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ORR: Operations Readiness Review

EBTM 881 CAPSTONE PROJECT

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Supply Chain Management

Table of Contents

1. Introduction & Problem Motivation

As a Global Supply Chain organization employee at my company, I would like to develop a standard template that will effectively and consistently drive Operations Readiness Reviews ("ORRs") at both a Program and a Sector Level. This will help our organization better understand potential risk within our suppliers thus lowering the risk of our internal programs going over schedule and/or cost.

ORR's can serve several purposes for our companies programs. One reason ORR's are conducted is to allow program stakeholders to effectively assess a supplier's ability to support manufacturing needs per the current and forecasted requirements. This includes things such as, labor, tooling, training, staffing, scheduling, testing, inspection, etc. In other words, stakeholders complete assessments of the supplier's quality system and their internal processes. ORR's are also used as an assessment of planning of current status, including supply base, to achieve on time deliveries to meet program requirements. ORR'S can also be used to identify potential affordability opportunities like easier build processes/better material to use/or just the fact that overall risk is decreased.

In the past, my company never had a standardized process for assessing suppliers which meant risks were never properly identified up front. Since it was up to each individual program to conduct an ORR however they would like, there was no clear way to identify risks. Because our programs were not asking these in depth, standardized questions it became difficult to have confidence in our suppliers since they continuously would build our product wrong or very late. They key goals of creating this standardized process are to understand our suppliers capabilities while also building and maintaining a strong relationship with them.

When deciding what I wanted to do for my Capstone Project I knew I wanted to do something through my employer. This was important to me because I knew I would get to solve a problem at work and actually watch my Capstone grow into something bigger. I started by going to our "tools team" under our Global Supply Chain organization and asking them if they needed any assistance on upcoming projects. Luckily for me, our Quality Assurance organization had just recently moved under Global Supply Chain and they needed a ton of help in several areas, one being creating a lean ORR process. I have never worked in our Quality organization but I had always wanted to do a "stint" there so I felt this opportunity was a perfect fit.

2. Problem Statement

After meeting with our internal "tools team" I was pointed to our Vice President of Operations, Vice President of Quality Assurance, Vice President of Global Supply Chain and Vice President of Manufacturing who tasked me with creating a better framework for how our suppliers are assessed due to our large variation of supplier scores. Because our current state is so strained creating this standardized process/new tool will help our programs identify potential risk before it becomes a reality. Our programs can then focus more on customer satisfaction, delivery dates, and hitting cost goals.

3. Background & Literature Review

For my literature review I primarily focused on two documents: The Department of Defense's Technology Readiness Level (TRL) handbook and their Manufacturing Readiness Assessment (MRA). By reviewing government documents I was able to build a skeleton of the ORR template.

The TRL handbook was an incredibly useful tool because it is often used to evaluate the maturity of critical elements of a products technologies. This was helpful in creating my template because a key goal of an ORR is to ensure our suppliers can successfully build our technology. Generally, TRLs are measured along a 1 through 9 scale which ranges from 1 being a basic readiness level to 9 where the technology is tested and proven, already integrated and successful in its intended environment (Source: DoD (2010), Defense Acquisition Guidebook) Figure 1 shows the 9 different readiness levels and descriptions NASA, DOD, and other organizations use.

Technology readiness level (TRL)		Description
1	Basic principles observed and reported	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development. Examples include paper studies of a technology's basic properties.
2	Technology concept and/or application formulated	Invention begins. Once basic principles are observed, practical applications can be invented. Applications are speculative, and there may be no proof or detailed analysis to support the assumptions. Examples are limited to analytic studies.
3	Analytical and experimental critical function and/or characteristic proof of concept	Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate the analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.
4	Component and/or breadboard validation in laboratory environment	Basic technological components are integrated to establish that they will work together. This is relatively low fidelity compared with the eventual system. Examples include integration of ad hoc hardware in the laboratory.
5	Component and/or breadboard validation in relevant environment	Fidelity of breadboard technology increases significantly. The basiic technological components are integrated with reasonably realistic supporting elements so they can be tested in a simulated environment. Examples include high fidelity laboratory integration of components.
6	System/subsystem model or prototype demonstration in a relevant environment	Representative model or prototype system, which is well beyond that of TRL 5, is tested in its relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high-fidelity laboratory environment or in a simulated operational environment.
7	System prototype demonstration in an operational environment	Prototype near or at planned operational system. Represents a major step up from TRL 6 by requirement demonstration of an actual system prototype in an operational environment (e.g., in an aircraft, a vehicle, or space).
8	Actual system completed and qualified through test and demonstration	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.
9	Actual system proven through successful mission operations	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. Examples include using the system under operational mission conditions.

Source: GAO simplification of agency documents. | GAO-16-410G

The second document I used when creating the ORR template is the DOD's Manufacturing Readiness Assessment (MRA). This is similar to the TRL handbook in the sense the suppliers are being scored on a scale but rather than being scored on design maturity they are being scored on manufacturing readiness levels (MRL). Figure 2 shows the "maturity scale" companies are rated on. This ranges from 1 which is basic manufacturing readiness to 10 meaning they are ready for full rate production. MRA criteria are split and rated in 9 categories: Technology and Industrial Base, Design, Cost & Funding, Materials, Process Capability & Control, Quality Management, Manufacturing Workforce, Facilities, and Manufacturing Management.

MRL	Maturity
1	Basic Manufacturing Implications Identified
2	Manufacturing Concepts Identified
3	Manufacturing Proof of Concept Developed
4	Capability to produce the technology in a laboratory environment
5	Capability to produce prototype components in a production relevant environment
6	Capability to produce a prototype system or subsystem in a production relevant environment
7	Capability to produce systems in a production representative environment
8	Pilot line capability demonstrated
9	Low rate production demonstrated
10	Full Rate Production demonstrated and lean production practices in place

Internally, many of our customers already require our programs to complete MRAs so I was very familiar with this document. Figure 3 shows how many of our programs use MRAs in our current ORR process. First, we determine our suppliers MRA level, then we identify what led us to that rating, finally, we decide as a team what the supplier must focus on to improve this score.

The information and rating systems in TRLs and MRAs was critical for me to consider and implement in the ORR template. Assessing internal and external design maturity along with our supplier's readiness to manufacture would lower risk when they are given a new or complex design.

