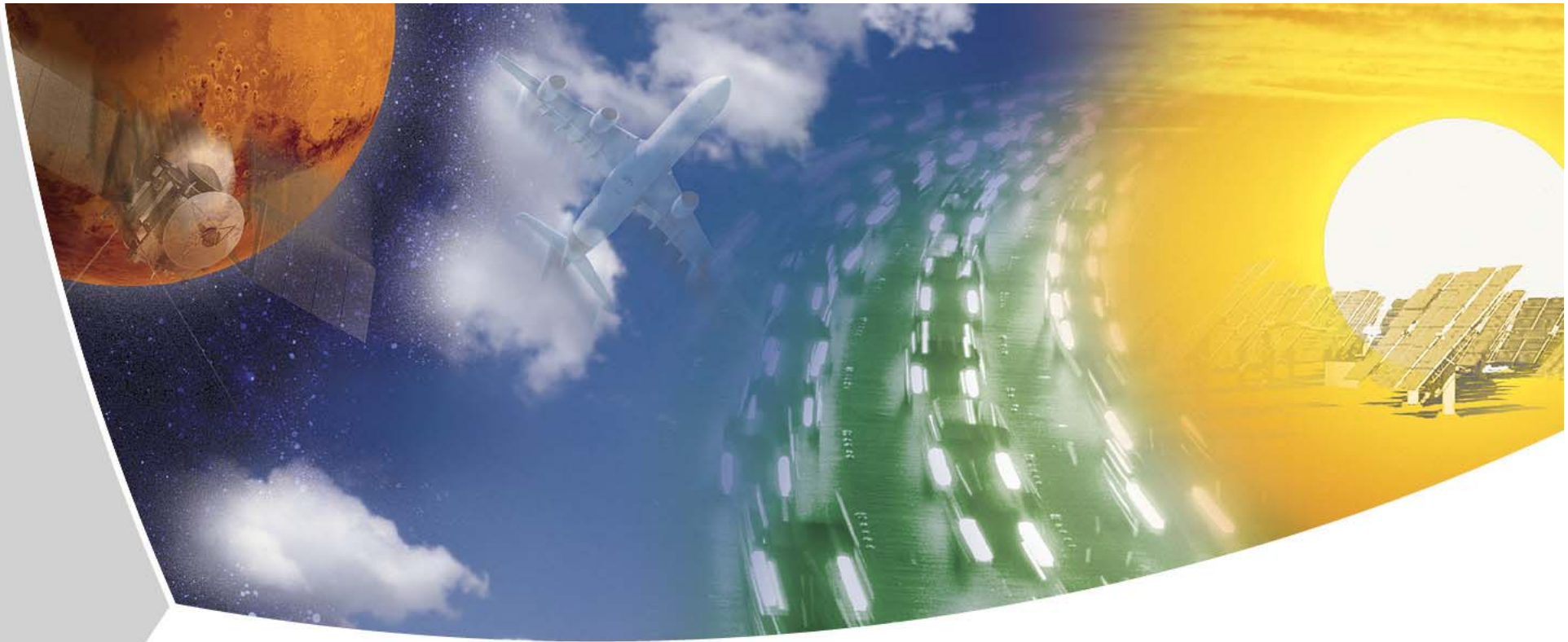




Satellitennavigation im Start- und Landezyklus von Luftfahrzeugen

Dr. Bernd Korn (DLR, Institut für Flugführung)

Hugo Zunker (Euro Telematik AG)

31. Mai 2007

„Satellitennavigation und
Verkehrsanwendungen –
Chancen innovativer Technologien“



Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

Folie 1 > SatNav -> B. Korn
Korn_SatNav-TMA_2007_05_31.ppt



Problem / Herausforderung:

**Verbesserung des Luftverkehrssystems:
höhere Effizienz bei gleicher Sicherheit**

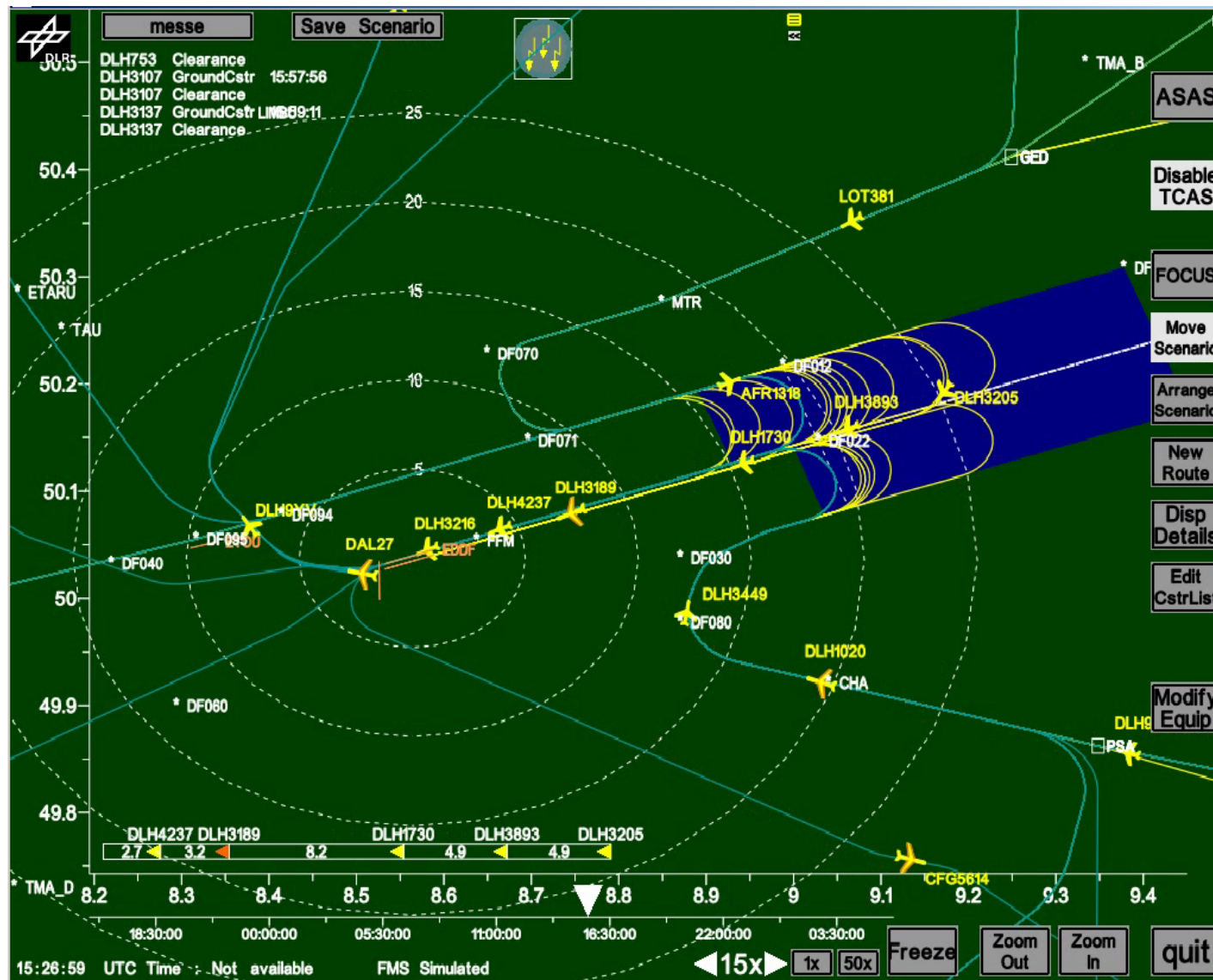
Einschränkende Randbedingungen:

**Leistungsfähigkeit der Operateure (Pilot /
Controller) / Infrastruktur / Ressourcen**

Lösung:

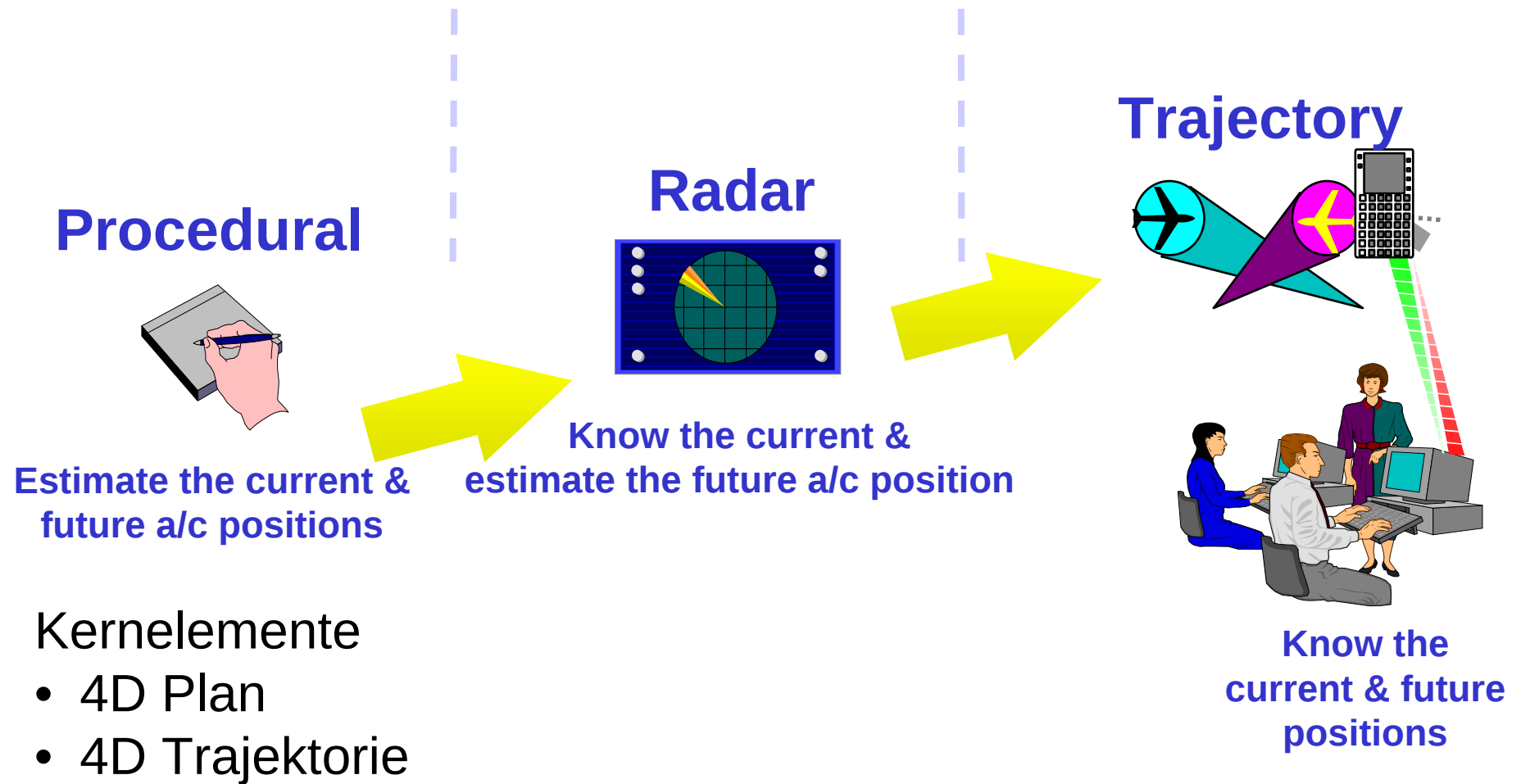
**Assistentensysteme zur Übertragung kognitiver
Funktionen auf 'intelligente' Maschinen.**



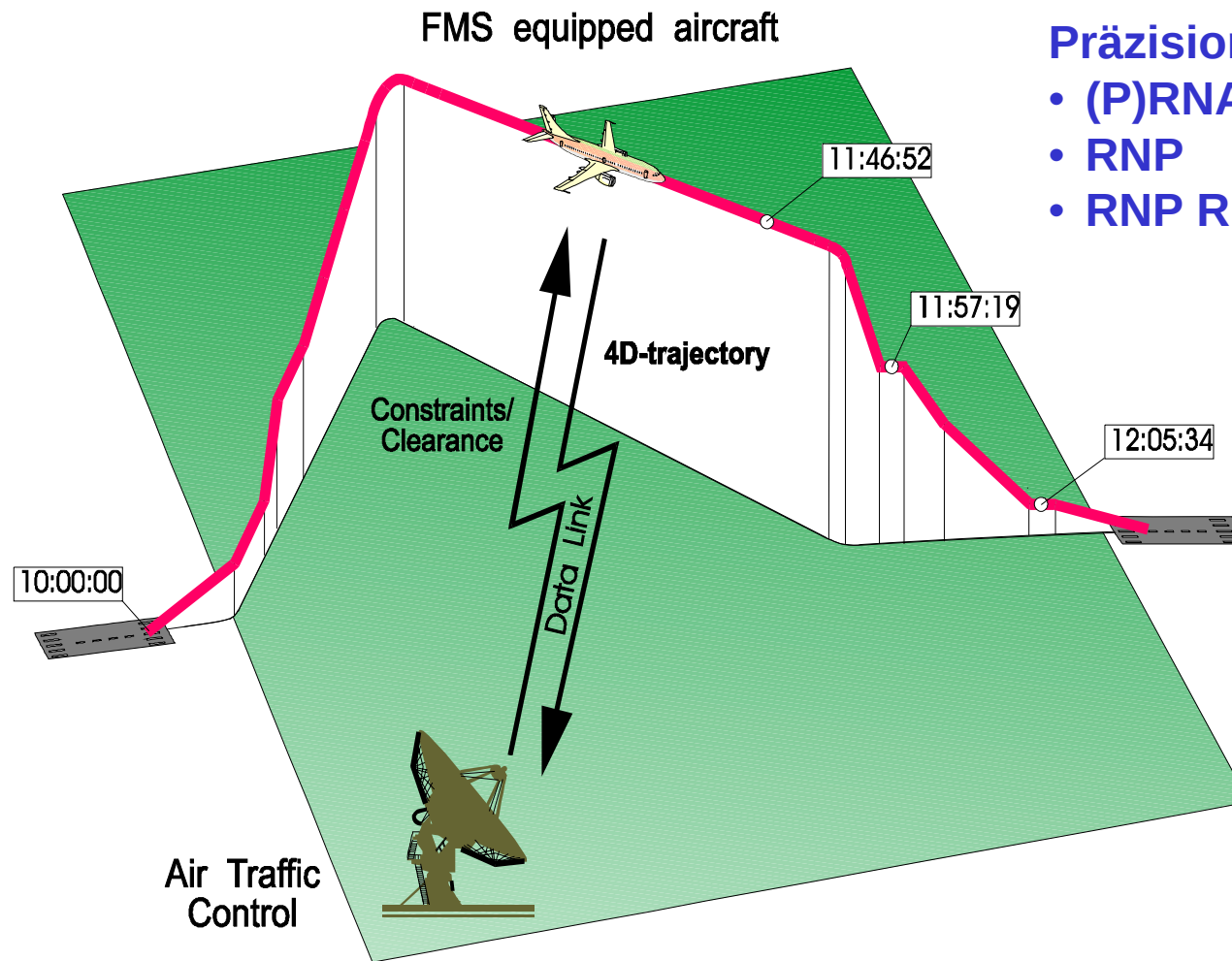




Wandel im ATM:



4D Trajektorie - Definition

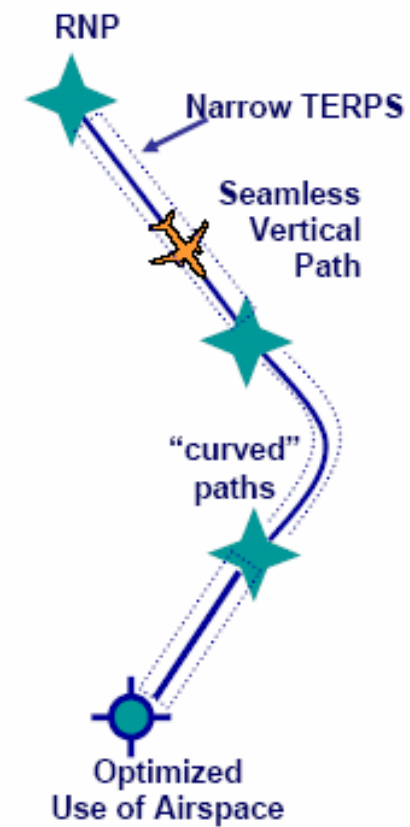
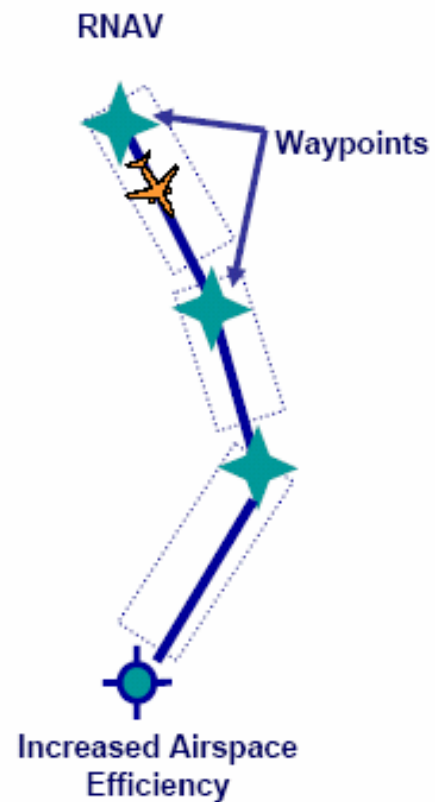
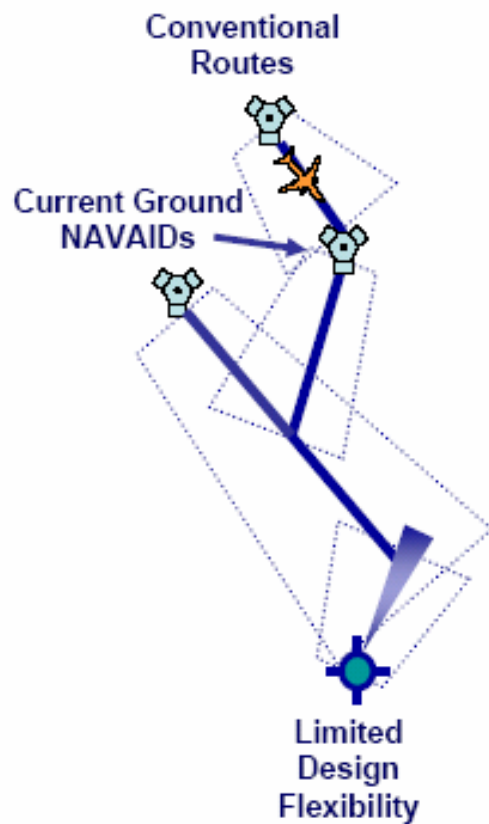


Präzisionsnavigation

- (P)RNAV
- RNP
- RNP RNAV



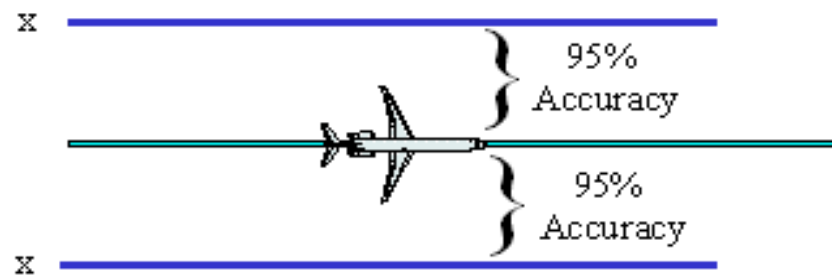
Performance Based Navigation - Definitionen





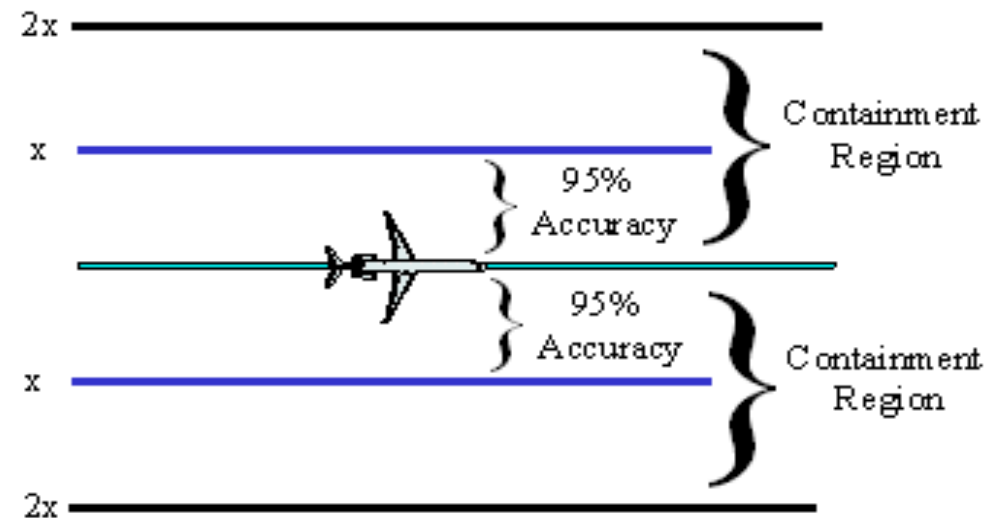
RNP – Required Navigation Performance

RNP-x



TSE < x in 95 % der Flugzeit
(Total System Error)

RNP-x RNAV

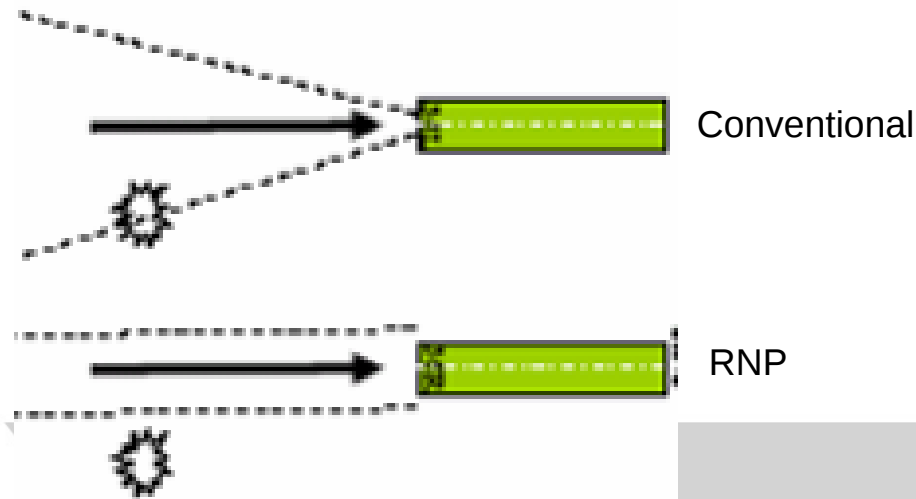


Erweiterung des RNP Konzepts um
Monitor/Integritätsanforderungen:
(99,999% Integrität innerhalb von 2x
RNP)



