

GNSS basierte Luftrettung in alpinen Regionen REGA-Trials Oberengadin

AHORN Nov. 2015, Wildhaus
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Outline

- Introduction
- Problem Statement
- Situation
- Probability and Statistics
- Flight Trials and some Results
- Outlook

Problem Statement

- Helicopter's navigation performance better than manufacturer specified
- Manufacturer reluctant to certify better navigation performance
- Operator collects practical and theoretical evidence
- Operator demonstrates attained navigation performance to the agencies
- After approval uses potential capabilities of the helicopters in daily operations

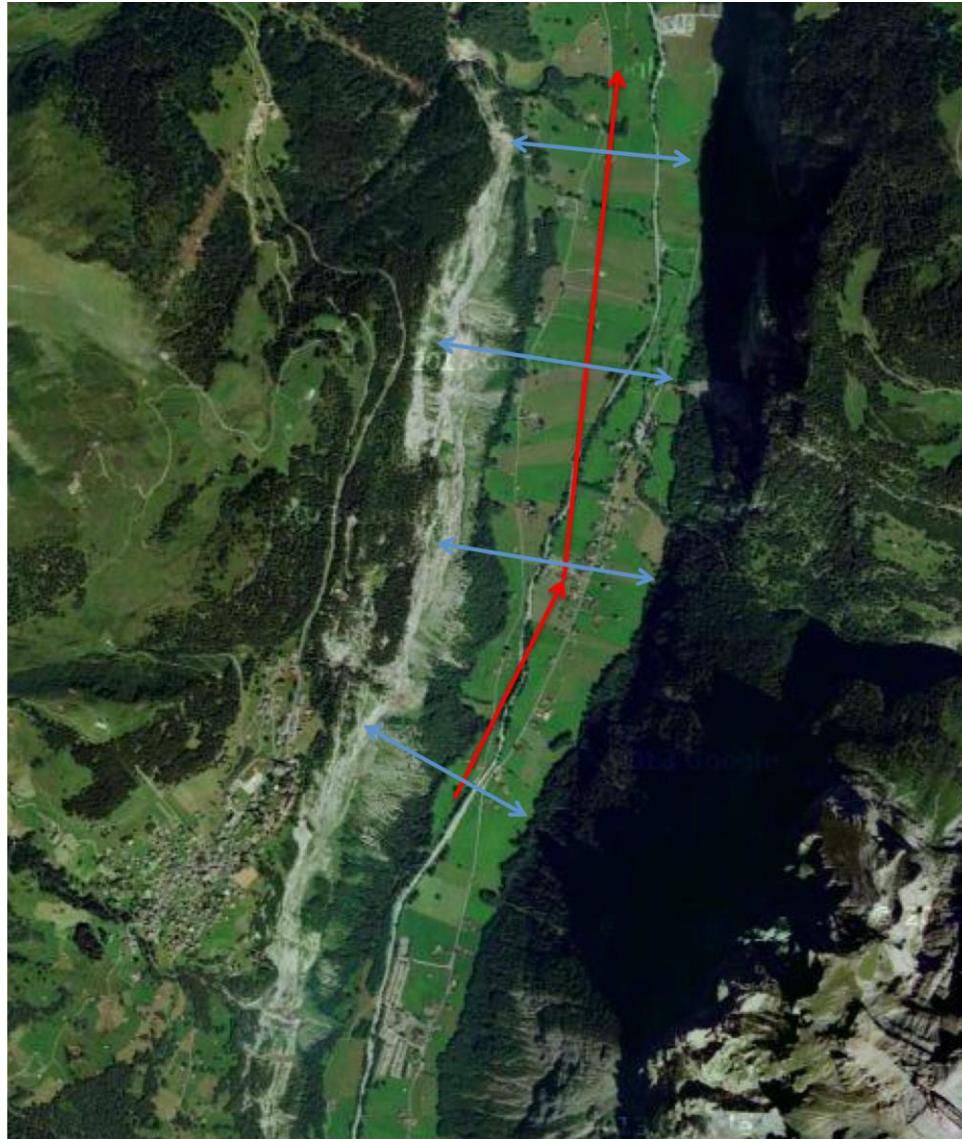
Trial Objectives

- Check AW109SP Helicopter FMS/AP capability for coping with the procedure/s
- Check procedure flyability
- RNP 0.1
- Radius to Fix (RF) in intermediate segment
- LPV PinS in the final segment
- Initial missed approach segment (after the MAPt)
- Visual Segment (from MAPt to RWY)
- Monitor the deviation of the helicopter
- Provide improvements to the procedure design
- Capture pilot feelings

Canyon and EM-Wave Interactions

Surface Patches	Urban	Alpine
Reflectivity	smooth	rough
Orientation	perpendicular	random
Structure	periodic	fractal
EM-Characterization	layered	arbitrary

