

"GNSS based applications and developments"

Nottingham, 11 nov 09



APPLICATIONS SHOWCASE 2009
State of the Art in GNSS Applications

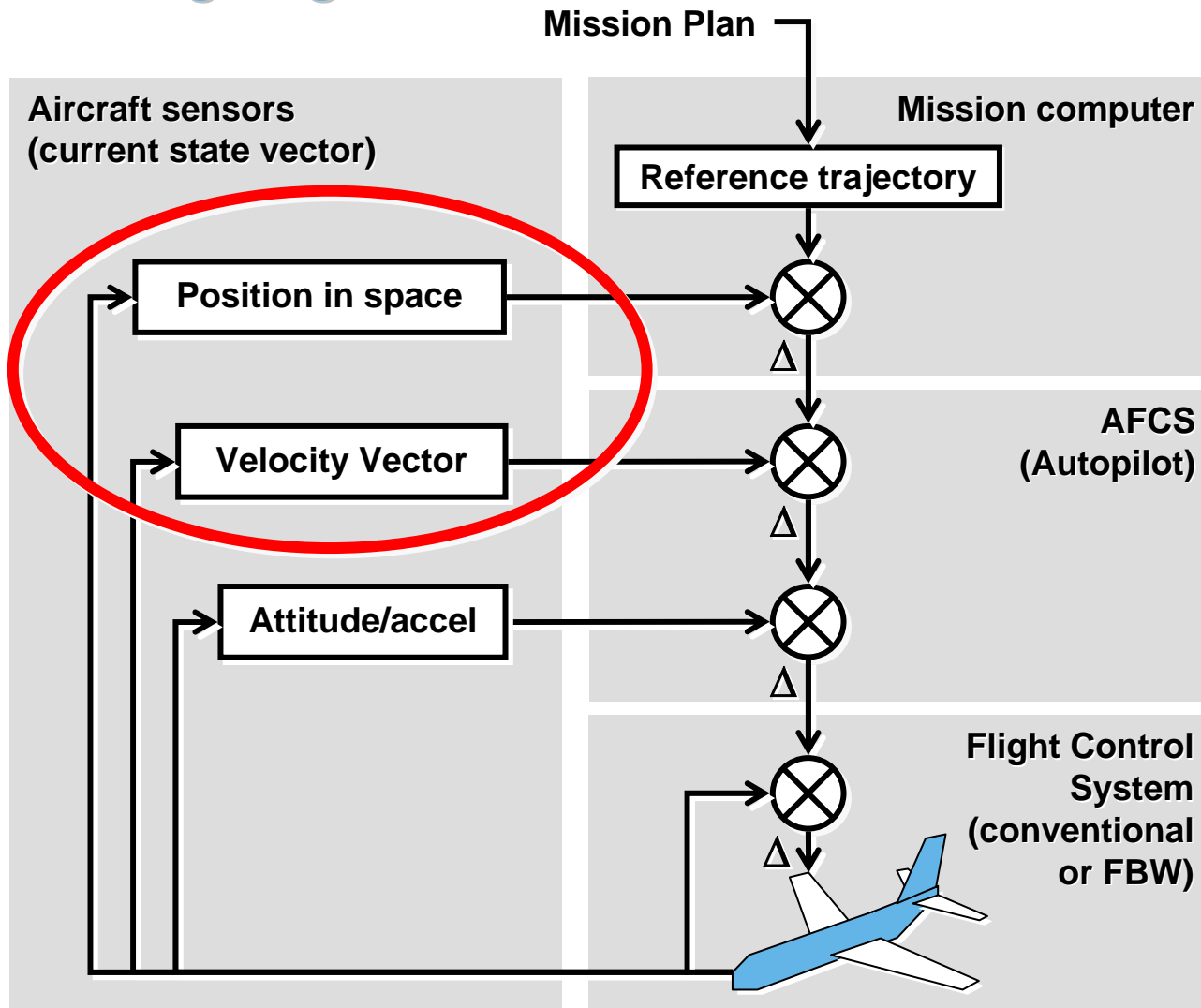
Okko F. Bleeker
Director European R&D

Rockwell
Collins

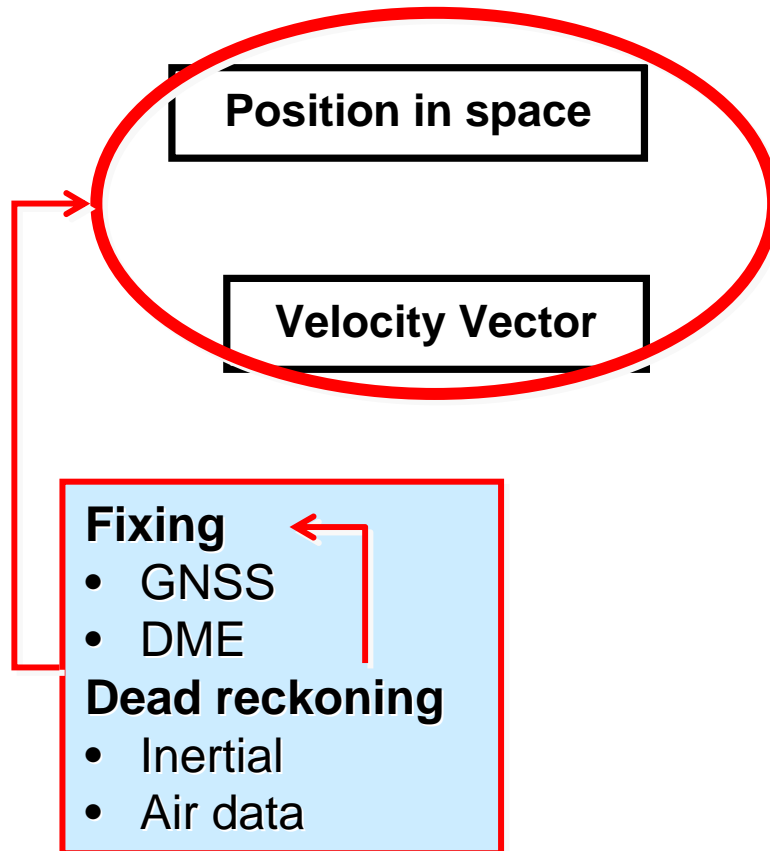
GNSS Aviation applications

- **Aviation GNSS application principles**
 - Aircraft flight guidance and control functions
 - navigation and System architecture overview
- **Application developments**
 - Reduction of minimums using SBAS
 - ADS-Broadcast operations
- **Recent demonstration projects and accomplishments**
- **Discussion**

