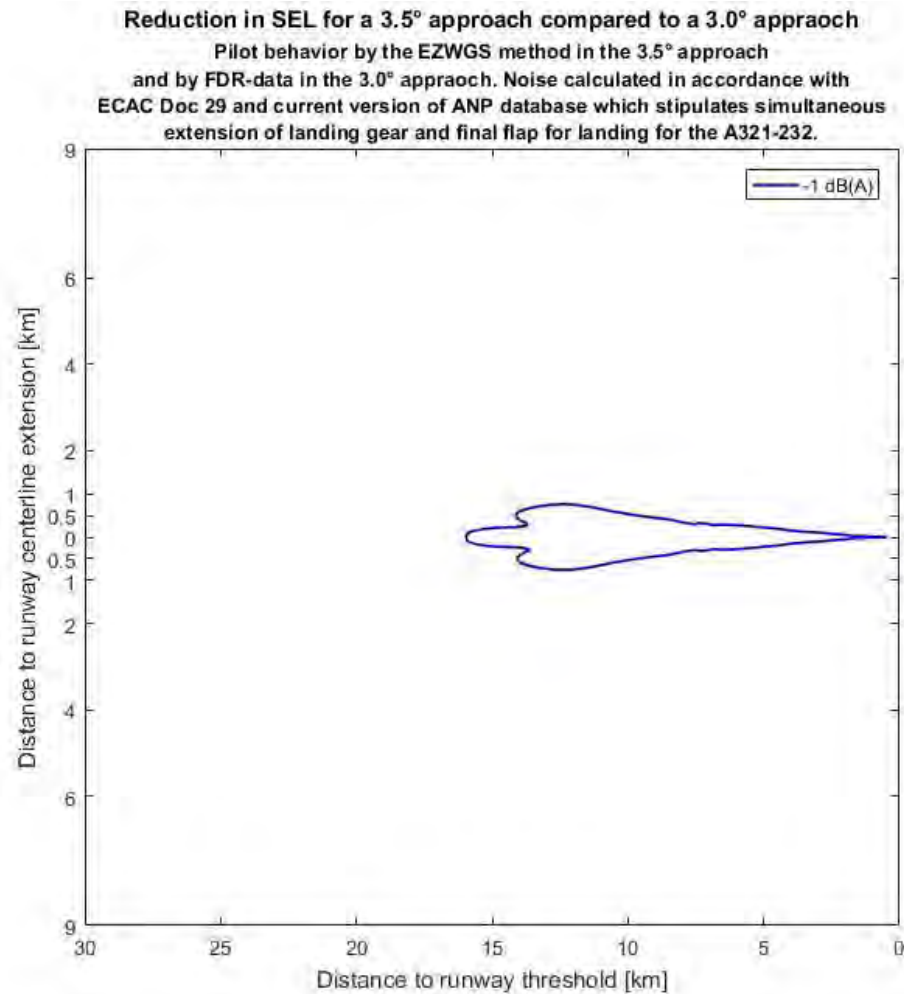
OPNOP – Objectives

- Describe noise during different phases of the approach and its dependence on:
 - Extension of flaps or slats
 - Extension of landing gear
 - Aircraft airspeed
- Describe how noise during an approach potentially can be distributed by the control of speed or when landing gear and/or slats/flaps are extended.
- If possible, describe the relation between CO₂-emissions versus noise in different operational scenarios.
- Assist other projects at the CSA with flight operational competence and FDR-data.