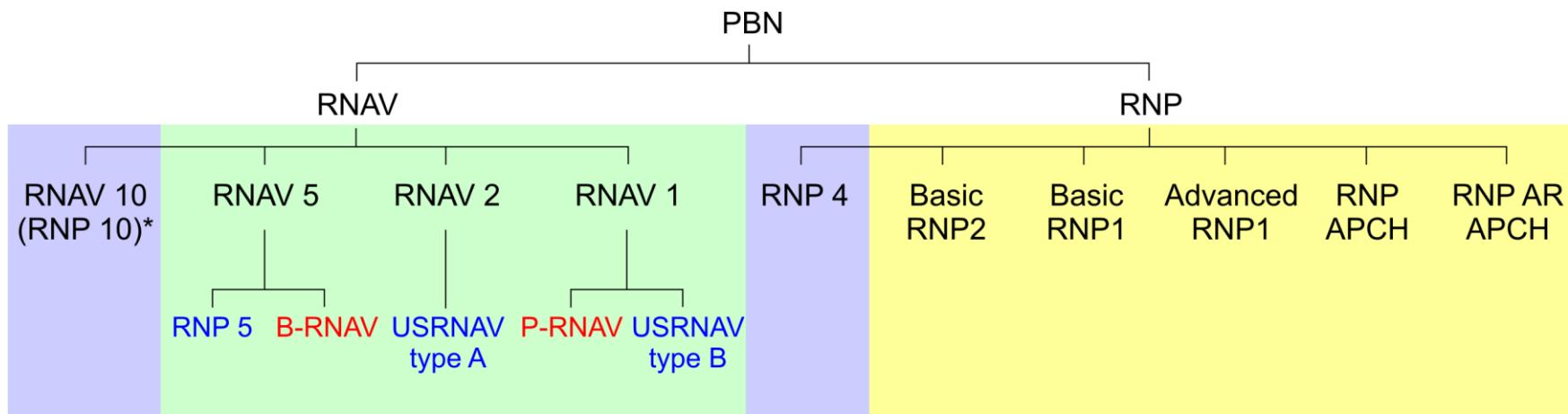
Alpine Canyon



Lauterbrunnen Valley - Berner Oberland

from Google Maps

Required Navigation Performance

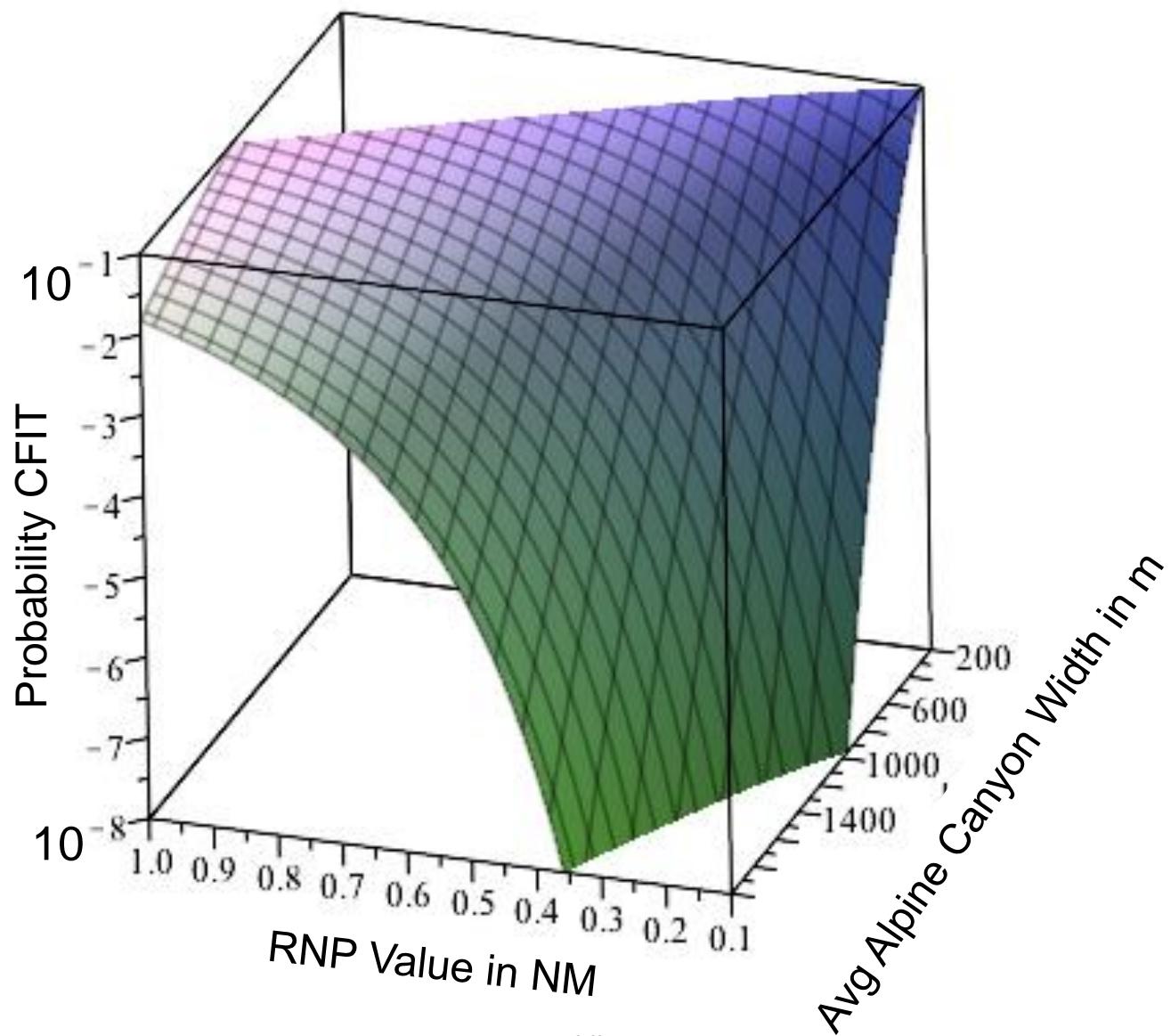


- Oceanic and Remote Continental navigation applications **'old' US designation**
- En Route and Terminal navigation applications **'old' European designation**
- various phases of flight

