



Design For Innovation In ATM

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EUROCONTROL | CARE Innovative Action | CREA! project 2002-2004



PROJECT GOALS

The CREA! project (Creative Research Environment for ATM) was carried out between 2002 and 2004 with a twofold aim:

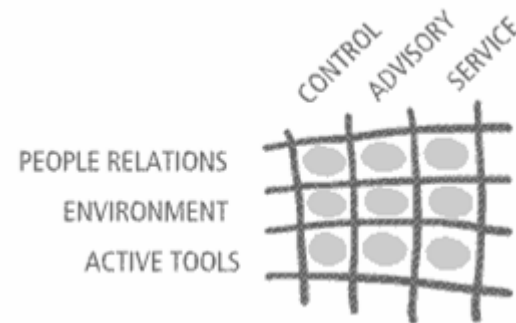
- To develop **innovative concepts** for future Air Traffic Management (ATM) scenarios
- To develop a **design approach** for creative design in complex systems



VISION

Transition from the current ATM scenario to more visionary and futuristic scenarios:

- the *control scenario*: the current situation where air traffic controllers act mainly as air traffic managers.
- the *advisory scenario*: an envisaged future free flight situation where the responsibility of traffic management is mainly moved on board and the controllers play an advisory and support role to the pilots.
- the *service scenario*: a completely futuristic scenario where the traffic management is decentralized and totally moved on board and ATCOs become “service and information brokers”.



STATE OF THE ART

Problem Solving

Innovation in complex domains is constrained by a problem solving view, neglecting other factors such as aesthetics, affective, cultural and emotional aspects of human cognition.

Emphasis is put on analysis and problem solving rather than on design.

- Standards, regulations and the difficulties of envisioning truly futuristic scenarios often constraint creativity and orient towards conservative solutions.

Alternative Solutions

The development of innovative outcomes is regarded as an activity of searching for alternative solutions within the constraints of the problem solving analysis.



CREA! APPROACH

Interdisciplinary Approach

- CREA! leverages creativity in action in artistic domains and offers a process model to integrate a variety of suggestions into integrated solutions.

Co-evolutionary Process

- Concept design, technology design and activity design are carried out in parallel so that each strand of the process could inform the others

Design Team

- Human Factors experts, artists and designers representatives of a range of disciplines from visual and multimedia arts with a focus upon music, architecture, visual design and interaction design.



CREA! APPROACH

Divergence

Boundaries of a design situation are extended so as to have a large enough, and fruitful enough, search space in which to seek a solution.

- Objectives are general and tentative
- Problem boundaries are instable and undefined
- Evaluation is deferred
- The initial brief is expected to be revised and evolved

Designers deliberately increase their uncertainty, getting rid of preconceived solutions and being inspired by a mass of information that may be relevant.



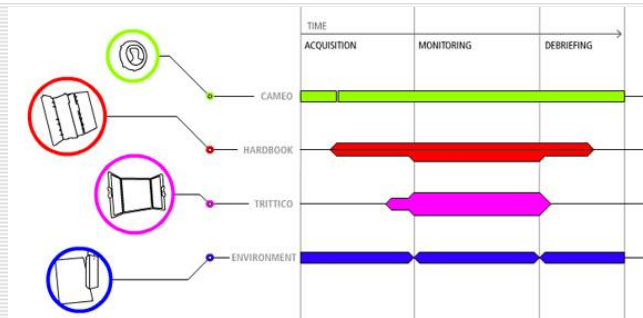
CREA! APPROACH

Convergence

Initial uncertainties are progressively reduced until one or a few of many possible alternative designs are left to be further elaborated.

The main features of convergence are:

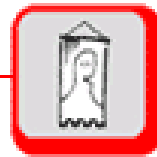
- Application of structured and systematic methodologies for evolving high level concepts into concept scenarios.
- Unforeseen sub-problems are anticipated with iterations on the soundness of concepts.
- The activity models used to represent the alternative solutions should now be sufficiently detailed to sustain the evaluation with end users.



