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Maintenance

TECHNICAL ANALYSIS TO DETERMINE CRITERION FOR 2 VS 3 LEVEL REPAIR

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This handbook implements a standard methodology for evaluating potential 2-level repair candidate (or the return of assets to 3-level repair) since the inception of the Air Force's Two Level Maintenance (2LM) program. This handbook methodology is not intended to be the final word on the evaluation of 2-level repair candidates. The methodology described is intended to identify strong 2LM candidates. System Program Directors (SPDs) and Major Command (MAJCOM) functional experts are encouraged to do additional analysis prior to making a definitive decision to induct an asset into 2-level repair. The process for evaluating 2-level repair candidates can be enhanced or refined as logistics experts learn more about the desired characteristics of 2LM assets.

Chapter 1

OVERVIEW OF THE PROCESS

1.1. General Overview . Based on the scope of the study and the aforementioned assumptions, this is a step-by-step overview of the recommended process for evaluating items for 2-level repair. The process can also be used to evaluate a 2LM item for possible return to 3-level repair. However, to avoid confusion in describing the process, the descriptions here focus on evaluating assets for 2-level repair to optimize lean logistics opportunities. The descriptions and instructions for this 2-level repair evaluation process follow the overviews and are in two parts: the first describes how to evaluate avionics and C-E assets, and the second describes how to evaluate engines.

1.2. Overview of Evaluation Process for Avionics/Communication-Electronics (C-E).

1.2.1. Step 1: Sorting by Manpower and/or High Acquisition Costs.

1.2.1.1. This step provides two sorting techniques to begin the overall analysis of assets for possible transition to 2-level repair. The sorting techniques focus on potential savings associated with eliminating manpower tied to intermediate level repair and avoiding the cost of buying high acquisition cost items. Either sorting technique may be used individually or both may be used simultaneously.

1.2.1.2. Sorting by manpower costs requires lead MAJCOM and SPD functional managers to prioritize intermediate level (I-level) shops by highest to lowest labor cost. Functional managers will also identify the test stations within each of the I-level shops, the estimated manpower assigned to those test stations, and list the national stock numbers (NSNs) which are repaired on those test stations.

1.2.1.3. When sorting assets by high acquisition cost, functional managers will first select a cost range on which to focus and then select specific assets from this range to evaluate in steps 2 through 4 of this process. Then, functional managers will identify the I-level shops that repair those assets and the associated test stations involved in those repairs. At this point, it will be necessary to compute manpower costs, as described above.

1.2.2. Step 2: Analysis by Test Station.

1.2.2.1. After selecting the specific shop(s) and/or high acquisition cost items for evaluation, functional managers will input logistics data for a small number of indicators into a matrix for those NSNs supported in the selected shops. The recommended logistics indicators for avionics/C-E assets are:

1.2.2.1.1. Mean Time Between Failures (MTBF)

1.2.2.1.2. Cannot Duplicate Rate (CND)

1.2.2.1.3. Percent Base Repair (PBR)

1.2.2.1.4. Daily Demand Rate (DDR)

1.2.2.1.5. Pipeline time

1.2.2.1.6. Asset position

1.2.2.1.7. Weight and Cube

1.2.2.2. This matrix will allow for further analysis of these NSNs by comparing them against these first tier logistics indicators. The result is a list of 2LM candidates prioritized by their relative scoring against these indicators. This list is used as a tool for further analysis or as a means for eliminating some candidates from consideration. The functional manager can evaluate NSNs in the matrix as a group of assets supported by the same test station(s).

1.2.3. Step 3: Analysis of Cost-to-transition, Impact to Mobility Footprint, and Impact to Operational Capability.

1.2.3.1. Those NSNs from step 2, which functional experts decide to pursue as potential 2LM items, will now be evaluated in terms of cost to transition to a different repair level, impact to mobility footprint, and impact to operational capability. Cost to transition is computed through a methodology developed to capture approximately 80% of the known costs associated with transitioning to a different repair level. These costs are:

1.2.3.1.1. Manpower savings at the base level.

1.2.3.1.2. Potential increased manpower costs at the depot level

1.2.3.1.3. Potential increased transportation costs for 2-level repair

1.2.3.1.4. Potential changes in inventory requirements

1.2.3.1.5. Re-computation of the readiness spares package (RSP) for 2LM support

1.2.3.2. To estimate the reduction in mobility footprint, total the number of 463L pallet positions which can be made available by eliminating a test station(s), if a component (s) is moved into 2LM. It is also necessary to estimate the number of mobility personnel who are no longer needed to deploy to do I-level repairs on those test stations. To date, we have not identified a simple methodology for capturing the impact of a repair level decision on the in-commission rate for an equipment item or aircraft availability rate for the weapon system. However, the MAJCOM Dyna-METRIC Microcomputer Analysis System (MAJCOM DMAS) can provide an assessment of the impact on aircraft availability based on the estimated 2LM pipeline time and worldwide asset position. MAJCOM DMAS is an automated analysis tool which is used for a number of theater, MAJCOM, or unit-level applications.

