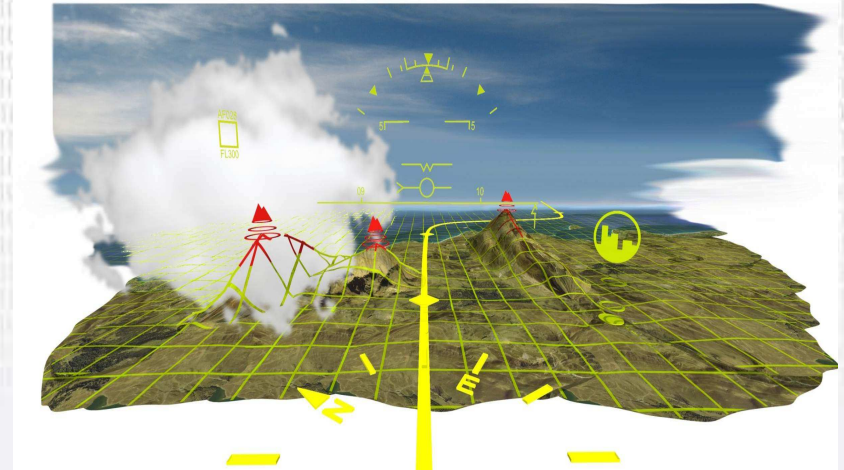# Thales Presentation
ICAO NGAP Symposium

March 2010

Francis ARCHAMBAULT – Director, Marketing and Product Policy

Benoît THUBERT – Advance Project Design Authority

Aerospace

THALES Avionics system development in recent History
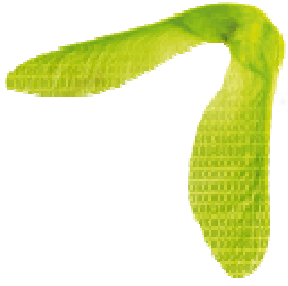
AIRBUS, BOMBARDIER, GULFSTREAM, ATR, EMBRAER, SUKHOI

- Interactive Cockpit Display Systems,
- Flight Management Systems,
- Integrated Modular Avionics,
- Electronic Flight Controls Computers,
- Head-Up Displays,
- Enhanced Vision Systems,
- IFE.

THALES Innovation

NEW TECHNOLOGIES

- Flight Deck Innovation Strategy,
- Global Environment – Thales actions & major Industry initiatives,
- R&D and emerging technologies – some considerations,
- Avionics evolving Business Model,
- New generation of flight crew & new approach to develop flight deck,
- Competency and training methods,
- Bridging the gap between pilots and systems,
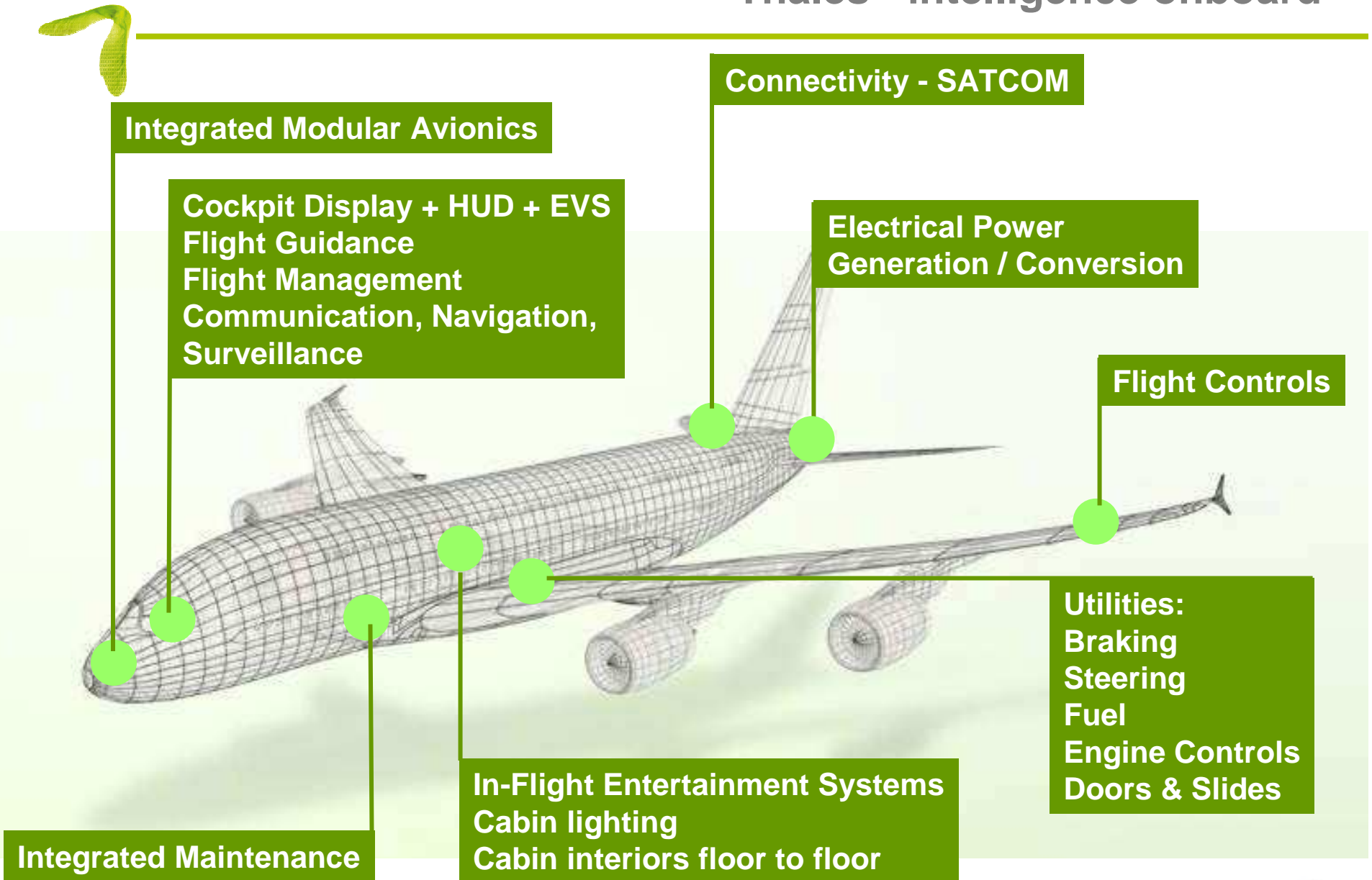- New interaction languages,
- Helping pilots to handle complexity.

