



# CONTRACT-BASED AIR TRANSPORTATION SYSTEM (CATS)

## Concept & Work Plan

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# Introduction



- Air Traffic in Europe is expected to triple till 2020
- Air Traffic Management (ATM) system currently in operation will not be able to cope with such growth figures

- Need for more capacity, efficiency, safety and cost-effectiveness
- Radical changes are required to fulfil these requirements

**→ Contract-based Air Transportation System**

# Current Situation



- Air transport supply chain involves e.g.
    - Airports
    - Airlines
    - Air Navigation Service Providers (ANSPs)
  - Different interests and objectives
    - ANSPs' prime objective is safety
    - Airlines' main objectives are punctuality & costs
  - Actors optimise their processes locally
    - in accordance with their own constraints
    - not considering the global objectives
- Highly collaborative and system-wide approach shall be applied for optimising the overall ATM system

# CATS Approach



- Transition from means-based to performance-based management (contract-based system)
- Ground and airborne segments will be integrated more closely
  - Respecting schedule
  - Improving efficiency
  - Enhancing interoperability
- **Contract of Objectives (CoO)** will be concluded among all involved actors through CDM
  - New way for performing ATM by mutually agreed objectives

# Project Background

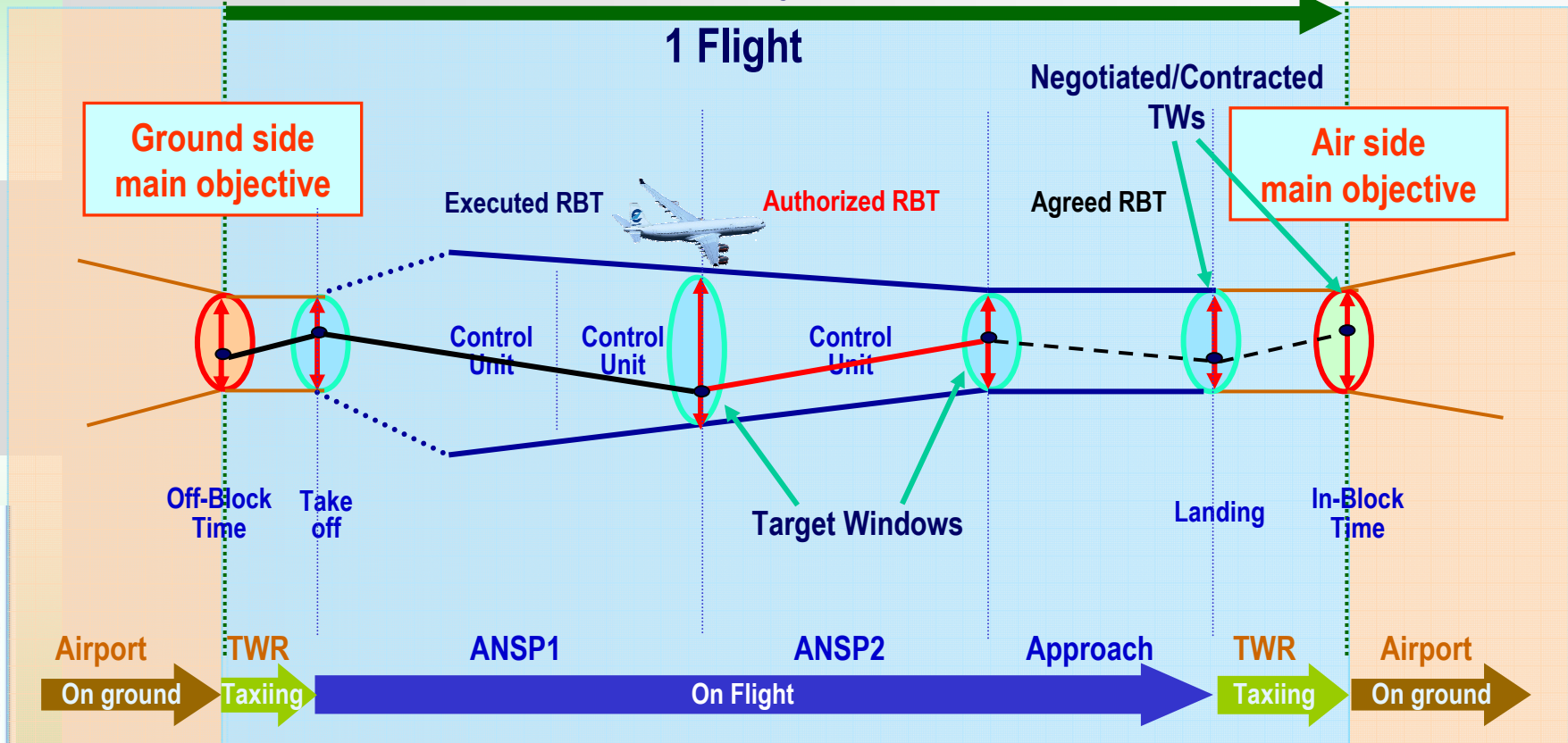


- Proposal for an innovative ATM solution capable of
  - coping with the expected traffic figures (beyond 2020)
  - improving the efficiency of the European Air Transportation System
  
