Drawing System Diagrams

Basic Steps

1. Identify all major subsystems
   - Derived from your project goal, objectives and requirements

2. Identify all interfaces between components
   - These are either relationships or real connections between components

3. Produce your drawing
   - Components are labeled boxes
   - Interfaces are arrowed lines keyed to the interface function
   - Keep your layout as straight forward as possible
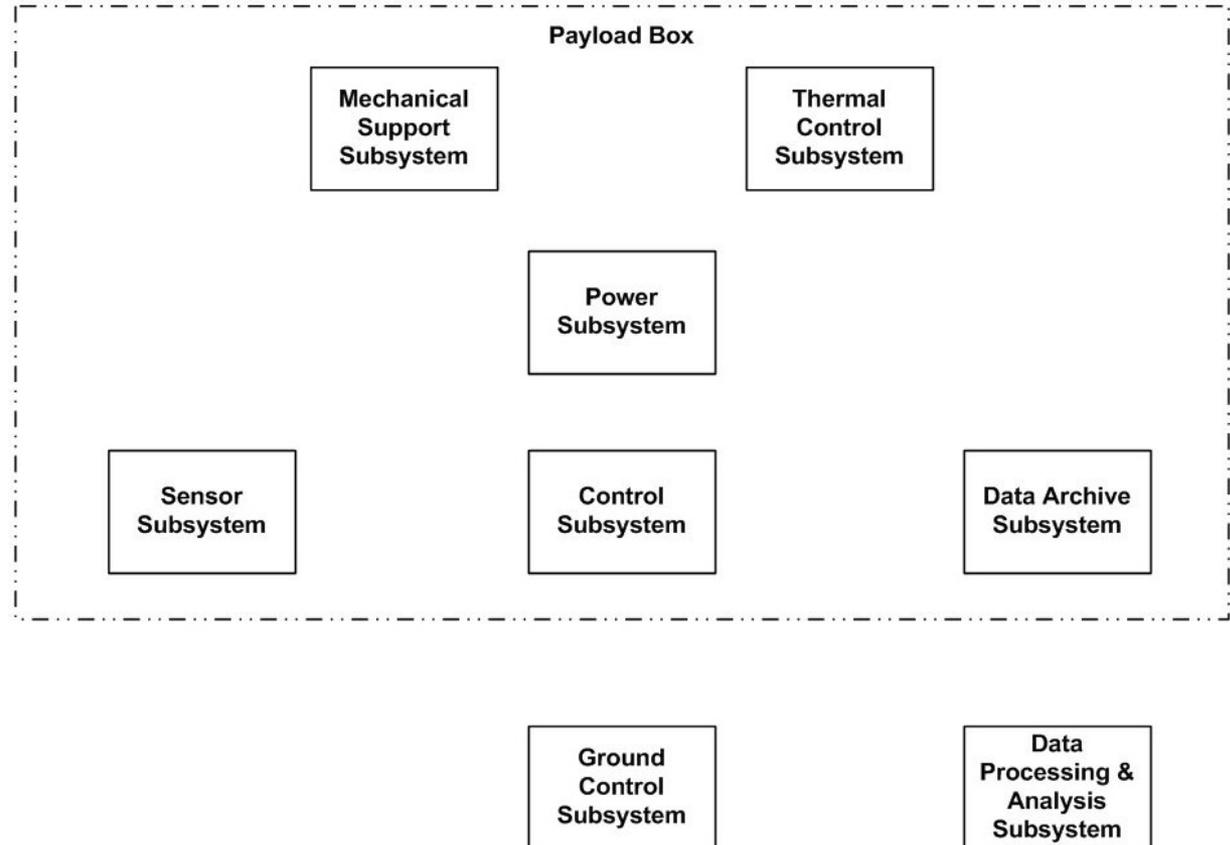
Identify Subsytems and Components

- Components are based upon the project goal, objectives, requirements, and level of detail