4. Data

A crucial piece of data was collected prior to creating a standardized process for completing ORRs. Figure 4 shows 3 programs who rated the same supplier in the same year (2019). As you can see, each program gave extremely different ratings based on the questions they asked, or did not ask, during their Operations Readiness Review with this supplier. By creating a standard template programs will be asking the same questions which should lower the variation in supplier ratings. Once we roll out this template I will conduct a repeatability analysis by having 3 different programs do this all over again using our new system. This is my plan to validate variation has decreased.

Supplier	Program	Rating
1005865	VSUVS	5.49
1005865	CBNFVR	7.15
1005865	GHSTSHP	8.53

Another way I plan to test my template is by measuring the percent of programs conducting ORR's with a means of tracking closure of critical actions coming out of ORR's, and later estimating the number of missed actions that were prevented by using a robust ORR process, and later defining a metric to measure reduction of defects, returns, etc.

5. Model and Analysis

The ORR template is broken into 7 sections based on key stakeholders within NGC programs: Programmatics, Manufacturing, Procurement, Quality, Schedule, Design and Sustainment. Each section is broken out into focus area with questions that are listed and weighted based on criticality. Figure 5 shows the 7 sections and a few of their focus areas.

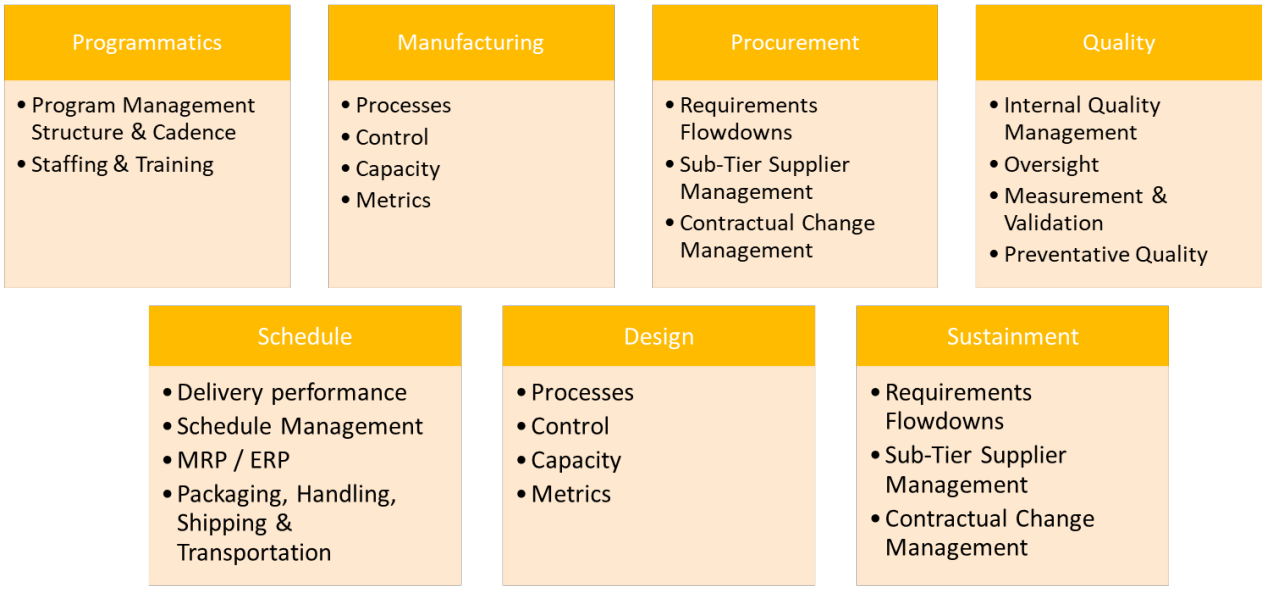


Figure 6 is the first tab in the ORR template, Programmatics. The primary focus here is to understand how the supplier will work directly with our program office, how they internally handle risk management, and what their internal staffing and training is like. Risk/Issue Management and Staffing/Training are weighted the heaviest in this section because they tend to cause the most damage to schedule if not given a healthy score.

Focus Area	Questions
1. Program Management	a. Outline the Program Management organization for the Program. b. What program management metrics are routinely published and how are they communicated to the workforce (.e.g. shop floor boards, WAR rooms - show examples)? c. What is the cadence of program management oversight of the programs? Are records kept and action items tracked to completion? d. What is your process for notifying (our company) of class 2 changes?
2. Risk/Issue Management	a. How do you identify and prioritize risks and issues and how do you manage them? b. What are your top current risks (i.e. funding, schedule, design, procurement, quality and manufacturing, outsourcing or insourcing) through XXX (insert any applicable program phase(s) here) - including sustainment and how/when are you mitigating them? To what level within your organization are these currently escalated, and who is the current owner? c. What are your top current issues, how are you managing them and when (date/LRIP lot) do you expect them to be resolved? To what level within your organization are these currently escalated? d. Provide an example of how you have recently mitigated a risk.
3. Staffing/Training	a. Show the Program staffing resource plan increases broken out for both indirect (non-touch labor) and direct (touch labor) functions to support the programs for the next 5 years (including Sustainment for all questions). Provide the functions that are defined as indirect and direct. b. Provide lead times for recruiting, hiring, training, clearance, etc. c. What is your employee attrition rate? Is there an impact to the Program line of business? d. List the Programs critical/unique/single point of failure skills required that could pose a risk and demonstrate training is timely and effective. e. Show the training/certification matrix/process for all touch labor. f. If applicable, please provide a status on any union bargaining agreement(s) g. Where do you primarily recruit your key labor from?

Figure 7 focuses on the Manufacturing section of the ORR template. This section has 6 focus areas: Manufacturing Processes, Production Returns/Repair/Replacement Processes, Manufacturing Controls, Improvement/Manufacturability Initiatives, Manufacturing Performance and Capacity Plan. Capacity Plan has the biggest impact to the suppliers manufacturing score because if the supplier does not have the capacity to fulfill our PO in a timely and efficient manner we run the risk of being over schedule and/or cost.