- CATS shall be in line with main SESAR objectives, namely:
  - eliminating the fragmented approach of ATM
  - synchronizing the plans and actions of the different partners within a consistent and explicit framework
  - federating resources through a more closely integration of the ground and airborne segments

# CATS Concept - Overview



Contract of Objectives = RBT

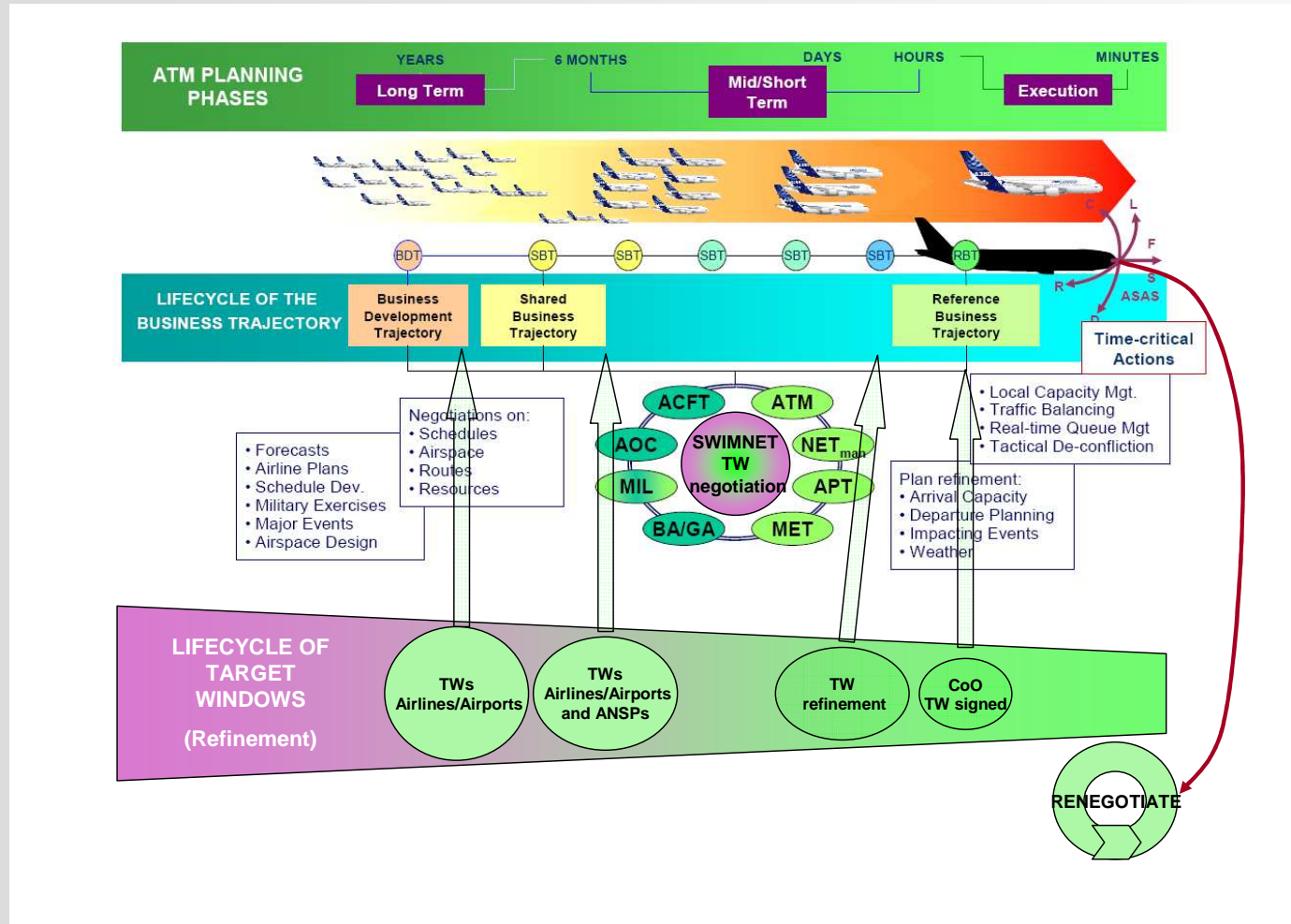


# CATS Concept – Overview



- Aim of the CoO is to create an operational link among all air navigation actors
  - Formal and collaborative commitment
    - to adhere to well-defined, shared and agreed objectives
- CoO is composed of many **Target Windows (TWs)**
  - temporal and spatial intervals in 4D
  - located at transfer of responsibility areas
  - agreed by all involved actors
  - link between planning and execution phases
- Enhanced collaboration will improve the system's efficiency and predictability
  - Punctuality at destination
  - Best utilisation of scarce resources

