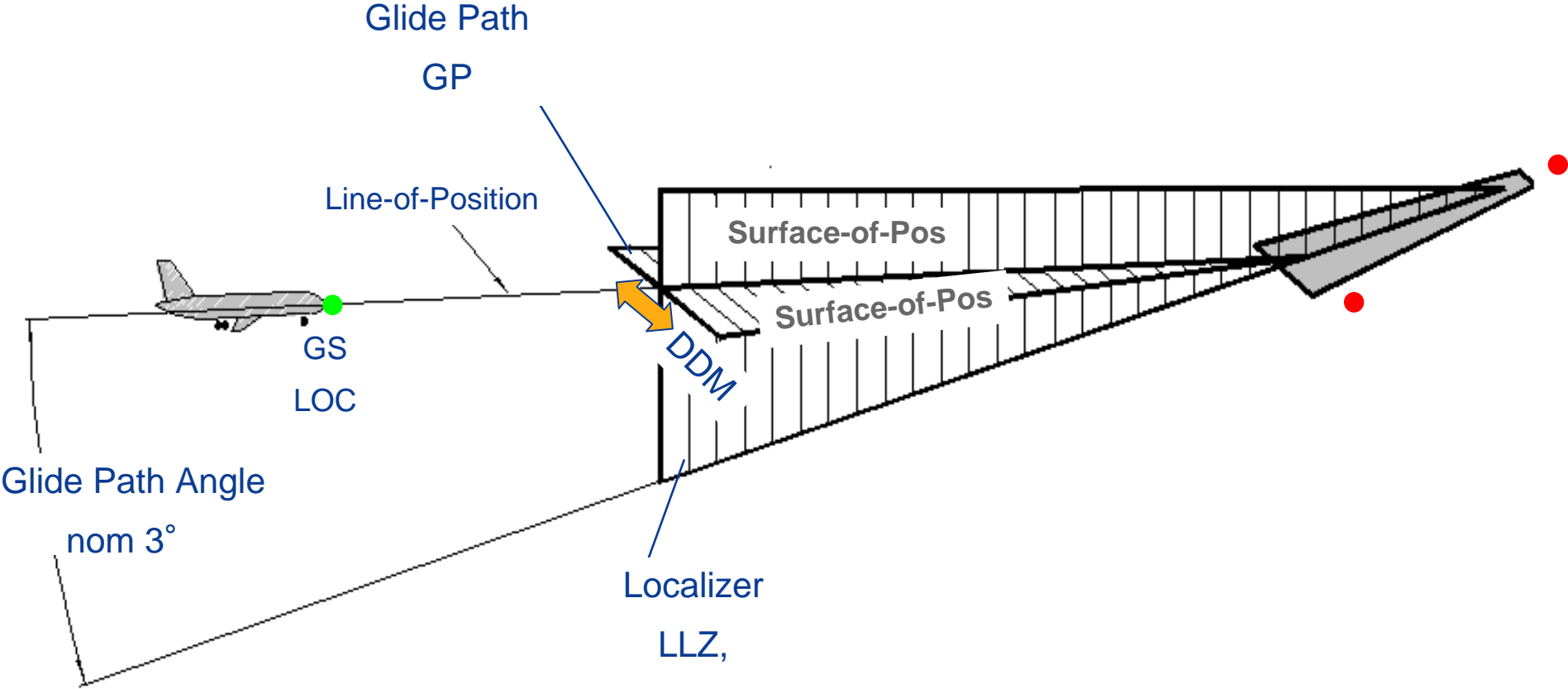


Outline

- + Introduction
- + Instrument Landing System - ILS
- + LLZ Orbit: Effects and Causes
- + Measurements and Computational Electromagnetics
- + Straight-In-Approach in Comparison
- + Specifications in Question
- + Other Solutions
- + Conclusions

ILS - Basic Layout



.....

ILS-Categories

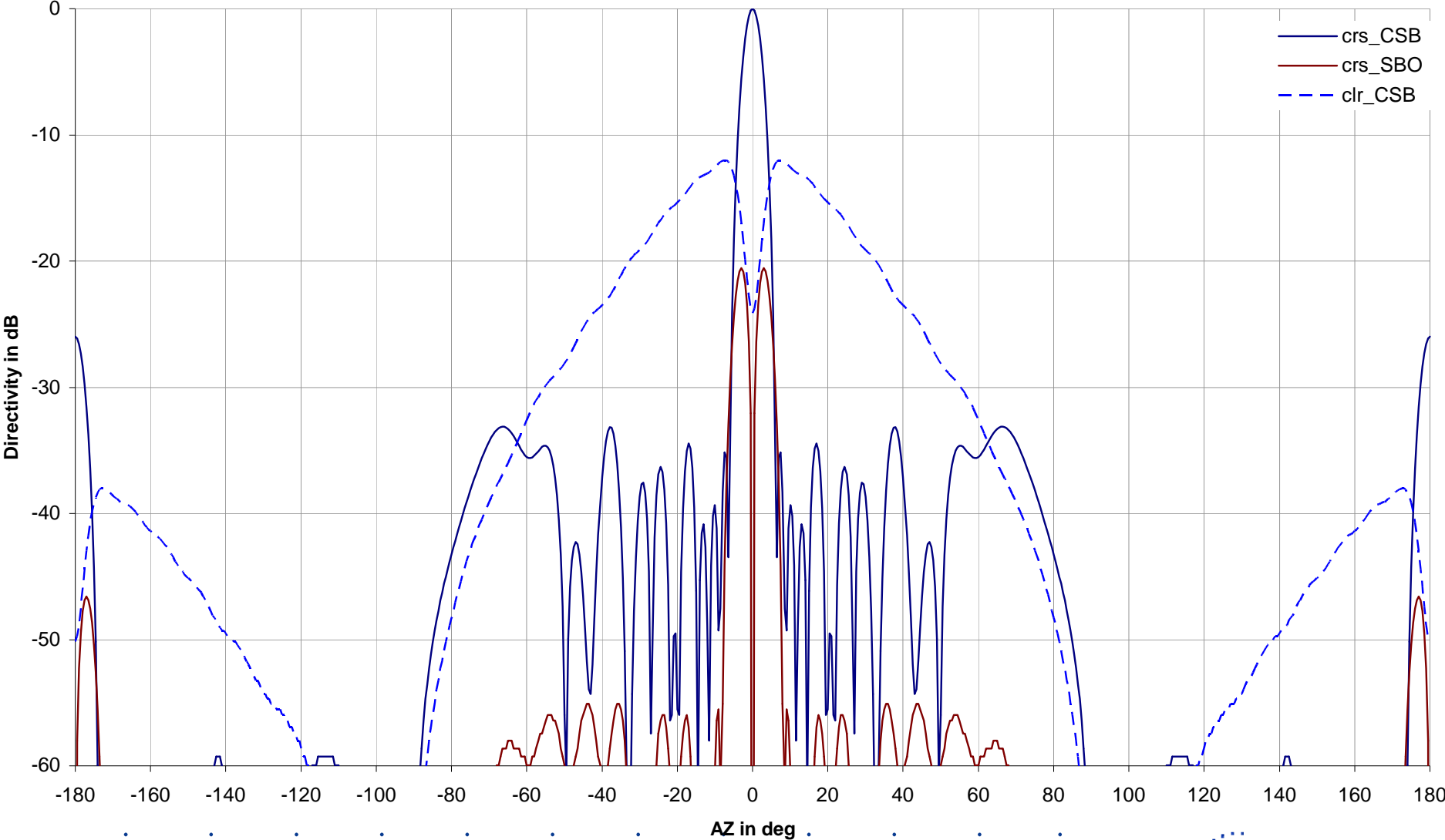
	Runway Visual Range	Decision Height
• CAT I:	800m	60m
• CAT II:	400m	30m
• CAT III:	200m	0m

