Transforming the Flight Deck

Guy André Boy

https://en.wikipedia.org/wiki/Guy_Andr%C3%A9_Boy
The old approach...
Human Centered Design
Human-Systems Integration…
Predicting the fatal flaws:
can we do things differently in aviation safety?
Predicting the fatal flaws: can we do things differently in aviation safety?

Yes, if you have a linear model…
No, if you don’t!
Prediction vs. Projection...
Prediction vs. Projection...

... Testing possible futures
First, the best way to predict the future is to invent it, because we can then say, “the future’s there for us to shape — we’re not helpless.” As long as we don’t violate too many of Newton’s laws, we can probably make new technology work out. We should decide what we want and then make it happen.

— Alan Kay
Flight tests
Modeling and Simulation

Human-In-The-Loop Simulation
Agile virtual engineering…

… and Human-Centered Design
Design rationale $\rightarrow$ Requirements/Statements
Design decisions $\rightarrow$ Solutions

Prototype

Integration into existing environment

Human-in-the-loop simulation

Formative evaluation $\rightarrow$ Testing results
Onboard Weather Situation Awareness System

- 2.5D and 3D visualization with integration of flight path, flight waypoints, NEXRAD data, hazardous weather (represented by cylinders) (1);
- Hazardous weather avoidance (2);
- Automatic trajectory recalculation (3).
Onboard Weather Situation Awareness System

From Tactical to Strategic
Onboard Weather Situation Awareness System
Tangible Interactive Systems…

… Synthesis and Integration

Realistic scenarios & simulations + professional pilots → Good HCD
FUEL LEAK

A fuel leak may be detected by either:

- the sum of the FOB and the F USED is significantly less than the FOB at departure, or
- passenger observation (fuel spray from engine or wing tip), or
- total fuel quantity decreasing at an abnormal rate, or
- fuel imbalance, or
- a tank emptying too fast (leak from engine or a hole in a tank), or
- a tank overflowing (due to a pipe rupture in a tank).
- excessive fuel flow
- fuel smell in the cabin

LAND ASAP

WHEN A LEAK IS CONFIRMED

■ LEAK FROM ENGINE:

- THR LEVER (of affected engine) .................. IDLE
- ENG MASTER (of affected engine) .................. OFF
  The Xfeed valve can now be selected open for rebalancing or to allow use of the fuel from both wings. Do not restart the engine.

■ LEAK NOT FROM ENGINE or LEAK NOT LOCATED

- FUEL X FEED ..................... AUTO
  The Xfeed valve must remain closed to prevent the leak affecting both sides. Selecting AUTO maintains the X-feed valve closed.
- L + R INR TK .................. SPLIT
  Shut INR TK SPLIT valve to isolate fuel leak.
- DESCEND TO GRVY FUEL FEEDING CEILING
  See GRVY FUEL FEEDING procedure.
- ENG START SEL .................. IGN
- ALL TK PUMPS (when gravity ceiling is reached) ...... OFF
  In almost all cases, switching the pumps off will prevent any further loss of fuel. All pumps must be switched off, even if the leak is from one wing only, as there are some failures on one side that will result in fuel loss from the other side.
- AVOID NEGATIVE G FACTOR

- If one engine flames out when there is still fuel in the feeding tank:
  - LEAK FROM ENGINE proc .................. APPLY
  - ALL TK PUMPS .................. ON
  NOTE: The flameout is due to air suction from a leak from the engine.

FOR LANDING

CAUTION

Do not use reverse.
Notify ATC.

NOTE: Even with a fuel imbalance of one lower tank full/or inner tank empty there is no
normal procedure needed for approach and landing.
Onboard Context-Sensitive Information System
OCSIS as a team player...

... exploiting the multi-agent framework
Develop creativity spaces…
Participatory design
20th century

From Hardware to Software

Incremental Accumulation of Artificial Functions into Structure...

Automation & User interface
20th century automation

Means (Concrete structure) → Purpose (Functional usability)

21st century tangibility

Purpose (Virtual function) → Means (Tangible experience)
From Software to Hardware

Hardware

New Stuff...

Software

Modeling
Simulation
Connectivity
Orchestration
3D Printing
...

Tangible
Interactive
Systems (TISs)

21st century
Disciplinary Evolution

Human Factors and Ergonomics (Human-Machine Interfaces)

- HFE experts correct engineering productions

Human-Computer Interaction

- From corrective ergonomics to interaction design

Human-Systems Integration

- Systems engineering and HCD combined
## Task vs. Activity

|-------|-------|-------|-------|-------|-------|-------|

1. **Observe activity when everything is built**
   - **HFE** (corrective ergonomics)

2. **Analyze and take into account tasks at design time**
   - **HCI** (interaction design)

3. **Observe and take into account activity at design time**
   - **HSI** (SE + HCD)
People

Human Centered Design

Technology

Organizations

Modeling and Simulation (Creativity)
Human-Systems Integration (Participatory Tests)
Complexity Management (Maturity)
Change management (Training)
Orchestrating Interactive Systems
FIT HCD graduate school...
Human-Centered Design

- Creativity Design Thinking
- Advanced Interaction Media
- Modeling and Simulation
- Usability Usefulness Engineering
- Life Critical Systems
- Complexity Analysis for HCD
- Function Analysis
- Cognitive Engineering
- Organization Design and Management
- Industrial Design
The time has come to move into a more humanistic approach of technology and to understand where our world is moving to in the early twenty-first century. The design and development of our future products needs to be orchestrated, whether they be conceptual, technical or organizational. Orchestrating Human-Centered Design presents an Orchestra model that attempts to articulate technology, organizations and people. Human-centered design (HCD) should not be limited to local/short-term/linear engineering, but actively focus on global/long-term/non-linear design, and constantly identify emergent properties from the use of artifacts.

Orchestrating Human-Centered Design results from incremental syntheses of courses the author has given at the Florida Institute of Technology in the HCD PhD program. It is focused on technological and philosophical concepts that high-level managers, technicians and all those interested in the design of artifacts should consider. Our growing software-intensive world imposes better knowledge on cognitive engineering, life-critical systems, complexity analysis, organizational design and management, modeling and simulation, and advanced interaction media, and this well-constructed and informative book provides a road map for this.
Thank You!...
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