1.2.4. Step 4: Subjective Issues.

1.2.4.1. This step requires the functional managers to run a checklist of repair environment factors against those NSNs which they are still considering for 2LM. After reviewing these checklist items for each NSN or group of NSNs, if supported by a common test station, logistics experts can now make a decision concerning whether or not to induct an item into 2LM, to do additional analysis, or to look at other repair alternatives, such as regional repair or privatization.

Chapter 2

EVALUATION PROCESS FOR AVIONICS/C-E ASSETS

2.1. Step 1: Sorting by Manpower and/or High Acquisition Costs.

2.1.1. Sorting by manpower costs. Sorting by manpower costs requires functional managers at the lead MAJCOM to prioritize I-level repair shops by manpower cost. By focusing on the manpower reductions resulting from the elimination of base repair workload, this prioritization targets one of the largest areas for potential savings associated with the transition to 2LM. The following is a recommended approach to prioritizing I-level repair shops, identifying shop test stations and associated NSNs supported by those test stations for step 1:

2.1.1.1. Lead command functional managers compile a list of the intermediate level shops within their commands. This list should focus on those shops whose workload is primarily in-shop and not directly tied to flightline sortie generation.

2.1.1.2. Manpower costs should then be computed for those I-level shops by base. Calculate manpower costs as follows:

2.1.1.2.1. Use the Unit Manning Document (UMD) to identify the manpower authorizations by grade for each I-level shop. Identify by base if several bases have the same I-level shop.

2.1.1.2.2. To calculate manpower costs of each I-level shop by base, use the composite rate w/out permanent change of station (PCS) (fully burdened rate) in AFI 65-503, US Air Force Cost and Planning Factors.

2.1.1.2.3. Then, add total manpower costs for each grade to determine the total I-level shop manpower cost.

2.1.1.3. Manpower cost for a single grade level = (manpower authorizations by grade) x (fully burdened cost as listed in AFI 65-503, Tables A19-1 and 26-1).

2.1.1.4. Develop a consolidated list of shops and their manpower costs, and a composite list of test stations/equipment and associated assets repaired in those shops. Test stations can be identified in the weapon system allowance standard. Assets repaired on those test stations can be identified through a coordinated effort of the SPDs, MAJCOM functional managers and base level shop chiefs.

2.1.1.5. Managers should consolidate these lists and total the manpower costs for shops that have the same type of test stations and support the same assets. This will provide a total estimate within the MAJCOM of potential manpower savings, if a particular I-level repair were eliminated.

2.1.1.6. The lead command functional managers can now prioritize the I-level shops by manpower cost.

2.1.2. Sorting by high acquisition cost.

2.1.2.1. When sorting by high acquisition costs, functional managers should identify a range of costs that they want to target first. The Recoverable Consumption Item Requirements System (D041) can be used in the selection of NSNs by cost. A program can be developed to pull all expendability, recoverability, retainability code (EERC) XD assets with a weapon system application code within a selected range of forecast acquisition costs (FAC). For example, managers may choose to initially focus on assets with a FAC of $1M or greater. After selecting the high acquisition cost items they want to focus on first, managers should then identify the shops in which these assets are repaired. At this point, managers should also complete the steps outlined above for estimating shop manpower costs and listing associated test stations and NSNs. This will help determine total potential savings if an asset(s) were transitioned to 2-level repair.

2.1.2.2. At the end of step 1, managers should select high cost shops, high acquisition cost assets or a combination of both for further analysis in steps 2 through 4. Assets will be grouped and tied to their appropriate test stations and analyzed as a group of assets. It should be understood that the process described here in step 1 is a generic, macro approach to target potential savings, and provides only a starting point for analyzing 2LM candidates. Functional managers can use other techniques for sorting (see "Conclusions and Recommendations").

2.2. Step 2: Analysis by Test Station.

2.2.1. After selecting the assets to be evaluated (step 1), managers will input a small number of logistics indicators/data for the NSNs into a matrix. Assets are grouped by test station(s) and are evaluated against first tier logistics indicators and the desired characteristics of a 2LM asset.

2.2.2. The result is a list of 2LM candidates ranked by their relative scoring against these indicators. Managers can use this list as a tool for further analysis or as a means of eliminating some candidates from consideration.

