The ESTRACK Management & Scheduling System

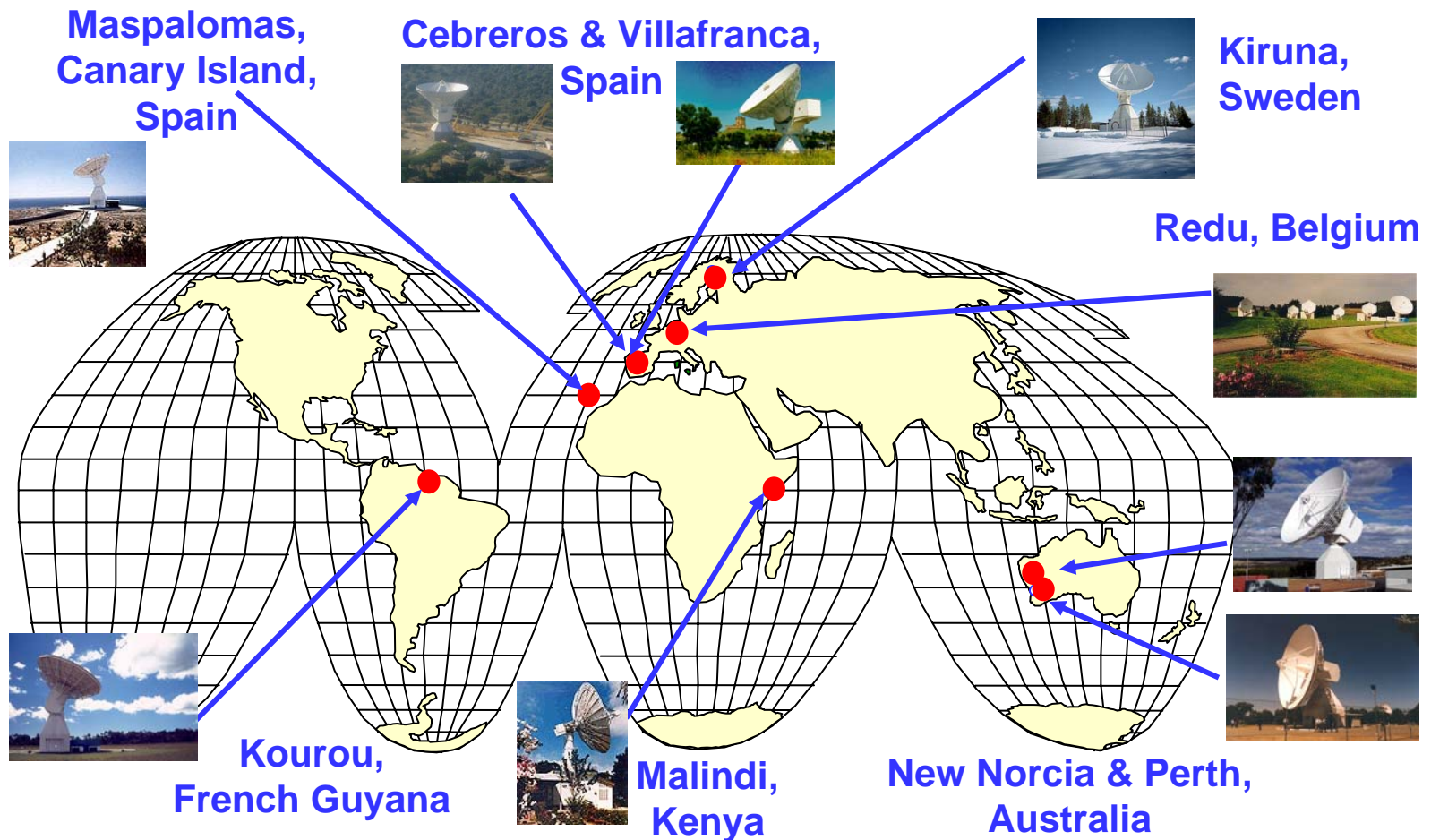## G.P. Calzolari (ESA)
M. Niézette and M. Götzelmann (VEGA)

Presentation Content

- ❖ ESTRACK Network and its evolution
- ❖ ESTRACK Management System (EMS)
- ❖ EMS Planning Component (EPS)
- ❖ EMS Scheduling Component (ESS)
- ❖ EMS Coordination Component (ECS)
- ❖ Conclusion

