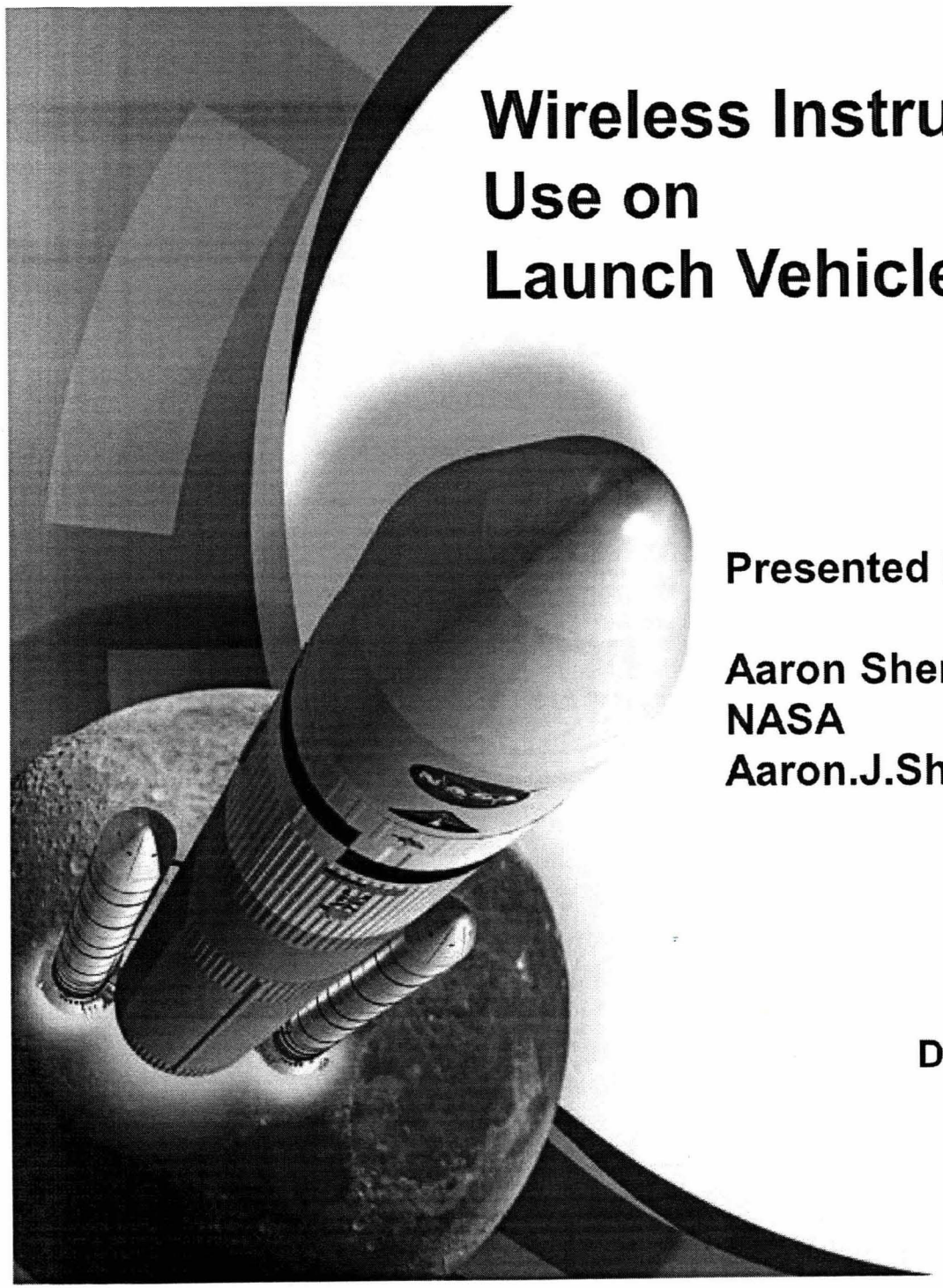

Wireless Instrumentation Use on Launch Vehicles

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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