Presented by

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# Augmented Reality at Airbus

## Tracking: Experiences, Restrictions & Future Scenarios



CIMPA

AIRBUS

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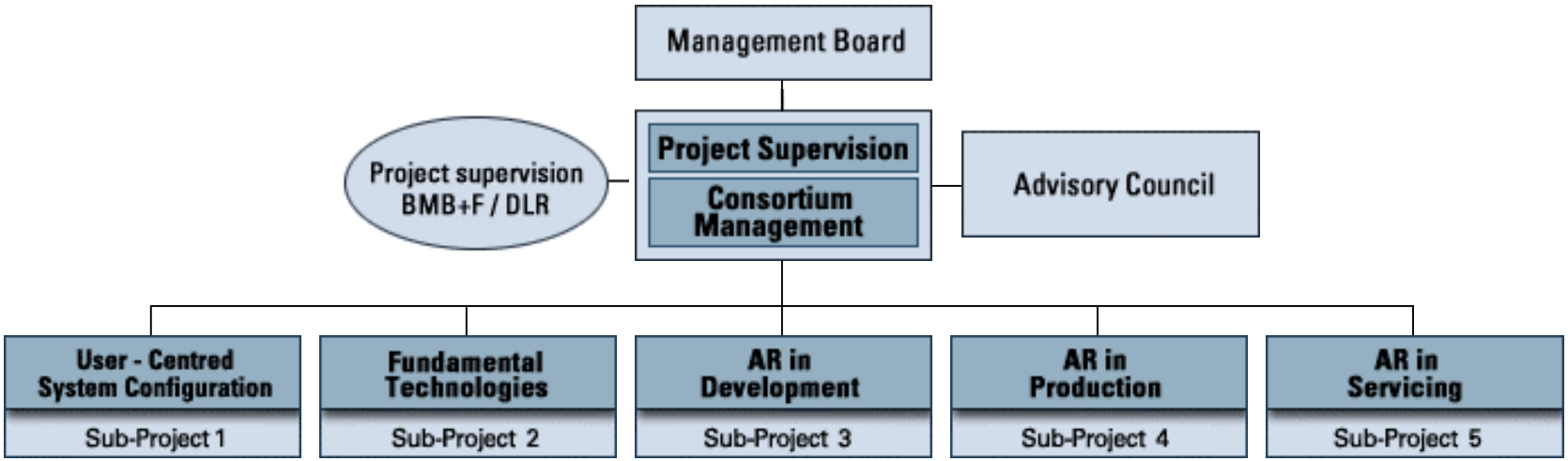
# The past – ARVIKA




**IAW**
Siemens A&D
Siemens ZT
Telekom
UI Design

DaimlerChrysler
**IGD**
Siemens A&D
Siemens ZT
TU Munich
VRCom
WZL
ZGDV

Audi
DaimlerChrysler
EADS-M
Airbus Germany
IGD
QualiSys
Siemens A&D
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**VW**
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**EADS-M**
Airbus Germany
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EADS-M
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Hüller-Hille
Index
Siemens A&D
**Siemens KWU**
Siemens ZT
TU Munich
WZL

**ARVIKA** members marked **bold** were sub-project leaders

# AR-supported installation tasks


**Installation of fresh water pipes**

- Step-by-step instruction
- Simple information system
- Overlay of 2D drawings

Hardware

- Standard laptop
- Sony Glasstron
- Web-Cam

Software

- Web-based Information System
- Marker-based tracking with AR-Browser

*„Make first experiences with AR“*

# AR-based development

**Visualisation of volumetric airflow on a passenger seat**

- Cooperation with DaimlerChrysler research
- Voxel CFD data superimposed on a real cabin mockup
- Other data can be displayed (e.g. temperature)