ESTRACK - ESA Tracking Network Overview

Maspalomas, Canary Island, Spain

Cebreros & Villafranca, Spain

Kiruna, Sweden

Redu, Belgium

Kourou, French Guyana

Malindi, Kenya

New Norcia & Perth, Australia
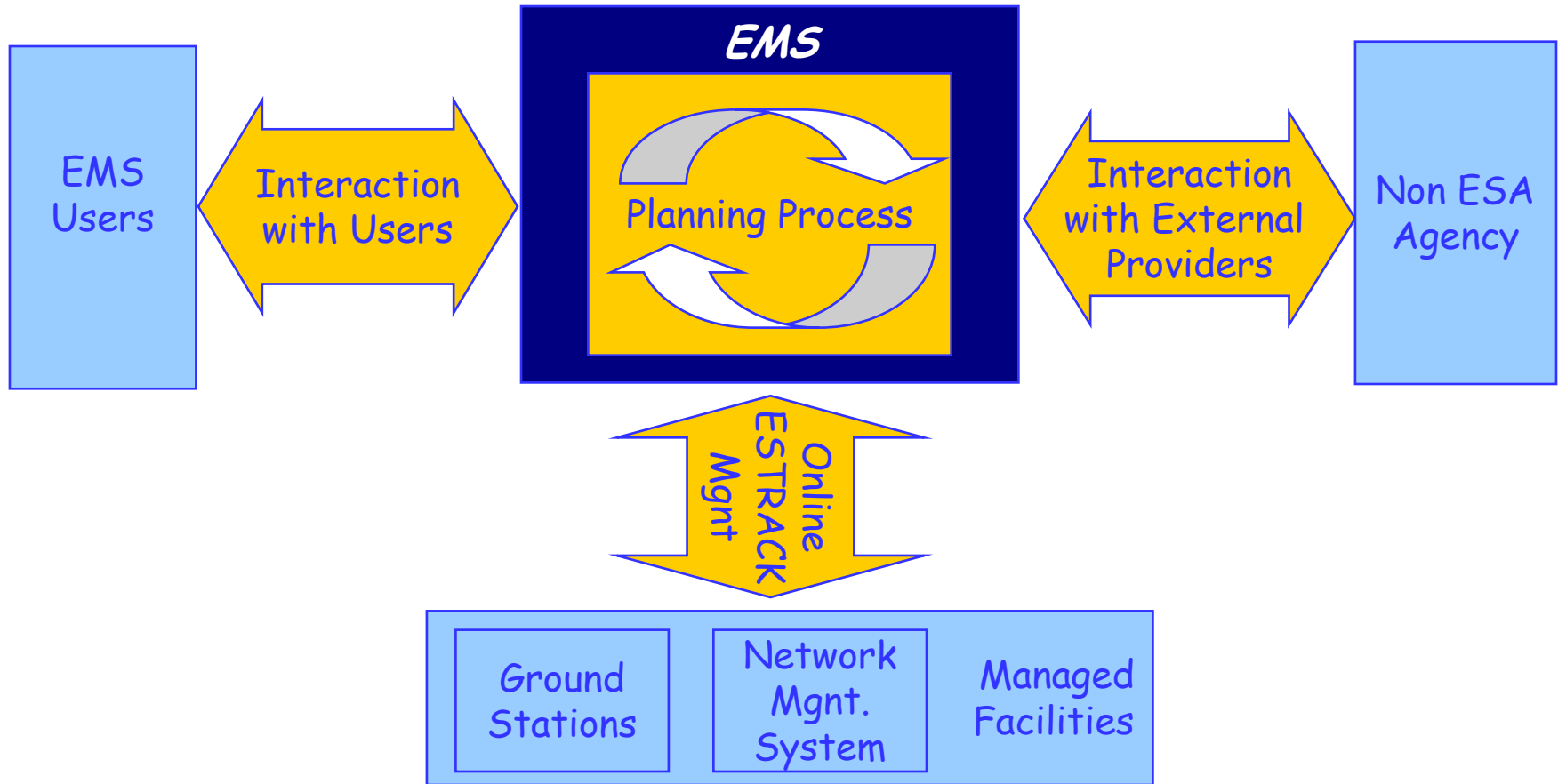
ESTRACK Evolution