(*) exception

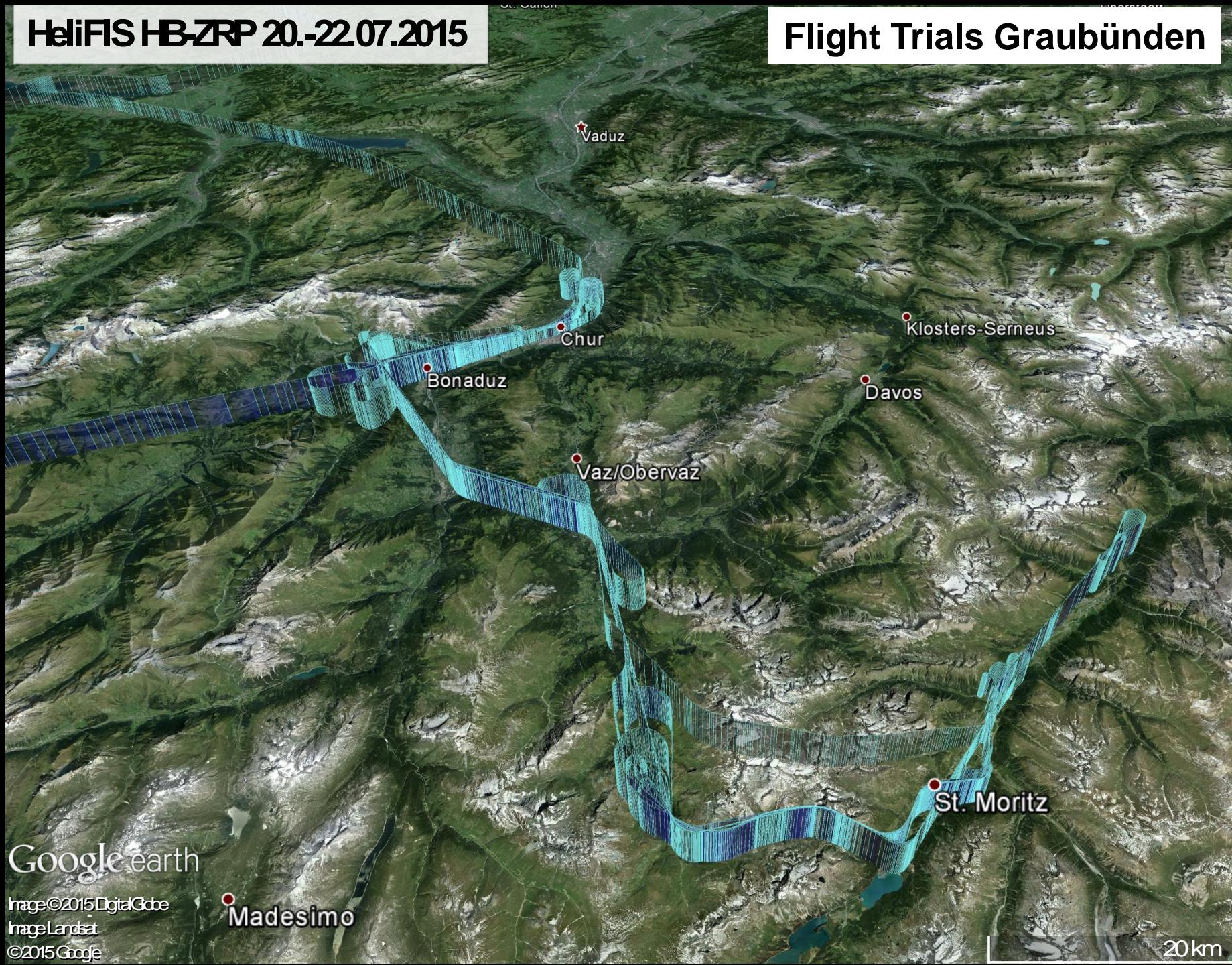
from: M. Scaramuzza

Probability of Controlled Flight into Terrain



HeliFIS HB-ZRP 20.-22.07.2015

Flight Trials Graubünden



Google earth

Image ©2015 DigitalGlobe

