OPNOP

OPerational Noise OPtimisation

KTH, Vernamack, Natmer, Novair

Bengt Moberg, 2019-10-10

ERAS

Evaluation of Realistic Approach Scenarios

KTH, Vernamack

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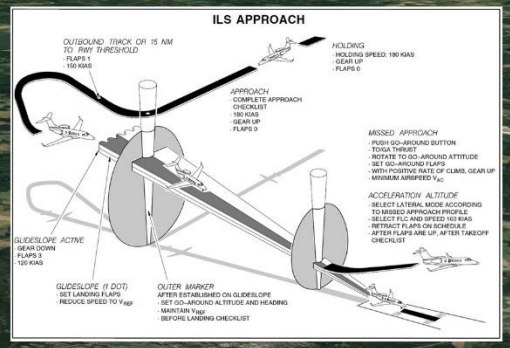
OPNOP

Operational Noise Optimization

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



100dB(A)max
95dB(A)max
90dB(A)max
85dB(A)max
80dB(A)max
75dB(A)max
70dB(A)max
65dB(A)max
50dB(A)max
50dB(A)max

optimization noun
op·ti·mi·za·tion | \ ˌäp-tə-mə-ˈzā-shən\

Definition of optimization
: an act, process, or methodology of making something as fully perfect, functional, or effective as possible

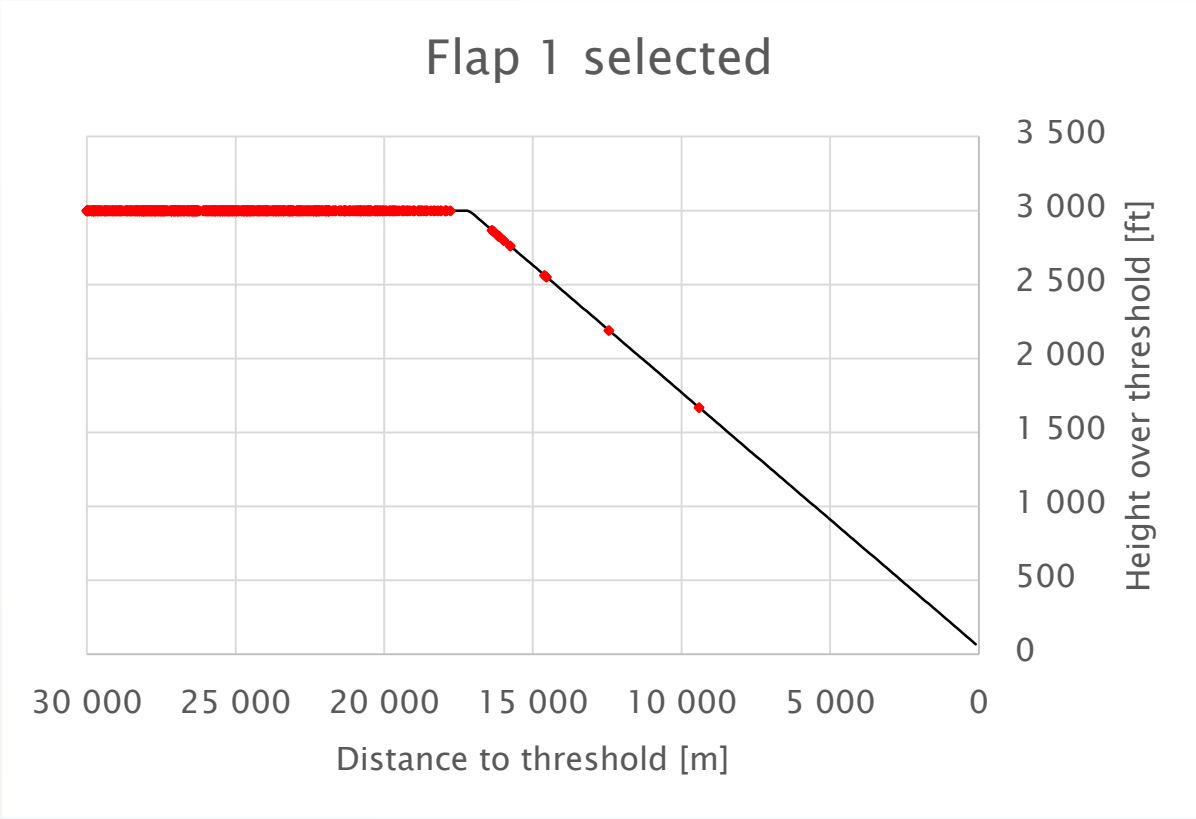
OPNOP – Research questions

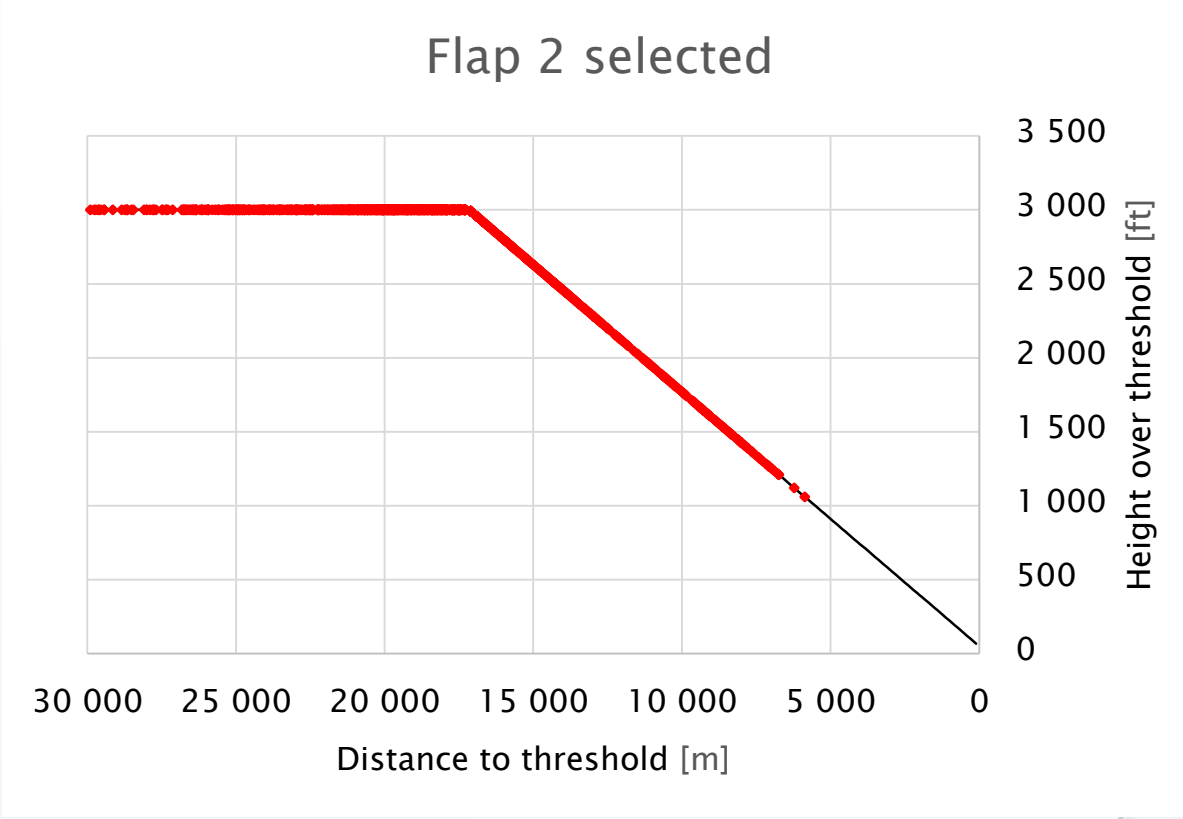
- Is it feasible to protect noise sensitive areas on the ground by operational recommendations to pilots?
- Is it reasonable to believe that operational recommendations can take actual weather into consideration?