- ❖ Yesterday
  - Ground stations almost exclusively dedicated to a given ESA mission
  - Ground stations operated locally

- ❖ Today
  - ESTRACK constantly growing in size, capability and complexity
  - Ground stations remotely operated on a routine basis
  - Ground stations supporting multiple missions, within and outside ESA
  - Users requests evolving from direct request of specific facilities to more generic tracking service requirements

- ❖ Tomorrow
  - Increasing level of cross-support
  - Increasing network load

➡ This demonstrated that a new network management & scheduling operational concept is required

ESTRACK Management & Scheduling System

EMS
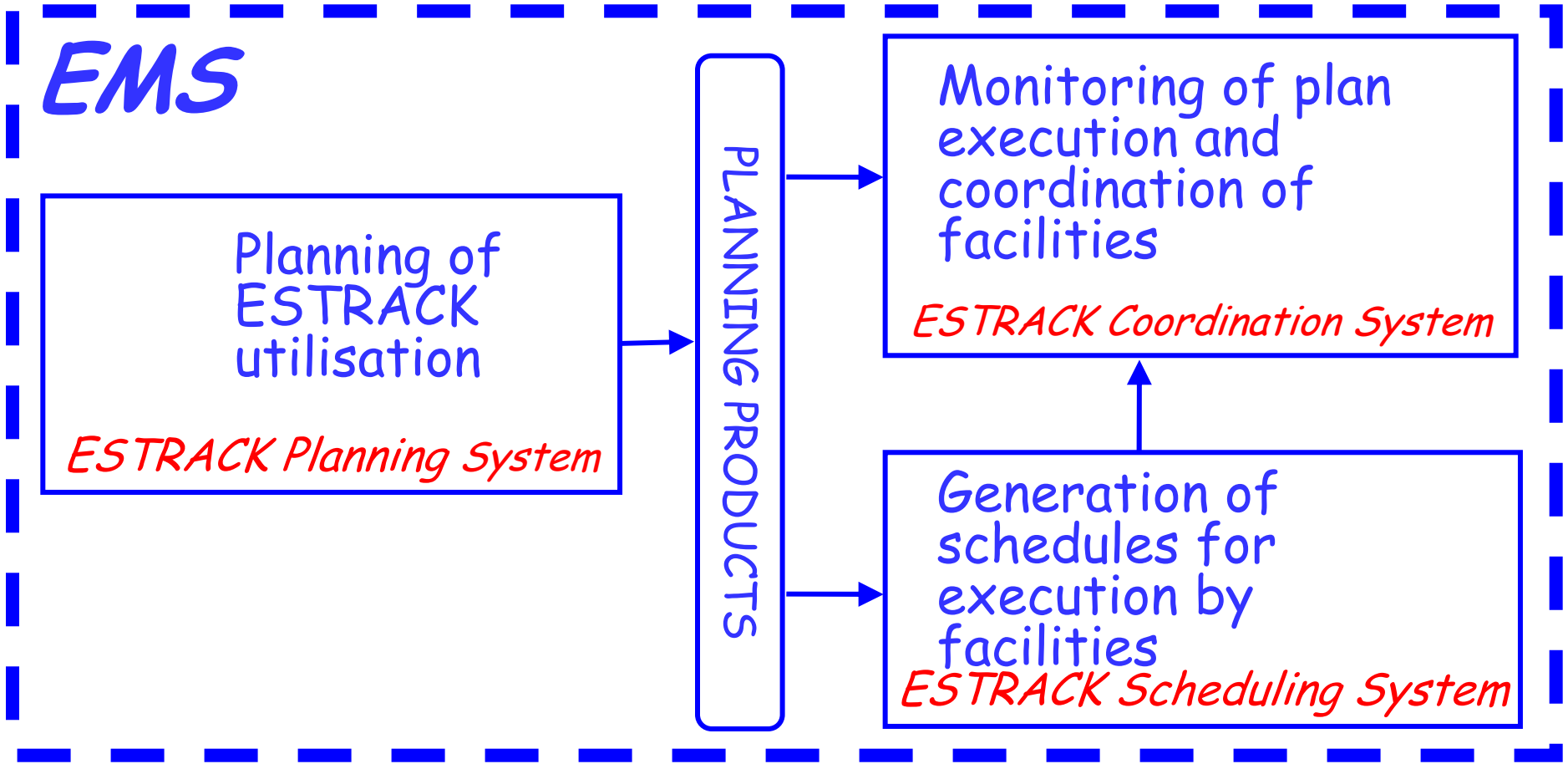
Planning Process

EMS Users ⟷ Interaction with Users ⟷ EMS

Interaction with External Providers ⟷ Non ESA Agency

Online ESTRACK Mgnt

Ground Stations | Network Mgnt. System | Managed Facilities

EMS Components

EMS