Typical LLZ Antenna Configuration 13 Elements

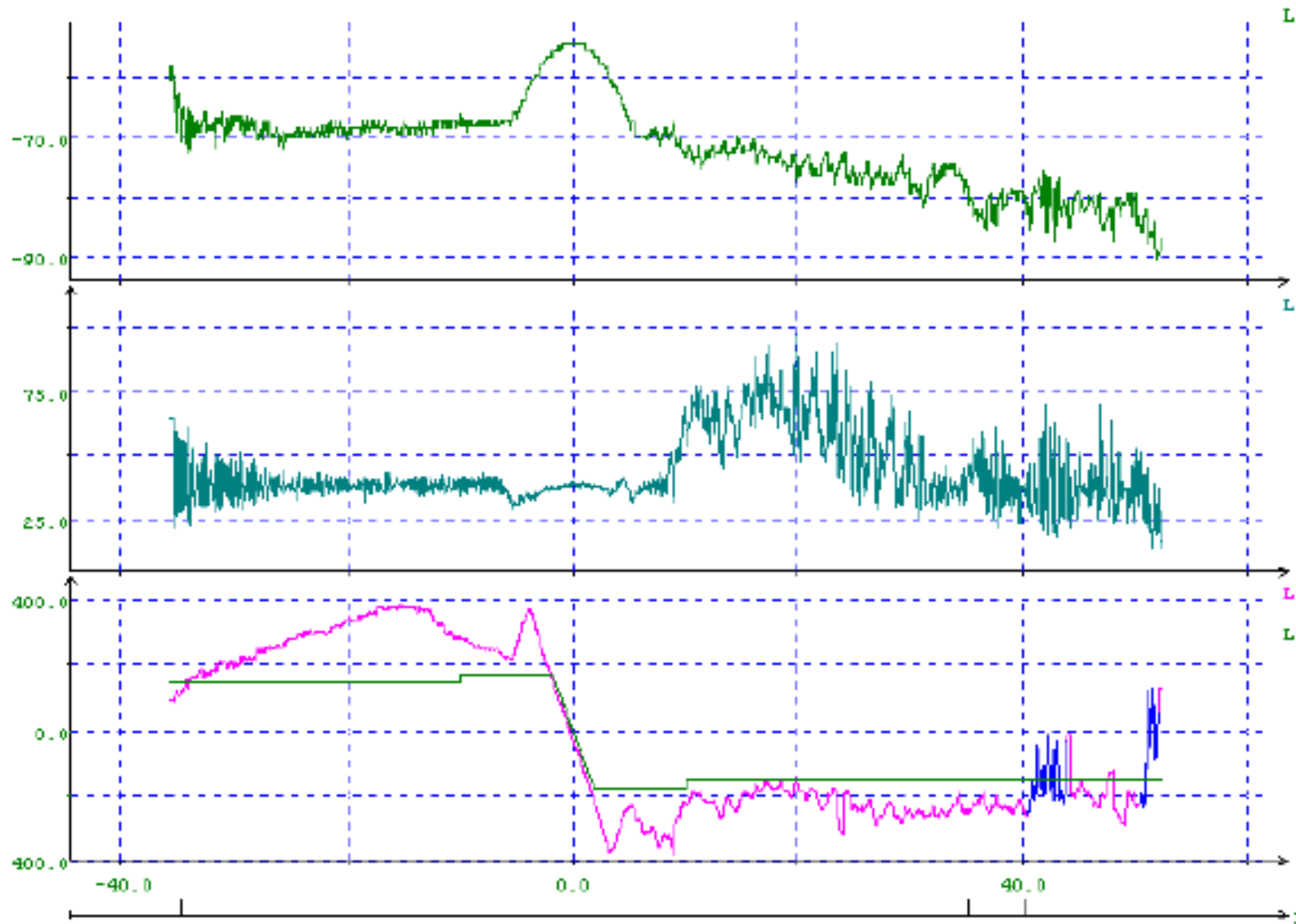


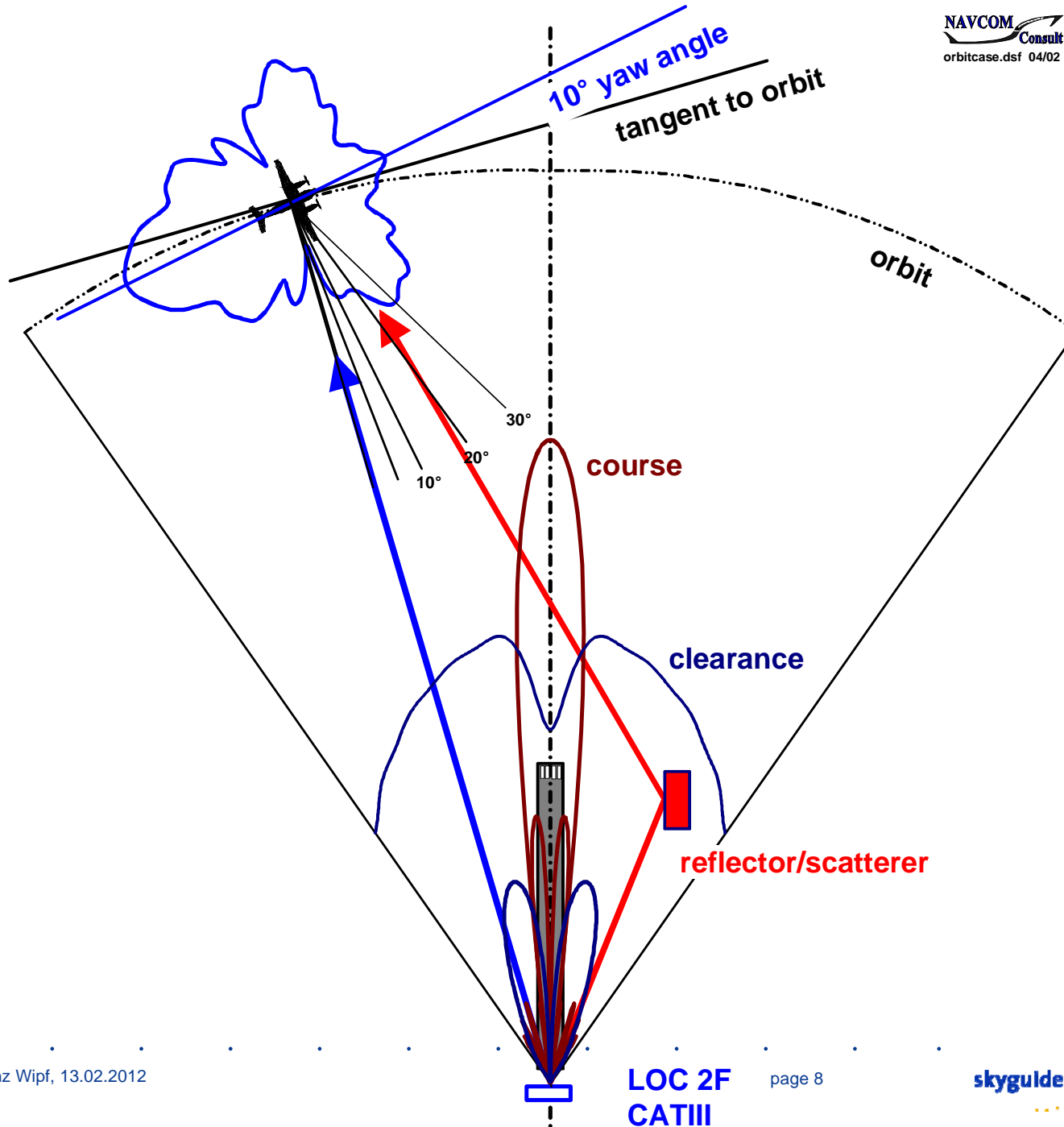
LLZ – Antenna Diagrams 25 Elements L=45m