# CATS Concept – TW lifecycle



# Drafting the Contract of Objectives



- Assignment of responsibilities based on
  - Individual requirements of the flight
  - Global requirements of the ATM system and involved actors
- Drafting process comprises three phases:
  - Phase 1: Airport resource management
    - ▶ Airports and airlines
    - ▶ Examining runway capacities, in order to bring the resources into line with airline demand on the date when the requested flights are to be performed
  - Phase 2: Resource management and anticipation of disruption
    - ▶ Airports, airlines and ANSPs (CDM process)
    - ▶ Incorporation of known or probable medium-term disruptions
  - Phase 3: Disruption management
    - ▶ The “Contract of Objectives“ incorporates the most recent data and any current disruptive factors which will affect future traffic.
    - ▶ The " Contract of Objectives " is issued shortly before off-block time at the airport.
    - ▶ After that time, the Target Windows are fixed.

# CATS Concept – Target Windows



- Calculation of Target Windows sizes and locations considers several constraints, e.g.
  - runway capacity,
  - congested en-route areas,
  - aircraft performance,
  - requirements of the airlines, etc.
- TWs sizes allow for intervention
  - room for manoeuvre in case of disruption
  - conflict management
- TW imposes constraints only if necessary
- Uncertainty is always evident and can never be fully erased
  - Difference between planning and execution
- CATS concept proposes to manage this uncertainty via the size of TWs

# CATS Concept – Renegotiation



- If for any reason a TW cannot be kept
- Collaborative Decision-Making (CDM) Process
  - Agreeing on the new TWs
  - Considering all actors' constraints
  - Supported by System Wide Information Management (SWIM) network
  - Aiming to respect punctuality at destination
  - Resulting in a new agreed CoO
- Three principles are applicable:
  - Safety and emergency
    - Aircrew and ATCo take an appropriate decision
    - No CDM process applied
  - Target Window cannot be kept, affecting only two actors
    - “Quick” renegotiation involving only these two actors
    - Result is published by using SWIM infrastructure
  - Target Window cannot be kept, affecting more than two actors
    - Renegotiation involving all actors across the supply chain applying a CDM process to achieve the best possible business outcome

