Nationaal Lucht- en Ruimtevaartlaboratorium
National Aerospace Laboratory NLR

Java Flying high
some TALIS observations

Total Information Sharing for Pilot Situational Awareness Enhanced by Intelligent Systems
EC-DG-IS IST-2000/28744

By

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Java Flying high Overview

- **Need for change**
- **Air Traffic Management concepts**
- **TALIS approach**
- **Java issues**
- **Conclusions**

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Need for change

uropean Air Traffic Management shows need for change

- More responsive (lead times of decades)
- More cost-effective (delays cost billions of Euro / year)
- While retaining or increasing current level-of-safety

ir transport business characteristics

- Business pressure leads to “faster, better, cheaper” paradigm

→ move from proprietary solutions to open systems and COTS

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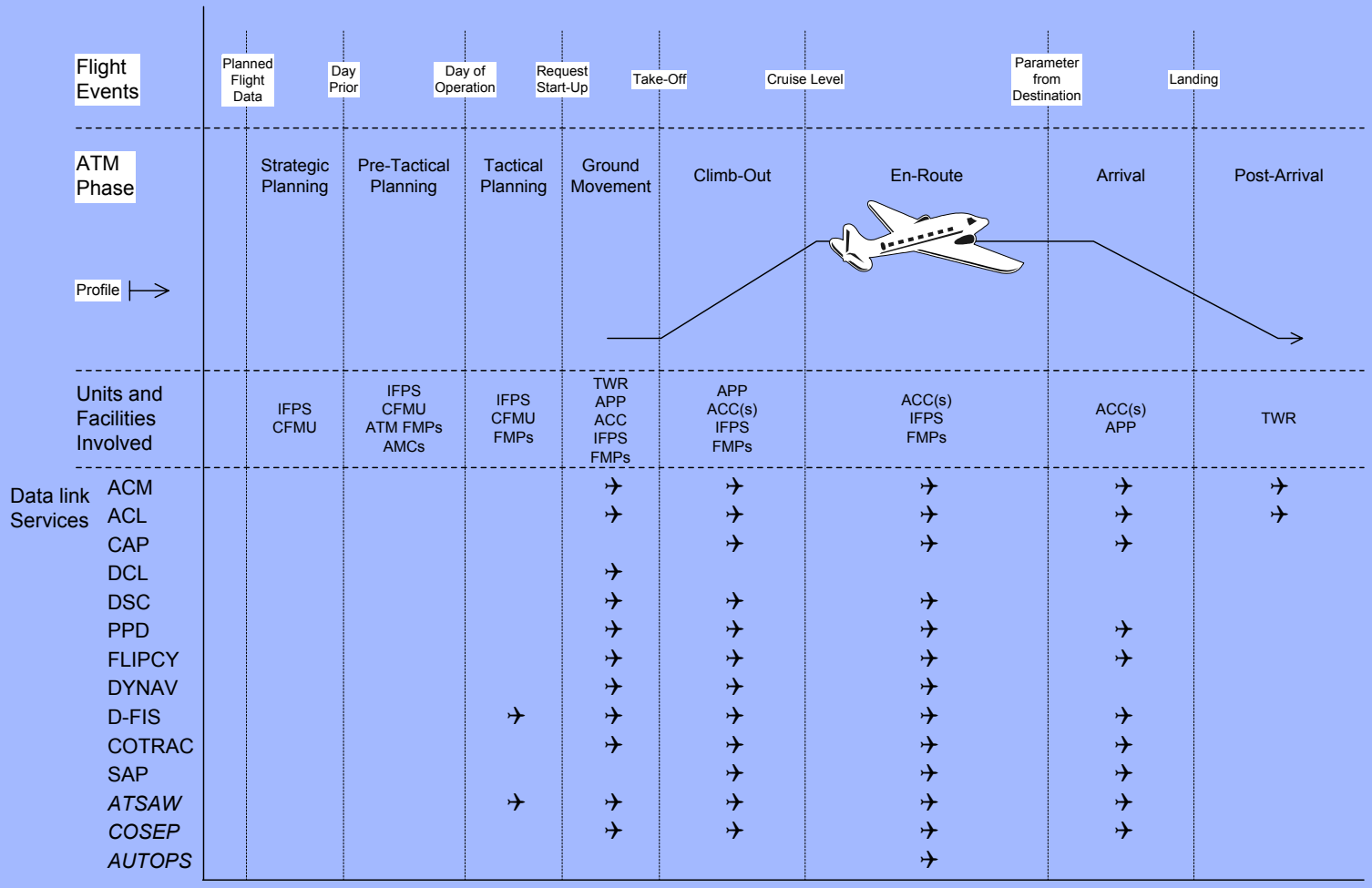
Air Traffic Management concepts



