Savannah River National Laboratory™

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Authenticated Sensor Interface Device for Securing Sensors and Data Transmission

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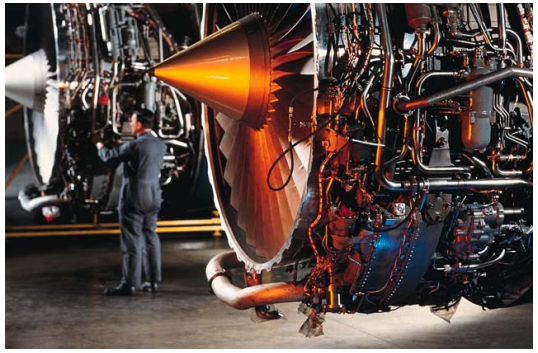
Background

Cyber Threats & High Reliability Operations

- **Cyber threats challenge the safety, security, and operation of all industries, including nuclear facilities and the protection of nuclear materials**
- **What requires high reliability operations?**
  - Critical Infrastructure and Key Resources
  - Dependent on the consequence of failure
    - *Risk to the public*
    - *Risk to the workers*
    - *Risk to the environment*
    - *Loss of production*
    - *Financial cost*
    - *Reputation/Trust*



Background

Innovating Cyber Techniques and Tools

- **New techniques and tools are required**
  - Data security
  - Authentication
  - Protection
  - Detection
  - Mitigation
- **More than just policies, plans and procedures**
  - Bolster resiliency through diversity and defense-in-depth
  - Explore non-traditional methods
  - Next-Generation cyber

Background

Safeguards, Security, & Process Sensor Applications

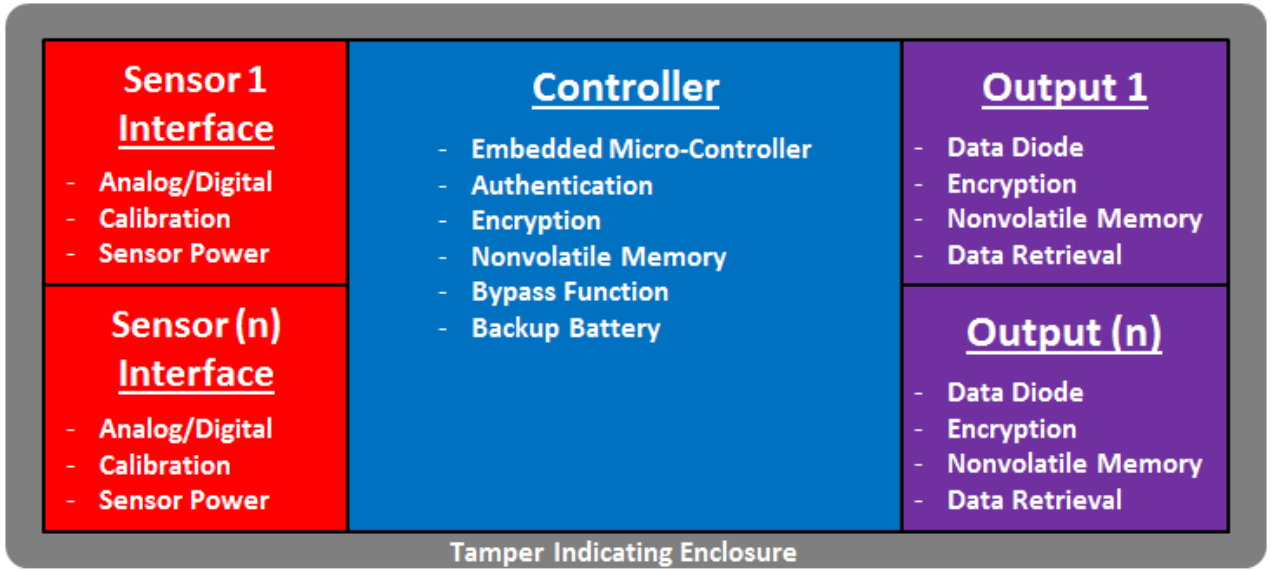
- **Drivers**
  - *Increasing number and capacity of nuclear facilities* and the amount of nuclear material in the world
  - *Increase in cyber attacks* on security, data, and industrial process control systems
  - *Increased cyber capability* of all adversaries
  - *Remote attacks* on processes can now be carried out
  - *Cyber-hardened sensors and control systems have not provided* by industrial vendors