THALES Training Technologies

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Thales Recent
Avionics developments

Thales - intelligence onboard

Connectivity - SATCOM

Integrated Modular Avionics

**Cockpit Display + HUD + EVS
Flight Guidance
Flight Management
Communication, Navigation,
Surveillance**

**Electrical Power
Generation / Conversion**

Flight Controls

**Utilities:
Braking
Steering
Fuel
Engine Controls
Doors & Slides**

**In-Flight Entertainment Systems
Cabin lighting
Cabin interiors floor to floor**

Integrated Maintenance

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Aeronautical equipment and functions

THALES - provides entire cockpit to Industry leaders

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Intelligence onboard Gulfstream G650 and Boeing 787

Aeronautical equipment and functions

- Cabin systems
- (IFE, Cabin lighting)
- Electrical Systems
- Navigation (Stand-by Instrument)
- Flight controls

Training & simulation

Three-axis fly-by-wire flight control computer system

- Primary and secondary flight control management
- Digital flight control computers
- Backup flight control unit

THALES - provides critical systems to the innovators

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TopSeries in-flight entertainment systems

- Integrated entertainment and communication solutions and connectivity with personal electronic devices
- TopSeries now represents 50% of the global market (> 1000 A/C in service)
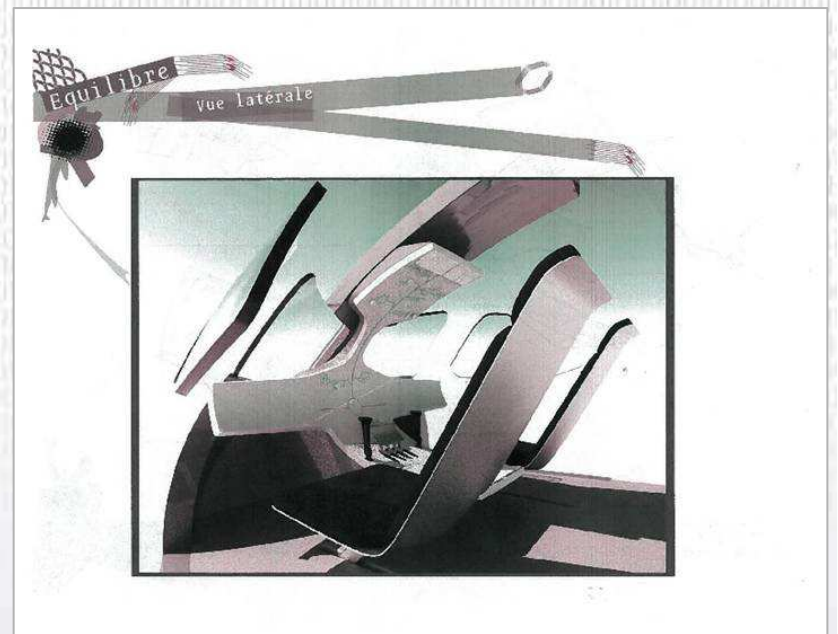
Connectivity Systems