EUROCONTROL COOPATS concept

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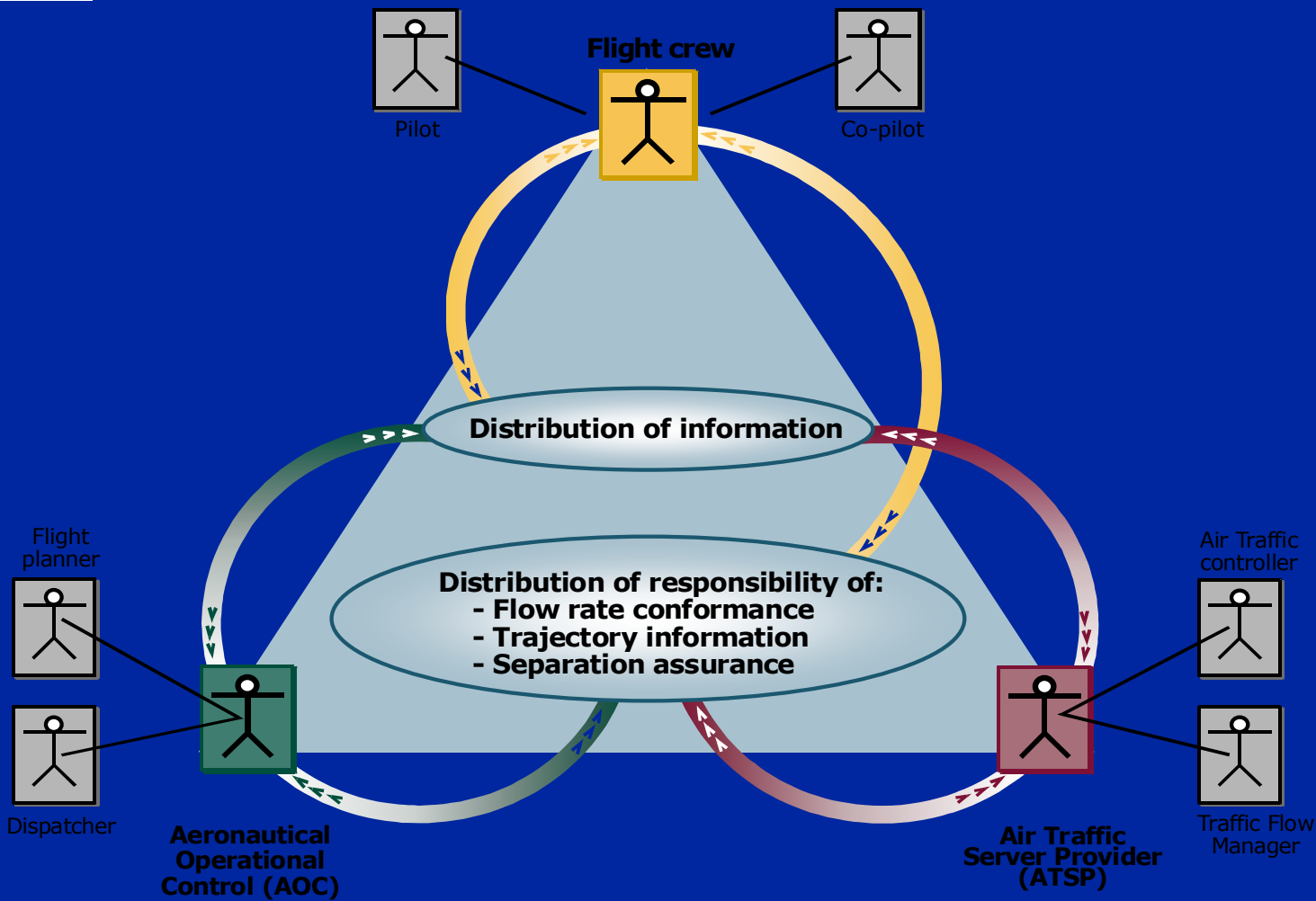
Air Traffic Management concepts