2.2.3. The indicators recommended in this study are first tier, easily accessible logistics indicators. They provide a quick overview of the status of each NSN in relation to reliability and maintainability, supply, and transportation indicators, as well as to the desired characteristics of a 2LM candidate. By reviewing the logistics indicators for each NSN and comparing them with the desired characteristics of a 2LM asset, the functional managers will have a broad understanding of how a specific NSN or group of NSNs may perform in a 2-level repair environment. Grouping assets by test station will provide insight into whether an entire test station can be eliminated in order to achieve the potential manpower savings. Functional managers will have to study the scores and rankings for each NSN and how they compare to the other NSNs supported by the same test station to help determine whether an asset(s) will perform well in a 2-level repair environment. It is important to note that as experience is gained using this process and more is learned about the performance of 2LM NSNs, these first tier indicators and the desired characteristics of a 2LM asset can be easily changed in the matrix. Recommended indicators and a description of the desired 2LM characteristics or those indicators follow.

2.2.4. Logistics Indicators for Avionics/ C-E.

2.2.4.1. MTBF: An indicator of the time between actual failures of a given asset. A high MTBF would be the desired 2LM characteristic because it indicates a highly reliable asset which would not significantly increase transportation costs or depot workload.

2.2.4.2. CND: An indicator of the frequency at which an asset appears to have failed on a weapon system or equipment end item, when that failure cannot be duplicated in the repair shop. Thus, the asset is returned to the supply system. A high CND rate would mean additional transportation costs and increased demand on the supply and repair systems in a pure 2-level repair environment where all base level repair capability has been eliminated. Thus, a low CND rate is preferred in a 2LM environment.

2.2.4.3. PBR: An indicator of the amount of repair activity at base level for the given asset. A low PBR would typically be a desired characteristic for a 2LM candidate since most of the repair activity is already at the depot (contractor). Thus, there is the opportunity to consolidate workload and optimize the depot repair capability. However, assets with a high PBR should be reviewed to determine if there is a high manpower cost associated with that high base repair level. If so, managers may elect to consider these candidates in the evaluation.

2.2.4.4. DDR: An indicator of the volume of these assets ordered on a daily basis. A low DDR would be most desirable in a 2LM environment because it indicates less demands on the supply and repair systems, and would minimize transportation requirements and costs. While a low DDR is a recommended starting point for this analysis, it is recognized that the repair cycle is complex and dynamic, and that other analyses might offer additional trade-offs. For example, a high demand rate might reflect a low reliability asset that requires more base repair activity, thus driving a large manpower requirement. Hence, analysts might want to study the potential for reducing the manpower requirement by moving the asset(s) into 2LM.

2.2.4.5. Pipeline Time: An indicator of the current pipeline, including transportation time to and from the primary source of repair, handling time, and the base and depot repair times. An asset with a short pipeline would be the most desirable for inducting into a 2LM environment because a short pipeline should theoretically minimize the necessity of buying new assets to sustain the pipeline. Again, this is a recommended starting point for this analysis. Therefore, items with a long pipeline should not be overlooked. It is possible that by transitioning to 2LM that long base repair cycle time could be eliminated thus avoiding or reducing the need for costly additional assets. When inputting pipeline time into the spreadsheet, actual pipeline times should be used. Pipeline standards or goals should only be used when actual pipeline times are unavailable.

2.2.4.6. Asset Position: An indicator of the current D041 requirement and number of carcasses available to meet that requirement. If an asset is already carcass short worldwide, then it might not be a good 2LM candidate because it could require buying additional inventory unless the pipeline is reduced. The worldwide asset position should be studied carefully. It is possible that inducting a component(s) into 2LM could make available assets that are awaiting repairs in the field and, thus, resolve the carcass short situation.

2.2.4.7. Weight and Cube: Current commercial small package express carriers will handle items – assets and their shipping package – weighing up to 150 lbs with maximum dimensions of 119” in length and 165” in length and girth combined. For larger items, evaluate the cost and availability of AMC and other commercial contract carriers to meet 2LM requirements.

2.3. Step 3: Analysis of Cost-to-transition, Impact to Mobility Footprint, and Impact to Operational Capability. In this step, the impact of the decision to transition from a 3-level to 2-level repair process is analyzed in a macro sense to determine the estimated cost to transition, the estimated impact on mobility footprint, and the impact on operational capability. The following describes the assessment managers will complete on those NSNs which they decide to evaluate for 2-level repair after step 2.

2.3.1. Cost to transition. Those components which logistics experts choose to continue evaluating will remain grouped based on their associated common support equipment. Cost savings can be estimated by evaluating the following:

2.3.1.1. Manpower savings at the base level

2.3.1.2. Potential increased manpower costs at the depot level

2.3.1.3. Potential increased transportation costs for 2-level repair

2.3.1.4. Potential changes in inventory requirement

2.3.1.5. Re-computation of the readiness spares package (RSP) for 2LM support

2.3.2. Base manpower computation.

2.3.2.1. Logistics experts will estimate the number of personnel that can be reduced by eliminating a specified test station(s), if their associated NSNs are inducted into 2LM. In order to compile a total estimated manpower reduction, this estimate must consider the number of shops that are affected AF-wide, if the specified test station(s) is eliminated at multiple bases. The potential savings from reduced manpower will be computed by the same methodology as current manpower costs were determined in step 1:

2.3.2.1.1. Manpower savings by grade = (estimated manpower reductions by grade) x (annual cost per grade as outlined in AFI 65-503)

2.3.2.2. Then, these manpower savings must be totaled by grade in order to compute manpower savings by test station (compute for all bases affected to project a MAJCOM or AF-wide savings).