- TopFlight Satcom: onboard satellite link allowing passengers and crew to communicate with the outside world
- First on an international flight with SMS and voice communications via mobile phone
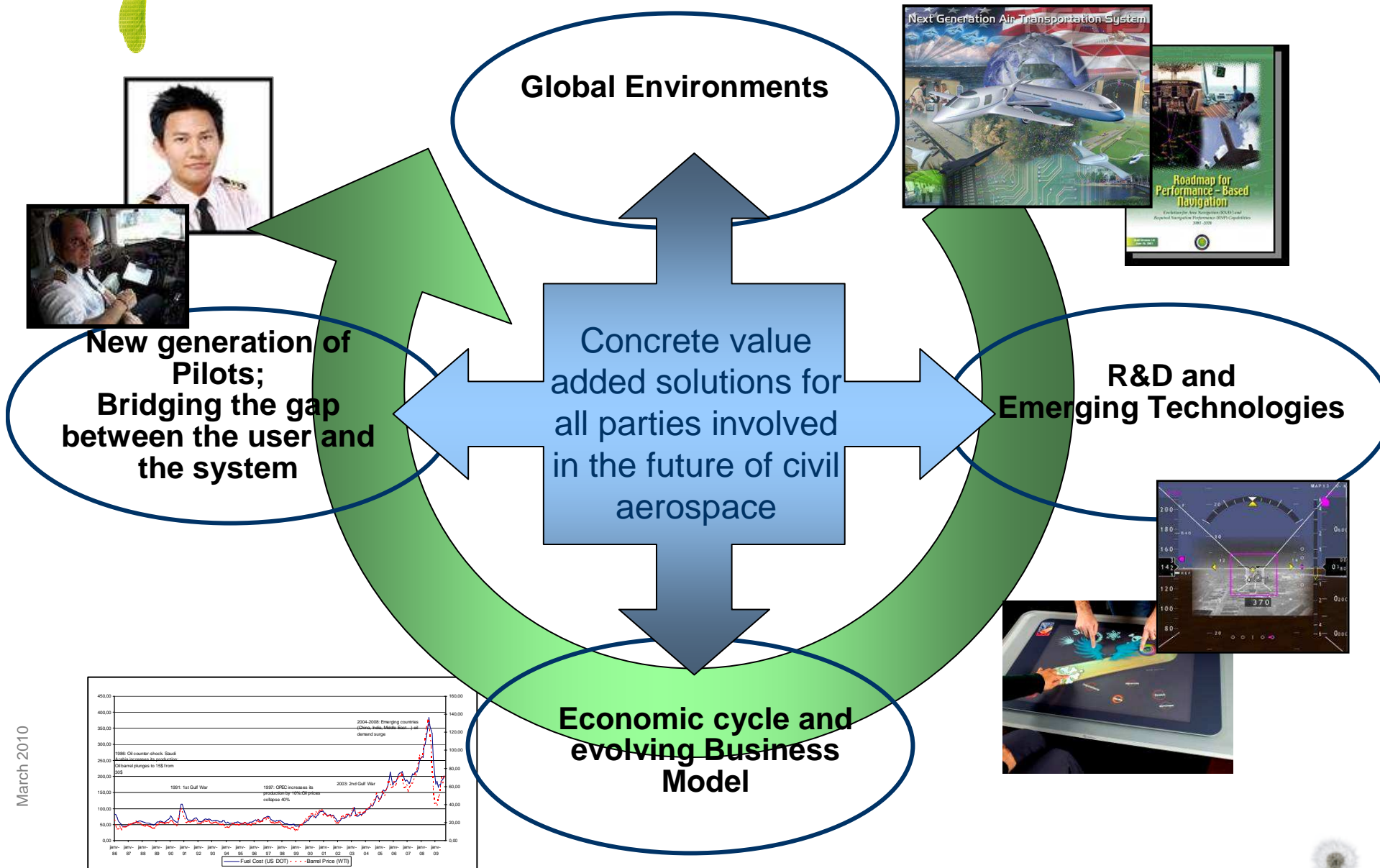- Internet connectivity, GSM, GPRS, WiFi.

