

*Airborne New and Advanced Satellite techniques and Technologies in A  
System Integrated Approach*

# **ANASTASIA**

## **Communications Workshop**

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Toulouse**

## Contents

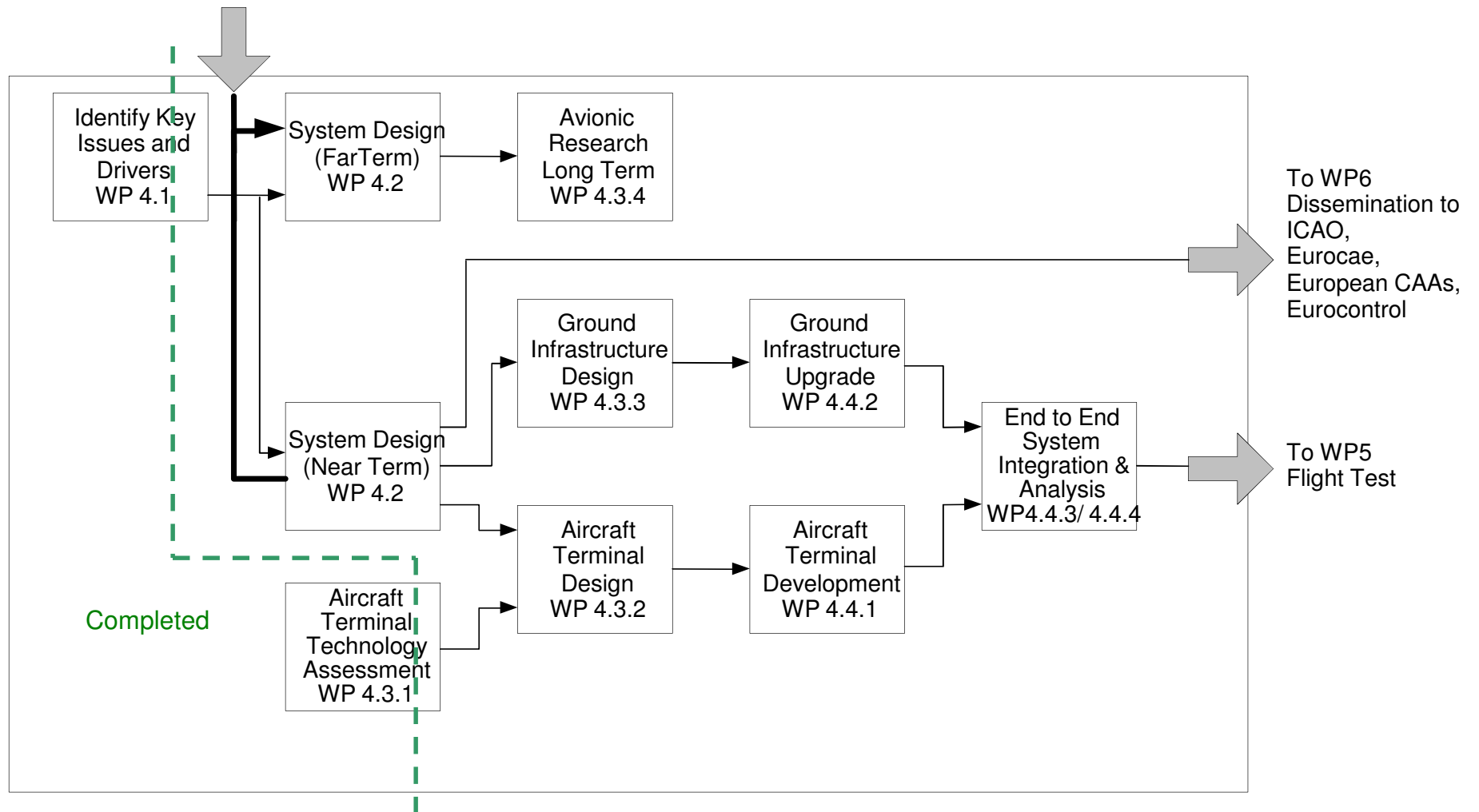
- **SP4 Communications Sub-Project description**
- **Satellite system alternatives**
- **Future Aircraft Implementation choices**