OPNOP – Pre-requisites

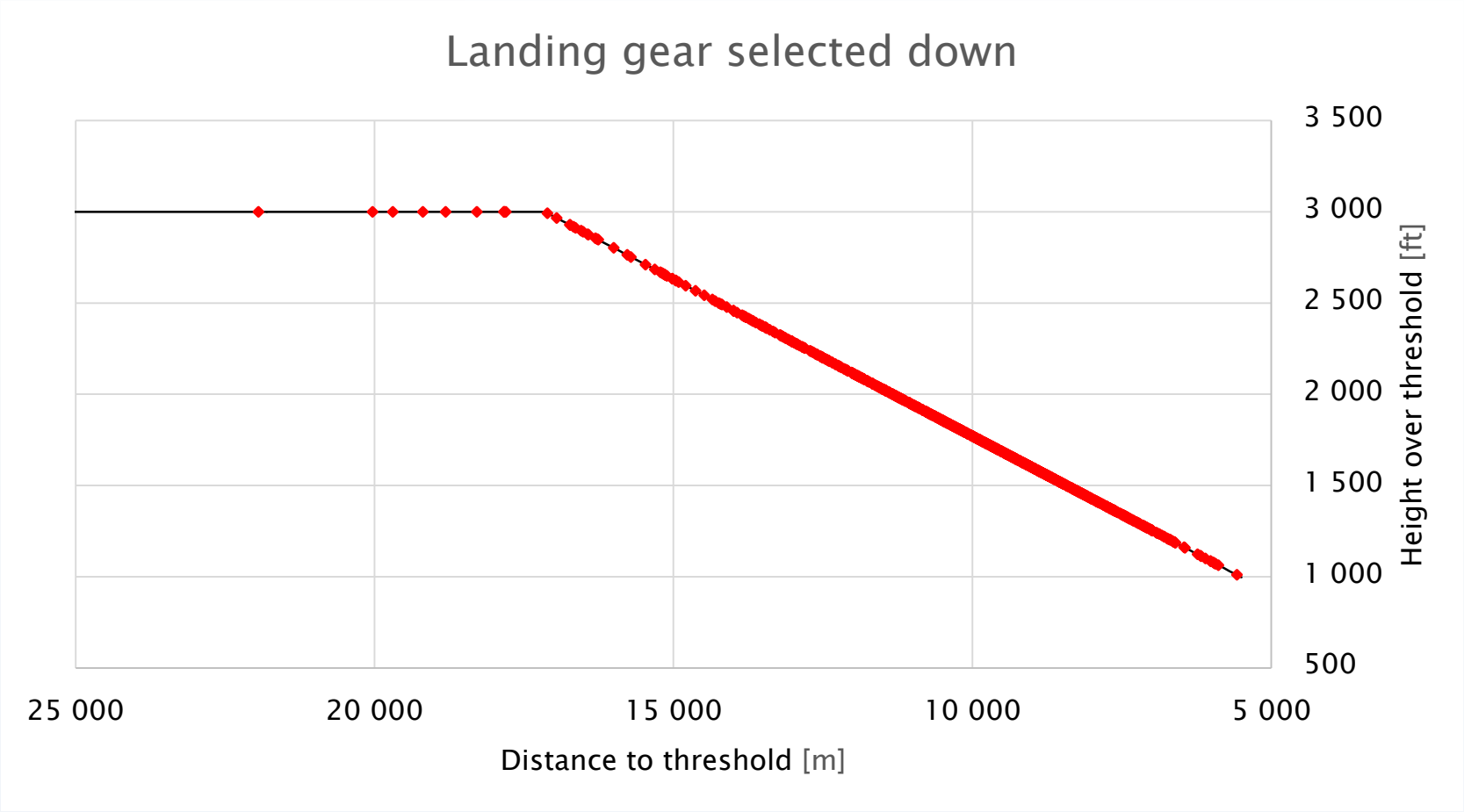
- Noise from landing aircraft is generated by the engines and by the airframe
- Engines can be in idle or up to maximum thrust
- The engine noise is dependent on rpm
- The airframe consists of fuselage, control surfaces, landing gear and a lot of small devices
- The airframe noise is airspeed dependent
- Hence! Noise is dependent on how the engines are operated and how the airframe is configured