Thales - brings innovation right to the passenger's seat

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Thales Innovation and future operational challenges

Aerospace

Global Environments

Concrete value added solutions for all parties involved in the future of civil aerospace

New generation of Pilots; Bridging the gap between the user and the system

R&D and Emerging Technologies

Economic cycle and evolving Business Model

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Onboard Avionics versus ATM cooperation

NextGen

- 4D trajectory exchange
  - Manage Gate To Gate Predictions
  - Improve datalink - clearance automation
  - Manage multiple RTA, ETA Slots display for negotiation
- ASAS procedures versus FMS, coupling with Traffic situation
- Departure / Arrival procedures ("green procedures")
- "What if" Concept and associated Option Routes
  - ETOPS & RIF routes with associated decision points
  - Multiple departure/arrival preparation for quick selection in case of runway change
- Accurate weather modelling for more precise predictions,
  - To use more accurate weather situation data
    - Grid winds/temperature, jet streams, turbulence
    - FIS-B Weather uplink

SESAR JOINT UNDERTAKING

CLEANSKY Joint Technology Initiative for Aeronautics & Air Transport www.cleansky.eu

THALES **THALES**
AVIONICS   **AIR SYSTEM**
A seamless collaboration

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Ground Segment

On board Segment

Airlab
TOULOUSE
RUNGIS

EISE
SEATTLE

Airline Operation Center

Tower Airport Control

Control Center

Cockpit Control & Displays

Avionics FUNCTIONS:
AP, FMS, ANF,TAWS,
Weather , TCAS/ADS-B,
Comm Data link , EFB apps

Other Thales simulators

Environment

DATA LINK

Other external simulators

HAL

Traffic generator,
Weather conditions
…

RMI

Engine, aircraft Model

Architecture Flexible

- EISE : EAGLE Integrated Synthetic Environment
- FMS : Flight Management System
- ANF : On-board Airport Navigation Function,
- TAWS : Terrain Avoidance & Warning System
- TCAS : Traffic alert & Collision Avoidance System
- EFB : Electronic Flight Bag : Crew info services

R & D investment from COTS electronics domains are transforming the civil aerospace market in most of the Avionics sub-systems as defined today…

- Display (CRT to LCD to… multi-touch)
- Man Machine Interface (Interactivity, Cursor Device… Haptic display)
- Augmented Vision (HUD, EVS, SVS … CVS)
- Integrated & opened architecture based on Full duplex network backbone using BUS coming from IT domain
- NAV and Inertia using GPS/GALILEO for all flight phases
- COM Ops and COM passengers (Low speed to Gigabits)

> **R&D investment in-line with know how and expertise through multi-domain activities**

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Federated electro-mechanical avionics

Quantity of products/sub-assembly /moving parts ↑

Products reliability ↓

Achievable MTBF ↓

Spares/repairs ↑

Product driven Revenue

Safety
(system safety, performance, environmental constraints, certification, …)

Human Factors
(teamwork, stress, confidence, workload, training, multi-culturality, …)

Life cycle cost
(reliability, availability, maintainability, testability…)

Integrated opened network

Quantity of LRUs ↓

Quantity of software/ functionalities ↑

Systems reliability
Required life cycle cost ↑

Spares/repairs ↓

System driven revenue

New different business model required in order to address safety, human factors and life cycle cost and generate profit

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| 3 years and more of civil and/or military training | 2000 -3000 flight hours | 15 years, 80000 F/H +, Multiple (4+) aircraft annotations |

Average age of flight crew in 2010 ; 40-50 years old + (10 000 F/H +)

| 18 months ab-initio / MCPL | 500 -1000 flight hours | 5 years, 1500 F/H, 1 or 2 type annotations |

Average age of flight crew in 2030 ; 25-35 years old + (3 000 F/H +)

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» **No more 3 crew cockpit**

» **CRM Evolution**

- In the 90ties: CRM = Cockpit Resource Management
- In 2000:   CRM = Crew Resource Management (including PNC)
- In 2010:   CRM = Company Resource Management (Including, AOC, Ground Ops…
- In 2020 ?   CRM = Complete Resources Management? including ATC?