## SP4 Communications Objectives

- **Design, implement and demonstrate a prototype of an affordable aeronautical SATCOM system that will meet evolving ATM requirements.**
- **Based on current or near-term planned space segment.**
- **Research the system design and economics of a far-term space-based SATCOM system capable of ATM**
- **Research antenna design to increase bandwidth, and reduce size, weight and cost.**

# Communications Sub-Project Structure

Comms, Nav & Surveillance  
Requirements from WP2



## SP4 Partners and Main Activities

<b>Airbus France</b>	<b>System design including aircraft architectures and reviewing/advising on aircraft terminal design</b>
<b>Inmarsat</b>	<b>System design, ground infrastructure</b>
<b>DLR</b>	<b>Review of technology/systems, system design</b>
<b>Airbus Germany</b>	<b>System design including aircraft architectures and reviewing/advising on aircraft terminal design</b>
<b>Thales Avionics UK</b>	<b>SP4 coordination, aircraft terminal design, end to end integration</b>
<b>Astrium</b>	<b>Review of technology/systems, system design</b>
<b>EADS-CCR</b>	<b>Long term research (antennas)</b>
<b>NLR</b>	<b>Long term research (antennas)</b>
<b>University of Surrey</b>	<b>Review of technology/systems, system design, end to end integration</b>
<b>Gatehouse</b>	<b>Aircraft terminal design/development</b>
<b>TGS</b>	<b>Commercial analysis, long term research</b>
<b>Thales Research &amp; Technology</b>	<b>Aircraft terminal design/development</b>
<b>Wireless Intelligent Systems</b>	<b>System design, ground infrastructure</b>