- **ASID provides an "After-Market" Solution to secure vital sensors and aid in securing networks**

ASID

Authenticated Sensor Interface Device (ASID)

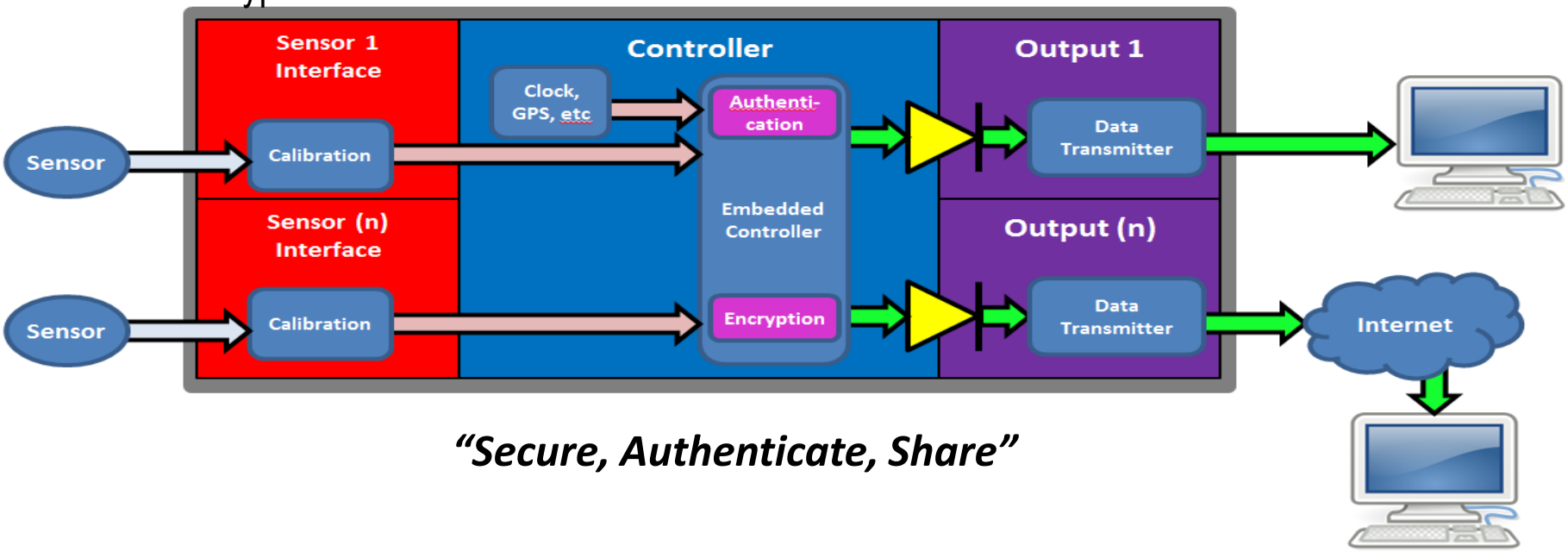
- **Secure**
  - Protect Each Party from attack or intrusion from all other parties
  - Protect the Sensor from manipulation from any party
- **Authenticate**
  - Authenticate Data transmitted to each party
- **Share Data**
  - Among a number of parties (if necessary)