2.3.3. Depot manpower computation.

2.3.3.1. Logistics experts will estimate the additions required at the depot for any anticipated increases in workload associated with transitioning from 3-level repair to 2-level repair. Then, they will compute the increased manpower costs as follows:

2.3.3.1.1. Estimated increased depot costs = (estimated increase in manpower authorizations by grade) x (annual cost per grade as outlined in AFI 65-503).

2.3.4. Transportation cost computation.

2.3.4.1. In order to calculate the estimated increased transportation costs for 2-level repair, the round trip cost of shipping an line replaceable unit (LRU) to its primary source of repair will be multiplied by the estimated number of additional shipments. It is assumed that the estimated additional shipments for 2LM are the number of LRUs that were either determined to be CND, or fixed at the I-level shop during a single year.

2.3.4.1.1. Total increase in transportation costs = [(total # of assets CND in I-level shop) + (total # of assets repaired in I-level shop)] x round-trip shipping costs to the primary source of repair .

2.3.5. Methodology to capture impact on Inventory.

2.3.5.1. This methodology provides a cost impact to inventory requirement based on the changes in the total requirement from the current repair pipeline to a 2-level repair. The methodology is similar to the D041 requirements computation. The cost impact is a one-time cost or savings necessary to size the new pipeline properly. The cost impact is reflected as a range which includes the minimum estimated impact and the maximum estimated impact to cost based on the total 2-level requirement. One time savings could accrue if planned repairs or purchases are no longer required to sustain the pipeline. Conversely, one time costs could be incurred if more repairs or purchases are required to properly size the new 2-level pipeline. In general, minimal savings or costs are generated through repair actions while greater savings or costs are generated by asset acquisitions.

2.3.5.2. The primary factors used in this methodology are depot demand rate (DDR1), not reparable this station (NRTS), base repair time (BRT), order and ship time (O&ST), depot repair time (DRT) and a bench check serviceable (BCS) rate. The variables for O&ST, BRT and DRT would be the programmed times used in D041.

2.3.6. RSP Recomputation.

2.3.6.1. A re-computation of the weapon system RSP may be required as part of the cost analysis, if the current RSP is a remove, repair, and replace kit (RRR). RSP costs may change due to the reduction or elimination of shop replaceable units (SRUs) from the RSP that are typically used in a 3-level repair environment and a possible increase in LRUs for a 2-level repair environment.

2.3.7. Total estimated cost savings.

2.3.7.1. Based on the previous computations just described, the following equation is used to compute the total estimated savings for transitioning from 3-level repair to 2-level repair.

2.3.7.1.1. Total estimated savings = (base manpower savings) - (increased depot manpower costs) - (increased transportation costs) + or - change in inventory requirement + or - change in RSP cost.

2.3.7.2. To evaluate these costs more easily, cost information can be displayed in a table such as the example, Impact Assessment for Step 3, Table 2.1.

Table 2.1. Impact Assessment for Step 3.

Sample Cost Analysis			
(Displays cost savings associated with the elimination of a single test station)			
	3LM	2LM	Other
Base level manpower savings			
Depot manpower increased costs			
Increased transportation costs			
Inventory cost changes (+ or -)			
RSP changes (+ or -)			
Total cost change (+ or -)			
Estimated reduction in 463L pallet positions			
Estimated reduction in mobility positions			
Can aircraft availability goal be met with current worldwide assets? Yes/No			

NOTE: If logistics experts decide to leave a CND capability or any repair capability at the base level, as has been done in recent 2LM situations, then costs and manpower impacts should be adjusted accordingly.

2.3.8. Impact to mobility footprint.

2.3.8.1. In order to determine the impact on the mobility footprint, it is necessary to estimate the number of reduced 463L pallet positions for support equipment and the reduced number of mobility personnel associated with the test station(s) under review. Again, if test stations and affected personnel are at multiple bases/locations, it may be necessary to compute a command or AF total. Also, the impact on the mobility footprint should include any changes (+ or -) to 463L pallet positions as determined by the RSP re-computation.