Aircraft - flight guidance and control functions

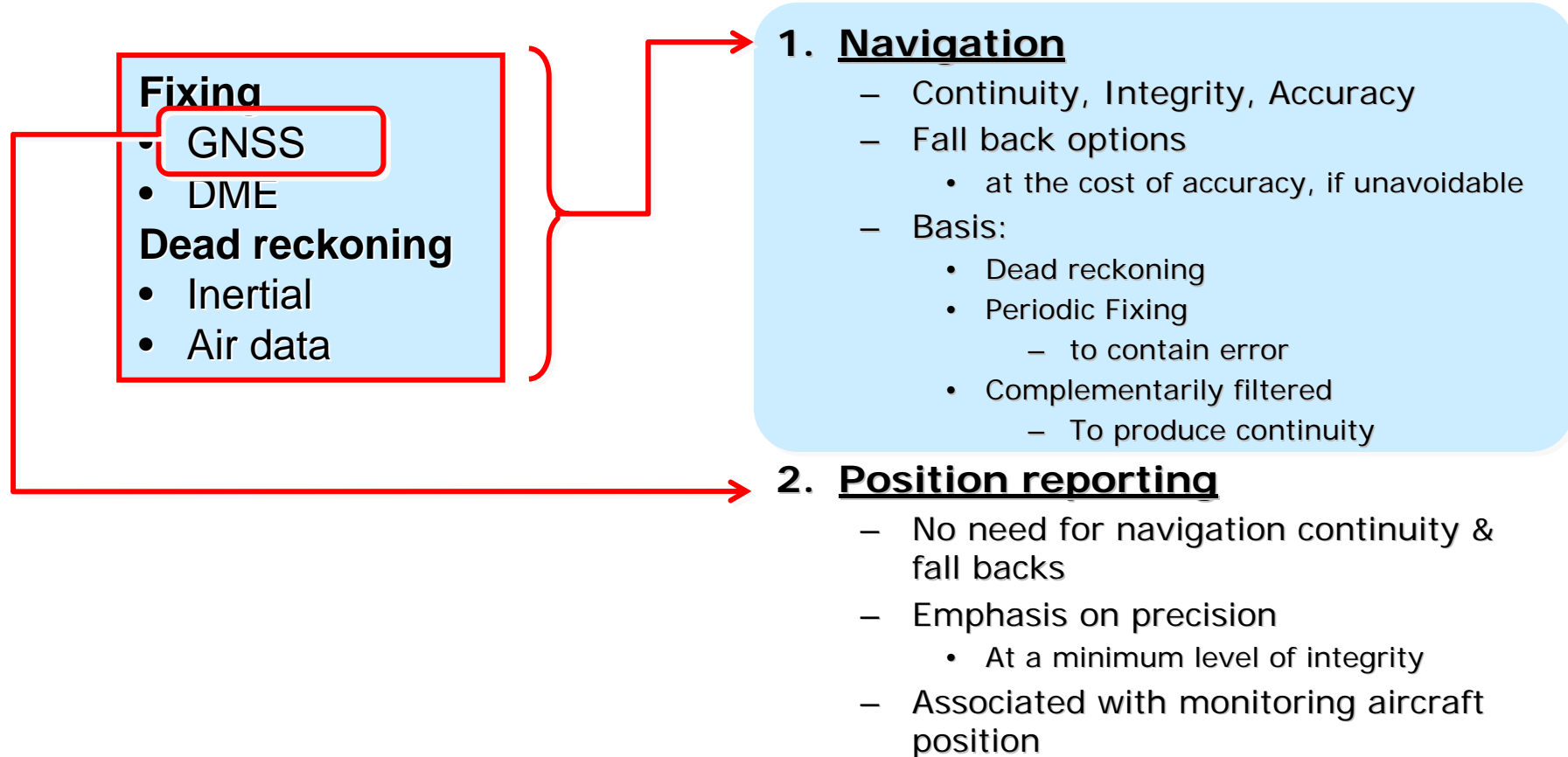


Position determination function

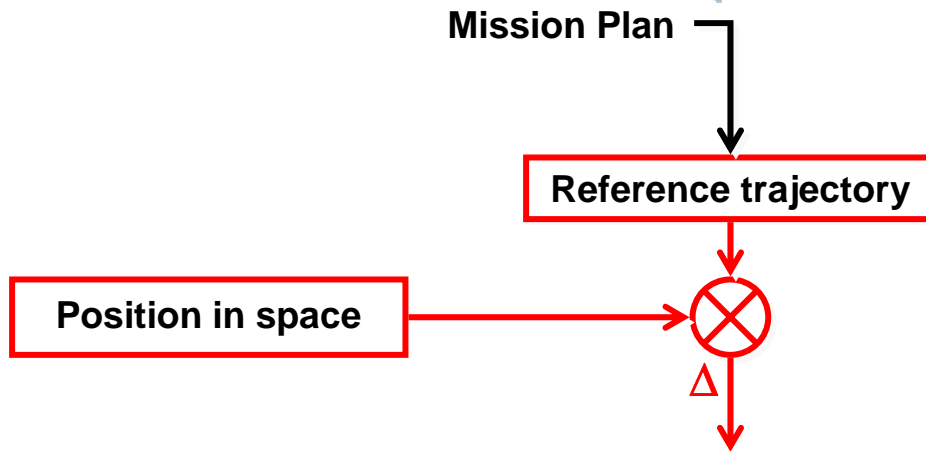


- **Position in space - Aviation application**
 - High dependability
 - Trustworthiness
 - Precision
 - Little ability to verify
- **Generic Approach**
 - No reliance on single source
 - Overdetermination to achieve integrity, reliability
 - Typically multi-source/dissimilar
 - Dead reckoning
 - Fixing
- **Complementary filtering for dependability**
- **Recursive filtering for long term accuracy**