Focus Area	Questions
1. Manufacturing Processes	a. Show manufacturing sequence block diagram with production span time and first pass yield for all kitting/fabrication/assembly/test and packaging/shipping for your most complex processed component or part family. Including external supply chain activities, highlight all Critical/Key/Bottleneck processes. b. Identify the critical path within the overall product flow diagrams. c. Will the manufacturing processes change to meet XXX (insert any applicable program phase(s) here) ? If so, what changes will be made? Specifically address any new processes or processes specific to this hardware. d. Identify the single points of failure in the manufacturing flow. What contingency plans do you have in place to mitigate the risk of those single points of failure? e. How are work instructions configuration controlled and incorporated into manufacturing and how often are they reviewed? How do you validate that your drawings are fully incorporated into your work instructions?
2. Production Returns / Repair / Replacement Processes (0 flight hours)	a. Show manufacturing repair concept/capability and repair processes/procedures for parts returned to you. b. Provide pareto of common failure causes and associated repairs/replacements. c. Provide RTAT (historical, current, goal, etc.) monthly for the last 12 months. d. Provide the drivers impacting, and strategies for reducing RTATs. Include the projected improvements.
3. Manufacturing Controls	a. For those Critical/Key/Bottleneck processes highlighted in Focus Area 1, what methods do you use to ensure that only conforming product is passed from one operation to the next? b. How do you measure the effectiveness of those methods / control plans?
4. Improvement / Manufacturability Initiatives	a. What continuous improvement/manufacturability initiatives are in work, planned or recommended to improve the product yield, manufacturing processes capability and/or increase capacity? b. What are the dates and milestones with expected improvements?
5. Manufacturing Performance	a. What quality metrics are used to monitor critical processes? What are targets for those critical processes, and what is past performance(utilize a development program data set / example if possible)? b. Please provide a summary of your most recent internal Manufacturing Readiness Review
6. Capacity Plan	a. State your assumptions for each major process step (to include but not limited to manufacturing loss/shrinkage/yield, number of shifts, hours per shift, work days per year, % equipment utilization, % efficiency and overtime rate) for capacity analysis. b. Are there any DX rated programs currently or anticipating award that will take priority? c. For each process used in manufacturing The Program components and assemblies show the plan for current and projected Program demands (production, and spares as provided by the customer) from now to 2025: 1. Capacity and investment decision points for: a) Capital equipment, b) Tooling/STE (Special Test Equipment, material handling equipment). 2. Facility/floor plan (# of stations) 3. Illustrate usage percentages of shared resources by process or equipment

Procurement (Figure 8) is the only section of the template where all focus areas are weighted evenly. After meeting with subject matter experts internally it was voted Requirements Flow downs, Sub-tier Management, Sub-tier Supplier Quality Oversight, Sub-tier Readiness, and contractual changes can all be detrimental to our program delivery dates and cost saving efforts.

Focus Area	Questions
1. Requirements Flowdown	a. Outline the process for evaluation of (our company) flowdowns and requirements to determine compliance and ability to meet all requirements b. What training is put into place to ensure that your team is procuring to our requirements? c. Share with us a copy of your procurement system approval d. Provide evidence that you have appropriately flowed contract requirements to your suppliers. e. Provide evidence of how you are ensuring that your suppliers are flowing these requirements down to their suppliers. f. How do you schedule and order process material or end item consumed materials not included in the BOM.
2. Sub-tier Management	a. How many suppliers do you have for The Program and how do you manage those suppliers performance? b. How do you ensure that your suppliers have current import/export licensing agreements / NDA's? How do you monitor the expiration of the licensing agreements? b. Provide your supplier delivery and quality performance for key sub-tier suppliers with same or similar products over the last 12 months . c. Provide root causes and corrective actions for any supplier issues that impacted deliveries to your customer. d. For all suppliers not meeting your contractual requirements, show supplier performance improvement plans and demonstrate results. e. How do you evaluate the viability and stability of your supply base? (financial performance, etc.) f. Identify your directed, sole and/or single source and critical suppliers (e.g. special processors). g. From your own Supply Chain Assessments, what risks and / or issues have you identified, and what is being done to mitigate these? h. What are your small business goals and your plans to achieve those goals? (if applicable) i. How do you communicate any producibility concerns raised by your sub-tier supply base to The Program?
3. Sub-tier Supplier Quality Oversight	a. When you are notified of a sub-tier supplier manufacturing process change, how do you review and manage that notification? b. Demonstrate your supplier approval process including sub-tier selection and approval of special processes. c. Discuss special process audits and audit frequency. d. Review deficiencies from audits and provide corrective actions. e. Demonstrate your supplier engagement strategy and zero defect approach including supplier visit / audit schedule. f. For your worst performing suppliers show performance trend for the last 12 months, show improvement plan by supplier and demonstrate the impact of sub tier performance. g. How will you flow the results of your subtier MRR/MRAs to The Program?
4. Sub-tier Readiness	a. For your supply base, describe the process you are using to determine if your suppliers are ready to support an XXX (insert any applicable program phase(s) here program b. Provide summary of sub-tier capacity assessments of your suppliers to support current through XXX (insert any applicable program phase(s) here. Include special processing and spare/repair capacity. c. For any supplier sourcing change: -provide rationale for selection and current qualification status of new suppliers including tooling, capital and PNR requirements. -provide pre-contract verification of suppliers ability to produce at rate. -provide how you will flow this information back to The Program? Please provide an example of what your notification process looks like? d. For any supplier move, provide detailed transition plan and mitigation of risks. e. Provide evidence that sub-tier suppliers have adequate repair capacity (if applicable).
5. Contractual Changes	a. What is your process for managing contractual changes to purchase orders / subcontracts? Provide a copy of the procedure documenting your process and an example of how the process was managed and any additional changes to the PO / Subcontract were communicated back to your customer and verified. b. Outline the process for further communicating and documenting these changes to the manufacturing organization and ensuring all necessary documentation is updated to reflect the latest contractual requirements. Please provide an example of this process.

There are 4 key focus areas in the Quality portion of the template (Figure 9): Internal Quality Management, Quality Oversight, Measurement and Validation, and Preventative Quality with Preventative Quality holding the heaviest weight of 30%. Our Vice President of Quality worked with me when deciding weightings here. He believes Preventative Quality merits having the largest weighting because this holds the supplier accountable in showing they are constantly working to prevent defects thus giving us functioning parts that are ready for production.

