Control Centers
What do the consoles do?
Mental Models - Displays, Applications, Objects

from Gemini to Shuttle

Displays
- Monochrome Alpha-Numeric
  - Channel 1
  - Channel 73
- Monochrome Alpha-Numeric

Shuttle to ISS, Robotic Missions

Telemetry
- Plot Application
- Alpha-Numerics Application
- Timeline Editor
- Procedure Viewer
- Procedure Editor
- Trajectory

MCT to WARP

Objects, Models, Views

Composition
- View
- View
- View

The Thing (Model)
Physical Co-Location

- Why co-location?
- Gestures
- Face to face
Mission Operations

1. Monitor health & status
2. Examine science data
3. Examine other data
4. Decide what to do next
5. Command spacecraft

* Intermediaries (such as satellites and ground stations) omitted for simplicity.
Multi-Disciplinary Operations

Operations
Flight directors, planners, and decision-makers who conduct the mission.

Engineering
Specialists monitoring the health and status of subsystems, instruments.

Science
Experts in areas pertinent to the science goals of the mission.

Personnel from many different areas of expertise collaborate and contribute toward achieving mission goals. Effective communication is essential!
Multi-Disciplinary Communication

Operations  Engineering  Science

Face-to-face  Voice loops  Chat clients  Logs
Mission Tools

Operations personnel use a broad variety of tools to work with a broad variety of data.

- Telemetry visualization
  - Plots
  - Alphanumerics
  - Dense displays
- Telemetry dictionaries
- Data product viewers
  - Imagery
  - Spectra
- Procedures
  - Viewers, editors
  - Executors
- Planning tools
  - Timeline-based
  - Traverse-based
- Clocks, timers
- Session management
- Commanding
  - Issue commands
  - Sequencers
- Text editors
- Version control systems
- Webcams
- Console logs
- Simulators
Mission Requirements

New missions do new things. The hardware, software, and human processes that worked for one mission may not be appropriate for another.
History

• The early Mercury Control Centers were distributed around the world

• Centralization became possible only with advances in communications and tracking networks