- For example, system level (High Level) diagram our components would be our subsystems:
    - Requirement: Measure Something -> Sensor Subsystem
    - Requirement: Store Data for analysis -> Data Archive Subsystem
    - For your payload to operate by itself during flight you need a Control Subsystem
    - Requirement: Provide Payload Power -> Power Subsystem
    - Requirement: Maintain payload integrity through flight -> Mechanical Support Subsystem
    - Requirement: Maintain components within operating temperature -> Thermal Control Subsystem
    - Requirement: Control system from the ground -> Ground Support Subsystem

- Different kinds of subsystems may be required based on the goals and objectives of the project

Example System Level Drawing

- Each sub-system has its own box

- Components are arranged in a way to show their connections to other components

- **Components do not need to be drawn in their physical arrangement**

  - But it is often useful group items in major categories like ground and flight systems

Payload Box

Mechanical Support Subsystem

Thermal Control Subsystem

Power Subsystem

Sensor Subsystem

Control Subsystem

Data Archive Subsystem

Ground Control Subsystem

Data Processing & Analysis Subsystem

Determine the interfaces

- Interfaces are the "connections" between the systems
  - Could be a physical connection (e.g. wire, mechanical)
  - Could be an electrical signal (e.g. Serial, radio signal)
  - Not a wiring diagram showing all connections
- Each type of interface should be represented by a different kind of line
- Each interface should be labeled according to its specific characteristics
- Arrows on the ends of the line indicate flow
  - For example: Electrical power is usually 1 way, communications are often bidirectional