Required Navigation Performance

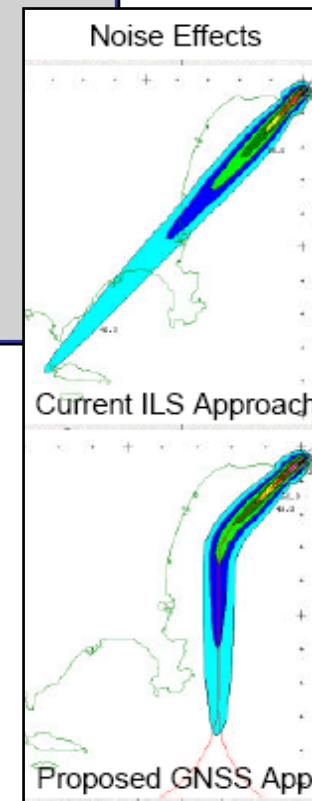
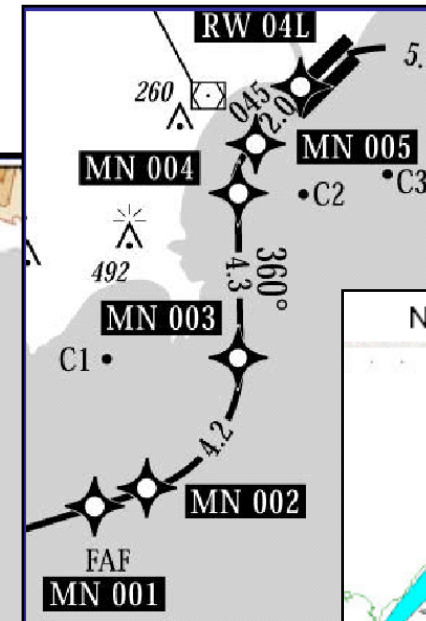
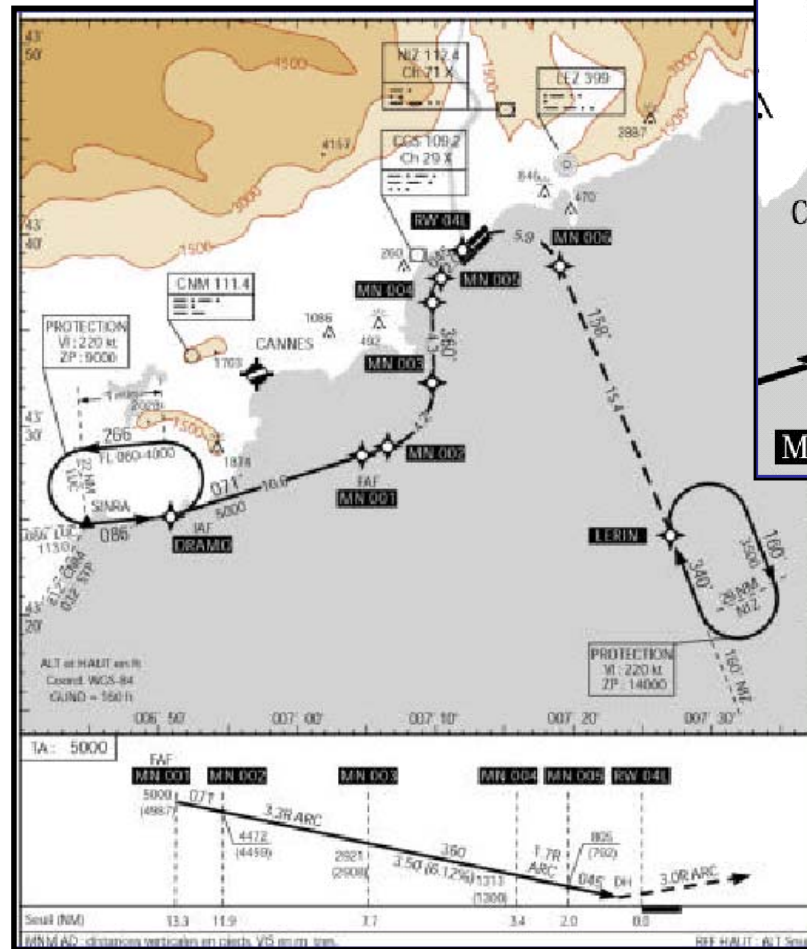
- Erhöhte Vorhersagbarkeit der Flugzeugtrajektorie
 - Sicherheit
 - Kapazität
- Reduzierte Arbeitslast des Controllers (keine Radarvektoren nötig)
- Effizientere/Flexiblere Nutzung des Luftraums (insb. TMA) möglich
 - Vermeidung von (lärm-) sensiblen Gebieten
 - Optimierte Routenführung bei Hindernissen (Bergen, etc.)



Beispiel: Curved Approaches

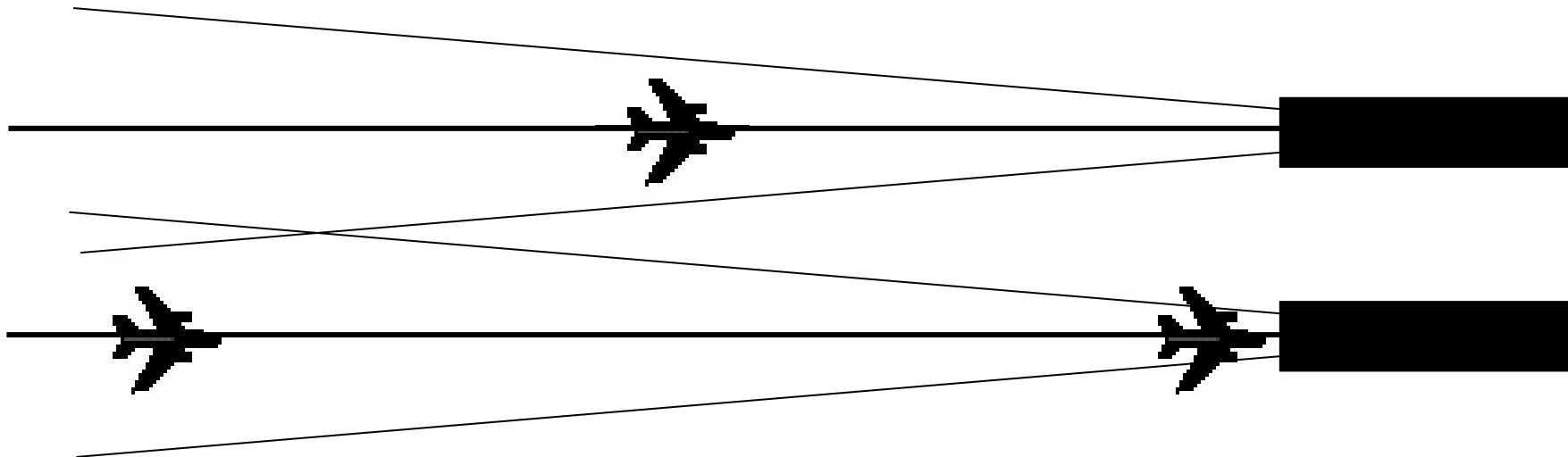
Anflug auf Nizza (experimental)