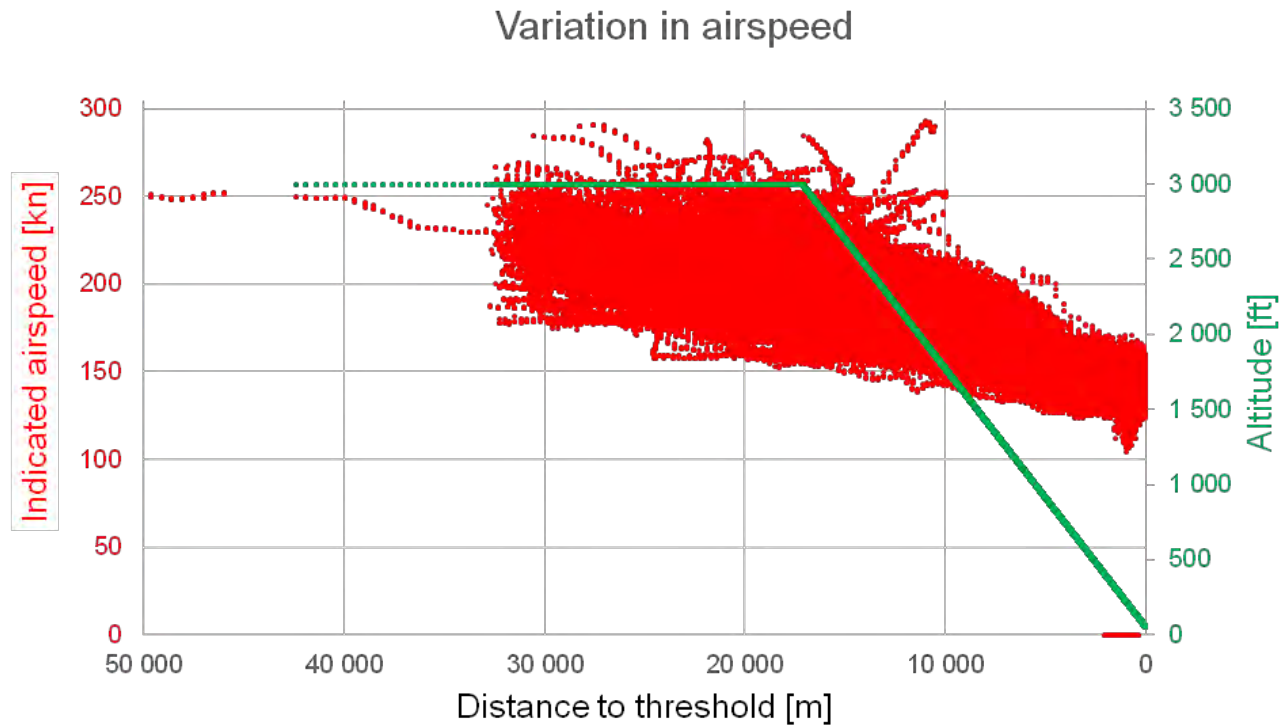
From previous project Brantare



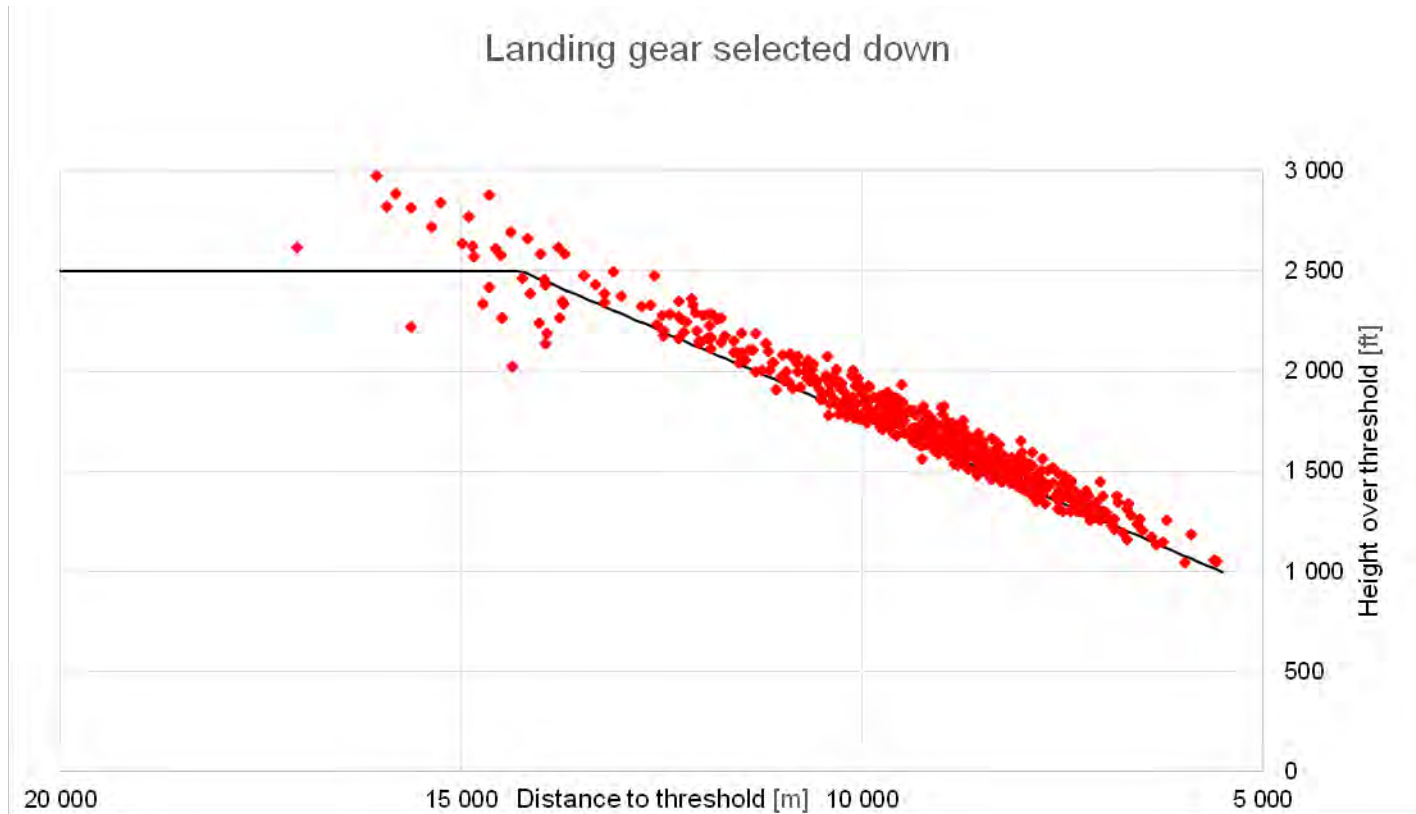
From previous project Brantare



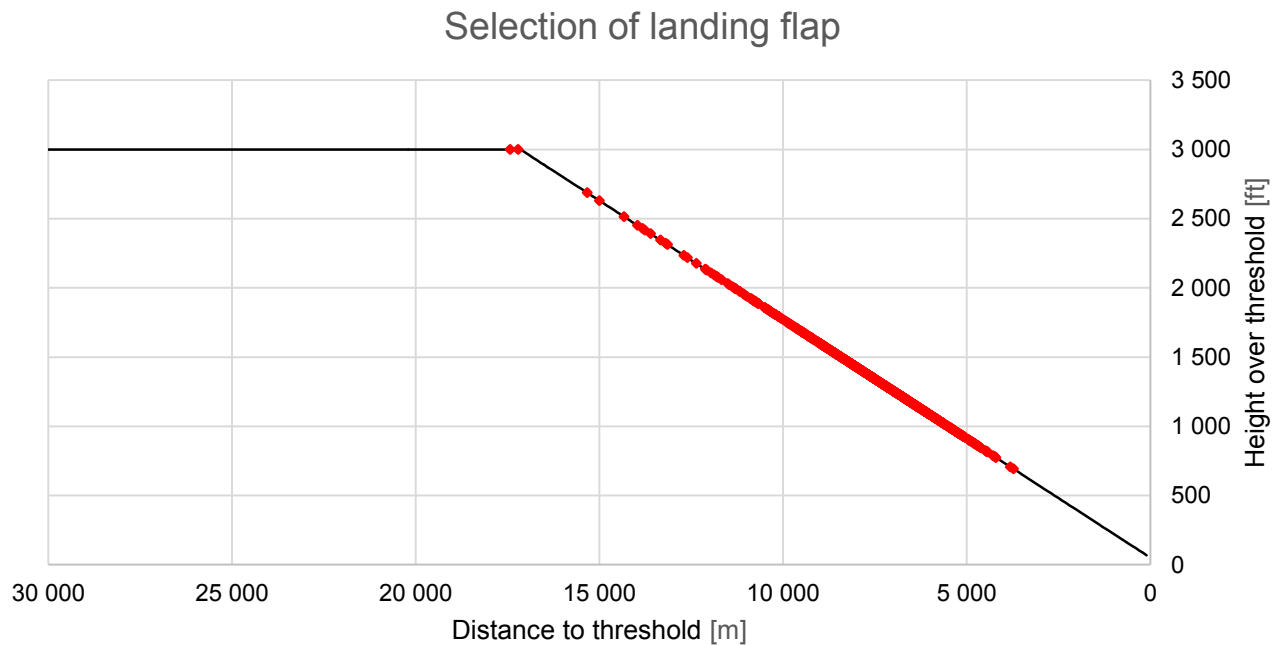
How do pilots operate the aircraft?



How do pilots operate the aircraft?



How do pilots operate the aircraft?



Collecting data

- Novair is the airline participating in the project
- Earlier project Airbus A321-232
- New aircraft Airbus A321-251N (A321Neo)
- Δ dB approach = -0,9 dB (less noise)
- Δ dB departure = -4,5 dB (less noise)



- New aircraft – new noise profiles
- No use of old FDR-data

Collecting data

And then...

