DoD Manufacturing Readiness Levels (MRLs)											
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A - Technology and Industrial Base	**Technology Maturity**	Should be assessed at TRL 1.	Should be assessed at TRL 2.	Should be assessed at TRL 3.	Should be assessed at TRL 4.	Should be assessed at TRL 5.	Should be assessed at TRL 6.	Should be assessed at TRL 7	Should be assessed at TRL 7 or TRL 8.	Should be assessed at TRL 8 or TRL 9.	Should be assessed at TRL 9.
	A.1 - Industrial Base	Global trends in emerging industrial base capabilities identified.	Potential industrial base capability gaps identified.	Industrial base capabilities for potential sources identified for system concepts.	Industrial base capabilities surveyed for preferred materiel solution, key technologies, components, and/or key processes. Industrial base capability risks and issues included in AoA.	Industrial base capabilities assessment initiated to identify potential manufacturing sources. Sole/single/ foreign source vendors and vendors of technologies with potential obsolescence issues identified and planning initiated to minimize risks.	Industrial base capabilities assessment for MS B has been completed. Industrial capability in place to support mfg of development items. Plans to minimize sole/single /foreign sources & obsolescence issues complete. Need for sole/single/foreign sources justified. Potential alternative sources identified.	Industrial capability to support production analyzed. Sole/single/foreign sources stability and obsolescence issues are assessed/monitored. Potential alternate sources developed if necessary.	Industrial base capability assessment for MS C completed. Industrial capability is in place to support LRIP. Sources are available, multi-sourcing where cost-effective or necessary to mitigate risk.	Industrial capability assessment for Full-Rate Production (FRP) has been completed and capability is in place to support start of FRP.	Industrial capability supports Full-Rate Production (FRP) and is assessed to support modifications, upgrades, surge and other potential manufacturing requirements.
	A.2 - Manufacturing Technology Development	Global trends in manufacturing science and technology identified (i.e., concepts, capabilities).	Potential manufacturing science and technology gaps identified.	Manufacturing technology requirements identified to address potential capability gaps for system concepts.	Manufacturing technology development initiatives defined for preferred materiel solution. Manufacturing technology development requirements considered in the AoA.	Required manufacturing technology development efforts initiated.	Manufacturing technology efforts continuing. Required manufacturing technology development solutions demonstrated in a production relevant environment.	Manufacturing technology efforts continuing. Required manufacturing technology development solutions demonstrated in a production representative environment.	Primary manufacturing technology efforts concluding. Improvement efforts continuing. Required manufacturing technology solutions validated on a pilot line.	Manufacturing technology process improvement efforts initiated for FRP.	Manufacturing technology continuous process improvements ongoing.
B - Design	**B.1 - Producibility Program**	Hypotheses developed for cause-effect relationships between technology variables and producibility.	Studies performed to test hypotheses regarding cause-effect relationships between technology variables and producibility. Elements identified which have a potential impact to producibility (i.e., materials, processes, capabilities, limitations).	Relevant materials/processes evaluated for manufacturability using experiments/models.	Initial producibility and manufacturability assessments in selection of preferred materiel solution completed. Results considered in AoA documented in AS key components/technologies.	Producibility and manufacturability assessments of key technologies and components initiated. Ongoing design trades consider manufacturing processes and industrial base capability constraints. Manufacturing processes assessed for capability to be tested and verified in production. Manufacturing processes assessed for influence on Operations & Support (O&S).	Producibility assessments and producibility trade studies (performance vs. producibility) of key technologies/components completed. Results used to shape Acquisition Strategy, Systems Engineering Plan (SEP), Mfg and Producibility plans, and planning for EMD or technology insertion programs. Preliminary design choices assessed against manufacturing processes and industrial base capability constraints. Producibility enhancement efforts (i.e. DFM,DFA, etc.) initiated.	Detailed producibility trade studies using knowledge of key design characteristics and related manufacturing process capability completed. Producibility enhancement efforts (i.e. DFM,DFA, etc.) ongoing for optimized integrated system. Manufacturing processes re-assessed as needed for capability to be tested and verified. Manufacturing processes re-assessed as needed for potential influence on O & S.	Producibility improvements implemented on system. Known producibility risks and issues managed for LRIP.	Prior producibility improvements analyzed for effectiveness during LRIP. Producibility issues and risks discovered in LRIP managed for FRP.	Design producibility improvements demonstrated in FRP. Process producibility improvements ongoing. All modifications, upgrades, Diminishing Mfg Sources & Material Shortages (DMSMS) and other changes assessed for producibility.