RWY 04

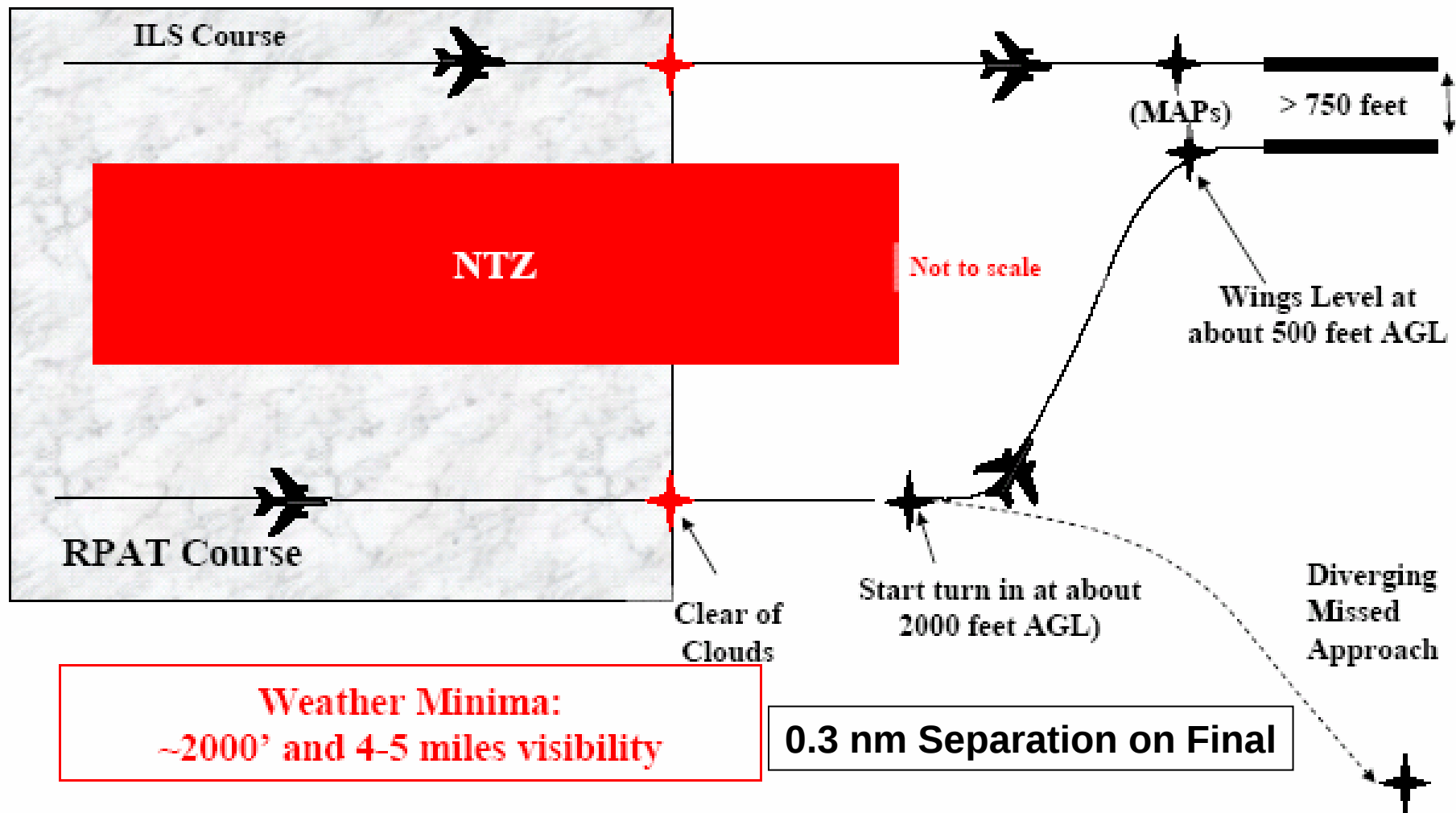




Beispiel: Closely Spaced Parallel Approaches „Staggered Approach“



Beispiel: Closely Spaced Parallel Approaches „RNP Parallel Approach Transition“





Beispiel: Anflug auf SFO – RWY 28R* - experimental



Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

* Quelle: **smiths**

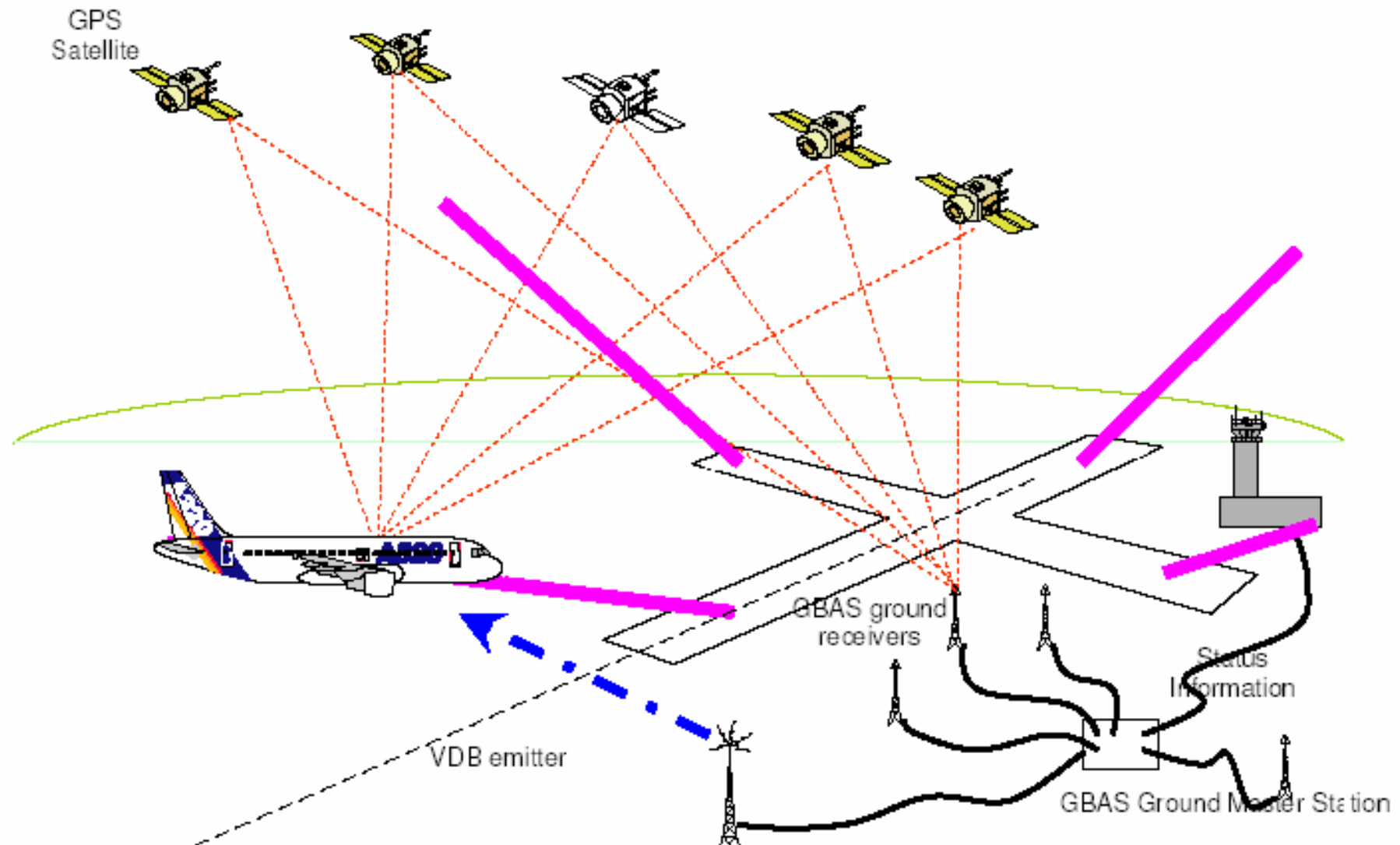
Folie 12 > SatNav -> B. Korn
Korn_SatNav-TMA_2007_05_31.ppt



