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Attribute Measurement System Integration

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Caveats

- Some material in this presentation addresses system design considerations
  - We understand that the AVNG design phase is complete
  - This material was included for completeness
  - The AVNG was designed in accordance with these ideas
  - I am not suggesting any AVNG redesign
- This presentation includes many lessons we have learned in previous demonstration systems
  - My personal version of the issues
  - Some of the time constraints may not be applicable to the AVNG

Attribute Measurement Systems

- Attribute Measurement Systems
  - AMS
  - One or more “attributes” of item of interest
  - Modules
    - Detectors
    - Information Barrier (IB)
    - Unclassified display
- AVNG
  - Two (+) attributes
    - Plutonium isotopic ratio
    - Plutonium mass
    - (Plutonium presence)
  - Information Barrier
  - Unclassified display

Lessons From Previous AMS Designs

- System Integration
  - Modular design is crucial
  - Finalize modules before integration
  - Allow adequate time for integration
- Information Barrier
  - Allow for troubleshooting
  - Consider system robustness
  - Make system easy on itself
- General
  - Keep it simple
  - If it isn't broken - don't fix it

Modular Design

- Each piece of AMS can be tested independently
- We found this to be essential for assembling a working system
- Allows troubleshooting efforts to be concentrated on incorrectly functioning modules
- Only viable alternative if the hardware is being built by different groups

Finalize Modules Before Integration

- Not doing this caused the largest **technical** problems with US demonstrations
- Should get each module fully operational before integration can begin
- Troubleshooting individual modules following integration is made much more difficult by AMS structure and especially IB

Allow Sufficient Integration Time

- Integration of AMS systems is a separate task
- If the physics is understood and the modules work correctly, then integration may be the hardest technical problem
- Integration is the final assembly task. As such, all earlier slippages in the schedule are taken out of the integration time
- If any other part of the development team is over optimistic, integration is the area that suffers

AMS Troubleshooting

- The AMS structure is very good at protecting classified data
- This is a good thing in terms of security
- Unfortunately, the AMS can also be very good a protecting unclassified and test data
- This can make troubleshooting difficult in the event of hardware or software failure
- Failures **will** occur

Error Recovery

- A simple AMS can work well if operations are performed in exactly the correct fashion
  - This **is** the case in a limited demonstration
  - This will **not** be the case in an operational system
- However, the system can fail in unrecoverable ways if everything isn't done exactly right
- The AMS needs to be tolerant of "glitches" during operation
- Concept of operations—anticipated use

AMS "Normal" Operation

- Concept of operations
- AMS systems are unique
- Turn-on and turn-off of AMS related to security functions
- Many of the electronic components and detectors are not specified for this type of operation
- This can cause random and inexplicable hardware failures

Simple is Good

- Every additional feature is another opportunity for failure
- Need to keep focused on the goals of the AMS
- Build the system to meet those goals
- Concept of operations (again)

Unnecessary Fixes

- Every “fix” is an opportunity to make things worse
- If something is really wrong, it should be fixed
- Keep focused on the goals
- Try to get it right the first time -
  - patches are always an issue

Lessons from Previous Demonstrations

- Allow enough time
- Use modules, but get the modules working first
- Design for reliability, but ...
- Something will break - need to be able to diagnose and fix it
- Keep focused on the goals of the AMS
- Don’t make non-essential changes