	B.2 - Design Maturity	Current capability deficiencies and gaps identified.	Analyses performed to evaluate the feasibility of potential solutions to address capability gaps.	High level performance, lifecycle, and technical requirements defined and evaluated for system concepts. Trade-offs in design options based on experiments and initial MOEs.	Form, fit, and function constraints, and manufacturing capabilities identified for preferred systems concept. SEP and T&E Strategy recognize the need for the establishment/validation of manufacturing capability and management of manufacturing risk for the product lifecycle. Initial KPPs identified for preferred systems concept. System characteristics and measures to support required capabilities identified.	Lower level performance requirements sufficient to proceed to preliminary design. All enabling/critical technologies and components identified and the product lifecycle considered. Evaluation of the design for Key Characteristics (KC) initiated. Product data required for prototype component manufacturing released.	System allocated baseline established. Product requirements and features are well enough defined to support preliminary design review. Product data essential for subsystem/system prototyping has been released and all enabling/critical components have been prototyped. Preliminary KCs for the design identified and mitigation plans initiated.	Product design and features are well enough defined to support Critical Design Review (CDR) even though design change traffic may be significant. All product data essential for component manufacturing released. Potential KC risks and issues identified with mitigation plans in place.	Detailed design of product features and interfaces completed. All product data essential for system manufacturing released. Design change traffic does not significantly impact LRIP. Key Characteristics (KCs) are attainable based upon pilot line demonstrations.	Major product design features and configuration are stable. System design has been validated through operational testing of LRIP items. Physical Configuration Audit (PCA) or equivalent complete as necessary. Design change traffic is limited. All KCs are controlled in LRIP to appropriate quality levels.	Product design is stable. Design changes are few and generally limited to those required for continuous improvement or in reaction to obsolescence. All KCs are controlled in FRP to appropriate quality levels.

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C - Cost & Funding	**C.1 - Production Cost Knowledge (Cost modeling)**	Hypotheses developed regarding technology impact on affordability.	Cost model approach defined.	Manufacturing cost estimates for system concepts developed. Initial cost models developed which include high-level process steps and materials.	Cost estimates refined based on anticipated production volumes associated with preferred materiel solution. Cost model updated with identified cost drivers (i.e., process variables, manufacturing, materials, and special requirements). Cost driver uncertainty quantified. Cost model supports AoA and ASR.	Prototype components produced in a production relevant environment, or simulations drive end-to-end cost models. Cost model includes materials, labor, equipment, tooling /STE/SIE, WIP, setup, yield /scrap/rework, capability/ capacity constraints.	Cost model updated with design requirements, material specifications, tolerances, integrated master schedule, results of system/subsystem simulations and production relevant prototype demonstrations.	Cost model updated with the results of systems/sub-systems produced in a production representative environment, production plant layout and design and obsolescence solutions.	Cost models updated with results of pilot line build.	FRP cost model updated with result of LRIP build.	Cost model validated against actual FRP cost.
	C.2 - Cost Analysis	Initial manufacturing and quality costs identified.	Potential manufacturing and quality cost drivers and system affordability gaps identified.	Analyses conducted to refine manufacturing and quality cost drivers, risks, and development strategy (e.g., lab to pilot to factory). Potential cost reduction and system affordability gap closure strategies identified.	Producibility and lifecycle cost risks and issues assessed for preferred materiel solution. Initial cost analysis supports Analysis of Alternatives (AoA) and Alternative Systems Review (ASR).	Costs analyzed using prototype component actuals to ensure target costs are achievable. Decisions regarding design choices, make/ buy, capacity, process capability, sources, quality, key characteristics (KCs), yield/rate, and variability influenced by cost models.	Costs analyzed using prototype system/sub-system actuals to ensure target costs are achievable. Cost targets allocated to sub-systems. Cost reduction and avoidance strategies developed. Manufacturing cost drivers for "Should-Cost" models provided.	Mfg costs rolled up to system/sub-system level and tracked to targets. Detailed trade studies & engineering change requests supported by cost estimates. Cost reduction and avoidance strategies underway. Manufacturing cost drivers for "Should-Cost" models updated.	Costs analyzed using pilot line actuals to ensure target costs are achievable. Manufacturing cost analysis supports proposed changes to requirements or configuration. Cost reduction initiatives ongoing. Manufacturing cost drivers for "Should-Cost" models updated.	LRIP cost goals met and learning curve analyzed with actual data. Cost reduction initiatives ongoing. Touch labor efficiency analyzed to meet production rates and elements of inefficiency are identified with plans in place for reduction.	FRP cost goals met. Cost reduction initiatives ongoing.