FAA DAG-TM concept Distributed Air-Ground Traffic Managemenmt

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TALIS approach

Concepts

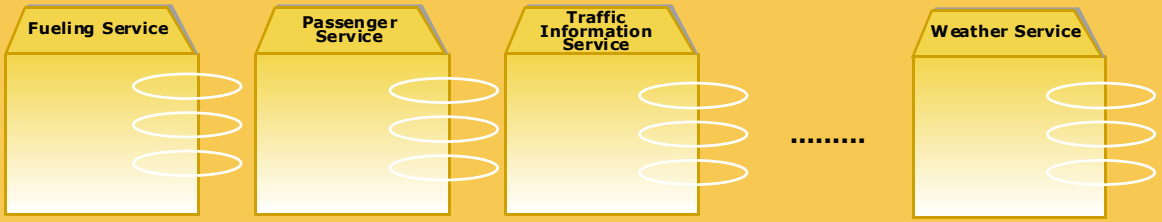
COOPATS

DAG - TM

User needs

- Airborne separation assurance
- Air traffic situational awareness
- Co-operative separation assurance
- Autonomous flight operations
- Departure clearances
- System wide information management
- ....
- Intelligent pushback & taxing
- Free manoeuvring for user preferred
  - departures
  - separation assurance
  - traffic flow management
  - trajectory conformance
- Collaboration for user preferred arrival metering
- ....

TALIS



COTS

Navigation:
- VOR / DME
- ILS
- MLS
- GPS
- GLONASS
- Galileo
- LAAS / WAAS

Communication:
- ACARS
- SSR Mode S
- VDL Mode 2/4
- Gatelink
- ATN
- Satellite
- IP

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TALIS approach

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TALIS approach

TALIS requirements

- **support variety of location / flight phase dependant applications**
- **support variety of applications which evolve over time**
- **support mix of hardware and software platforms**
- **realistic time-to-market for new TALIS applications**
- **accommodate air transport concerns**
  - real-time
  - safety / certifiability
  - security

  Note these concerns are application dependant

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TALIS approach

DO-178B Safety classification (including FAR/JAR-25 frequency definition)

- **level A: Catastrophic failure**
  extremely improbable $< 1x10^{-9}$ per Flight Hour
- **Level B: Hazardous/Severe-Major**
  extremely remote $1x10^{-9} <$ hazardous failure $< 1x10^{-7}$
- **Level C: Major failure**
  remote $1x10^{-7} <$ major failure $< 1x10^{-5}$
- **Level D: Minor failure**
  probable minor failure $> 1x10^{-5}$
- **Level E: No Effect undetermined**