2.3.9. Impact to operational capability.

2.3.9.1. It is difficult to define an asset's impact on operational capability as it transitions from a 3-level repair process to a 2-level repair process. The difficulty lies in tying a repair level decision and a single reparable to the overall operational impact, as measured by in-commission rate or aircraft availability. However, because this relationship has a direct impact on the planned mission, it should be a part of the overall assessment. To date, we have not identified a simple methodology for capturing either the impact of a repair level decision on the in-commission rate for an equipment item, or aircraft availability rate for the weapon system. However, the MAJCOM DMAS model can provide an assessment of the impact on aircraft availability, based on the estimated 2-level repair pipeline for the asset under review and the worldwide asset position. An assessment would only be required if there is a shortage of assets worldwide. In a shortage situation, an assessment could quantify the impact to aircraft availability. However, if there are sufficient assets on-hand, or resources available to buy the needed assets to support the 2LM requirement, then a DMAS assessment would only serve to tell us what we already knew: no impact to operational capability.

2.3.9.2. MAJCOM DMAS is an automated analysis tool which is used for a number of theater, MAJCOM, or unit-level applications. If the NSNs being evaluated are not already loaded in weapon system management information system sustainability assessment model (WSMIS SAM), some manual inputs will be required to use MAJCOM DMAS for the operational capability assessment WSMIS SAM is the basic database for MAJCOM DMAS RSP assessments. The current MAJCOM DMAS files are squadron specific; however, data and parameters can be changed to mimic a MAJCOM or AF-wide assessment. An experienced analyst should perform the assessment within the MAJCOM DMAS model. Note that MAJCOM DMAS can evaluate only one mission, design, and series system (MDS) at a time. Thus, if the asset under evaluation is used on several MDSs, the analyst will run the model for each MDS and make some interpretations and projections about what the impact will be based on transitioning the asset to 2-level repair.

2.3.9.3. The following table shows how the impacts to cost, mobility footprint and operational capability can be displayed for analysis, including a column(s) for analyzing other repair options that functional managers might choose to pursue, such as contract repair or regional repair:

2.4. Step 4: Subjective Issues.

2.4.1. The front end of this process is primarily qualitative in order to quickly screen candidates and allow logistics experts to focus on strong candidates and savings. However, there are other factors besides qualitative data that will impact the final decision to move an asset into a new repair environment. Thus, it is recommended that the following list of repair environment issues be reviewed prior to making a final repair level decision. These focus on depot concerns, mobility issues, and software uploading requirements for avionics. This checklist should also assist logistics experts in developing a transition plan for those assets selected for 2LM. Subjective issues for consideration**:**

2.4.1.1. Is this asset (s) pending replacement, upgrade, or modification? If yes, consider the implications of transitioning to 2-level repair at this time.

2.4.1.2. When will additional depot manpower, if required, be in place? When will depot technicians be trained to do the repairs and inspections once accomplished at base level?

2.4.1.3. When will depot technicians have access to the I-level repair technical data?

2.4.1.4. When will additional test stations for depot, if required, be in place?

2.4.1.5. When will bit and piece support be adjusted to meet the new repair level requirement?

2.4.1.6. When will additional inventory, if required, be available to support the 2-level pipeline requirement?

2.4.1.7. Are current depot facilities adequate for absorbing the 2-level repair workload or would military construction funds be required to provide appropriate facilities?

2.4.1.8. How will the decision to transition between a 3-level and a 2-level repair process affect test aircraft and special missions?

2.4.1.9. Are there any depot, Base Realignment and Closure (BRAC), or outsourcing/privatization issues that would affect the transition of this item?

2.4.1.10. Are there any force structure changes which would impact the repair level decision on this asset?

2.4.1.11. How will you accomplish Time Compliance Technical Orders (TCTOs) and inspections that were previously done through the I-level repair activity?

2.4.1.12. Will a change in the repair level of this asset still meet the unique mobility requirements of different MAJCOMs? (this review is necessary for assets that are used by multiple MAJCOMs).

2.4.1.13. Can software uploading requirements on this item(s) be accomplished in a

2-level repair process? (Consider manpower, response time, and cost)

2.4.1.14. Are there field level calibrations or alignments required on this asset? If yes, then how will those calibrations and alignments be handled?

2.4.1.15. Are there any special transportation or handling requirements for this asset(s) such as hazardous, classified, outsized, etc? If yes, how will the special requirements be met?

2.4.1.16. Are there any wing retained tasks and support required for contingency taskings?

2.4.2. Managers should now list their recommended 2LM candidates and determine if additional analysis is required prior to making a decision to induct into 2LM. Also, at this point, other repair alternatives could be considered such as regionalization or outsourcing/privatization.

Chapter 3

OVERVIEW OF THE PROCESS: ENGINES

3.1. Step 1: Selecting an Engine(s) for Analysis.

3.1.1. This step provides a sorting technique to identify an engine(s) for analysis and possible transition to 2-level repair. This sorting technique focuses on potential savings associated with manpower and tied to intermediate level repair of engines in the Jet Engine Intermediate Maintenance (JEIM) shops. Sorting by manpower costs requires lead MAJCOM and SPD functional managers to prioritize JEIMs by labor cost from highest to lowest. After reviewing manpower costs, an engine (s) should be selected for analysis. Similar to the sorting technique used for avionics/C-E assets, NSNs repaired in the JEIM should be identified.

