



Boeing Technology | Phantom Works

Advanced Air Traffic Management

User Challenges Tailored Arrivals Experience

Rob Mead

Lead Engineer for Tailored Arrivals and Communications
Phantom Works Air Traffic Management
The Boeing Company

ICNS Conference
Plenary Session
Tuesday 6 May 2008

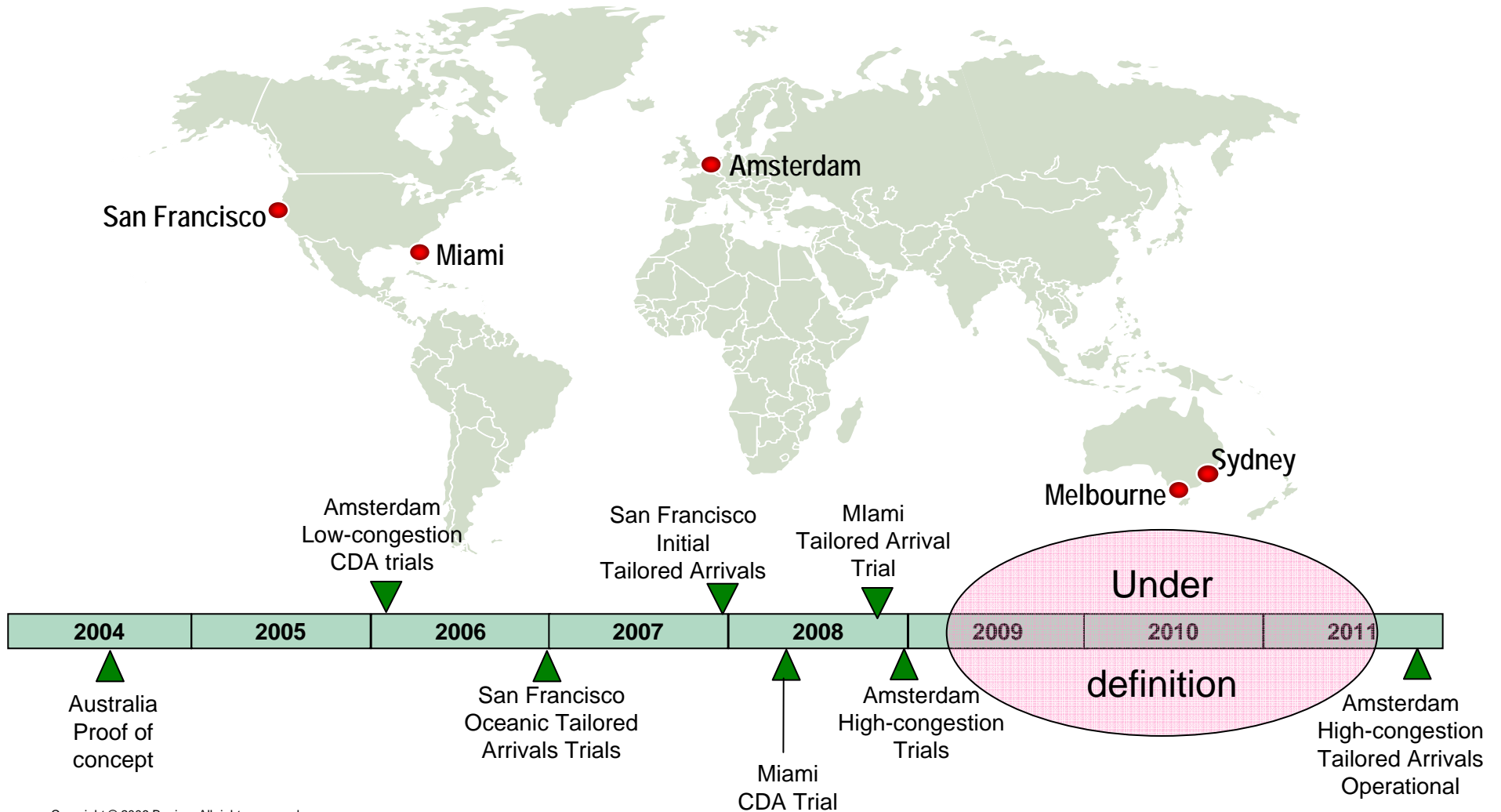
Topics

Boeing Technology | Phantom Works

- What are some user challenges for implementing “Information Takes Flight”, especially making aircraft nodes on the network?
- Tailored Arrivals experience
- Relationship to information sharing
- What’s the biggest user challenge?

