



**SPACE SHUTTLE PROGRAM**  
**Space Shuttle Vehicle Engineering Office**  
NASA Johnson Space Center, Houston, Texas



# Auxiliary Instrumentation System

**Network Support Group**  
**R. Yates**

**16 May 2001**



<b>AIS Goals / Objectives</b>	Presenter <b>Yates</b>	
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- **Goals**

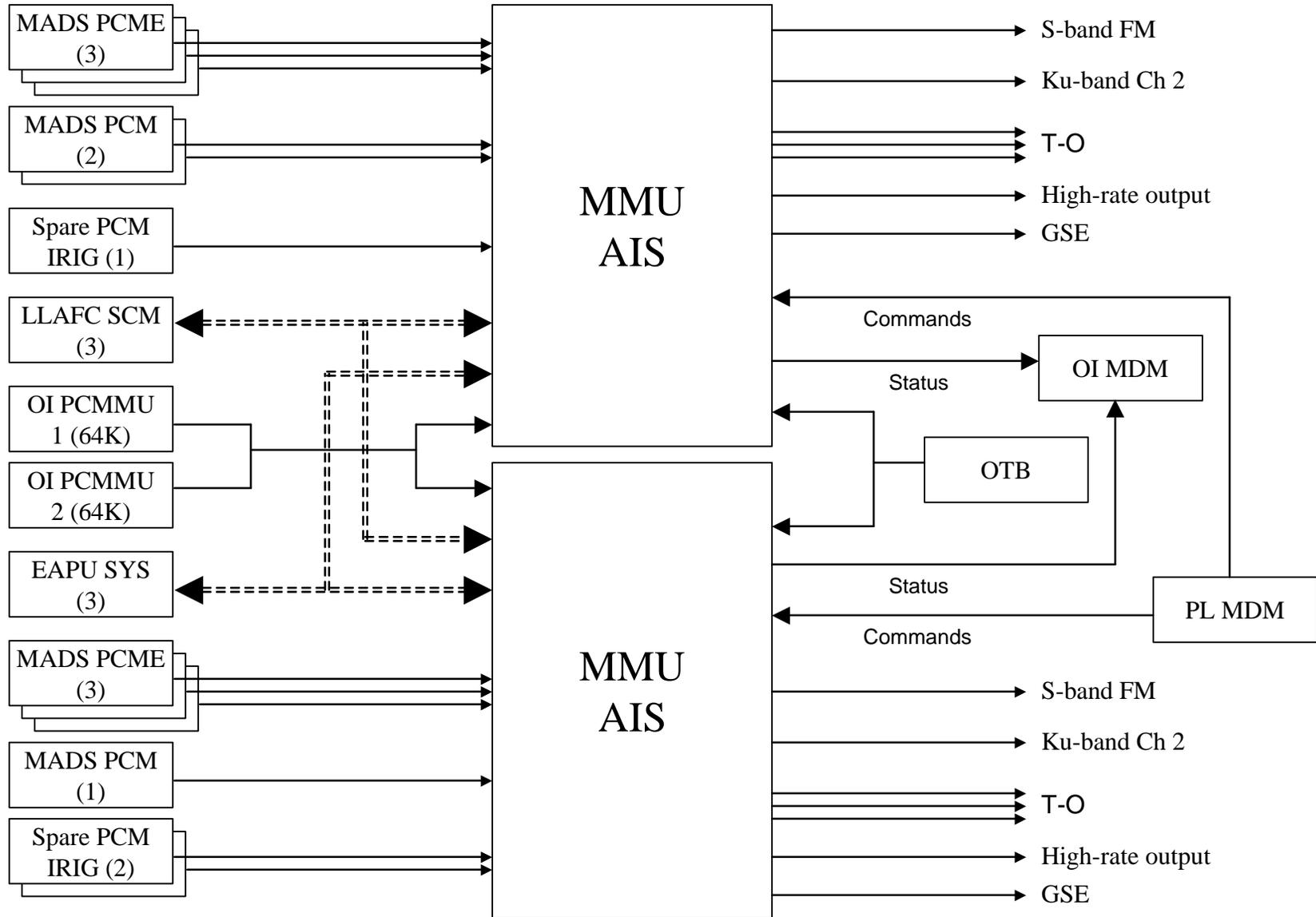
- Solve the obsolescence problem of the MADS/OEX tape recorder
- Provide a capability to acquire, record, and playback non-critical data from new upgrades, including LLAFC and EAPU
- Provide a capability to offload non-critical data from OI telemetry

