



Wireless Instrumentation Use on Launch Vehicles

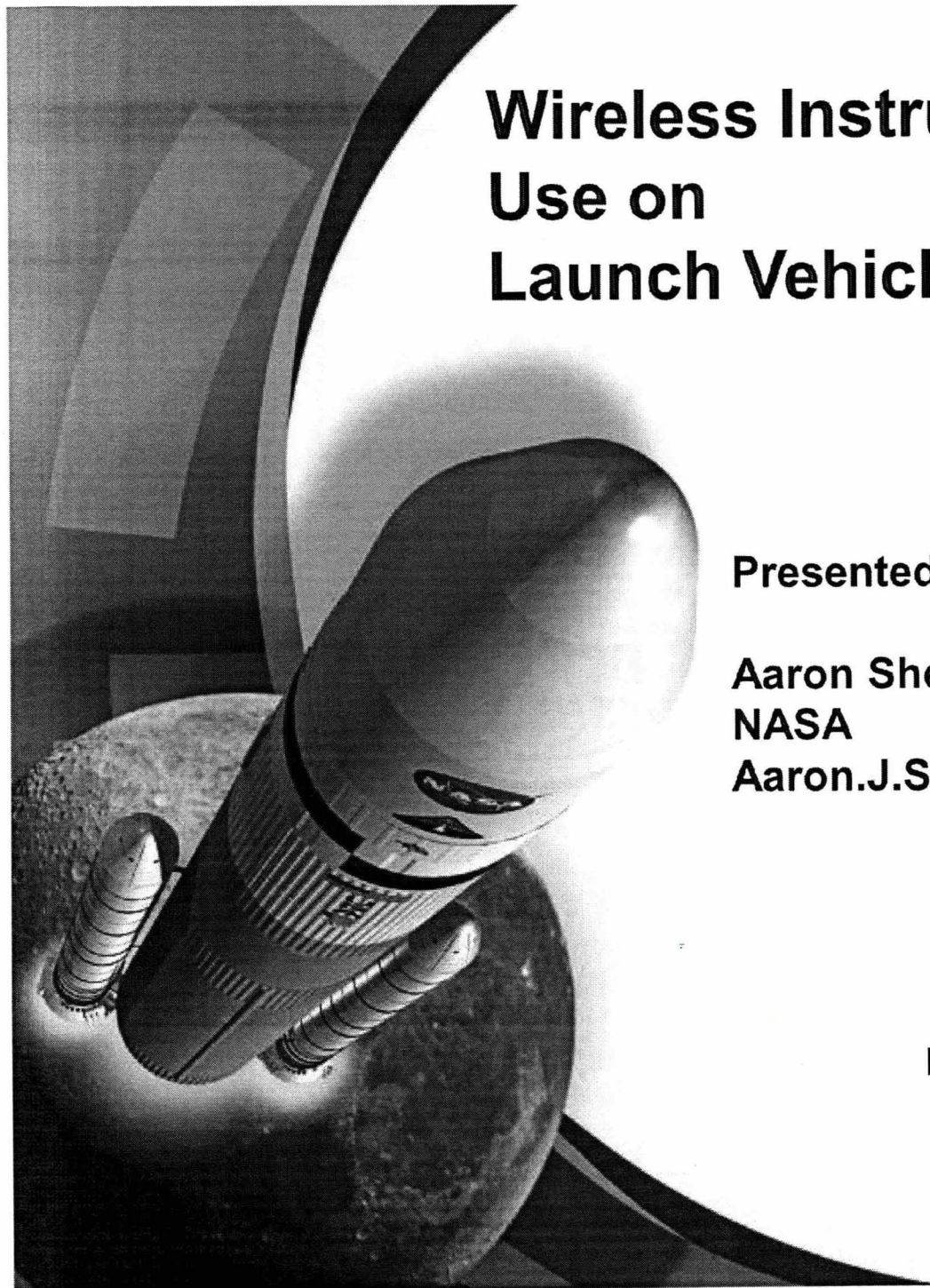
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Wireless Instrumentation Goals

- Wireless instrumentation can:
 - Cut down lead times vs wired solutions
 - Provide greater flexibility/adaptability to changing needs/goals vs wired solutions
 - Eliminate wiring (design/cost/weight savings)
 - Allow more direct instrumentation
- The ideal solution replaces all wires with wireless connections

- How feasible is the ideal solution?

What is Available Today?

- **Ground Rules:**

- Evaluate products available supporting wireless between sensors and acquisition units and between acquisition units.
- Wireless means RF
- Considering commercially available solutions (not R&D options)
- Mission objectives could be long duration

- **Data Sources:**

- Wireless product information from vendors
- Wireless projects from NASA centers
- Instrumentation needs on similar projects

Evaluation Criteria

- **Functional performance is the primary filter**
- **Other factors:**
 - **Cost**
 - **Mass**
 - **Power**
 - **Reliability**
 - **Redundancy**
 - **Operational Factors**
 - **Vehicle side effects**

Study Results

- **There are 4 basic wireless architectures that emerged:**
 - **Wireless Acquisition Units**
 - **Wireless modules integrated with data collection systems**
 - **Mesh sensor networks**
 - **Passive Tags (RFID/SAW technology; RF reflection technology)**
- **None of the architectures/vendors provided solutions that met 100% of the instrumentation needs**
- **Technical hurdles still exist:**
 - **Performance**
 - **Power**
 - **Data transfer**
 - **Availability**
 - **Integration**
- **Psychological barriers**

Future Work

- **Recommendations:**
 - Continue using wired sensor solutions as the primary choice for vehicle instrumentation
 - Assess needs and use wireless instrumentation where appropriate
- **Future Work:**
 - Support R&D and SBIR efforts for wireless technologies
 - Promote relevant demonstrations of wireless systems
 - Look for opportunities to use partial wireless solutions
 - Participate in wireless/sensor communities (International Society for Automation, JANNAF sensors database)
 - Re-evaluate wireless solutions using different assumptions to identify technologies for adaption/evolution

Conclusions

- **Is it viable?**
 - Wireless solutions are generally not ready to replace wired technologies for launch vehicles
 - Issues remain for power, communication links, sample rate, timing and bandwidth
 - Despite issues, there will still be cases where wireless will be beneficial
- **Technologies are continuing to emerge**
 - Support developing technologies (Internal R&D, SBIR)
 - Promote use of wireless in demonstration environments
 - Follow industry trends for evolving technologies