Regional Work for Global Results

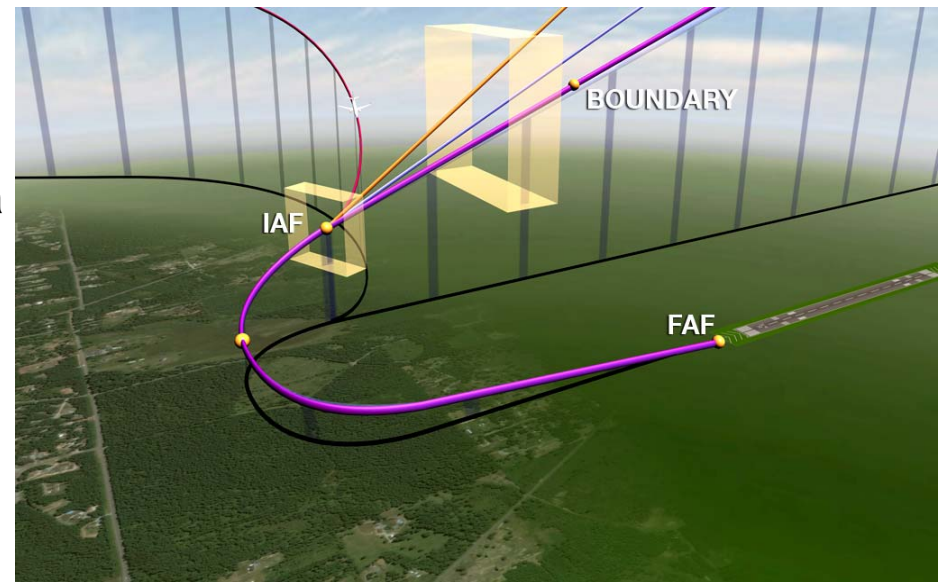
Boeing Technology | Phantom Works



Tailored Arrivals (aka: “Dynamic STAR”)

Boeing Technology | Phantom Works

- Tailored arrival — key features:
 - Continuous descent from cruise altitude to touchdown
 - **Tailored** for traffic, environment, ...
 - Controller-to-aircraft communication by data link*
 - Definition of flight path in both time and space (4D)
 - Flight path through multiple centers
- Benefits:
 - 100 to 400 kg less fuel per flight
 - Flight duration reduced by several minutes
 - Dramatically reduced VHF voice communication
 - Overall efficiency improved
 - Important step toward modernization of ATM



*If ATC does not have data link, tailored arrivals can still be achieved by using pre-negotiated set of standard arrival procedures pre-stored in FMS.