Focus Area	Questions
1. Internal Quality Management	a. Show all major internal and third party audit findings including associated mitigation/validation plans for the last 12 months. b. Demonstrate that the Root Cause Corrective Action (RCCA) process is robust and effective. Provide recent examples including validation of corrective actions. Does your plan consider reach across actions? Does it demonstrate investigation of adjacent products, processes, programs, divisions and business units? Please provide a recent example. c. Discuss quality performance trends for the last 12 months related to manufacturing and test in-house as well as internal/external escapes (CARs, QARs, MRB, Tool/FOD Control, stock sweeps, surveys, etc.). Show the relation of these trends to the performance needed to achieve Organizational Goals. d. Are you currently AS9100 / IS9001 certified at the location(s) in which you manufacture The Program products? e. What is your process to control non-conforming material when you find it and show us an example
2. Quality Oversight	a. When you identify or execute a manufacturing process change, how do you review and manage that notification to the customer? b. Demonstrate your approval process including sub-tier selection and approval of special processes. c. Discuss special process audits and audit frequency. d. Review deficiencies from audits and provide corrective actions.
3. Measurement and Validation	a. Show methods for the validation and calibration of production & inspection equipment, tools and software programs used to automate, control and monitor manufacturing processes and inspect product prior to release for production use. b. Provide Measurement Systems Analysis (MSA) & Gage R &R results for any variable measurement devices used in your processes. c. What future inspection process improvement / optimization is your company considering? d. If you have submitted an FAI in the last year or are in the process of submission, please provide status in detail. Review any corrective action associated with failed/repeat delta or full FAIs. e. Is a compliance (requirements) verification matrix completed to ensure all product requirements are met and inspected/tested? What is the process that outlines how that matrix is to be completed and requirements evaluated?
4. Preventive Quality	a. Explain the process for identifying preventive projects to improve or maintain process performance such as PFMEA or a Zero Defect plan. Show progress against planned objectives. b. Demonstrate what quality initiatives are completed or in work to prevent defects from occurring? Show the measured impact to Quality metrics for completed projects. Show the projected impact for projects still in work or planned. c. Identify and list process and product-level The Program Key / Critical Characteristics (KC), or supplier defined process control characteristics and the current level of capability (Cpk, Ppk or other appropriate measure) for each. d. For any processes that do not meet threshold of Cpk ≥ 1.33, show your control plan to prevent escapes. Do you have a continuous improvement plan for any process that does not meet the threshold of Cpk ≥ 1.33? e. Describe how process variation is controlled/mitigated (such as Six Sigma Analysis, Error/Mistake Proofing, and Statistical Process Control (SPC) type tools) and show the current status/trends.

Section 5 of the template is Scheduling (Figure 10). Delivery performance holds the largest weighting since one of the key objectives of an ORR is to ensure our programs are meeting our schedule. Other focus areas include: Schedule Management, MRP/ERP System, and Packaging, Handling, Shipping & Transportation.

Focus Area	Questions
1. Delivery Performance	a. Show your last 12 months delivery performance to customer (PO contractual dates) for all demand (production, spares, repairs, etc.) b. For all deliveries over the last 12 months, provide a pareto of the root causes for any deliveries late to customer need. c. Provide corrective actions and delivery recovery plan for items noted in b. If your supply base is the root cause, provide details in Procurement section question 2. d. Provide evidence that the corrective actions are effective.
2. Schedule Management	a. Demonstrate how the shop floor schedule is managed to support the aggregated customer demand and is it linked to your MRP/ERP system? b. How do you manage priorities between production, repairs, and spares? c. Show how your production schedule accommodates losses due to your internal scrap/rework/repair. d. Are there Government and / or Customer Furnished materials that drive your schedule? If so, provide a timeline with need dates for review. Demonstrate the process for controlling CFM once received.
3. MRP/ERP System	a. How do you maintain accurate information in your inventory management system? b. What is your inventory accuracy, goal and what are your plans to reduce any gaps? c. Do you have any planned changes, enhancements to or a conversion to an MRP/ERP system? How are you planning to mitigate the risks involved with the change?
4. Packaging, Handling, Shipping & Transportation	a. As required by your PDS / Drawing – are you prepared to meet our specific packaging and labeling requirements? Do you have a process defined to manage that? If so please share. b. What are your processes for managing (if applicable?):- 1: reusable containers 2: export licensing 3: shipping method (land, sea, air) 4: component packaging and product protection effectiveness 5: energetics, dangerous goods, explosives (Expertise in packaging and shipping) c. What are your special packaging instructions?

Design is section 6 in the template (Figure 11) with 6 focus areas: Design Maturity, Delivered Hardware Performance, Acceptance Test Plan/Procedure (ATP) Effectiveness, DMS/Obsolescence, Product Design Improvement and Configuration Management. Delivered Hardware Performance is the most critical focus area in this section with a weight of 30%. Again, this is because this portion prevents possible defects/returns with efficient artifacts given.

Focus Area	Questions
1. Design Maturity	a. Show forecast of any upcoming or in work design change activity and define any impacts to production. b. If qualification testing is incomplete, provide status including percent complete and any potential impacts to undelivered hardware up to and including final configuration. c. Outline the results of your internal design review of these requirements and identify and risk that has been identified
2. Delivered Hardware Performance	a. Review pareto of items returned for functional failure and the root cause of the failure(s). b. What are the activities to resolve and prevent recurrence of the returns listed above? c. Provide data on your product's current and projected reliability. If current reliability is below projected, provide improvement plan.
3. Acceptance Test Plan/Procedure (ATP) Effectiveness	a. Demonstrate ATP effectiveness via a Pareto of escapes to the customer. b. Why was the ATP not effective in preventing these escapes? c. What improvements are planned for your ATP? d. What is the percentage of no fault found / RTOK and what is the improvement plan for reduction?
4. DMS / Obsolescence	a. Demonstrate how you manage DMS identification and how any issues identified are reported internally and communicated externally to your customers. b. Review any DMS notifications issued for The Program their current approval status, and mitigation actions implemented. c. Are there any materials, paints, oils, lubricants, sealants, treatments, etc. that are potentially being made DMS/obsolete or unavailable due to legislative changes (e.g. REACH / COSHH) or otherwise and what is the mitigation plan?
5. Product Design Improvement	a. What design / engineering changes are in work or are recommended to improve product operation / functionality and / or producibility to support increased rates? Review effect on manufacturing build plans. b. For initiatives that have not yet been implemented, show the current time phased implementation schedule for each initiative and the current status of each to support meeting rate production. c. Highlight any impacts that may affect the design of record, including product, process and/or qualification. Include form/fit or function changes of all planned improvement initiatives.
6. Configuration Management	a. Demonstrate your configuration management controls are put in place and followed to ensure correct release and controls of the documents used in the manufacturing processes and those released to any sub-tier suppliers. b. Provide status on Physical Configuration Audits & Functional Configuration Audits (PCA/FCA).