Example Interface Representations

- Use different line styles
  different interfaces types
  - Power
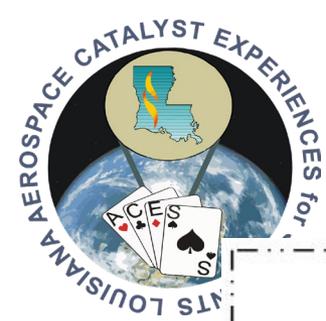 - Data
  - Control
  - Mechanical
  - Thermal
- Interface flow
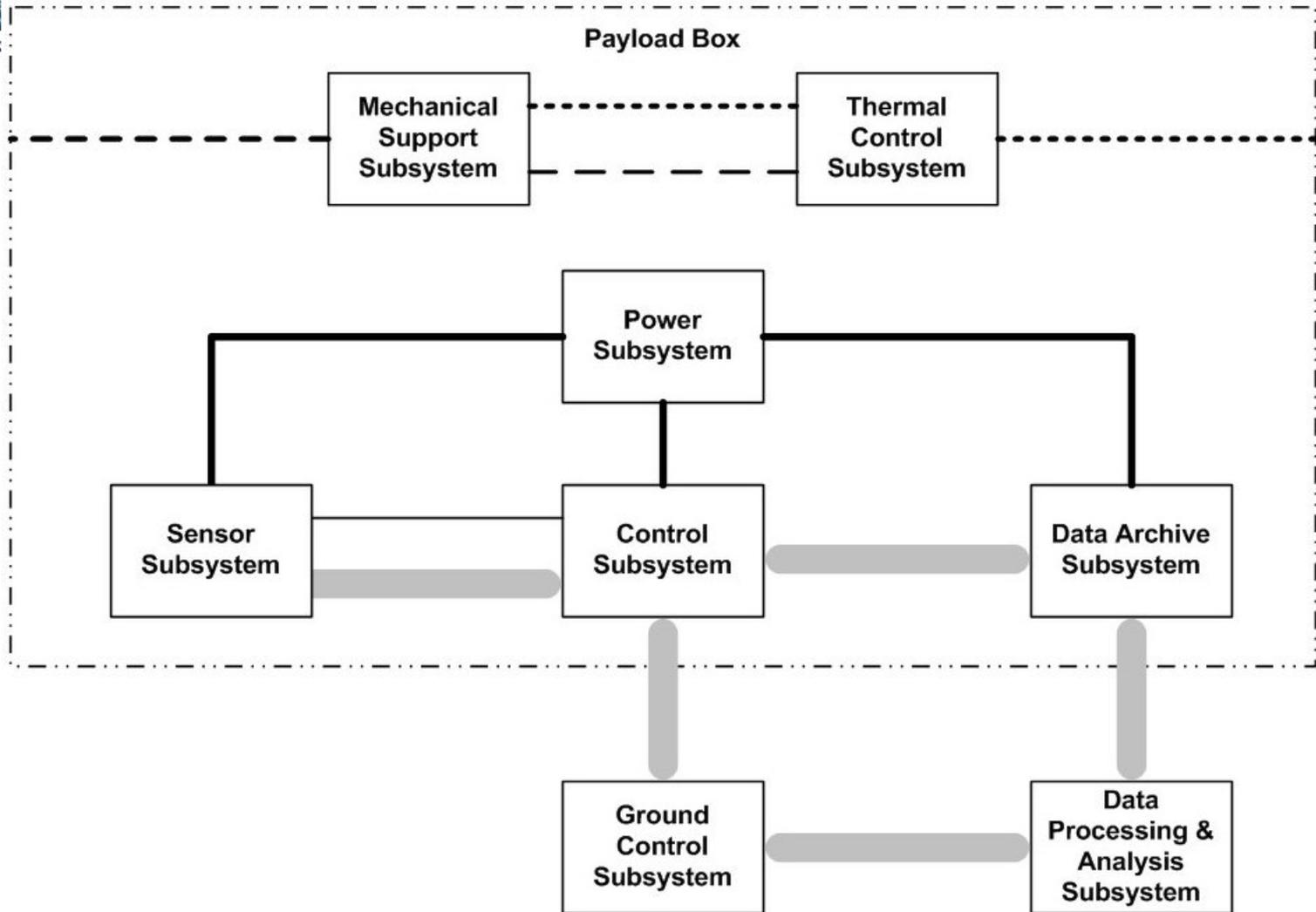 - To component