Planning of ESTRACK utilisation *ESTRACK Planning System*	PLANNING PRODUCTS	Monitoring of plan execution and coordination of facilities *ESTRACK Coordination System*
		Generation of schedules for execution by facilities *ESTRACK Scheduling System*

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EMS Architecture

EMS User
- Flight Dynamics
- Mission Planning

Planner MMI

Online MMI

SMF — Mission Operation: MAS, MCS, NIS

File Server

Format Converter

EMS
- ESTRACK Planning System
- Planning Products
- ESTRACK Coordination System
- ESTRACK Scheduling System

Proxy

External Provider (scheduling office)

ESTRACK Ground Station

Communications Network Management

SICF

M&C

Schedules

SICF

The ESTRACK Management & Scheduling System

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User Interaction with EPS
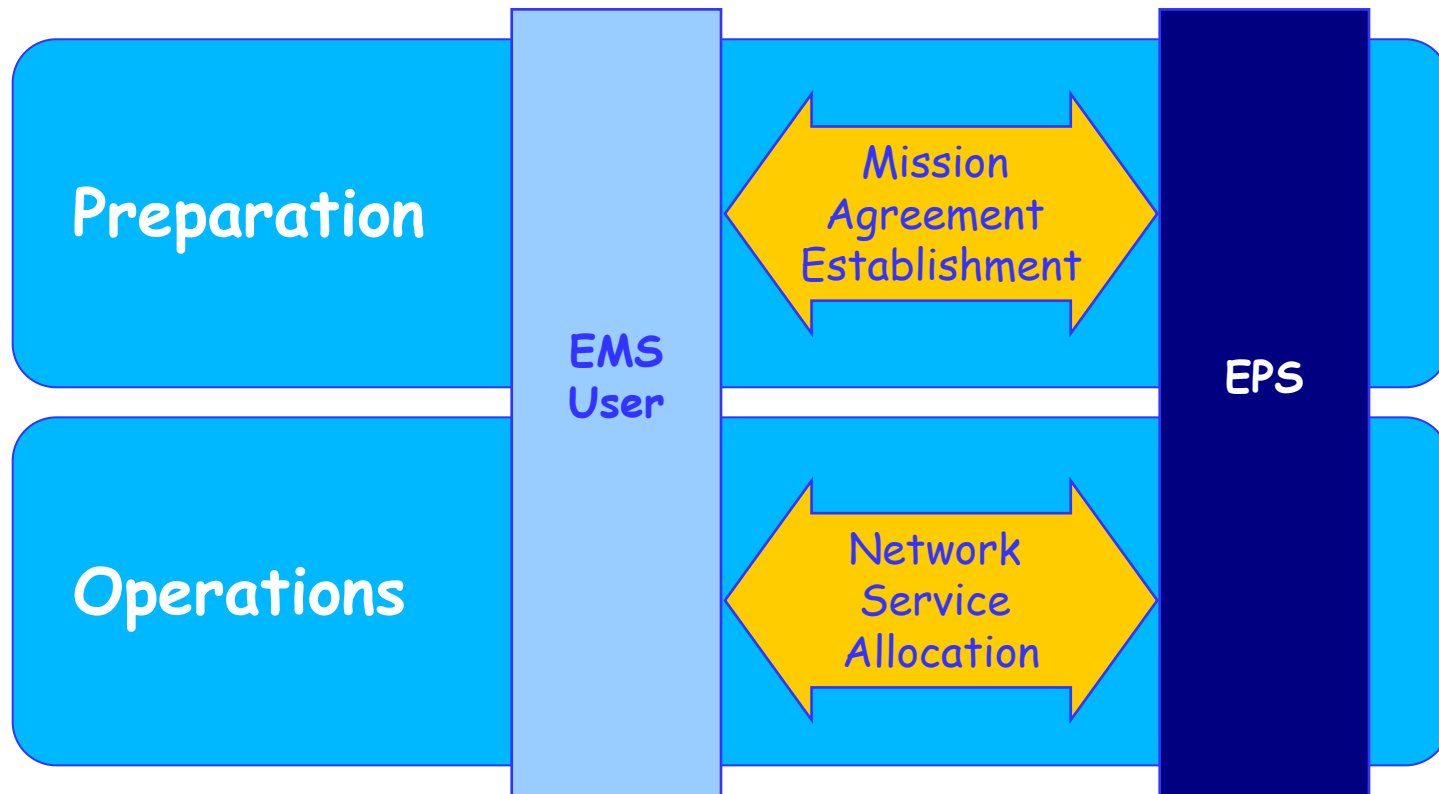
Mission Agreement Establishment
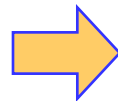
ESTRACK Services are only provided in the framework of a Mission Agreement.

