1. Using Message-Oriented Middleware to Integrate Legacy Applications and Commercial Off-the-Shelf Products – The RADIUM Case Study
   • Jared Stallings - Raytheon Intelligence and Information Systems
   • A successful internal prototype effort using MOM

2. Telepresent Agents - A New Paradigm for Sharing Information in Networked Systems
   • Russ Abbott - The Aerospace Corporation
   • Can we take communications concerns out of the equation?

3. A Modular, Data Driven System Architecture for GSFC Ground Systems
   • Everett Cary - Emergent Space Technologies, Inc.
   • GSFC has successfully allowed integration of dozens of components, now going operational.

4. Successes of Component-Based Approach in Similar Industries
   • Gamal Balady - Mass Group
   • 80,000 copies sold! We can learn from similar industries.
Findings

1. We agree the industry is ready for more consistent approaches, interchangeable components, simplified integration, etc.
   • We can’t afford not to standardize key aspects
   • It is key to more rapid capability advancement

2. Message standards could be helpful, but . . .
   • Effort can be overtaken by raging incrementalism
   • Insufficient to allow plug-and-play development

3. API standards help plug-and-play development, but . . .
   • Tied to architecture approach (MOM, Web Services, etc.)
   • Effort almost guaranteed to be overtaken by raging incrementalism

4. Therefore . . .
   – Maybe we just punt! We can revisit the issue next year when things are worse
   – Groups like NASSA/GSFC can “standardize” plug-and-play through shared usage, not formal standards
   – We can keep working on technologies that help abstract comm details so that the standards approach becomes more viable
## Communication Hierarchy

<table>
<thead>
<tr>
<th>Technology</th>
<th>Hides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Move from $N^2$ to $2N$</td>
<td>Connectivity issues</td>
</tr>
<tr>
<td>JMS/MoM</td>
<td>Read/write issues</td>
</tr>
<tr>
<td>XML</td>
<td>Formatting issues</td>
</tr>
<tr>
<td>Interoperability standards</td>
<td>Field definition issues</td>
</tr>
<tr>
<td>Shared database</td>
<td>Communication issues</td>
</tr>
<tr>
<td>Telepresent agents</td>
<td>Content issues</td>
</tr>
</tbody>
</table>
“We are not alone”

• Other industries address similar functionality
  – SCADA – Supervisory Control and Data Acquisition
  – Factory control, environmental monitoring, building mngt, nuclear power plants, etc.

• How can one company sell 80,000 systems?
  – End-users demanded standardization
  – Device interface standards developed about 5 years ago
    • OPC. Test software released with each standard
  – 150 vendors now sell compatible components!
  – System is highly scaleable/configurable; decoupled (independent) component design

Having a non-aerospace presenter provide lessons-learned (and a “reality check”) should be considered for future GSAWs.
Economies of scale start with quantity 2.

Over 80,000 copies sold!

NASA GSFC working to field 3 systems this year.

The diagram shown here shows the patented (U.S. Patent #4,908,746) Open Software Bus architecture.