Brantare - Ops. variation - Flaps

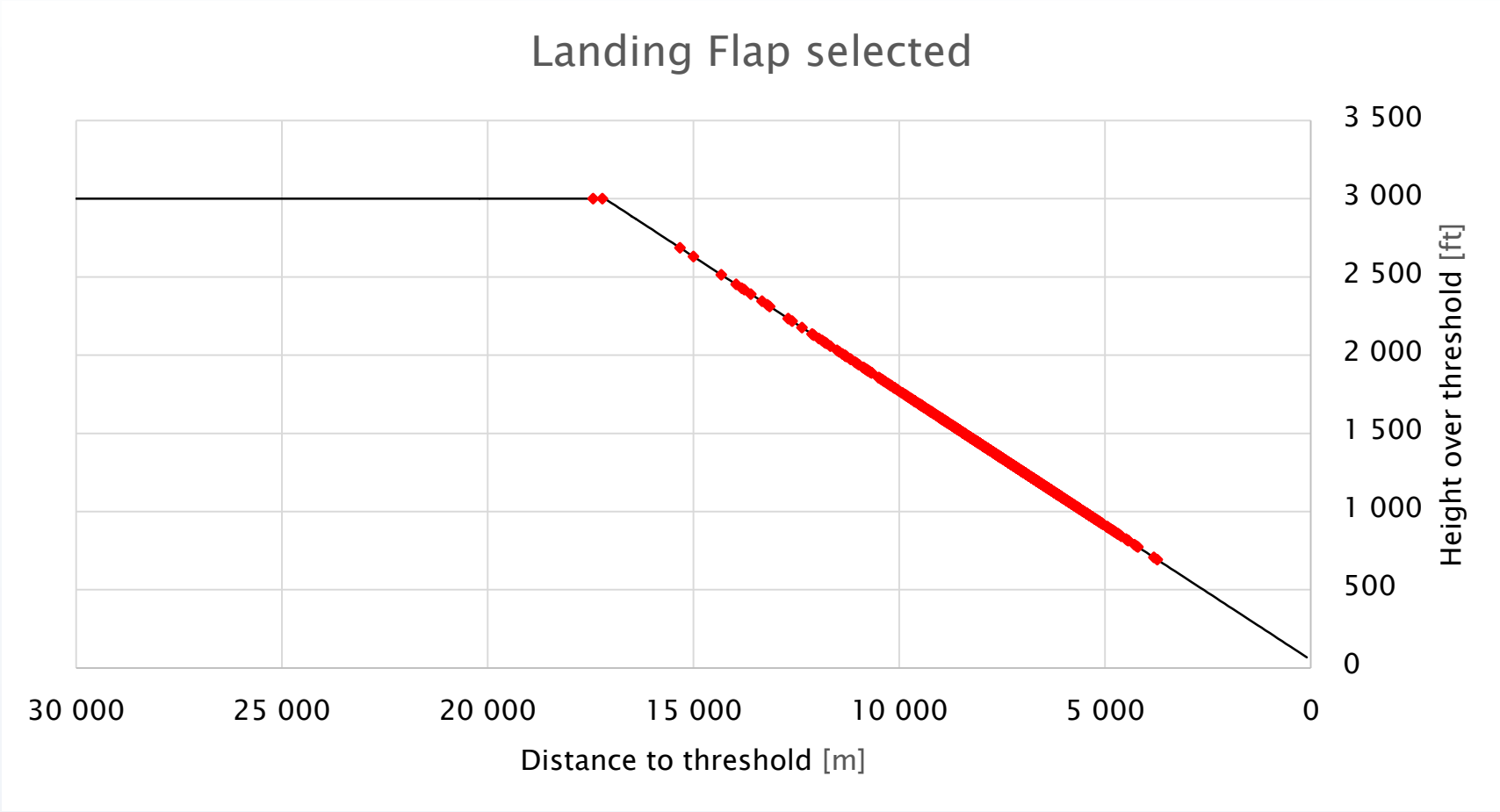




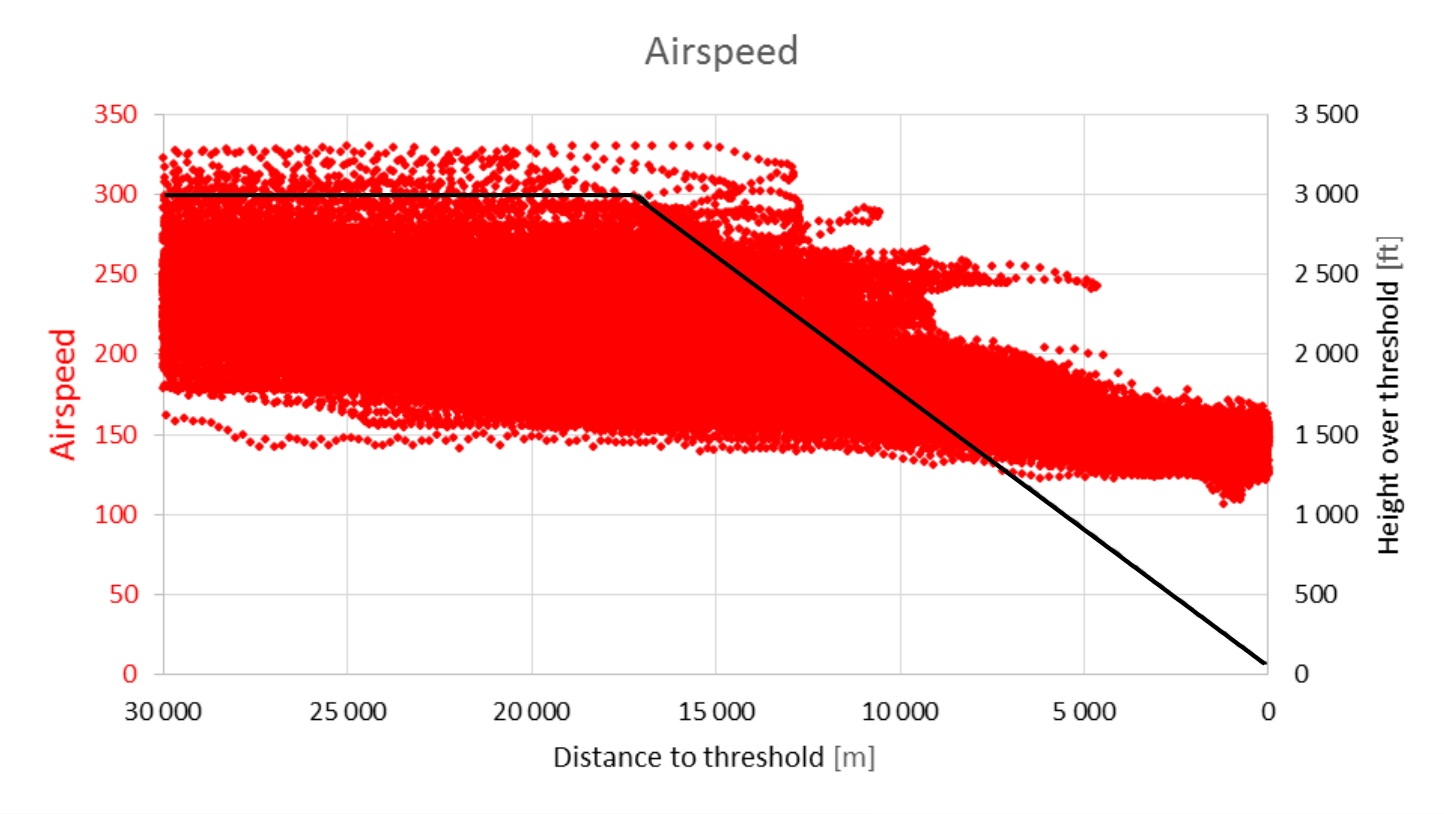
Brantare - Ops. variation - Gear



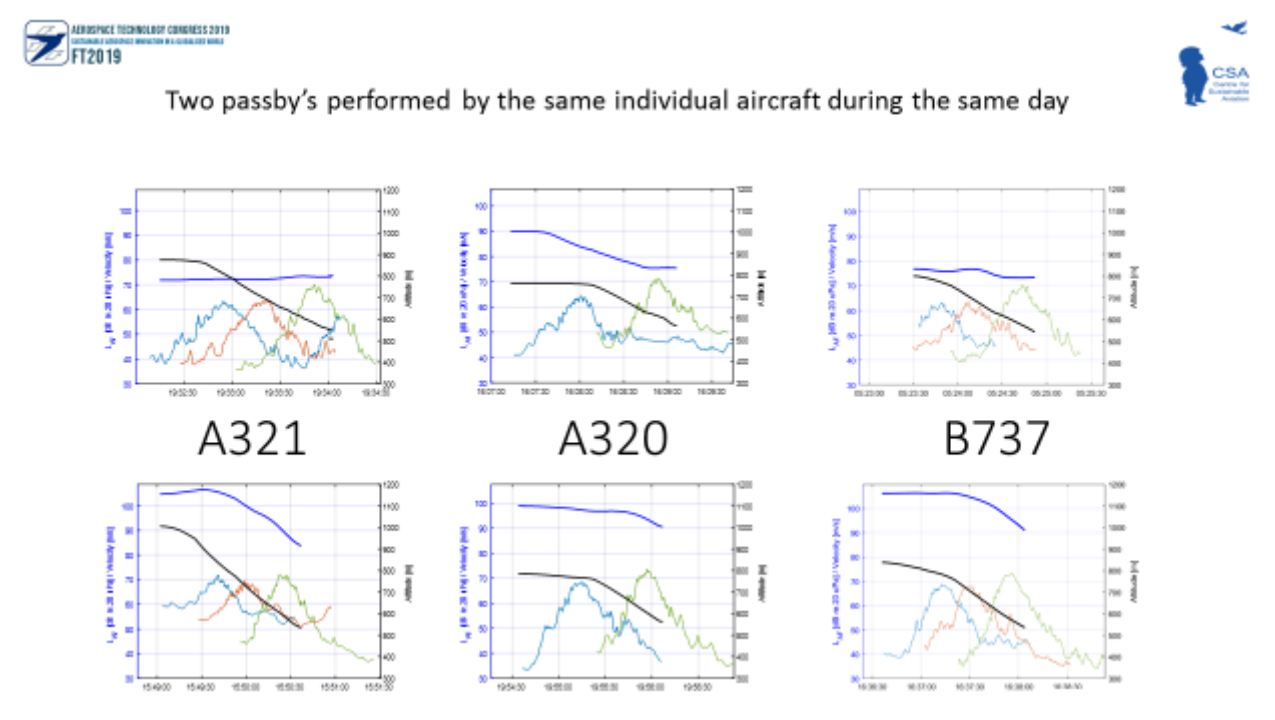
Brantare - Ops. variation - Flaps



Brantare - Ops. variation - Airspeed

