Ground Segment Standardization and Commonality:
Benefits, Risks and Obstacles

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Outline

- **Areas of Standardization**
- **Benefits**
- **Risks**
- **Obstacles**
- **Near-term Approach**

Potential Areas for Standardization

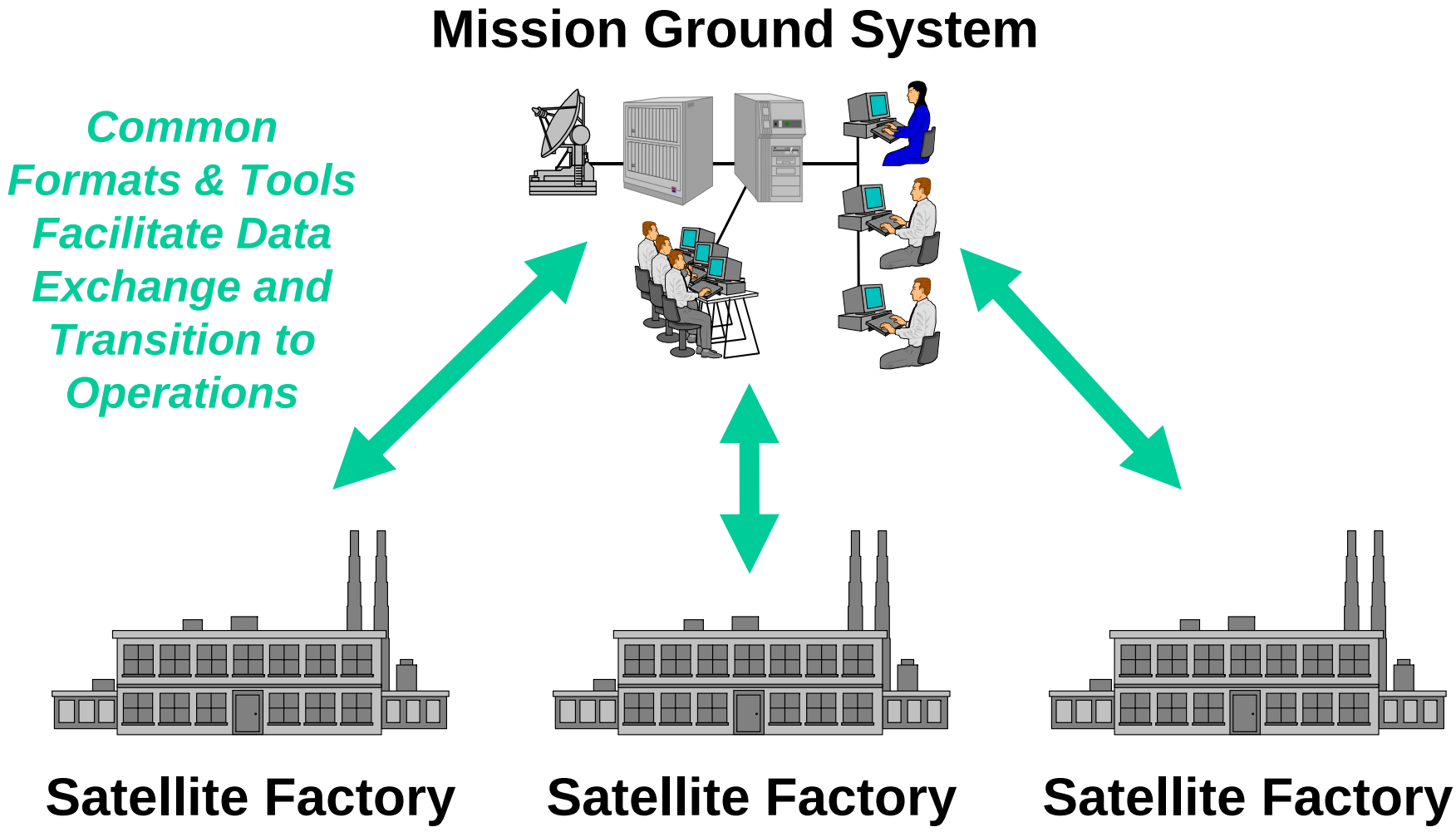
- **Satellite Bus TT&C has functional commonality across ground systems**
  - **Payload control, monitor, & processing too specialized**
- **Areas for Bus TT&C Standardization**
  - **HMI**
  - **Telemetry and Command Definitions**
  - **Procedure Languages (OMG proposal)**
  - **Data Transmission between Components**
  - **Data Archival and Retrieval interfaces**
  - **Data Analysis Tools**
  - **Data Transmission on the Ground**
- **Areas Requiring Space & Ground Synergy**
  - **Data Transmission between Space and Ground**

Benefits of Standardization

- **Improved interoperability**
  - **Requires active system-of-systems engineering process**
- **Reduced costs**
  - **Ground Systems development costs are significantly reduced when telemetry and command databases and satellite test procedures are reused for operations [1]**
  - **Upgrades are cheaper if common format is used for databases, procedures and data exchange**
  - **Training costs decrease with standard mission planning and data analysis tools**
- **Common look and feel created by a standard HMI will result in ease of use**
- **The reliability of systems is increased when standards and common components are used**

[1] SpaceOps 2004 paper "Ground Systems – The Need for Standardization"

Benefits of Standardization



Risks

Long lead time to develop standards

- **Developers and acquisition offices may miss window of opportunity for major systems needed today**
- **Retrofitting legacy systems can cause breakage and down time**
- **If standards and common systems are required:**
  - **Creativity can stagnate**
  - **Mission capabilities can be limited**
- **Competition leads to better, cheaper products**
  - **If everyone is forced to use common products, market is stifled, i.e. we do not get better, cheaper products**

Obstacles

- **Proprietary systems in use today are not interoperable and do not allow for interoperability without custom development**
- **Implementation of new standards will incur large costs**
- **Business case has not been made for the Return on Investment**
- **Resistance from Ground System vendors**
- **Resistance from Satellite vendors**
  - **Implementation of Ground System standards may limit business opportunities, e.g., no option to build ground system**
- **Acquisition process is currently geared to stove pipe or one-of-a-kind systems**

Near-term Approach

- **Evaluate existing standards for ground system acquisitions**
  - **Telemetry and Command Definitions (XML Telemetric and Command Exchange - XTCE)**
- **Develop near-term standards that directly promote interoperability**
  - **Common Look and Feel**
    - Display layout
    - Application behavior
  - **Procedure language**
    - Promote reuse of validated procedures across systems: factory, S-band, in-band
  - **Data Transmission**
    - Establish IP-based telemetry and command protocols to facilitate bent-pipe data exchange between ground systems via GIG
    - Facilitate transition to alternative comm network delivery services, e.g., space-based satellite control