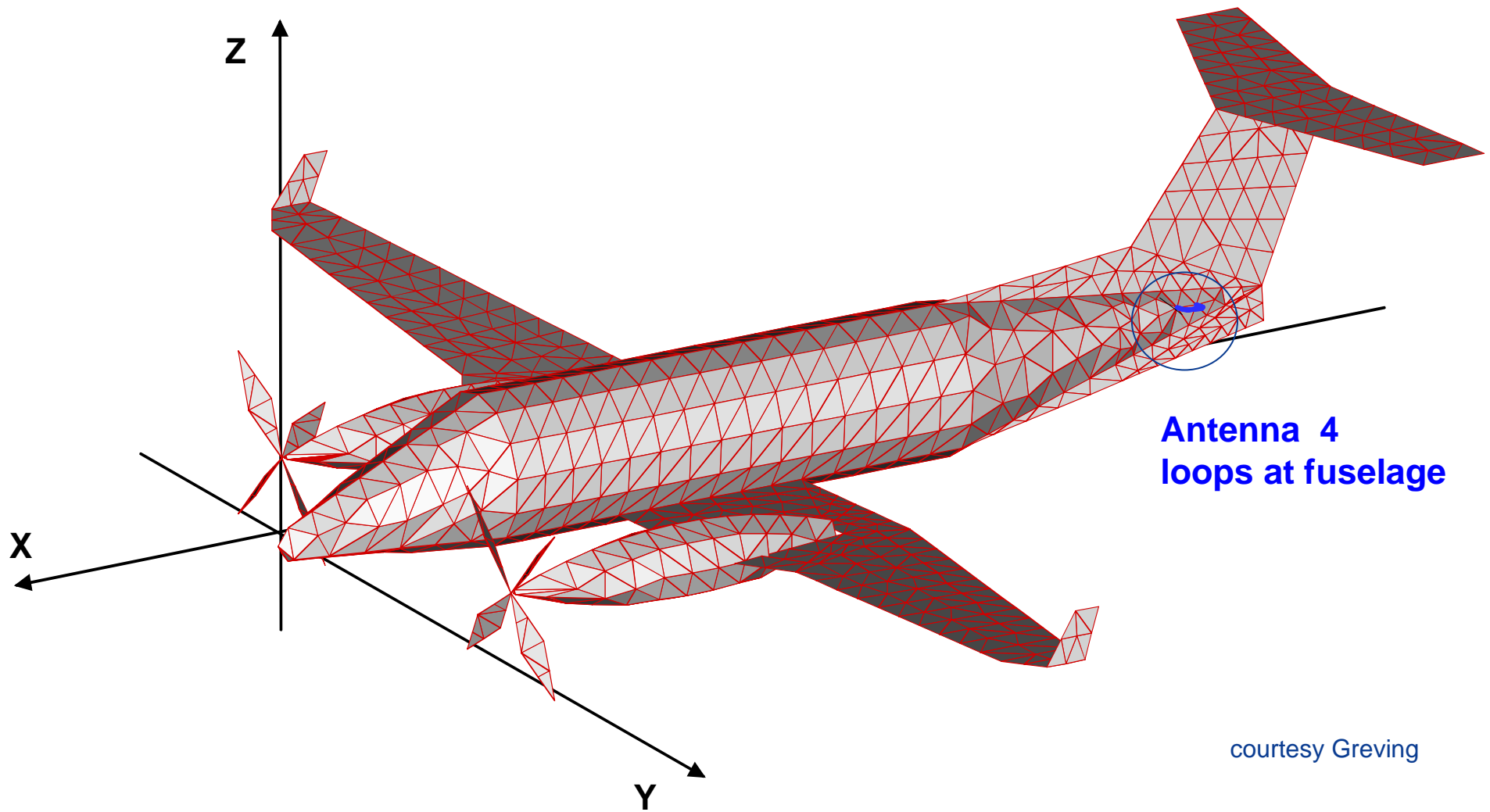
Course & Clearance



Flight Inspection Results



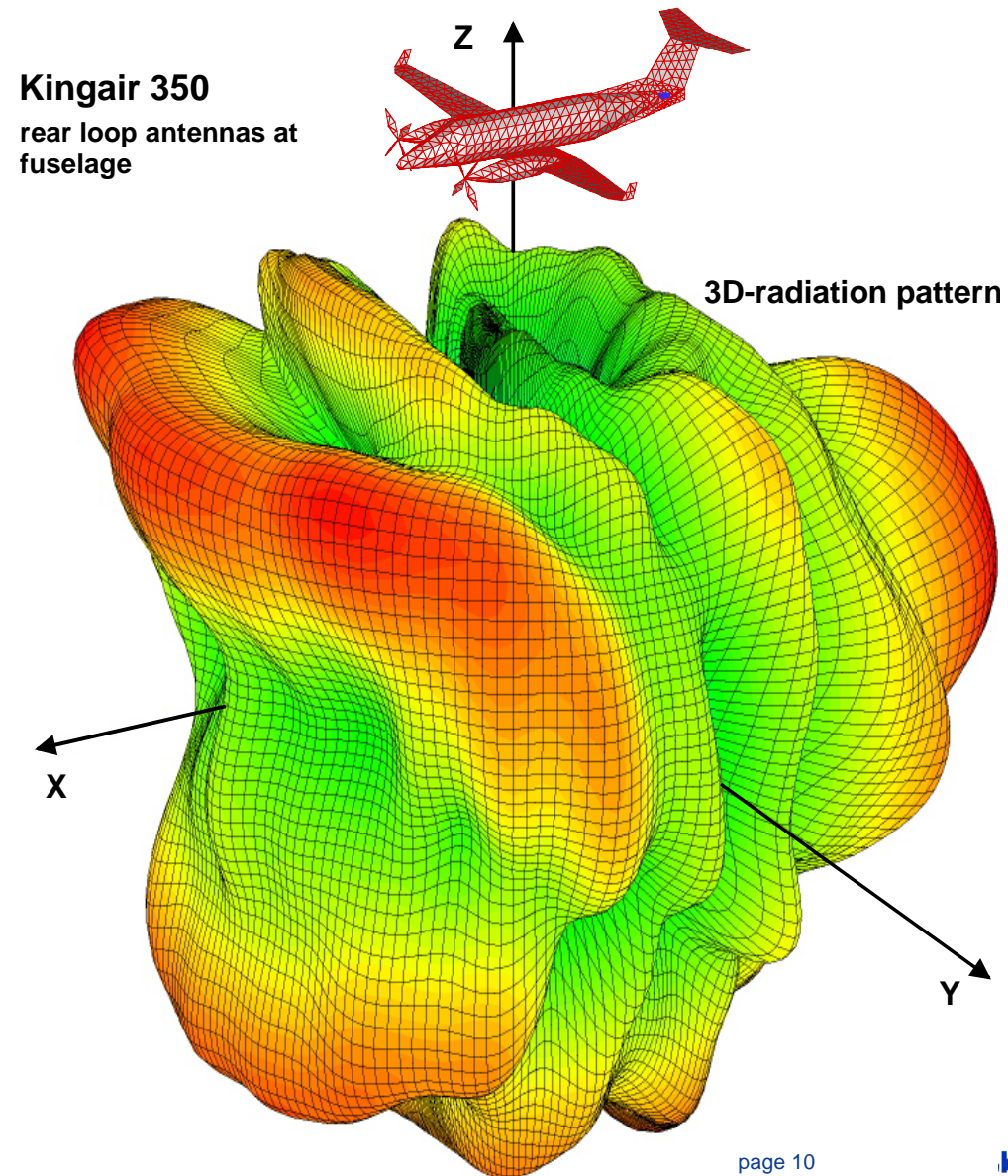