	C.3 - Manufacturing Investment Budget	Potential manufacturing investment strategy developed.	Program/projects have reasonable budget estimates for reaching MRL 3 through experiment. Manufacturing investment budget ROM estimates identified to support industrial base and manufacturing capability gap closure strategies.	Program/projects have reasonable budget estimates for reaching MRL 4 by MS A. Preliminary manufacturing investment budget estimates for manufacturing gap closure recommendations have been developed.	Mfg technology initiatives incorporated to reduce costs. Program has reasonable budget estimate for reaching MRL 6 by MS B. Estimate includes capital investment for production relevant equipment. All outstanding MRL 4 risks and issues understood with approved mitigation plans in place.	Program has updated budget estimate for reaching MRL 6 by MS B. All outstanding MRL 5 risks and issues understood with approved mitigation plans in place.	Program has reasonable budget estimate for reaching MRL 8 by MS C. Estimate includes capital investment for production-representative equipment by CDR and pilot line equipment by MS C. All outstanding MRL 6 risks and issues understood with approved mitigation plans in place.	Program has updated budget estimate for reaching MRL 8 by MS C. All outstanding MRL 7 risks and issues understood with approved mitigation plans in place.	Program has reasonable budget estimate for reaching MRL 9 by the FRP decision point. Estimate includes investment for LRIP and FRP. All outstanding MRL 8 risks and issues understood with approved mitigation plans in place.	Program has reasonable budget estimate for FRP. All outstanding MRL 9 risks and issues understood with approved mitigation plans in place.	Production budgets sufficient for production at required rates and schedule to support funded program.
D - Materials (Raw Materials, Components, Sub-assemblies and Sub-systems)	**D.1 - Maturity**	New material properties and characteristics surveyed and identified for research (e.g., manufacturability, quality).	Potential effects of new material properties on design application manufacturability and quality predicted based on research.	Effects of new material properties on design concept manufacturability and quality validated using experiments and models.	New materials and components for preferred materiel solution demonstrated in a laboratory environment.	Materials manufactured or produced in a prototype environment (may be in a similar application/ program). Maturation efforts in place to address new material production risks for technology demo.	Material maturity verified through technology demonstration articles. Preliminary material specifications in place. Material properties adequately characterized.	Material maturity sufficient for pilot line build. Material specifications approved.	Materials proven and validated during EMD as adequate to support LRIP. Material specification stable.	Materials controlled to specification in LRIP. Materials proven and validated as adequate to support FRP.	Materials controlled to specification in FRP.
	D.2 - Availability	Global trends for material availability, obsolescence, and DMSMS surveyed and identified for research.	Material availability, obsolescence, and DMSMS gaps identified.	Material availability, obsolescence, and DMSMS gap closure strategy defined.	Projected lead times identified for all difficult-to-obtain, difficult-to-process, or hazardous materials. Quantities and lead times estimated. Material availability risks and issues for preferred materiel solution considered in AoA. Mitigation plans incorporated in SEP for the preferred system concept.	Availability risks and issues addressed for prototype build. Significant material risks identified for all materials. Planning has begun to address scale-up issues.	Availability risks and issues addressed to meet EMD build. Long-lead items identified. Components assessed for future DMSMS risk.	Availability risks and issues addressed to meet LRIP builds. Long lead procurement identified and mitigated. DMSMS mitigation strategies for components in place.	Availability risks and issues pose no significant risk for LRIP. Long-lead procurement initiated for LRIP. Availability issues addressed to meet FRP builds.	Long-lead procurement initiated for FRP. Availability risks and issues managed for FRP.	All material availability risks and issues managed.