ENVISIONED DESIGN CONCEPTS

a personal ID tool that allows to set up the system according to individual preferences and to manage the communication process

CAMEO



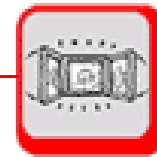
FLAG

a public display that can be used to extend the action/communication area of the single user and supports awareness by visualizing the processes



HARD BOOK

a personal tool that permits both to focus on specific processes and to share info and activities with the others



TRITTICO

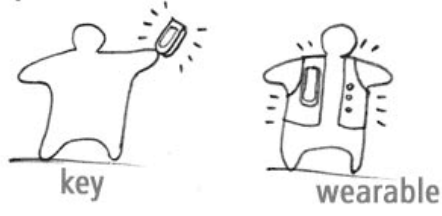
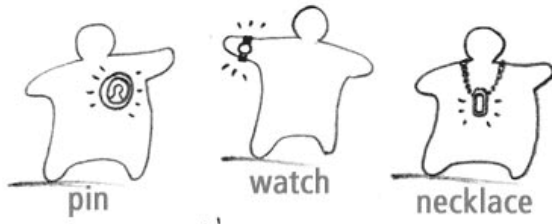
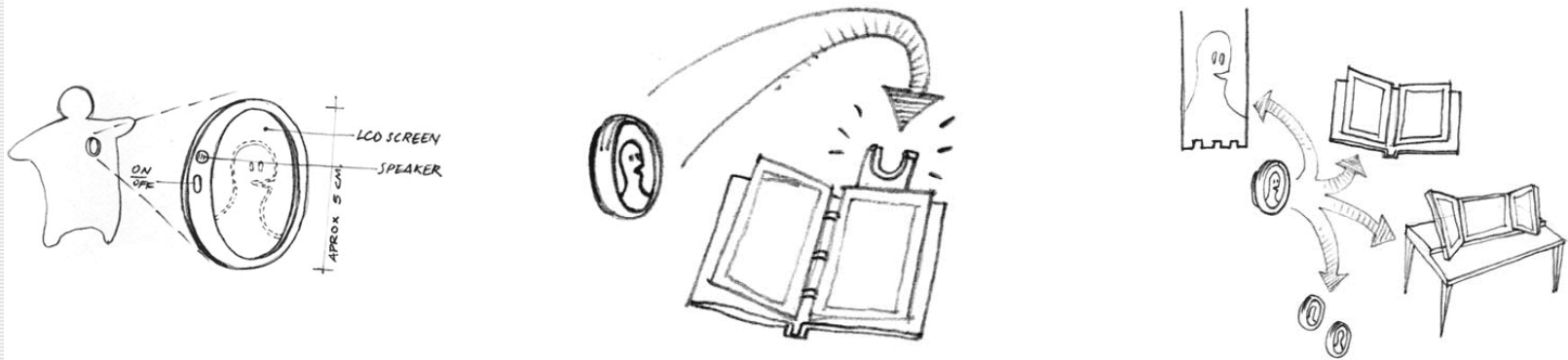
the main interface for the operational work