3.2. Step 2: Analysis by JEIM.

3.2.1. After selecting a specific engine(s) for analysis, managers will input logistics data for a small number of engine indicators into a matrix for those NSNs repaired in the JEIM. This matrix will allow for further analysis of these NSNs by comparing them against several first tier logistics indicators. The recommended logistics indicators for engines are:

3.2.1.1. Combined Maintenance Removal Rate (CMRI)

3.2.1.2. MTBF

3.2.1.3. PBR

3.2.1.4. Ratio of spares to installed engines

3.2.1.5. DDR (for modules and reparables)

3.2.1.6. Pipeline Time

3.2.1.7. Asset position

3.2.2. The result is a prioritized list of NSNs that can be used as a tool for further analysis or as a means of eliminating an engine(s) from consideration.

3.3. Step 3: Analysis of Cost-to-transition, Impact to Mobility Footprint, and Impact to Operational Capability.

3.3.1. Logistics experts can now evaluate the engine(s) that they decide to pursue as potential 2LM candidates in terms of cost to transition to a different repair level, impact to mobility footprint, and impact to operational capability. The methodology to evaluate these areas is similar to step 3 for avionics/C-E assets. These costs are:

3.3.1.1. Manpower savings at the base level

3.3.1.2. Potential increased manpower costs at the depot level

3.3.1.3. Potential increased transportation costs for 2-level repair

3.3.1.4. Potential changes in inventory requirements

3.3.1.5. Re-computation of the war readiness material (WRM) requirements for 2LM support

3.3.2. The impact to mobility footprint is estimated by totaling the number of 463L pallet positions that can be made available by eliminating JEIM support equipment, if an engine is moved into a 2-level repair environment. Next, the number of mobility personnel that are no longer needed to do I-level repair on those engines should be estimated.

3.3.3. Also, like avionics assets, MAJCOM DMAS can provide an assessment of the impact on aircraft availability, based on the estimated 2LM pipeline time and worldwide asset position. Engines are treated as line replaceable units (LRUs) in the MAJCOM DMAS model.

3.4. Step 4: Subjective Issues.

3.4.1. This step requires functional managers to run a checklist of repair environment factors against the engine(s) still under consideration for 2LM. After reviewing these checklist items for each engine(s), logistics experts can now determine whether the engine(s) is a strong 2LM candidate and can perform more detailed analysis prior to making the final determination to induct into 2-level repair.

Chapter 4

ENGINES

4.1. Step 1: Selecting an Engine(s) for Analysis.

4.1.1. Step 1 assists logistics experts in selecting an engine(s) to analyze for possible transition to 2LM. This sorting technique focuses on potential savings associated with manpower and tied to intermediate level repair of engines in the JEIM shops. Sorting by manpower costs requires lead MAJCOM functional managers to prioritize JEIM shops by manpower cost. This prioritization targets potential savings and focuses on the manpower reductions associated with eliminating the JEIM workload. The following is a recommended approach to prioritizing JEIM shops and identifying the NSNs supported in those shops:

4.1.1.1. Lead command functional managers compile a list of the JEIM shops within their commands. The functional managers should then compute the manpower costs associated with those shops as follows:

4.1.1.1.1. Use the unit manning document (UMD) to identify the manpower authorizations by grade for each JEIM shop.

4.1.1.1.2. Calculate manpower costs for each JEIM. Use the fully burdened cost rate in AFI 65-503.

4.1.1.1.3. Then, add total manpower costs for each grade to determine the total JEIM manpower cost.

4.1.1.2. Manpower cost for a single grade level = (manpower authorizations by grade) x (fully burdened cost as listed as listed in AFI 65-503, Tables A19-1 and 26-1).

4.1.1.3. Develop a consolidated list of manpower costs by JEIM and a list of the NSNs repaired in the JEIM.

4.1.2. At the end of this step, it is recommended that functional managers focus on an engine(s) that has a high manpower cost tied to the JEIM workload for further analysis in steps 2 through 4. It should be understood that the process described here in step 1 is a generic, macro approach to target potential savings. Other methods of sorting can be implemented as more is learned about the performance of engines in 2-level repair.

4.2. Step 2: Analysis by JEIM.

4.2.1. After selecting a specific engine(s) for analysis, managers will input a small number of logistics indicators/data into a matrix for those NSNs repaired in the JEIM. The engine reparables are evaluated against first tier logistics indicators and the desired characteristics of a 2LM asset. Reviewing the first tier logistics data for each NSN will provide some insight into how the asset will perform in a 2LM environment. Managers can use this list as a tool for further analysis (steps 3 through 4) or as a means of eliminating an engine(s) from consideration.