Mission Agreement

- Mission Identification
- Spacecraft Identification
- Administrative Information
  - Responsibilities …
  - Addresses …
- Validity period
- List of facilities
- ……
- ……
- ……
- Space / Ground ICD

EMS Configuration Database

The ESTRACK Management & Scheduling System
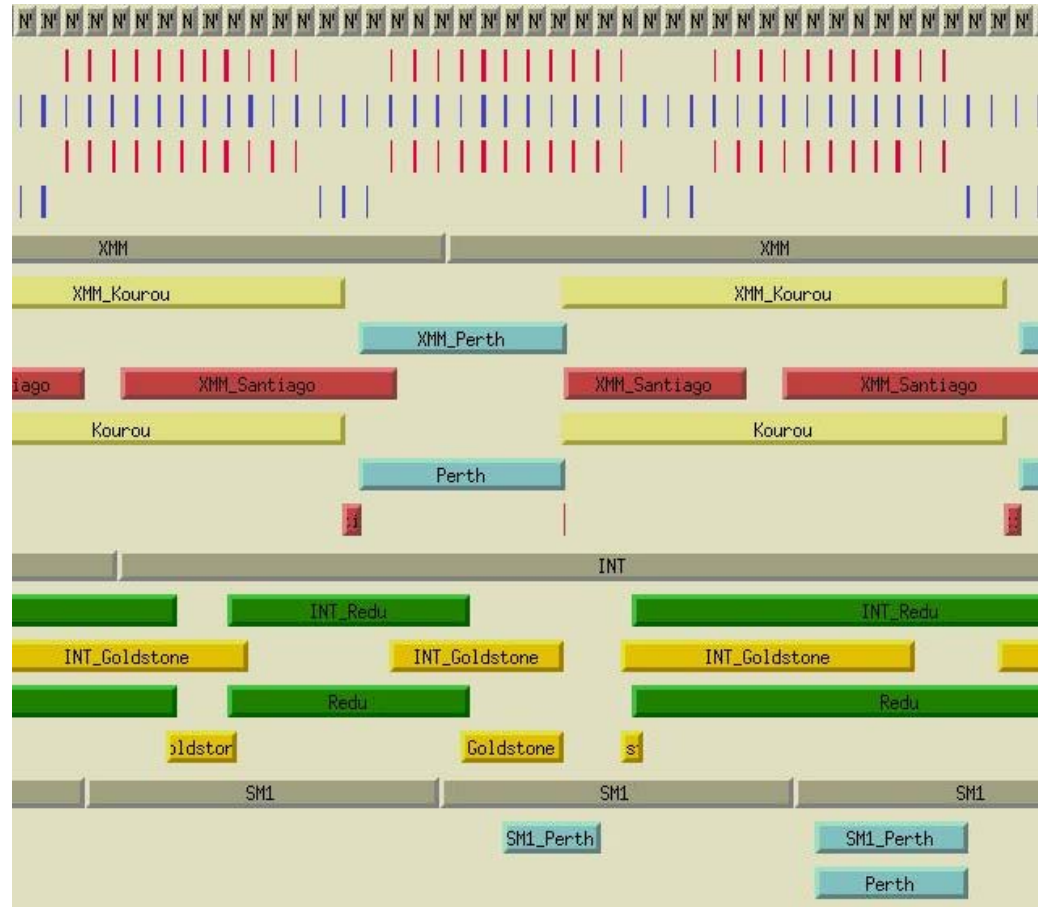
Examples of Network Service Allocation Requirements