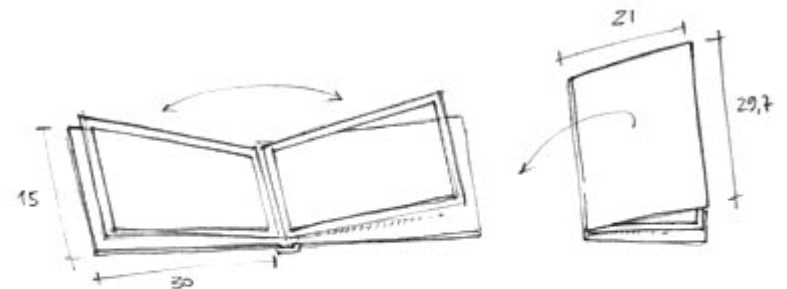
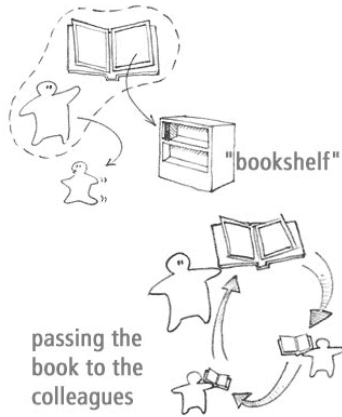
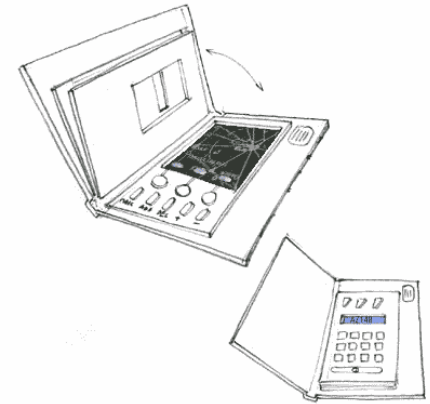
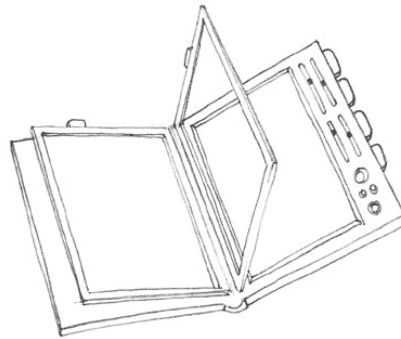
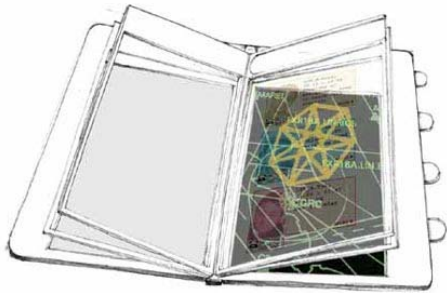
OSMOSIS SKIN

flexible and adaptable partitions to organize working and resting areas

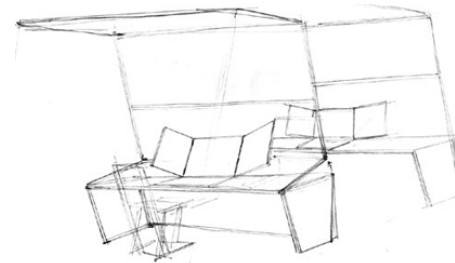
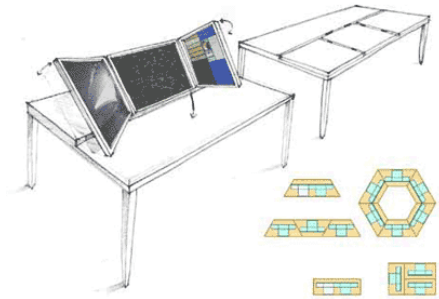
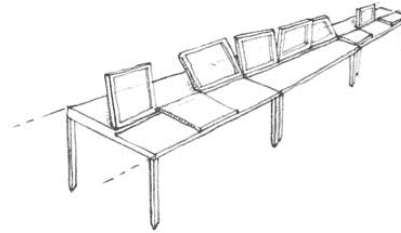
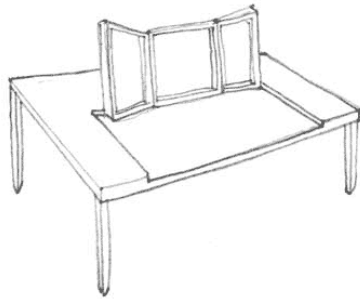
THE CAMEO