4.2.2. These recommended engine performance indicators are first tier, easily accessible logistics indicators. They give a quick overview of the status of each NSN in relation to reliability and maintainability, supply indicators, and the desired characteristics of a 2LM candidate. Unlike avionics and C-E assets, transportation indicators are not considered because most engine assets are too large to meet the current requirements of express transportation cost rates. By reviewing the logistics indicators for each NSN and comparing them with the desired characteristics of a 2LM asset, the functional managers will have a broad understanding of how a specific NSN or group of NSNs may perform in a 2-level repair environment. Functional managers will have to study the scores and rankings for each NSN and how they compare to the other NSNs supported in the same JEIM to help determine whether an asset (s) will perform well in a 2-level repair environment. It is important to note that these first tier indicators and the desired characteristics of a 2LM asset can be easily changed in the matrix as experience is gained in using this process and more is learned about the performance of engines in a 2-level environment. The indicators and characteristics currently loaded in the matrix are the recommended starting points from this study. The following are the recommended indicators and a description of the desired 2LM characteristics for those indicators.

4.2.3. Logistics indicators for Engines.

4.2.3.1. CMRI: An indicator of how often an engine must be removed from the aircraft. A low removal rate would be preferred for 2LM because a high removal would reflect a significant demand on supply and repair activities, and increased transportation costs to return the engine to depot level repair. CMRI would be used as an indicator of the number of complete engine removals for that engine.

4.2.3.2. MTBF: This metric would be input for engine reparables including engine modules. It is an indicator of the time between actual failures of a given module. A high MTBF would be the desired 2LM characteristic because it indicates a highly reliable asset which would not significantly increase transportation costs or depot workload.

4.2.3.3. PBR: Indicates the amount of repair being accomplished at base level. A low percent base repair indicates that most of the workload is accomplished at depot (or contractor) level. Thus, there is the opportunity to consolidate the workload and optimize the depot repair capability. However, assets with a high PBR should be reviewed to determine if there is a high manpower cost associated with that high base repair level. If so, managers may elect to target consider these candidates in the evaluation also.

4.2.3.4. Ratio of spares to installed engines: this ratio is an indicator of the current support posture for engines. A high ratio is preferred. A high ratio reflects a larger number of spares available proportional to the number of installed engines. This assists in limiting the possibility of holes in the aircraft. Depending on the bases/locations affected, this ratio should be computed command wide or AF-wide as appropriate depending on the bases/locations affected.

4.2.3.5. DDR: An indicator of the volume of these assets ordered on a daily basis. This indicator is suggested for analysis of engine modules or those NSNs repaired in a JEIM. A low DDR would be most desirable in a 2LM environment because it indicates less demands on the supply and repair systems and would minimize transportation requirements and costs. While a low DDR is a recommended starting point for this analysis, it is recognized that the repair cycle is complex and dynamic and other analysis might offer additional trade-offs. For example, a high demand rate might reflect a low reliability asset that requires more base repair activity, thus driving a large manpower requirement. Hence, analysts might want to study the potential for reducing the manpower requirement by moving the asset(s) into 2LM.

4.2.3.6. Pipeline Time: An indicator of the current pipeline to include transportation time to and from the primary source of repair, handling time, and the base and depot repair times. An asset with a short pipeline would be the most desirable for inducting into a 2LM environment because a short pipeline should theoretically minimize the buy of new assets to sustain the pipeline. Again, this is a recommended starting point for this analysis. Items with a long pipeline should not be overlooked. It is possible that by transitioning to 2LM that long base repair cycle time could be eliminated thus avoiding or reducing the need for costly additional assets. When inputting pipeline time into the spreadsheet, actual pipeline times should be used. Pipeline standards or goals should only be used when actual pipeline times are unavailable.

4.2.3.7. Asset Position: An indicator of the current D042, Comprehensive Engine Management System (CEMS), requirement and number of carcasses available to meet that requirement. If an asset is already carcass short worldwide, then it might not be a good 2LM candidate because, unless the pipeline is reduced, it could require buying additional inventory. The worldwide asset position should be studied carefully via CEMS asset reports. It is possible that inducting an asset(s) into 2LM could make available assets that are awaiting repairs in the field and, thus, resolve the carcass short situation.

4.3. Step 3: Analysis of Cost-to-transition, Impact to Mobility Footprint, and Impact to Operational Capability. In this step, the impact of the decision to transition an engine from a 3-level to 2-level repair process is analyzed to determine the estimated cost to transition, the estimated impact to mobility footprint, and the impact on operational capability. The following describes the assessment functional managers will complete on those engines which they decide to evaluate for 2-level repair after step 2.

