FOS User Interface Subsystem

Jim Creegan

System Design Review - 28 June 1994

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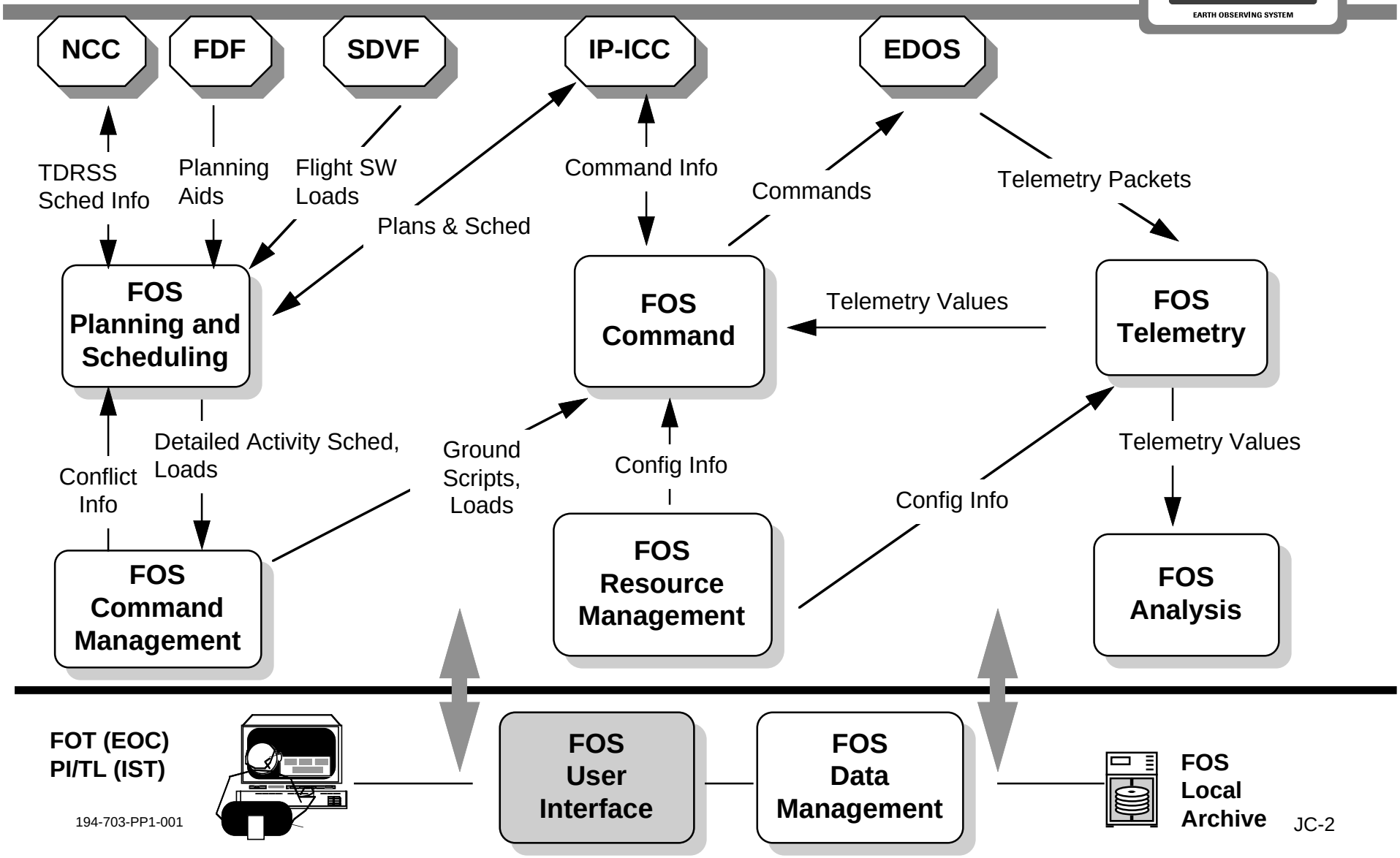
FOS Subsystem Diagram



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FOS User Interface (FUI) Subsystem

Overview

Design Drivers

Context Diagram

Context Scenarios

FUI Object Model

FUI Window Object Model

FUI Telemetry & Analysis Object Model

FUI Command Execution Object Model

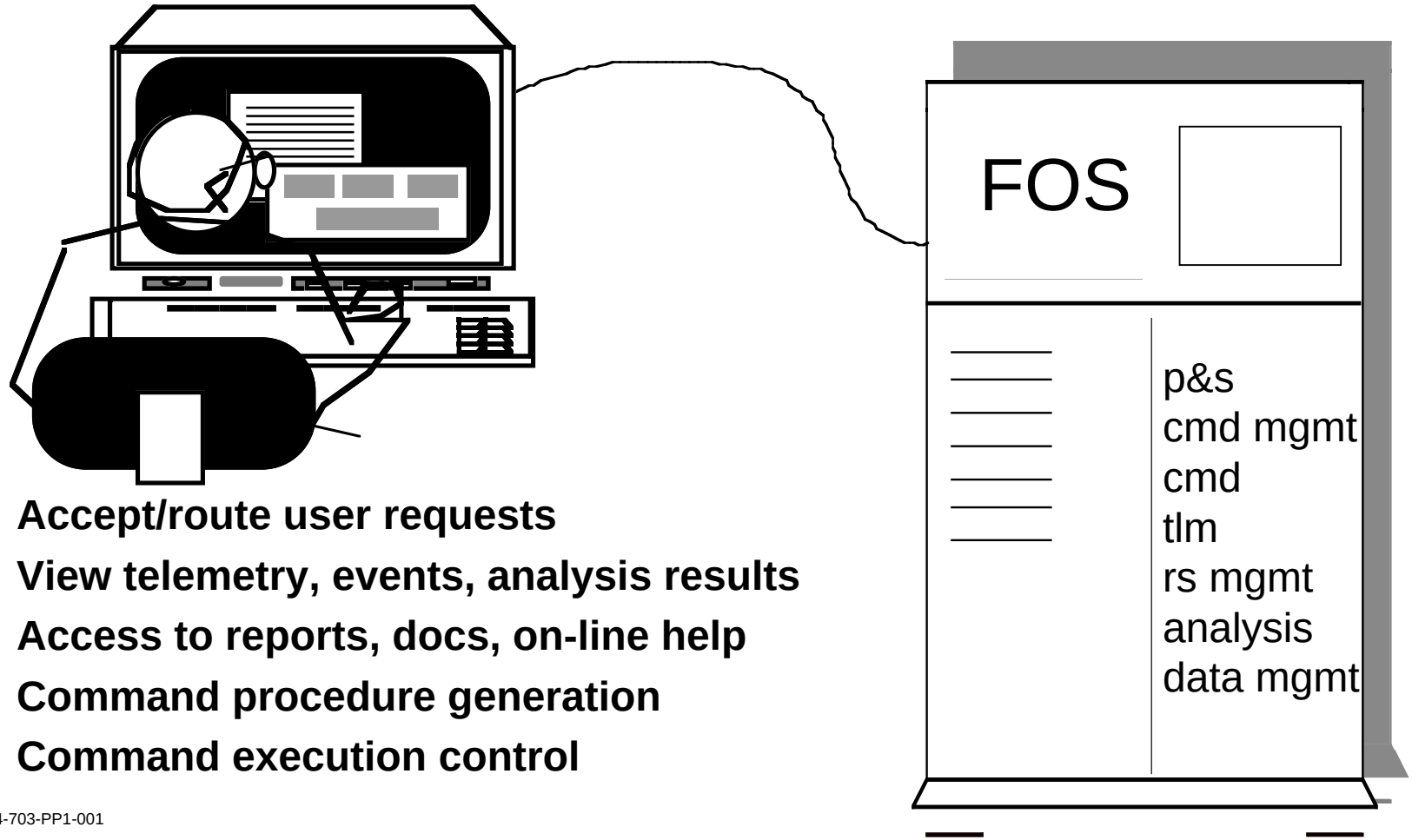
Monitor Telemetry Scenario

Off-line Analysis Scenario

Execution of a Ground Script Scenario

FUI Overview

FOS User Interface (FUI) Subsystem provides user interface services for all FOS Subsystems



- **Accept/route user requests**
- **View telemetry, events, analysis results**
- **Access to reports, docs, on-line help**
- **Command procedure generation**
- **Command execution control**

FUI Overview (cont.)