❖ One pass from AOS to LOS of a minimum duration per orbit
(e.g. Envisat)

❖ Maximum continuous contact per orbit, with mandatory contact in a time period between two events specified for each orbit, and minimum hand-over duration
(e.g. XMM, INTG)

❖ Maximum/Minimum total contact duration and number of passes within a period, with minimum pass duration
(e.g. SMART-1)

❖ Etc.

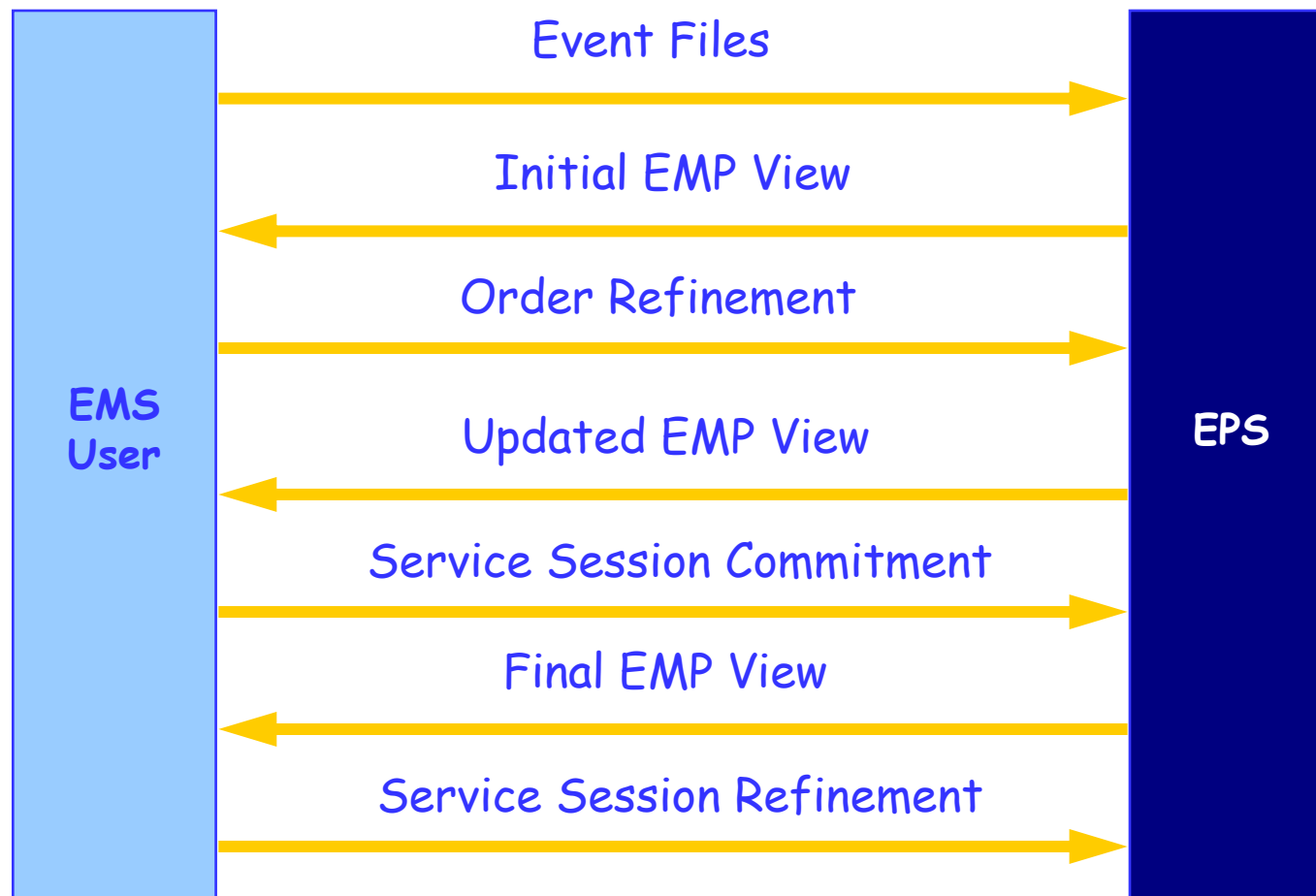*The ESTRACK Management & Scheduling System*