» **Technology competency**

- On board computers and electronics systems
- Automation
- Communication
- Decision aiding systems

» **Piloting competency**

- Situation Awareness
- Keep the flying basics (fly, navigate, communicate, manage the A/C)
- Flying techniques: Flying quality, ….

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Cockpit rapid design & validation tool

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During bids & programs

To rapidly test new configurations and cockpit solutions

To help to make choices and to validate specifications early

- Improve innovation by rapidly testing new configurations and solutions

- Focus and centric solutions by including the pilots in an immersive prototyping environment and thus enabling early validation of Cockpit Display System and function Man Machine Interface concepts

- Reduce development cycles and costs by increasing significantly the cockpit specification maturity at the first steps of the program
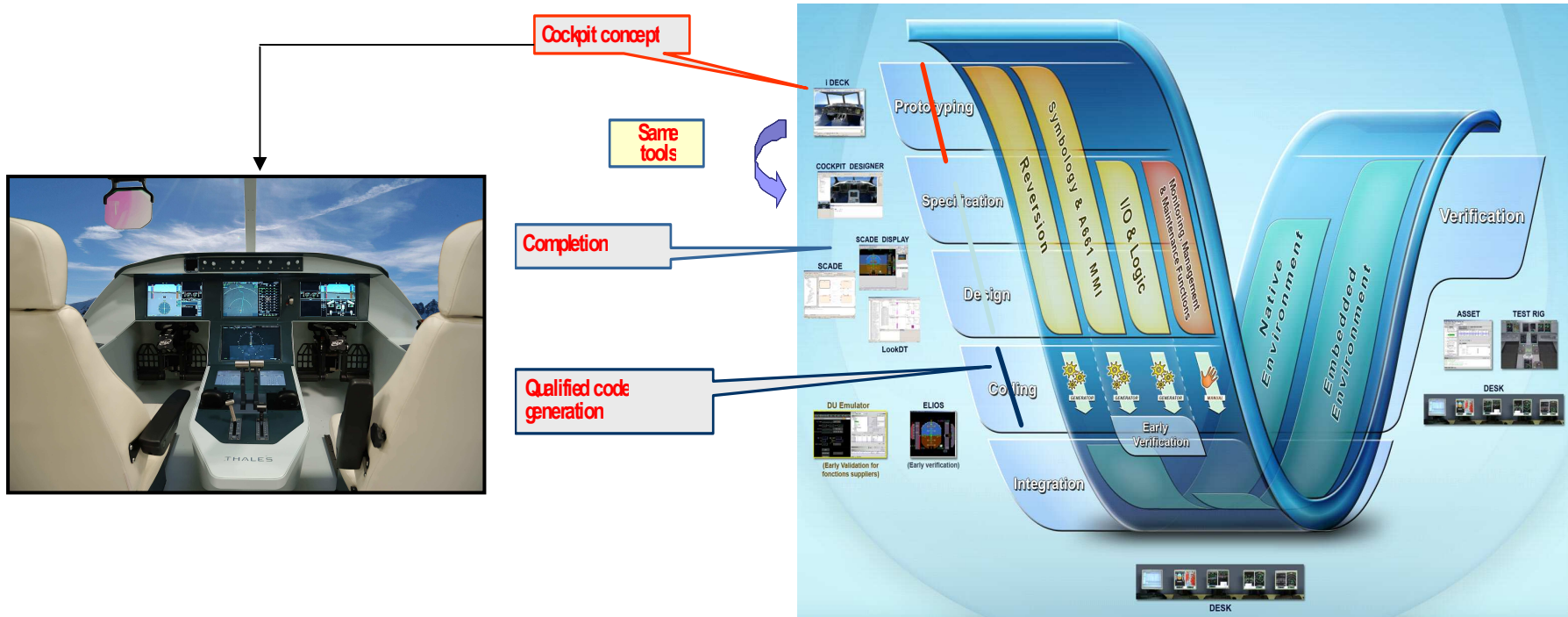
*i*Deck : improve innovation, competitiveness and maturity

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*i*Deck at the beginning of the «V development cycle»

- Improve requirement capture through short loop iterations with customers & users at the very beginning of the program
- Optimize continuity between specification and development using an appropriate continuous toolset

Start development earlier, with validated cockpit MMI and behaviour. Pilots, Engineers in-sync during early development phases