**Antenna 4
loops at fuselage**

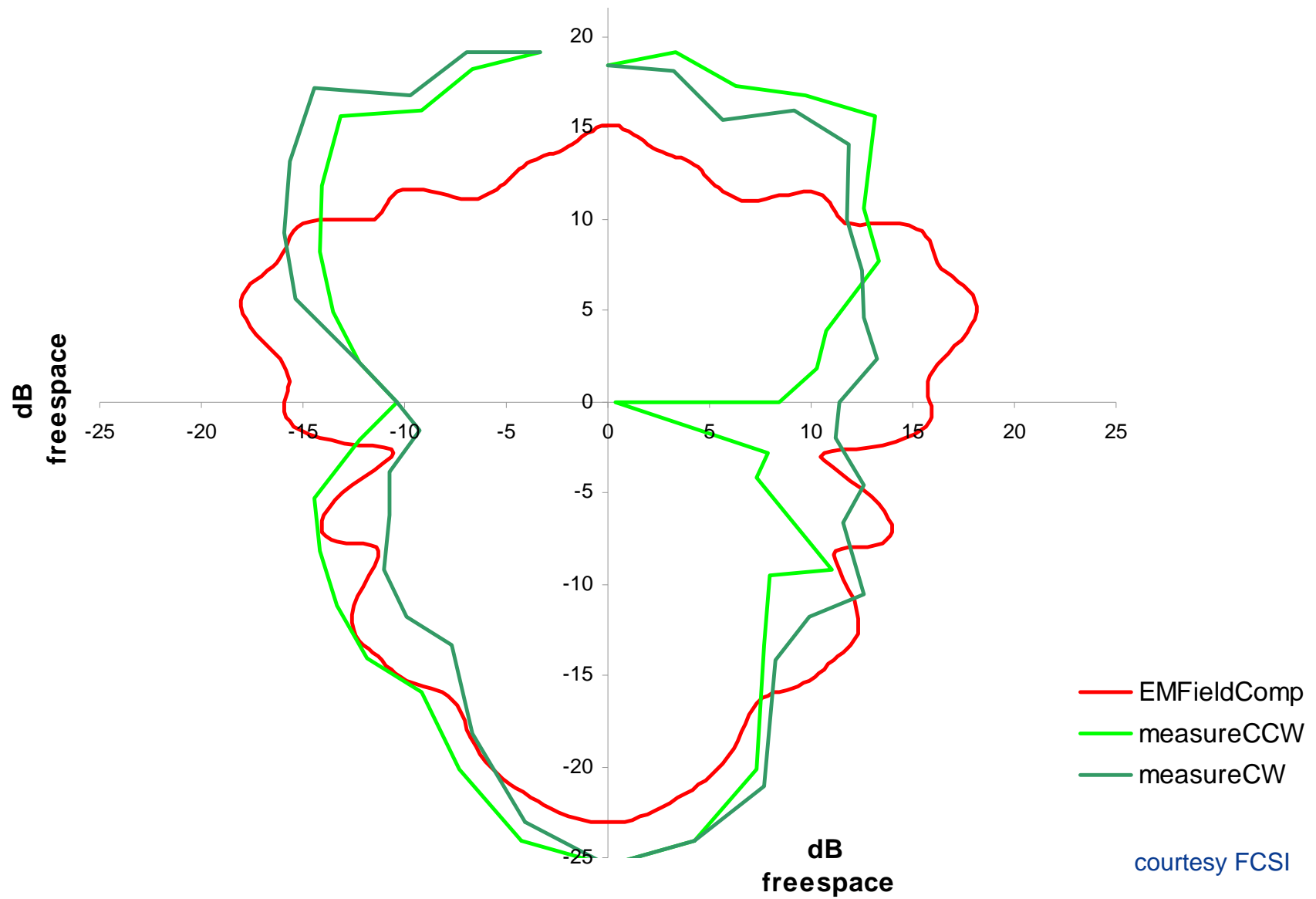
courtesy Greving

Computational Electromagnetics



courtesy Greving