Input to design:

Survey of Operators	Quick-Analysis, Spreadsheet display
Operator for a Day	Commanding insight
Review of Control Center User Interfaces	Structured flexibility (rooms)
Prototype Feedback	Different update rates for different pages, Playback & real-time concurrently
Instrument Team Technical Exchanges	Read only version of cmd window at the IST
Loral User Interface Heritage	Graphical Event Analysis, Command Parser

FUI Design Drivers

Platform Independence

- Don’t lock ourselves into any one vendor

COTS Independence

- Use COTS where appropriate
- Don’t lock architecture into one vendor’s product

Standards Based

- MOTIF compliant

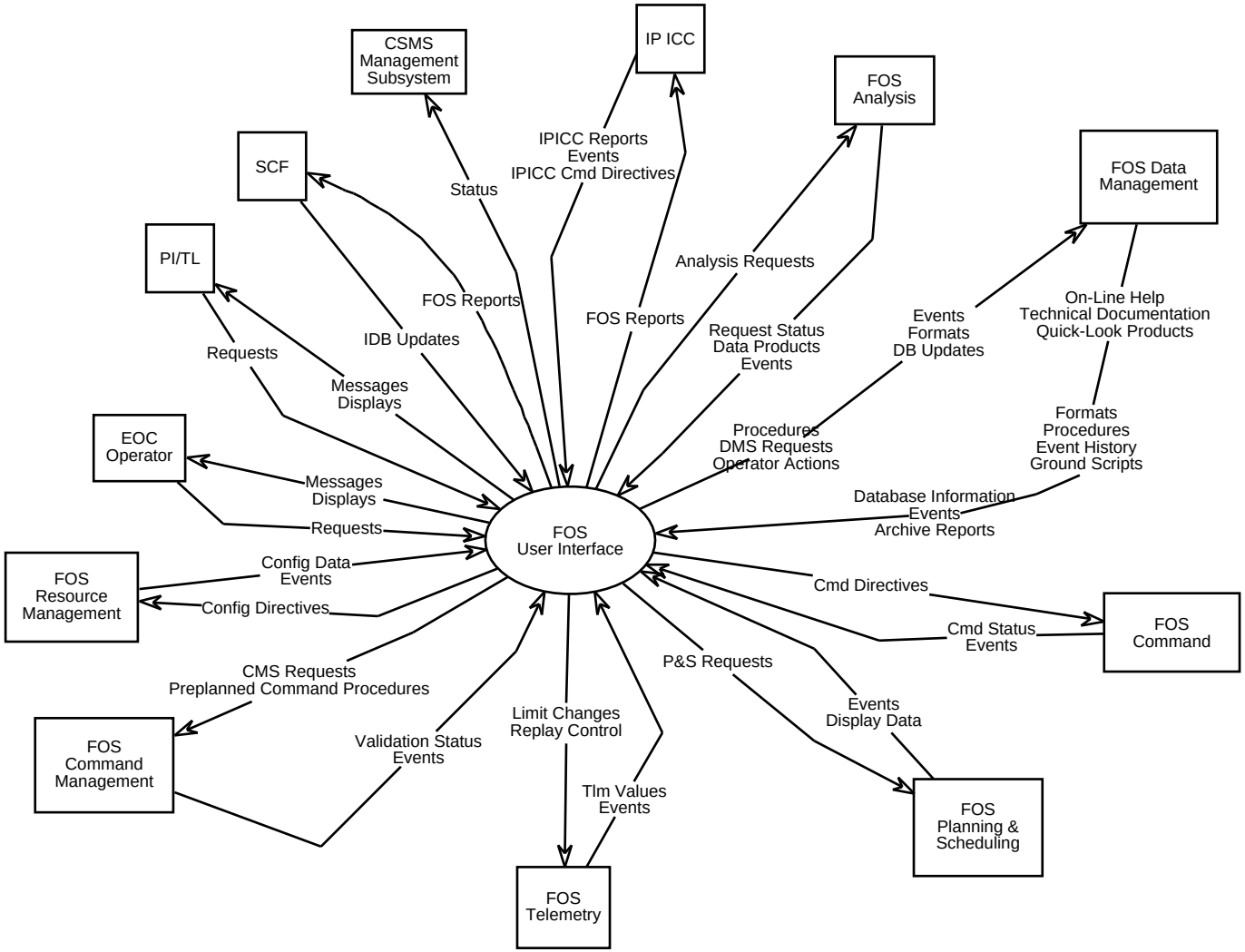
Extensible/Flexible

- Able to grow and change as technology advances
- Allow for user customization where appropriate

Clear Mental Models

- Ease of use, intuitive traversal techniques
- Consistency & clarity

FUI Context Diagram



FUI Context Diagram

Four Primary Classes of External Entities

- **Users - PI/TL and EOC Operators**
- **External ECS Facilities - IP ICC and SCF**
- **ECS Segment - CSMS**
- **FOS Subsystems**

Three Key Scenarios

- **Monitor Telemetry**
- **Off-Line Analysis**
- **Execution of a Ground Script**

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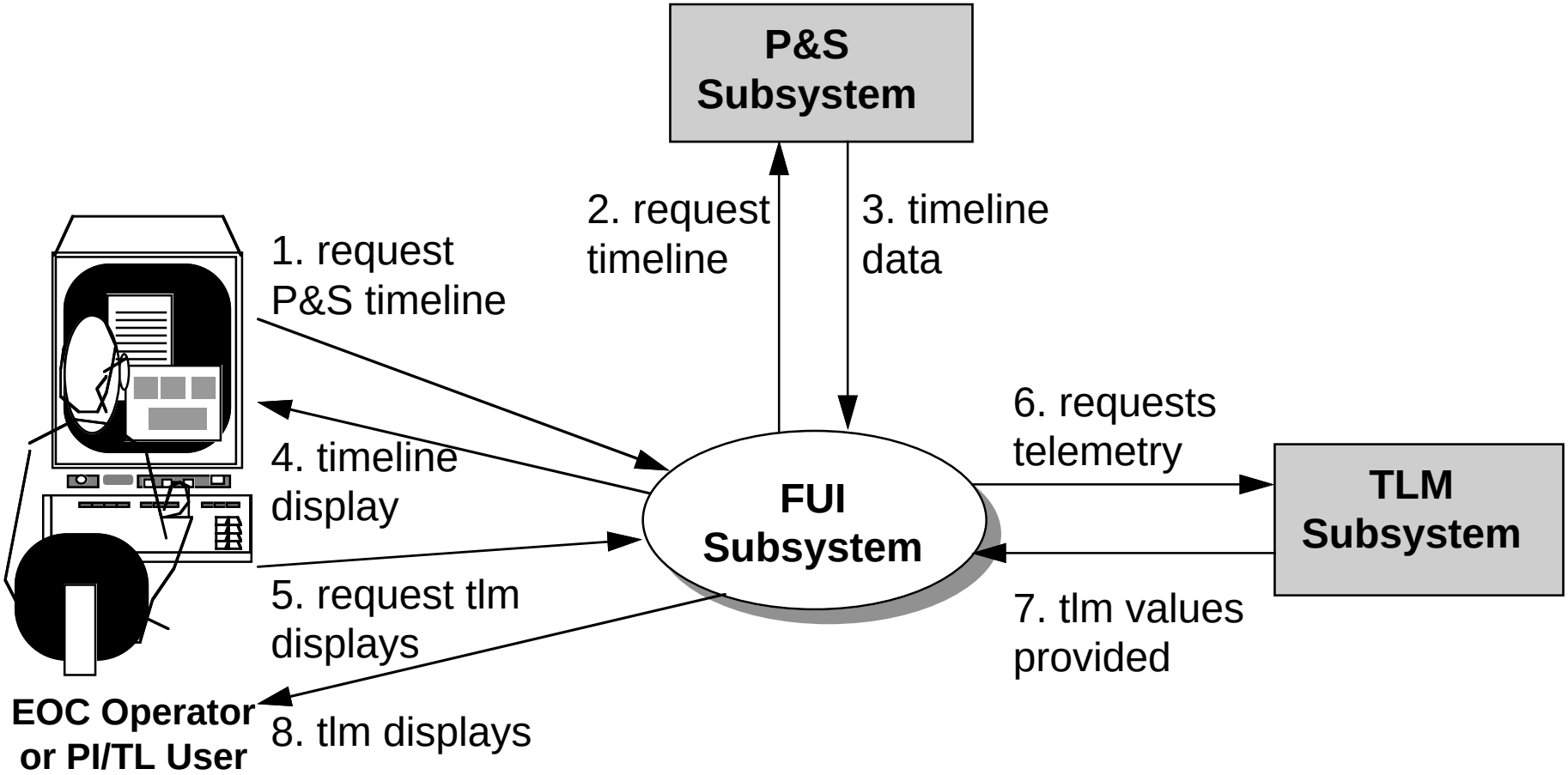
Monitor Telemetry Context Scenario