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Advanced Studies simulators	H/C Farnborough Airshow	S76 Dallas Heli Expo	*i*Deck / A350 version
A380 Bourget Airshow	A400M Bourget Airshow	RRJ Farnborough Airshow	*i*Deck / Advanced studies version

Platform & tools

iDeck : from "cockpit demo centre" to "cockpit design centre"

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Advanced Studies
Thales Bordeaux

A350 Program
Thales Toulouse

Topdeck vision
Customer facilities

A350
Farnborough Airshow

Business Jet
NBAA Orlando

*i*Deck : allowing rapid prototyping of specific cockpit solutions

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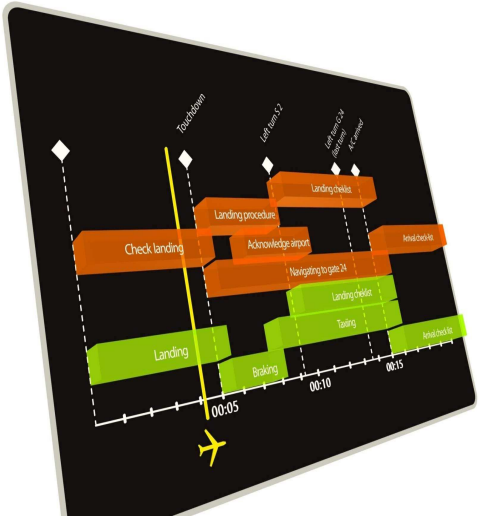
Empathic systems
Helping to anticipate

Adapting the cockpit to crew tasks, intentions and abilities

Personalization
Cockpit that takes crew and companies into account…

Research areas:
 - Pilot task analysis, intention detection, workload scheduling, cognitive resource management, anticipation of user errors, adaptive interfaces, incapacitation monitoring, biosensors…
- Multi-cultural (social & organizational), skill & training evolution, pilot sociological evolution, company procedures & culture, personalization vs. cross-crew qualification,…

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Dematerialization
Reducing device footprint and increasing display area

Direct interactions
Using natural human interaction skills (touch, feel, …)

Research areas:
- Flat projection, OLED display, pico-projectors, ePaper, flexible screens, high-performance/high integrity, wide eye-box HUD, compact optics
- Touch interaction patterns, haptic feedback, 3D view & interactions, personal viewers (in glasses), 3D sound, active noise reduction, gesture recognition, integrated biosensors
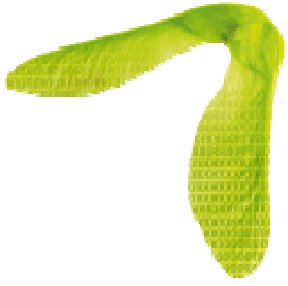
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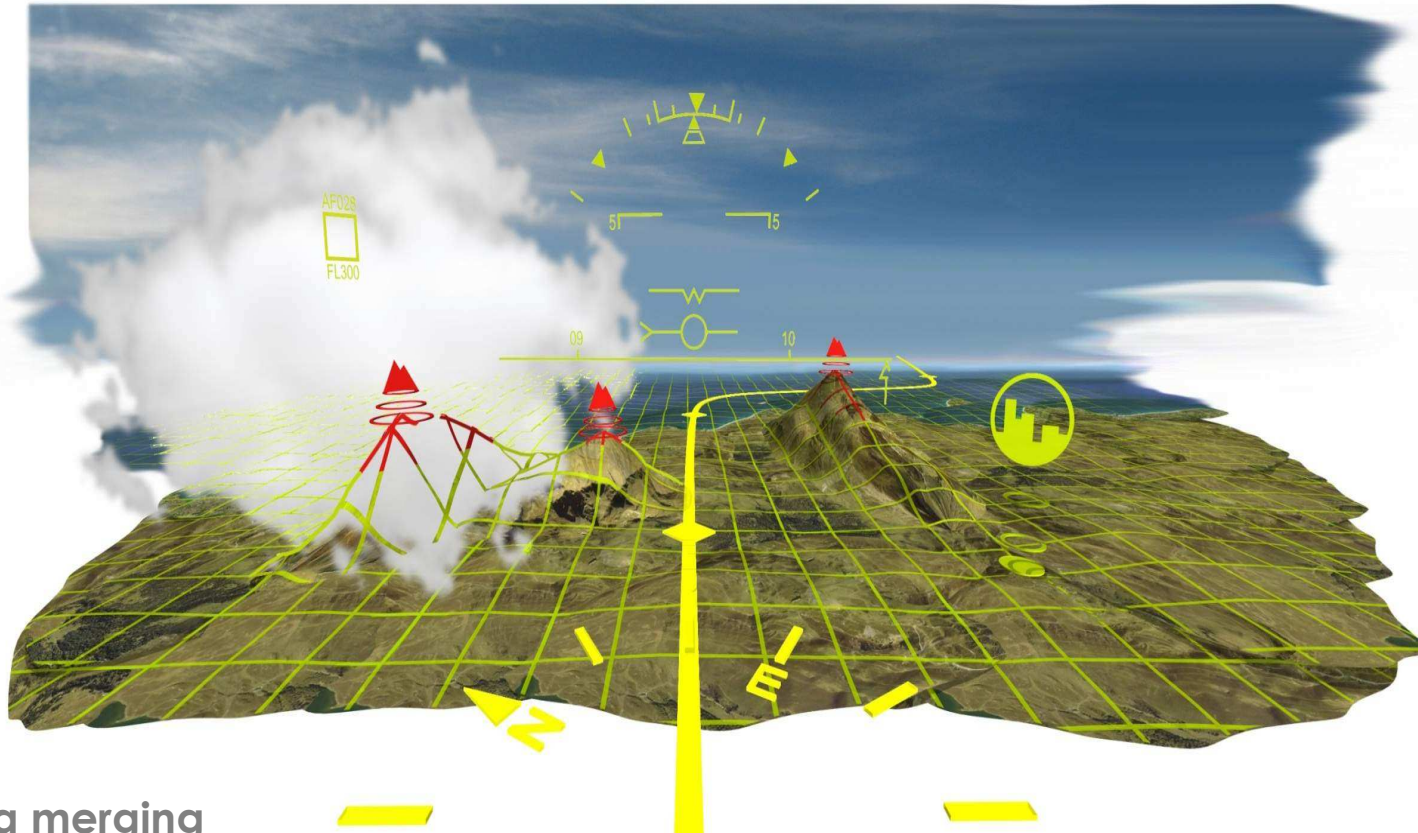
Data merging