Position determination function

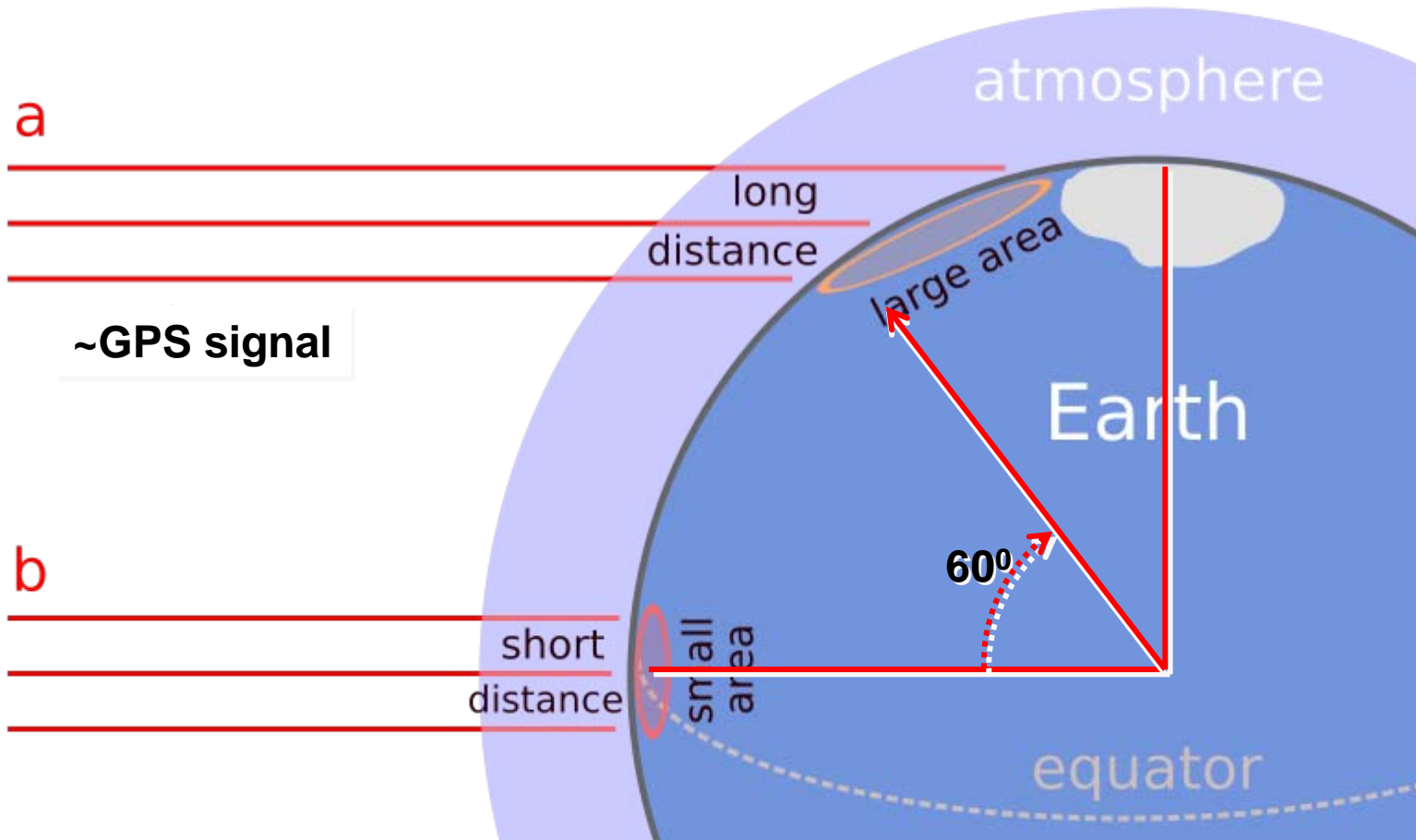


LPV – lateral, vertical precision and integrity

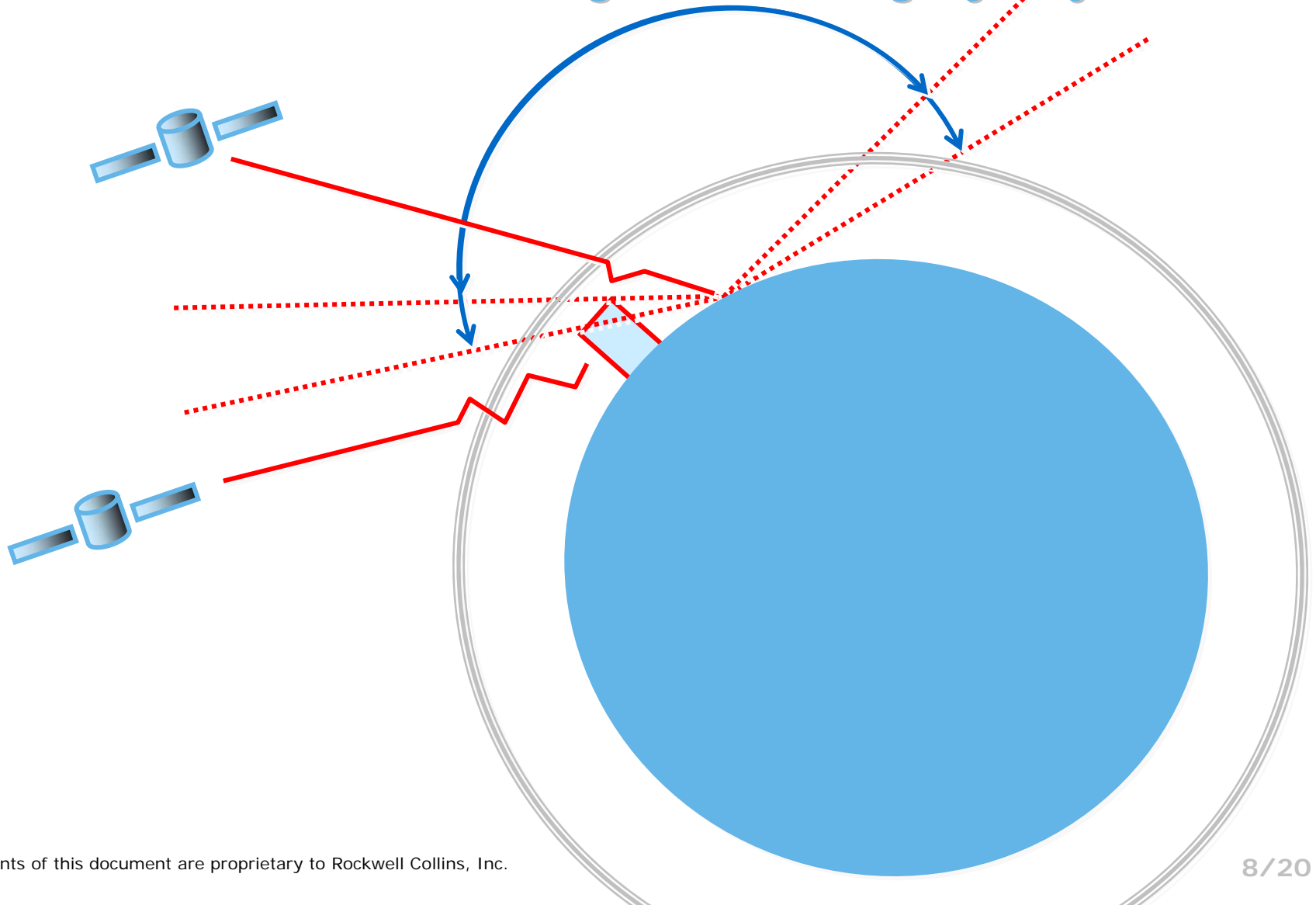


- **Control goodness depends equally much on position, reference trajectory, process**
 - Accuracy
 - Resolution
 - Integrity
 - Continuity
- **FMS Process (SW)**
 - needs level B minimum qual level
- **Reference trajectory**
 - =procedure
 - FAS data block coding
 - end-end process control
- **Position**
 - GNSS
 - with SBAS