Beispiel: CAT III Anflug auf CDG 09R

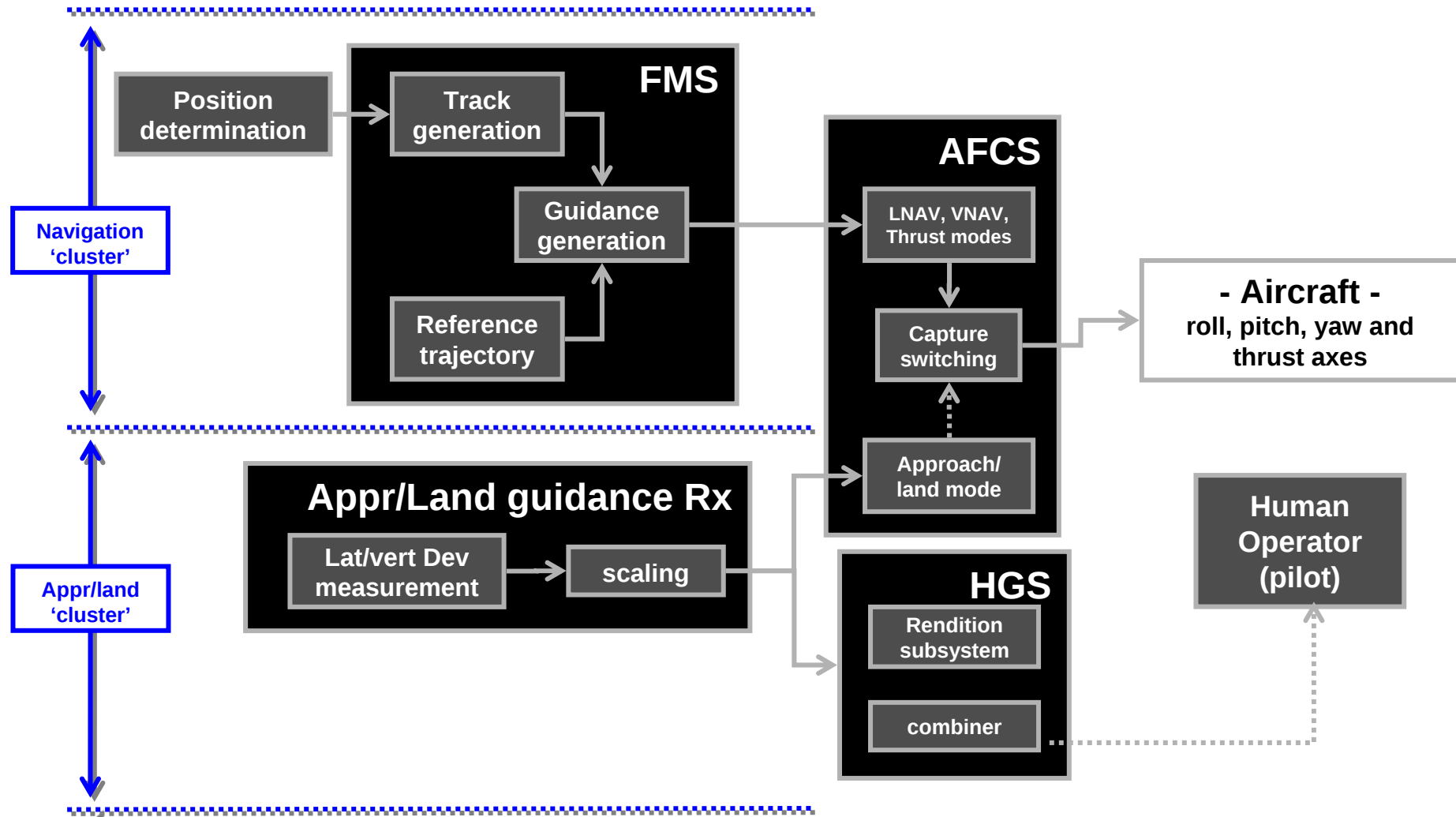


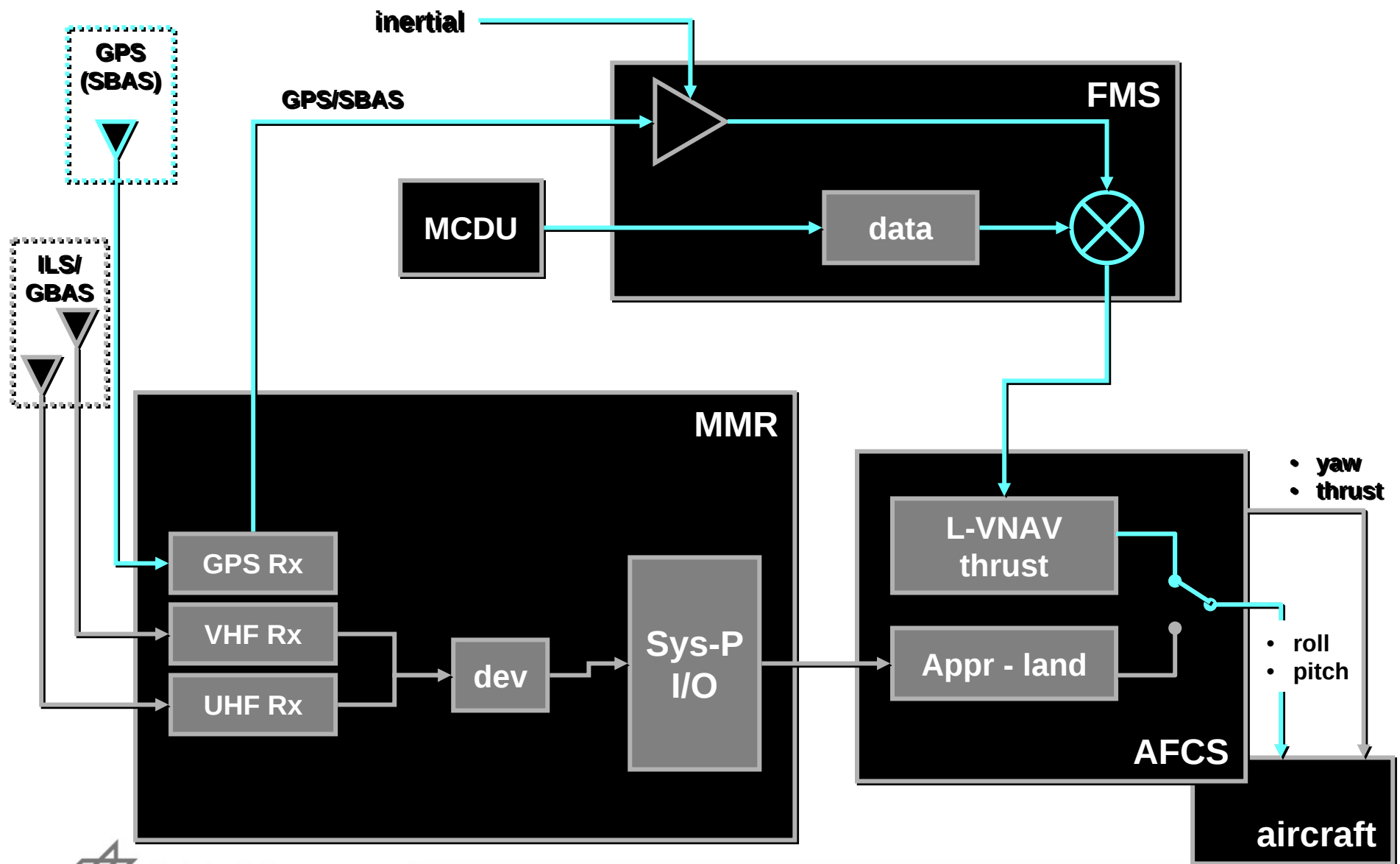
GBAS: Ground Based Augmentation System

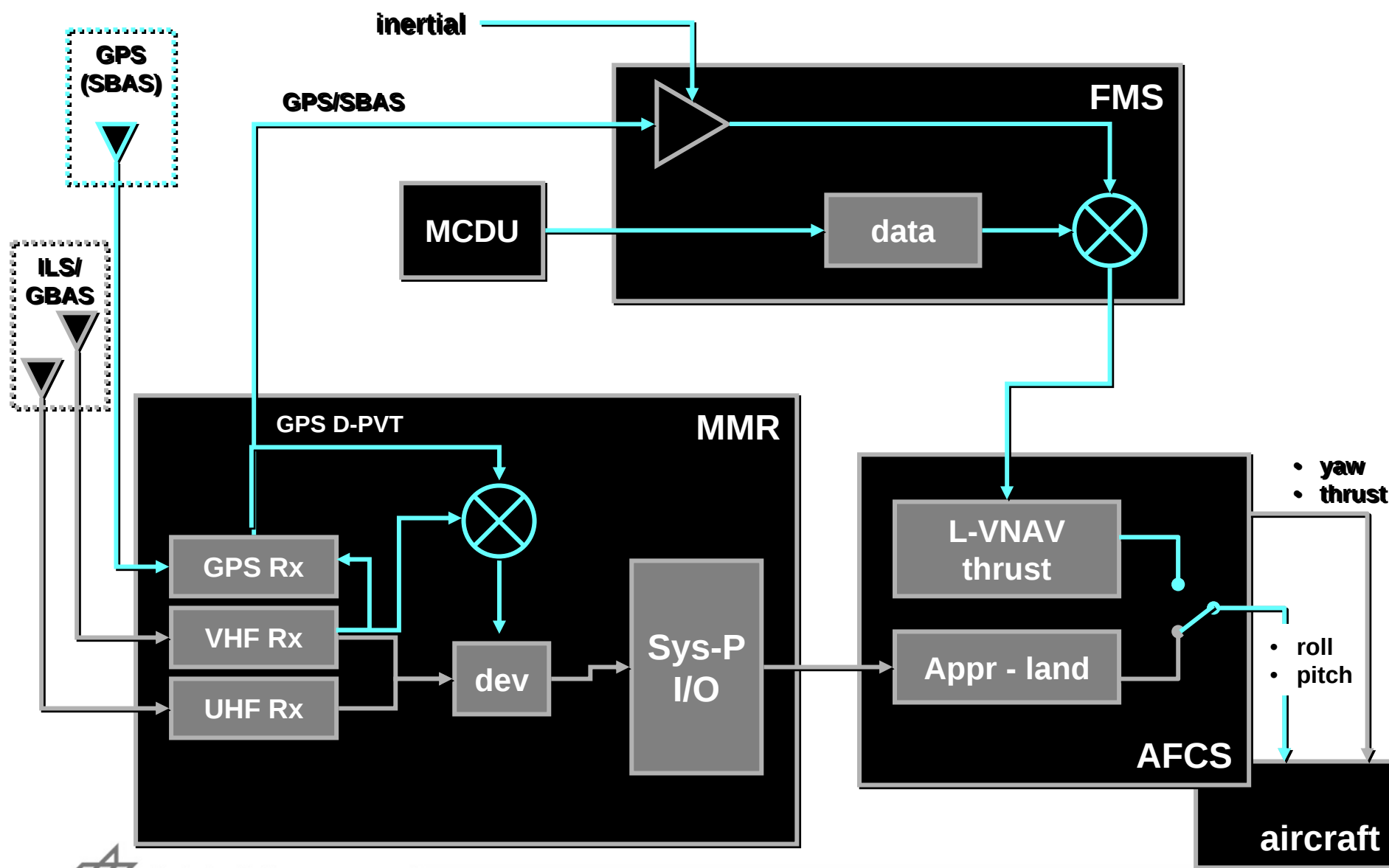


Einführung GBAS CAT I Curved Approach → 2015+

Flight Management System

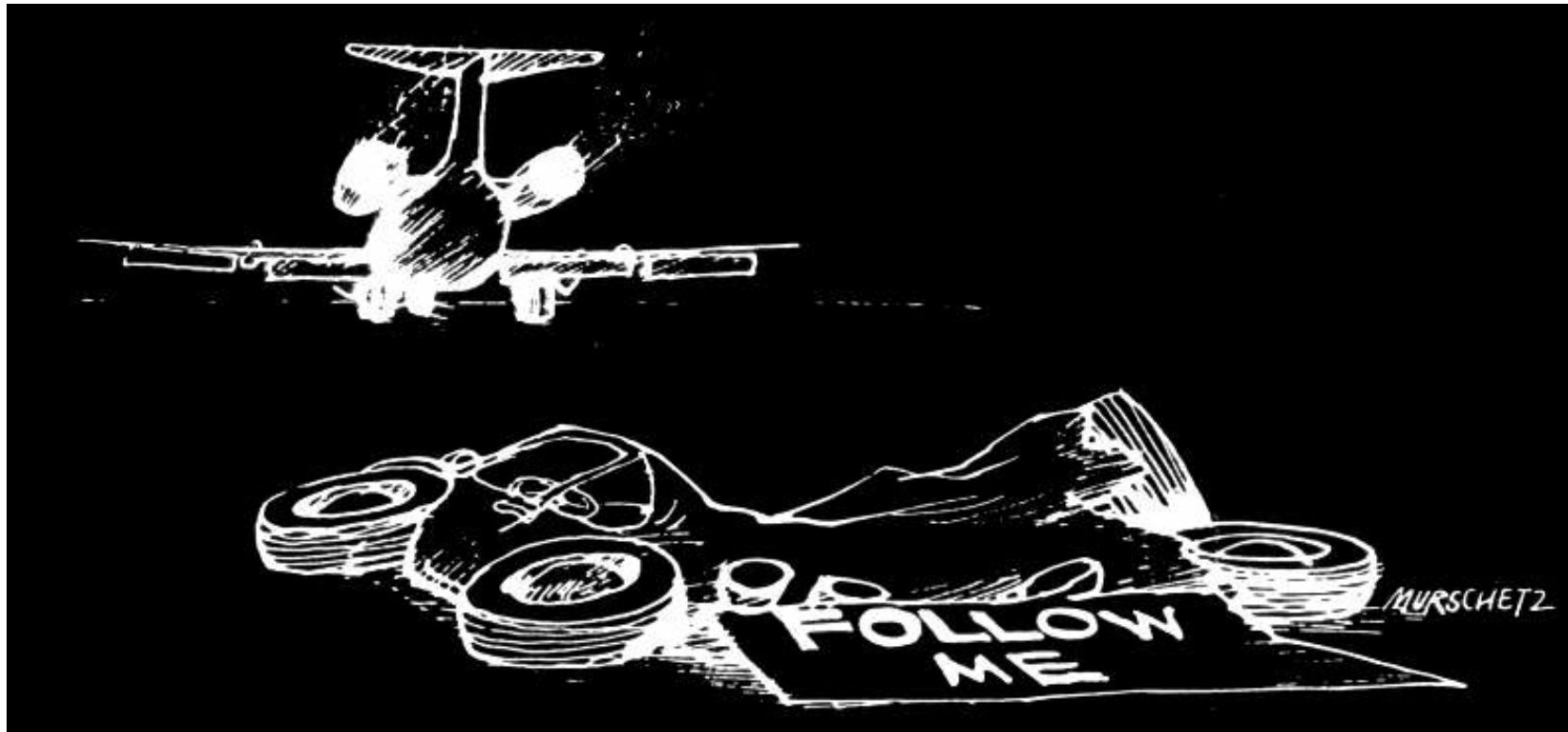








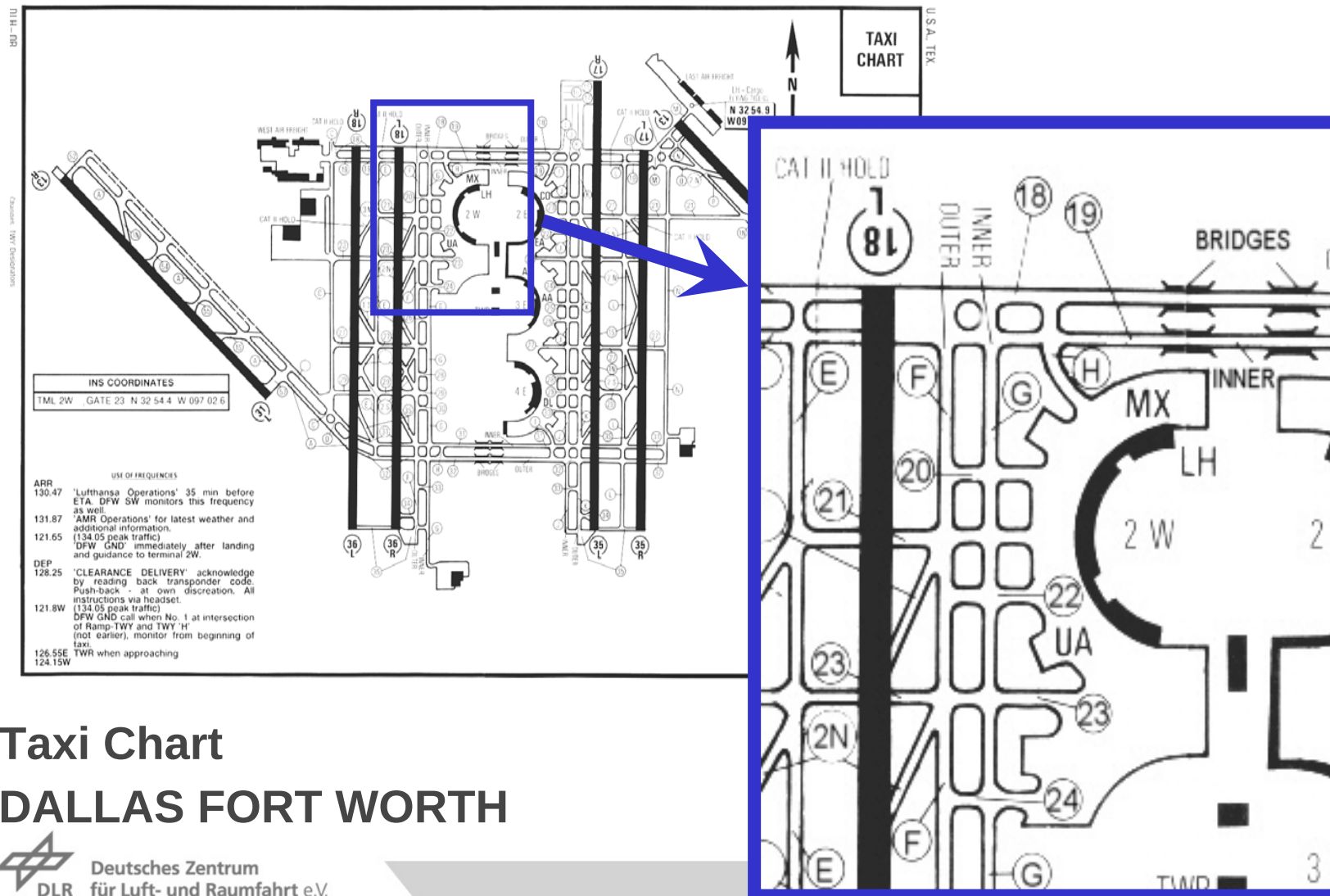
Taxiing – Navigation auf dem Flughafen





Heutige Situation im Cockpit





Taxi Chart

DALLAS FORT WORTH



Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

-> B. Korn

Korn_SatNav-TMA_2007_05_31.ppt

Rollführungssystem TARMAC-AS

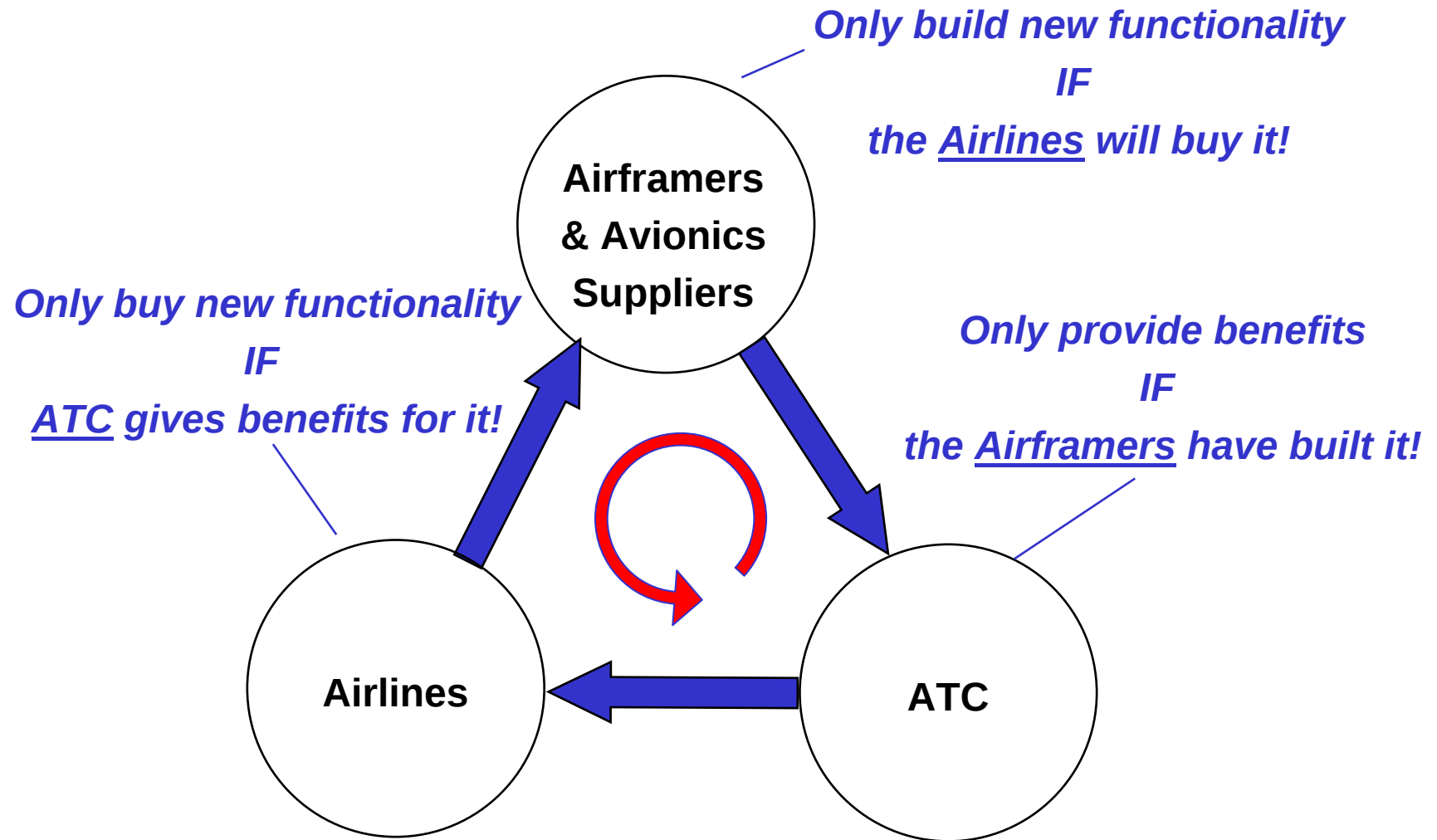


**Taxi and Ramp Management and Control
Airborne System (TARMAC-AS)**

- Anzeigen von
 - Flughafenkarte
 - Eigenen Position und der von anderen Verkehrsteilnehmern
 - Rollanweisungen
 - Zeitleiter für zeitgenaues Rollen
- Datenlink zum Bodensystem
- Generierung von Warnungen
 - bei Clearance overrun
 - zur Kollisionsvermeidung
 - bei Runway incursion



Without Mandates...