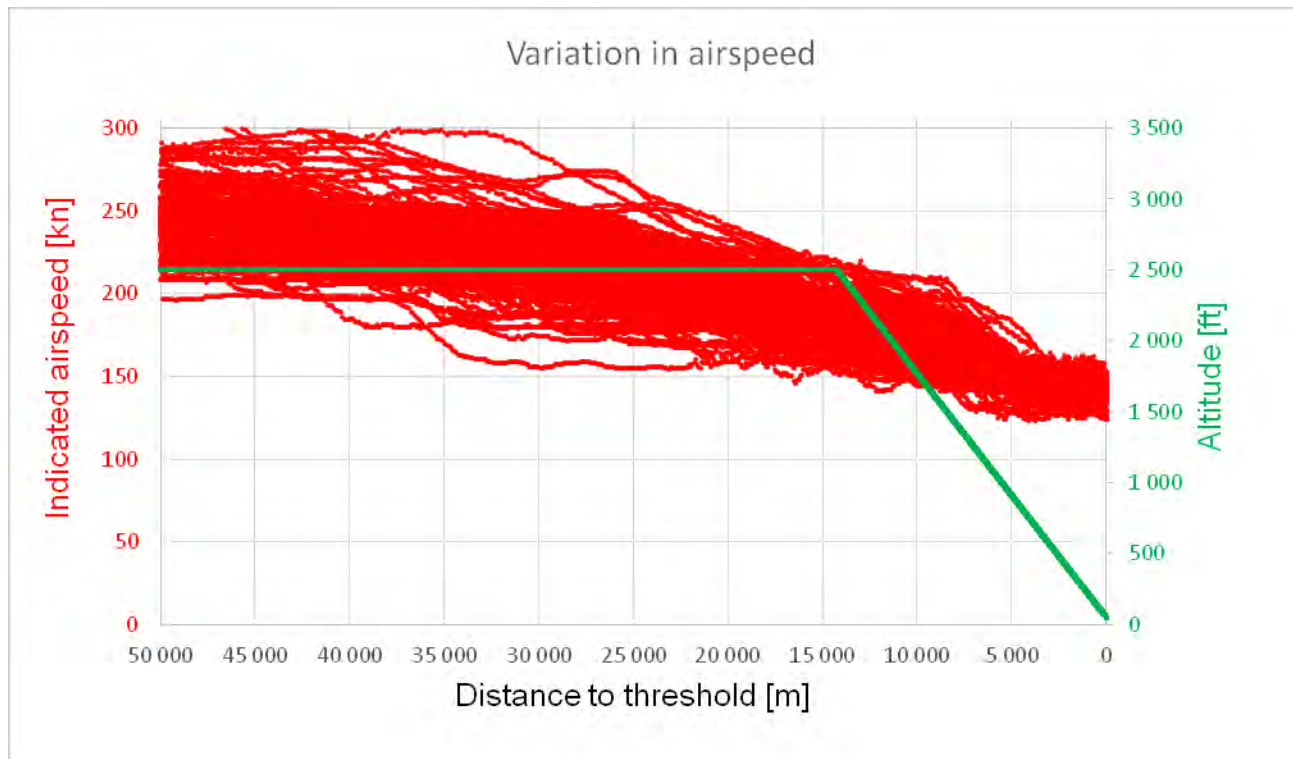
- Covid19
 - No data coming in
 - Bankruptcy for Novair?
 - ???
- A solution was found
- FDR-data collected from 198 flights into Arlanda runway 26.

Collecting data

- FDR- data washed and cleaned and joined with noise data in an SPSS database

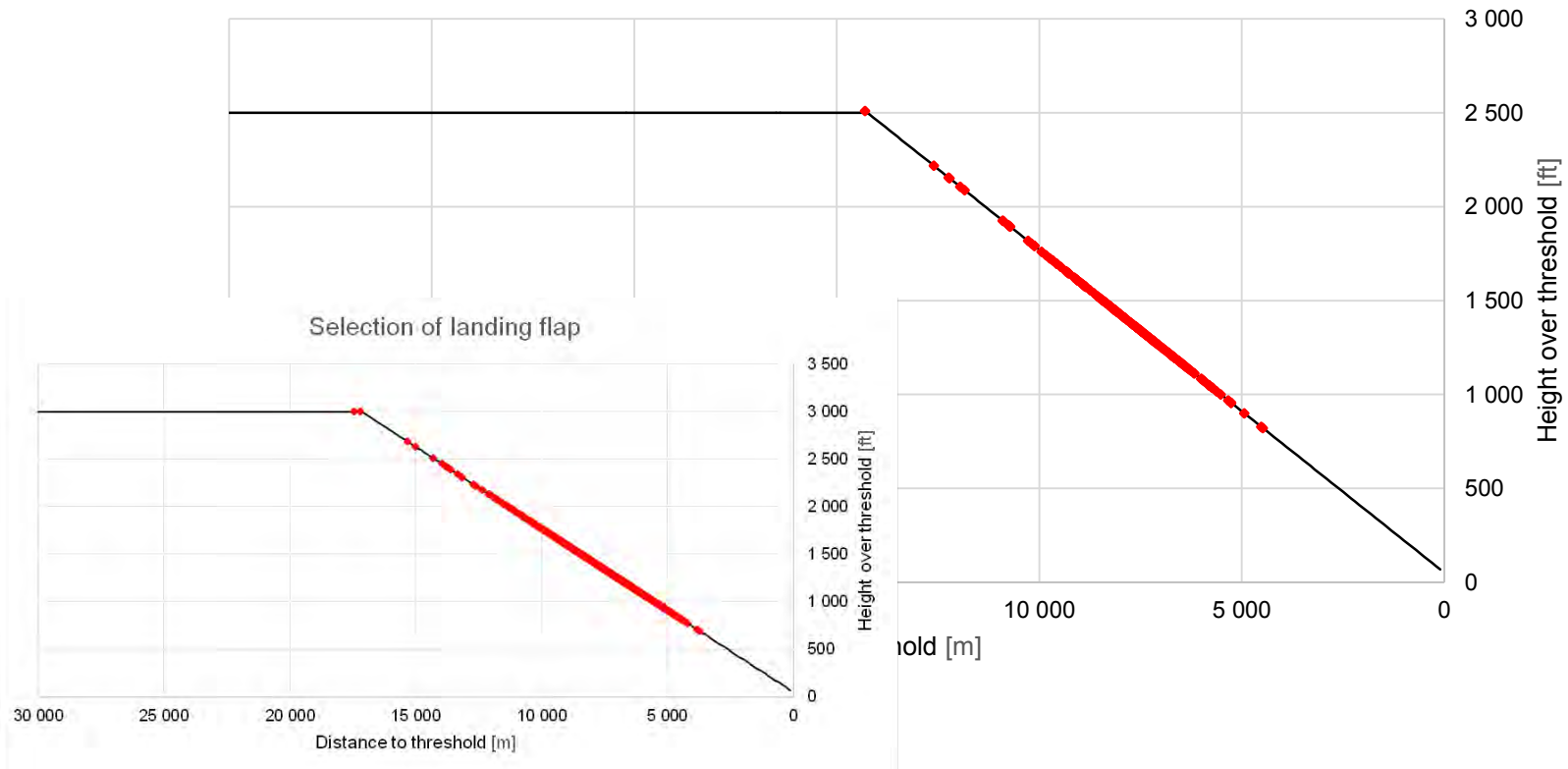


How do pilots operate the aircraft?