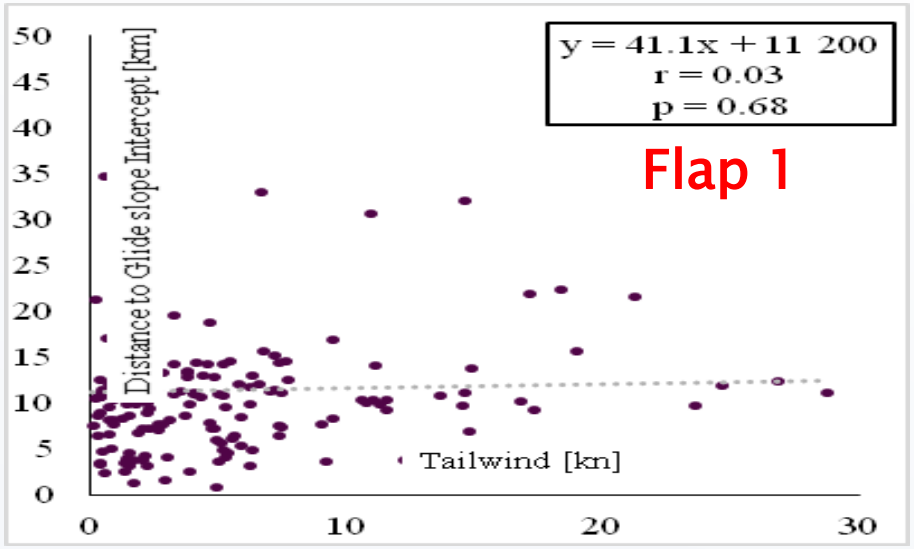


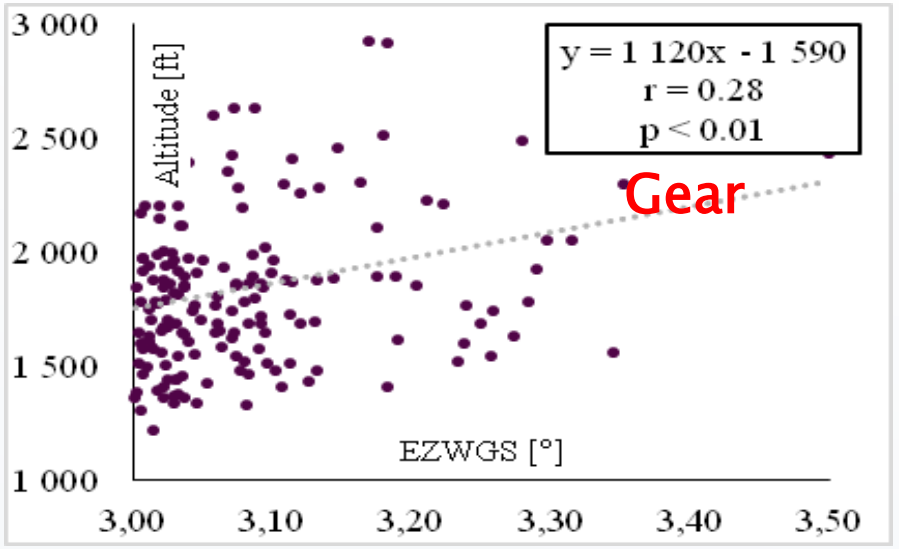
Variation in Airspeed

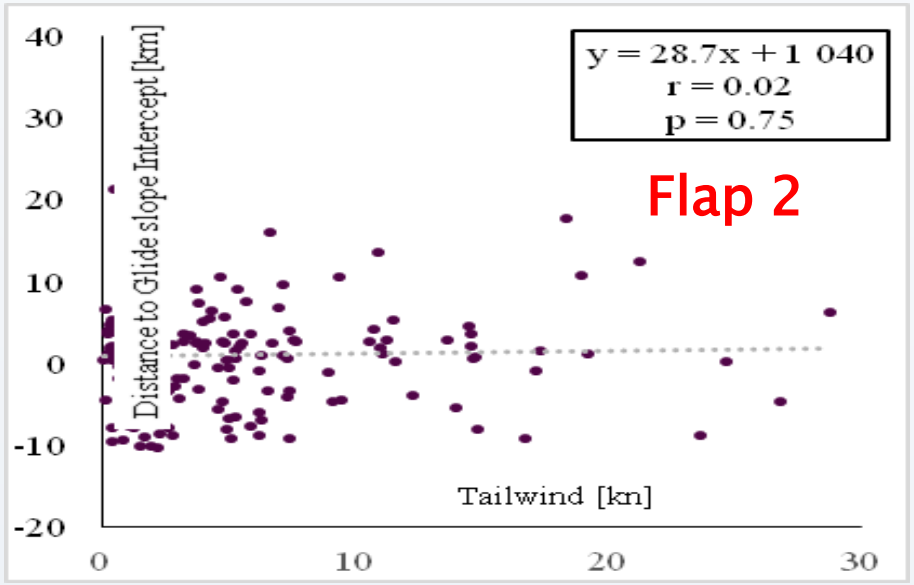


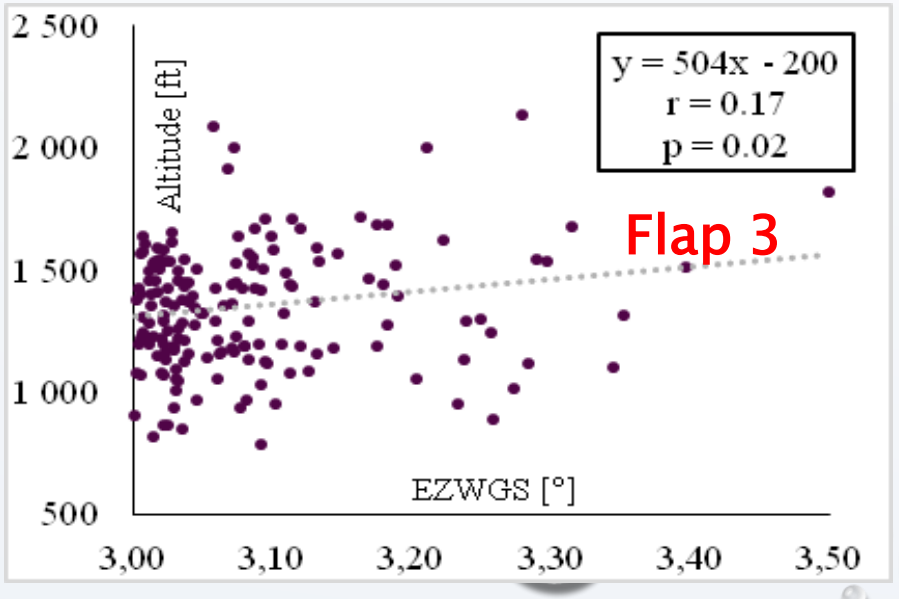
Picture from the ULLA project showing variation in airspeed and noise