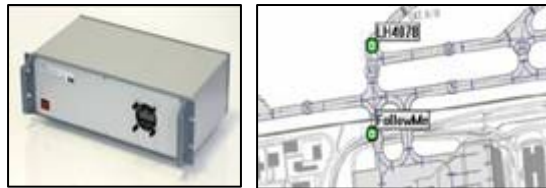
Workshop
Satellitennavigation und
Verkehrsanwendungen
[Euro Telematik Beitrag]

Euro Telematik AG
Riedweg 5
89081 Ulm
Tel. +49 (0)731/93697-0
www.euro-telematik.de

Technologies for air traffic monitoring and management



CDTI-2000
Multi-function
display



AeroFleet Airport
ADS-B based ground traffic
display



AeroFleet
Satellite communication
based fleet tracking and
communication system



Flight Companion CDTI
PDA based map and
traffic display

CDTI: Cockpit Display of Traffic Information

CDTI-2000

Certified multi-function map, terrain and traffic information system



- Traffic awareness display
- Terrain awareness display
- Moving map
- Communication terminal function
- JTSO-C113, C147

Flight Companion CDTI[®]

PDA based map, terrain and traffic display



- Traffic awareness display
- Terrain awareness display
- Ground collision warning
- Moving map

Fleet tracking and management solutions



AeroFleet

Management system for
air fleet operators



- Global communication over Iridium