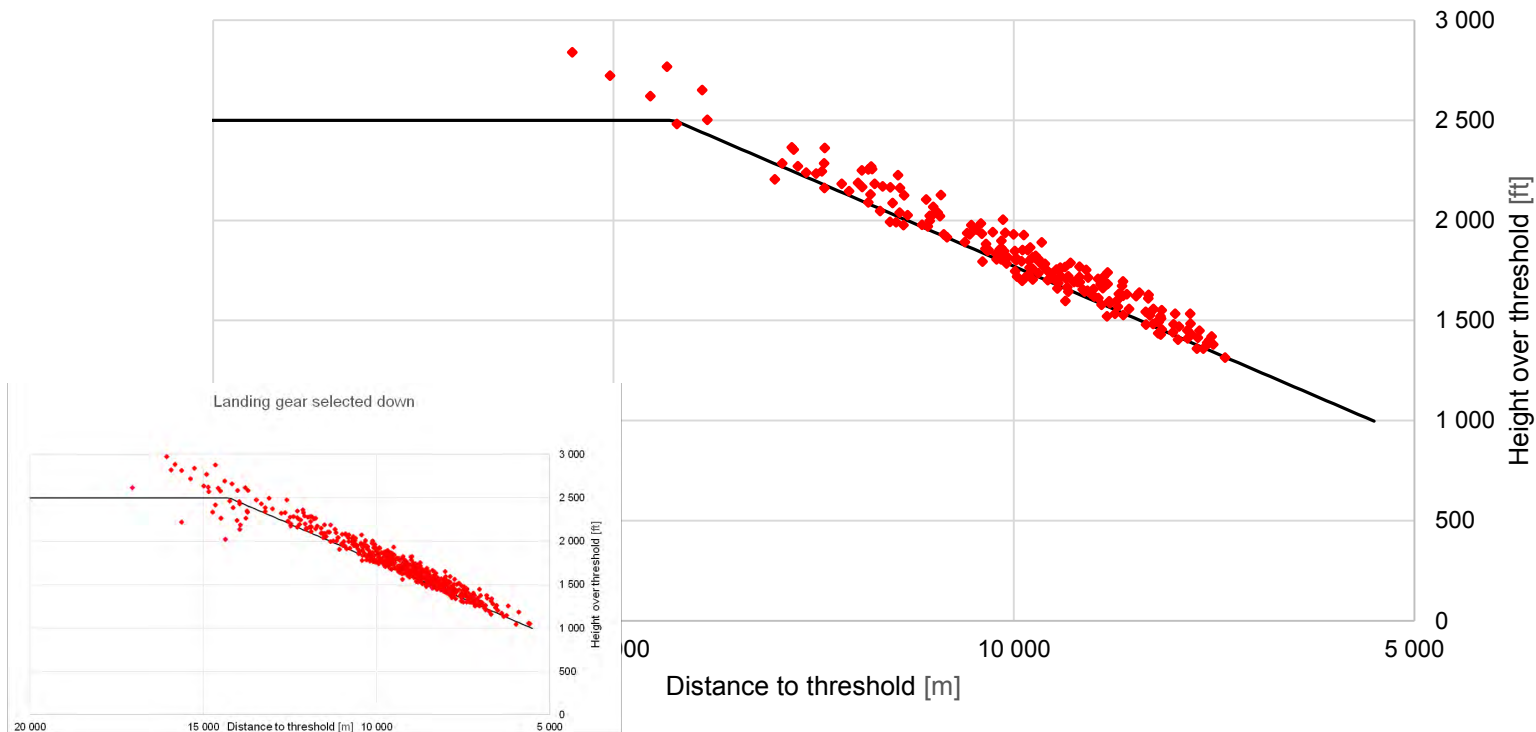
How do pilots operate the aircraft?

Selection of landing flap



How do pilots operate the aircraft?

Landing gear selected down



How do pilots operate the aircraft?



How do pilots operate the aircraft?



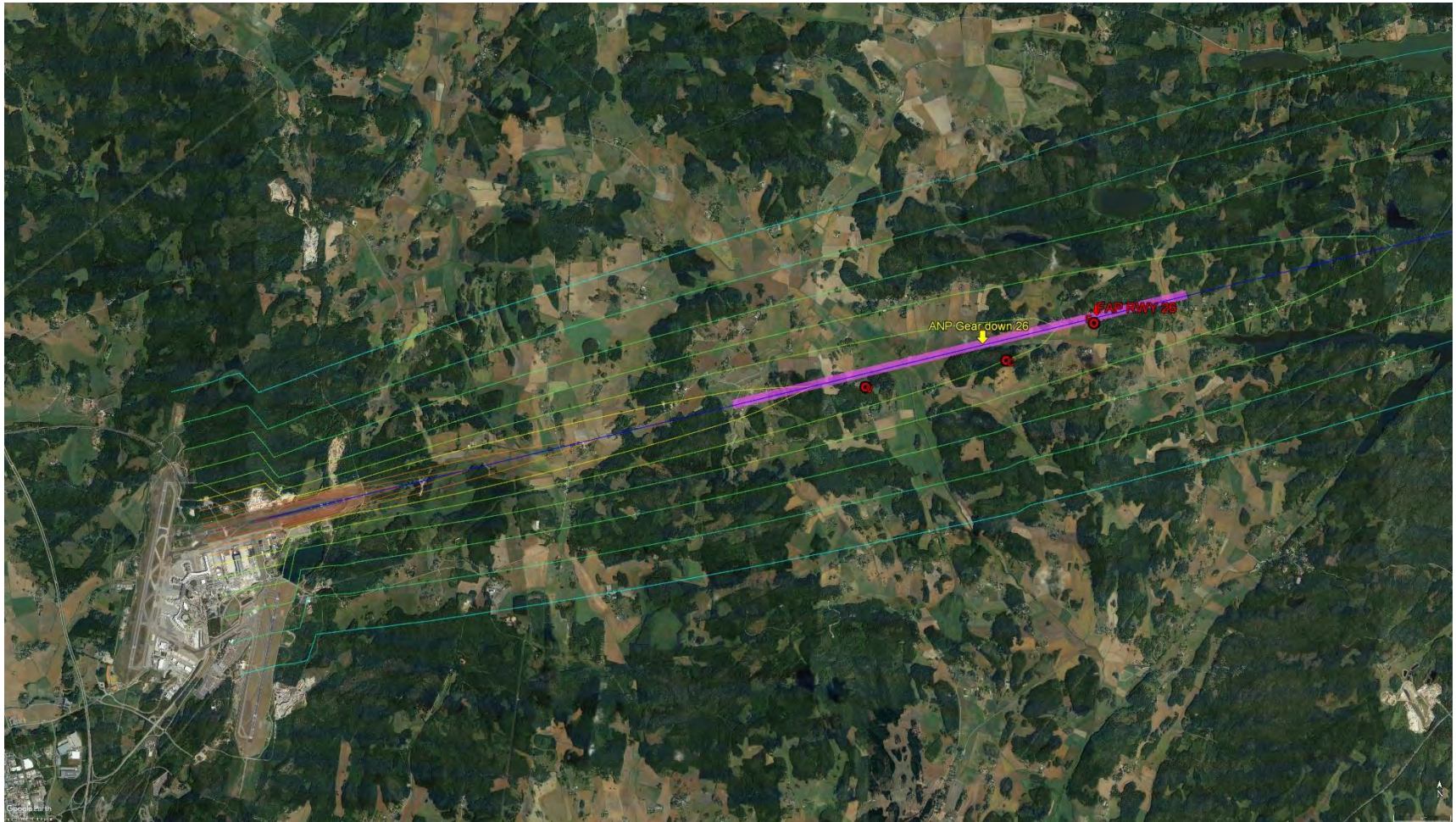
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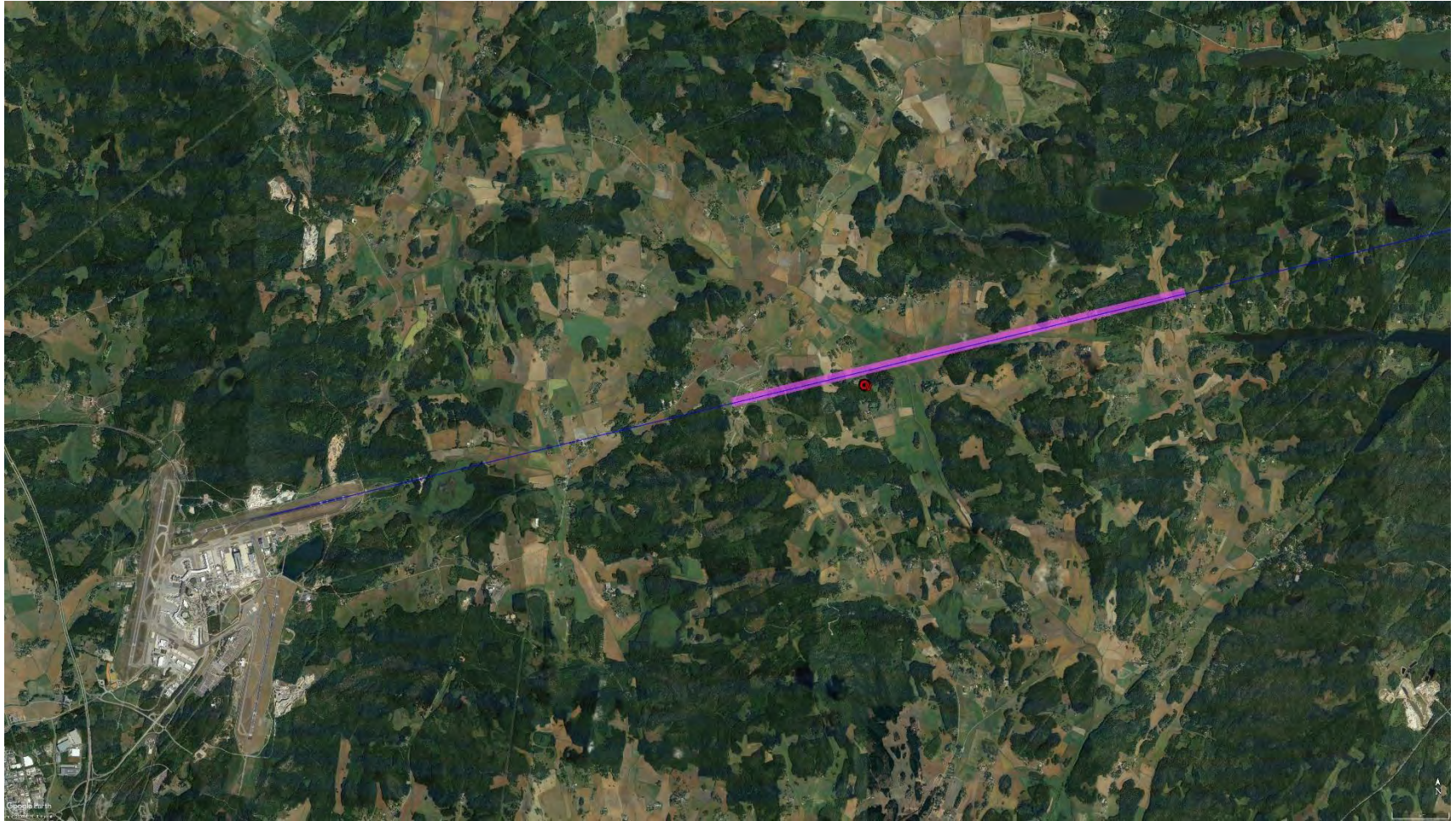
How do pilots operate the aircraft?