A safe synthetic view to pilot, navigate and manage the mission

Research areas:
Safety critical display, sensor fusion, image processing, certified database, confidence, immersion, distributed situation awareness, 3D augmented reality, graphic data merging, sensors,…

> **THALES Civil Aircraft Training Solutions**

» Thales has 45 years of Full Flight Simulator design and production.

» Thales has the largest installed Customer base and has been consistently in the top two manufacturers of pilot training equipment

» Thales has a proud record of firsts in the industry

Total Thales Civil Simulators	617	1959 - 2007
Total Level D Certified	151	1979 - 2007
Total Level C Certified	103	1959 - 2007

Aircraft Type	Customer	CA Date
A300	First FFS for Airbus	1975
B757	First FFS for Boeing	1979
B767	First FFS for Boeing and TWA	1979
BAe 146	First FFS for BAe	1984
A320	First FFS for Airbus and American West	1985
B747-400	First FFS for Boeing	1986
A330/340	First FFS for Airbus	1989
B777	First FFS for United	1992
B737NG	First FFS for Lufthansa	1995
A380	First FFS for SIA	2007
B787	First FFS for Boeing	2007

A320 Simulator Cockpit

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Aircraft launch airline SINGAPORE AIRLINES are the world's first airline to have their A380 FFS and TFST certified for training 23 August 2008

THALES training solutions benefit from close synergy with THALES avionics

LUFTHANSA and MALAYSIAN AIRLINES have also chosen THALES to supply their A380 training simulators

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» *THALES Selected as Training Systems Supplier by SUKHOI/ALENIA*