Tailored Arrival Components

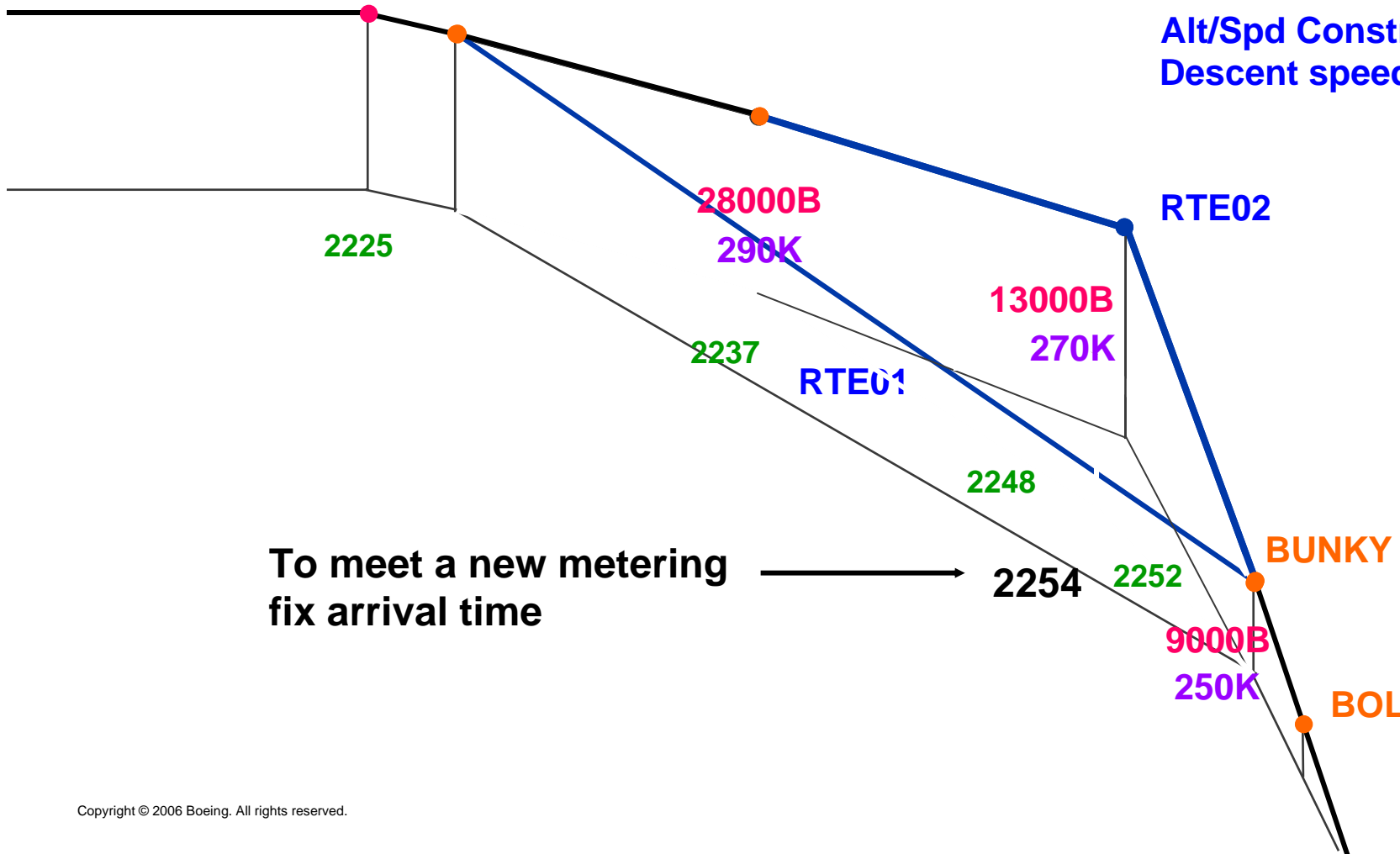
Boeing Technology | Phantom Works



.82m / 316k

TOD DANKS

Path Shortening
Path Stretching
Alt/Spd Constraints
Descent speed schedule



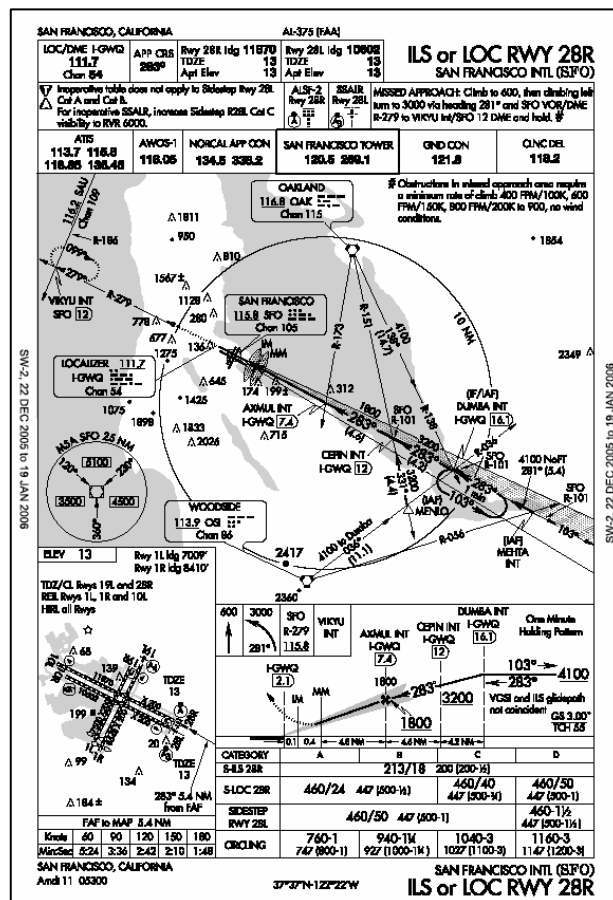
Tailored Arrival Clearance via SUPER (29 Jan 2008)

Boeing Technology | Phantom Works

- From ALCOA, PAINT, DACEM, etc.
- Clearance includes published procedure, transition, and runway
- Clearance includes vertical, lateral, and speed constraints
- Clearance is from en route airspace through to destination