- **Objectives**

- Replace the existing MADS/OEX controllers, recorders, and frequency division multiplexers (FDMs) with digital equipment
- Record LLAFC and EAPU data *via* new MIL-STD-1553B data buses
- Record PCMMU low-data-rate output
- Make all recorded and input data available *via* existing S-band FM, Ku-band, and T-0 telemetry links



<b>AIS Architecture</b>		Presenter	<b>Yates</b>
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<b>AIS Mission Timeline</b>	Presenter <b>Yates</b>	
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- **Prelaunch**
  - Route PCMMU LDR, LLAFC, EAPU, and MADS data through T-0 lines
  - T-9 min: Start recording PCMMU LDR and MIL-STD-1553B data
  - T-1 min: Start recording MADS data
  
- **Ascent**
  - Record all input data
  - Stop recording MADS data 16 minutes into flight
  
- **Orbit**
  - Record PCMMU LDR and MIL-STD-1553B data; dump to ground as required for analysis or to free memory
  
- **Entry**
  - L-75 min: Start recording MADS PCM data
  - L-13 min: Start recording PCM Encoder data (less SSME data)
  
- **Landing**
  - Wheel Stop: Stop recording MADS PCM data
  - Wheel Stop + 2 min: Stop recording PCM Encoder and EAPU data
  - Wheel Stop + 2 hr: Stop recording PCMMU LDR
  - Wheel Stop + 48 hr: Stop recording LLAFC data



<b>AIS Comm Features</b>	Presenter	<b>Yates</b>	
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- AIS may be commanded to:
  - 1) Route any data input channel to one or more output channels
  - 2) Dump stored data to one or more output channels
  
- For routing data ...
  - Output rate will equal input rate, except for MIL-STD-1553B channels
    - Input / output rates up to 5 Mb/s
    - PCMMU LDR is 64 kb/s
  - For MIL-STD-1553B channels, user will select output rate
    - 10 rates between 6.4 and 64 kb/s, and 6 rates between 128 and 768 kb/s
  
- For dumping stored data ...
  - (See table on next page)
  
- AIS will format data correctly per IRIG-106-99
  
- Operators responsible for commanding rates that are compatible with telemetry links



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<b>AIS Dump Rates</b>	Presenter <b>Yates</b>	
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Data Rate (kb/s)	T-0 Umbilicals	S-band FM	Ku-band Ch. 2	Ku-band Ch. 3
1024	X	X	X	
2048	X	X	X	X
4096	X	X	X	X
8192				X
16384				X
32768				X
49152				X

**Supported**

**Not Supported**

**Not Connected**



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<b>Data Destination By Flight Phase</b>	Presenter <b>Yates</b>	
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	Prelaunch	Ascent	Orbit	Entry	Postlanding	Postflight
<b>EAPU</b>	<b>LCC, MCC</b>		<b>MCC</b>		<b>MCC</b>	<b>MCC</b>
<b>LLAFC</b>	<b>LCC, MCC</b>		<b>MCC</b>		<b>MCC</b>	<b>MCC</b>
<b>MADS (SSME)</b>	<b>LCC</b>					<b>MSFC</b>
<b>MADS (Other)</b>	<b>LCC</b>					<b>LCC, MCC</b>
<b>PCMMU</b>	<b>LCC, MCC</b>		<b>MCC</b>		<b>MCC</b>	<b>MCC</b>



<b>AIS Schedule</b>	Presenter	<b>Yates</b>
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- **Formulation Phase (Present – Oct 2001)**
  - Define content, schedule, and cost
  - Complete SRR and SDR
  - Define system requirements and architecture
  - Compete and select AIS prime integrator
  - Partner Implementation-Phase Decision Package with SSP Elements
  
- **Implementation Phase (Nov 2001 – 2004)**
  - Develop system, just short of installation
  - Complete PDR, CDR, DCR, and AR
  - Design, develop, and certify flight hardware and software
  - Plan vehicle integration
  - Update facilities to accommodate new system
  - Update operational procedures
  
- **Deployment Phase (2004 – ?)**
  - Install system and make it operational
  - Complete flight hardware production
  - Install system into vehicle (tied to OMM periods)