ESTRACK Management Plan (EMP)

Network Service Allocation

EMS User → EPS: Event Files

EPS → EMS User: Initial EMP View

EMS User → EPS: Order Refinement

EPS → EMS User: Updated EMP View

EMS User → EPS: Service Session Commitment

EPS → EMS User: Final EMP View

EMS User → EPS: Service Session Refinement

Scheduling Approach Summary

- ❖ Generation driven by the ESTRACK Management Plan

- ❖ All required variable information taken from EMP

- ❖ Static information contained in Schedule Templates

- ❖ Generation of SICF from Transfer Service Instances

- ❖ Single master schedule controlling load and execution of individual schedules and running on EMS

- ❖ Additional readable schedule overview (Timeline for Operations)

- ❖ No schedules generated for External Providers

The ESTRACK Management & Scheduling System

ESTRACK Coordination System

MCS

Planning Products

ESTRACK Coordination System

Ground Station

Network Mgnt. Sys.

Schedule Generator
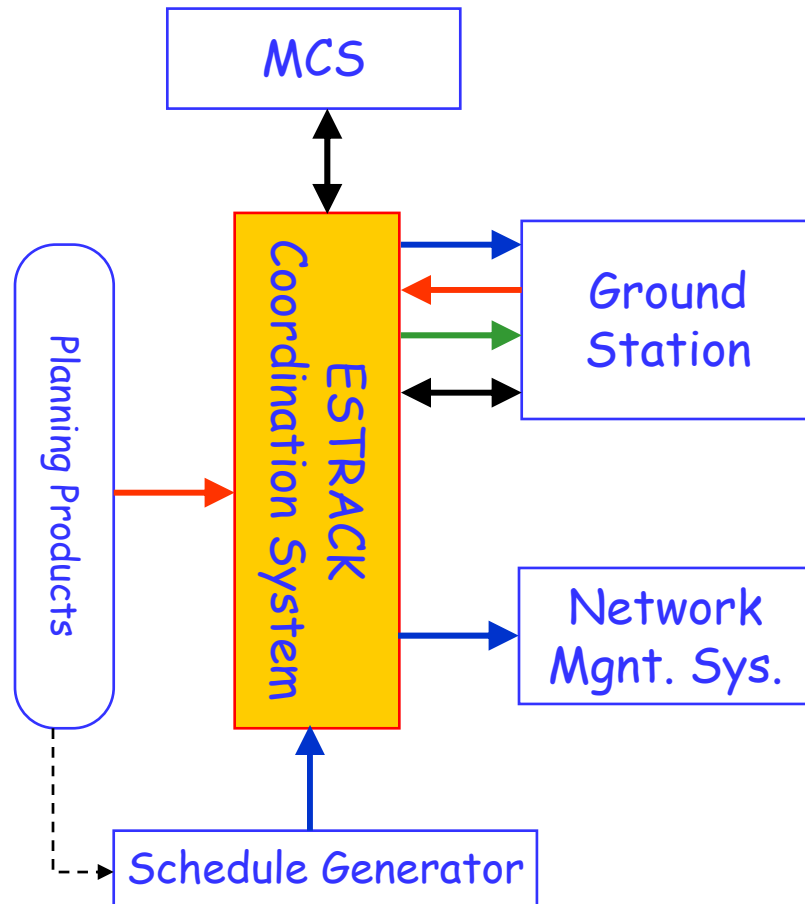
FEATURES

Downloading of schedules

Monitoring of plan execution

Routine control of schedules

Coordination of facilities and the MCS for special events (e.g. station hand over)

Conclusion

- A new ESTRACK network management and scheduling concept has been proposed

- The new concept introduces the ESTRACK Management & Scheduling System (EMS) as part of EGOS

- EMS leads to better usage of the ESTRACK resources through increased flexibility and automation

- EMS is decomposed into three functional blocks: Planning, Schedule Generation, and Coordination

- The concept requires a formalisation of the mission requirements for each mission in mission agreements

- The planning and scheduling components of EMS are under development at ESOC (releases in spring and summer 2007)