DO-278 uses 6 Assurance Levels AL1 - AL6

IEC 61508 uses Safety Integrity Levels SIL1 - SIL4

Eurocontrol for ECAC area will probably use 6 Assurance Levels AL1 - AL6

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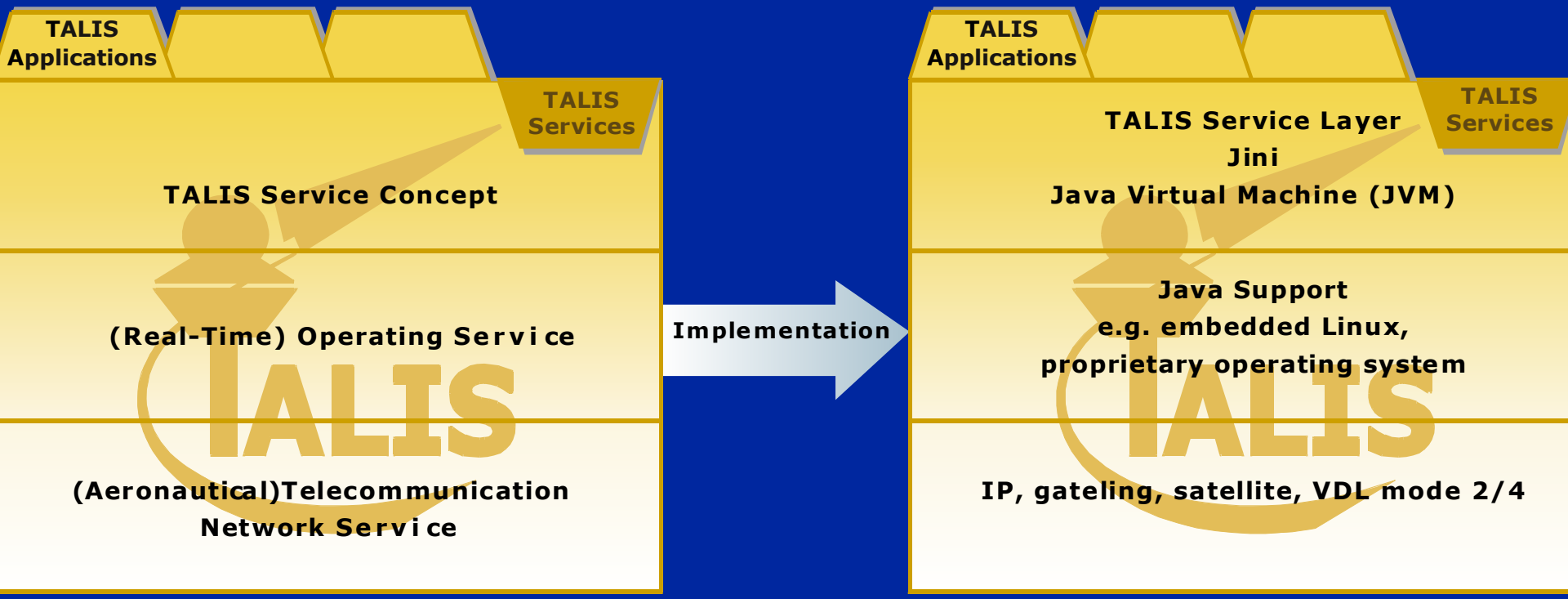
TALIS approach



Java Flying high
TALIS approach

Java advantages

- Open, i.e. Vendor independent
- COTS, capitalise on huge commercial investment and concentrate on air transport added value
- Java allows easier integration into existing business systems (i.e. Enterprise Application Integration)
- Java / Jini allows easy update of application software and even install new applications

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Java issues

real-time

- TALIS supports mix of soft real-time and non real-time applications running concurrently
- run time addition of new TALIS applications

safety / certifiability

- airborne part DO-178B
- mix of airborne applications levels from E up to B/C running concurrently (no (Preliminary)System Safety Assessment available yet (P)SSA)
- ground part standard being completed, DO-278 (FAA, extension DO-178B, March 2002) or dedicated Eurocontrol standard
- varying mix of ground applications levels running concurrently

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Java issues

- **security**
  - TALIS application may not obtain unauthorised data of other applications
    - e.g. All passengers on board is valid exchange, passenger X on board is unauthorised
  - protection of critical applications needed
    - (e.g. authentication for aircraft clearances)
  - mix of applications running concurrently on same platform

Java Flying high Conclusions

- **For TALIS Java with its many COTS developments seems appropriate choice**
- **Open issues are**
  - real-time (work is being done in RTJ group)
  - safety / certifiability
  - security
- **TALIS starts with low level applications, increasing to more critical applications as technology matures and experience is gained**