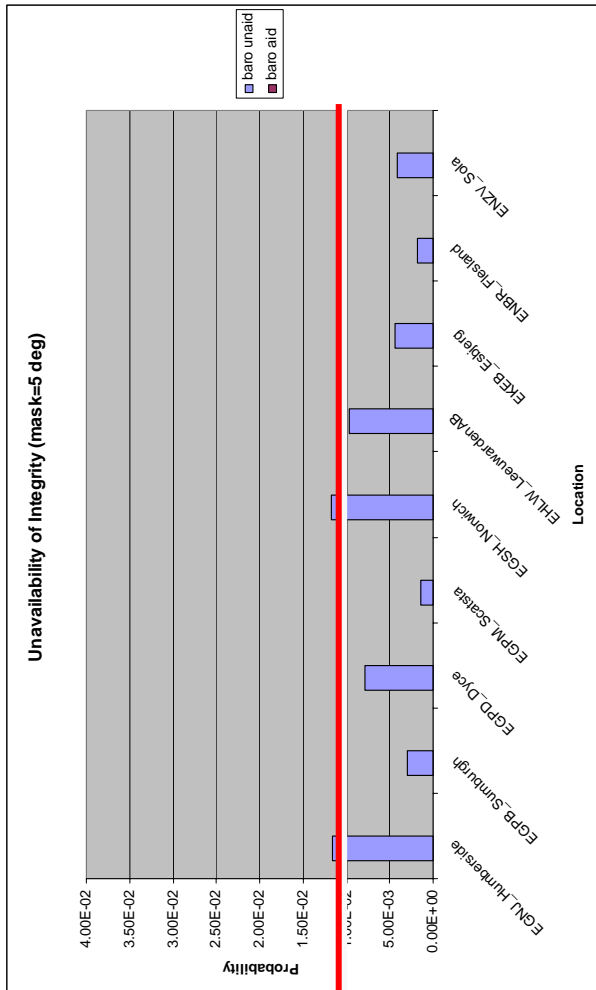
GPS signal in space vs latitude



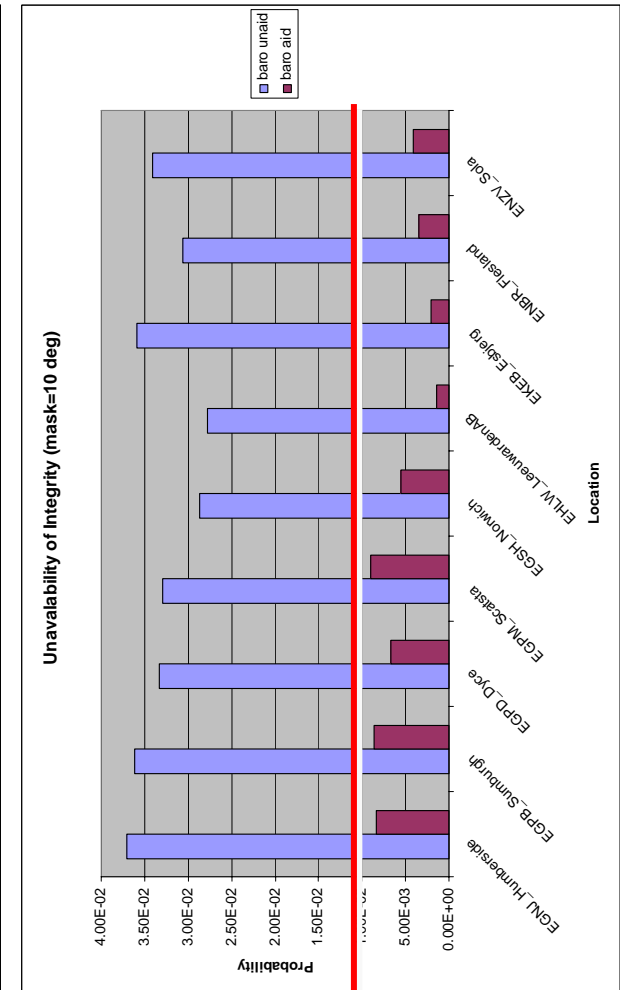
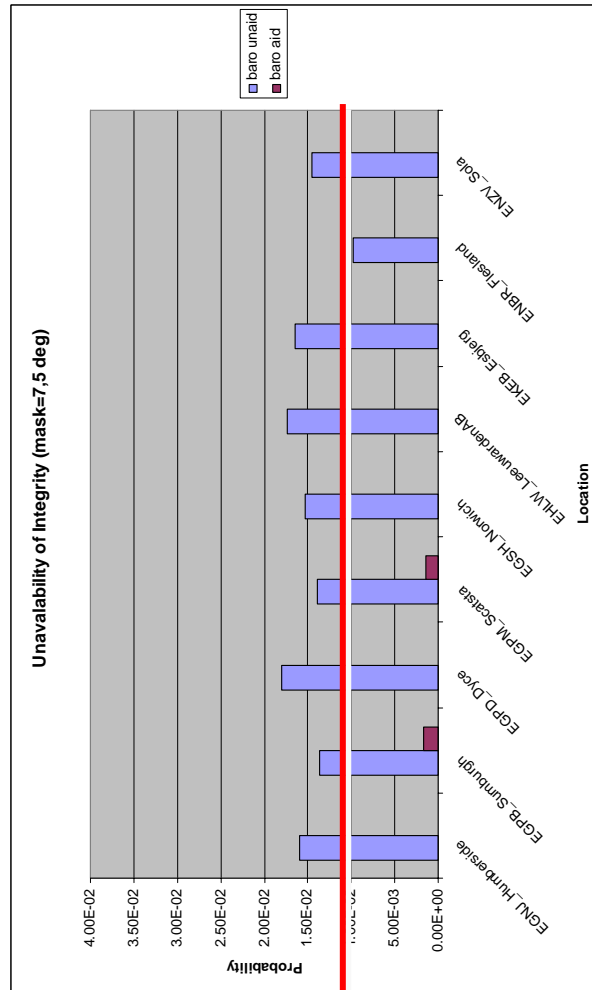
Visible satellites, 'mask-angle', masking by objects



Unavailability of integrity (North Sea latitudes)