**Contract signed
for 3 Full Flight Simulators**

SuperJet 100 Cooperation ⇨ The best evidence

THALES

Desktop Trainer
Maintenance Training

Flight Training Device

FFS

Briefing / De-Brief Station

Long term single source supply of training suites for the B787

- Full Flight Simulators
- Flat panel trainers
- Classroom simulation systems

Extensive support agreement covering availability of training equipment

- Software and hardware fault correction
- Spares, repairs, obsolescence management
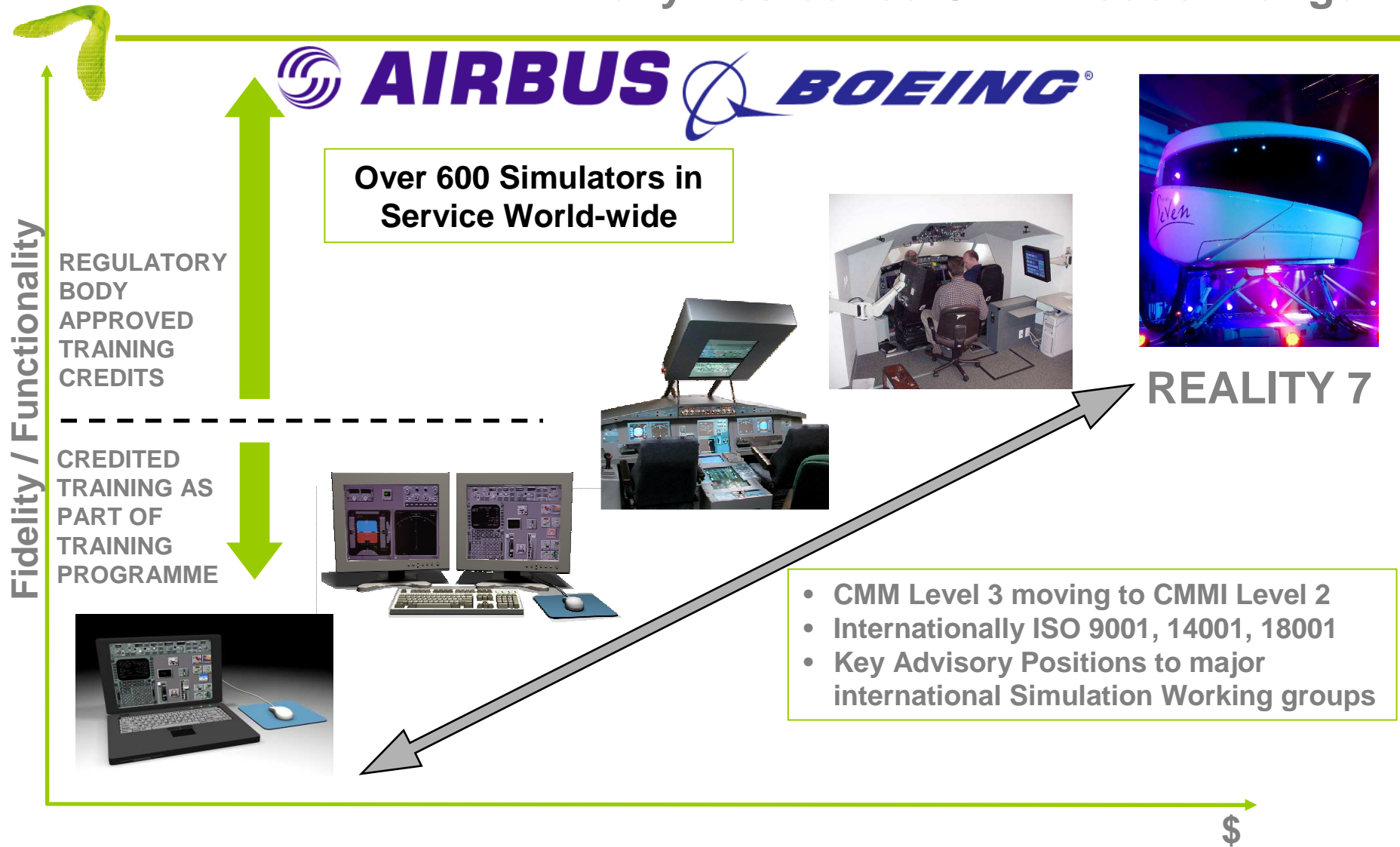- Update and engineering services

Availability based contracting model including lifecycle cost guarantees

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Fully Accredited Civil Product Range

Over 600 Simulators in Service World-wide

Fidelity / Functionality

REGULATORY BODY APPROVED TRAINING CREDITS

CREDITED TRAINING AS PART OF TRAINING PROGRAMME

REALITY 7

- **CMM Level 3 moving to CMMI Level 2**
- **Internationally ISO 9001, 14001, 18001**
- **Key Advisory Positions to major international Simulation Working groups**

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Integrated Product Range Delivers Cost Effective Training

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AVIONICS   AIR SYSTEM   TRAINING & SIMULATION

ENSURING THE SUCCESS OF OUR KEY CUSTOMER

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