ASID

ASID Functional Features

- **Sensor Interface**
  - Diverse input capabilities including digital protocols, voltages, mA, thermocouple, etc.
  - Bidirectional communications to sensor
- **Microcomputer Core**
  - Provides capability for adaptation to diverse applications
- **Predictable Data Source**
  - Available for authentication and/or encryption services
- **Data Diode Function**
  - Physically isolates each party and the sensor from attack
- **Non-volatile Memory & Battery Backup**
- **Modular Design**
  - Expandable number of inputs and outputs
- **Tamper Indicating Enclosure**
  - Protects ASID electronics from attack

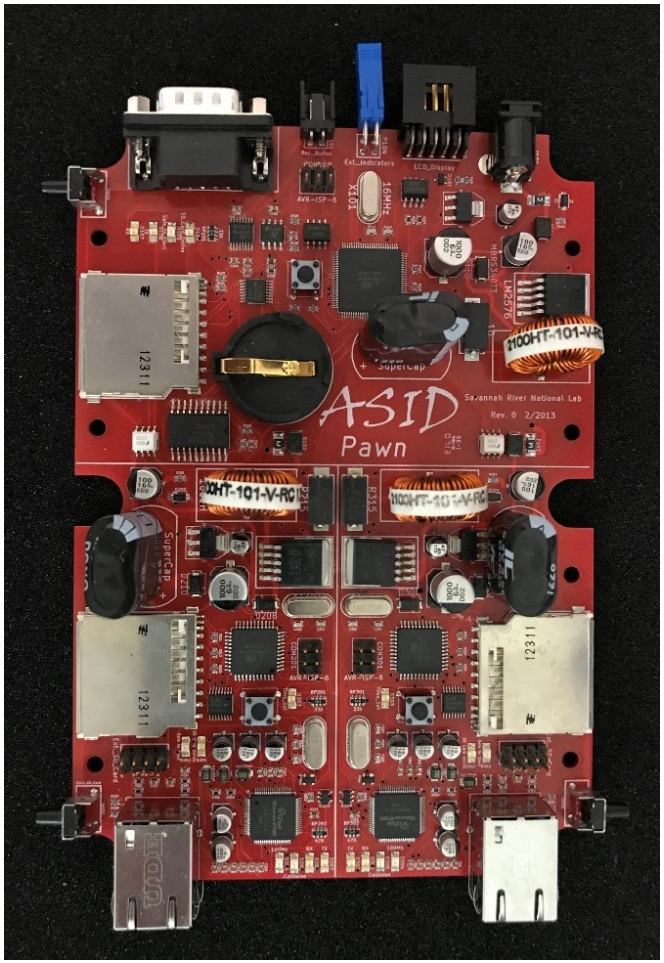


"Secure, Authenticate, Share"

ASID Security Features

- **Data Diode**
  - Malicious or fraudulent data cannot be sent back into the device from a receiving party or external attacker
- **Sensor Integrity**
  - Even with two-way communications to the sensor, sensor integrity is maintained due to data diode protection
- **Segregation**
  - One party cannot attack or manipulate data being received by another party, or their systems
- **Authentication**
  - External attacker could not "spoof" data being sent to a party
- **Confidentiality**
  - Data is encrypted, preventing external attackers from reading the original sensor data stream
- **Anti-reply**
  - An external attacker cannot replay encrypted packets