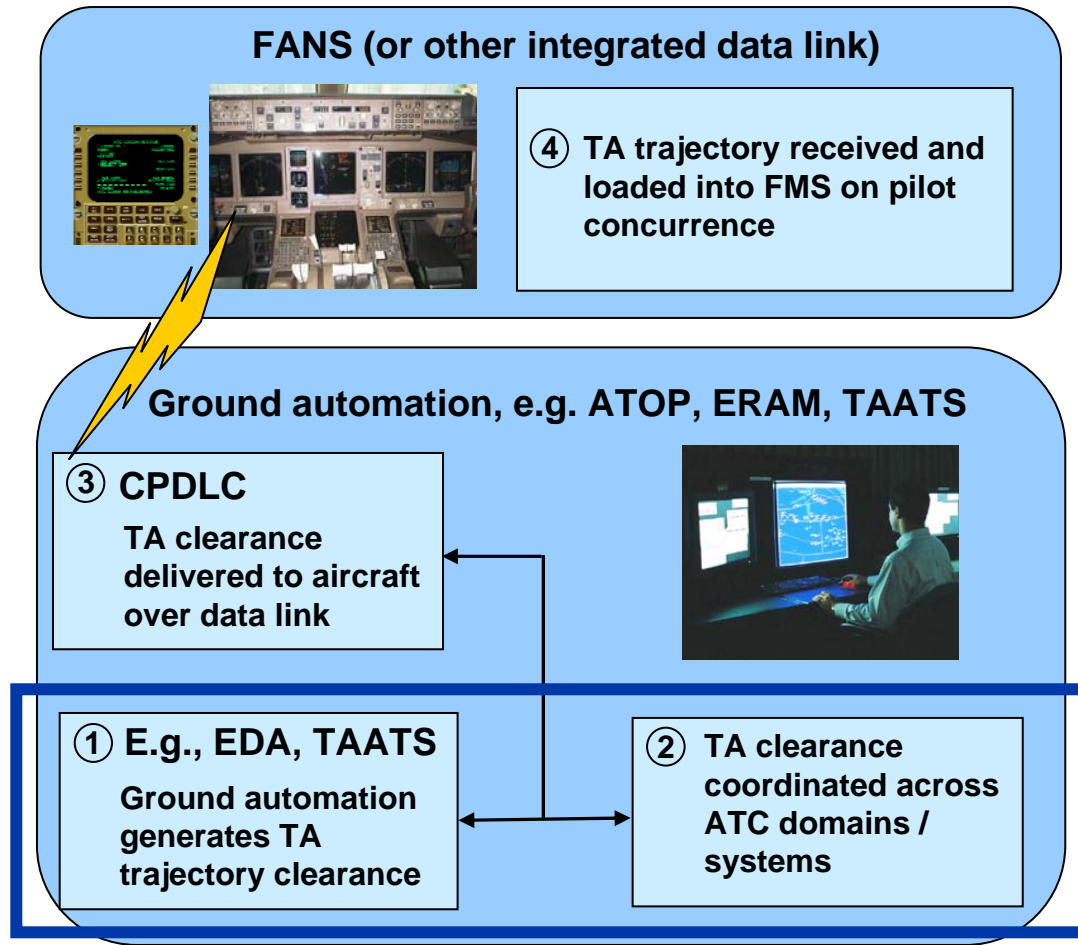
UPLINK CLEARANCE BRAVO At ALCOA cleared to

- SUPER** -----/21000A
- RAINS** -----/21000B
- PIRAT** -----/15000B
- BRINY** -----/12000B
- N3722 W12223** -----/6000A
- OSI**
- MENLO** 210/4000A
- ILS28R Approach**
- Runway 28R**



What we need ...

Boeing Technology | Phantom Works



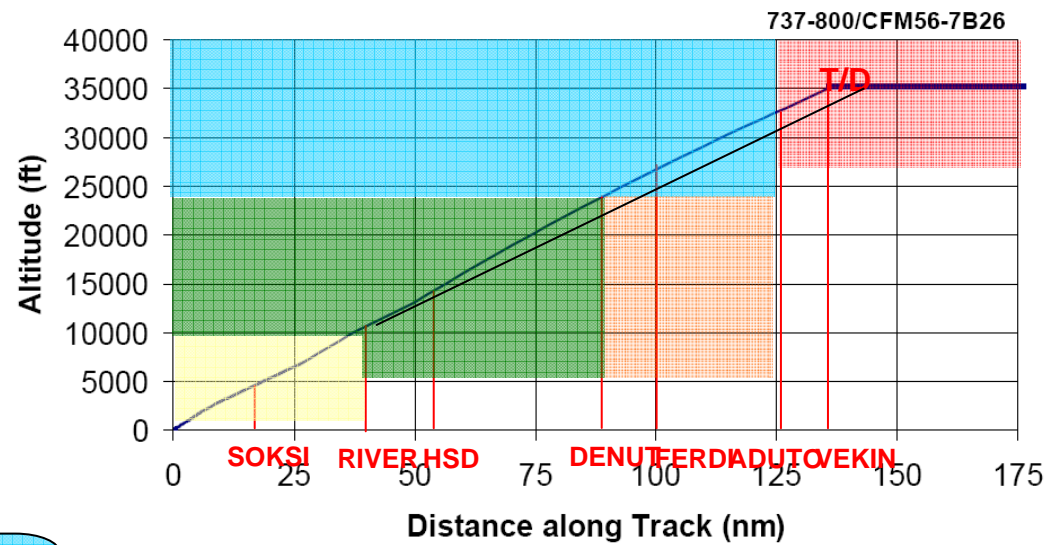
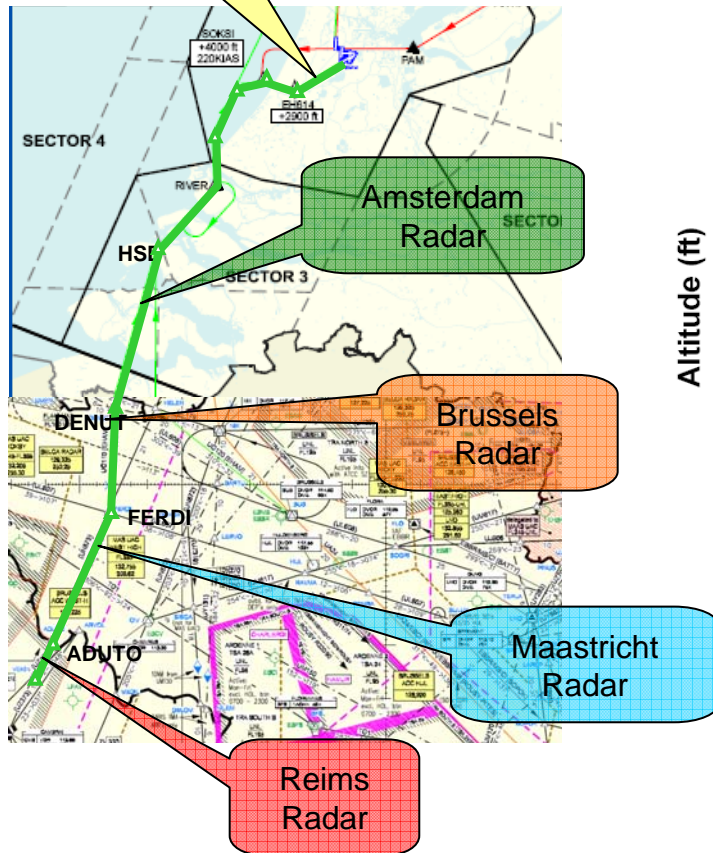
- ⑤ TA trajectory flown with FMS
- ⑥ Aircraft downlinks ETA information (at waypoints) along with other useful parameters for ATC trajectory confirmation and tuning
- ⑦ TA procedure broken off if trajectory cannot be continued for any reason