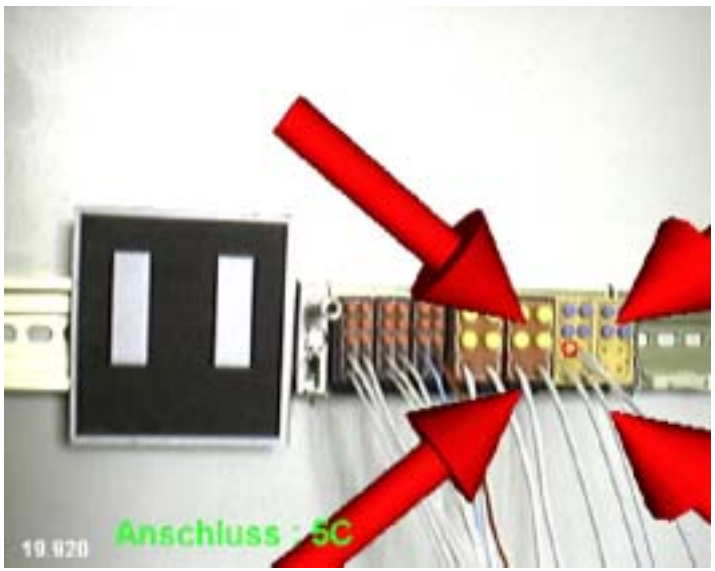
Hardware

- Standard laptop
- Sony Glasstron
- Web-Cam

Software

- DBView (VR software made by DaimlerChrysler research)
- Marker-based tracking with DBView AR-Module

# AR-supported cable plugging




**Mobile AR support while finishing the connector plugging**

- System shows where to connect the cable
- Special display-centric AR user interface
- Fully speech operated hands-free system

Hardware

- Xybernaut MA V
- Binocular HMD (Tekgear M2)
- Mini-Camera (Toshiba IK-MX1)

Software

- SVG-based information system
- Marker-based tracking with embedded AR-Browser/Amire

# Outcome

None of the prototypes has been deployed in productive setting!

# WHY?

Missing user acceptance

Maturity of HMDs not high enough

Unsolved cabling issues

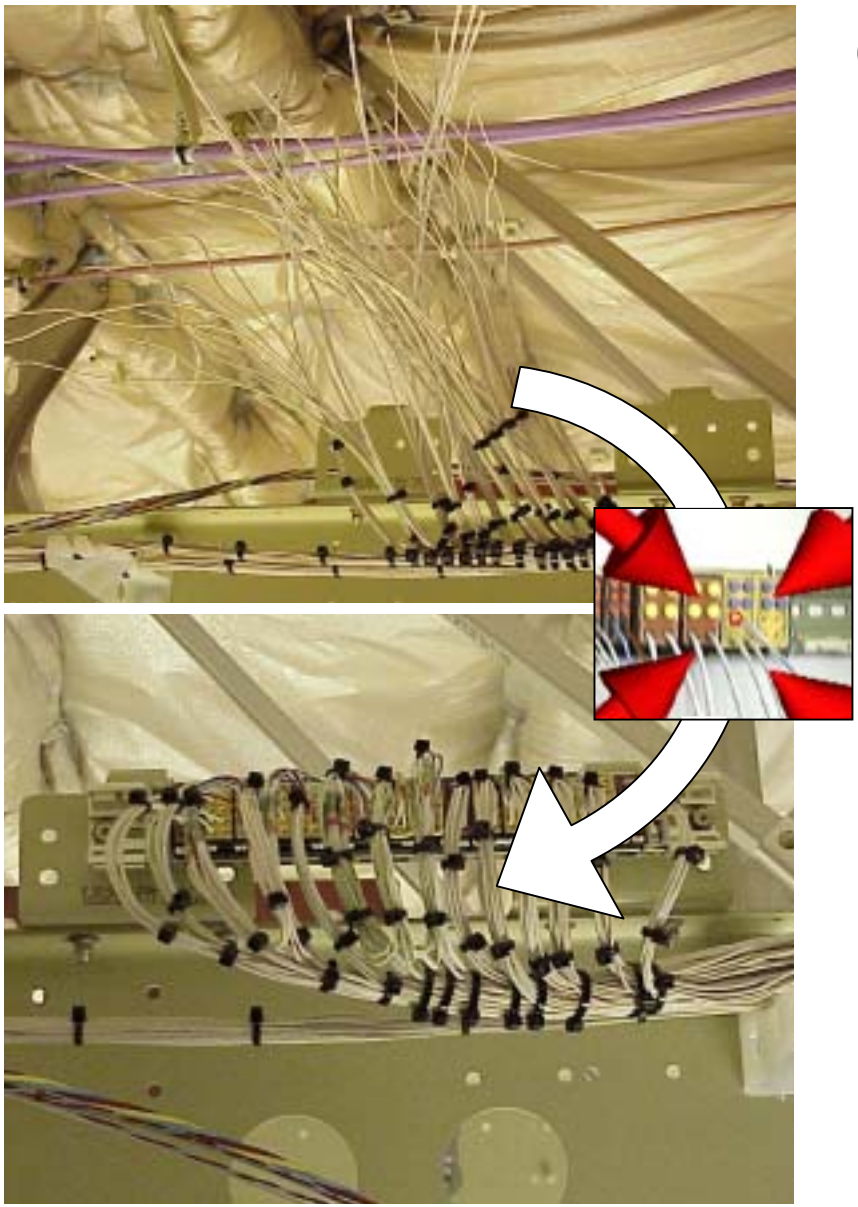
Too expensive
(hardware, software, training, support, service, etc.)