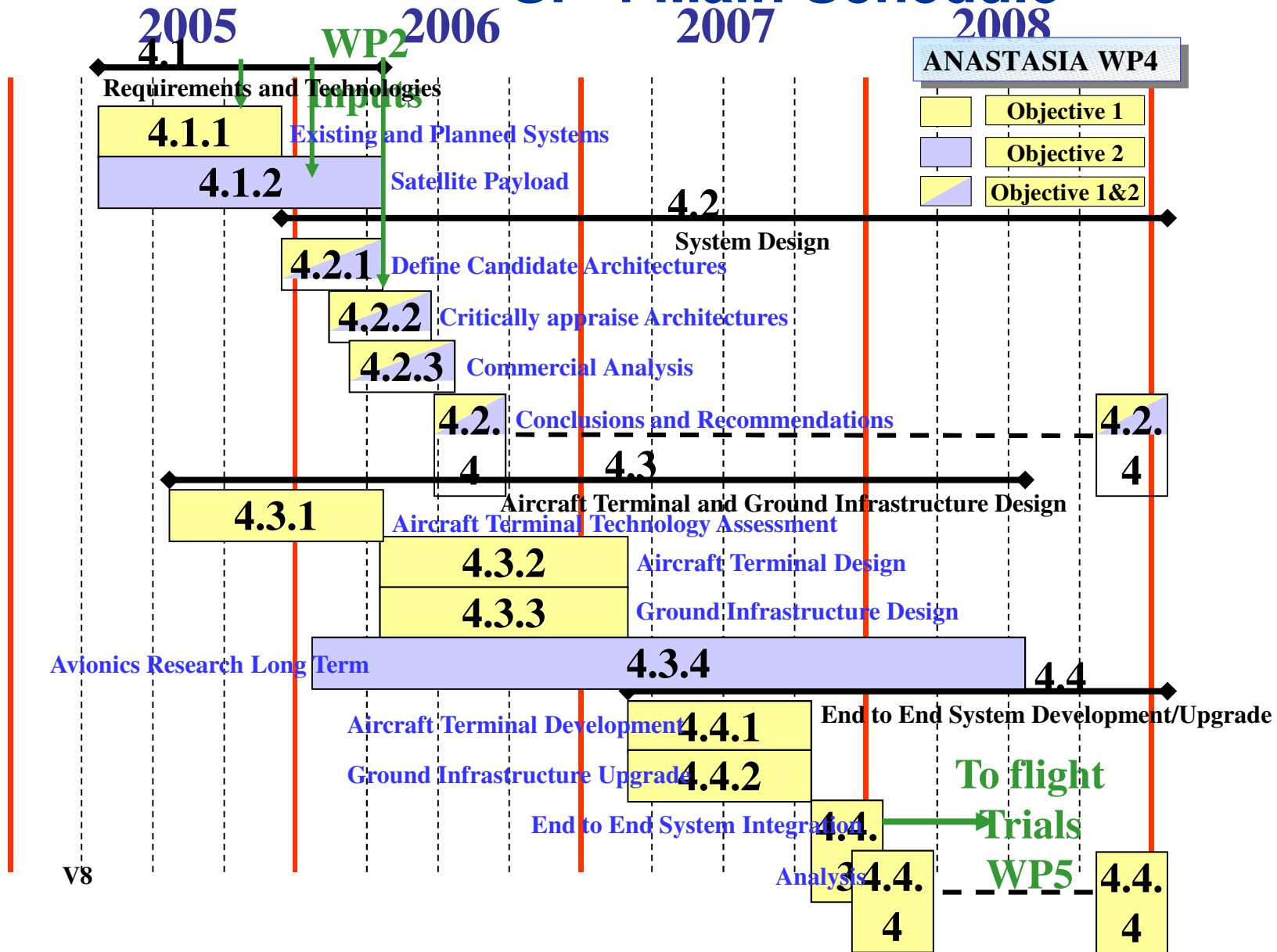
## **SP 4**

# **Main Outputs**

- **WP 4.1 : Analysis of requirements and satellite technologies/systems**
- **WP 4.2: Definition and critical technical/commercial analysis of 2 near term and 2 far term satellite systems**
- **WP4.3: Aircraft terminal and ground infrastructure design of one of the near term systems. Longer term research (multifrequency antennas)**
- **WP4.4: Aircraft terminal and ground infrastructure development/upgrade. End to end integration over satellite link ready for flight test in WP5.**