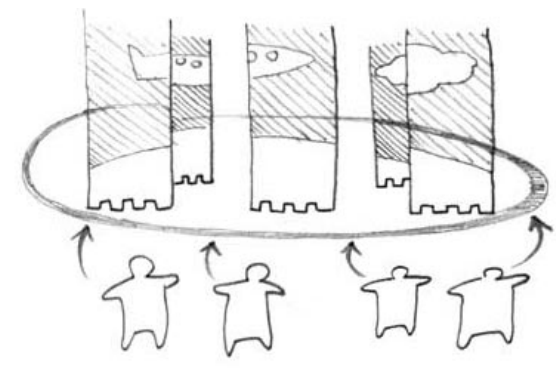
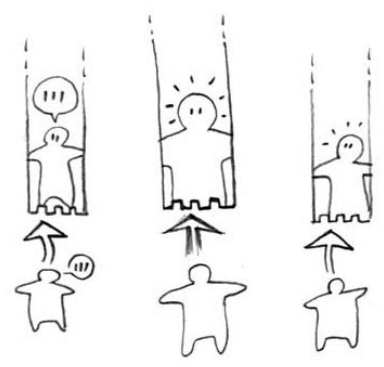
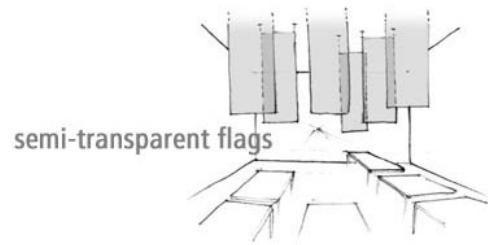
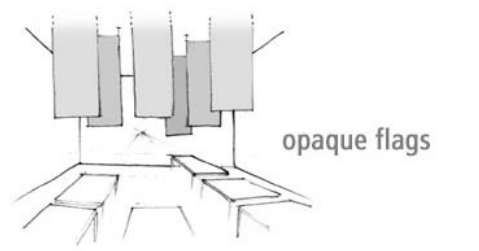
THE HARDBOOK



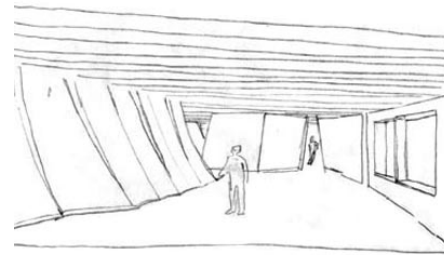
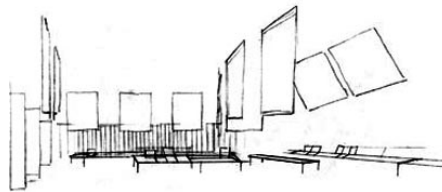
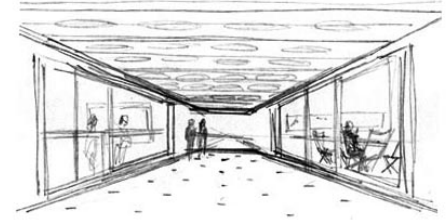
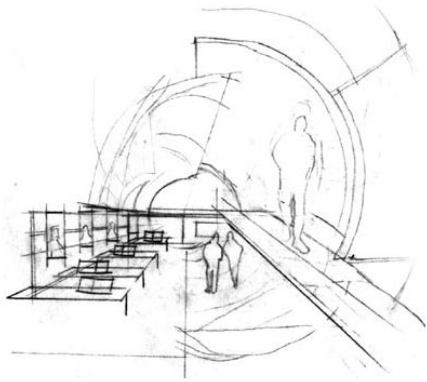
THE TRITTICO