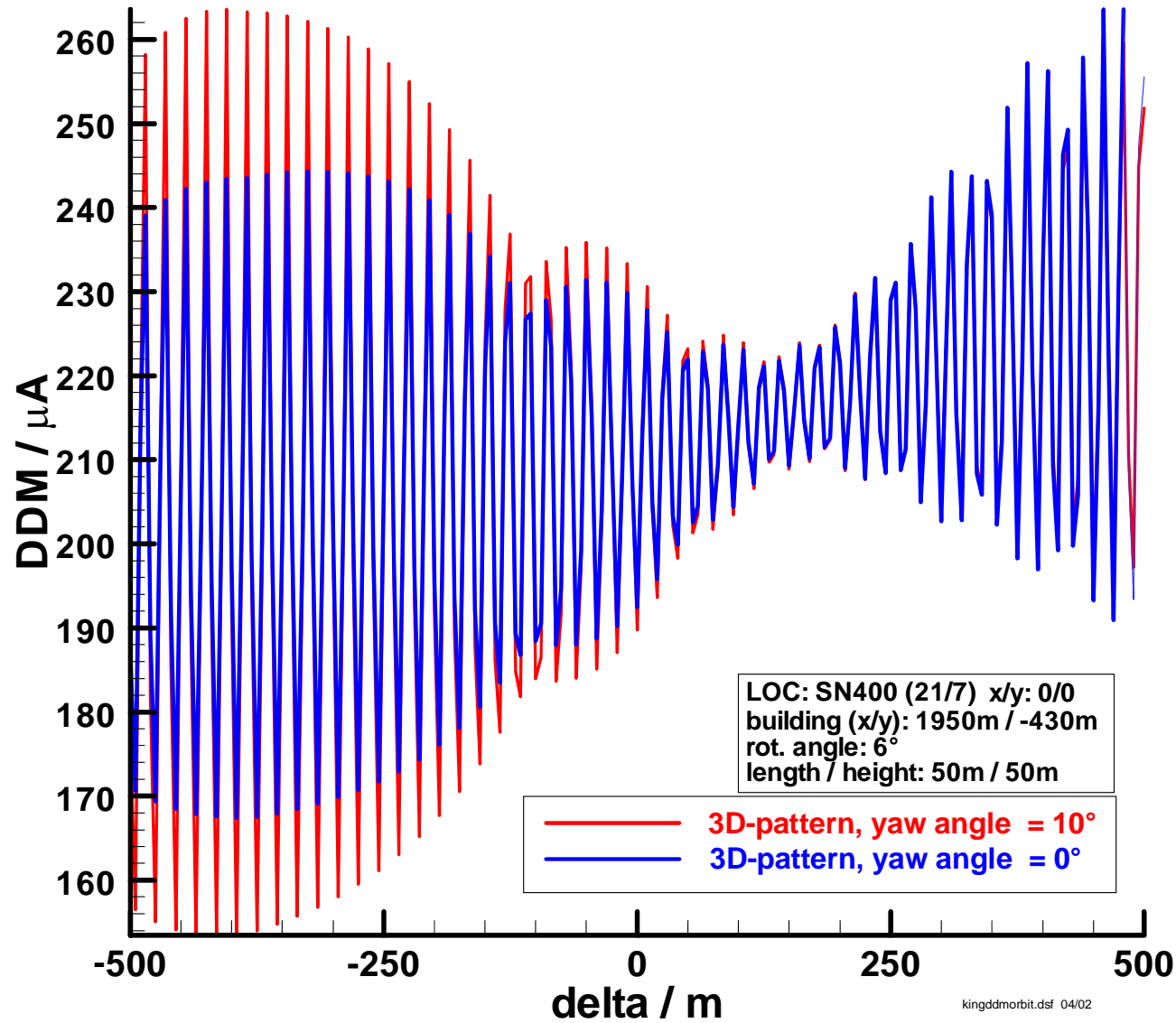
Calculation vs. Measurements



courtesy FCSI

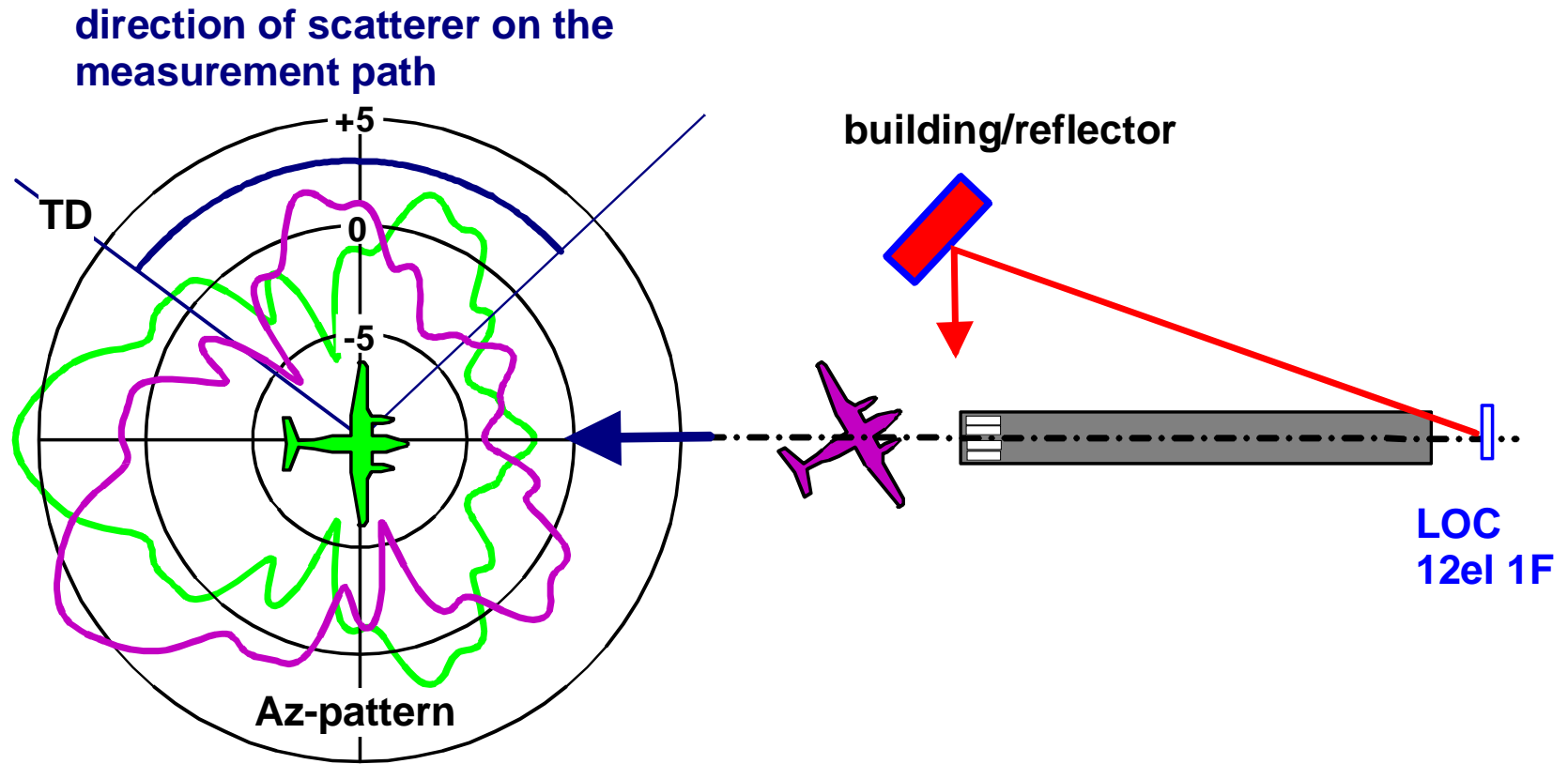
