Alexander Lay
Airbus Operations GmbH

New Projects Developing Avionic Systems and Flight Deck Operations, and their Contribution to Future Air Traffic Management

DAPHNE (Developing Aircraft PHotonic Networks) Project Overview

This work was supported by the EC under the Seventh Framework Programme (FP7) through project DAPHNE "Developing aircraft photonic networks" (Grant Agreement ACP8-GA-2009-233709).

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Introduction

- DAPHNE aims to:
  - Develop photonic networks and components for aircraft
  - Exploit photonic technology from terrestrial communications networks
  - Identify and address technology gaps in implementing photonics extensively throughout the aircraft industry

- Project info
  - DAPHNE started in Sep-09 and will run for three years
  - The project has fifteen partners from seven nations
    - Avionic equipment
    - Aircraft manufacturers
    - Photonic industry members
    - Academic network specialists.
  - Project coordinator: Airbus

- DAPHNE is supported by the European Commission's Seventh Framework Programme (FP7)
  - Project website www.fp7daphne.eu

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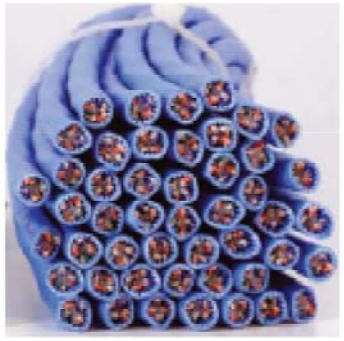
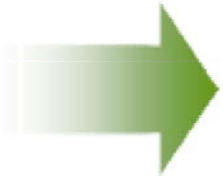
Objectives 1

- Photonics could advance aircraft systems state-of-the-art
  - Reduced size and weight
  - Hugely increased transmission speed
  - Excellent EMC without heavy and bulky shielding
  - Increased functionality for modular and reconfigurable networks
    - WDM
    - Wavelength switching
    - OEO conversion





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Objectives 2

- Photonics permits a single network to provide a “signal transport function”
- Supports channel segregation needs associated with different DALs
- Hierarchical segregation allows novel modular network designs
  - Physical (multiple fibre)
  - Wavelength (single fibre)
  - Temporal (single channel).

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Challenges

- Major differences between aircraft networks and terrestrial telecoms systems and other optical networks (e.g. rail, automotive):
  - Network size
    - Fewer nodes (thousands rather than millions)
    - Shorter link lengths: (metres rather than kilometres).
  - Traffic type
    - Signal speeds from sub-kbps to multi-Gbps
    - Avionic protocols; not all are directly fibre-compatible
  - Component limitations
    - Aircraft systems demand extended performance
  - Component standards
    - Pre-requisite for component qualification in many aircraft manufacturers

- DAPHNE aims to tackle these problems to establish the basis for a common infrastructure for aircraft photonic networks.

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Impact (1)

- Reduced Aircraft Development Cost
  - Standard set of “building blocks”
  - Components standardisation
  - Certified solutions
  - Reduced time to market

- Reduced Aircraft Operational Cost
  - Reduced weight -> Reduced fuel consumption
  - Extended range
  - Components standardisation

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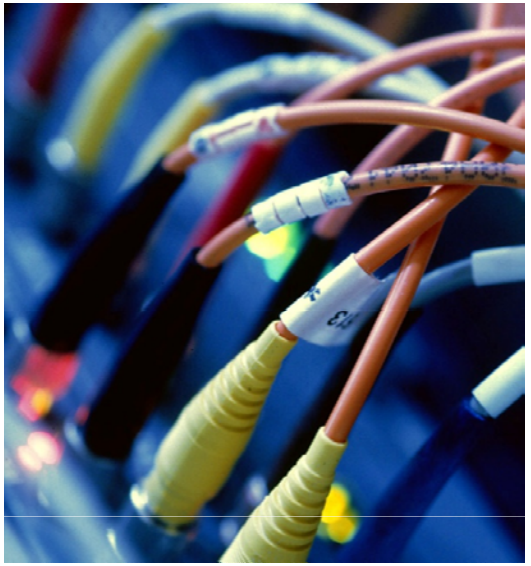
Impact (2)