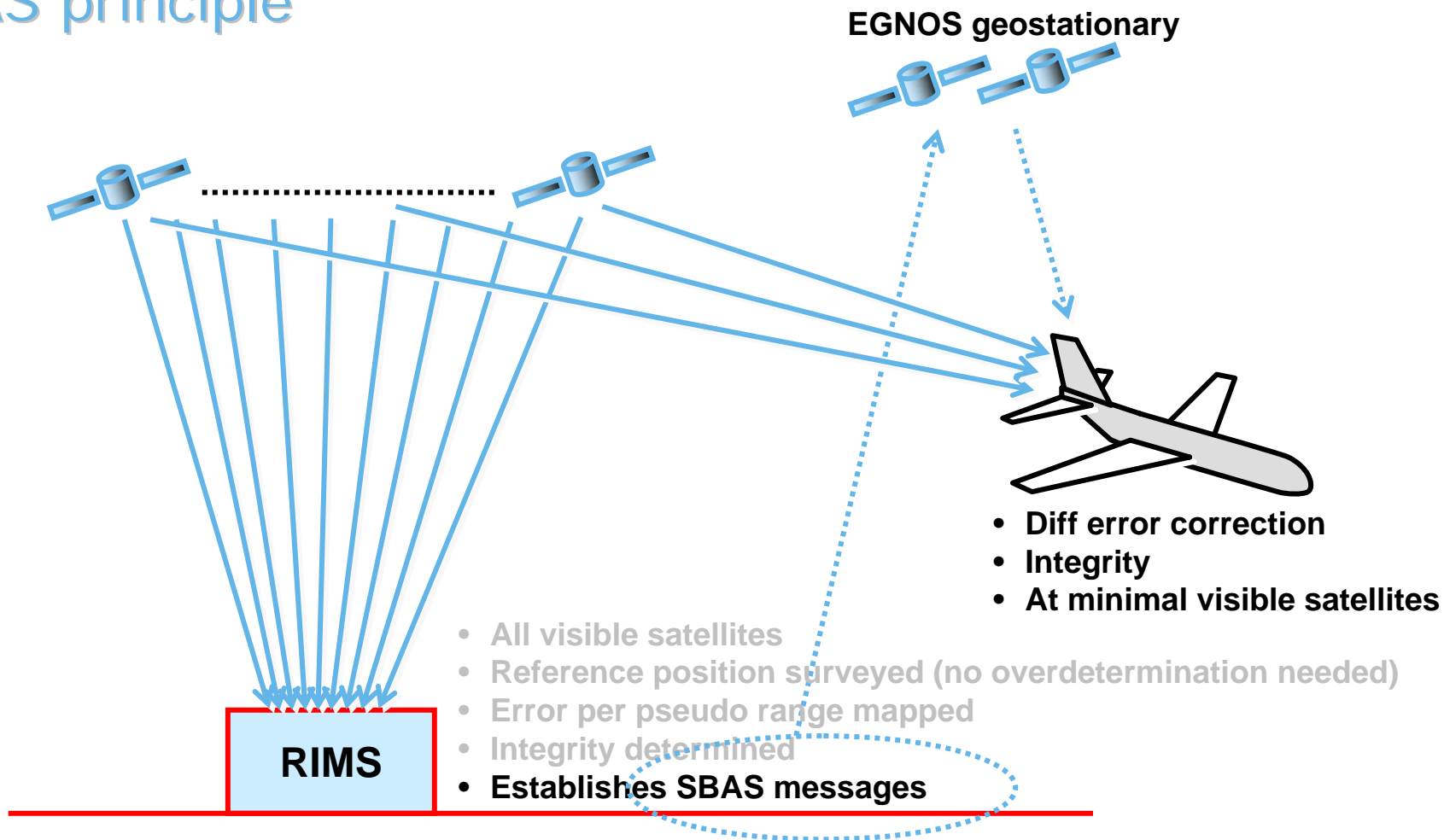


1*10⁻²/hr

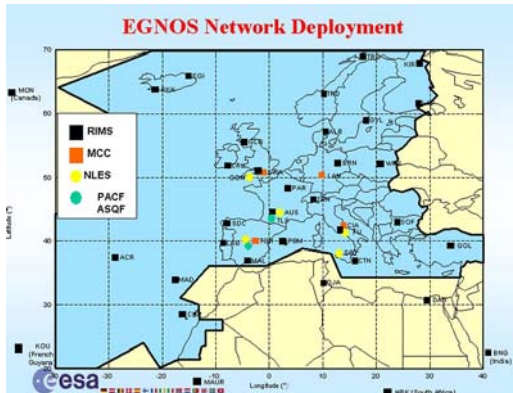


North Sea area

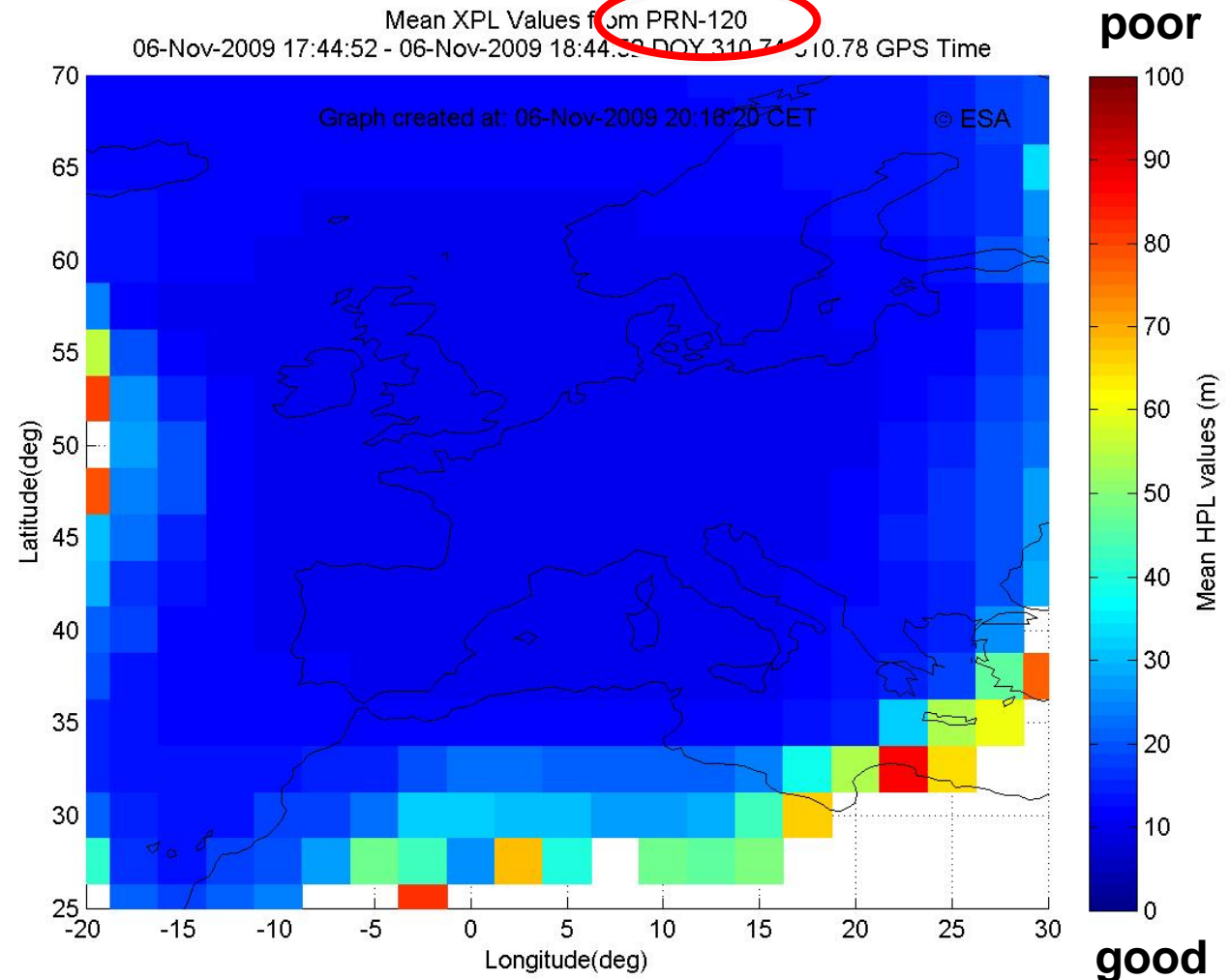
SBAS principle



EGNOS functions and performance (06 nov 09)