Brantare – Tailwind dependency

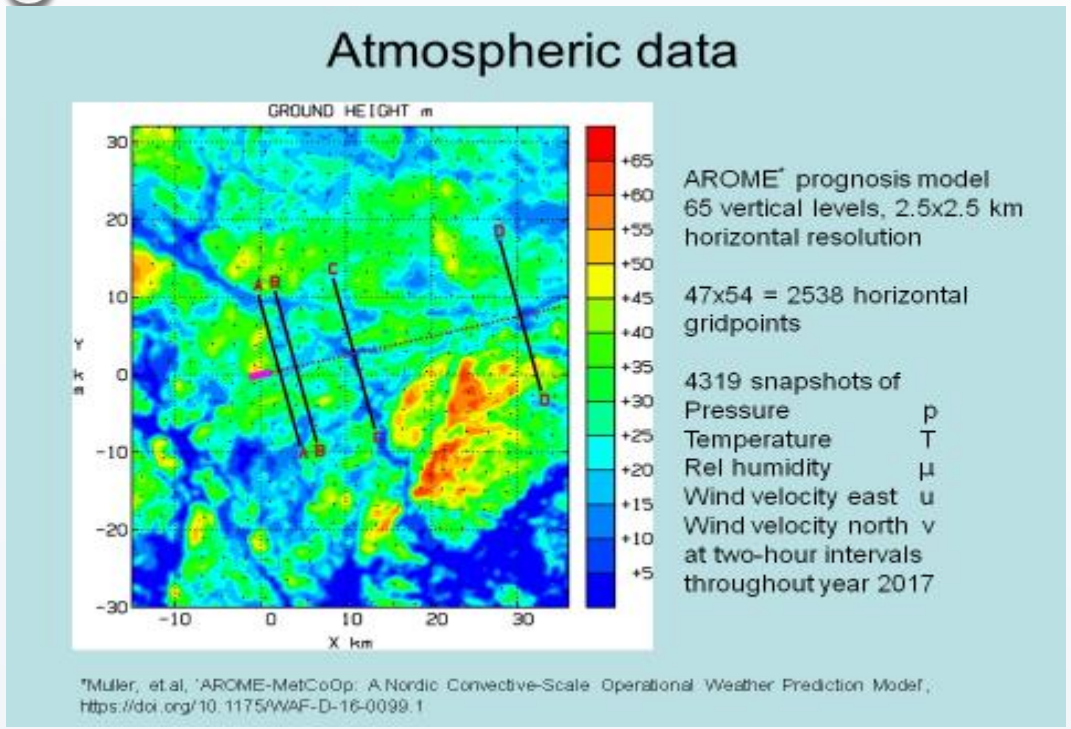




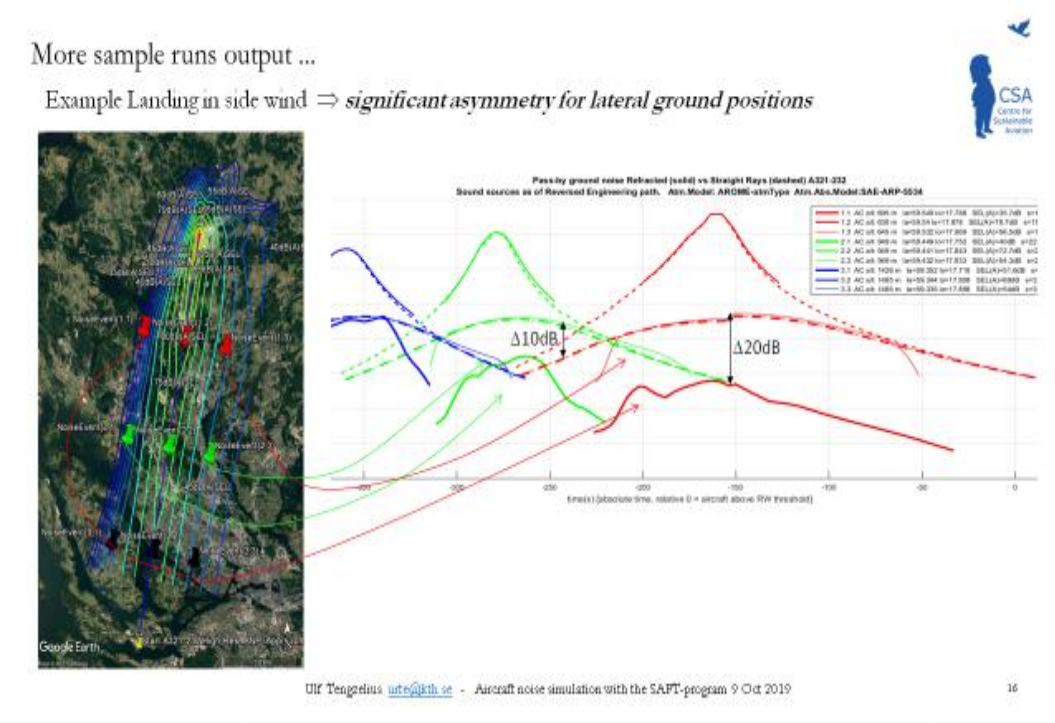




Weather dependency – Noise propagation

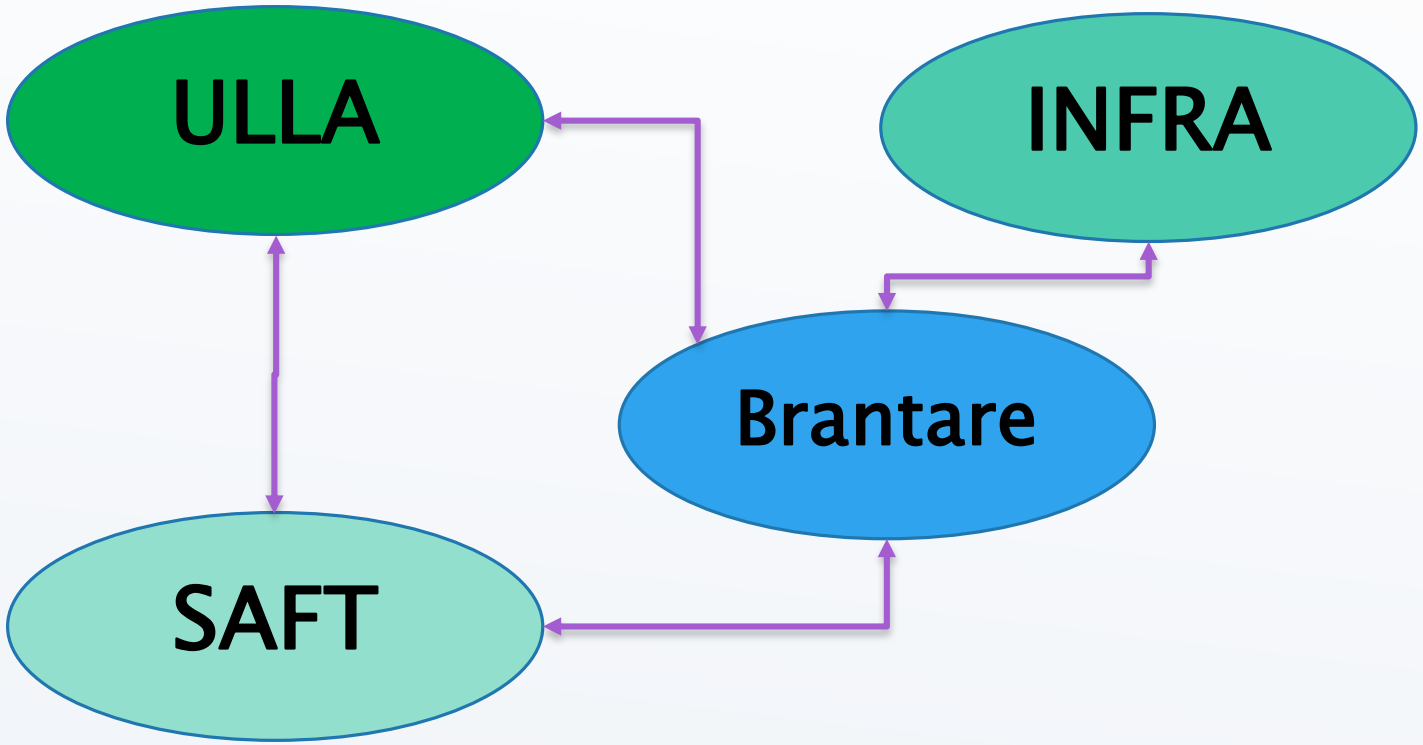


Pictures by Ilka Karasalo

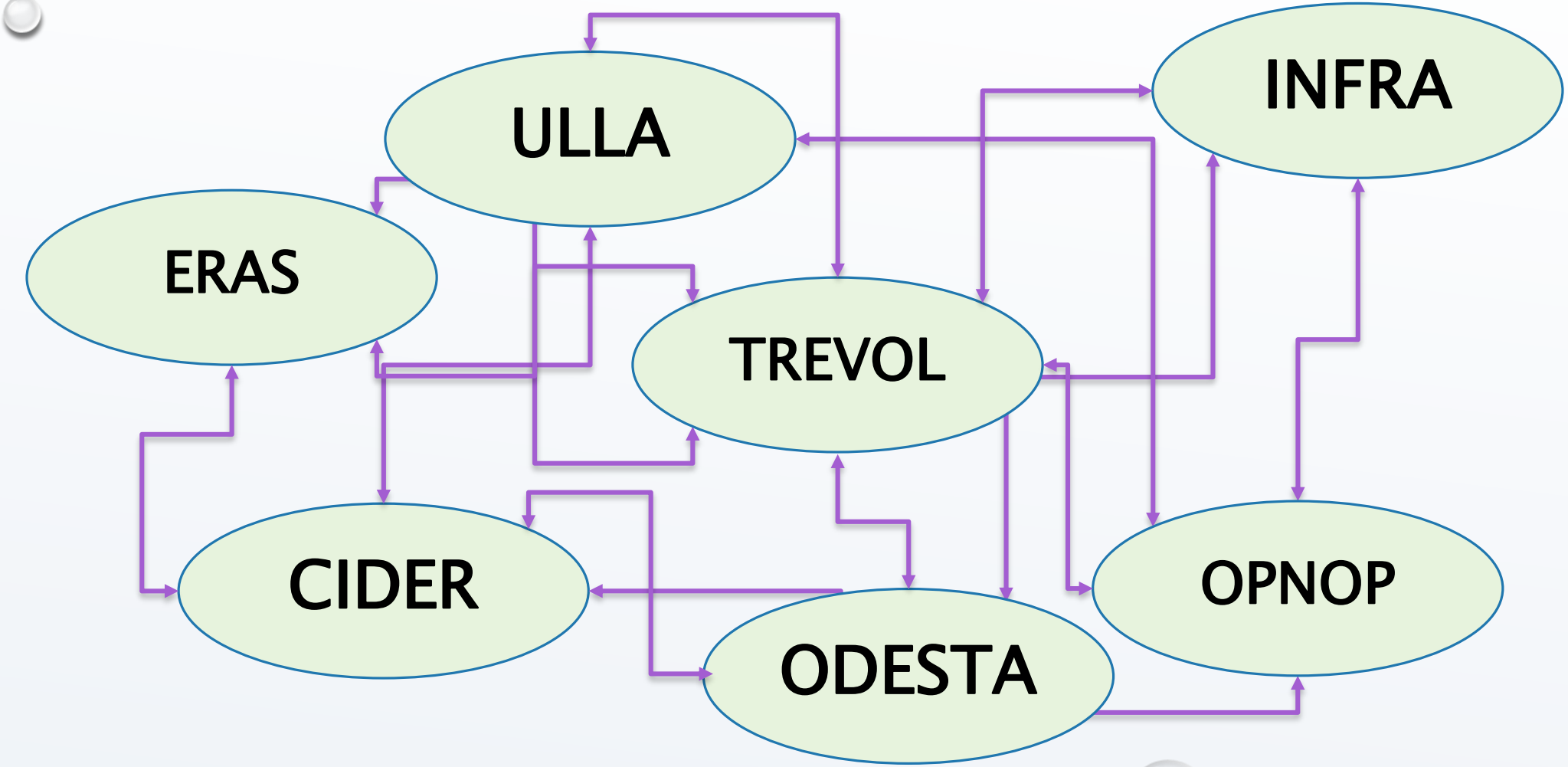


and Ulf Tengzelius (SAFT-project)

CSA – Collaboration & Info Sharing



CSA – Collaboration & Info Sharing



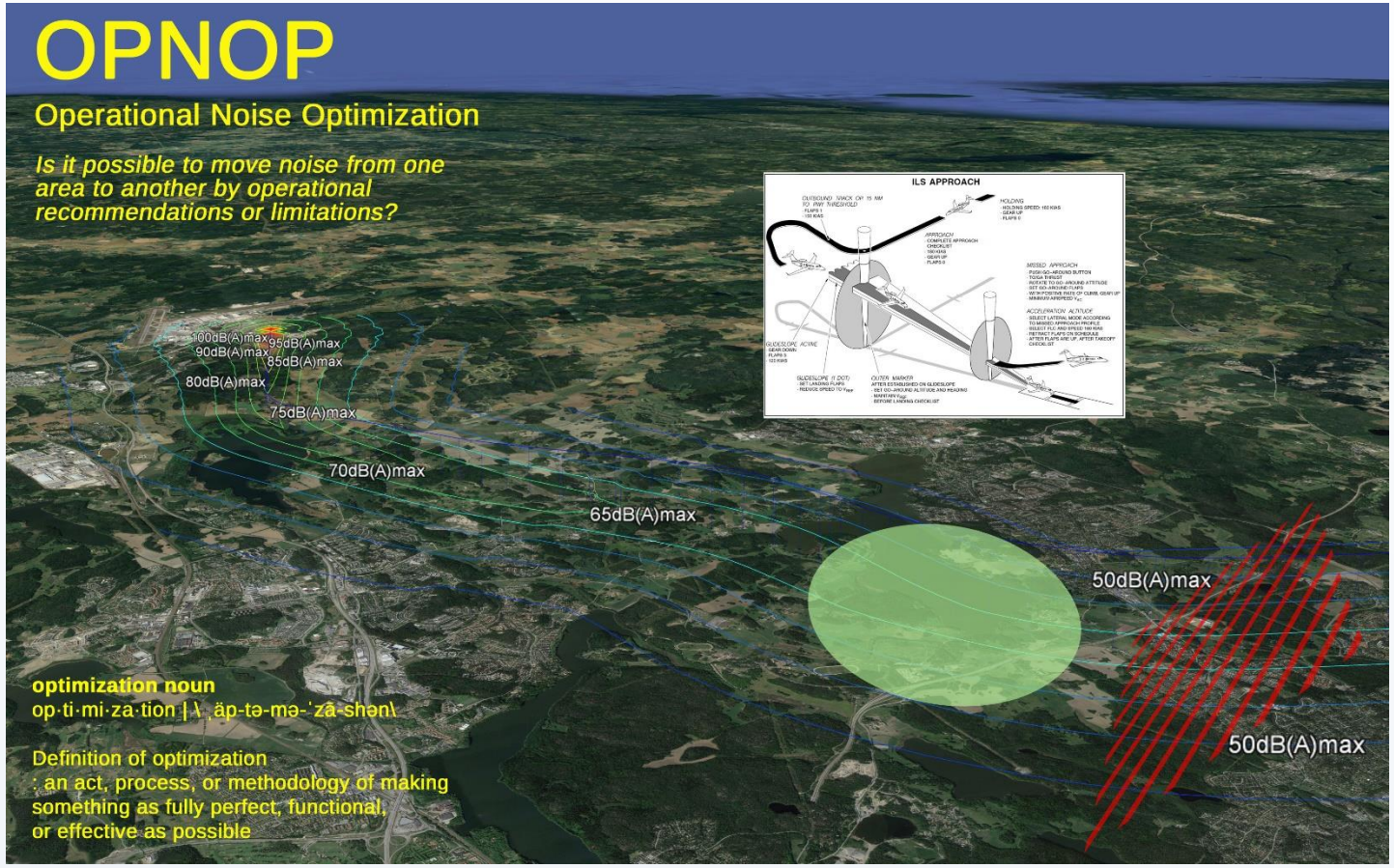
OPNOP – Research questions

- Is it feasible to protect noise sensitive areas on the ground by operational recommendations to pilots?
- Is it reasonable to believe that operational recommendations can take actual weather into consideration?

