BELL R&M DIGITAL TRANSFORMATION BEST PRACTICES AND LESSONS LEARNED

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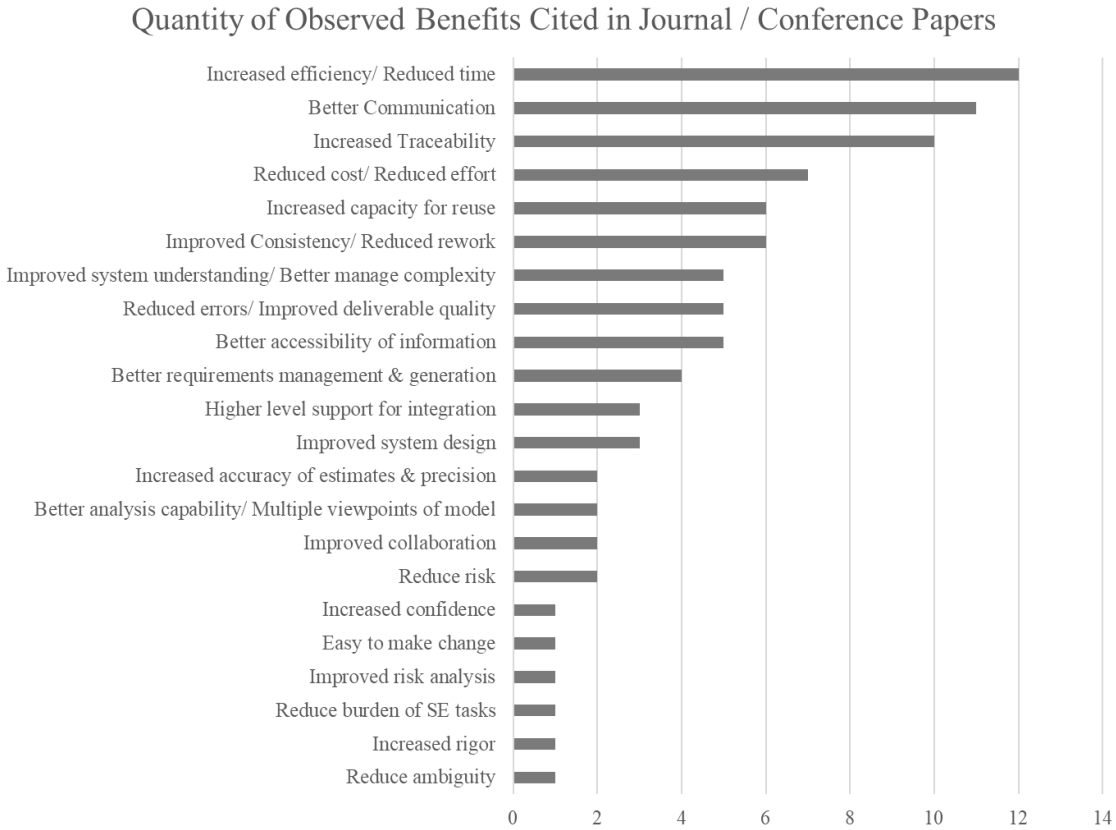
Background and Introduction

- **DoD requires contractors and future programs to digitally transform**
  - Digital Engineering Body of Knowledge
- **Organized into 5 elements to accomplish goal**

Background and Introduction



Source: Henderson, K., & Salado, A. Value and Benefits of Model-based Systems Engineering (MBSE): Evidence from the Literature.

Background and Introduction- Digital Transformation

1. Formalize development, integration, and the use of models to inform enterprise and program decision-making.
2. Provide an enduring, authoritative source of truth.
3. Incorporate technological innovation and the physics of failure within models.
4. Establish infrastructure and environments.
5. Develop the skillsets and motivation for transformation within the workforce.