THE FLAGS



THE OSMOSIS SKIN



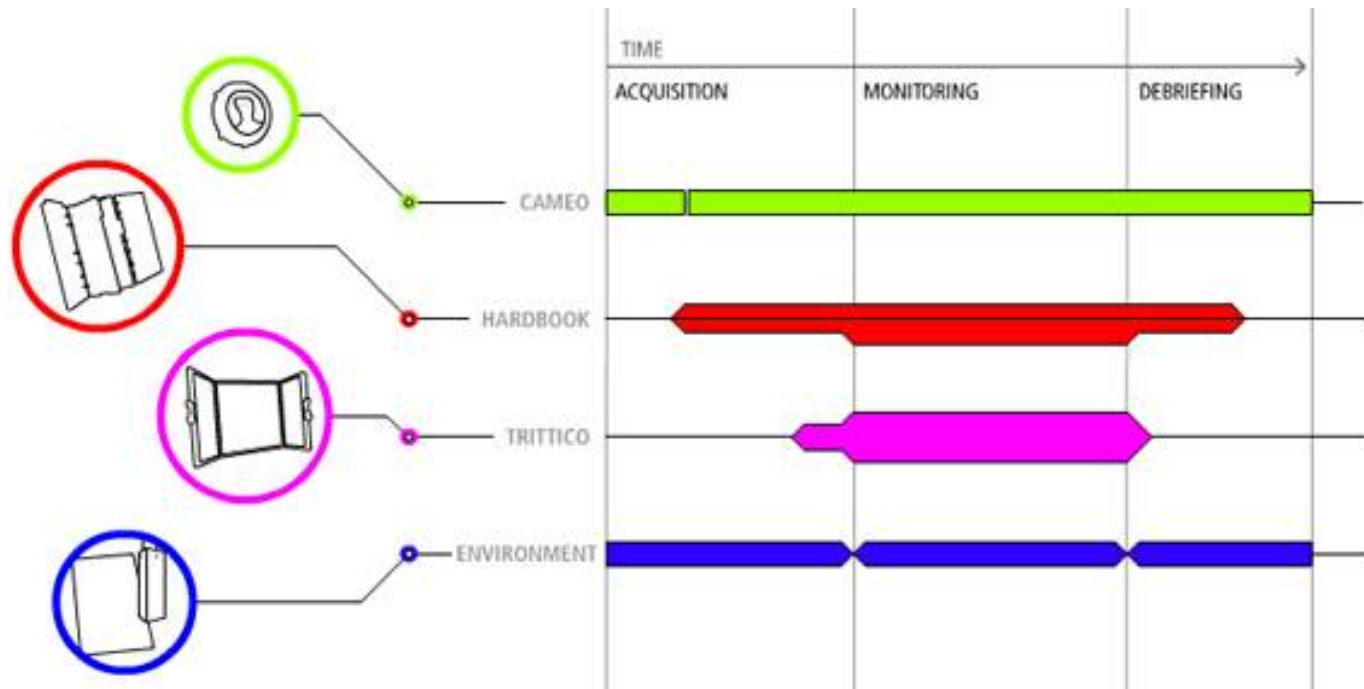
FINAL CONCEPTS



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ACTIVITY MODEL



SCENARIOS

From convergence to the system development, scenarios are used to guide the next stages of the design process, in particular they are used