# Project Overview – Key facts



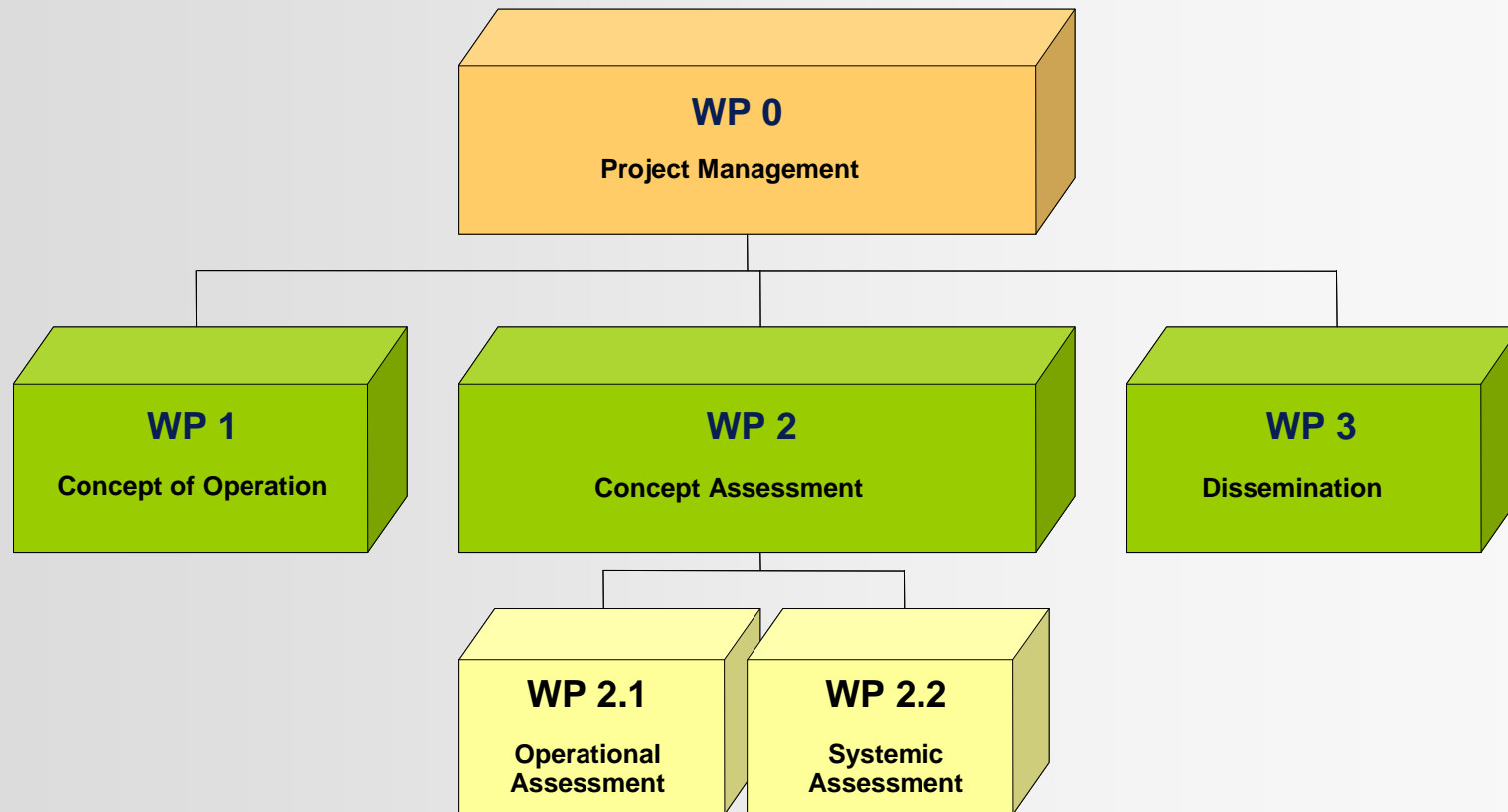
- FP6 project, co-funded by the European Commission
- Project duration: 11/2007 to 10/2010

- 9 Partners

- Frequentis AG
- EUROCONTROL
- Air France Consulting
- University of Leiden
- SkySoft ATM
- Unique – Zurich Airport
- ETH – Eidgenössische Technische Hochschule Zurich
- University of Trieste
- ENAV – Italian ANSP



# CATS Work Breakdown Structure



# Project Overview – Aims



- Define and assess the CoO and Target Windows involving all actors in the supply chain
- Assessment is conducted by two means:
  - Operational Assessment (3 HIL experiments: small-scale prototyping sessions)
    - ▶ Controller-Controller
    - ▶ Controller-Aircrew
    - ▶ Renegotiation involving
      - Controller (ANSP)
      - Aircrew (Airline), and
      - Airport
  - Systemic Assessment
    - ▶ Safety and Risk Assessment
    - ▶ Cost benefit Assessment
    - ▶ Legal Assessment

# Project - HIL Experiments



- First HIL experiment was conducted in from October 20<sup>th</sup> to October 31<sup>st</sup>, 2008 in Geneva at SkyGuide premises
- Second HIL experiment it planned to be conducted in the same timeframe 2009 again in Geneva

# Expected Benefits



- All in the ATM chain involved stakeholders know the objectives and priorities of the other actors
- Compliance with Target Windows could be evaluated and further used as metric for the quality of the service
- CoO is one of the many possibilities to implement SESAR's Reference Business Trajectory (RBT) aiming to achieve
  - More punctuality at destination
  - Optimisation of scarce resources
  - Improved predictability
  - Reduced overall costs
  - Taking into account environmental impacts

# Expected Results



- New Operational Concept
- Assessment of that Concept
  - 4 KPAs (derived from SESAR) are used for CATS validation
    - Safety
    - Capacity
    - Efficiency
    - Predictability
- Target Window Models
- Economic Models resulting from cost benefit analysis
- Collaborative Platform for multi-actor experiments

# Summary



- Implementation of Contract of Objectives aims to
  - Increase punctuality at destination and departures at airports
  - Reduce costs for the overall Air Transportation System
- CoO is independent of the economical models of the actors.
  - It allows for linking of divergent economical models, ensuring effective organisation of each of them.
- CoO allows for all traffic management operational methods (structured routes, free routes, current ANSPs, FABs, etc.)
  - Formalizing contract (at the transfer of responsibility area) between the various actors
  - Presenting it on all operators' working positions
- **Currently the ATM through CoO is still a concept!**
- The proof of concept is currently performed by the CATS consortium

