### Manufacturing Readiness Levels (MRLs)

<table>
<thead>
<tr>
<th>Acq Phase</th>
<th>Pre MSA</th>
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</thead>
<tbody>
<tr>
<td>Thread</td>
<td>MRL 1</td>
<td>MRL 2</td>
<td>MRL 3</td>
<td>MRL 4</td>
</tr>
<tr>
<td>Technology Maturity</td>
<td>Should be assessed at TRL 1</td>
<td>Should be assessed at TRL 2</td>
<td>Should be assessed at TRL 3</td>
<td>Should be assessed at TRL 4</td>
</tr>
<tr>
<td>Technology Transition to Production</td>
<td>Potential sources identified for technology needs.</td>
<td>Considered adequate for critical technologies.</td>
<td>Identified key technologies, components, and processes.</td>
<td>Identified key technologies, components, and processes, and key performance indicators.</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>New manufacturing needs identified.</td>
<td>Manufacturing technology efforts continuing.</td>
<td>Manufacturing technology continuous process improvements ongoing.</td>
<td>Manufacturing technology process improvement efforts initiated.</td>
</tr>
<tr>
<td>Producibility</td>
<td>Industrial capability to support production has been analyzed.</td>
<td>Industrial capability supports FRP.</td>
<td>Industrial capability is in place to support testing and verification in production, and influence on Operations &amp; Support (O&amp;S).</td>
<td>Industrial capability is in place to support FRP.</td>
</tr>
<tr>
<td>Military Readiness</td>
<td>Military requirements identified.</td>
<td>Manufacturing opportunities identified.</td>
<td>Manufacturing potential solutions identified.</td>
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</tbody>
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#### Technology Maturity
- Identified key technologies, components, and processes.
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#### Technology Transition to Production
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#### Manufacturing
- New manufacturing needs identified.
- Manufacturing technology efforts continuing.
- Manufacturing technology continuous process improvements ongoing.
- Manufacturing technology process improvement efforts initiated.

#### Producibility
- Industrial capability to support production has been analyzed.
- Industrial capability supports FRP.
- Industrial capability is in place to support testing and verification in production, and influence on Operations & Support (O&S).
- Industrial capability is in place to support FRP.

#### Military Readiness
- Military requirements identified.
- Manufacturing opportunities identified.
- Manufacturing potential solutions identified.
- Manufacturing potential solutions identified.

#### Design Maturity
- High-performance manufacturing requirements defined.
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#### Military Readiness
- Military requirements identified.
- Manufacturing opportunities identified.
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### Program has budget estimate for May 2009

- **MRL Matrix Version 7.1 May 2009**
- Special handling procedures effectively implemented in FRP.
- Program has budget estimate for reaching MRL 6 by MS B. Estimate includes capital investment for production-representative equipment. All Risk Mitigation Plans required to raise deficient elements to MRL 5 are fully funded.

### Materials maturity sufficient for pilot line build. Material specifications approved.

- FRP cost goals met. Cost reduction initiatives ongoing.
- Special handling procedures applied. Special handling procedures demonstrated on SDD or technology insertion programs production. Special handling issues pose no significant risk for LRIP.

### Detailed end-to-end value stream map cost model for major system components includes materials, labor, equipment, tooling/STE, setup, yield/scrap/rework, Work In Progress (WIP), and capability/capacity constraints.

### Costs rolled up to system level and tracked against targets. Detailed trade studies and engineering change requests supported by cost estimates. Cost reduction efforts underway and incentives in place.

### Manufacturing Investment Budget

- Version 7.1
- FRP cost goals met. Cost reduction initiatives ongoing.
- Manufacturing Investment Budget
- Detailed process chart cost models driven by key characteristics and process variables. Manufacturing, material, and specialized cost drivers assessed.
- Detailed end-to-end value stream map cost model for major system components includes materials, labor, equipment, tooling/STE, setup, yield/scrap/rework, Work In Progress (WIP), and capability/capacity constraints.
- Material properties and characteristic(s) predicted.
- Raw materials (Raw Materials, Components, Sub-assemblies and Sub-systems)