Current Challenges

1. Existing R&M software missing capabilities
2. Geographic silos
3. Differences in DoD services processes/ scoring
4. Differences in tools used by services

Software Capability

- **R&M Software Capability Review**
  - MADE
  - Reliasoft
  - Relyence
  - WQS/ WRR
- **REST API standard provides capability**
  - Also used in Jira and DOORS
  - Interface with PLM, CAD, Simulation systems and other databases
- **Web-based capability adds flexibility**

```
//JSON Object
{
   "employee": {
            "id": 1,
            "name": "Admin",
            "location": "Texas"
   }
}
//JSON Array
{
   "employees": [
            {
                     "id": 1,
                     "name": "Admin",
                     "location": "Texas"
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            {
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                     "name": "Author",
                     "location": "Alabama'
            },
            {
                     "id": 3,
                     "name": "Visitor",
                     "location": "USA"
            }
   ]
}
```

Business Case for Transformation

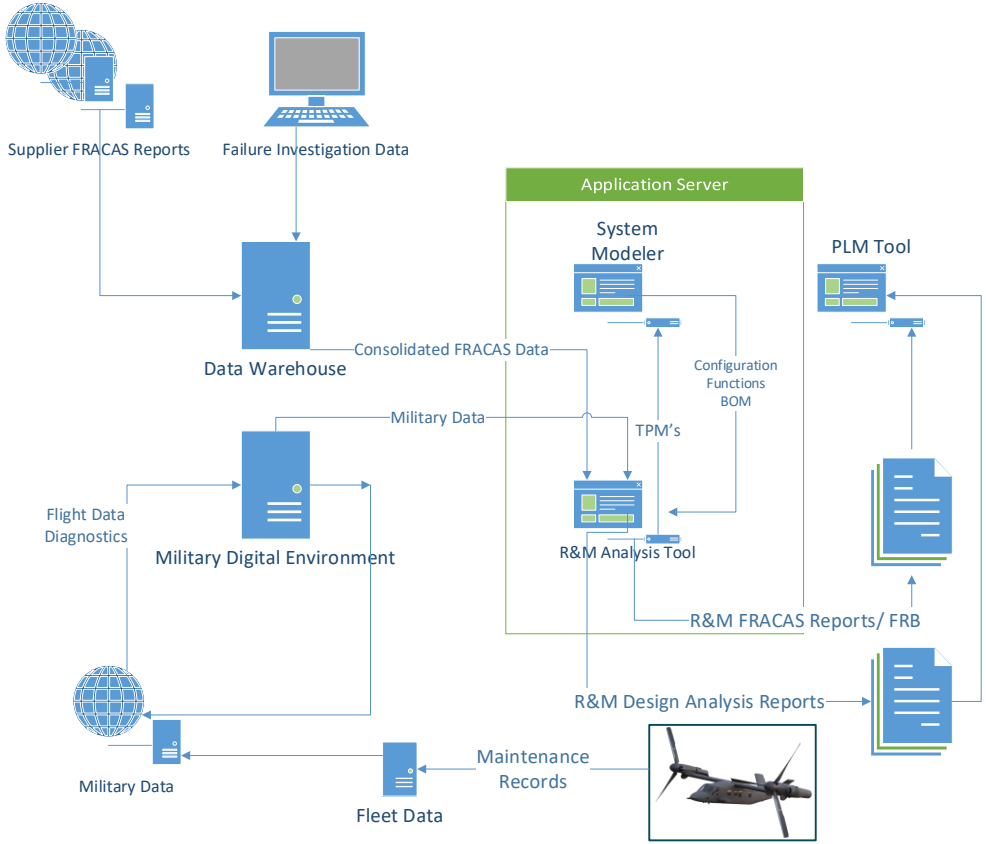
- What information is needed in the model?
- Who will use the model?
- What data will be used?
- What level of detail is needed?
- How will changes be communicated?
- How will data be reported to the customer?
- How will the digital environment impact the efficiency of product design and sustainment?

Goal: Increased Speed and Efficiency in R&M

Transformation Due To Data/ Data Systems

- **Types of Data:**
  - Supplier FRACAS Data
  - Prime Contractor FRACAS Data
  - Customer FRACAS Data
  - Contractor Reliability Life Models/ Predictions
  - Bill of Materials/ System Hierarchy
  - Reliability Analysis Results/ Reports
  - R&M Test Data
  - R&M Technical Performance Measures (TPMs)
  - Maintainability Handbook Data
  - Maintainability Results