	D.3 - Supply Chain Management	Global trends for supply chain capability and capacity surveyed.	Potential supply chain capability and capacity gaps identified.	Supply chain capability and capacity gap closure strategies defined.	Survey of potential supply chain sources for preferred materiel solution completed. Supply chain capability and capacity analyses considered in the AoA.	Potential supply chain sources identified and evaluated as able to support prototype build.	Lifecycle Supply Chain requirements updated. Critical suppliers list updated. Supply chain plans in place (e.g. teaming agreements, etc.) supporting an EMD contract award.	Effective supply chain mgmt processes defined, documented, and in place. Plan developed for predictive indicators. Assessment of critical first tier supply chain completed (i.e., capability, capacity, etc.).	Assessment of critical second and lower tier supply chain completed. Robust requirements flow down processes in place and verified. Supplier compliance with program requirements and changes validated. Plan for predictive indicators for use in production updated. Supply chain adequate to support LRIP.	Long term agreements in place where practical. Prime's supplier management metrics (including thresholds and goals) in place and used to manage risks. Predictive indicators to manage suppliers in place. Supply chain is stable/adequate for FRP.	Supply chain proven and supports FRP requirements.
	D.4 - Special Handling (i.e. Government Furnished Property, shelf life, security, hazardous materials, storage environ- ment, etc.)	Hazardous materials identified and safety procedures in place.	Initial evaluation of potential regulatory requirements and special handling concerns completed. Raw materials and components assessed for special handling and potential regulatory requirements.	ESH compliance risk identified. List of hazardous materials identified and alternatives evaluated. Special handling procedures applied in the lab. Special handling concerns assessed.	ESH compliance risk mitigated lab environment. List of hazardous materials updated and alternatives assessed. Special handling procedures applied and disposal procedures evaluated. Special handling requirements identified and analyzed.	ESH requirements and special handling procedures applied in production relevant environment. Special handling requirement gaps identified. New special handling processes demonstrated in lab environment.	ESH requirements addressed & documented. Special handling proce-dures demo'd in production relevant environment. Plans for special handling require-ment gaps, risks, and issues complete. Mfg assessed for material storage and waste handling risks.	ESH compliance demo'd in production representative environment (PSE). Special handling procedures applied in PSE. Special handling procedures developed and annotated on work instructions for pilot line. Hazardous material storage and disposal plan in place for the pilot line.	ESH compliance demonstrated in pilot line production.Special handling procedures applied in pilot line environment and demo'd in EMD or technology insertion programs. Special handling risks and issues managed for LRIP. All work instructions contain special handling provisions as required. Hazardous material storage and disposal plan evaluated and in place for LRIP.	ESH compliance demonstrated in LRIP. Special handling, and hazardous material storage and disposal procedures demonstrated in LRIP environment. Special handling, and hazardous material storage and disposal risks and issues managed for FRP.	ESH compliance demonstrated in FRP. Special handling and hazardous material storage and disposal procedures effectively implemented in FRP.

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E - -Process Capability & Control	**E.1 - Modeling & Simulation (Product & Process)**	Modeling and simulation approaches/tools identified to support manufacturing and quality activities.	Modeling and simulation in development initiated.	Manufacturing and quality gaps for system concepts identified using modeling and simulation.	Production modeling and simulation tools utilized to define manufacturing and quality requirements for preferred materiel solution. Modeling and simulation results considered in the AoA.	Initial modeling & simulation (product or process) developed at the component level and used to determine constraints.	Initial modeling & simulation developed at the sub-system or system level, and used to determine system constraints.	Modeling & simulation used to determine system constraints and identify improvement opportunities.	Modeling & simulation verified by pilot line build. Results used to improve process and determine that LRIP requirements can be met.	Modeling & simulation verified by LRIP build, assists in management of LRIP, and determines that FRP requirements can be met.	Modeling & simulation verified by FRP build. Production simulation models used as a tool to assist in management of FRP.