- Transparent Network to future Avionics Upgrades
- Passenger-friendly Cabin
  - Broadband to the seat
- Reduced Aircraft-On-Ground Time
  - Reduced maintenance
  - Simpler installation



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Consortium

UK

GOOCH & HOUSEGO GROUP

BAE SYSTEMS

AVoptics

AgustaWestland
A Finmeccanica Company

DENMARK

DTU

GERMANY

ILMENAU UNIVERSITY OF TECHNOLOGY

AIRBUS
AN EADS COMPANY

EADS

VIVID COMPONENTS

FRANCE

D-Lightsys
Digital & Lightwave Systems

Draka

CZECH REPUBLIC

SQS
VLÁKNOVÁ OPTIKA

PORTUGAL

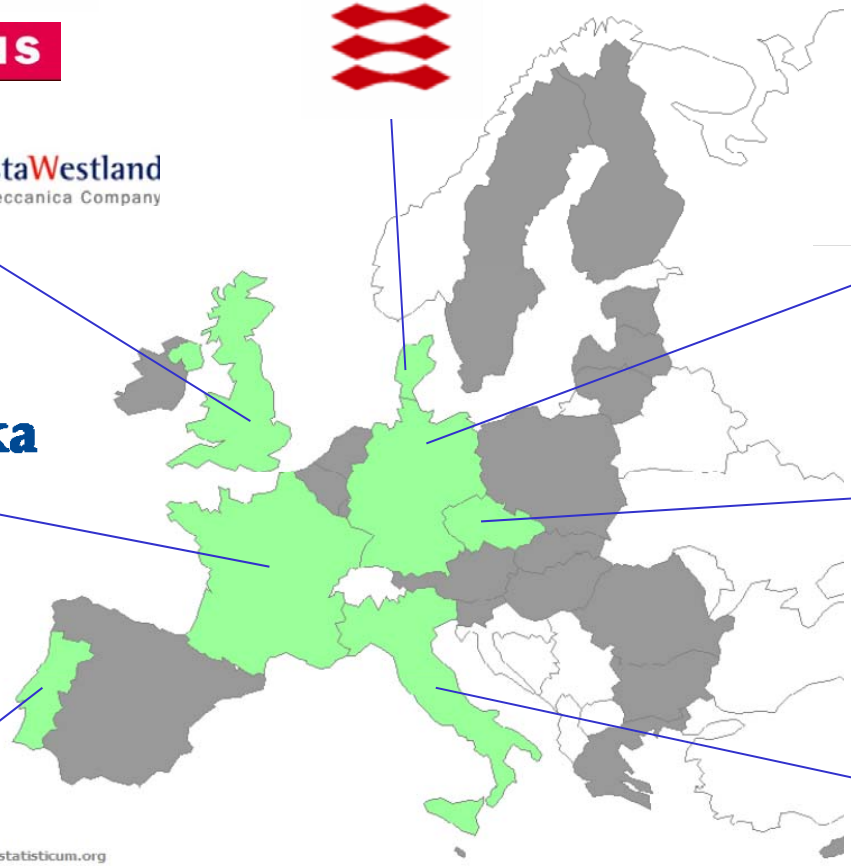
gmv
INNOVATING SOLUTIONS

INESCPORTO

www.statisticum.org

ITALY

SELEX GALILEO



•15 partners; 7 nations

• Project lead organisation: Airbus Deutschland.

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DAPHNE scope

- DAPHNE objectives will be tackled at four levels
  - Networks
    - Adapt optical network technology for aircraft platforms
  - Modules
    - Define a modular infrastructure for aircraft fibre optic networks
  - Components
    - Develop photonic component technology for aircraft environments
  - Dissemination and Standardisation
    - Disseminate project results to aircraft industry to ensure effective uptake.
    - Participation in Standardisation bodies (ARINC, ASD-STAN, SAE-ASD, …)

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DAPHNE scope: networks & modules

- Networks
  - Wide range of fibre optic network technology exists for terrestrial systems
  - For representative aircraft platforms this technology will be
    - Analysed
    - Adapted
    - Optimised
  - Large & small aircraft; rotary & fixed wing

- Modules
  - Define a scalable, modular infrastructure for aircraft networks
    - Including node and interconnect concepts
  - Avionic boxes and interfaces were designed for electronic equipment
    - Not optimised for photonics
    - New avionic box standard will be promoted
  - Standard practices for optical signal management
    - From circuit board to the external connector interface.