**Demonstration of aeronautical satcom system for European ATM**

# SP 4 Main Schedule

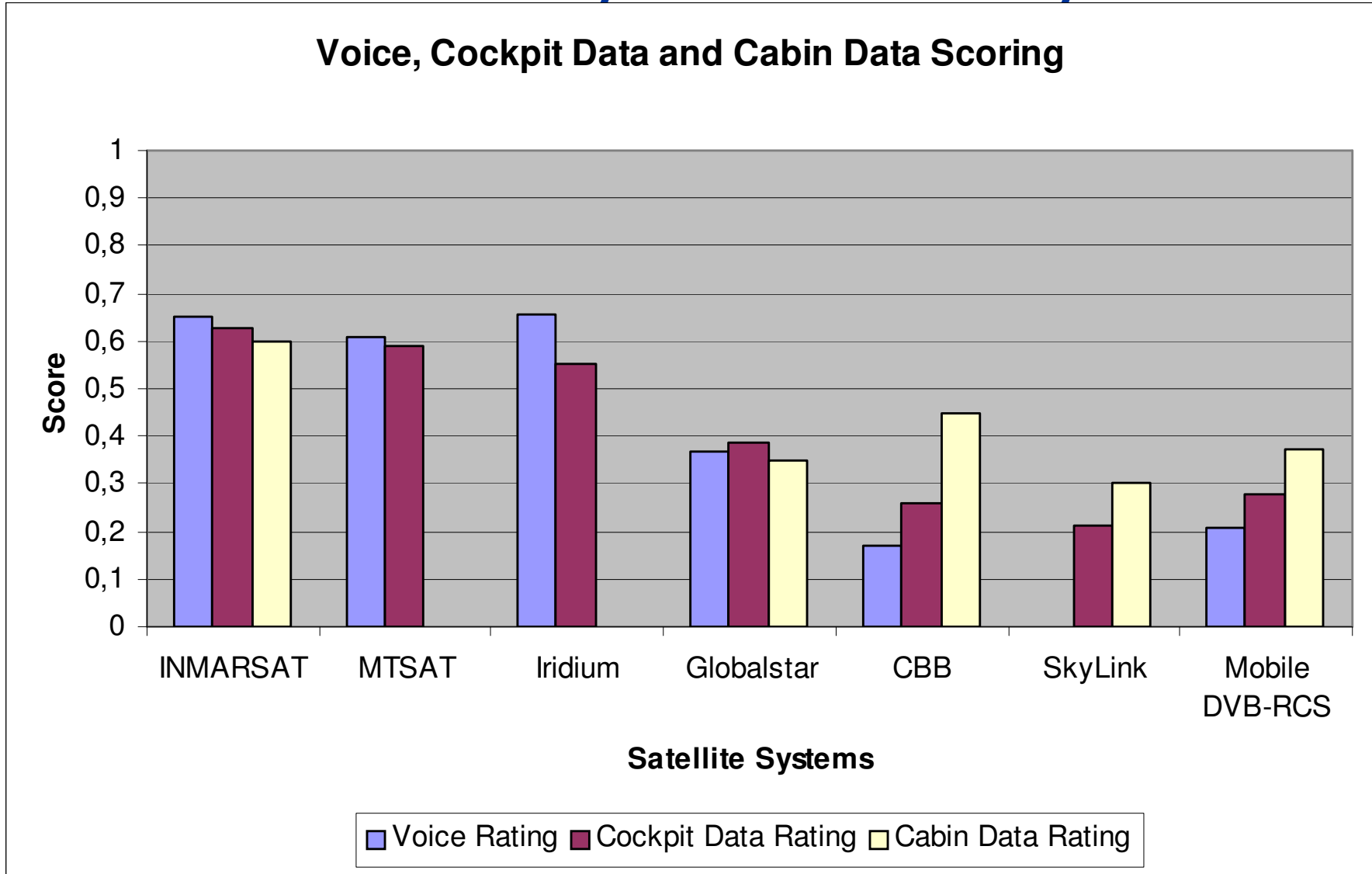


## **Current Satellite Systems Suitability for ATM**

- **Current Systems assessed using a method derived from the Eurocontrol FCS technology pre-screening study against the following criteria:**
- **Cockpit Voice**
  - **Pilots-Controller talk group, Pilot-Controller selective addressing, Broadcast, Pilot-Pilot, spare capacity, max talk group size, group dynamic management, end-to-end latency.**
- **Cockpit data**
  - **Addressed data, broadcast data, pilot-pilot data, max data rates, max group size, prioritisation capability, end-to-end latency.**
- **Cabin data**
  - **Addressed data, broadcast data, max data rates (up and down), VoIP.**
- **Others**
  - **Technology maturity, aviation safety services certification, ship set costs, protected spectrum, authentication and integrity (security), geographic coverage, flight phase availability.**
- **Voting system derived (too complex to describe here) combining the scores with the results summarised on the next page.**

# Current Satellite Systems Suitability for ATM

**Voice, Cockpit Data and Cabin Data Scoring**



## **Critical Assessment Criteria**

- **GEO systems were penalised for voice latency**
  - **FAQ: What is the minimum requirement on voice latency for ATM and passenger communications? Opinions vary. Why?**
- **MTSAT and Iridium have only very low data capacity – quite unsuitable for future cabin applications for sure. But:**
  - **FAQ: But what capacity per passenger should we be aiming for?**
  - **FAQ: Supposing that unlimited capacity was available and cheap, what capacity would the average passenger use?**
- **Globalstar, SkyLink and CBB are penalised for not supporting direct pilot-to-pilot communication, having no aviation certification, and not using bandwidth reserved/protected for aviation use.**
  - **FAQ: Can ATM work without direct pilot-to-pilot capability?**
  - **FAQ: Could ATM work over an uncertified system?**
  - **FAQ: Could ATM use unprotected bandwidth perhaps as a back-up to VHF?**

## Critical Assessment Criteria (cont)

- SkyLink doesn't support any voice service, not even VoIP.
  - FAQ: Is an ATM system possible based purely on data?
- Mobile DVB-RCS is penalised for being technically immature, not being designed for secure services, not having protected bandwidth.
- CONCLUSION: no system can match the current VHF capabilities in all respects AND deliver the bandwidths "required" for cabin use.
  - FAQ: Is the cost of a dedicated ATM constellation justifiable or do we compromise? If so, what gets compromised?

## **ANASTASIA Demonstrator Technology Assessment**

- **For a satellite based system to be adopted for ATM, it must be cost-effective to fit to all types of aircraft.**
  - **Small and light – low bandwidth omni antenna**
  - **Cheap – maximise use of COTS**
- **Future SATCOM market segmentation**
  - **Regionals & low-cost operations – “ ANASTASIA” terminal optimised for ATM and used only for ATM**
  - **Larger aircraft – SATCOM capable of high bandwidths for cabin use with ATM capability “riding on the back” of it – BUT no satellite system is ideal for this**
  - **OR - larger aircraft fit “ANASTASIA” terminal for ATM AND a dedicated SATCOM system cabin system**

# Demonstrator Hardware