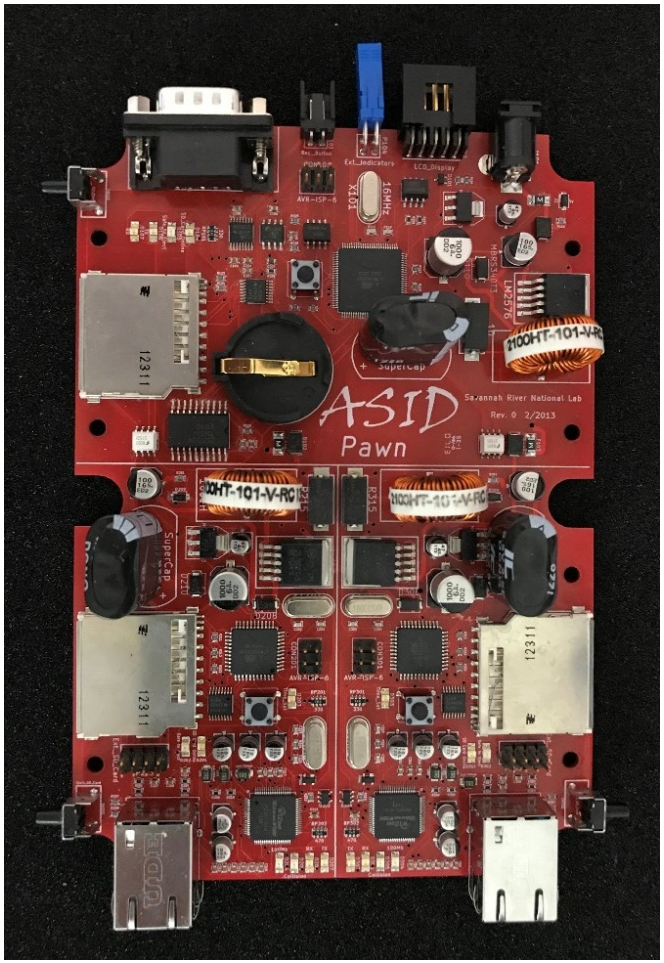
"Secure, Authenticate, Share"



Additional Features

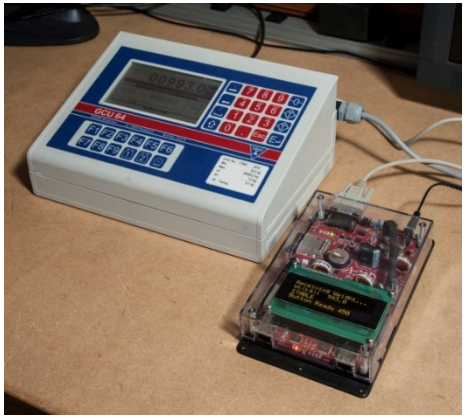
- **On-board Memory**
  - Stores raw sensor data
  - Stores each party's data to permit retrieval in case of loss of communications
- **Bypass Switch**
  - In the event of a failure of the ASID, the operator could enter bypass mode to bypass the ASID to ensure operations are not impacted

"Secure, Authenticate, Share"



Field Testing of ASID

- **ASID tested with the Wohwa Accountancy Scale**
  - SRNL conducted a joint use demonstration using a 20,000 kg Wohwa Accountancy Scale
  - Prototype ASID designed with custom software to autonomously retrieve data from the Wohwa scale controller
  - The Wohwa controller required a bi-directional digital communications
    - *ASID controller/sensor module requested data from the Wohwa controller*
    - *ASID controller module transmitted the data to each output module*
    - *Each output module transmitted the data to its respective data collection computer*
  - Note that authentication and encryption was not tested or implemented prior to this testing.