	E.2 - Manufacturing Process Maturity	Hypotheses developed regarding cause-effect relationships between process variables and process stability and repeatability.	Studies performed to test hypotheses regarding cause-effect relationships. Initial process approaches identified.	Cause-effect relationships between process control variables and process stability and repeatability validated through laboratory experiments. Critical process control variables identified.	Maturity of critical processes for preferred materiel solution assessed. Process capability requirements and improvement plans developed and documented in the SEP.	Process Maturity assessed on similar processes in production. Process capability requirements identified for pilot line, LRIP and FRP.	Manufacturing processes demo'd in production relevant environment. Collection or estimation of process capability data from prototype build and refinement of process capability requirements initiated.	Manufacturing processes demonstrated in a production representative environment. Collection and/or estimation of process capability data and refinement of process capability requirements ongoing.	Manufacturing processes for LRIP verified on a pilot line. Process Capability data from pilot line meets target. Process capability requirements for LRIP and FRP refined based upon pilot line data.	Manufacturing processes are stable, adequately controlled, capable, and have achieved program LRIP objectives. Variability experiments conducted to show FRP impact and potential for continuous improvement.	Manufacturing processes are stable, adequately controlled, capable, and have achieved program FRP objectives.
	E.3 - Process Yields and Rates	Hypotheses developed regarding future state manufacturing yields and rates.	Studies performed to test hypotheses regarding yields and rates.	Initial estimates of yields and rates for system concepts identified through laboratory experiments. Yield and rate gaps for system concepts identified.	Yield and rate assessments on preferred materiel solution completed and considered in the AoA. Yield and rate gap closure strategies identified for the preferred materiel solution and documented in the SEP.	Target yields and rates established for pilot line, LRIP, and FRP. Yield and rate issues identified. Improvement plans developed/initiated.	Yields and rates from production relevant environment evaluated against targets and the results feed improvement plan.	Yields and rates from production representative environment evaluated against pilot line targets and the results feed improvement plans.	Pilot line targets achieved. Yields and rates required to begin LRIP refined using pilot line results. Improvement plans ongoing and updated.	LRIP yield and rate targets achieved. Yields and rates required to begin FRP refined using LRIP results. Yield improvements ongoing.	FRP yield and rate targets achieved. Yield improvements on-going.
F - Quality Management	**F.1 - Quality Management**	Quality management considerations surveyed and included in early planning activities.	Quality management needs assessed, analyzed, and validated.	Quality management requirements for system concepts identified.	Quality strategy for the preferred materiel solution developed, considered in the AoA, and documented in the SEP and the AS.	Quality strategy updated to reflect Key Characteristic (KC) identification activities.	Initial Quality Plan and Quality Management System (QMS) is in place. Quality risks and metrics have been identified and improvement plans initiated.	Quality targets established. Quality Management System (QMS) elements (i.e., control of nonconforming material, corrective action, etc.) meet requirements of appropriate industry standards. Program-specific Quality Program Plan being developed.	Program-specific Quality Program Plan established. Program Quality Manager assigned. Quality targets assessed against pilot line, results feed continuous quality improvements.	Quality targets verified on LRIP line. Continuous quality improvement on-going. Management review of Quality measures conducted on regular basis and appropriate actions taken.	Quality targets verified on FRP line. Continuous quality improvement on-going. Statistical controls applied where appropriate.
	F.2 - Product Quality	Quality metrology state of the art surveyed. Hypotheses developed regarding cause-effect relationships between technology variables and quality.	Studies performed to test hypotheses regarding cause-effect relationships between technology variables and quality. Elements identified which have a potential impact on quality (i.e., materials, processes, capabilities, limitations).	System concept elements evaluated for quality using experiments, modeling and simulation. Initial product quality requirements, risks, and issues identified. Inspection technologies identified.	Product quality requirements and the inspection and acceptance testing strategy for the preferred materiel solution considered in AoA and documented in the AS. Product quality risk and issue mitigation plans documented in the SEP.	Roles and responsibilities identified for acceptance test procedures, in-process and final inspections, and statistical process controls for prototype units.	Key Characteristic (KC) management approach defined. Initial requirements identified for acceptance test procedures and in-process and final inspection requirements for EMD units. Appropriate inspection and acceptance test procedures identified for prototype units.	Quality data from the production representative environment collected and analyzed and results used to shape improvement plans. Control plans completed for management of Key Characteristics. Test and Inspection plans being developed for EMD units.	Key Characteristics (KCs) managed. Measurement procedures and controls in place (e.g. SPC, FRACAS, audits, customer satisfaction, etc.). Pilot line data meets capability requirements for all Key Characteristics. Test and Inspection plans complete and validated for production units.	Data from LRIP demonstrates production processes for all Key Characteristics and other manufacturing processes critical to quality, are capable and under control for FRP.	Key Characteristics (KCs) controlled at rate. Results achieve targeted statistical level on all KCs. Results reflect continuous improvement.
