Development Planning for Producibility and Maintainability Reduces Total Cost of Ownership and Increases Readiness
Fig. 1

¼” hole in Fiberglass composite
Left – Burrs/spurs after drilling
Right – Clean holes new process

Fig. 2

¼” hole in Carbon Fiber composite
Left – Delamination after drilling
Right – Clean holes new process
New processes may enable better performance and lower cost.

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Importance of Design for Manufacturing and Maintenance

Early in the design

70-75% of Cost Decisions Made during concept & preliminary design phase impact 80% of Total Life Cycle Costs
Early DFx trade studies of manufacturing and maintenance processes

Enable manufacturing and maintenance processes to help drive the design of complex systems

- Reduce non-recurring and recurring acquisition costs
- Reduce lifecycle costs for sustainment and service life extensions
- Increase system readiness
- Launch program on-time, on-budget, on-target
Accessibility difficulties are a common feature in maintenance.

A great deal of effort has been spent to improve cockpit design.

Yet much less effort has been made on designing for maintainability.

Photo: Colin Drury
able maintenance and repair procedures to help drive
design of complex systems impacting TCO

US Department of Defense lists the three key questions about maintainability:

1. Strength limitations:
   - Can the maintenance person physically carry, lift, hold, twist, push and pull objects as required?

2. Accessibility difficulties:
   - How easy is it to gain physical access to the work areas?

3. Visibility problems:
   - Can the work area be seen directly, or must work be done by feel or with the use of mirrors etc?
engage the manufacturing engineers in the earliest stages of system engineering
engage the sustainment engineers in the earliest ages of system engineering
Utilizing a single infrastructure for cross discipline engineering & supplier collaboration
Scott Lucero, Office of the Sec. of Defense, states:

“MBE facilitates “cross-domain coupling,” .... Cross-domain coupling results in benefits such as improved integration of modeling and simulation, which in turn can lower product development costs.”
A single SE environment that integrates cross-discipline engineering and production modeling.
Utilize a single collaborative infrastructure across the supply chain.

Tiers “n” Partners / Suppliers
Forecast the capabilities of potential suppliers and the related logistics to understand supply chain risks early.
Validation with modeling and simulation eliminates the cost and time associated with physical prototypes.
Understanding the impact of changes in requirements
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Understand the impact of changes in the Requirements manufacturing, maintenance and repair operations

- Requirements changes can impact:
  - Both the non-recurring and recurring cost
  - Schedules
  - Tooling and production, testing and maintenance equipment
  - MRL status of new processes that would have to be proven out
  - Potential supply chain participants and related logistics
  - Mean Time to Repair and related asset availability

- Make your trade study decisions on requirements changes based on facts, not opinions
Engage the manufacturing and sustainment engineers in the earliest stages of system engineering to impact the design when it is least costly.
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Impact the design when it is least costly

Design for producibility and sustainment early in concept and preliminary design pay big dividends in cost and readiness
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Understand the impact of changes in the Requirements on manufacturing, maintenance and repair operations
Provide an integrated Systems Engineering environment that includes manufacturing and sustainment engineering across the supply chain we can reduce TCO, time to mission and increase readiness.
THANK YOU

Chuck Buckley
Aerospace and Defense
Dassault Systemes DELMIA

chuck.buckley@3ds.com
www.3ds.com