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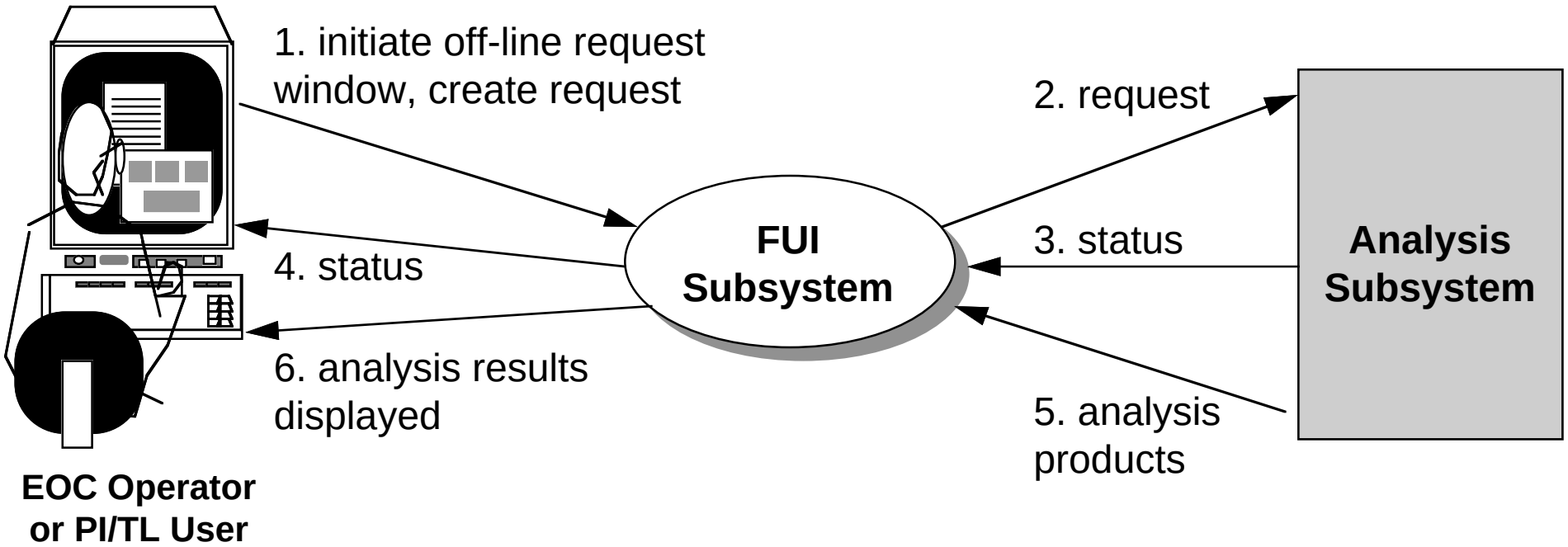
Off-Line Analysis Context Scenario



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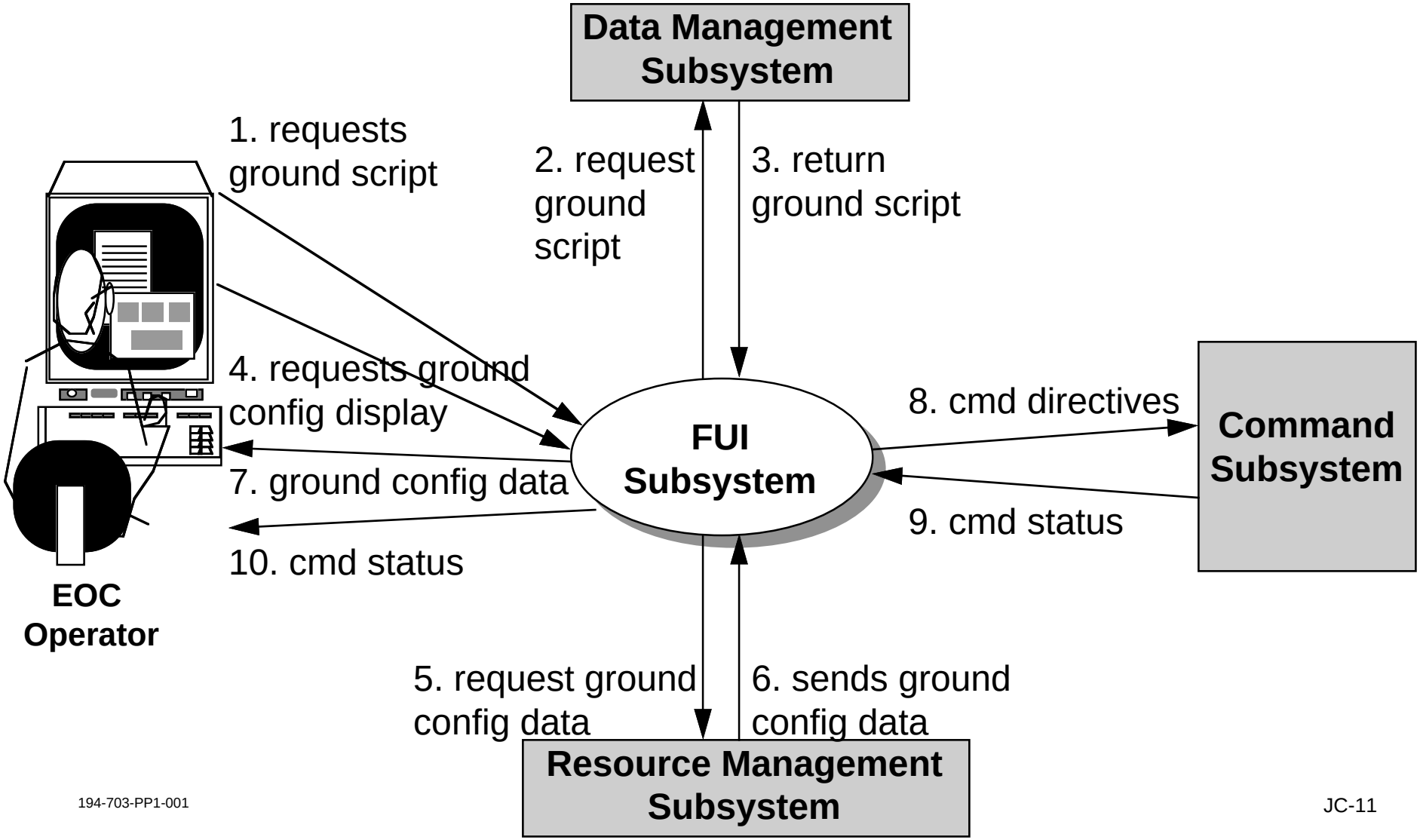
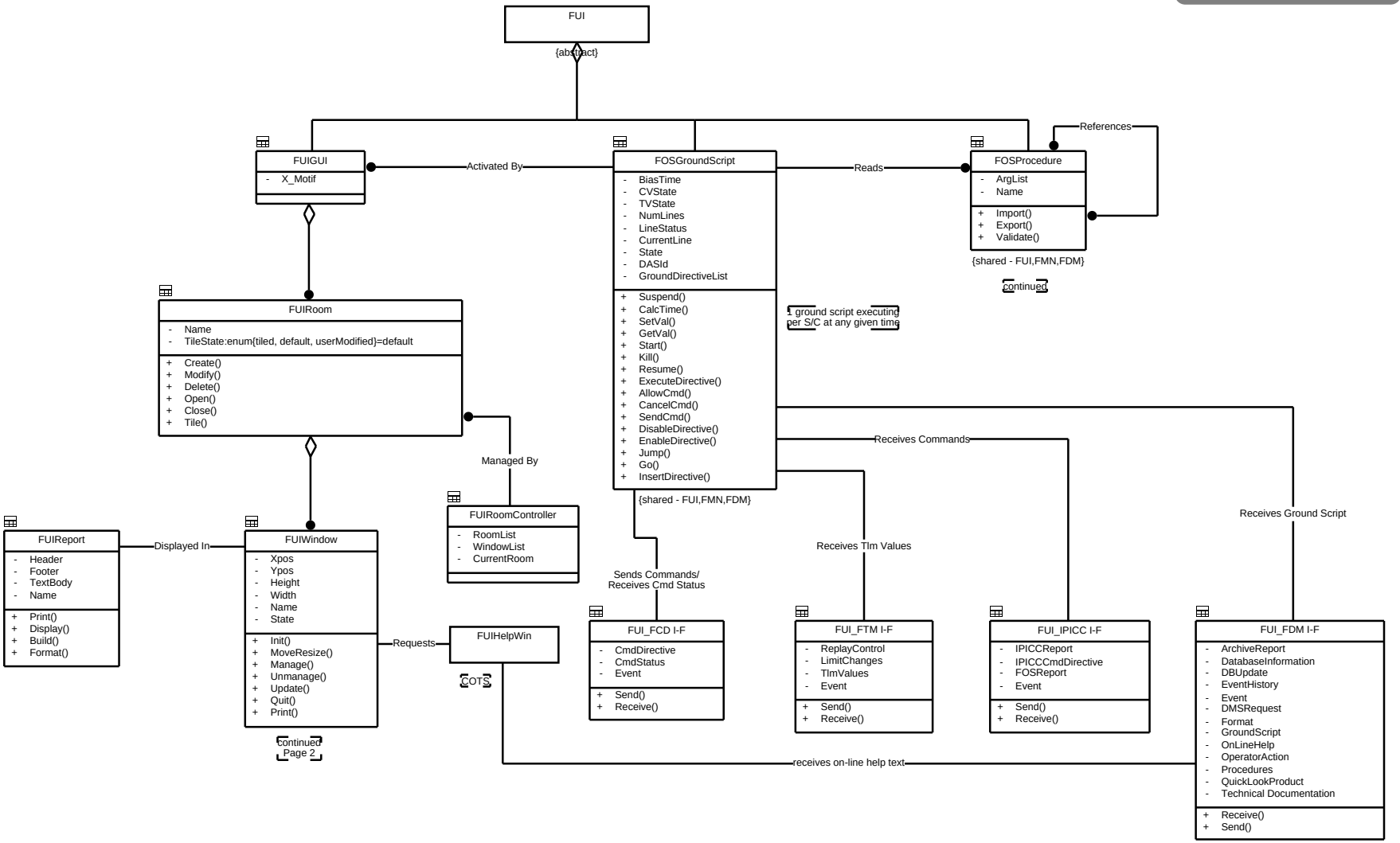
Execution of a Ground Script Context Scenario