Image Landsat

©2015 Google

Madesimo

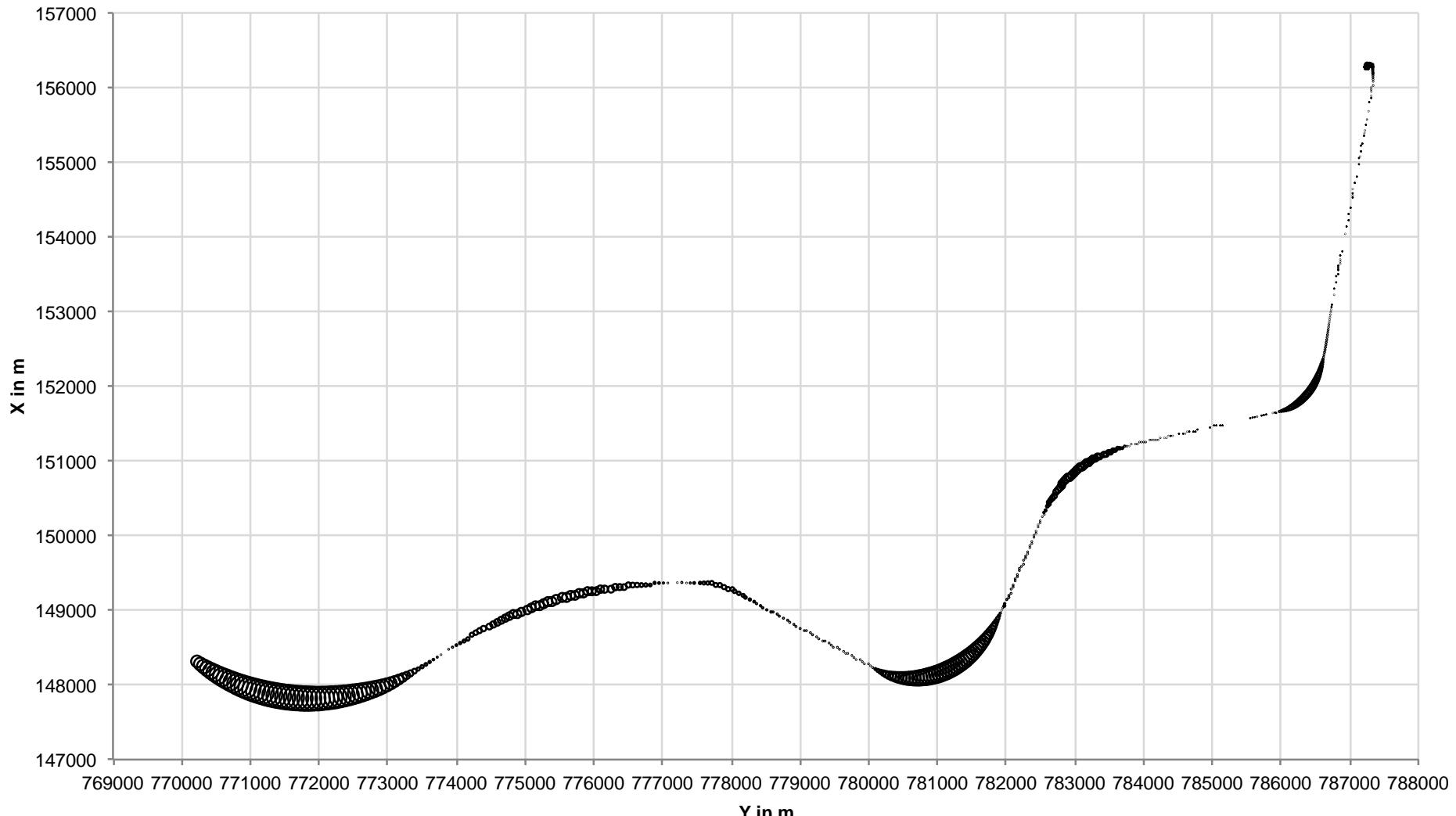
20 km

Helicopter Agusta-Westland AW109 SP



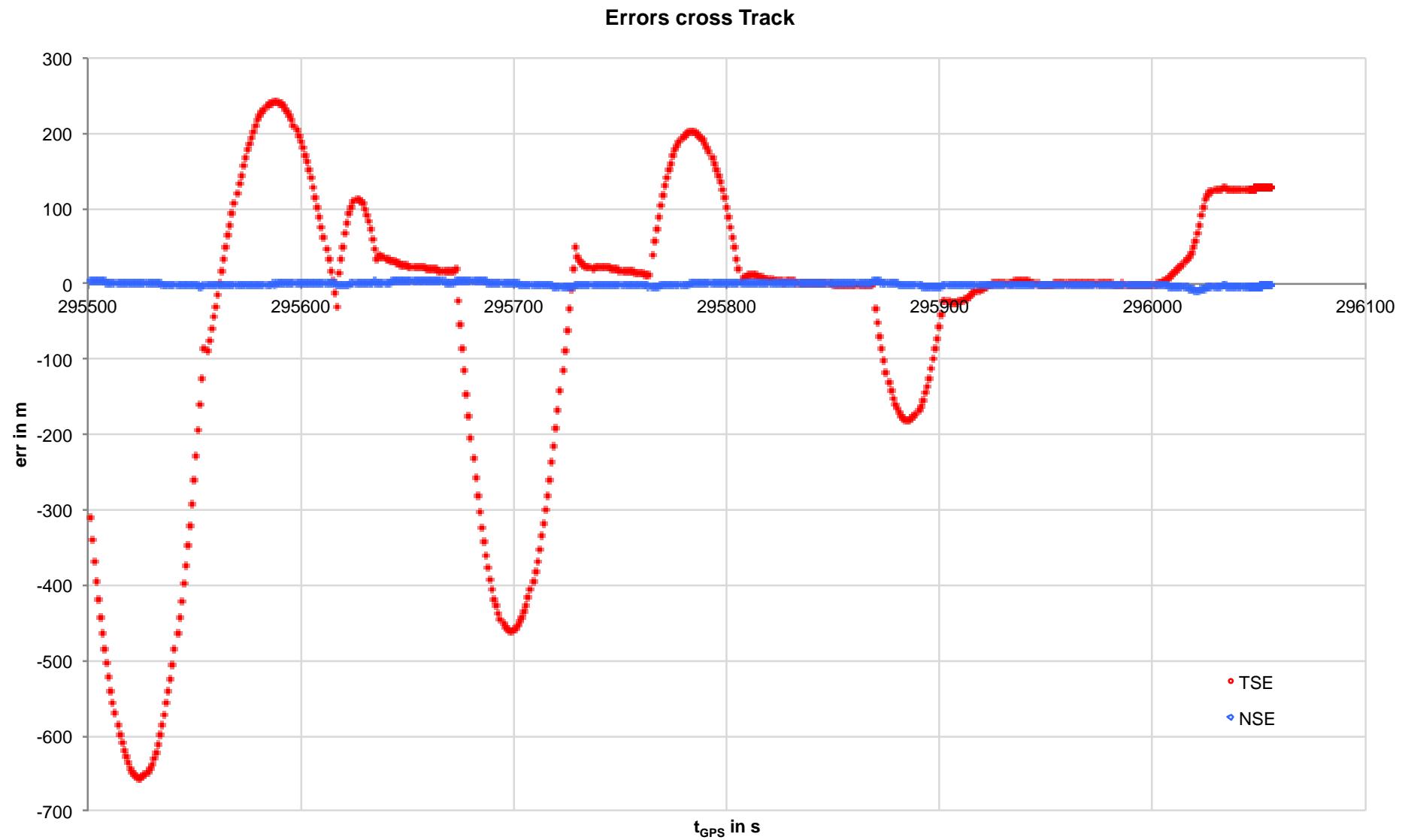
Exemplary Flight Procedure

TSE cross Track