The key hurdles

About that coordination ...

Boeing Phantom Works

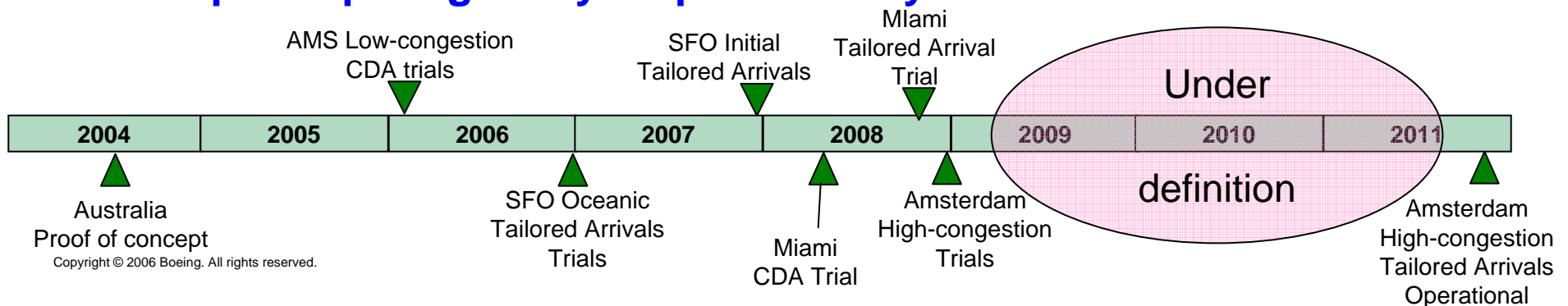
Schiphol Approach



How are we doing with all that?

Boeing Technology | Phantom Works

- Proof of concept in the three major aviation regions
- Congested airspace requirements capture exercises conducted in the US and Europe
- Congested airspace trials, with automation, will be conducted late 2008 in Europe, with implementation expected to follow
- Congested airspace planning initiated in the US
- Early deployment in the US, achieving benefits and working transition
- Significant information on early 4D applications for NextGen & SESAR
- **Users participating every step of the way**