	F.3 - Supplier Quality Management	Supplier quality and quality management systems state of the art surveyed.	Initial supplier quality and quality management systems evaluated.	Supplier quality and quality management system requirements for system concepts identified.	Potential supplier quality capabilities, risks, and issues identified for the preferred materiel solution, including subtier suppliers. Supplier quality management system requirements defined, and documented in the AS.	Supply base quality capabilities and risks identified, including subtier supplier quality management.	Supply base quality improvement initiatives identified addressing supplier Quality Management System (QMS) shortfalls, including subtier supplier quality management.	Key supplier Quality Management Systems (QMSs) meet appropriate industry standards. Supplier quality data from production representative units collected and analyzed. Strategy for audits of critical supplier processes outlined.	Supplier program-specific Quality Management Systems (QMSs) are adequate. Supplier products qualification testing and first article inspection completed. Acceptance testing of supplier products is adequate to begin LRIP. Plan for subcontractor process audits in place and implemented by prime contractor.	Supplier quality management of Key Characteristics (KCs) and other critical manufacturing processes demonstrates capability and control for FRP. Acceptance testing of supplier products reflects control of quality adequate to begin FRP. Subcontractor quality audits performed as necessary to ensure subcontractor specification compliance.	Supplier quality data reflects adequate management of Key Characteristics (KCs) and control of critical manufacturing processes, including quality management down to subtier suppliers. Results achieve high statistical level (e.g. 6-sigma) on all critical dimensions. Subcontractor quality audits performed as necessary to ensure subcontractor specification compliance.

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G - Mfg Workforce (Engineering & Production)	**G.1 - Mfg Workforce (Engineering & Production)**	Workforce skill sets to support emerging trends in manufacturing and technology surveyed.	Workforce skill sets to support emerging trends in manufacturing and technology evaluated.	Workforce skill set requirements for system concepts identified. Workforce skill set capability gaps identified.	Workforce skill set and production workforce requirements (technical and operational) for the preferred materiel solution identified and considered in the AoA. Workforce training and development requirements to close skill set gaps defined. Availability of workforce for TMRR Phase determined.	Skill sets identified and plans developed to meet prototype and production needs. Special skills certification and training requirements established.	Mfg workforce skills available for production in a relevant environment. Resources (quantities and skill sets) identified and initial plans developed to achieve requirements for pilot line and production.	Manufacturing workforce resource requirements identified and plans developed to achieve pilot line requirements. Plans to achieve LRIP workforce requirements updated. Pilot line workforce trained in production represent environment.	Manufacturing workforce resource requirements identified and plans developed to achieve LRIP requirements. LRIP personnel trained on pilot line where possible. Plans to achieve FRP workforce requirements initiated based on pilot line.	LRIP personnel requirements met. Plan to achieve FRP workforce requirements implemented.	FRP personnel requirements met. Production workforce skill sets maintained in spite of workforce attrition.
H - Facilities	**H.1 - Tooling / Special Test and Inspection Equipment (STE/SIE)**	State of the art tooling, test and inspection equipment surveyed.	Potential tooling, STE, and SIE requirements identified.	Tooling, STE, and SIE requirements for system concepts identified. Special tooling, STE, and SIE gaps identified.	Tooling/Special Test Equipment (STE)/Special Inspection Equipment (SIE) requirements for the preferred materiel solution considered as part of AoA.	Tooling and STE/SIE requirements identified with supporting rationale and schedule.	Prototype tooling and STE/SIE concepts demonstrated in production relevant environment. Requirements development efforts for production tooling and STE/SIE complete.	Design and development efforts for production tooling and STE/SIE initiated with STE/SIE validation plans complete. Manufacturing equipment maintenance strategy developed.	Tooling, test and inspection equipment proven on pilot line and additional requirements identified for LRIP. STE/SIE validated as part of pilot line validation IAW validation plan. Manufacturing equipment maintenance demonstrated on pilot line.	All tooling, test and inspection equipment proven in LRIP and additional requirements identified for FRP. Manufacturing equipment maintenance schedule demonstrated. STE/SIE validation maintained as necessary.	Proven tooling, test and inspection equipment in place to support maximum FRP. Planned equipment maintenance schedule achieved. STE/SIE validation maintained as necessary.