Coordinates X Y : LV03 – CH1903

Cross Track Errors Time Series



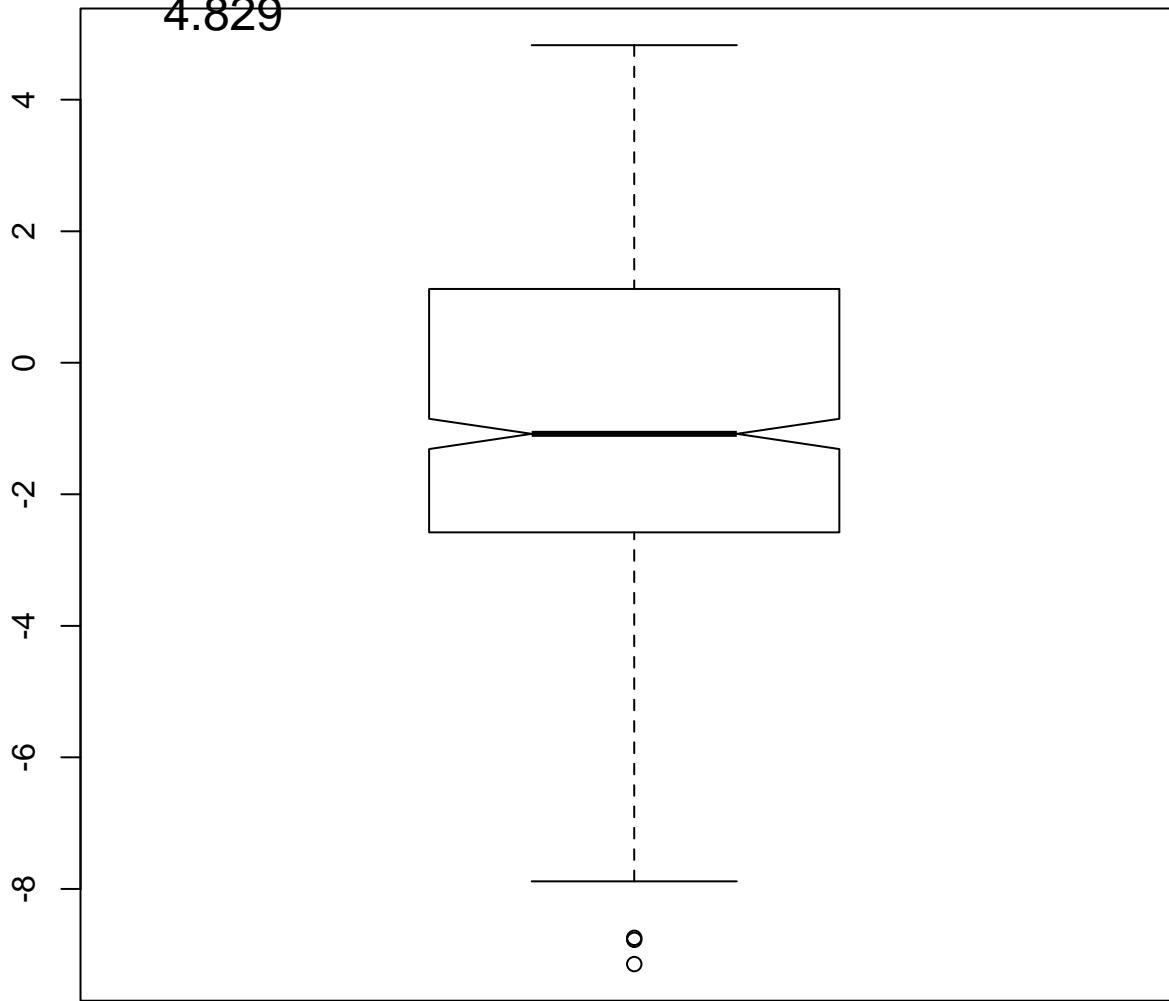
NSE Cross Track

Min. 1st Qu. Median Mean 3rd Qu.

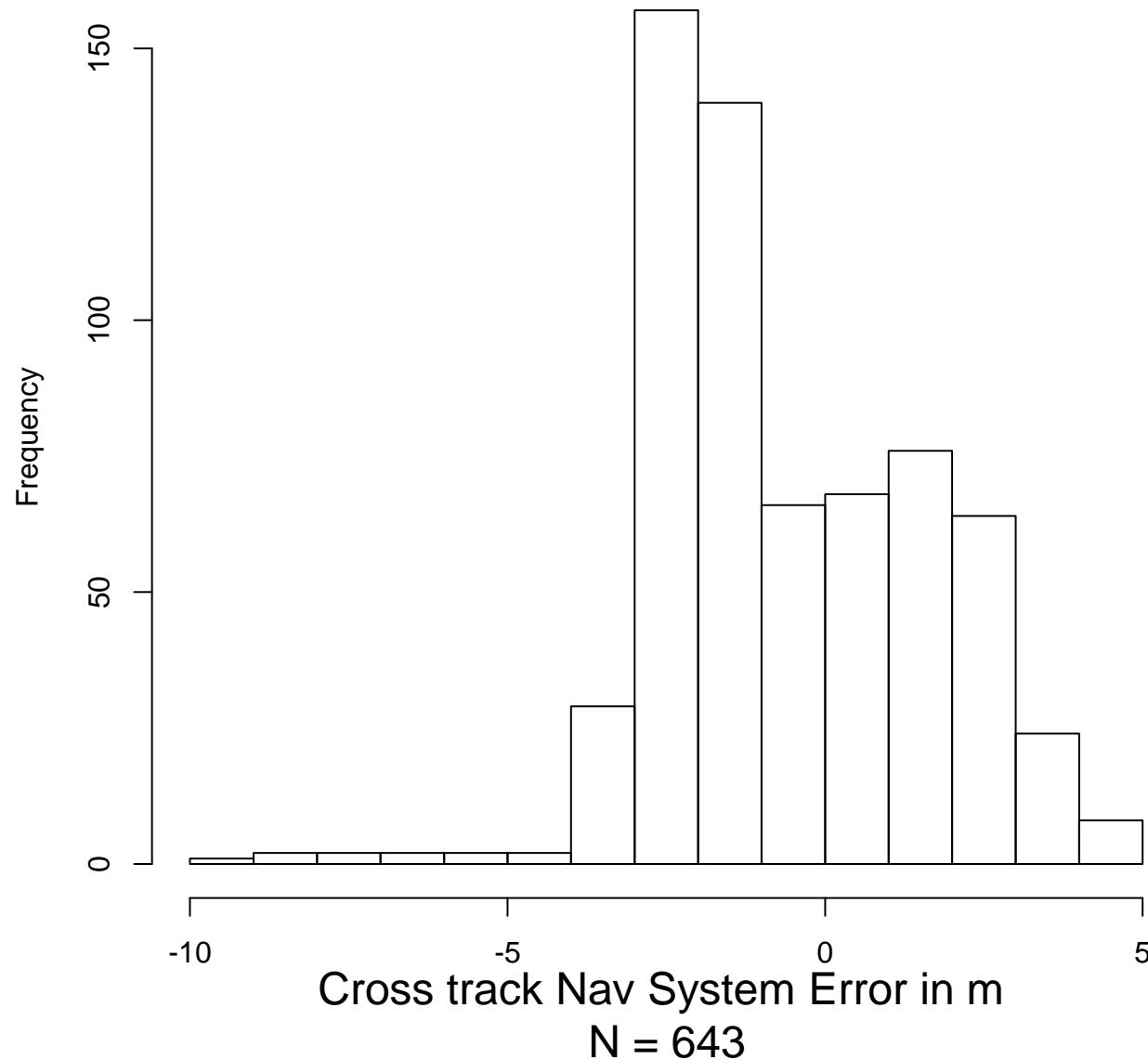
Max.