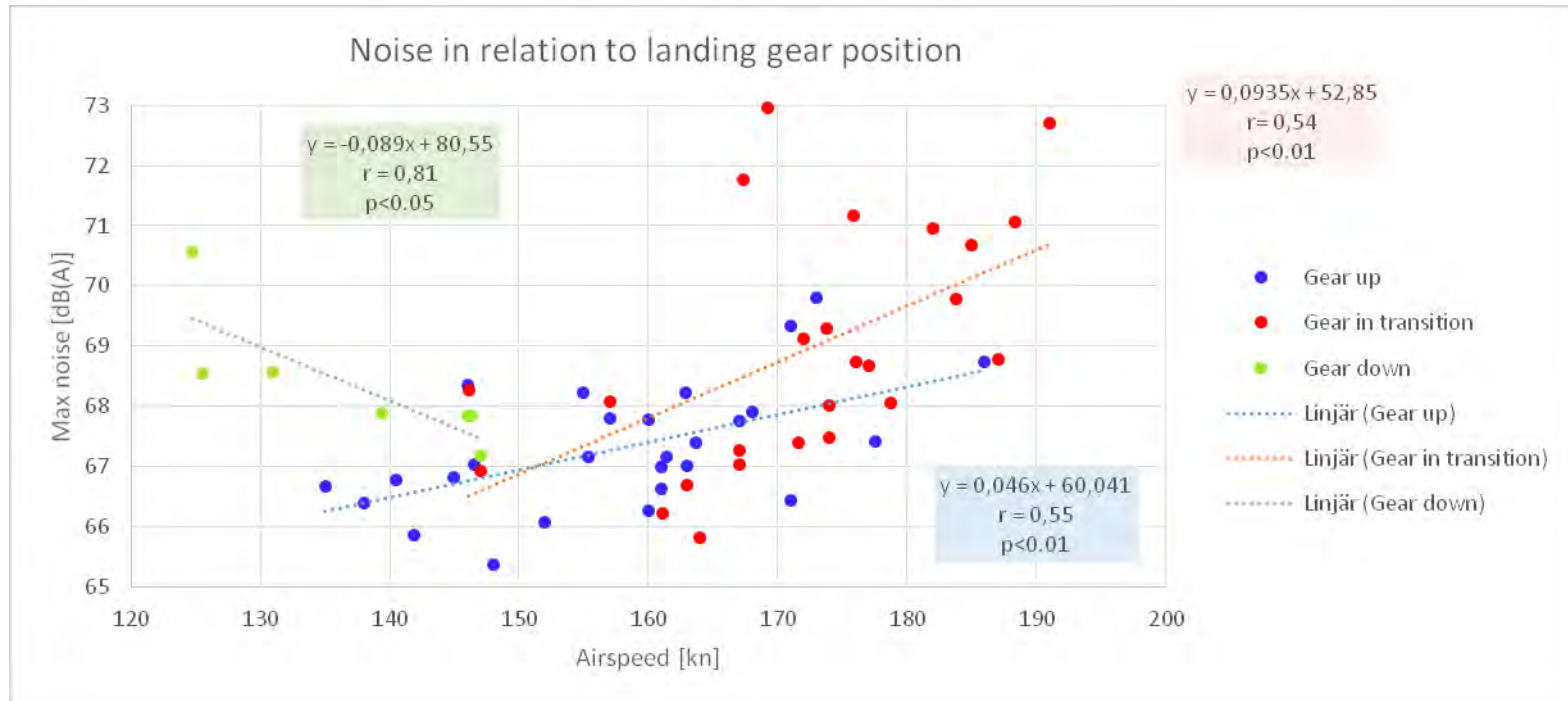
How do pilots operate the aircraft?



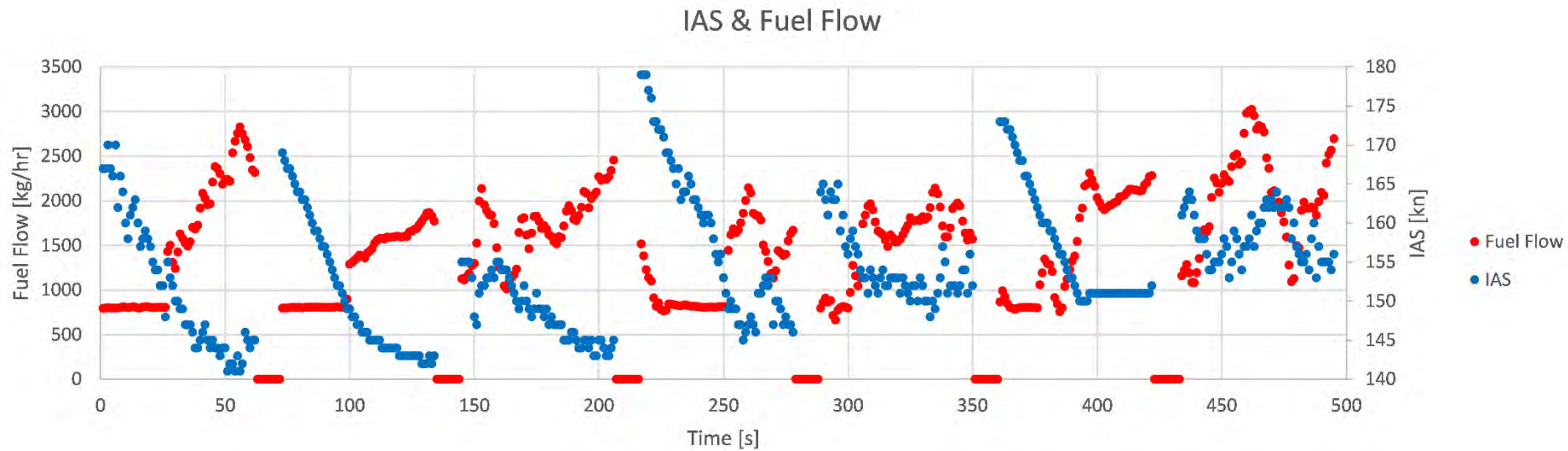
How do pilots operate the aircraft?



