Scale	Manufacturing Readiness Level (MRL): Produceable at relevant cost, scale, and schedule?	OE-I Critical Activities
9	**LRIP demonstrated; capability in-place to begin FRP.** ▪ The system, component, or item has been previously produced, is in production, or has successfully achieved low-rate initial production. Technologies should have matured to TRL 9. This level of readiness is normally associated with readiness for entry into Full-Rate Production (FRP). All systems engineering/design requirements should have been met such that there are minimal system changes. Major system design features are stable and have been proven in test and evaluation. **(Level 10) Full-Rate Production demonstrated and lean production practices in place.** ▪ Technologies should have matured to TRL 9. This level of manufacturing is normally associated with the Production or Sustainment phases of the acquisition life cycle. Engineering/design changes are few and generally limited to quality and cost improvements. A system, components, or items are in full-rate production and meet all engineering, performance, quality, and reliability requirements. The manufacturing process capability is at the appropriate quality level.	
8	**Pilot line capability demonstrated; Ready to begin Low-Rate Initial Production.** ▪ Detailed system design is complete and sufficiently stable to enter low-rate production. All materials, manpower, tooling, test equipment and facilities are proven on the pilot line and are available to meet the planned low-rate production schedule. Manufacturing and quality processes and procedures have been proven on a pilot line and are under control and ready for low-rate production. Known producibility risks pose no significant challenges for low-rate production.	
7	**Capability to produce systems, subsystems, or components in a production representative environment.** ▪ System detailed design activity is nearing completion. Material specifications have been approved and materials are available to meet the planned pilot line build schedule. Manufacturing processes and procedures have been demonstrated in a production representative environment. Detailed producibility trade studies are completed and producibility enhancements and risk assessments are underway. Technologies should be on a path to achieving TRL 7.	▪ Plan and execute production representative environment demonstration ▪ Finalize system design ▪ Materials specs and availability
6	**Capability to produce a prototype system or subsystem in a production relevant environment.** ▪ This MRL is associated with readiness for a Milestone B decision to initiate an acquisition program by entering into the Engineering and Manufacturing Development (EMD) Phase of acquisition. Technologies should have matured to at least TRL 6. The majority of manufacturing processes have been defined and characterized, but there are still significant engineering and/or design changes in the system itself.	▪ Conduct prototype production relevant environment demonstration ▪ Work with program office to define manufacturing requirements to support Milestone B decision ▪ Identify system engineering/design changes
5	**Capability to produce prototype components in a production relevant environment.** ▪ Manufacturing strategy refined and integrated with Risk Management Plan. Identification of enabling/critical technologies and components is complete. Prototype materials, tooling, and test equipment, as well as personnel skills, have been demonstrated on components in a production-relevant environment, but many manufacturing processes and procedures are still in development.	▪ Conduct technology production relevant environment demonstration ▪ Develop Manufacturing Strategy ▪ Identify enabling/critical technologies and components ▪ Identify and document key design performance parameters ▪ Identify special tooling/facilities/material handling/skills
4	**Capability to produce the technology in a laboratory environment.** ▪ This level of readiness acts as an exit criterion for the Materiel Solution Analysis (MSA) Phase approaching a Milestone A decision. Technologies should have matured to at least TRL 4. This level indicates that the technologies are ready for the Technology Development Phase of acquisition. Producibility assessments of design concepts have been completed. Key design performance parameters have been identified as well as any special tooling, facilities, material handling and skills required.	▪ Demonstrate ability to produce technology in a lab environment ▪ Develop producibility assessments of design concepts ▪ Identify and document key design performance parameters ▪ Identify special tooling/facilities/material handling/skills
3	**Manufacturing Proof of Concept Developed.** ▪ This level begins the validation of the manufacturing concepts through analytical or laboratory experiments. Experimental hardware models have been developed in a laboratory environment that may possess limited functionality.	▪ Design experimental hardware models ▪ Plan and execute lab-level manufacturing experiments ▪ Prototype component production in relevant environment demonstration
2	**Manufacturing Concepts Identified.** ▪ This level is characterized by describing the application of new manufacturing concepts. Applied research translates basic research into solutions for broadly defined military needs.	▪ Identify and document new manufacturing concepts of project's scientific principles
1	**Basic Manufacturing Implications Identified.** ▪ Basic research expands scientific principles that may have manufacturing implications. The focus is on a high-level assessment of manufacturing opportunities. The research is unfettered.	▪ Analyze manufacturing implications of project's scientific principles and incorporate into reports/studies