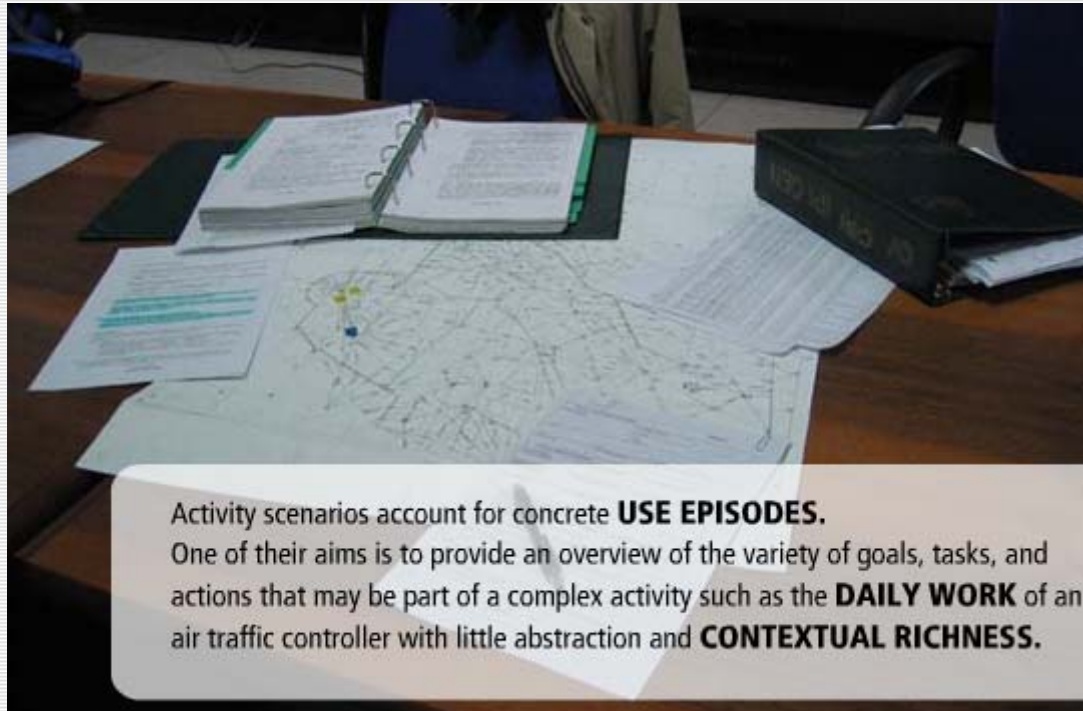
- To structure data gathered through activity analysis,
- To envision system role and functionalities,
- To assess and validate envisioned solutions.

Five categories of scenarios are used in the CREA! approach:

- Activity Scenarios
- Envisioning Scenarios
- Mock-up Scenarios,
- Prototype Evaluation Scenarios
- Scenarios of Integration



ACTIVITY SCENARIOS



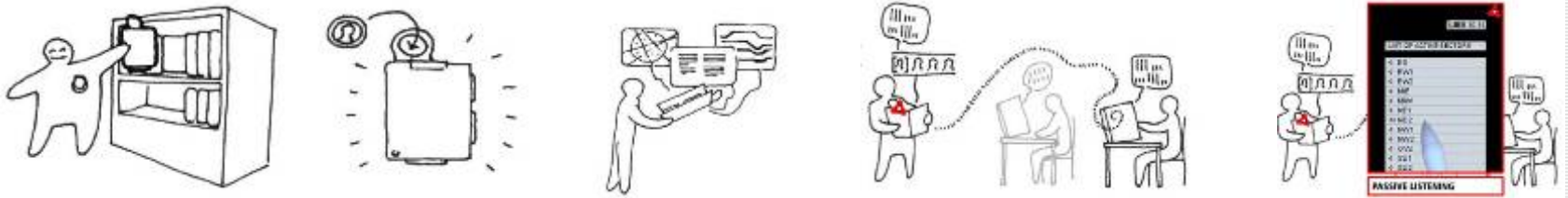
Activity scenarios account for concrete **USE EPISODES.**

One of their aims is to provide an overview of the variety of goals, tasks, and actions that may be part of a complex activity such as the **DAILY WORK** of an air traffic controller with little abstraction and **CONTEXTUAL RICHNESS.**



