Multi-Option Fuze for Artillery (MOFA)
Using Risk Mitigation Process to Develop and Implement Automation

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By

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Agenda

- ➢ What is MOFA?
- ➢ Why was automation needed?
- ➢ Process used to mitigate risk
  - ▪ Identify automation needs
  - ▪ Complete QFD
  - ▪ Complete Risk Assessment
  - ▪ Develop Statement of Work
  - ▪ Complete Oversight and Design Reviews
  - ▪ Validate and Qualify
- ➢ Lessons Learned
- ➢ Summary

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What is MOFA?

- ➤ M782 Multi-Option Fuze for Artillery

    - ▪ Army's next generation, NATO standard all purpose artillery fuze for bursting munitions.

    - ▪ Inductively set in one of four modes (Proximity, Time, PD, Delay)

    - ▪ Operable with all existing and developmental artillery systems (105mm and 155mm)

    - ▪ Operable with all bulk filled projectiles

- ➤ ATK MOFA Program Status

    - ▪ Successfully completed first article in January 2004, with ballistic results exceeding requirements in all test modes, including perfect performance in proximity mode.

    - ▪ Initiated full rate production in February 2004

    - ▪ Production rate will ramp up to 27,000 units per month

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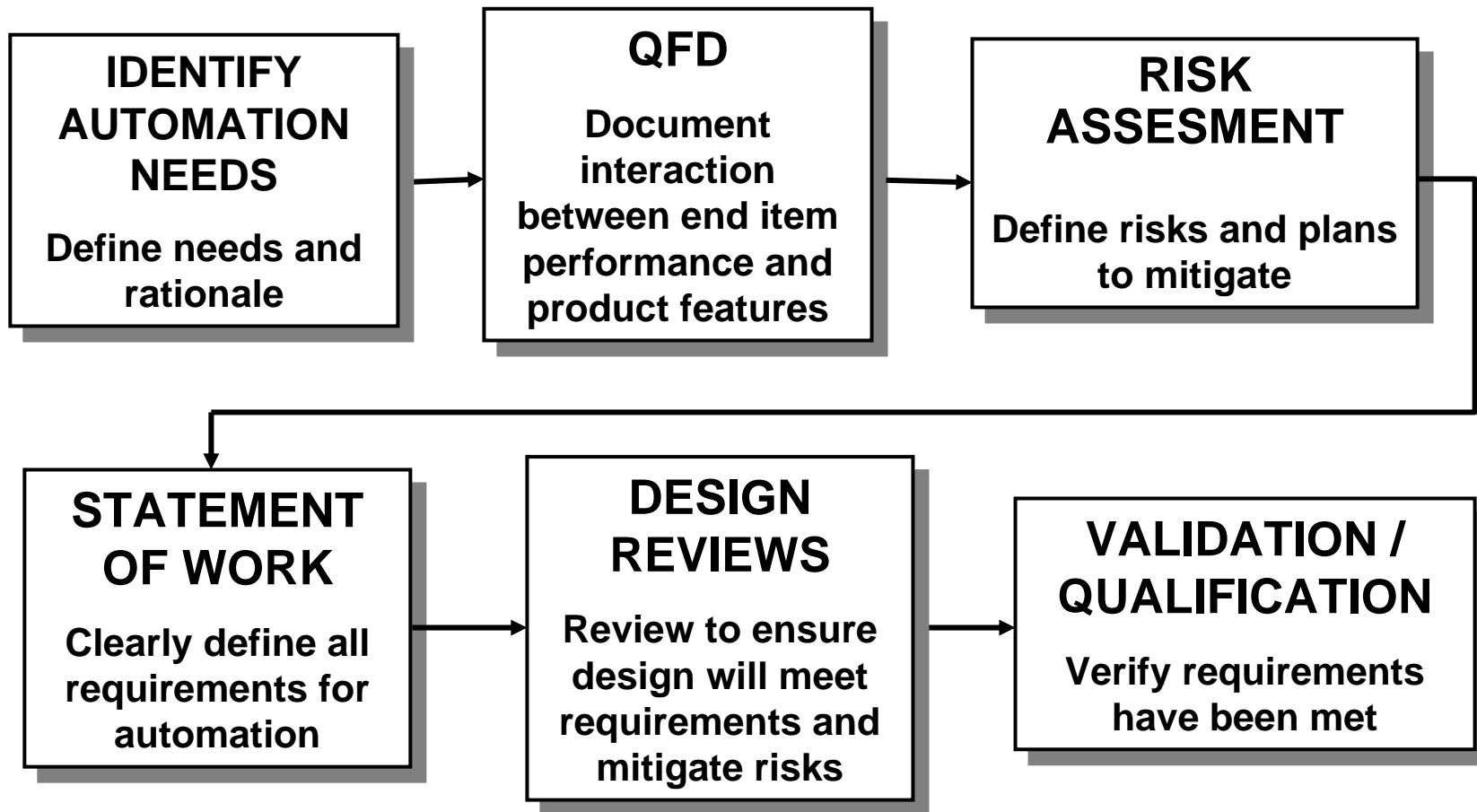*ALLIANT TECHSYSTEMS*

Why Was Automation Needed?