OPNOP – Method

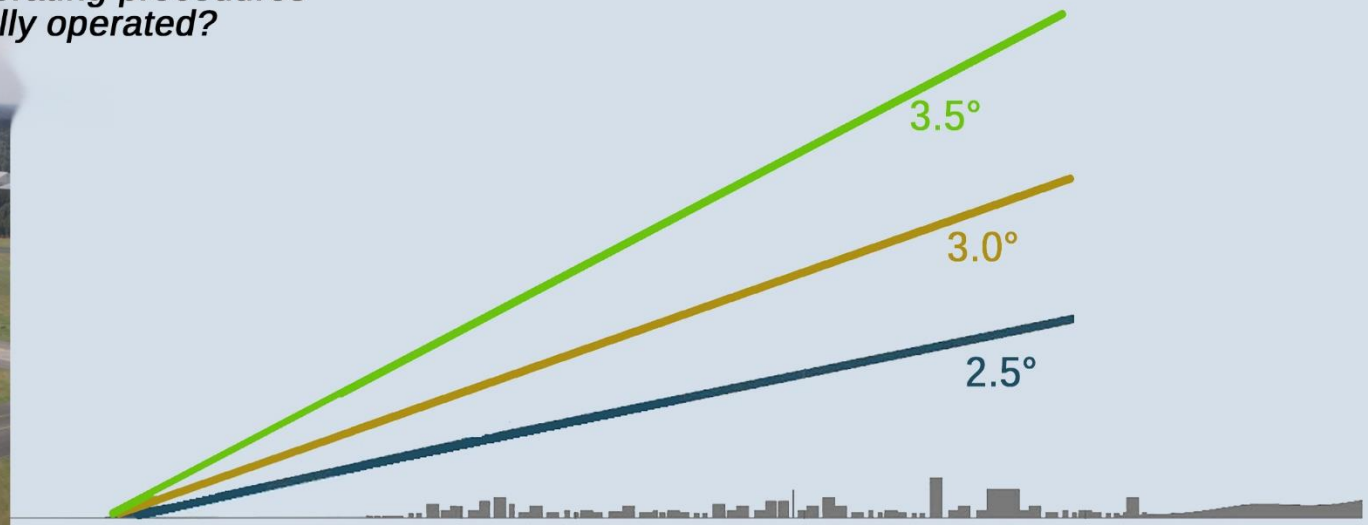
- Collect FDR-data from Novair's aircraft
- Collect weather data for the same flights
- Collect noise data from the flights in co-op. with ULLA
- Send data to ULLA, CIDER, TREVOL, ODESTA and ERAS for use in their projects
- Analyze noise and compare with flight operational events
- Develop new operational scenarios for minimum noise
- Evaluate new scenarios with software from the SAFT-project (noise) and software from Airbus (Fuel and CO_2)

Questions on OPNOP?



ERAS - Evaluation of Realistic Approach Scenarios

How well do theoretical noise calculations correlate to aircrafts' standard operating procedures and the way the aircraft are actually operated?



ERAS

- When noise is calculated in Sweden, the document “Kvalitetssäkring av flygbullerberäkningar” is the governing document
- But it points to ECAC Doc 29…
- …and in Europe the Aircraft Noise and Performance database (maintained by Eurocontrol) is the basis for the calculations

FÖRSVARSMAKTEN NATUR VÅRDS VERKET TRANSPORT STYRELSEN

Kvalitetssäkring av flygbullerberäkningar-Underlag för enhetlig tillämpning 2011-10-31 version 1.0

Kvalitetssäkring av flygbullerberäkningar

Underlag för en enhetlig tillämpning

Förord

Transportstyrelsen och Försvarsmakten har fått i uppdrag av regeringen (regeringsbeslut 19,1997-04-17 samt regeringsbeslut 7, 2006-01-26) att i samråd med Naturvårdsverket fastställa en metod för flygbullerberäkningar.

Transportstyrelsen, Försvarsmakten och Naturvårdsverket enades den 19 mars 2010 om principer för kvalitetssäkring av flygbullerberäkningar i Sverige. Principerna innebär att ECAC dokument 29 ska vara utgångspunkten för det kvalitetssäkringsdokument som nu tagits fram. Kvalitetssäkringsdokumentet, som innehåller beräkningsmetoden för flygbuller, ska säkerställa en enhetlig tillämpning. Denna beräkningsmetod är en revidering av nu gällande beräkningsmetod som myndigheterna fastställde 1998.

De tre berörda myndigheterna har i en arbetsgrupp, där även Boverket och Socialstyrelsen har deltagit, tagit fram kvalitetssäkringsdokumentet. Dokumentet innehåller teknisk/akustisk specifikation av hur flygbullerberäkningar ska utföras i Sverige. Konsulter har anlitats i utredningsarbetet för att ta fram visst tekniskt underlag.

Kvalitetssäkringsdokument, daterat 2011-10-31 fastställs härmed.

Transportstyrelsen
Staffan Widlert

Försvarsmakten
Gunnar Karlson

Naturvårdsverket
Maria Ågren

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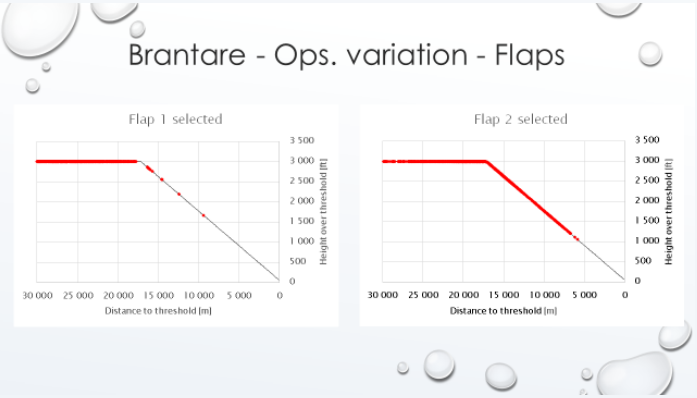
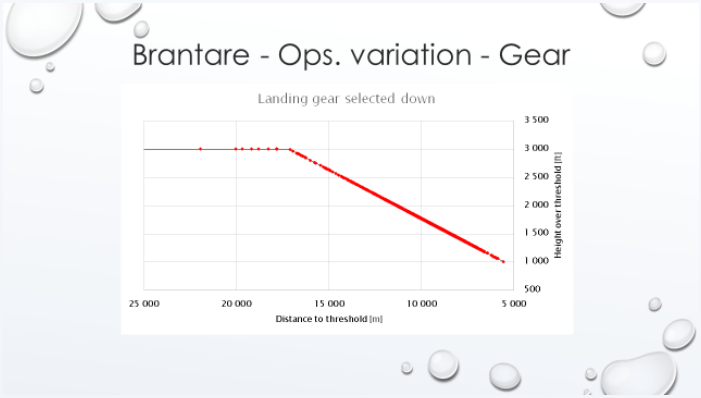
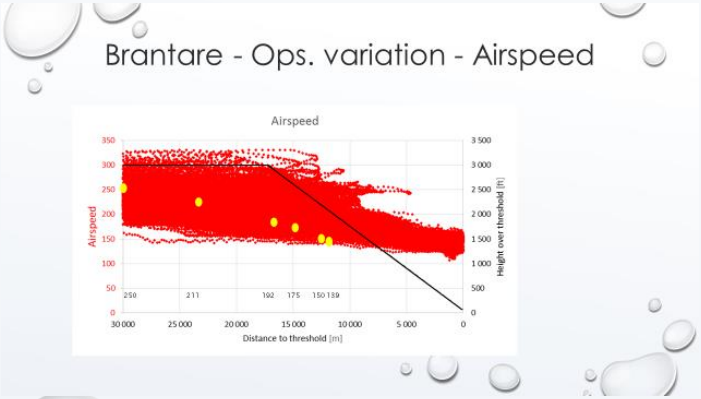
ERAS