FUI Object Model



FUI Object Model

FUIGUI -

- **room**
  - **user defined collection and arrangement of windows**
  - **3 states (default, tiled, last)**
- **room controller**
  - **manages creation, placement, movement of windows**
  - **uses motif window manager calls (no funny stuff)**
- **windows can resize and place themselves (see following charts)**

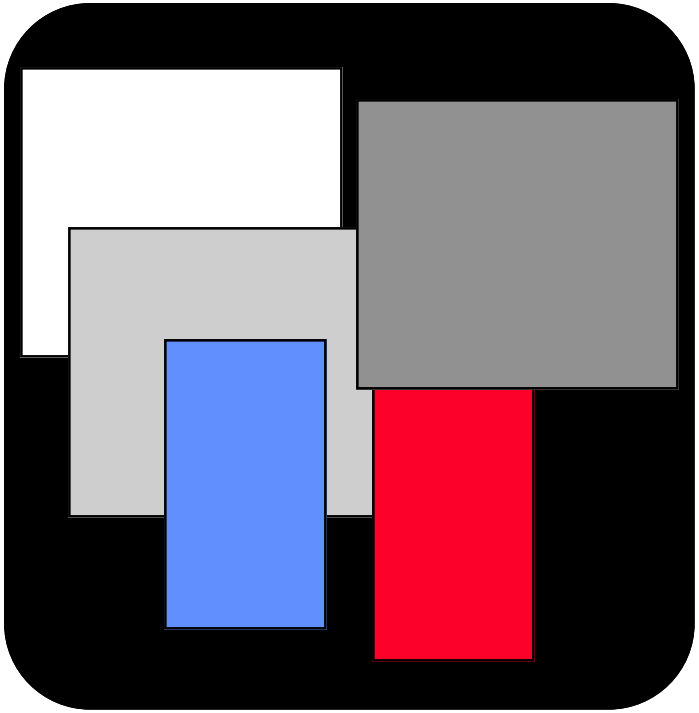
Ground Script

- **shared object**
- **one active per s/c at a time**

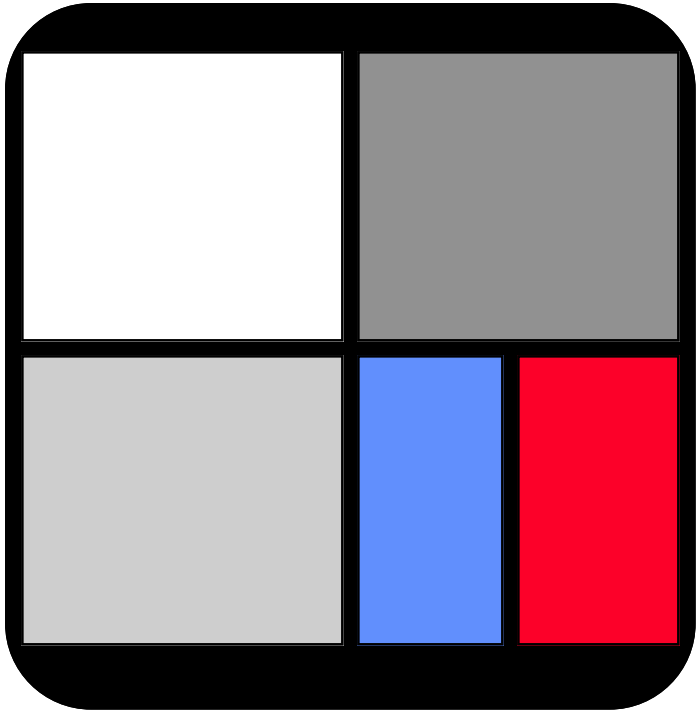
Procedure

- **class definition shared between FUI, CMS, & DMS**
- **contains STOL-like command directives**
- **can contain other procedures**

Rooms

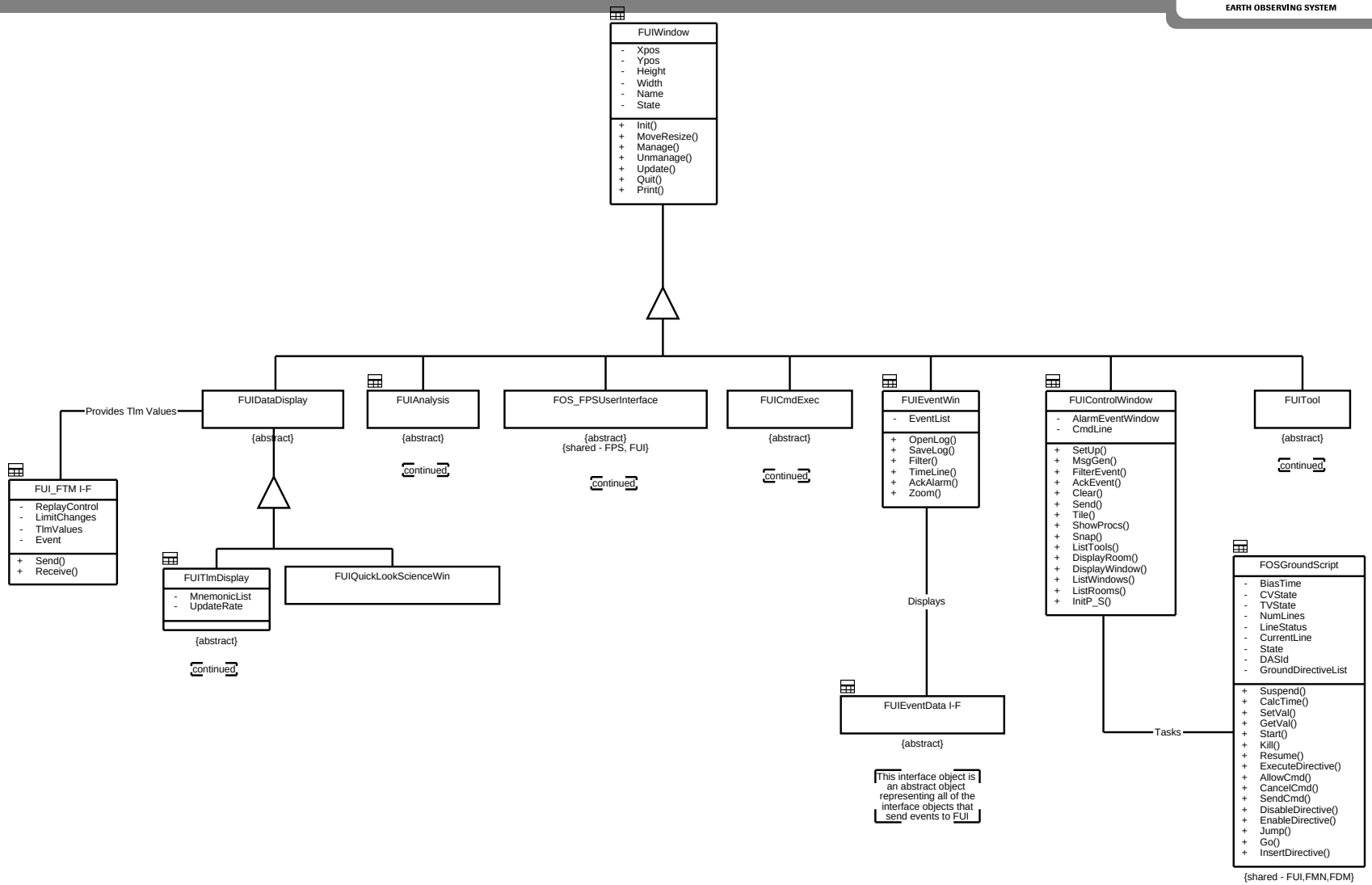


default



tiled

FUI Window


FUIWindow
- Xpos
- Ypos
- Height
- Width
- Name
- State
+ Init()
+ MoveResize()
+ Manage()
+ Unmanage()
+ Update()
+ Quit()
+ Print()
FUIDataDisplay
{abstract}
Provides Tlm Values
FUIAnalysis
{abstract}
continued
FOS_FPSUserInterface
{abstract}
{shared - FPS, FUI}
continued
FUICmdExec
{abstract}
continued
FUIEventWin
- EventList
+ OpenLog()
+ SaveLog()
+ Filter()
+ TimeLine()
+ AckAlarm()
+ Zoom()
FUIControlWindow
- AlarmEventWindow
- CmdLine
+ SetUp()
+ MsgGen()
+ FilterEvent()
+ AckEvent()
+ Clear()
+ Send()
+ Tile()
+ ShowProcs()
+ Snap()
+ ListTools()
+ DisplayRoom()
+ DisplayWindow()
+ ListWindows()
+ ListRooms()
+ InitP_S()
FUITool
{abstract}
continued
FUI_FTM I-F
- ReplayControl
- LimitChanges
- TlmValues
- Event
+ Send()
+ Receive()
FUITlmDisplay
- MnemonicList
- UpdateRate
{abstract}
continued
FUIQuickLookScienceWin
Displays
FUIEventData I-F
{abstract}
This interface object is an abstract object representing all of the interface objects that send events to FUI
Tasks
FOSGroundScript
- BiasTime
- CVState
- TVState
- NumLines
- LineStatus
- CurrentLine
- State
- DASId
- GroundDirectiveList
+ Suspend()
+ CalcTime()
+ SetVal()
+ GetVal()
+ Start()
+ Kill()
+ Resume()
+ ExecuteDirective()
+ AllowCmd()
+ CancelCmd()
+ SendCmd()
+ DisableDirective()
+ EnableDirective()
+ Jump()
+ Go()
+ InsertDirective()
{shared - FUI,FMN,FDM}