  - From component
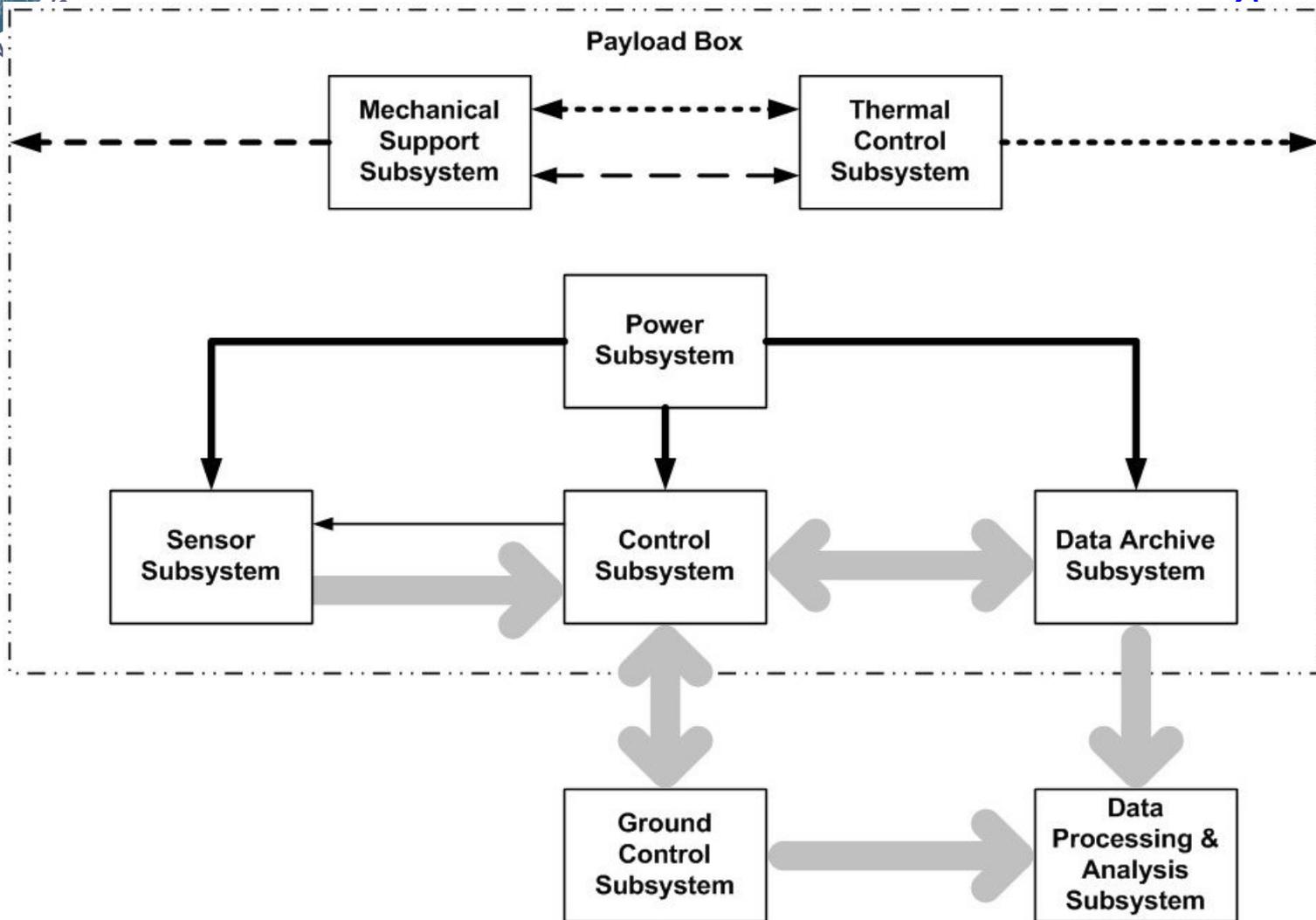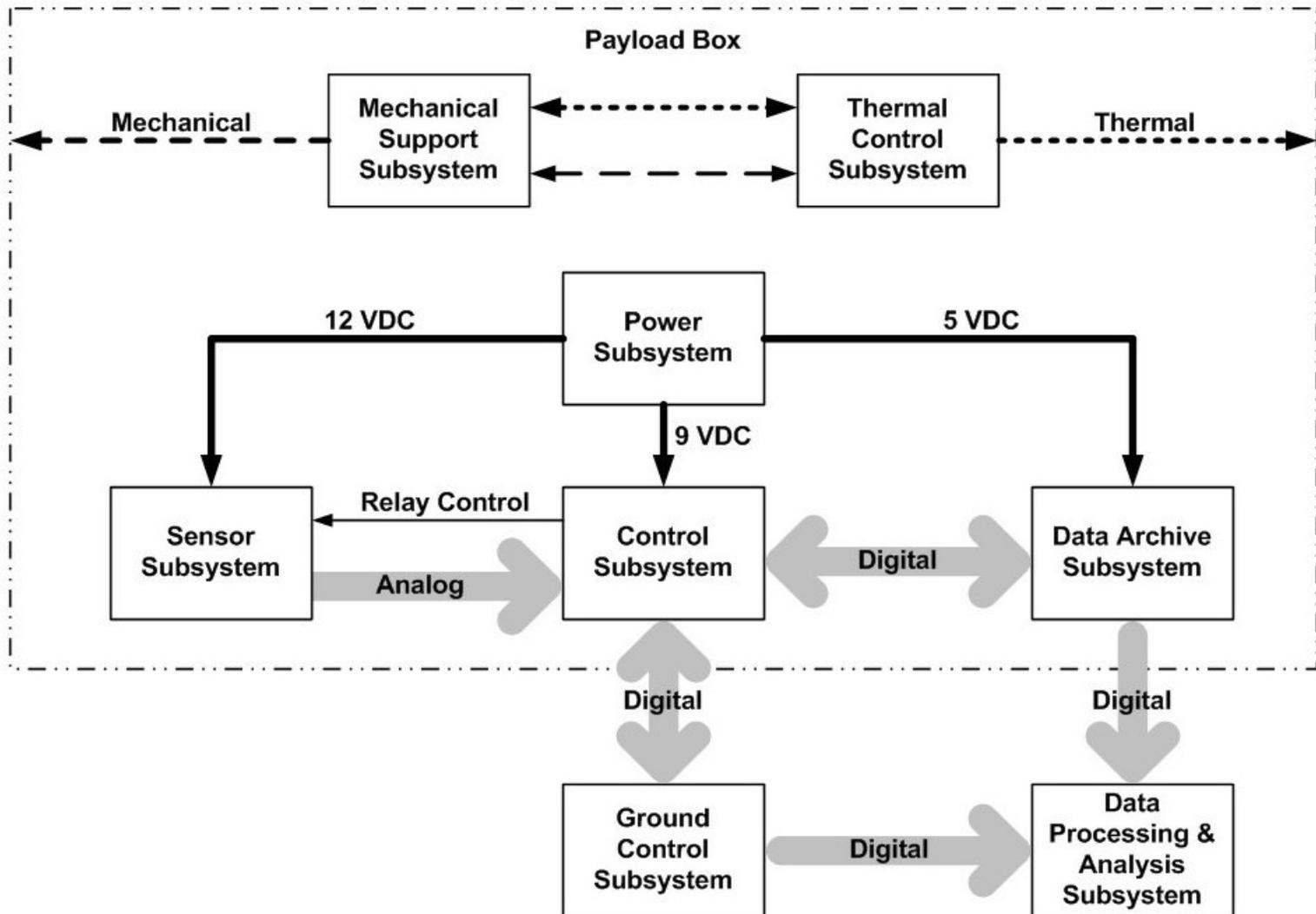 - Bi-directional