Source: ESA



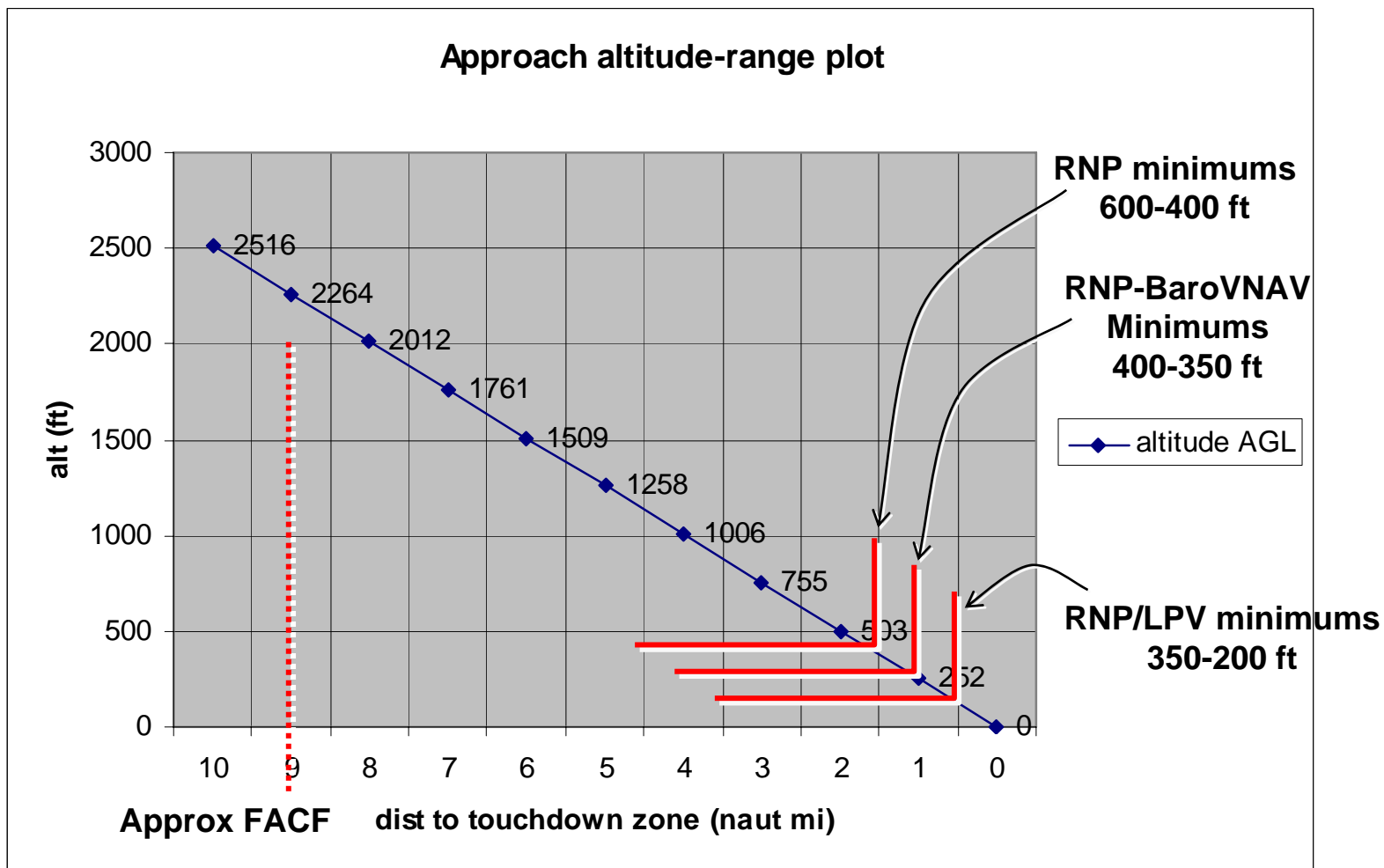
GIANT, GPS-EGNOS LPV demonstrations, aug-sep 08