DDM on orbit flight in the clearance region

(Radius 11km, Elevation 1.1°)

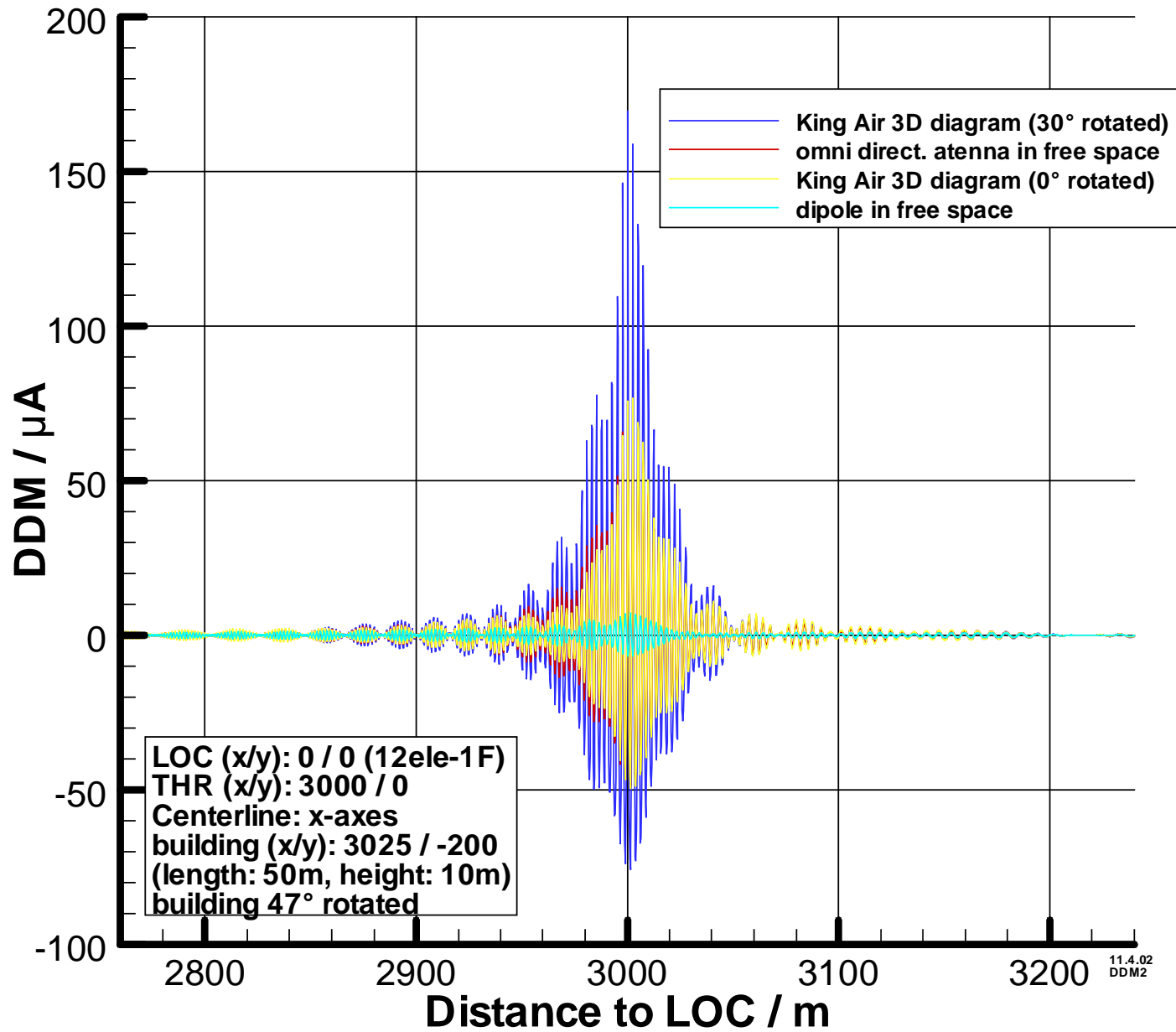


courtesy Greving

Straight-In-Approaches?