-9.143 -2.579 -1.081 -0.628 1.121

Cross track Nav System Error in m
N = 643

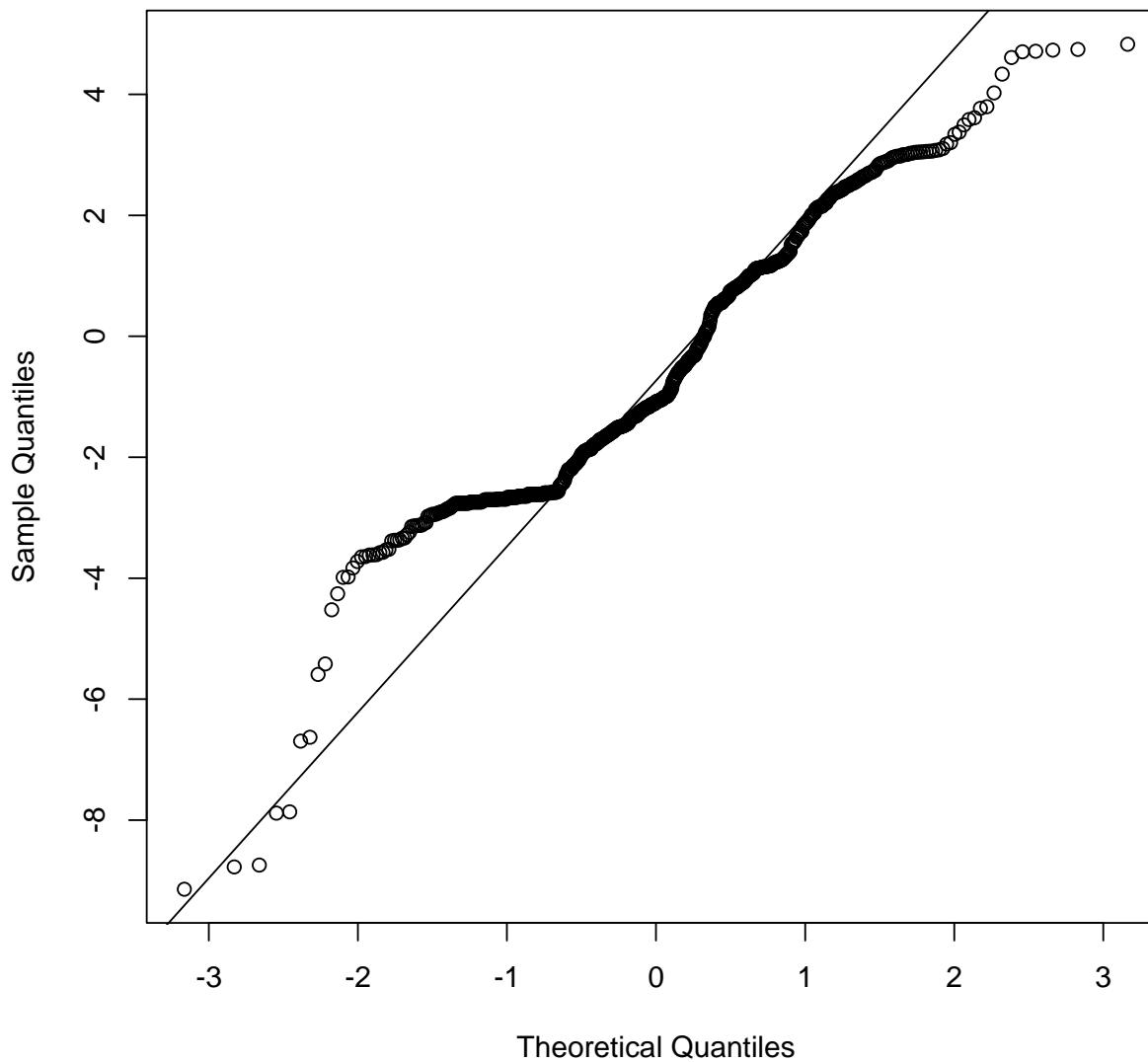


NSE Cross Track



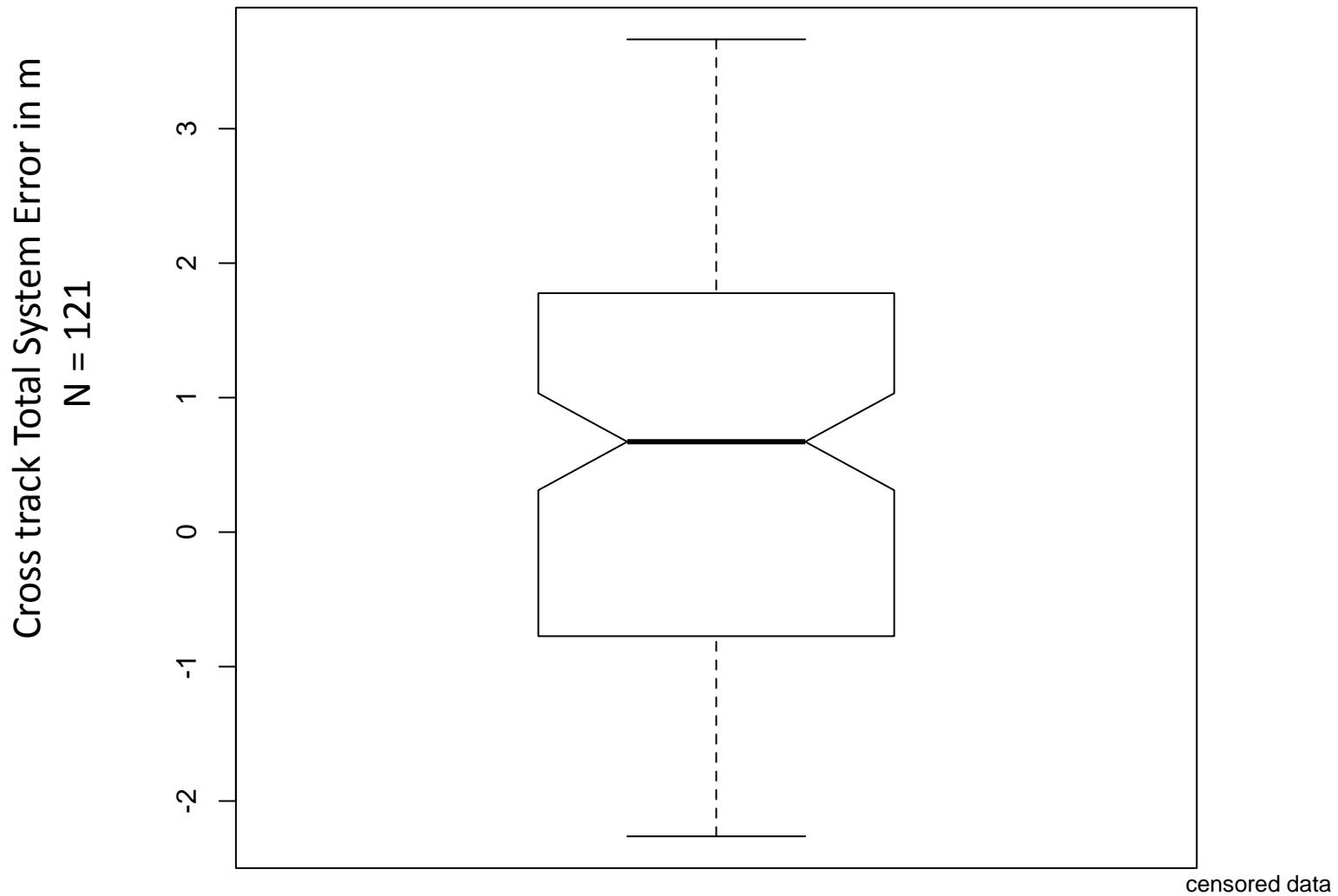
NSE Cross Track

Normal Q-Q Plot

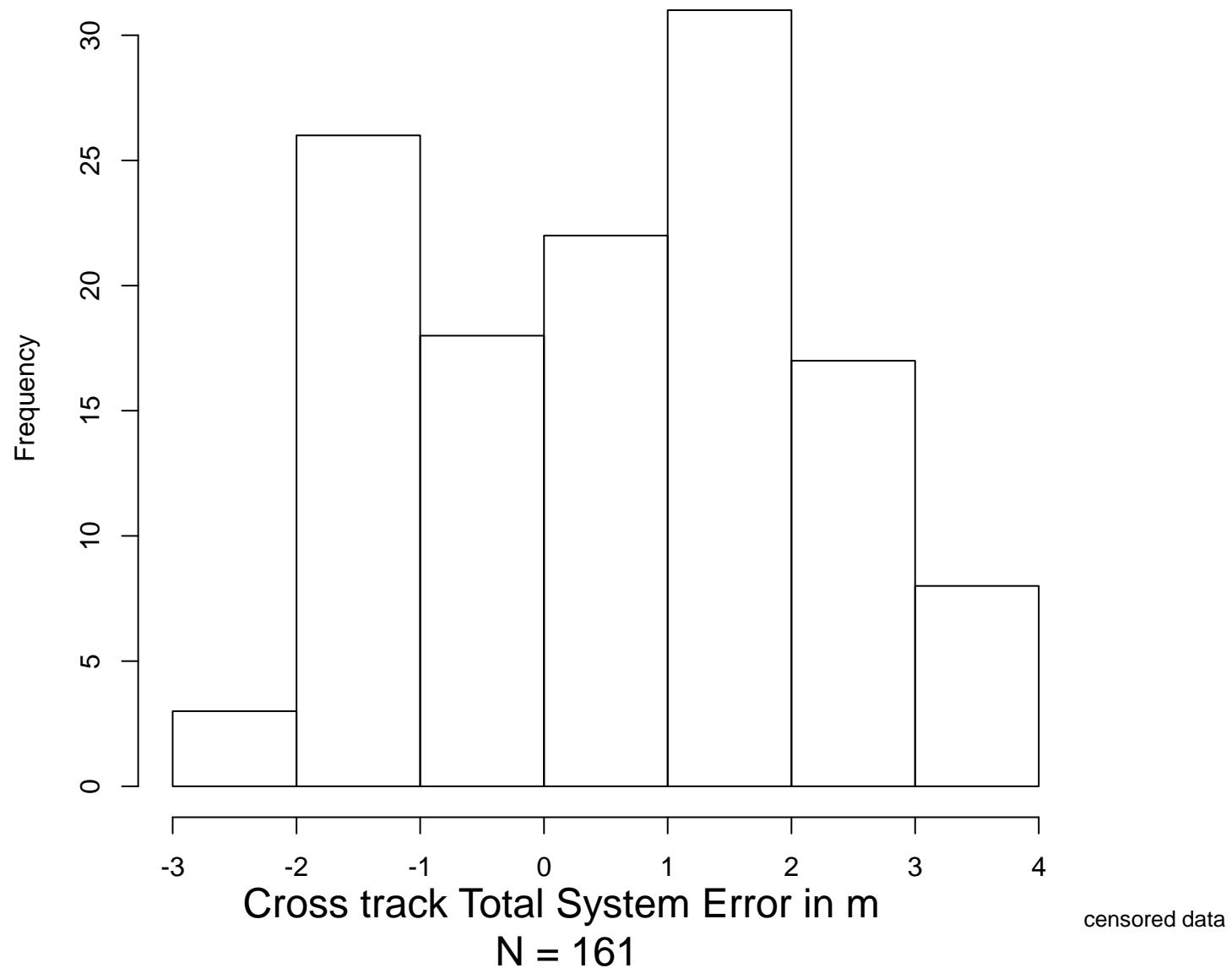