- Position reporting
- Fleet tracking and management
- Client/server based ground station

AeroFleet Airport

Multi-sensor ADS-B tracking system,
targeted at small airports, local airfields
and heliports



- Client/Server based display system
- Based on Mode S 1090 MHz ES format
- Output of surveillance data via
ASTERIX Cat 21 protocol

Introduction

LINA is a RTD project co-funded by the BMWi as part of the Luftfahrtforschungsprogramm 2007-2012.

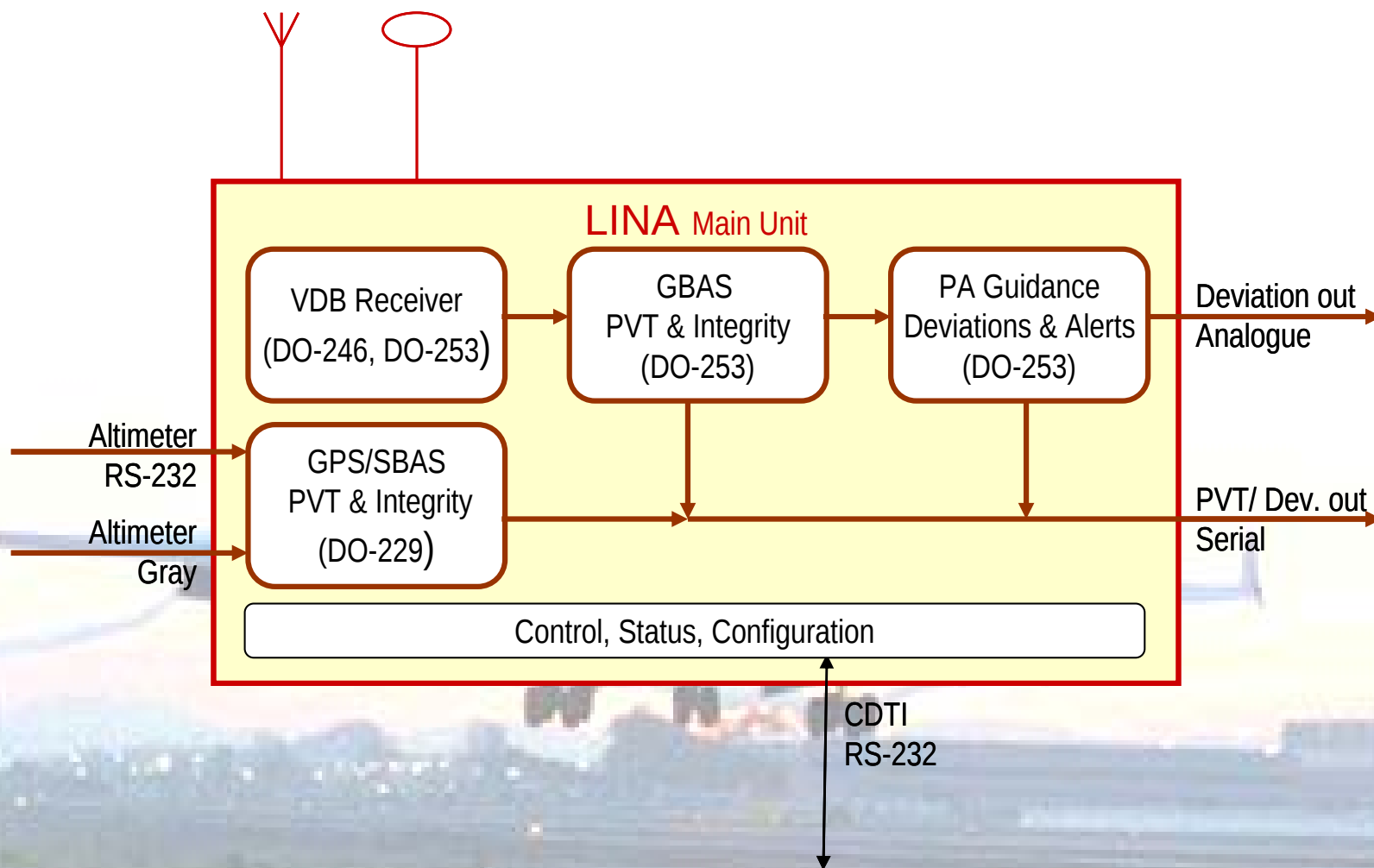
LINA is coordinated by THALES ATM GmbH.

The Euro Telematik work addresses the on-board avionics.

The main goals for the avionics work are:

- Development of a prototype SBAS/GBAS on-board equipment to support satellite navigation based approaches up to CAT-I for General Aviation.
- Concept verification and validation during two flight test campaigns on a DO-128 and, finally, one on a A320.
- Assessment of the additional introduction of the Galileo Safety-of-Life service into the GBAS application.

Functional Overview



Avionics