Add the interfaces

# Indicate the direction of interface flow

Add labels

Detailing Subsystems

- Remember from System Design, we will have multiple levels of detail for system drawings

- Each of the previous subsystems would have more detailed drawings

- As you develop your design and requirements, you should develop more detailed system drawings

- System drawings help you identify the interfaces and may point out an interface you have missed

- A good rule of thumb is 3 iterations of system diagram in increasing detail
  - High-Level System overview
  - Subsystem functional version
  - Refined Subsystem with detailed components and interfaces

- More complex subsystems may need additional detailed levels, and simpler systems may not need as many
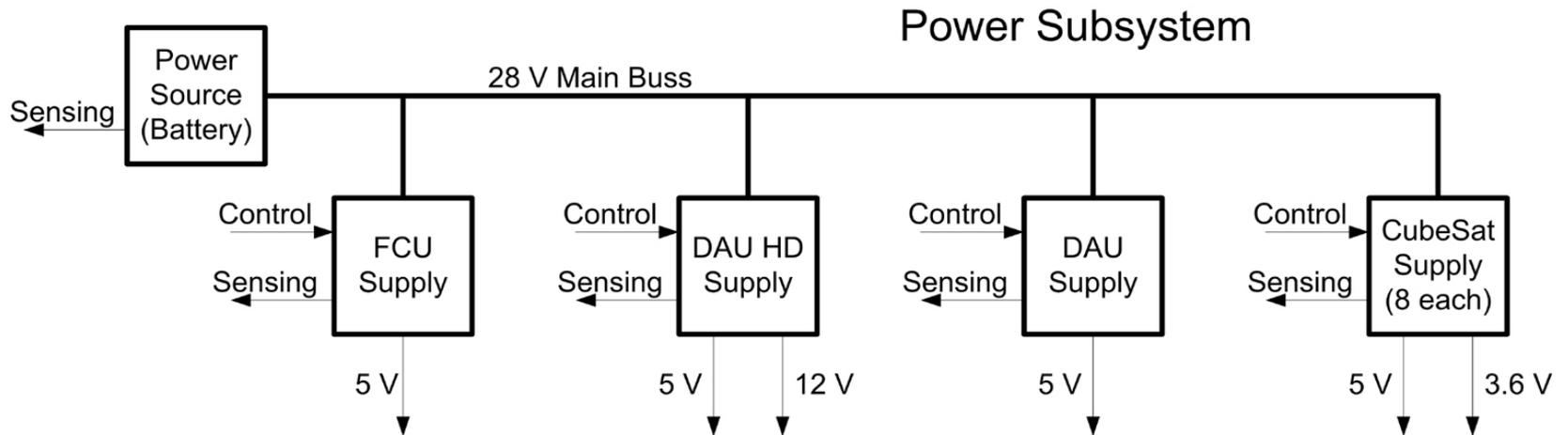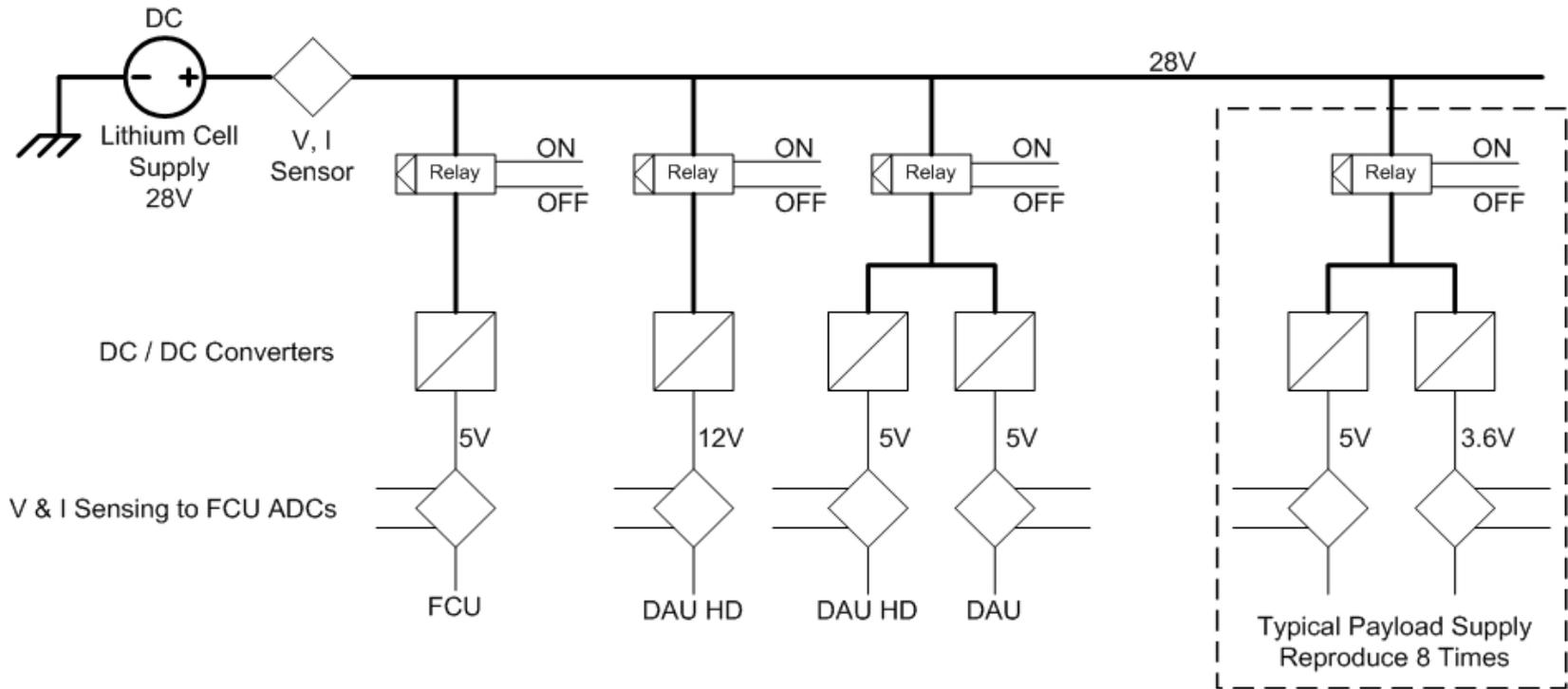
System Level Drawing Example
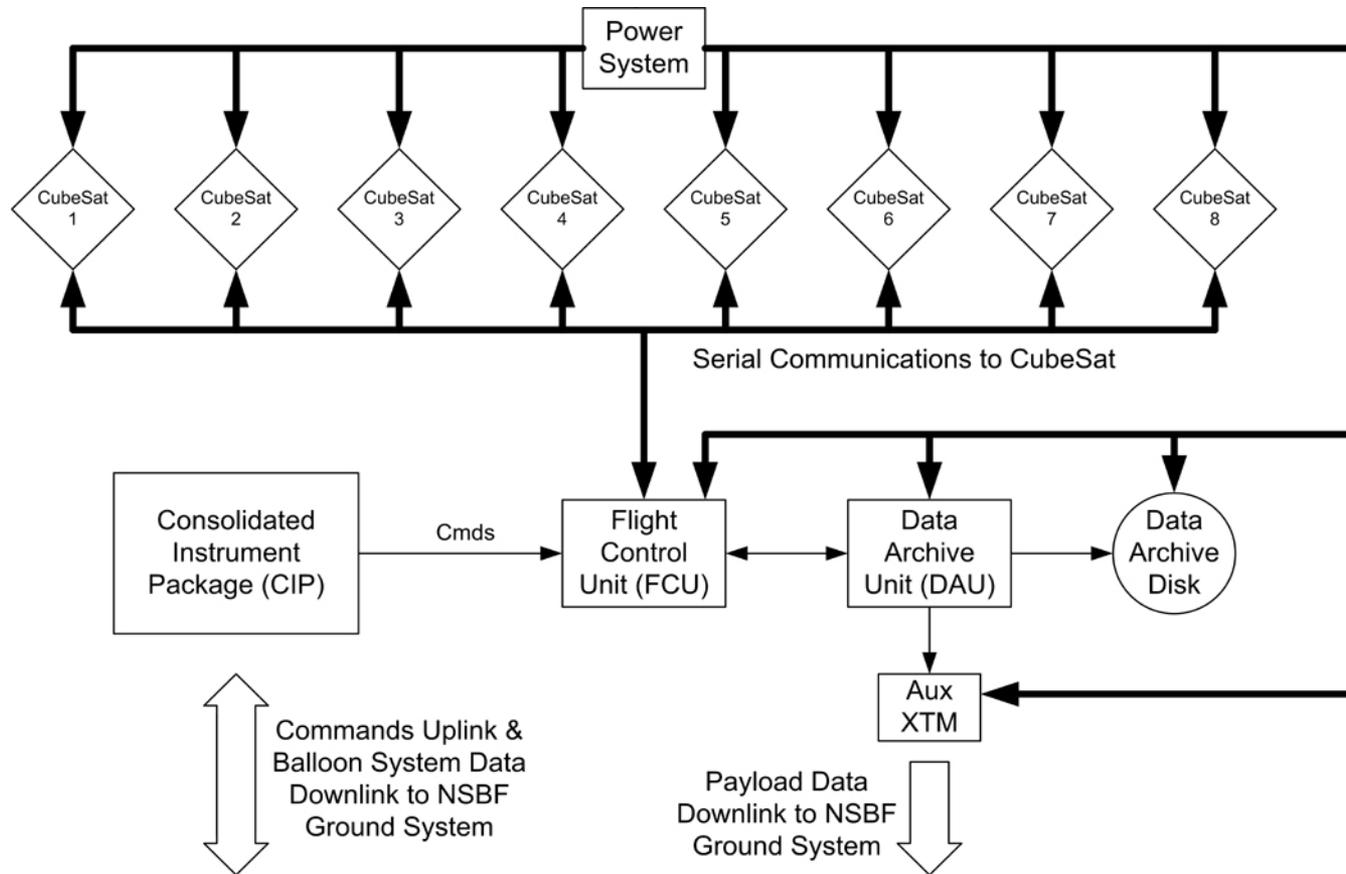
Subsystem Level Example

Power Subsystem

Refined Subsystem Example

Drawing Readibility

- Do not try to squeeze too much information into a single drawing
  - Give subsystems individual drawings
  - Can spread interfaces across multiple drawings
    - Could have multiple versions of the system-level diagram for different sets of interfaces

- Show connections to outside systems
  - A control signal coming from a sensor subsystem
  - Do not need to draw the entire control system on the sensor drawing, but show the details of where the controls connect inside the sensor subsystem

- Try to vary line style as well as color and include a legend

Drawing Software Options

- Recommend using the same software for flowcharts

- Microsoft Office Suite: Visio works well

- Google Drawings

- Draw.io

- Choose something with predefined blocks and arrow connectors rather than image editing software