courtesy Greving



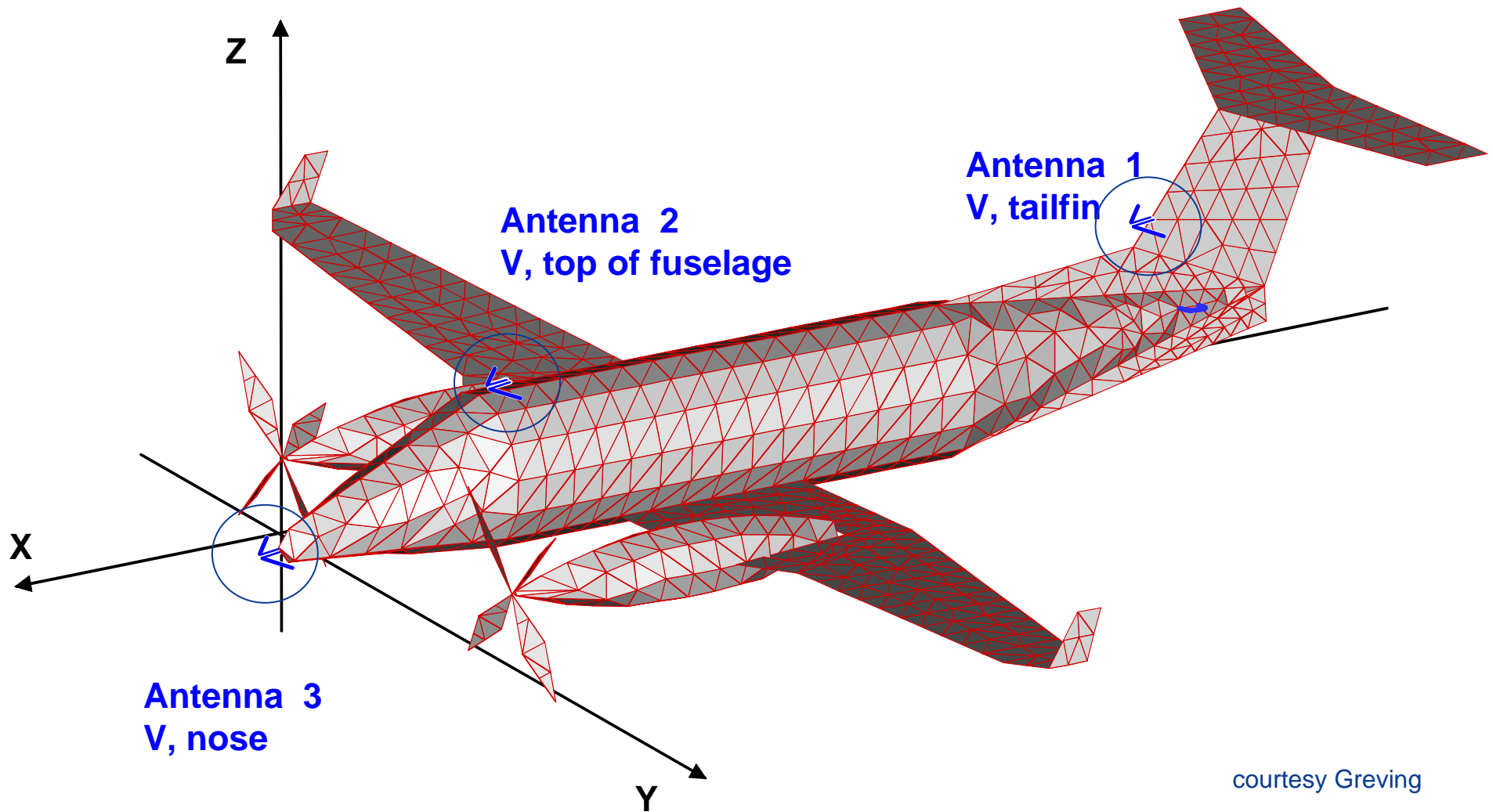
Antenna Diagram within Spec?

“.. frequency range 108 –112 MHz, the horizontal component of the radiated signal in the forward and rearward directions shall not be down more than **10 dB** when compared to the max radiation from a standard horizontal dipole antenna resonant at 113 MHz and mounted 10 inch above a ...”