**Difficult tracking conditions inside an aircraft**

# General tracking restrictions

- Due the length of fuselage global stationery systems are not suitable
- Electro-magnetic systems are not compatible with the metallic environment
- No temporary tracking equipment can be installed (e.g. on a tripod)
- Markerless video tracking is difficult because...
  - ... state of construction is always changing
  - ... geometry data is not complete (e.g. screws and isolation)
  - ... of bad lighting conditions (movable lamps and hard reflections)
  - ... many identical looking parts (e.g. stringers)

# Future Scenario 1: Manufacturing



**Cable plugging support**

Scenario characteristics

- All work inside the fuselage
- Most work beneath the ceiling (on a ladder)
- Many workers inside fuselage at this stage
- Many viewpoints movements

Needed Tracking Quality

- High accuracy: < 1 mm
- High response frequency: < 80 ms

Tracking Approach

Prototype approach (marker based tracking) not allowed and too time-extensive

# Future Scenario 2: AR Quality management

Picture not yet available to public

Picture not yet available to public

**Compare state of construction (As-Designed vs. As-Built)**

Scenario characteristics

- Check the correct installation of harnesses by superimposing the virtual model on the real built environment
- Tablet PC instead of HMD usable
- Only few viewpoints movements

Needed Tracking Quality

- Medium/Low accuracy: < 1 cm
- Low response frequency: < 200 ms

Tracking Approach

Only inertial tracking methods could be used today.

# Future Scenario 3: Service

Picture not yet

available to public

Picture not yet

available to public

**Fresh Water Tank Maintenance**

Scenario characteristics

- AR maintenance information system
- Short distance to the augmented object
- Very narrow environment
- Many viewpoint movements

Needed Tracking Quality

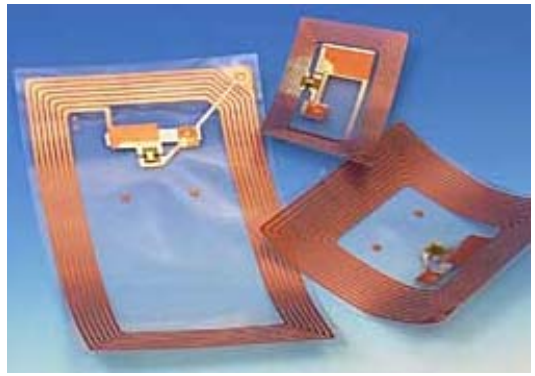
- Medium accuracy: < 5 mm
- Response frequency: < 40 ms

Tracking Approach

Today there is no solution available

# Recent work on tracking

**RFID study in cooperation with EADS research center and Technical University of Munich (TUM)**

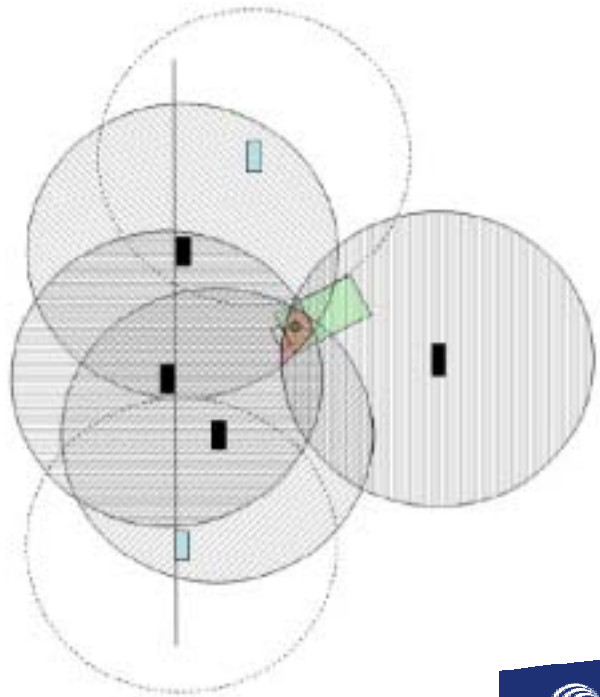


*Background:* More and more parts in the aircraft have RFID chips attached for maintenance reasons

Idea: Use the RFID chips for tracking purposes!