FUI Window

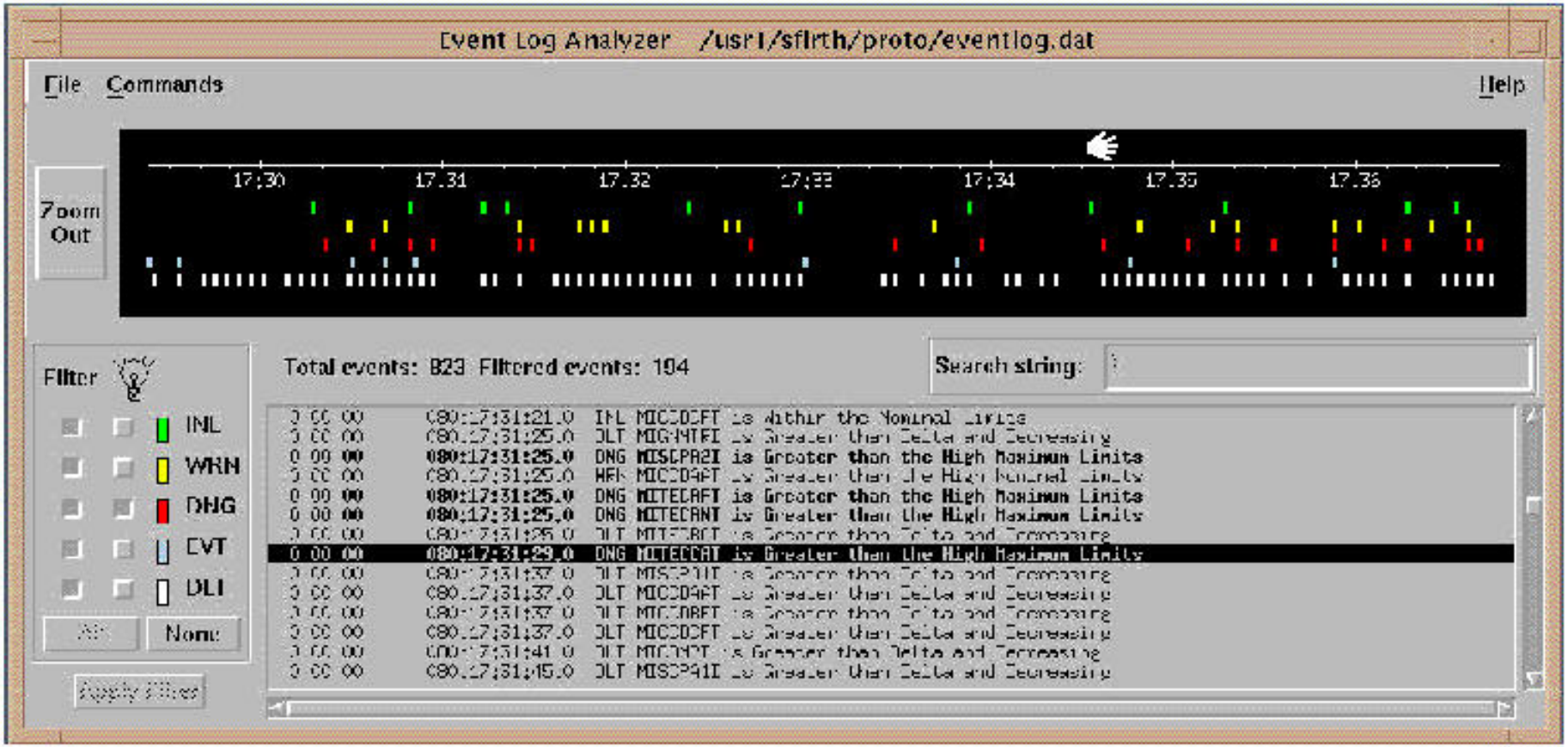
Every type of window

- Data Display
  - different telemetry displays (see following charts)
  - independent of data source (real-time, playback, simulator)
- Analysis
  - displays to request analysis (see following charts)
- P&S Windows
  - abstract of all P&S windows (see P&S discussion)
  - P&S windows inherit behavior from FUI Window
  - live in the FUI world like all other windows

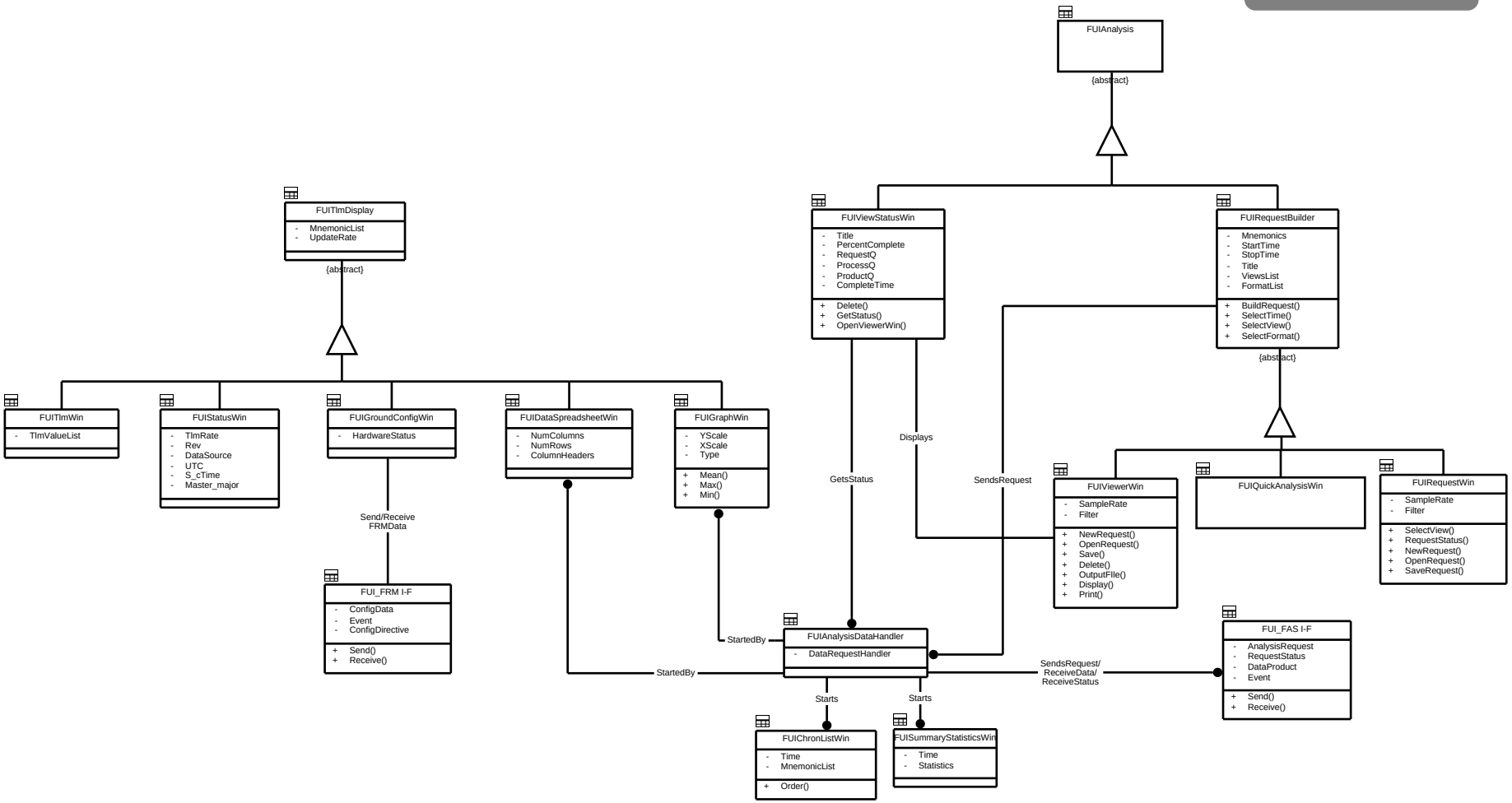
FUI Window (cont.)