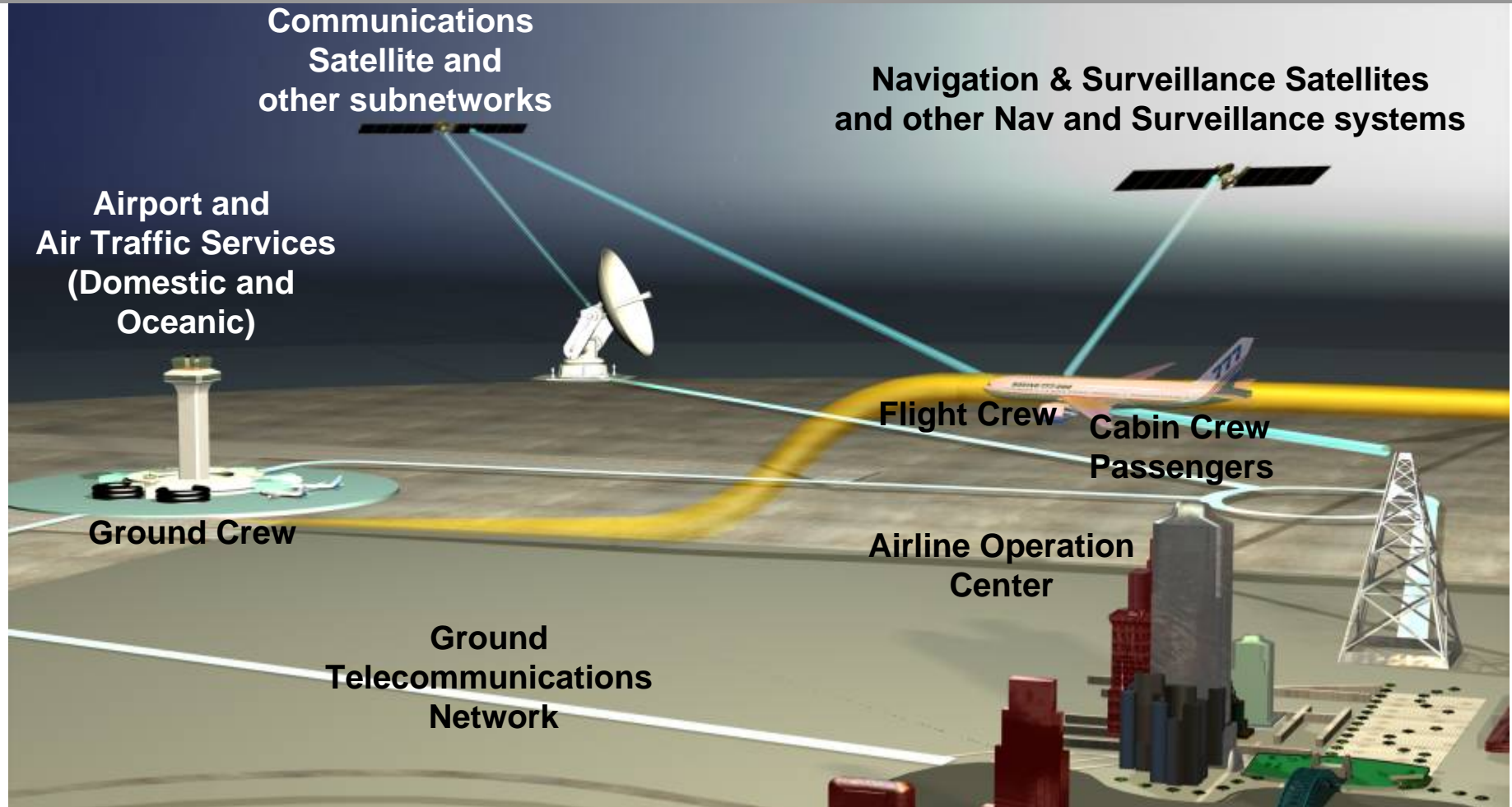
Tailored Arrivals and Info Sharing

Boeing Technology | Phantom Works

- Boeing chose to work Tailored Arrivals for three primary reasons
 - It provides benefit to our airline customers
 - It creates real-world experience on key 4D issues
 - It demonstrates and promotes integrated datalink
- In a nutshell:
 - *Close integration of onboard and ground flight management functions is the key to implementing the NextGen flight operations that will create the benefits of fewer delays, increased route efficiency, lower fuel consumption, further reduction of environmental impact, and lower per-flight system operations costs.*