The final section suppliers will be scored on is Sustainment (Figure 12). This section has 6 focus areas with 4 of them holding equal weight while 2 hold a lesser value. Focus areas 1 & 2 are weighted at a mere 10% since they are not as damaging to program cost/schedule while the other focus areas are 20% weightings.

Focus Area	Questions
1. Organization - How will you support The Program sustainment operations?	a. What locations have been identified as operating centers / locations for sustainment activities? b. Demonstrate how you maintain repair records of returns? c. Provide status of standard repair agreement. Provide status of repair lay in material. (If applicable)
2. Repair Material Availability and Supply (Internal & External Supply Routes)	a. How do you provision for and supply components required for Repairs, both internally and externally? b. Provide evidence of materials management (flow downs, material specifications, spares & repairs demands, capacity availability). c. For external Repair activities, how do you ensure that sub-tier suppliers are approved, qualified, knowledgeable, experienced in repair & maintenance activities? d. How do you ensure that all components, materials and consumables used meet the required specification and have appropriate traceability?
3. Repair Planning - What are the processes and/or systems used to meet repair turn-around time?	a. What are the processes and/or systems used to measure and achieve a stable repair turn-around time (RTAT) or Supplier Response Time? b. What initiatives will be used to improve Supplier Response time or RTAT? c. Describe and demonstrate your process for inspection and classification of components. d. Are components classified and segregated into the following categories:- (1) Satisfactory (serviceable) condition with the appropriate release certification (2) Unserviceable Components (3) Quarantine - Show how unacceptable components are segregated from good stock, and how this separation is maintained (4) Unsalvageable / Scrap Components e. Are there certain product families based on The Programs provided parts lists that will automatically be segregated into one of the four categories (e.g. scrap)? f. If not classified as above, explain and describe the methodology used and show approval to use this method. g. Have there been any issues arising due to inadequate segregation, and what corrective actions have been put in place to prevent recurrence?
4.-Repair Capacity (Rate) - what is your strategy for meeting current and future planned repair projections?	a. Provide a Repair Process Flow Diagram, as well as an annual repair capacity analysis (see Capacity Template worksheet), listing any assumptions, particularly associated with sustainment processes for: (1) Cycle times for repair activities, e.g. receipt, inspection, initial test, actual repair, re-test, pack & ship etc. (2) Provide strategy plan including: manpower, facilities, tools, test equipment, and material. Also, provide plan for surge capability. (3) Provide evidence that demonstrates the integration of repair quantities with production quantities to include workload assumptions based on capacity constraints. (4) Identify the limiting constraints to include but not limited to part availability.
5. Repair Capability - Demonstrate Supplier Response Time Capabilities	a. Provide evidence of current repair & maintenance capabilities. (e.g. engineering repair, rate repair, card swapping, automated testing, probing, timings, product throughput etc.). b. Provide plan for repair & maintenance facility capability in support of your products. c. What are the future requirements for tooling and test equipment to support repair & maintenance of your product. d. What is the effectiveness of repairs carried out? Show data for mean time between unscheduled removal / confirmed faults. e. What is the percentage of no fault found / RTOK? What improvement activities are occurring to reduce these returns?
6. Performance Metrics	a. Discuss Repair & Maintenance current performance and any trends identified. What is the relation of those trends with the goals needed for Full Rate Repair & Maintenance Support (Scrap, Rework, span time, hours per unit (HPU), defects, yield, NFF etc.) b. How effective are you at fixing a fault first time? c. How is information on repairs related back to Original Equipment (OE) manufacturing where applicable, and actions / changes / improvements recorded?

As shown above, each focus area has several different questions listed within. Each focus area is given a score 1 to 10 based on the Scoring Guide shown in Figure 13 below. 10 is the highest rating meaning there is very low impact to the program/answers provided are sufficient. 1 is a high risk rating and provided documents are not ideal for program success. Green ratings are given for a score of 8.5 and higher, yellow ratings used for a score in the range of 7 to 8.4, and red ratings are used for a score less than 7.

2020 Assessment Guidance

10	Very Low Risk of Impact At This Time, Sufficiently Covered All Aspects of Expected Evidence. Supplier is exceeding expectations and plan. Supplier operating effectively and expected to continue into Full Rate Production. Or answer is Best-In-Class example
9	Low risk, Expected Evidence covered sufficiently to build confidence that supplier is cognizant of what they need to do to achieve full rate production and actively tracking production readiness activity to plan.
8	Medium Risk. Risk identified, and documented formally, with impacts to program identified. Mitigation in place and operating effectively.
7	Medium Risk. Risk identified with impacts to program identified. Mitigation in place. Expected evidence not complete, and/or product deliveries behind schedule but recovery anticipated during next LRIP.
6	High Risk. Risk Identified. Mitigation plan for future impact implemented. Plans and processes not operating effectively.
5	High Risk - Evidence Expected For This Phase of Program Not Available. Reasonable expectations not being achieved. Issue Identified, recovery plan provided and in work. However impact unavoidable in current contract.
4	High Risk - Evidence Needed By Program Not Available Nor Reasonably Forecasted. Issue Identified, no demonstrated performance against current recovery plan in place. Critical Path impacted.
3	High Risk - Supplier is not supplying expected evidence. Issue Identified, no demonstrated performance against recovery plan. Supplier may not be able to succeed on their own without direct engagement and program involvement.
2	High Risk - Supplier is not supplying expected evidence. Issue Identified, recovery plan being developed. Unacceptable levels of resources and efforts in handling risks and satisfying intent of production plans, process, and transition.
1	High Risk -Supplier is not supplying expected evidence. Issue Identified. Plans and Processes not established, no recovery plan. Recovery not possible within the PO contract constraints.