- Command Execution
  - control of the executing ground script (see following charts)
  - one “interactive” copy per spacecraft
  - multiple “read-only” views, including at the IST
- Event
  - display of all events and alarms, filtering capability
  - prototyping visual methods of viewing events
- Control
  - command line, access to tools & functions, last 3 events
- Tool
  - abstract object of different tools
  - procedure builder, display builder, playback controller, document viewer, environmental setup, info transfer
  - additional tools added as system evolves

Event Analyzer Display



FUI Telemetry & Analysis



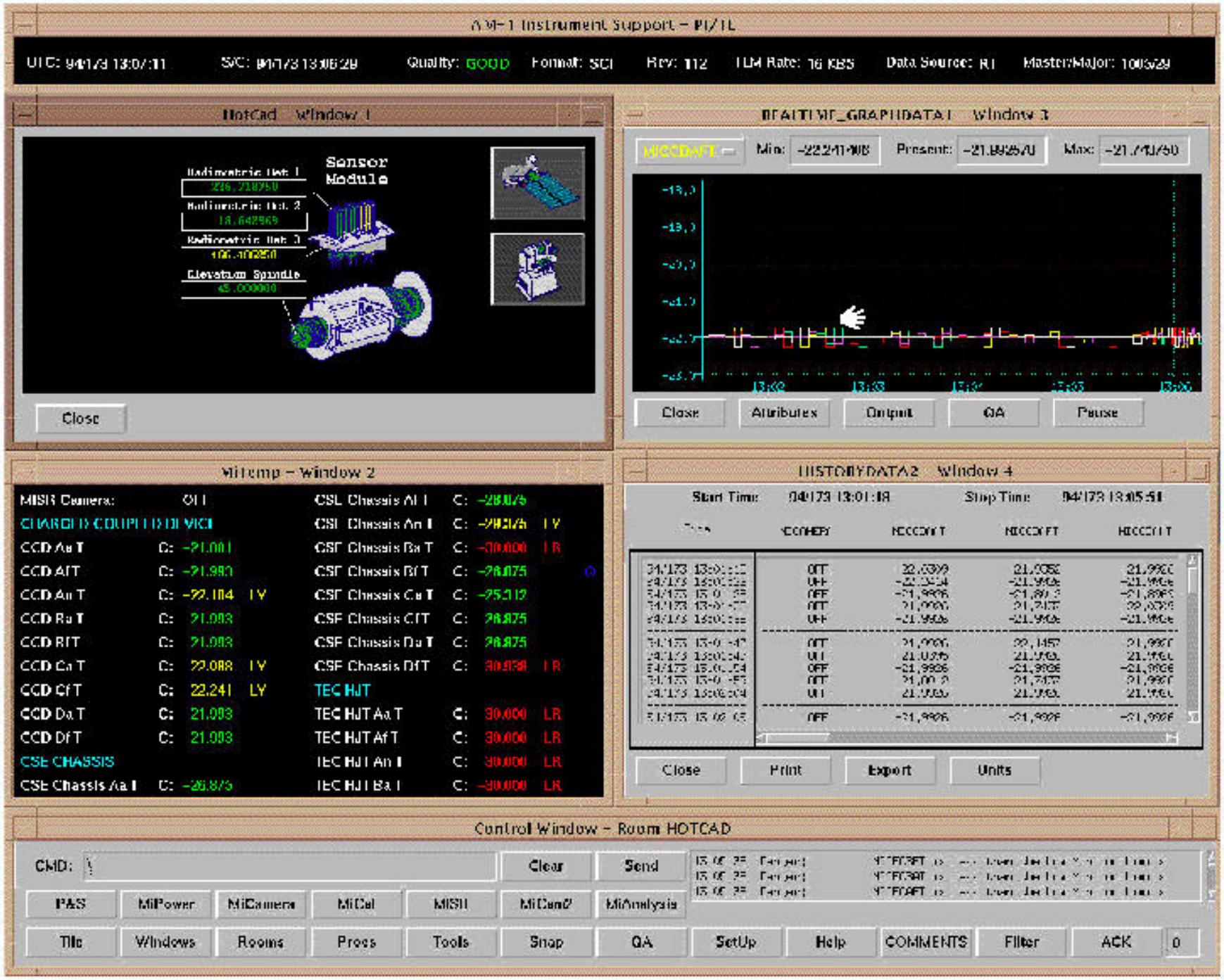
FUI Telemetry & Analysis

Telemetry

- **Telemetry**
  - **alphanumeric , color limits, delta limits, static & quality indicators**
  - **EU or raw, mnemonic or descriptor**
- **Status**
  - **s/c & ground time, data source, major/master frame, etc.**
- **Ground Configuration**
  - **logical strings & status of ground equipment**
- **Spreadsheet**
- **Graph**

Other display methods could be added here

Same displays for off-line analysis and quick-analysis


AM-1 Instrument Support - PI/TL
Quality: GOOD
Format: SCI
Rev: 112
TLM Rate: 16 KBS
Data Source: RT
HotCad Window 1
Sensor Module
Radiometric Det 1
Radiometric Det 2
Radiometric Det 3
Elevation Spindle
Close
REALTIME_GRAPHDATA1 Window 3
Min:
Present:
Max:
Close
Attributes
Output
QA
Pause
MiTemp - Window 2
MISR Camera: OFF
CHARGED COUPLED DEVICE
CCD Aa T
CCD Af T
CCD An T
CCD Ba T
CCD Bf T
CCD Ca T
CCD Cf T
CCD Da T
CCD Df T
CSE CHASSIS
CSE Chassis Aa T
CSE Chassis Af T
CSE Chassis An T
CSE Chassis Ba T
CSE Chassis Bf T
CSE Chassis Ca T
CSE Chassis Cf T
CSE Chassis Da T
CSE Chassis Df T
TEC HJT
TEC HJT Aa T
TEC HJT Af T
TEC HJT An T
TEC HJT Ba T
HISTORYDATA2 Window 4
Start Time:
Stop Time:
Close
Print
Export
Units
Control Window - Room HOTCAD
CMD:
Clear
Send
P&S
MiPower
MiCamera
MiCal
MISR
MiCam2
MiAnalysis
Tile
Windows
Rooms
Procs
Tools
Snap
QA
SetUp
Help
COMMENTS
Filter
ACK

FUI Telemetry & Analysis (cont.)

Quick-Analysis, Off-line Analysis, Viewer all use request builder

Quick-Analysis

- Access different views of real-time and near real-time data

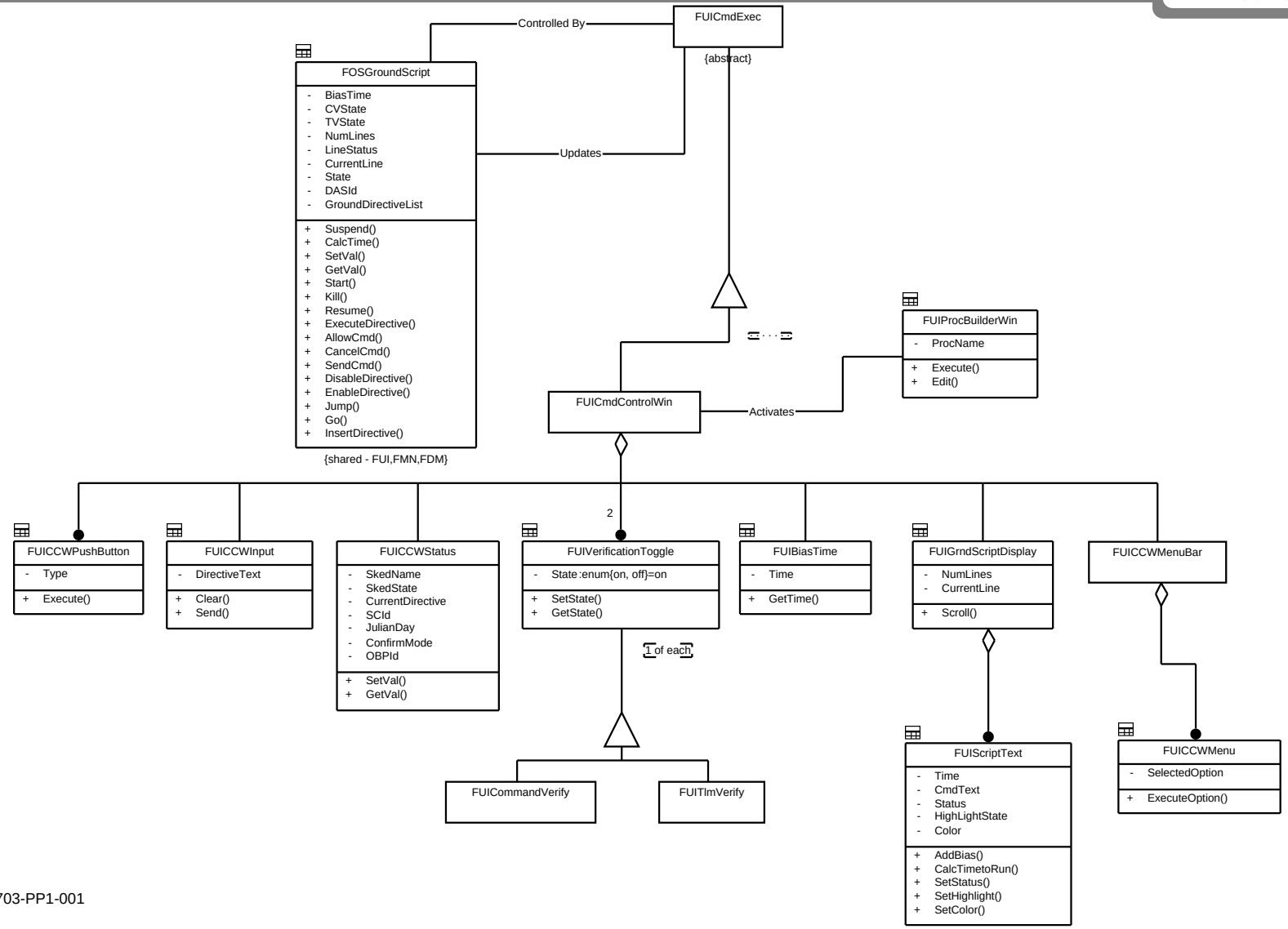
Off-Line Analysis

- Request Window
  - additional filters (time, sample rate, min/max reduced, etc.)
- Viewer
  - once analysis request is serviced, allows additional views of data
- Status
  - status of analysis requests

