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 at 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