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Joint Development: Technical Considerations and Past Experience

Duncan W. MacArthur

Abstract:

Most arms-control-treaty-monitoring scenarios involve a host party that makes a declaration regarding its nuclear material or items and a monitoring party that verifies that declaration. If this verification requires the use of a measurement system, it is probable that the measurement system will be developed specifically for the intended treaty monitoring use. Such a system needs to be trusted by both parties; I term the trust-building process as "certification" for the host party and "authentication" for the monitoring party. In a traditional development scenario, one party designs, builds, and certifies (or authenticates) the measurement system; the other party then authenticates (or certifies) the system built by the first party. A significant difficulty in this type of development is achieving certification authentication simultaneously. In an alternative development scenario, that of joint development, both parties develop the design together, cooperate on fabrication and testing, and obtain systems based on the agreed-on design. In this paper, I will discuss the differences between joint development and traditional development (in terms of cost, resource requirements, international perception, trust by both parties, etc.) and the advantages and disadvantages of using the joint development of measurement systems for treaty verification uses. I will draw examples from the Russian "AVNG" attribute measurement system that was described in a series of presentations at the 2010 Institute of Nuclear Materials Management meeting in Baltimore. I will conclude that the joint development process has significant advantages, particularly in the design phase of a project. However, I will note that joint development is not a panacea and, in particular, does not directly address the question of "Is the measurement system working?"

Joint Development –
Technical Considerations and Past Experience

Duncan MacArthur

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Development Methodologies

- Traditional development
  - One party designs, builds & certifies (or authenticates)
  - The other party authenticates (or certifies) the system built by the first party

  Can certification and authentication be believed simultaneously?

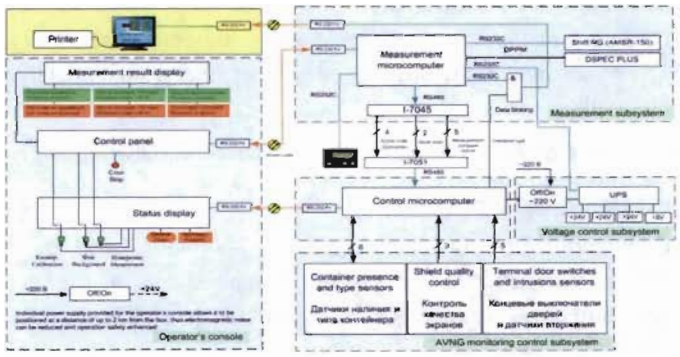
- Joint development
  - Both parties develop design together
  - Both parties obtain systems based on agreed design
  - Both parties are intimately familiar with design and capabilities of measurement system

  If host certifies "their" system and monitor authenticates "their" system, is demonstrating the continued equality of the two systems equivalent to authenticating the host system?

Constraints

- Intrinsic conflict
  - Host
  - Monitor
- Project goal
  - Externally generated
  - Internally generated
- Communications
- Time-line
- Access
  - Meetings
  - System
  - Sources

Joint Design



- Mostly discussion & paper
- Good collaboration possible

Joint fabrication

- True collaboration is difficult
- if one party supplies a measurement instrument; then
- The other party could...
  - ... observe fabrication
  - ... receive an identical instrument
  - ... build an identical instrument
  - ... randomly select from a collection of parts
  - ... ?

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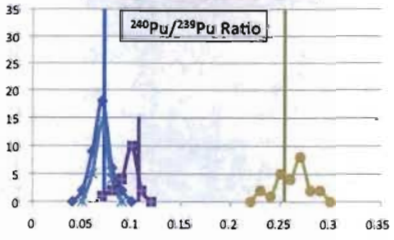
Joint Testing

- Large SNM sources
- Logistics
  - Testers
  - System
- Troubleshooting as a confidence-building technique
- Collaborative data analysis



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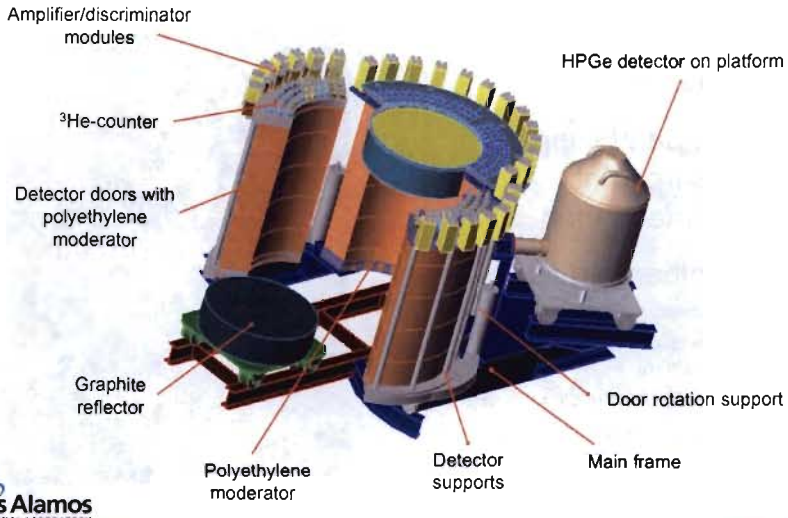
AVNG Measurement System



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AVNG Construction

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Third Parties

- Open design
- Incorporate third party input
- Convince third parties that the system can work
- Documentation and inspection
- System understanding

A very powerful tool

Positive Features of Joint Development

- Addresses authentication question - "Could it work?"
- Makes system design "better"
- Allows "design for authentication"
- Open design encourages third party acceptance
- Collaborative troubleshooting increases confidence
- Increases monitor understanding of system capabilities
- Documentation throughout raises the bar
- Visual inspection raises the bar further

Challenges of Joint Development

- Expensive
- Time-consuming
- Communication issues
- Where?
- Lots of paperwork
- Lots and lots of travel

- Most of these are also issues for multi-organization development within one country

Need to Address

- Political pressure
- Access requirements
- Authentication question - "Is it working?"
- Potential false sense of security

Joint development is part of the solution but not a panacea

Future Joint Developments

- Joint design
  - Most important phase
  - Open design
  - Clear joint goal
  - Technical collaboration
  - Maximize interaction
    - Meetings
    - Videoconferences
    - Phone calls
    - E-mail
  - Involve stakeholders
  - Design for certification
  - Design for authentication
- Joint fabrication
  - Modules
  - Third-party vendors
  - Random selection
- Joint testing
  - Address access
  - Documentation
  - Reference sources
  - Collaborative troubleshooting
  - Joint evaluation

Joint Development - What We Want

Joint Development–A Lot of What We Get

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