Analysis Data Handler

- manages requests, status, startup of displays

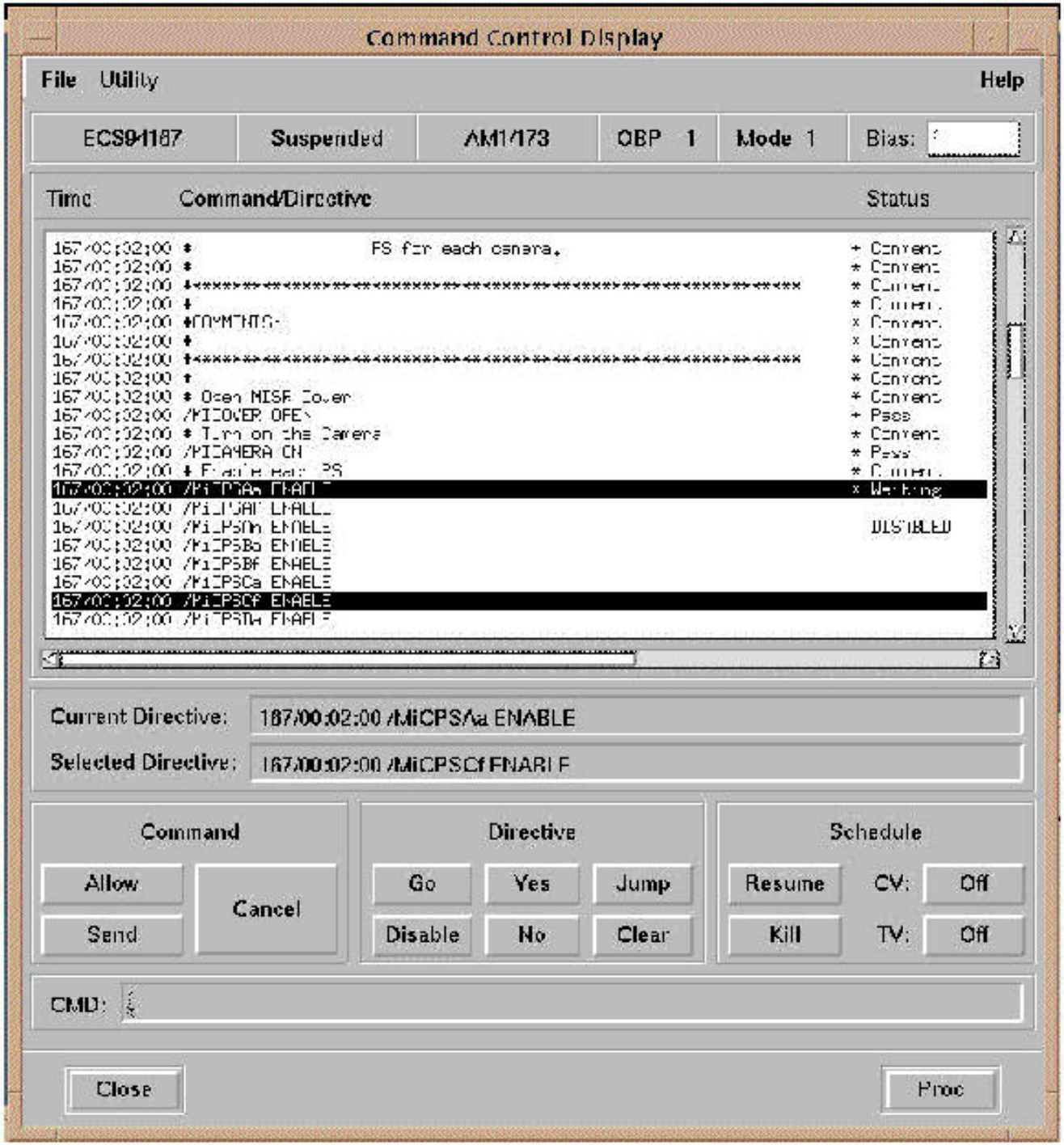
FUI Command Execution



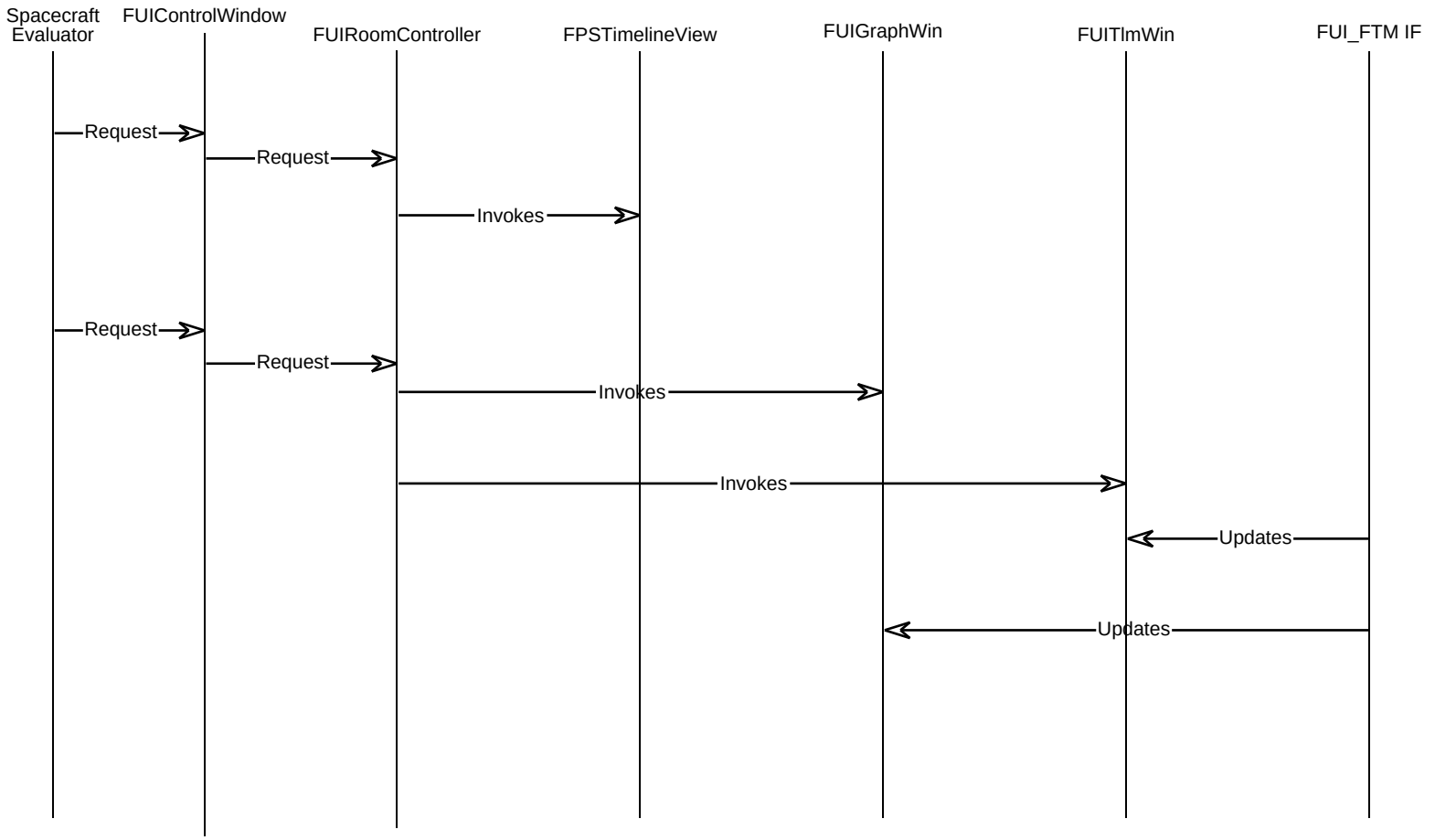
FUI Command Execution

Manages Execution of the Ground Script:

- **Displays ground script directives in a scrolling window**
- **Allows the user to control ground script execution (e.g. suspend)**
- **Posts status for each directive**
- **Provides quick access to emergency or convenience procedures**
- **Allows the user to control the verification of command directives**
- **Accepts manual directives from user**
- **Provides access to the procedure builder**


Command Control Display
File
Utility
Help
ECS94187
Suspended
AM1/173
OBP 1
Mode 1
Bias:
Time
Command/Directive
Status
FS for each camera.
Open MISR Cover
Turn on the Camera
Current Directive:
187/00:02:00 /MiCPSAa ENABLE
Selected Directive:
187/00:02:00 /MiCPSCf ENABLE
Command
Allow
Send
Cancel
Directive
Go
Yes
Jump
Disable
No
Clear
Schedule
Resume
CV:
Off
Kill
TV:
Off
CMD:
Close
Proc