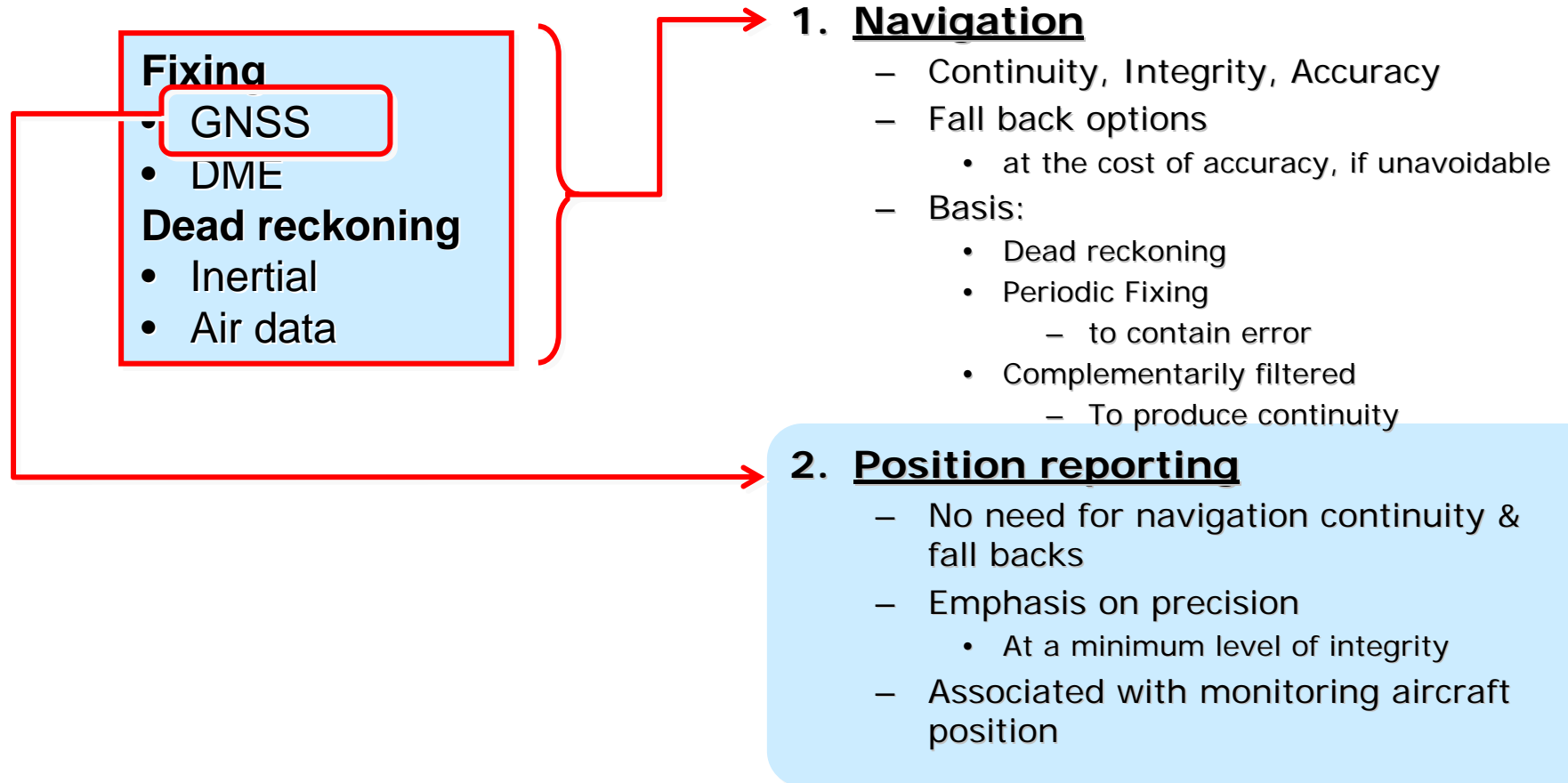
Valencia, Bologna, aug-sep 08

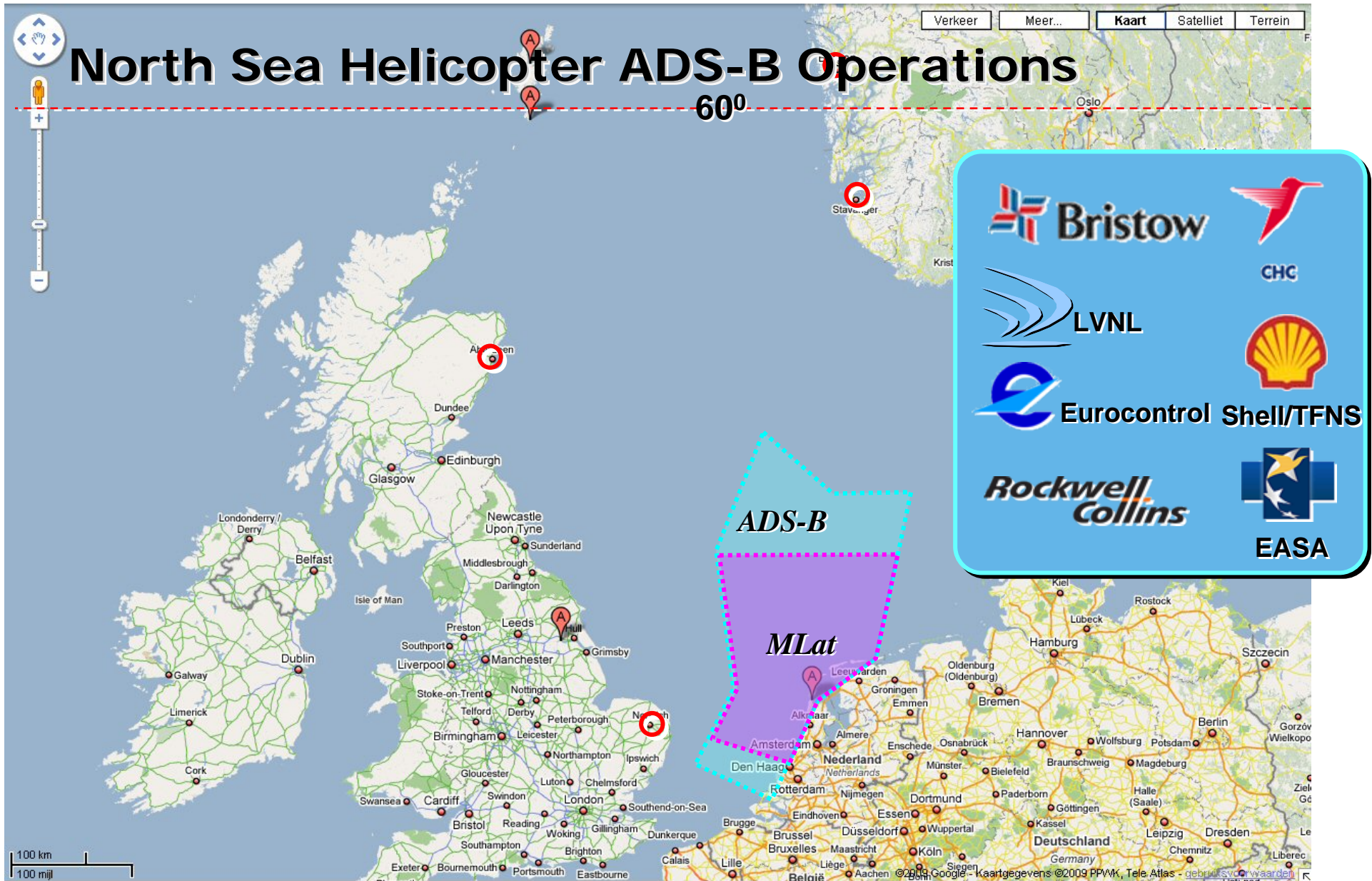


Summary available minimums



Main applications

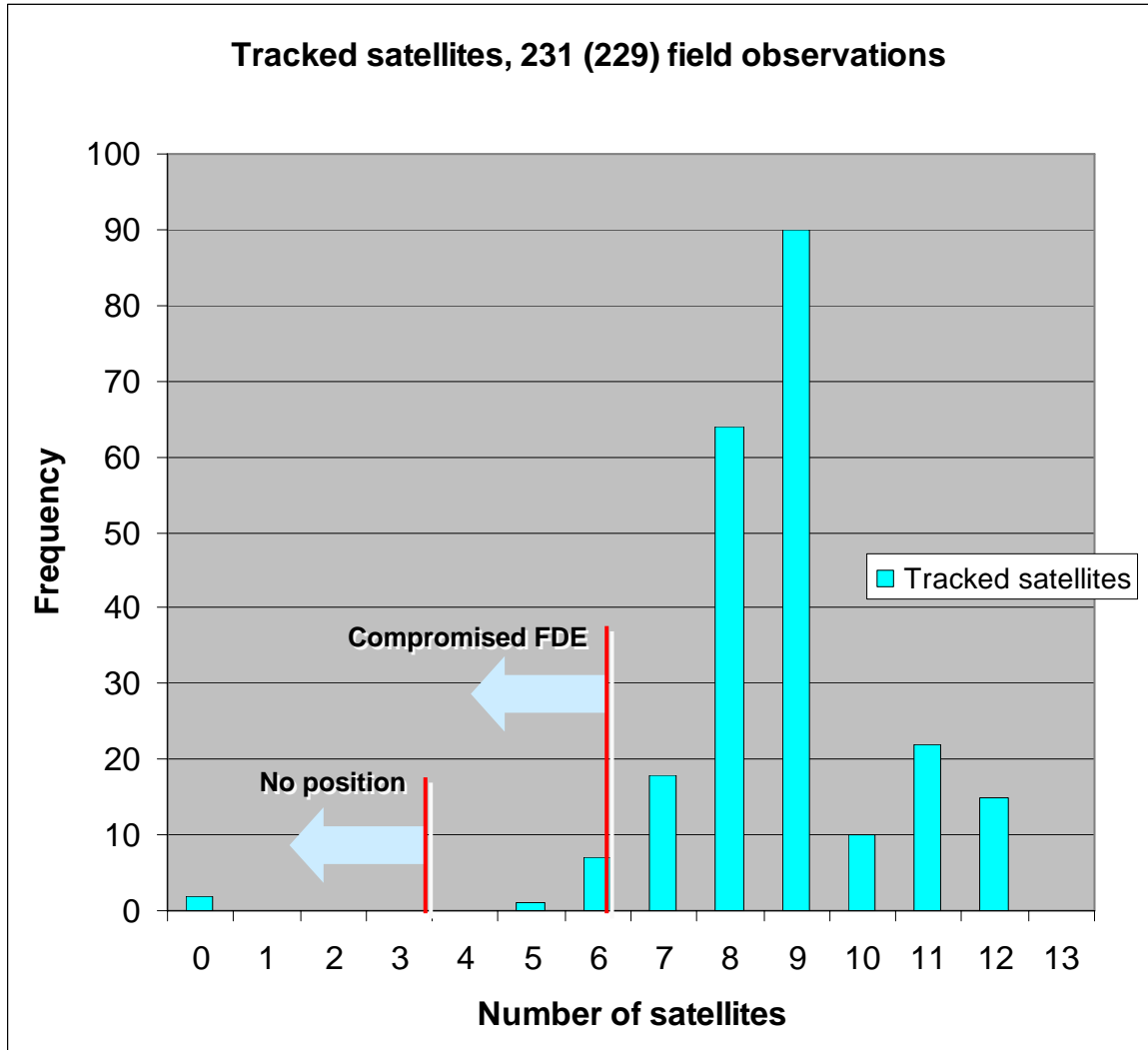




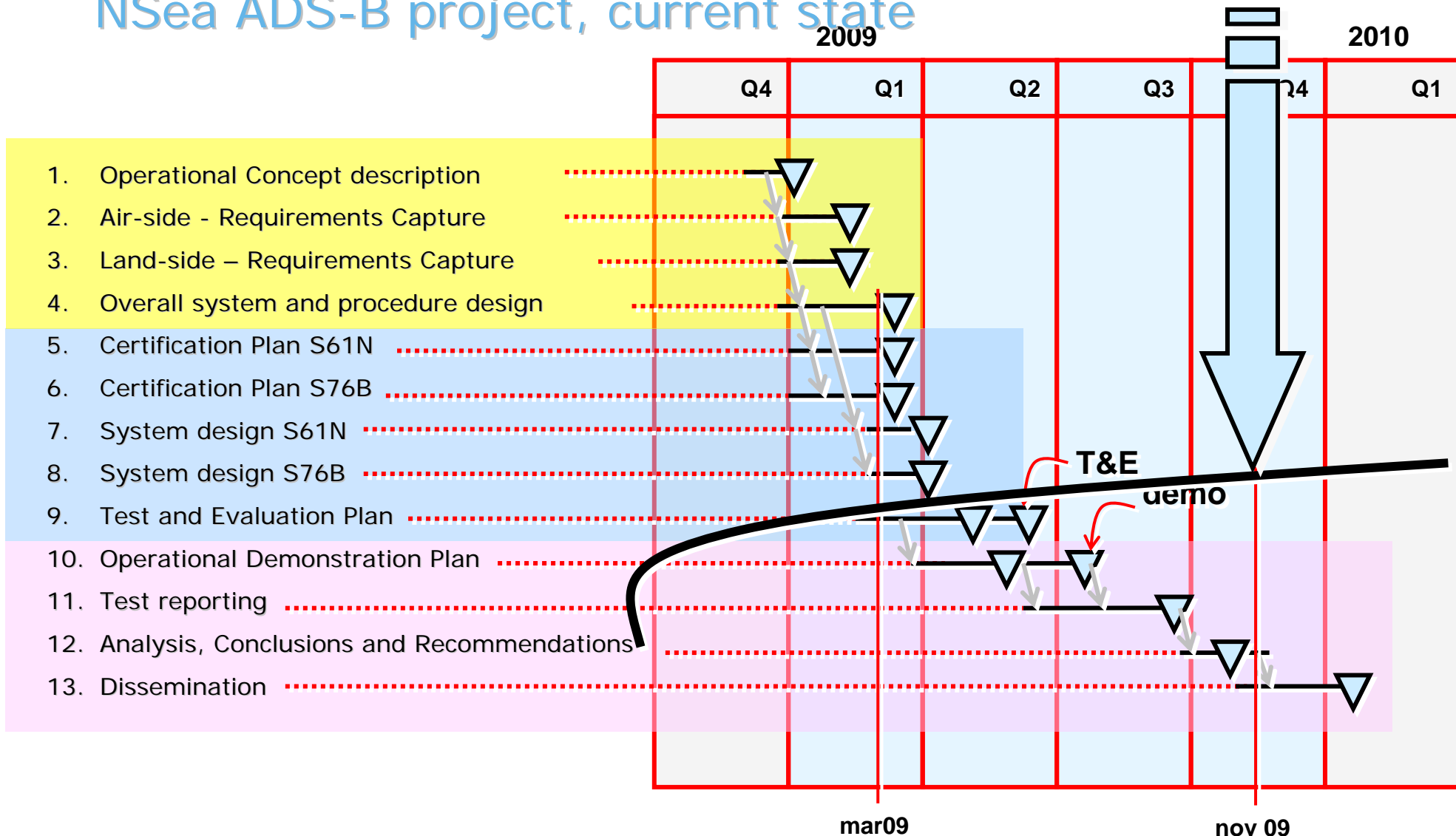
Satellite visibility and antenna placement



North Sea area field observations (mar-jul 09)



NSea ADS-B project, current state



Summary example current GNSS applications

- **Localizer precision with vertical guidance (LPV)**
 - Flight management system function
 - Enables the aircraft to be descended to lower minimums
 - On the basis of elevated navigation performance
 - GNSS incl SBAS (EGNOS) based
- **ADS-broadcast**
 - North Sea helicopter operations
 - Low altitude, surveillance
 - Helicopter application
 - Unaided GNSS
 - But possible need for SBAS
 - Expect completion first quarter 2010



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***Rockwell
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