Summary

- **Drivers**
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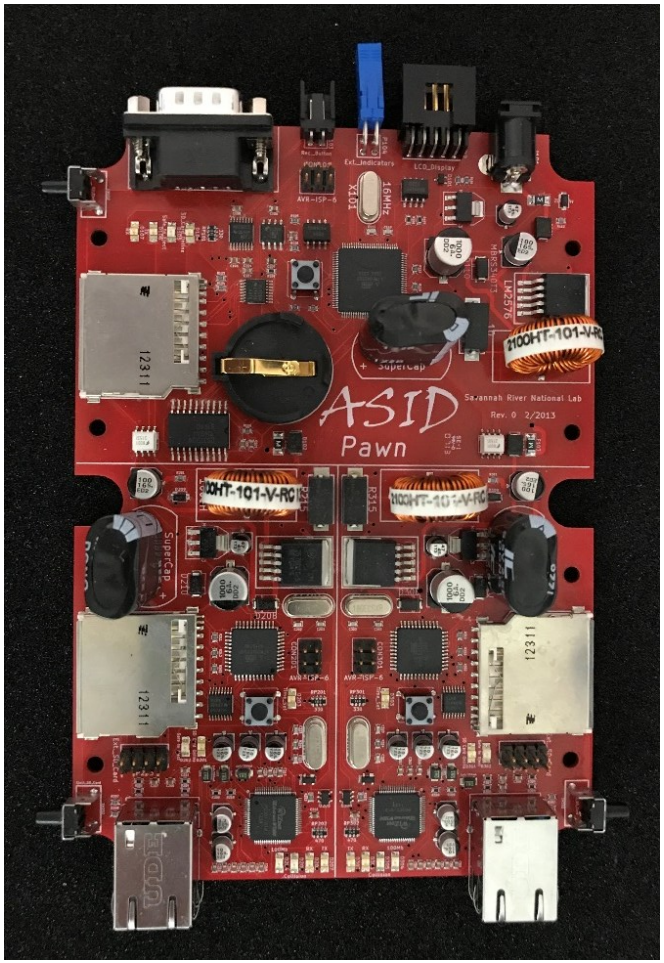
ASID

Summary

- **Cyber threats challenge all aspects of industry, including the ability to secure nuclear materials and nuclear facilities**
  - *Attacks can have severe consequences* on the operations of a facility or the validity of safeguards data
- **Many cybersecurity challenges must be considered when designing a networked industrial monitoring and control system**
  - *Securing the networks, sensors, controllers, and data transmissions is vital*

ASID can be a key component in ensuring the cybersecurity of a critical system and ensuring the validity of vital sensor data

"Secure, Authenticate, Share"



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Thank You

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Cyber Security

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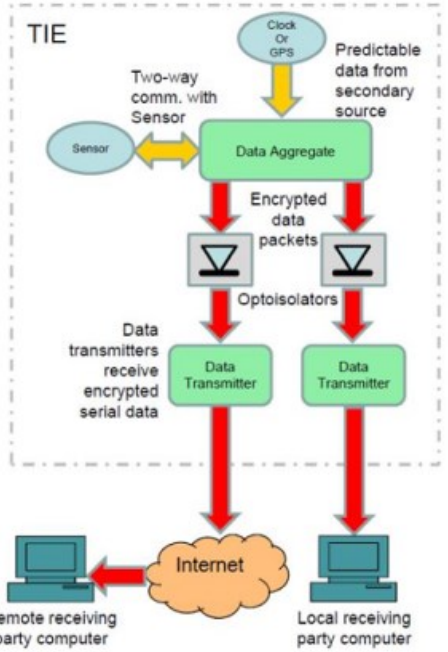

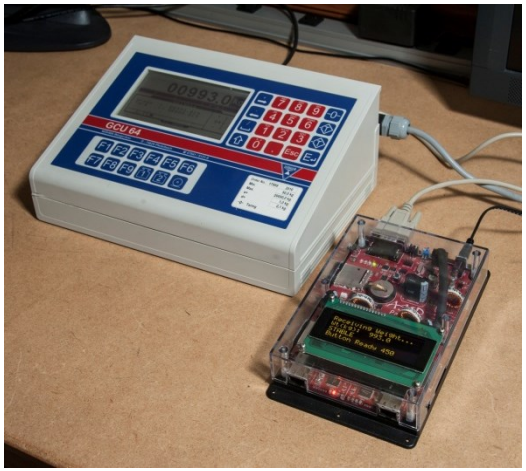

Security Features

- *Data Diode*
- *Segregation*
- *Sensor Integrity*
- *Authentication*
- *Confidentiality*

Functional Features

- *Data Diode*
- *Micro-Computer Core*
- *Sensor Interface*
- *Modular Design*
- *On-board Memory*