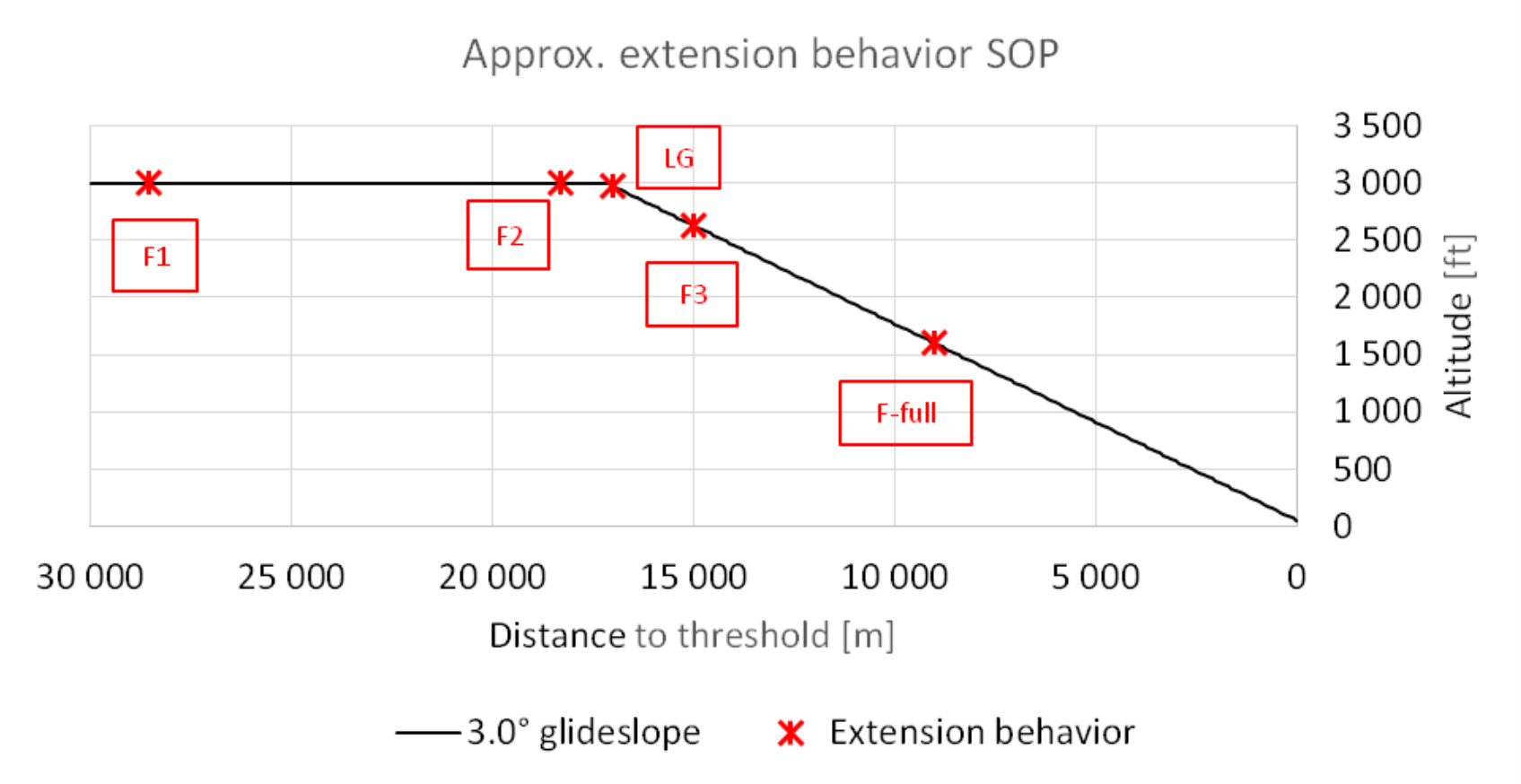
- Aircraft performance, operations and noise levels are described in the ANP-database
- But aircraft operations is also described in every aircraft's SOP.
- And the there's the real life…