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# BACKUP CHARTS



<b>Architecture Card Layout</b>	Presenter <b>Yates</b>	
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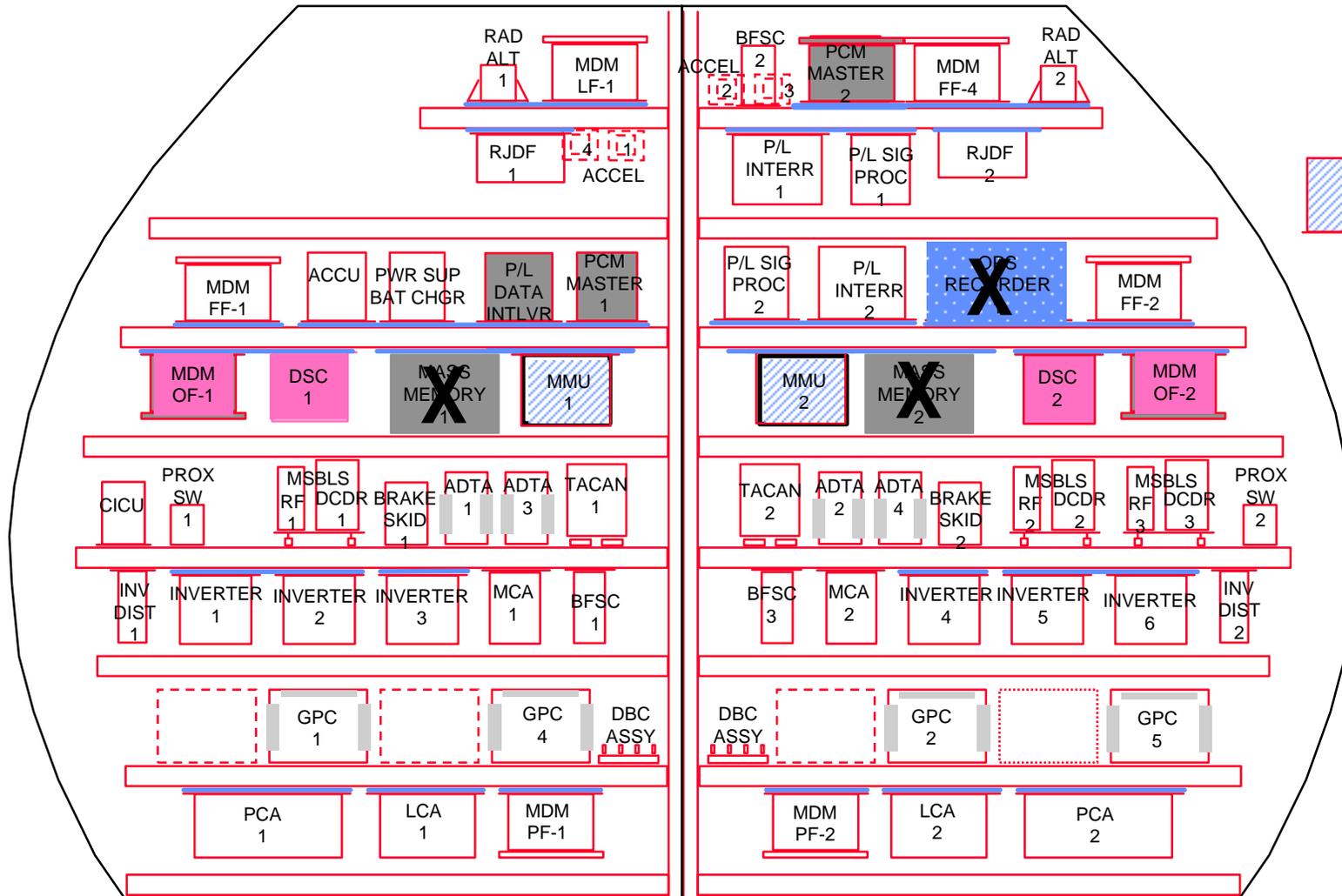
- **Bold** depicts new AIS cards
- **MMU #1 and #2** have identical hardware and software

Power Supply
SBC
SSR I/O
SSR Memory (0.5 GB)
<b>1553 Card</b>
SSMM
<b>AIS I/O #1</b>
<b>AIS I/O #2</b>
<b>AIS Power Mgmt</b>
<b>AIS Memory #1 (3 GB)</b>
<b>AIS Memory #2 (3 GB)</b>
<b>AIS Memory #3 (3 GB)</b>
<b>AIS Memory #4 (3 GB)</b>
<b>AIS Memory #5 (3 GB)</b>