SCENARIOS

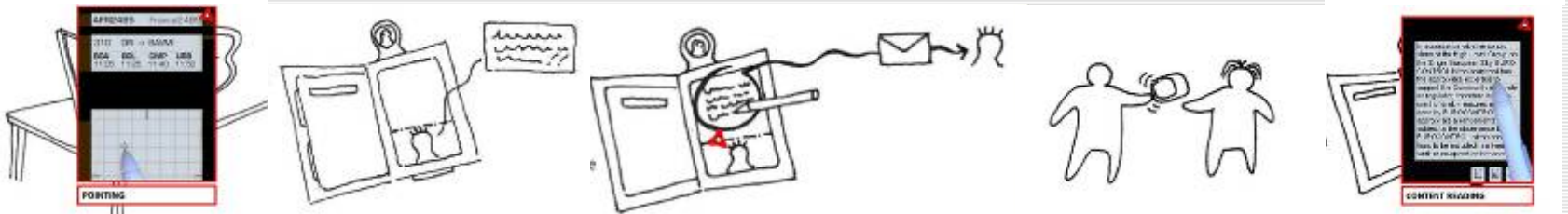
AQUISITION



Personal Identification

Information Aquisition

MANAGEMENT



Pointing

Audio messaging and written communication

Turn Shift

Content reading

DEBRIEFING

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THE HARDBOOK MOCK-UP



EVALUATION WITH ATCOs



AIR TRAFFIC CONTROLLERS INTERACTING WITH A CARDBOARD MOCK-UP OF THE HARDBOOK



SCENARIOS

AQUISITION



Adjusting physical configuration of CWP

MANAGEMENT

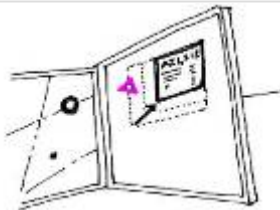


Activating CWP, loading personal settings, and use the Handbook as a pointing device



Spatialised sound

DEBRIEFING

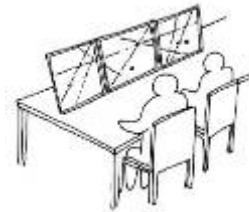


Window resizing

Different configuration to adapt to different activities



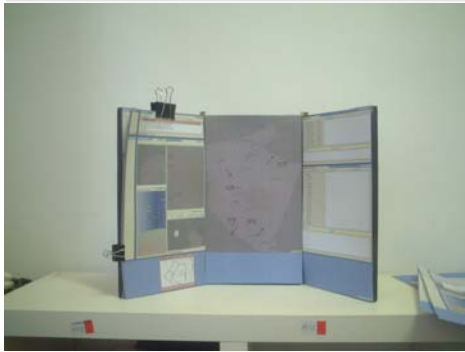
Enlarging radar screen to support turn shift



Content reading

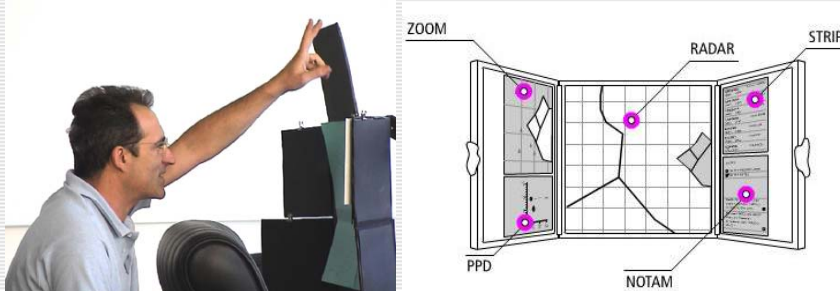


THE TRITTICO MOCK-UP



MOCK-UPS & SCENARIOS

Mock-ups were iteratively refined on the basis of the feedback collected through evaluation sessions, progressively specifying interfaces