Information sharing exists today

Boeing Technology | Phantom Works

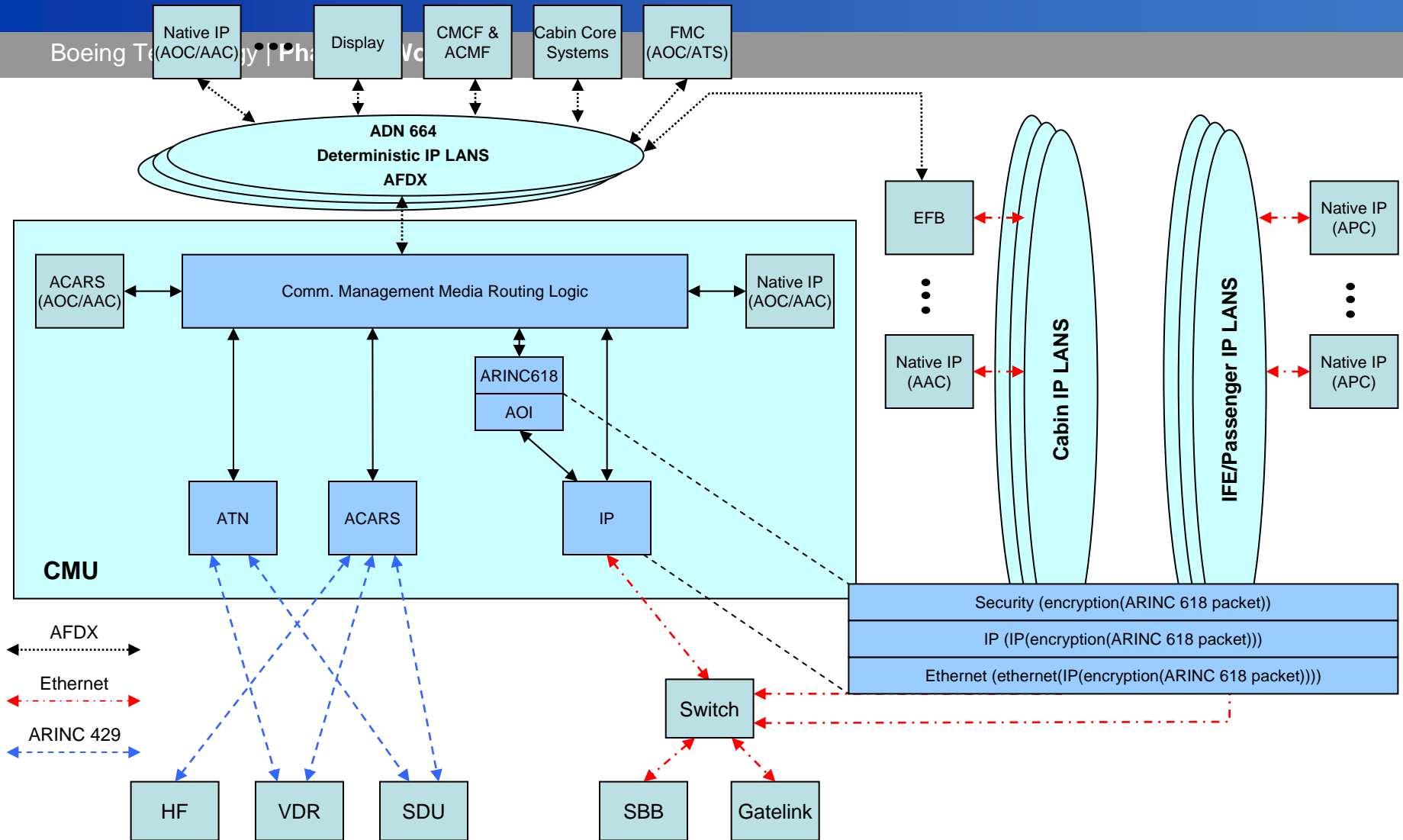


Why do we often find things a little challenging?

Boeing Technology | Phantom Works

- Putting new systems and procedures in both aircraft and on the ground is tough
- Timescales
 - Airlines need it to pay back in 12 months
 - ANSPs are happy with a 10 year return
- Build cycles
 - ANSPs have good reasons for building in spirals
 - Airlines need to certify as much as possible all at once
- Backwards compatibility
 - Airlines absolutely need it; they can't upgrade all fleets
 - ANSPs would like as many aircraft equipped as possible, because it reduces the systems and procedures their controllers support
- We love to do R&D, and assume Operations will embrace our technology
- **We have a tendency to look past “transition”**

Transition is crucial





Boeing Technology | Phantom Works

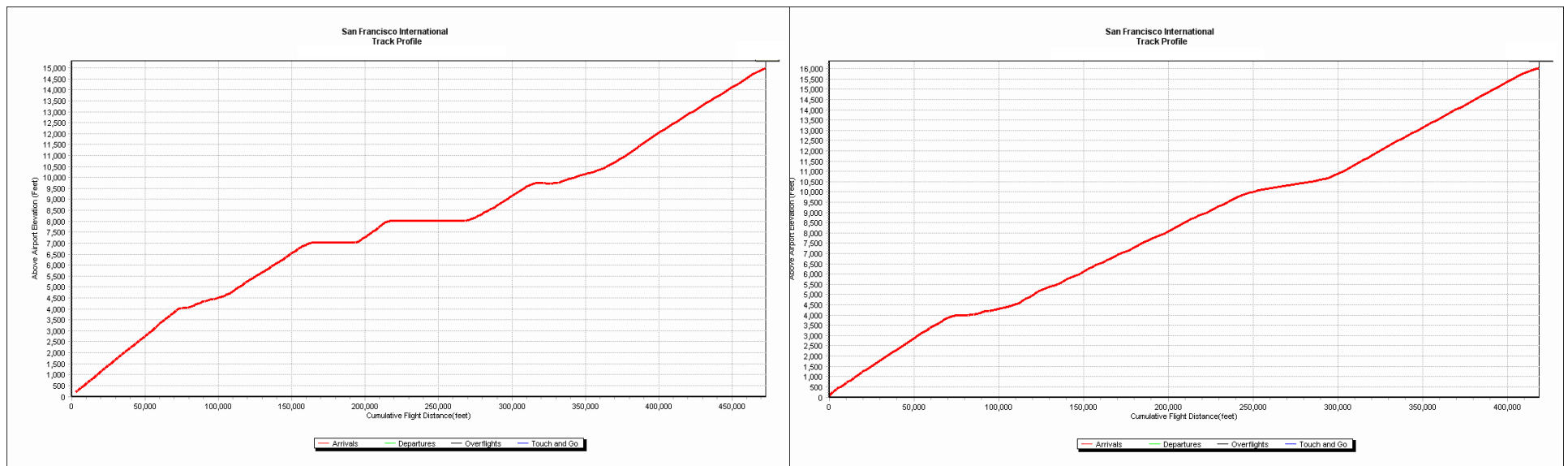
Advanced Air Traffic Management

**We can create activities that bridge
the gap, and directly address
transition**

This is a good thing ...