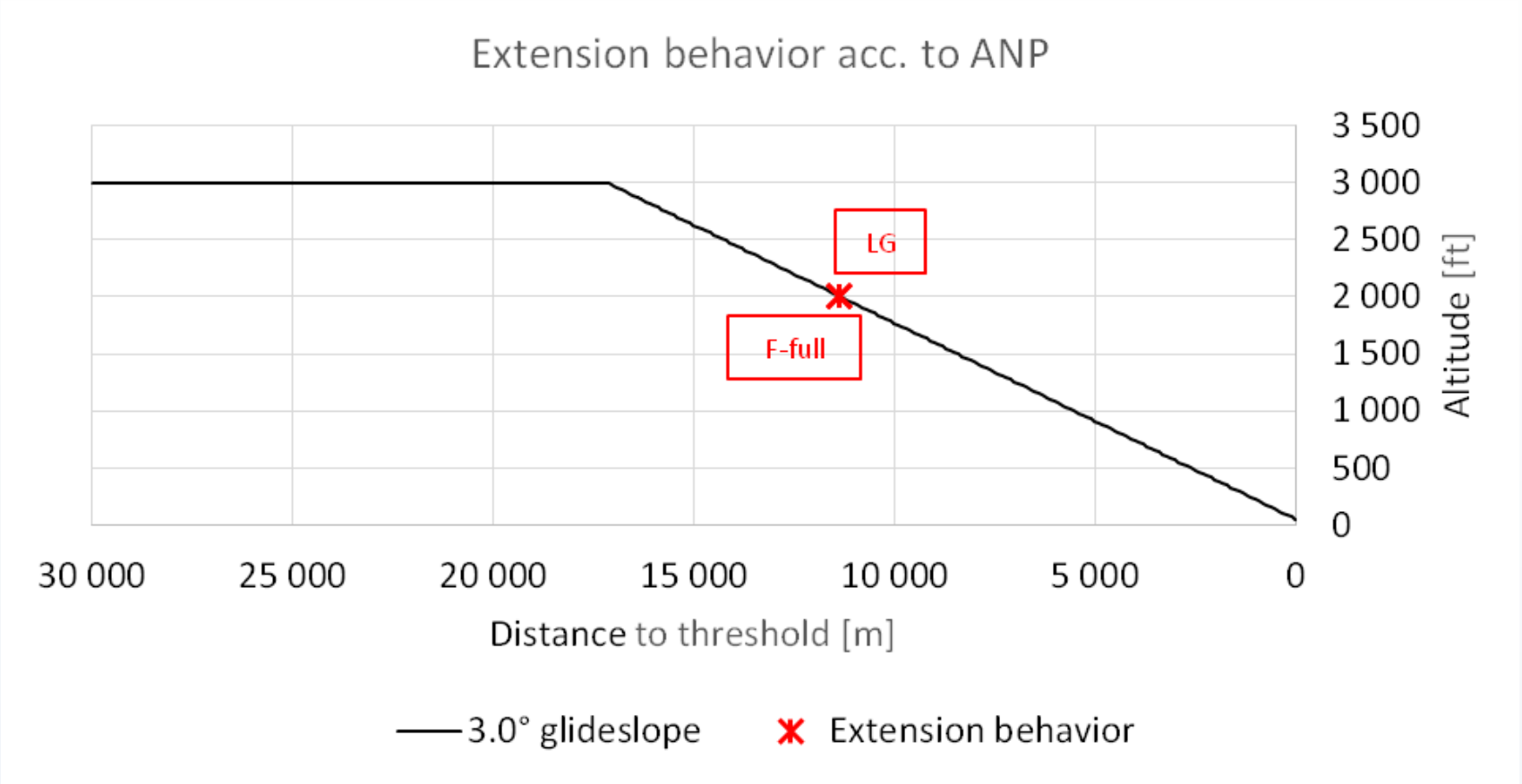




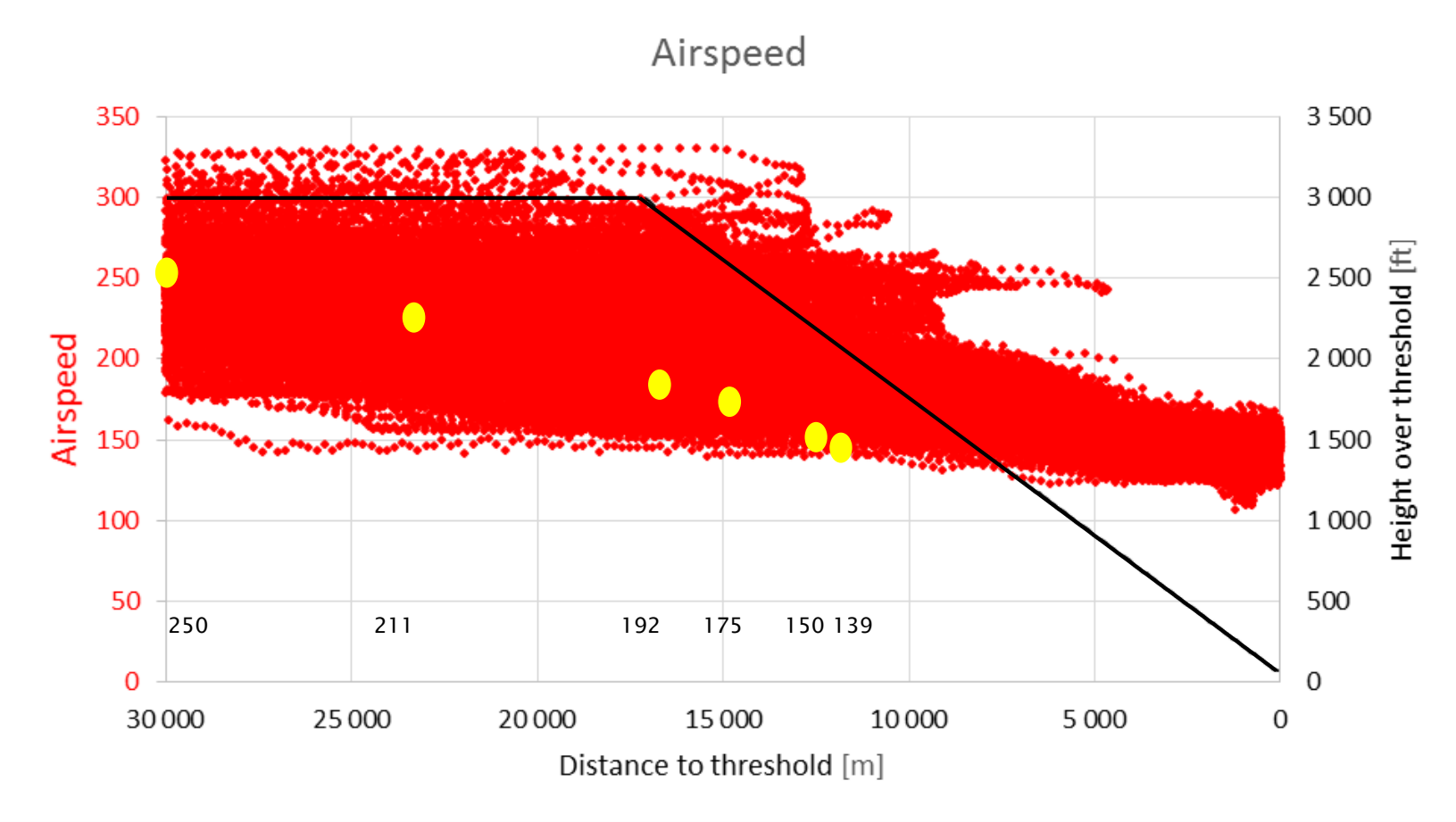
ERAS


Approx. extension behavior SOP
LG
F1
F2
F3
F-full
3 500
3 000
2 500
2 000
1 500
1 000
500
0
Altitude [ft]
30 000
25 000
20 000
15 000
10 000
5 000
0
Distance to threshold [m]
3.0° glideslope
Extension behavior

ERAS


Extension behavior acc. to ANP
3 500
3 000
2 500
2 000
1 500
1 000
500
0
Altitude [ft]
LG
F-full
30 000
25 000
20 000
15 000
10 000
5 000
0
Distance to threshold [m]
3.0° glideslope
Extension behavior

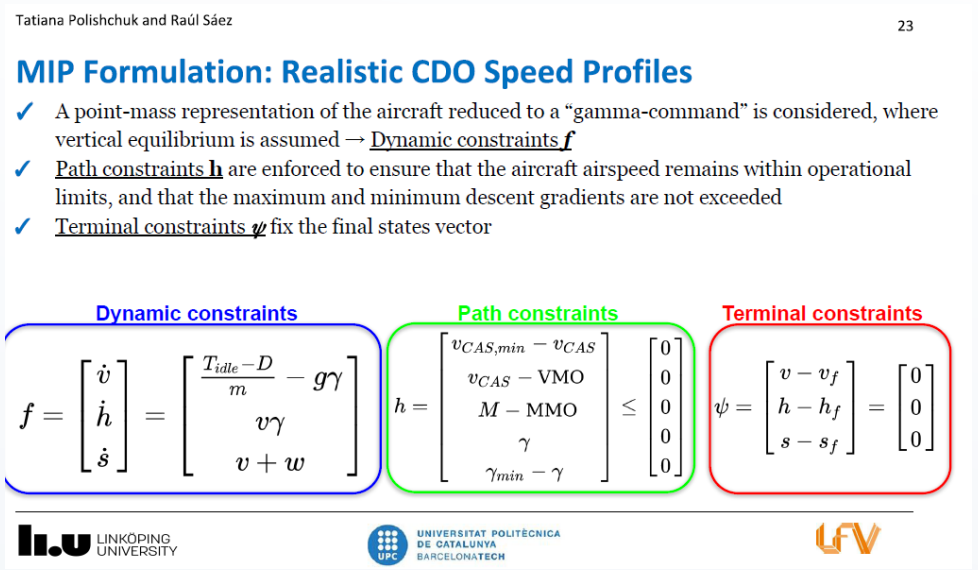
Brantare - Ops. variation - Airspeed



Yellow dots acc. to ANP database

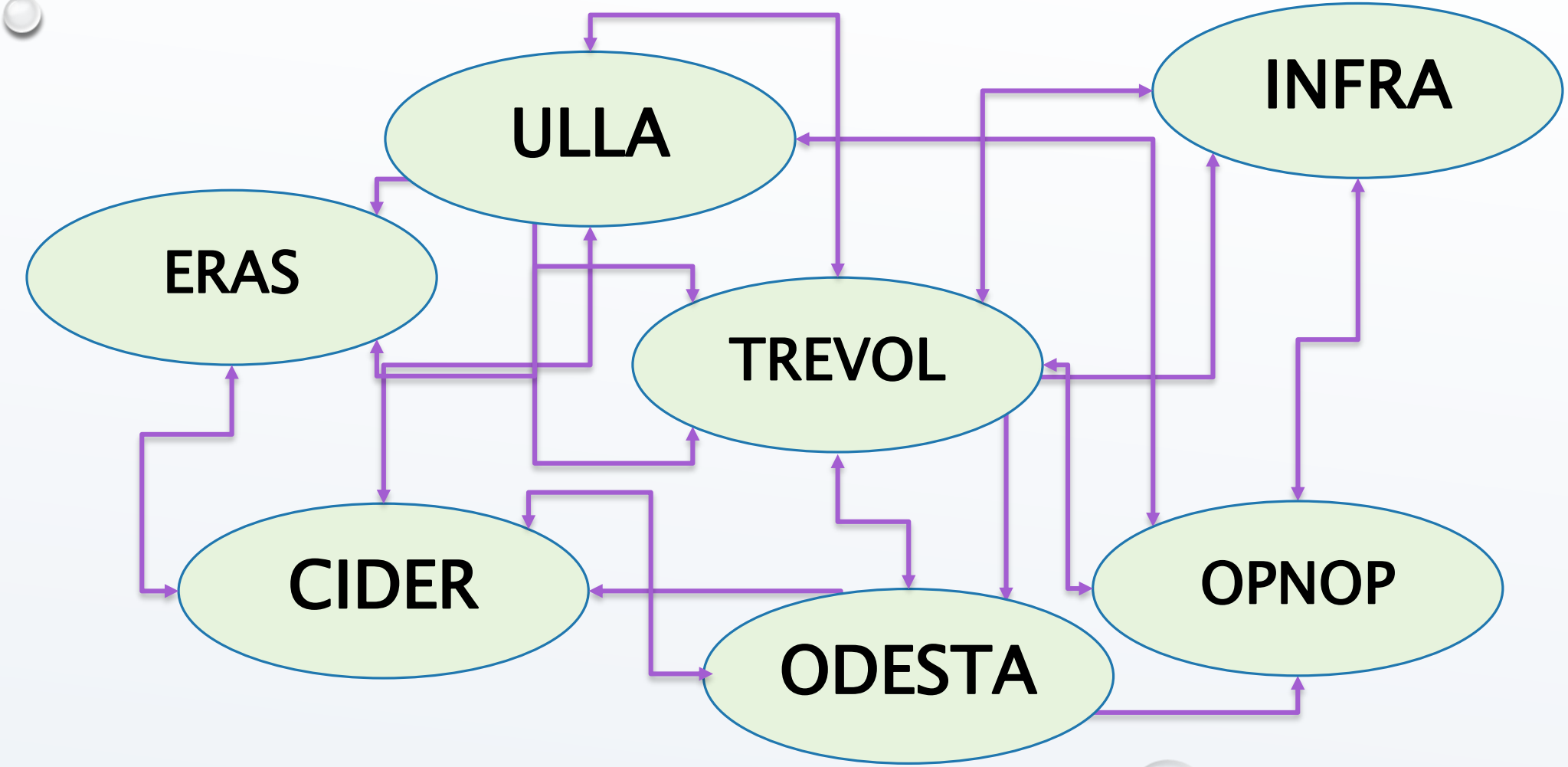
ERAS - method

- Select 10 relevant aircraft types
- Evaluate ANP, SOP and real life procedures
- Create realistic approach scenarios) in order to minimize noise but still by manageable by ATC
  (co-ordinate with ODESTA)
- Verify in flight simulators



Picture from Valentin Polishcuk

CSA – Collaboration & Info Sharing



Questions?