Study Results:

- Tracking possible but very unprecise
- Standalone usage of RFID tracking not advisable
- Combination of RFID tracking with precise methods which need initialisation like markerless tracking or a gyrospic approach



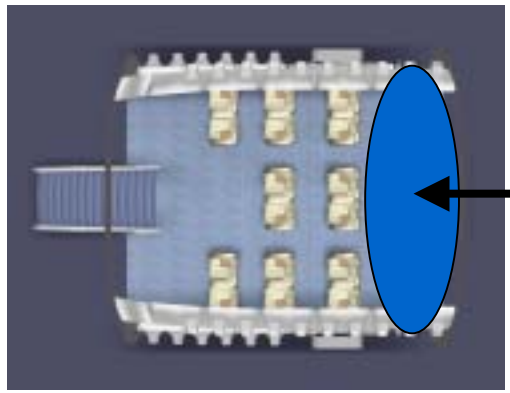
→ EADS research was engaged to develop a tracking framework allowing sensor fusion

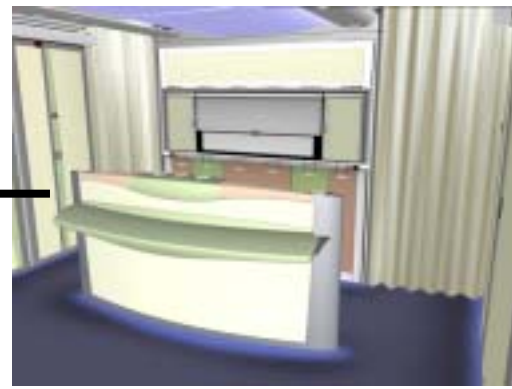
# Less restrictions – Mockup Scenario

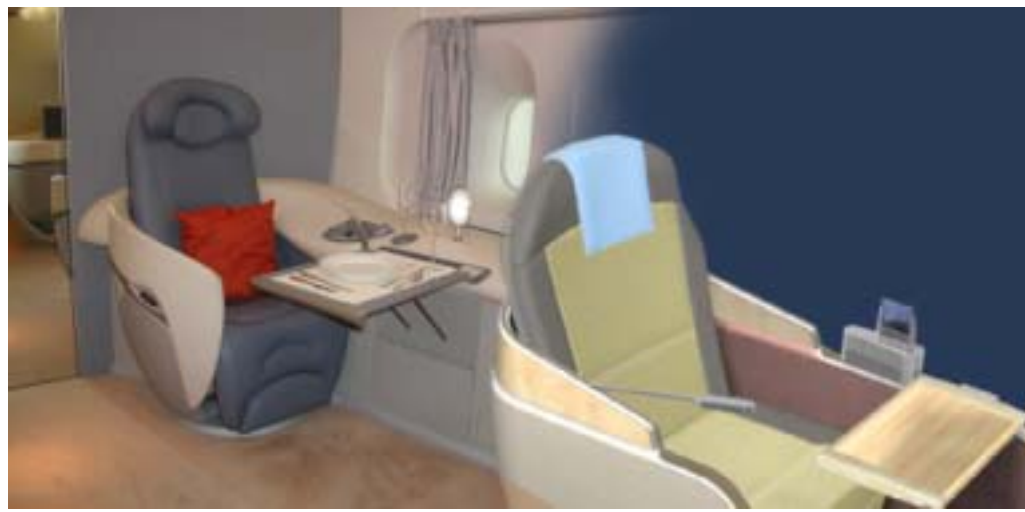
Use Augmented Reality to overlay parts of a sales/design mockup with a virtual configuration or design concept.

Design Mockups: Substitution of expensive and inflexible prototypes

Sales Mockups: Fixed Sales Mockups can be augmented with customer specific solutions







**Less Tracking Restrictions:**

- No metal: only wooden mockups
- Fixed state of construction
- Limited small number of people

**Tracking approach:**

Combine inertial sensors with:

- Video-based Markerless Tracking
- Infrared „Inside-out“ Solution (maybe)

# Open discussion

**How do you think tracking for AR will develop in the coming years?**

**What are the key technologies solving our problems?**

**Thank you very much for your attention!**