How noisy is it?



Why the noise in these 7 cases?



Can noise be moved?



Can noise be moved?



Can noise be moved?



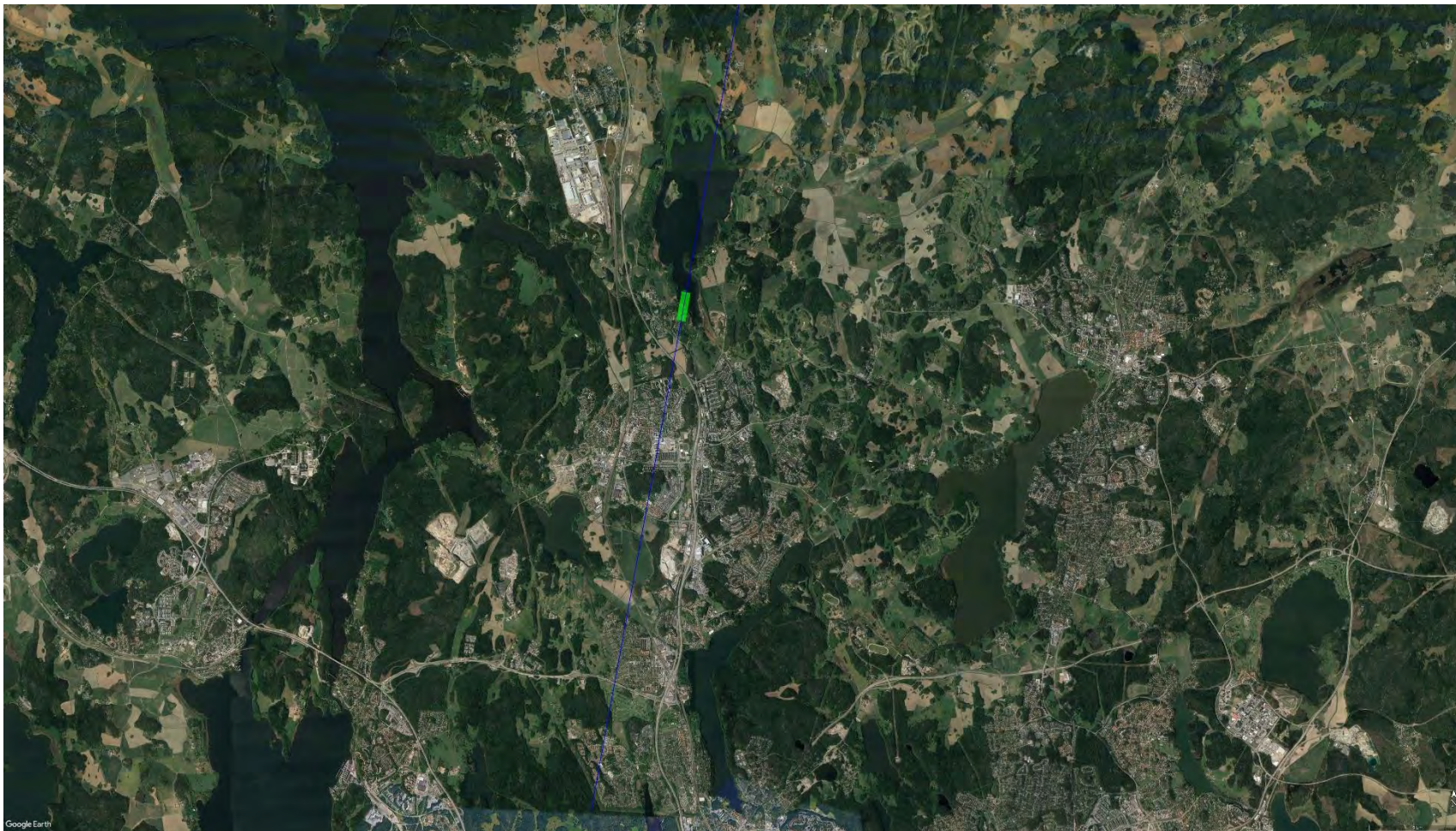
Can noise be moved?



Can noise be moved?



Can noise be moved?



Can noise be moved?



Can noise be moved?



Can noise be moved?