**Equipment Installation Drawing**

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Location of new MMU

**FORWARD AVIONICS BAYS 1 & 2  
 EQUIPMENT INSTALLATION DRAWINGS**



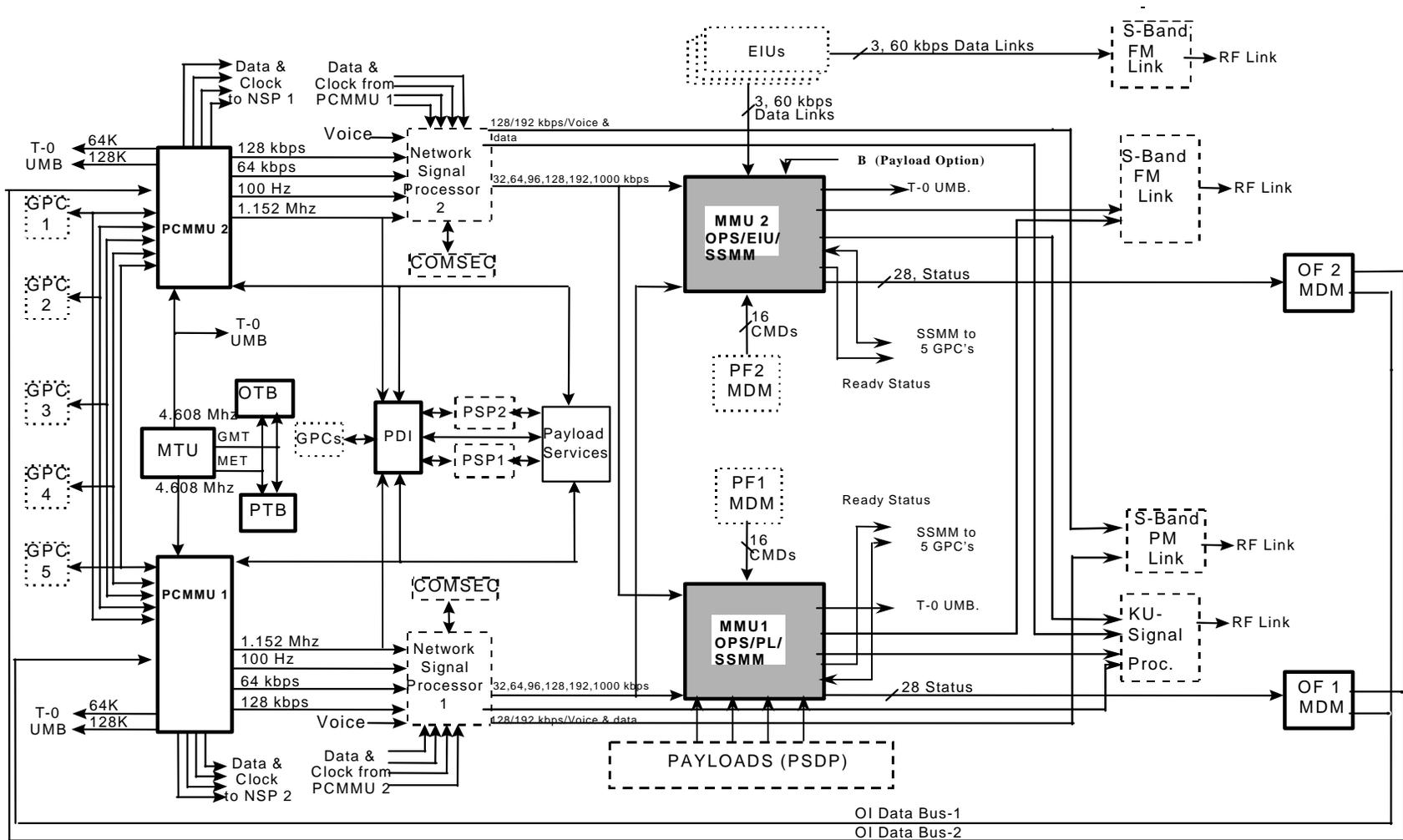
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<h3>Preliminary Integrated Architecture</h3>		Presenter	Yates
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**Figure 1 – MMUs / Instrumentation & Telemetry System**