- ➢ High Volume Production (Schedule)
  - ▪ Current contract basic quantity of 491,000 units, with additional option quantities up to 300,000 units
  - ▪ Monthly delivery rates up to 27,000 units
  - ▪ Follow on business opportunities
- ➢ Minimize Product Variation (Quality)
  - ▪ Effective automation will reduce operator variability resulting in higher quality, more consistent performing product
- ➢ Reduce Production Cost (Cost)
  - ▪ Effective automation reduces direct labor, resulting in lower product cost to user

Cost, schedule and quality requirements drove automation need

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Risk Mitigation Process

IDENTIFY AUTOMATION NEEDS

Define needs and rationale

QFD

Document interaction between end item performance and product features

RISK ASSESMENT

Define risks and plans to mitigate

STATEMENT OF WORK

Clearly define all requirements for automation

DESIGN REVIEWS

Review to ensure design will meet requirements and mitigate risks

VALIDATION / QUALIFICATION

Verify requirements have been met

Application of disciplined process to mitigate risk

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Identify Automation Needs

➤ Using basic process flow chart, define process steps and assemblies that are candidates for automation

➤ Breakdown candidate processes into detail steps with basic automation concepts

➤ Review basic automation concepts with selected automation vendors to identify feasibility

➤ Finalize process steps and assemblies to proceed

➤ ATK selected two assemblies for automation

Disciplined approach resulted in high payoff automation with minimum risk

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Quality Function Deployment (QFD)

➢ Objective - Translate customer requirements into appropriate product requirements by breaking down needs into manageable and accountable detail

IDENTIFY CUSTOMER REQUIREMENTS	→	IDENTIFY PRODUCT KEY CHARACTERISTICS	→	IDENTIFY PROCESS KEY CHARACTERISTICS

➢ Correlation to Automation

- Define product key characteristics of assemblies to be automated
- Define key process characteristics that will control key product characteristics
- Require automation to properly control key process characteristics

QFD process defines baseline automation requirements

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Risk Assessment

- ➤ Objectives
    - ▪ Define production risks
    - ▪ Rank production risks using defined system to achieve consistency
    - ▪ Define mitigation plans for automation design

- ➤ Results
    - ▪ 23 production risks identified
    - ▪ Ranking range from 3.5 (high) down to 0.6 (very low)
    - ▪ Mitigation plans defined for each risk to be addressed in automation design

Applying risk assessment process drives risk mitigation

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Statement of Work

- ➢ Developed to identify <u>detailed</u> requirements for automation
  - ▪ General description of each assembly process
  - ▪ Detailed description of each required station, including definition of risk mitigation requirements
  - ▪ Cycle time requirements for each station
  - ▪ Automation approval and acceptance criteria
    - ✓ Preliminary at source
    - ✓ Preliminary at ATK
    - ✓ Final at ATK
- ➢ Program management and master schedule requirements
- ➢ General mechanical, electrical, controller, air requirements
- ➢ Maintenance, safety and operating manual requirements
- ➢ Verification plan

Detailed SOW that includes risk mitigation plans and verification

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Oversight and Design Reviews

➤ Production engineer assigned to project to provide oversight

- Generally visited automation vendor twice weekly
- Ongoing review of design and build process

➤ SOW defined preliminary and critical design review requirements

➤ Each design review included verification for conformance to SOW

- Particular attention paid to risk mitigation items

➤ Key results were identification of areas that would have caused cost, schedule and quality problems

Oversight and design reviews critical to ultimate success

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Validation / Qualification

- Informal validation during automation build process
  - Exercise equipment during assembly process to ensure macro level conformance
- Preliminary acceptance at source
  - Formal run-off with equipment full assembled and operational at vendor facility
- Preliminary acceptance at ATK
  - Formal run-off with equipment fully assembled and operational at ATK
- Final acceptance at ATK
  - Formal run-off to demonstrate cycle time capability over two week period of full production.

Validation and qualification ensure automation readiness

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Lessons Learned

➢ Automation delivery to ATK was six weeks behind schedule

➢ Lessons learned included:

  ▪ Need for validation of system effectiveness with potential faults

  ▪ Need for better analysis of scope vs. schedule

  ▪ Need for understanding of vendor project team commitments to other projects

  ▪ Need for more detailed warranty requirements and support

Additional analysis and definition could have prevented issues

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Summary

➢ Quality, cost and schedule requirements defined need for automation

➢ Disciplined process was incorporated to mitigate risk

- Process for defining specific automation needs

- Process to correlate customer requirements and key product / process characteristics into automation requirements

- Process to assess risk and identify mitigation plans to be incorporated into automation

- Process to clearly identify all automation requirements in a Statement of Work

- Process of oversight and formal review to ensure automation design meets defined requirements

- Process to validate and formally qualify automation for use

➢ Lessons learned along the way documented for future automation projects

Disciplined process used to mitigate automation risk

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