RTCA

Other Antenna Type

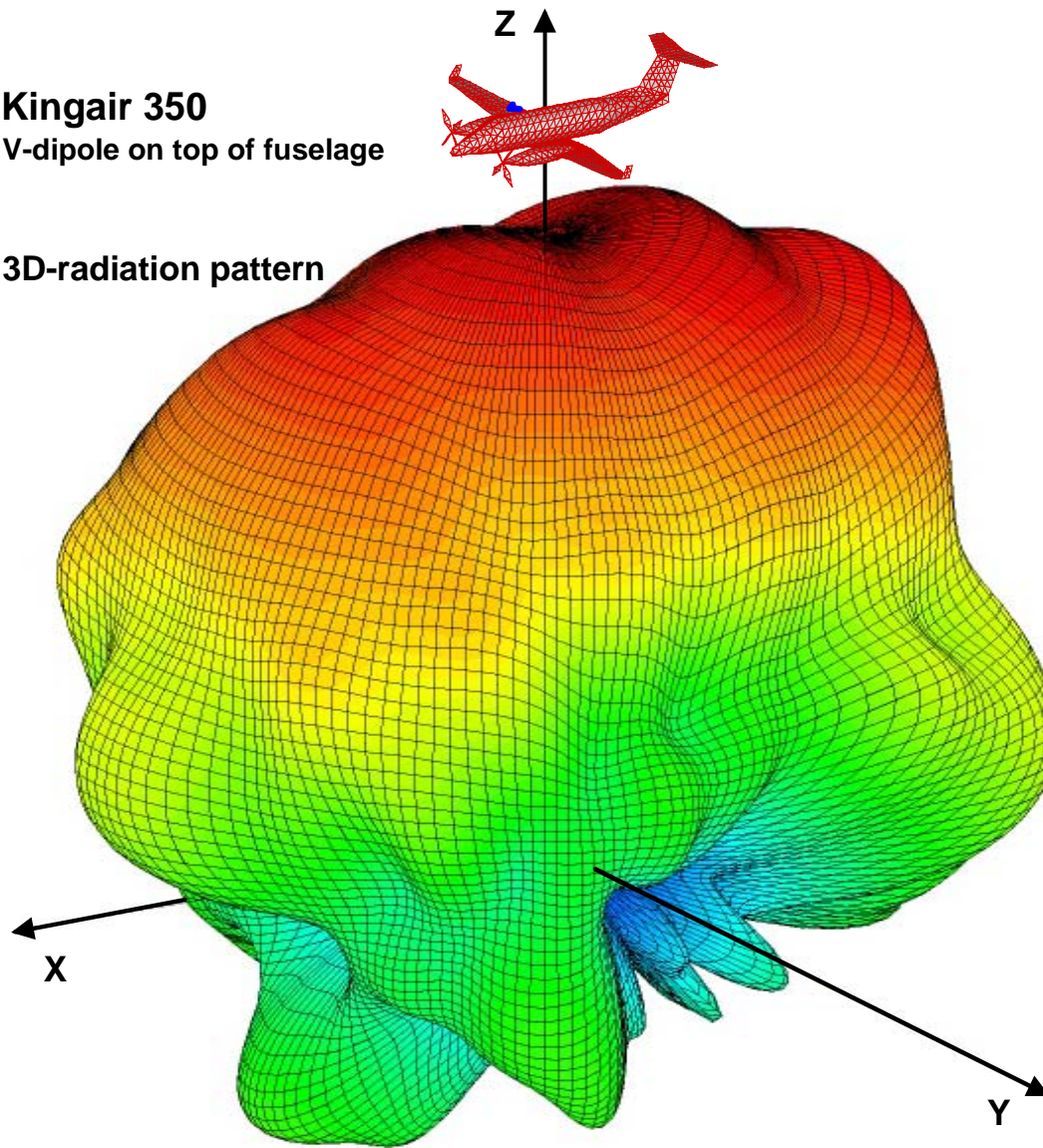
better Mounting Locations?



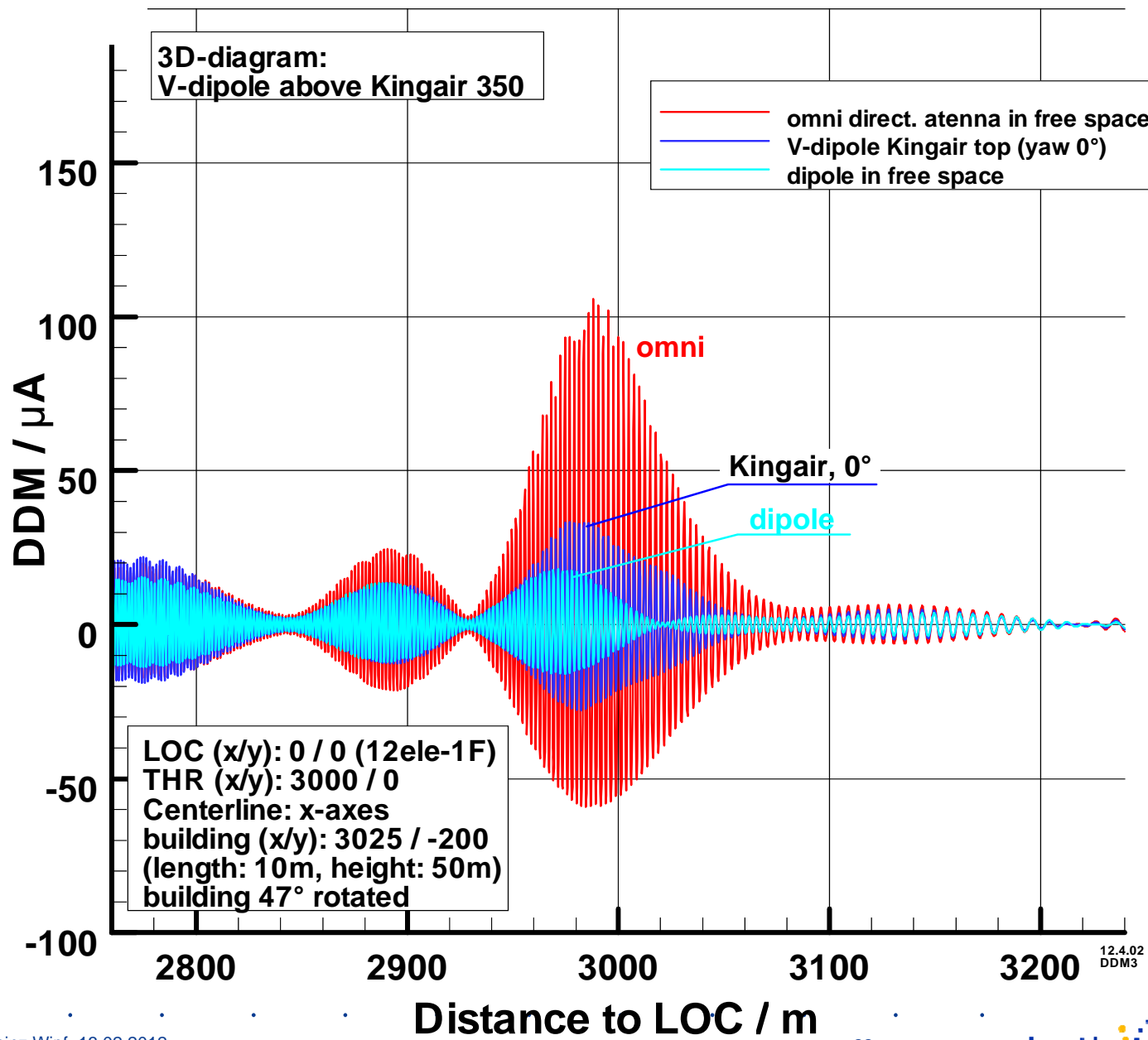
courtesy Greving

Kingair 350
V-dipole on top of fuselage

3D-radiation pattern



DDM LOC on GP for different antennas



12.4.02
DDM3

courtesy Greiving

Conclusions

- Antennas once mounted on an aircraft differ from specified free-space pattern.
- Given certain typical flight inspection procedures and aircraft attitudes together with multipath, 3d aircraft antenna diagram care must be taken to avoid erroneous results.
- RTCA/DOC-195 spec may not suffice to embrace flight inspection applications.