Transformation Due To Data/ Data Systems

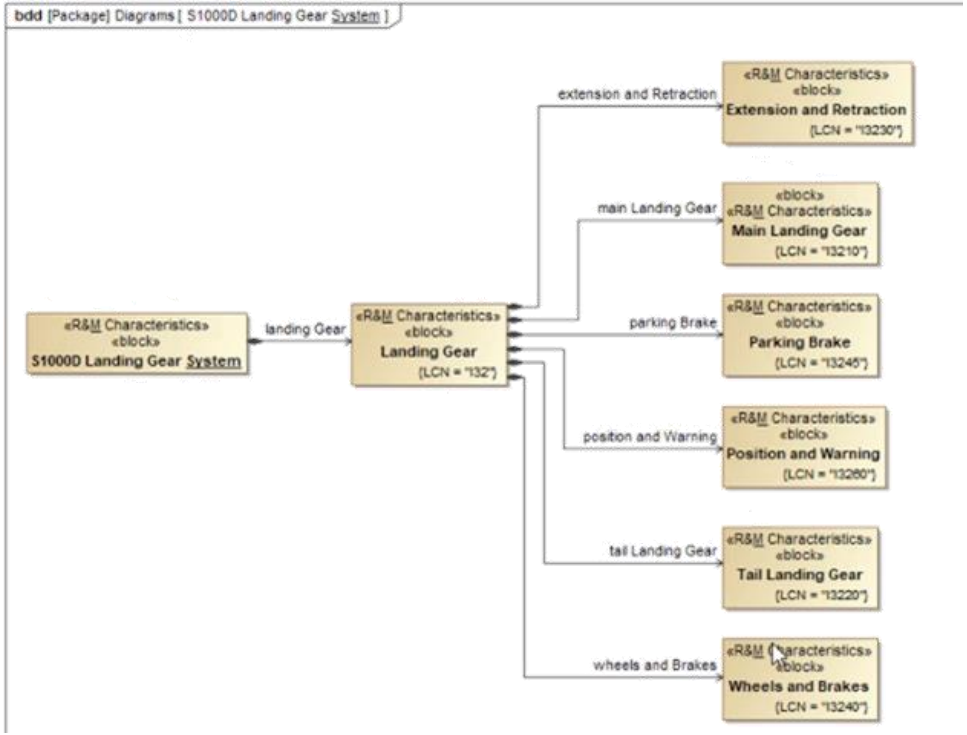


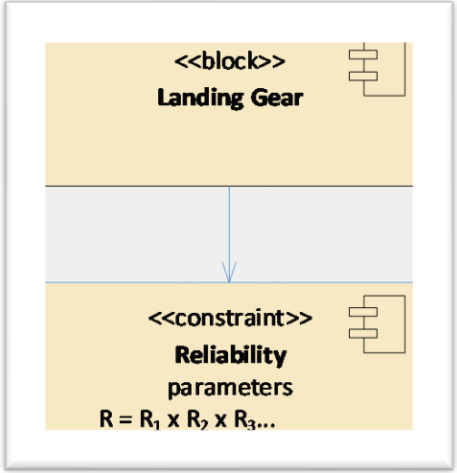
Workforce Transformation

- **All R&M engineers must use and navigate architecture software**
- **Engineers must know what data is included in model and how often it is updated**
  - Configuration Management
- **Must have capability to setup what-if models for trade studies**
- **Evidence of success: able to pull R&M reports from MBSE tool**
  - MTBF, MTTR, Availability TPMs
- **Build MBSE R&M model such that it supports system functionality**

Goal: Implement transformation so that DE is Integrated with R&M Engineering

Workforce Transformation





R&M Digital Thread Process and Structure

- **Considerations:**
  - Computer resources
  - Timing of updates
  - Fidelity of data
  - Level of live detail
- **Update timing**
- **Metatag usage**
- **Standards and shared definitions**

Summary & Conclusion

- **Digital Engineering Transformation impacts how Reliability organizations conduct business**
- **Current processes and tools must be integrated as part of a thoughtful strategy of transformation**
  - Efficiently and effectively implementation of DE capability
- **Paper reviews each consideration from the DE Body of Knowledge reviewed**
- **Provides the “what” and “how” of performing the R&M aspects of a digital transformation within an existing business**
- **Meets goals of the Digital Engineering Strategy**

Next Steps and Future Work

- Fully implement software
- Include additional data synchronization
- Share lessons learned with other IPTs
- Continue to develop and grow R&M engineering in DE