Because there are several different questions within each focus area it is up to the program to give one overall score per area based on the supplier's answers and artifacts provided. Figure 14 shows each sections and their retrospective focus areas along with the weightings.

1.0 PROGRAMMATICS	Wt	Rating
1. Program Management	20%	
2. Risk / Issue Management	40%	
3. Staffing/Training	40%	
2.0 MANUFACTURING	**Wt**	**Rating**
1. Manufacturing Processes	10%	
2. Production Returns / Repair / Replacement Processes (0 flight hours)	5%	
3. Manufacturing Controls	15%	
4. Improvement / Manufacturability Initiatives	10%	
5. Manufacturing Performance	20%	
6. Capacity Plan	40%	
3.0 PROCUREMENT	**Wt**	**Rating**
1. Requirements Flowdown	20%	
2. Sub-tier Management	20%	
3. Sub-tier Supplier Quality Oversight	20%	
4. Sub-tier Readiness	20%	
5. Contractual Changes	20%	
4.0 QUALITY	**Wt**	**Rating**
1. Internal Quality Management	25%	
2. Quality Oversight	20%	
3. Measurement and Validation	25%	
4. Preventive Quality	30%	
5.0 SCHEDULE	**Wt**	**Rating**
1. Delivery Performance	40%	
2. Schedule Management	25%	
3. MRP/ERP System	20%	
4. Packaging, Handling, Shipping & Transportation	15%	
6.0 DESIGN	**Wt**	**Rating**
1. Design Maturity	10%	
2. Delivered Hardware Performance	30%	
3. Acceptance Test Plan/Procedure Effectiveness	25%	
4. DMS / Obsolescence	20%	
5. Product Design Improvement	10%	
6. Configuration Management	5%	
7.0 SUSTAINMENT	**Wt**	**Rating**
1. Organization	10%	
2. Repair Material Availability and Supply (Internal & External Supply Routes)	10%	
3. Repair Planning	20%	
4. Repair Capacity (Rate)	20%	
5. Repair Capability	20%	
6. Performance Metrics	20%	

Each section then gets weighted again based on the focus area scores. This provides the program with the final ORR score. Shown in Figure 15.

Category Summary	Category Score	Category Weight
1.0 PROGRAMMATICS		10%
2.0 MANUFACTURING		20%
3.0 PROCUREMENT		20%
4.0 QUALITY		15%
5.0 SCHEDULE		15%
6.0 DESIGN		5%
7.0 SUSTAINMENT		15%

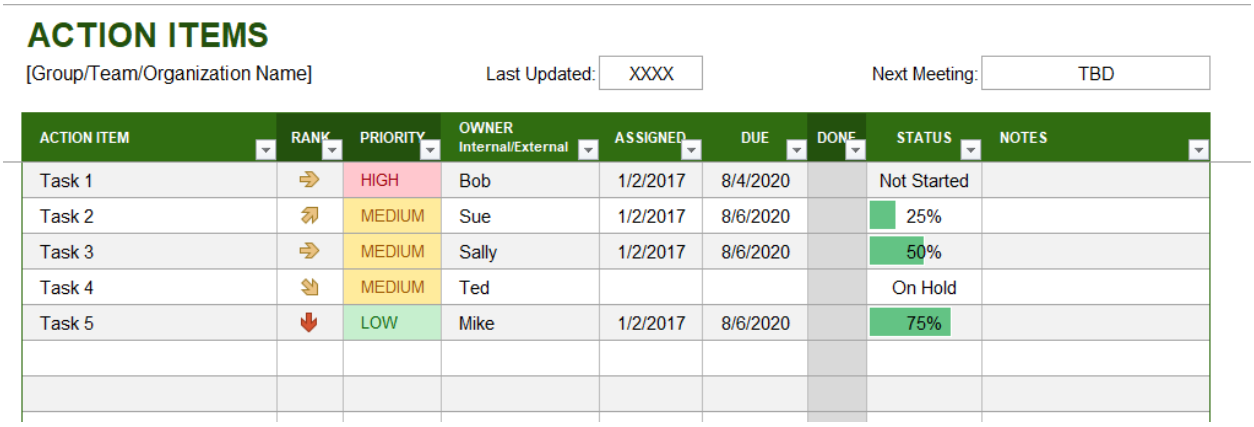
Figures 16 shows an example of what the Scoresheet looks like with scores given in each section.

Category Summary	Category Score	Supplier Overall ORR Score
1.0 PROGRAMMATICS	7.4	7.04
2.0 MANUFACTURING	4.9	
3.0 PROCUREMENT	7.8	
4.0 QUALITY	6.7	
5.0 SCHEDULE	6.7	
6.0 DESIGN	8.7	
7.0 SUSTAINMENT	8.9	

5.1. Supporting Documentation

Along with giving internal programs and our suppliers this template to utilize I also created supporting documentation to go with the template. This will ensure suppliers and programs both understand and are prepared to use the template which will lead to a successful ORR. There are 3 key documents that should be used: The Action Item Template, Guidance Document, and the Letter of Expectations that must be sent to the supplier. Figures 17-19 show the supporting documentation.

The Action Item Template should be filled out during the ORR. The ORR mediator (typically a Program Manager) should be tracking all actions both internally and externally. After the ORR is conducted this will be posted to our ORR site for tracking from the suppliers side and the program side as well. This is critical due to the fact that if any action items go unresolved the overall risk will not decrease and we could end up facing an issue later down the line.



ACTION ITEMS

[Group/Team/Organization Name] Last Updated: XXXX Next Meeting: TBD

ACTION ITEM	RANK	PRIORITY	OWNER Internal/External	ASSIGNED	DUE	DONE	STATUS	NOTES
Task 1		HIGH	Bob	1/2/2017	8/4/2020		Not Started	
Task 2		MEDIUM	Sue	1/2/2017	8/6/2020		25%	
Task 3		MEDIUM	Sally	1/2/2017	8/6/2020		50%	
Task 4		MEDIUM	Ted				On Hold	
Task 5		LOW	Mike	1/2/2017	8/6/2020		75%	

The document below (Figure 18) is the Letter of Expectations given to the supplier. This document lets the supplier know we will be coming within 60 days and gives them enough time to look over the template and gather their artifacts. Once they have their answers and artifacts it is up to them to send us the information back for internal review. At that point the supplier and program would meet to go

over the supplier ORR score, questions, concerns, etc during the actual ORR.