ERAS – Project members



- KTH (Project lead)
- Vernamack AB

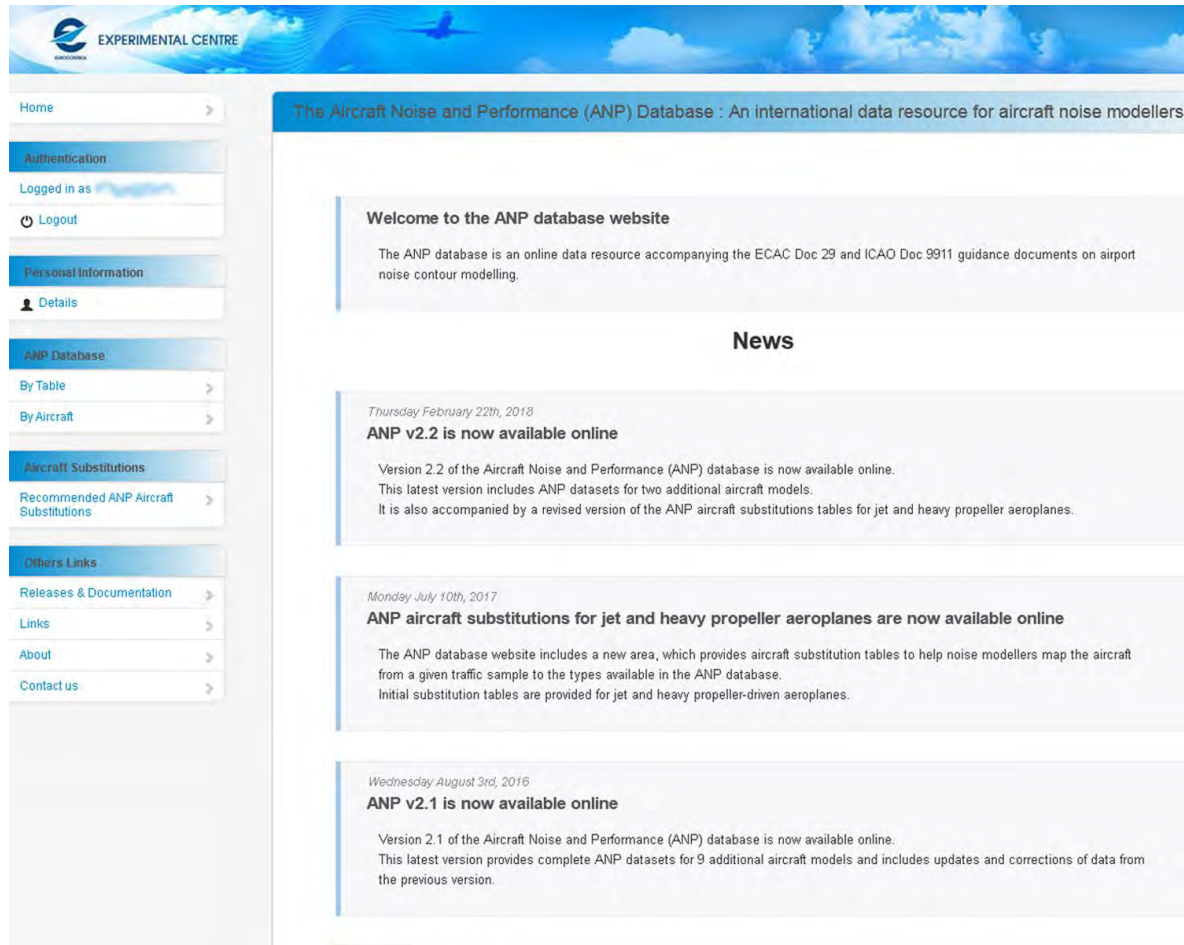
ERAS – Objectives

- Describe differences between the ANP-database, aircraft manuals and praxis in the operation of 10 different passenger aircraft.
- Assist in laying a foundation for a continued development of the noise calculation software developed in the SAFT-project at CSA by giving alternative descriptions of aircraft approach procedures in relation to the ANP.
- Describe the relation between fuel consumption (CO₂-emissions) versus increased or reduced noise in different operational scenarios.
- Assist other projects at the CSA with flight operational competence.

... or in short...

Evaluation of Realistic Approach Scenarios

What is the ANP?



The screenshot displays the ANP Database website interface. The header features the 'EXPERIMENTAL CENTRE' logo and a blue sky background with a plane. The main navigation bar includes 'Home', 'Authentication', 'Personal Information', 'ANP Database', 'Aircraft Substitutions', and 'Others Links'. The 'ANP Database' section is expanded, showing 'By Table' and 'By Aircraft' options. The 'Aircraft Substitutions' section is also expanded, showing 'Recommended ANP Aircraft Substitutions'. The 'Others Links' section includes 'Releases & Documentation', 'Links', 'About', and 'Contact us'. The main content area is titled 'The Aircraft Noise and Performance (ANP) Database : An international data resource for aircraft noise modellers'. It contains a welcome message, a 'News' section with three articles, and a footer.

The Aircraft Noise and Performance (ANP) Database : An international data resource for aircraft noise modellers

Welcome to the ANP database website

The ANP database is an online data resource accompanying the ECAC Doc 29 and ICAO Doc 9911 guidance documents on airport noise contour modelling.

News

Thursday February 22th, 2018
ANP v2.2 is now available online

Version 2.2 of the Aircraft Noise and Performance (ANP) database is now available online. This latest version includes ANP datasets for two additional aircraft models. It is also accompanied by a revised version of the ANP aircraft substitutions tables for jet and heavy propeller aeroplanes.

Monday July 10th, 2017
ANP aircraft substitutions for jet and heavy propeller aeroplanes are now available online

The ANP database website includes a new area, which provides aircraft substitution tables to help noise modellers map the aircraft from a given traffic sample to the types available in the ANP database. Initial substitution tables are provided for jet and heavy propeller-driven aeroplanes.

Wednesday August 3rd, 2016
ANP v2.1 is now available online

Version 2.1 of the Aircraft Noise and Performance (ANP) database is now available online. This latest version provides complete ANP datasets for 9 additional aircraft models and includes updates and corrections of data from the previous version.

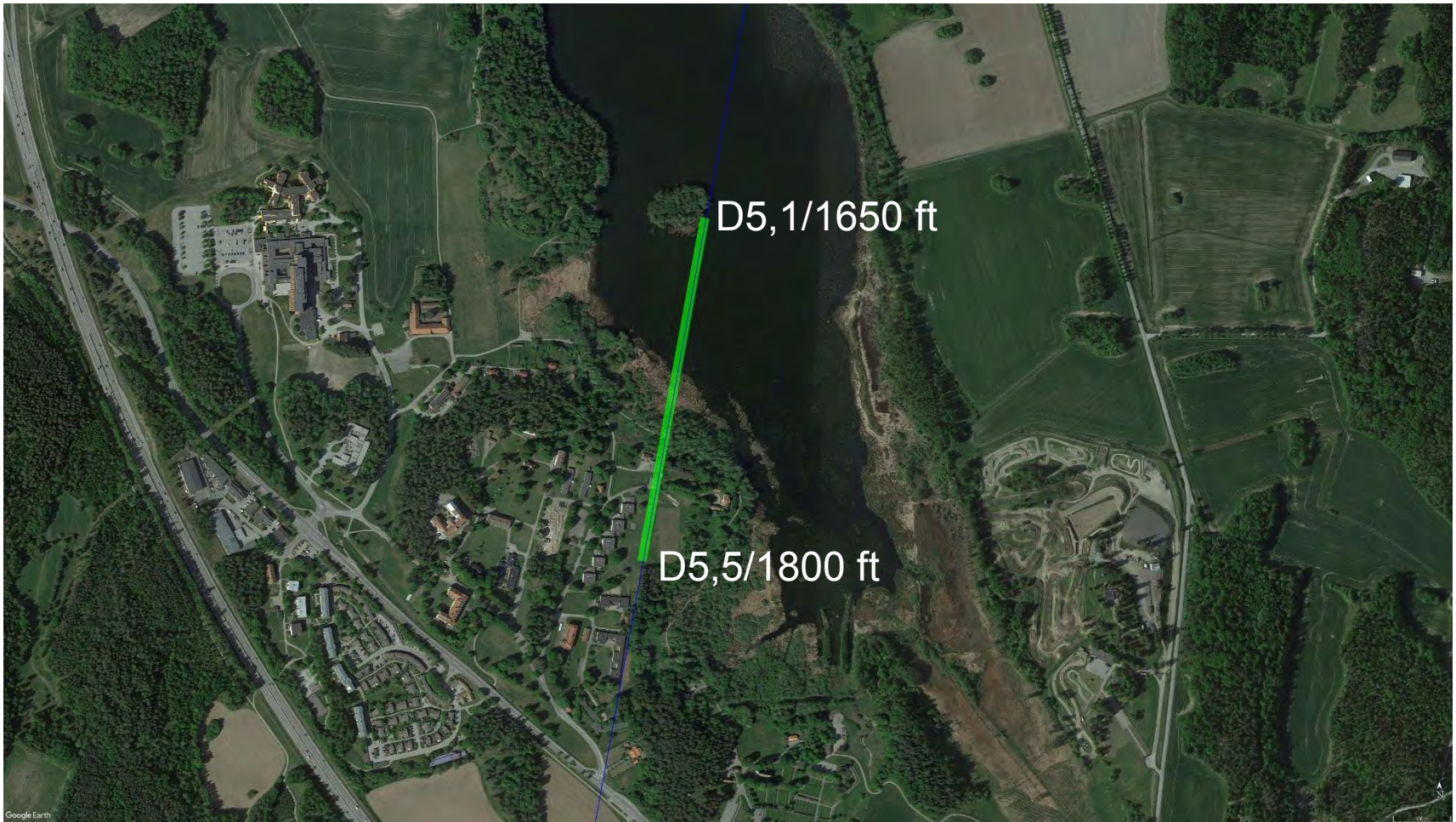
When is the gear extended?



