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BAE Systems

Developing Aircraft PHotonic NEtworks

DAPHNE project overview

Content

Introduction

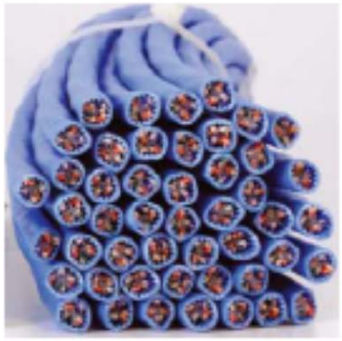
- DAPHNE aims to:
  - Develop photonic networks and components for aircraft
  - Exploit photonic technology from terrestrial communications networks
  - Identify and address technology gaps in implementing photonics extensively throughout the aircraft industry

- 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

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



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).

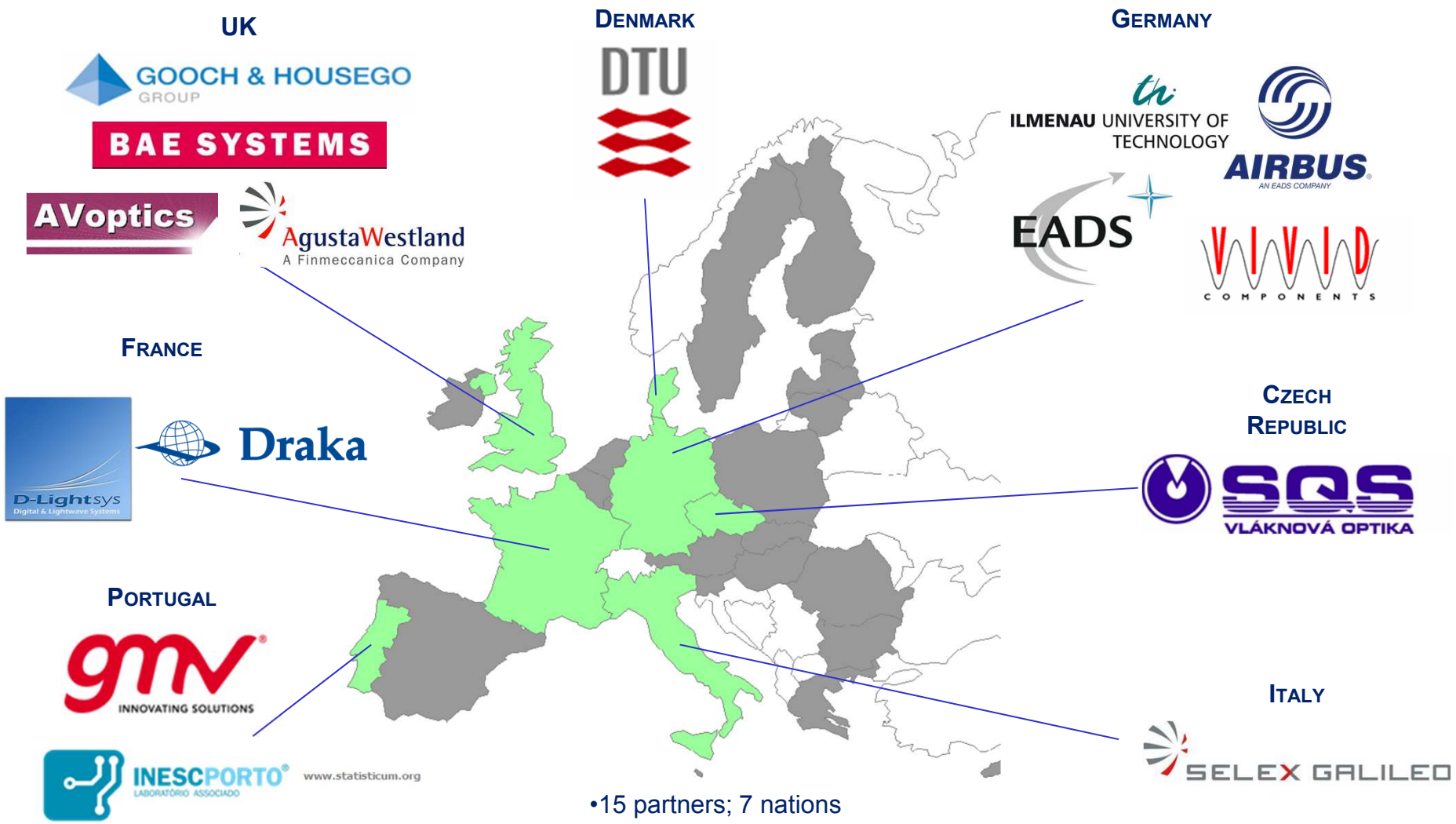
Image provided courtesy of AgustaWestland; all rights reserved

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.

Consortium



•15 partners; 7 nations

• Project lead organisation: Airbus Deutschland.

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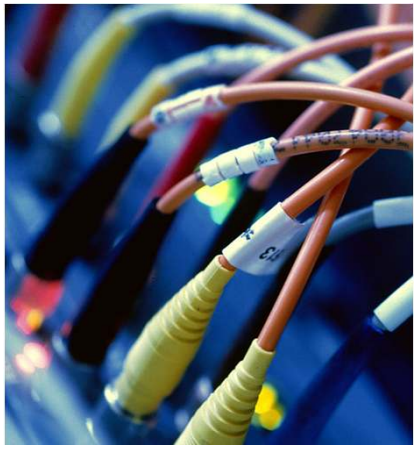
DAPHNE scope

- 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
    - Disseminate project results to aircraft industry to ensure effective uptake.

DAPHNE scope: networks & modules

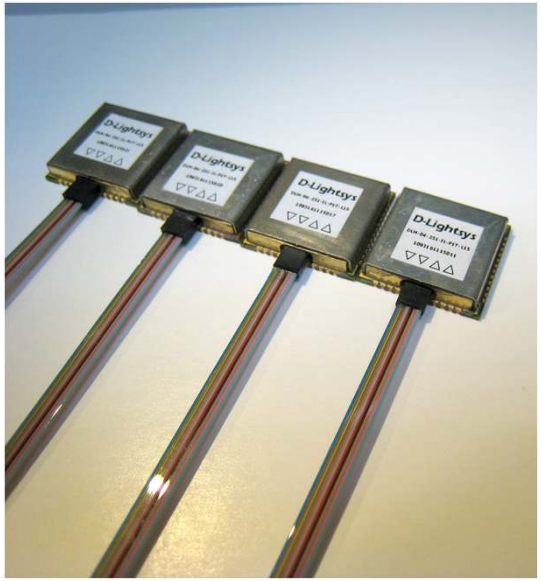
- Networks
  - Wide range of fibre optic network technology exists for terrestrial systems
  - For representative aircraft platforms this technology will be
    - Analysed
    - Adapted
    - Optimised
  - Large & small aircraft; rotary & fixed wing



- 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.

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
  - Uptake by industry is essential to the project success
  - 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.

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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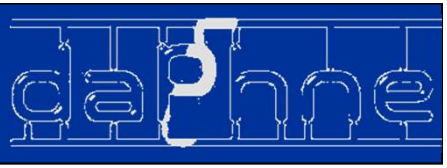

Introduction & objectives

Project scope

Project progress

DAPHNE Advisory Group

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.

DAG contact

- Interested?!
- Please see DAPHNE members at the Gooch and Housego display
- DAG leader and contacts
  - Nick Brownjohn (Airbus)
  - nicholas.brownjohn@airbus.com