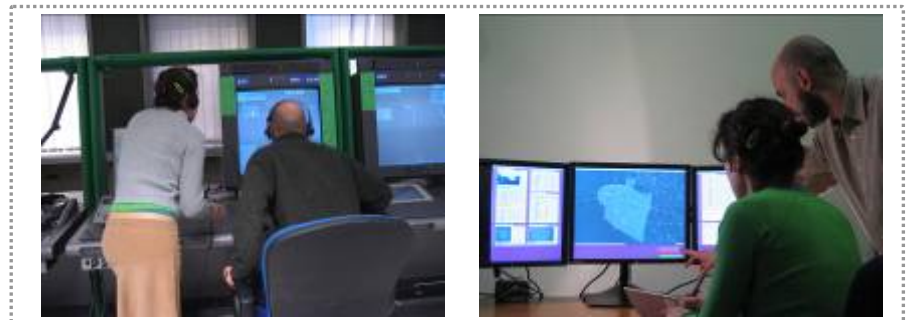
SCENARIO OF INTEGRATION



A "WIZARD OF OZ" TESTING SESSION



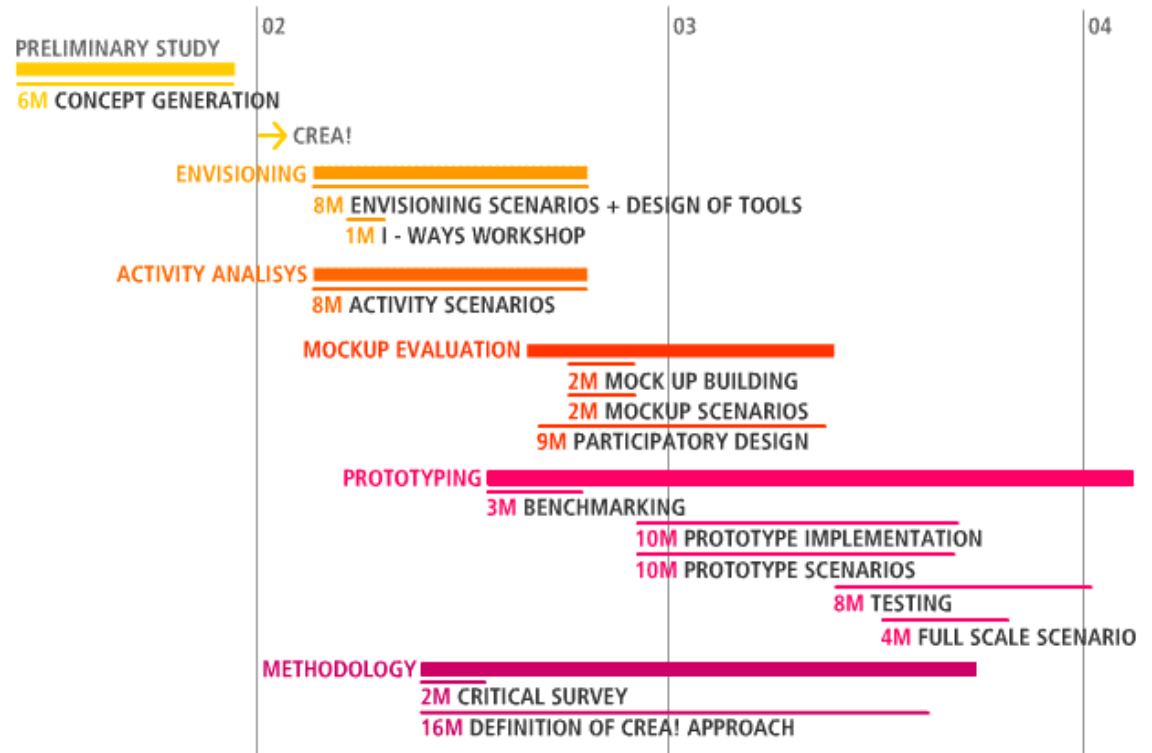
INFORMATION ACQUISITION



TURN SHIFT



CONCLUSIONS



24 man months

6 designers

6 Air Traffic Controllers

3 External experts (visual designer, architect and musician)

CONCLUSIONS