Date

Ms. Jane Doe
Title
Company Name
Street and Address
City, State, Zip Code

Dear Ms. Doe:

This letter is to notify you of (Our Company's) intent to conduct an Operations Readiness Review (ORR) with your company in support of the X Program. My name is X and I am the ORR facilitator that you will be coordinating with leading up to the onsite review.

This review is intended to evaluate your ability to support our manufacturing needs for current and future forecasted requirements. In addition we will be evaluating your QMS system, process controls, risk and affordability opportunities.

Ultimately, the objective is to confirm with a high degree of confidence that we are mutually positioned for success for our current and any future requirements.

This review will be conducted on site at your facility with participation from all key (internal) Stakeholders. Please review the attachments enclosed, complete the supplier self-assessment and submit your presentation and all required documents at least 1 week in advance of the scheduled on site visit.

The intent of the on-site visit is to evaluate objective evidence provided to establish a risk and readiness score. Please be prepared to demonstrate through that evidence your preparedness, your sound process controls and the proactive measures you employ to reduce risk and ensure compliance to your contractual commitments.

Sincerely,

XXX

Figure 19 shows our internal guidance document. This is given to programs so they know what is expected of them during the ORR process.

Operations Readiness Review (ORR) Guidance Document

Objective of the ORR

The purpose of conducting an ORR is to allow the stakeholders to effectively assess a supplier's ability to support manufacturing needs per the current and forecasted requirements (Labor, tooling, training, staffing, schedule, testing, inspection, etc).

In addition, the following are objectives of the ORR:

- Assessment of planning and current status including supply base to achieve deliveries to meet program requirements.
- Complete assessment of Quality System/Processes.
- Identification of potential affordability opportunities.
- Identification of follow on activities to monitor and support risk mitigation activities being worked by the supplier.

Completion of the ORR evaluation will highlight the risk areas of concern and additional watch items that need to monitored to ensure the success of the program. A high or moderate risk evaluation could drive increased customer oversight and support of follow up meetings.

When to conduct an ORR

An ORR should be conducted before a supplier's first order delivery. The timing of the ORR can be supplier specific, depending on the lead time and complexity of the material being procured. The intent is to catch any risk before the supplier is too far down the path to correct their misunderstanding of drawing requirements or process issues.

An additional opportunity of using an ORR exists to evaluate a supplier's readiness when moving to the next phase of a program i.e. EMD to LRIP. EMD and LRIP have different Manufacturing Readiness Levels (MRL's) that should be assessed. It is therefore good practice to conduct a review during end of one phase and beginning of the next.

ORR Planning and Supplier Selection:

Candidates for an ORR are Critical and Strategic suppliers that should be selected based on the greatest potential for risk and/or impact to the program. This could be associated with total contract value, design maturity, producibility, supplier capacity, and/or historical delivery and quality ratings. The risk cube is a comprehensive quantitative risk assessment that can be leveraged to identify risk by program in support of ORR supplier selection as well as the bottoms up risk assessment which is a more qualitative approach. (Look at P100 – SSSP document strategic sourcing plan document that should be developed during the sourcing phase).

When planning supplier ORR's during the proposal phase, two assessments should be performed. After selecting the number of suppliers that will require an ORR, a bottom's up assessment should be performed to evaluate the cost associated with the number of suppliers being visited, the number of resources / stakeholders involved in the review and the number of days required for each review. A

travel assessment should also be performed to incorporate travel costs associated with supporting the suppliers selected to perform the review. There is a travel BOE tool accessible for use to calculate the anticipated travel costs associated with conducting each review.

All supplier oversight and support that is required must be coordinated through Global Supply Chain so that all costa are captured appropriately during the proposal phase.

ORR Stakeholders: Stakeholders in an ORR can vary depending on the supplier, the product and the program, however it's generally a best practice to ensure the following functional team members are included in the reviews:

Core / Critical Stakeholders:

- Global Supply Chain Program Management (Supply Chain Planning Manager and Subcontracts Manager)
- Supplier Performance Management
- Engineering (lead designer of the product / component)
- Manufacturing Engineering (particularly someone knowledgeable of the supplier process or end user of suppliers product)

Optional / Supporting Functions:

- Program Management
- Mission Assurance
- OPM

Successful execution of an ORR:

Prior to an ORR the program should select an "ORR Lead" who will use the "Roles and Responsibilities" document Appendix A. Typically the ORR Lead will be the Global Supply Chain SCA Manager or Category Manager.

Whenever possible, obtaining and reviewing a supplier's ORR package including objective evidence, prior to the actual ORR event, will drive a more effective review. This will allow the internal team to coordinate questions, evaluate any high level concerns and develop a review strategy prior to visiting with the supplier on site.

Documenting action plans resulting from the ORR:

Actions documented in the ORR tool should be succinct, clearly written to directly address a risk identified during the ORR, and they should include both an action owner and ECD. These actions can be owned by the Supplier or an (internal) stakeholder. All documented actions should be monitored by the ORR Lead along with other key stakeholders for progress on a recurring basis (time frame to be established during the ORR).

Actions should be categorized into three buckets: Risk, Opportunity or General Actions. Risk actions should be prioritized first.