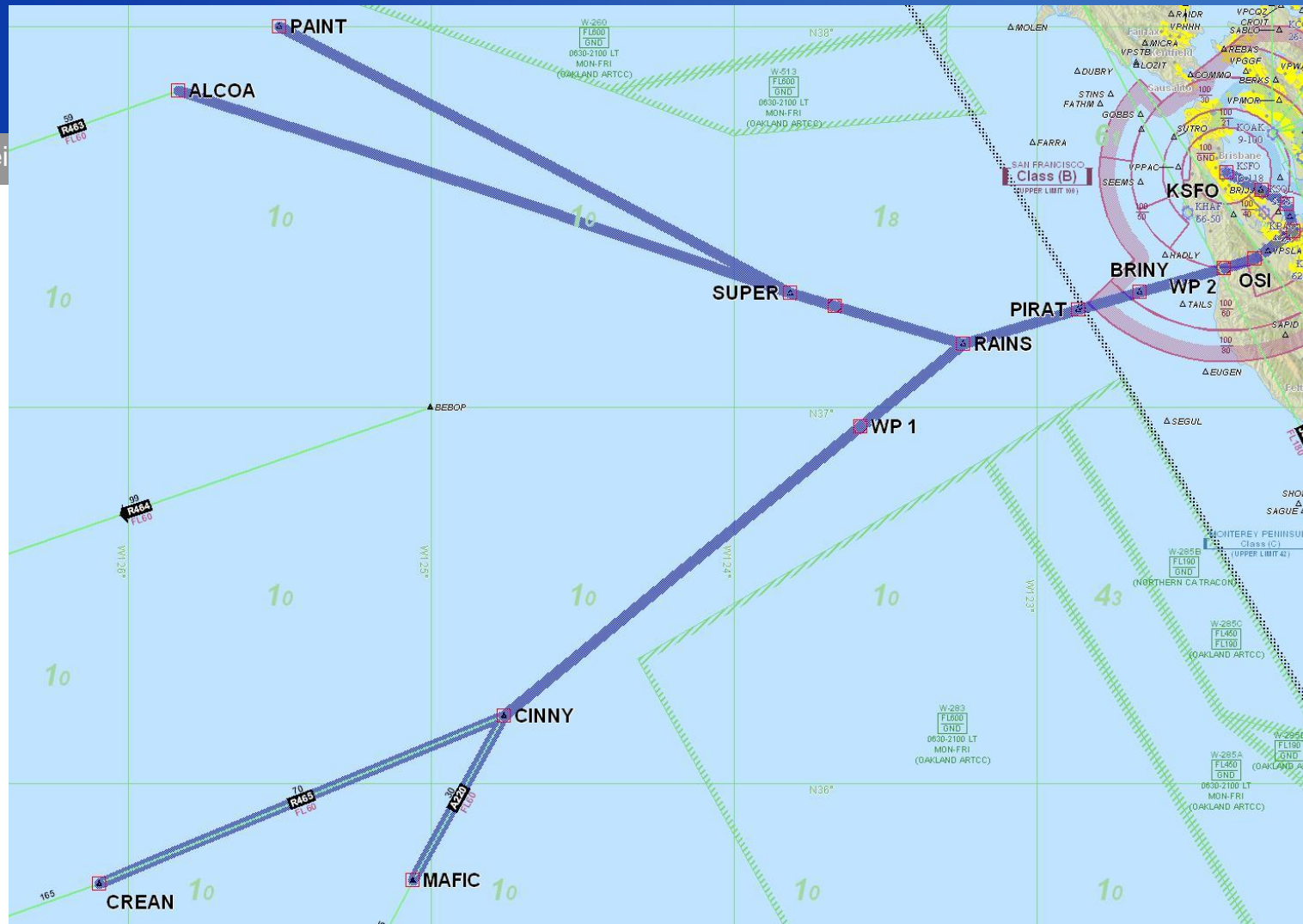
Boeing Technology | Phantom Works

- Develop, validate and formalize cross-center procedures (“descend via ...”), including coordination mechanisms
- Maintain and increase momentum, by providing the basis for continued development and deployment in the US & elsewhere
- Provide some immediate benefits, pending full automation
- Provide experience with information sharing (boy do we learn ...)



Today

Boei



- Multiple changes from 3 Dec 2007 to 27 Jan 2008
- From local procedures department, requiring no change to the end-end procedure
- And boy have we learned



Boeing Technology | Phantom Works

Advanced Air Traffic Management

Questions?