Approach procedures for three different aircraft types

	B737-700			B737-800			A321 (-232)		
	Procedural steps			Power setting			Procedural steps		
	ANP	FCOM (Boeing)	Praxis	ANP	FCOM	Praxis	ANP	FCOM	Praxis
F0	6000 ft / 250 kt	3000 ft / 197 kt	3000 ft / +210 kt	6000 ft / 272.3 kt 3000 ft / 260 kt	3000 ft / 207 kt	3000 ft / +210 kt	6000 ft / 250 kt 3000 ft / 191,6 kt 2530 ft / 175.2 kt 2133 ft / 149.8 kt	3000 ft/ 220 kt	3000 ft/ +210 kt
F1	3000 ft / 171 kt	3000 ft / 177 kt	3000 ft / 200 kt	3000 ft / 243.3 kt	3000 ft / 187 kt	3000 ft / 200 kt	N/A	3000 ft/ 220 kt	3000 ft/ 220 kt
F2	1500 ft / 140 kt	3000 ft / 147 kt	3000 - 2000 ft	3000 ft / 171.4 kt	3000 ft / 157 kt	3000 - 2000 ft	N/A	2000 ft / 198 kt	3000 ft / -200 kt
L/G	N/A	3000 ft	approx 2000 ft	2777 ft / 144.9 ft	3000 ft	approx 2000 ft	2033 ft / 138.5 kt	2000 ft	1742 ft
F3	N/A	2999 ft / 134 kt	approx 1500 ft	N/A	2999 ft / 147 kt	approx 1500 ft	N/A	1700 ft/ 148 kt	1348 ft / 148 kt
F4	1000 ft / 133 kt	N/A	N/A	2777 ft / 144.9 ft	N/A	N/A	2033 ft / 138.5 kt	N/A	N/A

This should be feasible for the A321!



ATC requirements

11 ATC approach controllers at Arlanda ATCC answered a questionnaire regarding highest and lowest speed at pre-defined distances before the threshold with different mixes of traffic.

D	Speed window [kn]
4	147-164
6	153-183
10	168-210
20	191-233
30	208-247

[illegible]

Evaluation of approaches

Approach #1 - Standard ILS-approach - 3,0°
For test purposes only - Not for operational use

Approach #2 - Low drag - High speed - 3,0°
For test purposes only - Not for operational use

Approach #3 - Low drag - Low speed - 3,0°
For test purposes only - Not for operational use

Approach #4 - Lowest drag - Lowest speed - 3,0°
For test purposes only - Not for operational use

Approach #5 - ILS-approach - 2,5°
For test purposes only - Not for operational use

Approach #6 - Low drag High speed - 2,5°
For test purposes only - Not for operational use

Approach #7 - Low drag Low speed - 2,5°
For test purposes only - Not for operational use

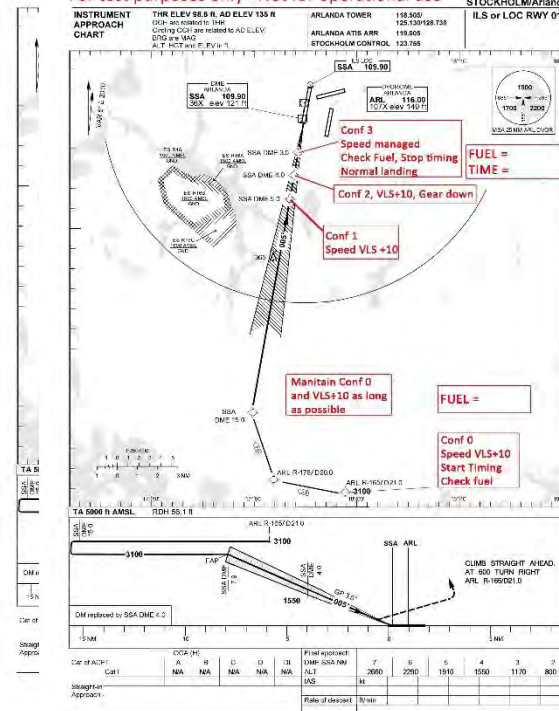
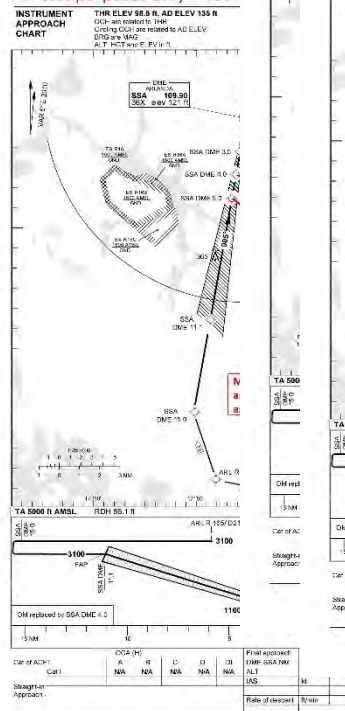
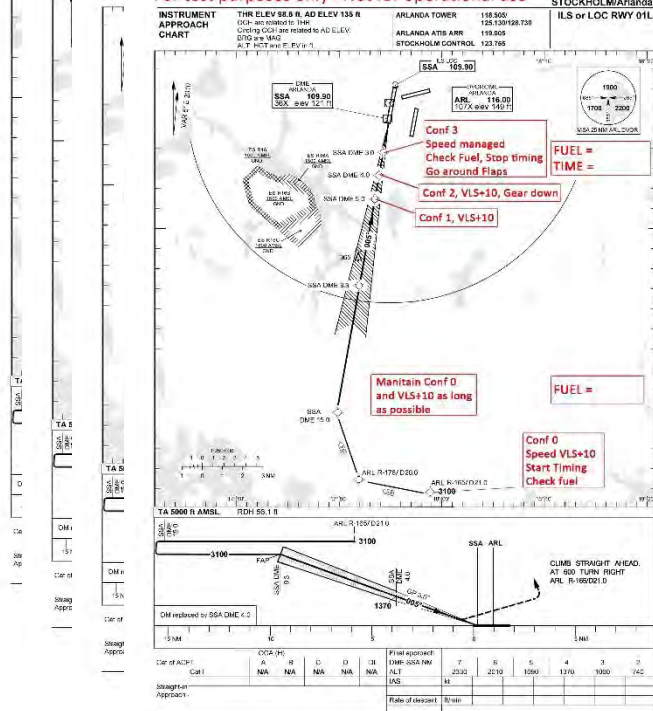
Approach #8 - Lowest drag Low speed - 2,5°
For test purposes only - Not for operational use

Approach #9 - ILS-approach - 3,5°
For test purposes only - Not for operational use

Approach #10 - Low drag High speed - 3,5°
For test purposes only - Not for operational use

Approach #11 - Low drag Low speed - 3,5°
For test purposes only - Not for operational use

Approach #12 - Lowest drag Low speed - 3,5°
For test purposes only - Not for operational use



Thank you!



novair 

The novair logo, featuring the word "novair" in a dark blue, lowercase, sans-serif font, followed by a yellow graphic element resembling a stylized wing or a fan.

BRA 

The BRA logo, featuring the word "BRA" in a grey, italicized, sans-serif font, followed by a graphic element consisting of a series of parallel, horizontal lines in various colors (blue, green, yellow, red, blue) forming a wing-like shape.