An Overview of Advanced Data Acquisition System (ADAS)

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Aerospace industry requires highly reliable data acquisition systems. Traditional systems employ end-to-end hardware and software redundancy, typically, redundancy adds weight, complexity, and cost, a single component failure may render the redundant path useless.
What is ADAS?

- ADAS is an intelligent, self-calibrating, self-healing, highly reliable, and cost effective multi-channel data acquisition system
- Reliably maintains data integrity at a reduced weight, size, and cost
- The architecture provides a "spare part toolbox" approach for identified critical components
- Number of spare components in the toolbox is based on their proneness to failure
R & D Status

- Development stage
  - Architecture was defined
  - First prototype built
  - System components, component interfacing, and user interface tested
  - Preliminary software developed
  - System demonstration

- Technical considerations
  - Hardware limitations
  - Reliability optimization is based on application specifics
  - Reliability/flexibility vs. complexity trade-offs
Reliability/Cost Examples (1)

One channel, non-redundant

IN → Signal Cond. 0.98 → OUT

Reliability = 0.99 * 0.98 * 0.96 = 0.9314
Cost = 1X, failure rate = 6.86%

One channel, traditional end-to-end redundant

IN → Signal Cond. 0.98 → Signal Cond. 0.98 → OUT

Reliability = (1 - (1 - 0.9314)^2) = 0.9953
Cost = 2X, failure rate = 0.47%
Improvement factor = 14.57

*Component reliability factors for demonstration purposes only
Reliability/Cost Examples (2)

Novel ADAS approach (single channel)

Reliability = 0.9979
Cost = 2X, failure rate = 0.21%
Improvement factor = 32.68

Reliability = 0.9994
Cost = 2X+, failure rate = 0.06%
Improvement factor = 121.66
Reliability/Cost Examples (3)

Eight-channel Traditional end-to-end redundancy

Eight-channel ADAS redundancy
What's New?

- Redundancy at the component level minimizes component count (toolbox approach)
- Enhanced flexibility
- Autonomously re-configurable
- Higher reliability at a reduced weight, size, and cost
- Smart power management will minimize unnecessary power consumption
What's New?

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Technical Advantages

- Fault tolerant system
  - Fast recovery
  - Minimal data interruptions
- System health monitoring and management
- Detection of system degradation (proactive prevention of failures)
- Optimized power consumption
■ Long duration flight instrumentation
■ Automated remote system operation
■ Higher reliability at a reduced weight, size, and cost
■ Lower maintenance cost
■ Critical data availability
NASA Plans/Options

- Internal development
- Partnering for commercial development
- Patent/licensing of technology
Remaining R&D

- Embedded-distributed redundant intelligence
- Digital and control lines redundancy
- Assessment of reliability vs. complexity
- Smart power management
Applications

- Industrial and manufacturing process monitoring
- Rocket launch facilities and test stands
- Crash test facilities
- Aerospace vehicles
- Medical equipment
- Remote systems
- ???
Product Benefits

- Maintains signal integrity (improved reliability)
- Reduces weight, size, and cost
- Self-calibration assures accuracy even in extreme environmental conditions
- Smart power management optimizes energy consumption
Commercial Advantages

- Dictates new trends for highly reliable electronic circuits
- Supersedes the traditional end-to-end hardware and software redundancy approach
- Higher reliability at a reduced cost
- Lower maintenance expense
Intellectual Property

- NASA case number KSC-12301
- Patent pending
- Technology available for licensing
Short-Term

For further information contact...