Roles and Responsibilities of ORR Lead

Prior to ORR:

- Discuss facilities prior to the visit with supplier
    - Does the supplier have adequate meeting facilities: conference room, number or seats, projector, conference phone, etc.?
    - Can you plug your laptop into the projector?
    - Does the supplier have WiFi or LAN access for your laptop?
    - Does the supplier prefer to have information sent ahead of the visit via email or secure upload?
    - Does the supplier need specific information from (internal) team that will visit, such as confirmation of citizenship, etc?
    - Will any classified data be exchanged?
- If planning to discuss proprietary information, ensure proper NDA and/or terms and conditions coverage are in place
- Send Supplier Expectation Letter 60 days prior to ORR.
- Set up meeting internally 3-5 days before ORR with team to prepare ahead of time
    - Review key points of discussion, critical parts, go over expectations, etc
    - Spend time reviewing objective data

During the ORR:

- Responsible for proper introductions/Peer-to-peer relations
    - Consider (internal) and supplier personnel titles when scheduling a meeting
    - Make sure team minimizes cell phone/laptop usage during meeting
- Protect (internal) and supplier information
    - Avoid cross pollination of supplier information
    - Avoid sharing competitive insight where it provides no advantage to (our company)
- Keep meeting on track
    - Ensure meeting purpose and agenda make appropriate use of time and travel funds
    - Keep teams and meetings focused and on track
- Complete Manufacturing Readiness Review Checklist (Internal) – separate document
    - Supplier information
    - Attendees
    - Objectives and agenda
    - Major takeaways
- Complete Action Item Tracker during the visit

After the ORR:

- Thank you letter to Supplier and send out Action Item Tracker
- Set up follow up meeting for a month after ORR for Action Item status (Internal and External) and continue this routine until all action items are closed
- Work with GSC to set up reoccurring meeting with supplier if needed
- Provide Program Manager with Action Item Tracker to Program Management to ensure actions are being worked internally

6. Results and Recommendations

ORR's range from simple to complex depending on the supplier and the complexity of the hardware being purchased. The table below (Figure 17) shows the range of costs required to conduct ORR's depending on the complexity:

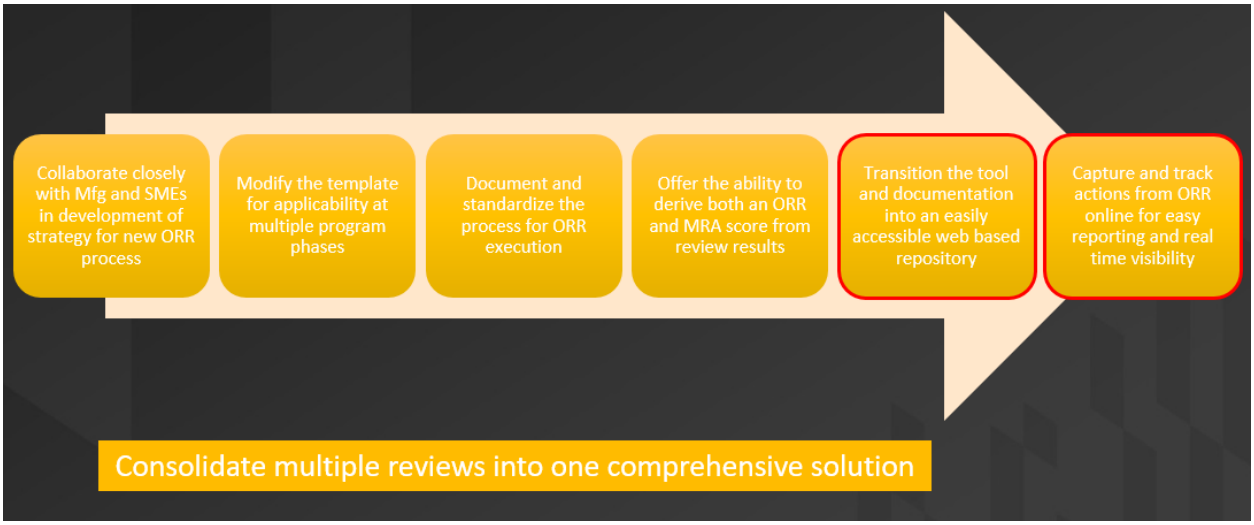
ORR Cost Element	Highly Complex ORR		Reduced Complexity ORR	
# of people	7	OPM, Engr, Mfg Engr, QE, GSC, Category, PMO	2	Mfg Engr, Process Specialist
# of days	6	Prep (1 day), PRR (1), Wrap-up & Presentation (1), Action Item Follow (1) Travel (2)	2.5	Prep (.5 day), PRR (1), Wrap-up & Presentation (.5), Action Item Follow (.5)
Hours	336		40	
Labor $	67,200	$200/Hour	8,000	$200/Hour
Travel Costs $	8,400	$1.2k per trip per person	-	No Travel Required
Total ORR Cost $	**75,600**		**8,000**	

*based on internal historical data

If we assume the average cost per ORR is in the middle of these examples above, the average ORR cost would be $41,800. If we also assume the average program migrating to a new contract phase (i.e. LRIP to FRP) conducts 10 ORRs, the ORR costs would be $418,000 for a typical program. Through the usage of a standard template and potentially online portal as described, a typical program could reduce its ORR costs easily by 15% or $63k. Further, by enabling a robust action item closure process, program risk will be reduced as well.

6.1 Updated Process

As a recap, this is how I created our new process (Figure 18). In the first phase I met with stakeholders to determine what questions should be asked to suppliers, how weightings should be decided in their focus areas, and what areas we typically miss/hurt us when we miss schedule/get parts with defects. In the second phase I combined the information given from my meetings into a uniform template and modified it to be applicable to programs in varying program stages. The third phase was creating the supporting documentation for internal and external use to go with the ORR template. The fourth phase was to meet with subject matter experts and executives to calculate section weighting to derive both a MRA and ORR score. Currently, this effort is in the fifth stage which is to transition the ORR template to an online tool/repository. This will lead for easier communication across all programs and also between suppliers and programs. Unfortunately, our funding went towards our internal COVID site so until next quarter this will not be funded. The final stage will be the roll out of the online tool.



7. Conclusions

In conclusion, by creating a standard ORR template (and supporting documentation) variation will decrease making our supplier scores more accurate across the company. This template will also help programs identify risks before they become a reality. Working with suppliers upfront will build a stronger relationship Having a robust, online tool to manage the ORR process including tracking responses from the supplier and organizing all of the artifacts will ultimately minimize the occurrences of issues and/or action items identified during an ORR that ended up not being acted upon and closed.

8. References

DoD (2010), Defense Acquisition Guidebook

Technology Readiness Assessment (TRA) Guidance. U.S. Department of Defense, April 2011.

United States of America, Department of Defense, OSD Manufacturing Technology Program. (2011). Manufacturing Readiness Level (MRL) Deskbook (Vol. 2.0).