Monitor Telemetry Scenario



Monitor Telemetry Scenario

- A spacecraft evaluator (SCE) brings up the Planning & Scheduling timeline window to determine the schedule for the next pass
- The SCE selects a room containing telemetry windows to monitor upcoming real-time telemetry. The selected room contains a graph window and a telemetry window
- During the pass, telemetry values are received from the FOS Telemetry subsystem
- Telemetry values are formatted and displayed to the SCE

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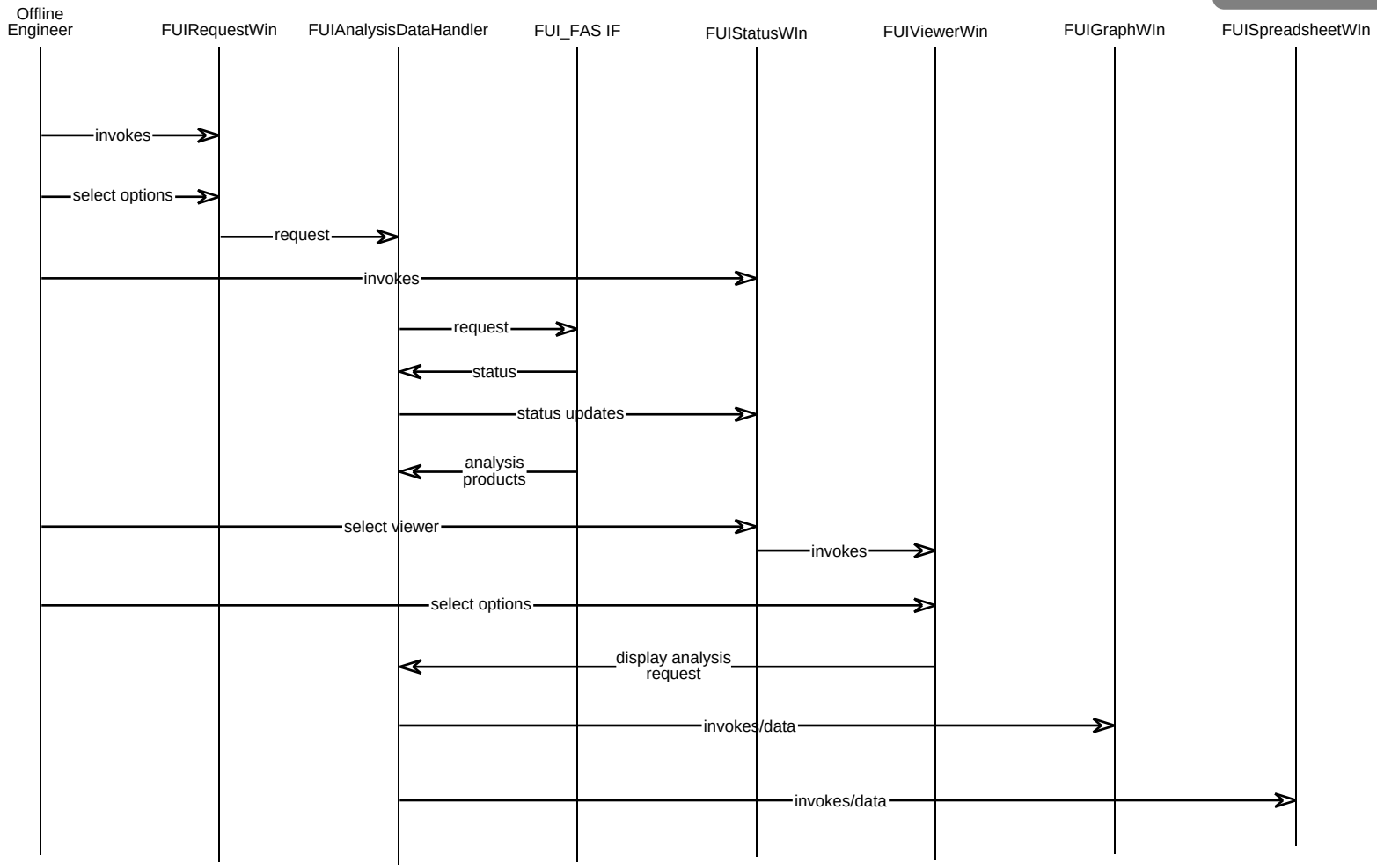
Off-Line Analysis Scenario



Off-line Analysis Scenario

- Following a pass, an Off-line Engineer (OLE) invokes the request window to create an off-line analysis request
- Once the request is completed, it is sent to the FOS Analysis Subsystem (FAS) for processing
- The status of the request is returned by FAS and displayed to the OLE in the Status window
- The data products are received from FAS when the processing of the request is complete
- The OLE selects the Viewer window and specifies the display formats (e.g., graph and spreadsheet)
- The analysis results are presented to the OLE in the specified display formats.

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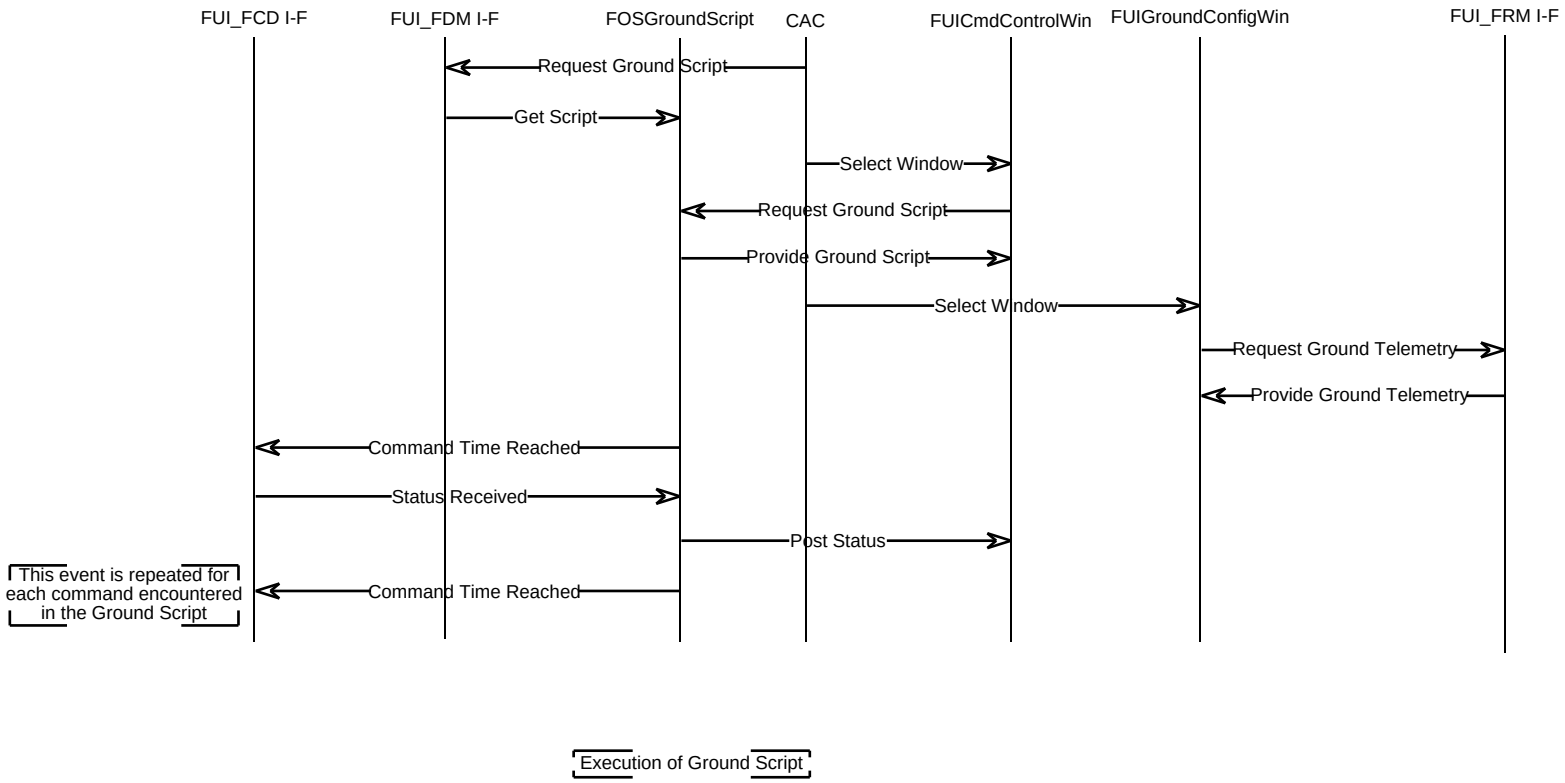
Execution of a Ground Script Scenario



Execution of a Ground Script Scenario

- The Command Activity Controller (CAC) requests execution of a ground script
- The specified ground script is retrieved from the FOS Data Management subsystem
- The CAC brings up the Command Controller window to view the execution of the ground script
- The CAC brings up the Ground Configuration window to check that all resources are available. Ground telemetry is received from the FOS Resource Management subsystem
- During execution of the ground script, command directives are sent to the FOS Command subsystem for uplink to the spacecraft
- Each command directive status is received from the spacecraft by the FOS Command subsystem, forwarded to the FUI subsystem, and displayed in the Command Control window