	H.2 - Facilities	Current facility capabilities and capacity surveyed.	Potential facility capabilities and capacity requirements identified.	Facility capabilities and capacity requirements and gaps for system concepts identified.	Capability and availability of mfg facilities for prototype development and production of the preferred materiel solution evaluated, included in the AoA, and documented in the AS and SEP. Human factors & ergonomics and safety requirements for manufacturing (personnel, processes & equipment) identified.	Manufacturing facilities identified and plans developed to produce prototypes. Human factors & ergonomics and safety requirements for manufacturing (personnel, processes & equipment) assessed.	Manufacturing facilities identified and plans developed to produce pilot line build. Human factors & ergonomics and safety requirements for mfg (personnel, processes & equipment) verified in a production relevant environment.	Manufacturing facilities identified and plans developed to produce LRIP build. Human factors & ergonomics and safety practices for mfg (personnel, processes & equipment) validated in a production representative environment.	Pilot line facilities demo'd. Mfg facilities adequate to begin LRIP. Plans in place to support transition to FRP. Workplace safety is adequate. Human factors & ergonomics and safety practices for mfg (personnel, processes & equipment) demonstrated on a pilot line.	Manufacturing facilities in place and demonstrated in LRIP. Capacity plans adequate to support FRP. Human factors & ergonomics and safety practices for manufacturing (personnel, processes & equipment) demonstrated in LRIP.	Production facilities in place and capacity demonstrated to meet maximum FRP requirements. Human factors & ergonomics and safety requirements for manufacturing (personnel, processes & equipment) demonstrated in FRP.
I - Mfg Management	**I.1 - Mfg Planning & Scheduling**	Manufacturing management considerations surveyed and included in early planning activities.	Manufacturing management needs assessed, analyzed and validated.	Manufacturing management requirements for system concepts identified.	Manufacturing strategy for the preferred materiel solution developed, considered in the AoA, and documented in the AS. Prototype schedule risk mitigation efforts documented in the SEP.	Manufacturing strategy refined based upon preferred concept. Prototype schedule risk mitigation efforts initiated.	Initial manufacturing approach developed. All system design related mfg events included in Integrated Master Plan/Schedule (IMP/IMS). Manufacturing risk, and issue mitigation approach for pilot line and/or technology insertion programs defined.	Initial Manufacturing Plan developed and included in IMP/IMS. Manufacturing risks and issues integrated into mitigation plans. Initial work instructions developed. Effective production control system in place to support pilot line.	Manufacturing Plan updated for LRIP. All manufacturing risks and issues identified and assessed with approved mitigation plans in place. Work instructions finalized. Effective production control system in place to support LRIP.	Manufacturing plan updated for FRP. All manufacturing risks and issues managed. Effective production control system in place to support FRP.	All manufacturing risks and issues managed.
	I.2 - Materials Planning	Materials planning state of the art surveyed.	Initial availability, lead time, handling and storage requirements for potential materials and components evaluated.	Materials and components list for system concepts developed. Initial materials planning requirements (i.e., availability, lead times, handling, and storage) identified.	Materials and components list with estimates for availability, lead times, handling and storage requirements developed and considered in the AoA.	Make/buy evaluations initiated and include production considerations for pilot line, LRIP, and FRP needs. Lead times and other materials risks and issues identified.	Most material make/buy decisions complete, material risks and issues identified, and mitigation plans developed. Bill of Materials (BOM) initiated.	Make/Buy decisions and BOM complete for pilot line build. Material planning systems in place for pilot line build.	Make/Buy decisions and BOM complete to support LRIP. Material planning systems proven on pilot line for LRIP build.	Make/Buy decisions and BOM complete to support FRP. Material planning systems proven in LRIP and sufficient for FRP.	Material planning systems validated on FRP build.