TSE Cross Track

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
-2.2620	-0.7739	0.6724	0.5941	1.7770	3.6640

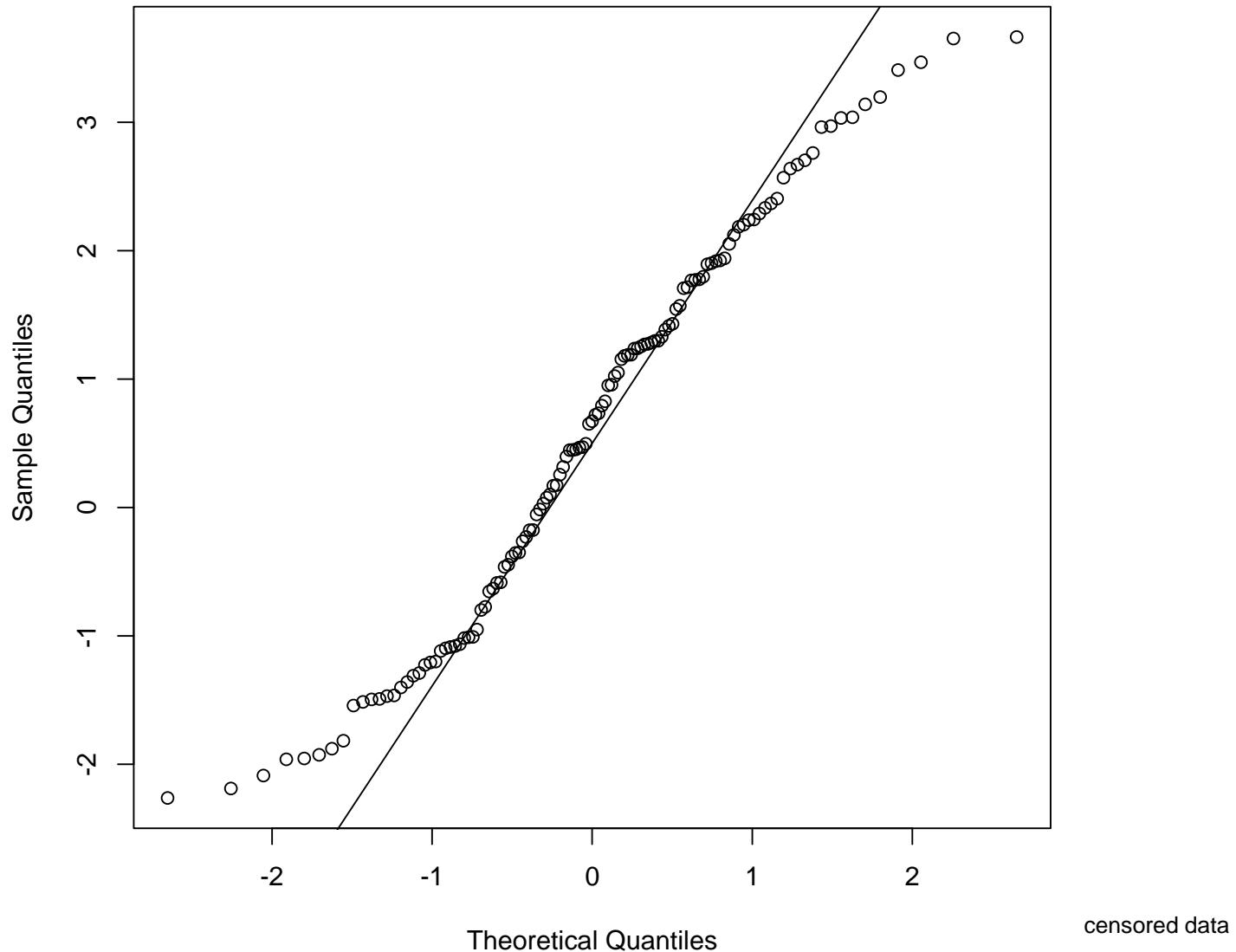


TSE Cross Track



TSE Cross Track

Normal Q-Q Plot



PROuD Large Scale Demonstrations

Operational Objectives

- Provide instrument approach capabilities to locations where conventional navigation facilities are not available.
- Enable continued access to heliports in difficult to reach areas during reduced visibility conditions
- Guarantee the continuity of vital services ...