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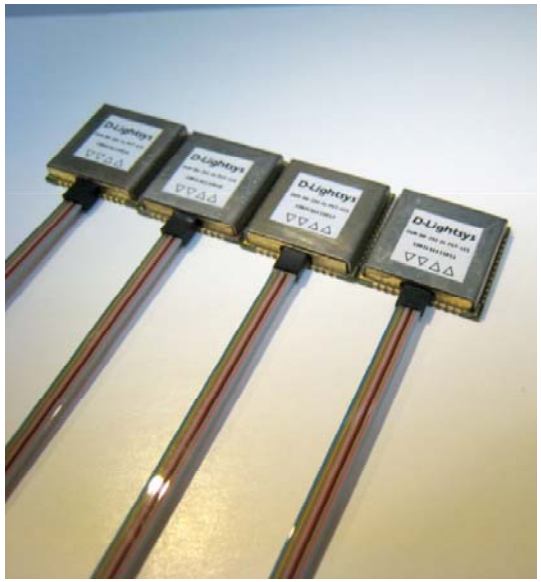
DAPHNE scope: components & dissemination

- Components
  - Adapt components for aircraft operational environments
    - Detailed requirements will follow from baseline studies
  - Likely to include
    - Ruggedisation for aircraft environments
    - Compact intra-module connectors
    - Full duplex MM fibre-optic transceivers
    - Single and multiple ribbon fibre break-out
    - Standardised interfaces



- Dissemination and Standardisation
  - Uptake by industry is essential to the project success
  - Contribution to Standardisation bodies
  - DAPHNE Advisory Group to engage relevant actors
    - Component suppliers
    - Equipment manufacturers
    - End-users
  - DAPHNE aims to establish the centre of mass of avionic photonic expertise firmly in Europe.

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Baseline studies: existing aircraft networks

- Capture requirements for existing & future aircraft data networks
  - Both electrical and optical networks
- Map functionality to aircraft zones & identify data flow characteristics
  - Normalised network descriptions to enable quantified analysis
- Identify technology gaps for components and infrastructure
  - Maintenance and repair considerations
  - Future requirements
  - Integration of legacy with current or future equipment and protocols.

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Baseline studies: terrestrial technology

- Review terrestrial network techniques and architectures
  - Latest WDM technology
  - FTTX
- Photonic component maturity assessment
  - Active and passive components
  - Cables and connectors
  - Identify gaps in functionality and performance
  - Define component developments for aircraft applications.

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Connections to other EU projects and SESAR

- DAPHNE photonic networks can be used for satisfying the data-load needs of the other projects:
  - ALICIA
    - Modular cockpit concept: can make use of an optical bus
  - SCARLETT
    - Modular avionics: can make use of an optical bus
  - SESAR
    - WP9 Aircraft Systems: Aircraft functions can make use of optical communication networks

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DAPHNE Advisory Group

- Relevant organisations will be invited to form the DAPHNE Advisory Group

- The DAG has three main aims:
  - Bring technical inputs from industry and fully define the project requirements
  - Receive periodic updates on the project and interact with the consortium to give a wider industrial perspective
  - Enable recommendations to be supported by a “critical mass” and to promote uptake of the project results.

- The DAG will meet on a bi-annual basis and will include manufacturers of
  - Components
  - Cables and fibre
  - Avionics modules
  - Aircraft
  - Manufacturing tools
  - Test equipment

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DAG contact

- Interested?!
- Contact us!
- DAG leader and contacts
  - Nick Brownjohn (Airbus)
  - nicholas.brownjohn@airbus.com

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Questions?

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Project contacts

- Technical leader
  - Nick Brownjohn (Airbus)
  - nicholas.brownjohn@airbus.com
- Administrative contact
  - Bruce Napier (Vivid components)
  - bruce@vividcomponents.co.uk
- Project website
  - www.fp7daphne.eu

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