4.3.1. Cost to transition.

4.3.1.1. The cost to transition is estimated by evaluating the following:

4.3.1.1.1. Manpower savings at the base level

4.3.1.1.2. Potential increased manpower costs at the depot level

4.3.1.1.3. Potential increased transportation costs for 2- level repair

4.3.1.1.4. Potential changes in inventory requirements

4.3.1.1.5. Re-computation of the WRM requirement

4.3.2. Base manpower computation.

4.3.2.1. Logistics experts will make an estimate of the number of personnel that can be reduced by eliminating a specified JEIM, if an engine is inducted into 2LM. If the specified JEIM is eliminated at multiple bases, this estimate must consider the number of JEIM's affected AF-wide to compile a total estimated manpower reduction. The potential savings from reduced manpower will also be computed by the same methodology as current manpower costs were determined in step 1:

4.3.2.2. Manpower savings by grade = (estimated manpower reductions by grade) x (annual cost per grade as outlined in AFI 65-503)

4.3.3. Depot manpower computation.

4.3.3.1. Logistics experts will estimate the additions required, if any, at the depot for anticipated workload increases associated with transitioning from 3-level repair to 2-level repair. This manpower cost increase will be computed as follows:

4.3.3.2. Estimated increased depot costs = (estimated increase in manpower authorizations by grade) x (annual cost per grade as outlined in AFI 65-503).

4.3.4. Transportation cost computation.

4.3.4.1. In calculating the estimated increased transportation costs for 2- level repair, the round trip cost of shipping an engine and its base level reparables to its primary source of repair is multiplied by the estimated number of additional shipments. The estimated additional shipments for 2LM are assumed to be the number of engines removed and the number of reparables (modules) that were either determined to be CND or repaired in the JEIM shop during a single year.

4.3.4.2. Total increase in transportation costs = [(total # of assets CND in JEIM) + (total # of assets repaired in JEIM)] x round-trip shipping costs to the primary source of repair.

4.3.5. Methodology to capture impact on Inventory.

4.3.5.1. The Propulsion Requirements System (PRS), a model available to the SPD, can be used to make projections about inventory requirements if an engine(s) is moved to 2LM. If the inventory projection indicates additional engines would be needed to support a 2-level repair pipeline, then include the cost of return to service from storage and/or cost to reopen an engine repair line/ facility in the cost-to-transition. Also, the same methodology that was recommended to determine potential changes to the inventory levels for avionics/C-E assets can be used and is described below.

4.3.5.2. This methodology provides a cost impact to inventory requirement based on the changes in the total requirement from the current repair pipeline to a 2-level repair. The methodology is similar to the D041 requirements computation. The cost impact is a one-time cost or savings necessary to size the new pipeline properly. The cost impact is reflected as a range which includes the minimum estimated impact and the maximum estimated impact to cost based on the total 2-level requirement. One time savings could accrue if planned repairs or purchases are no longer required to sustain the pipeline. Conversely, one time costs could be incurred if more repairs or purchases are required to properly size the new 2-level pipeline. In general, minimal savings or costs are generated through repair actions while greater savings or costs generated by asset acquisitions.

4.3.5.3. The primary factors used in this methodology are DDR1, NRTS, BRT, O&ST, DRT and a BCS rate. The variables for O&ST, BRT and DRT would be the programmed times used in D041.

4.3.6. WRM Re-computation.

4.3.6.1. A re-computation of the WRM requirements will also be done as part of the cost analysis and considered in the total cost to transition.

4.3.7. Total estimated cost savings.

4.3.7.1. Based on the previous computations just described, the total estimated savings for transitioning from 3-level repair to 2-level repair is computed as follows:

4.3.7.1.1. Total estimated savings = (base manpower savings) - (increased depot manpower costs) - (increased transportation costs) + or - change in inventory requirement + or - change in WRM cost.

4.3.7.2. To more easily evaluate these costs, cost information can be displayed in a table such as the example, “Sample Cost Analysis for Test Stations,” Table 4.1.

4.3.8. Impact to mobility footprint.

4.3.8.1. To determine the impact to mobility footprint, estimate the number of reduced 463L pallet positions for support equipment and mobility personnel associated with the JEIM shops evaluated in this process. Again, a command total must be computed if more than one JEIM location will be affected. Also the impact on the mobility footprint should include any changes (+ or -) to 436L pallet positions as determined by the WRM re-computation. Finally, based on engine failure rates, consider the impact to the transportation for replacement engines based on war plan requirements.

4.3.9. Impact to operational capability:

4.3.9.1. It is difficult to define an asset’s impact on operational capability as it transitions from a 3-level repair process to a 2-level repair process. The difficulty lies in tying a repair level decision and a single reparable to the overall operational impact, as measured by in-commission rate or aircraft availability. However, because this relationship has a direct impact on the planned mission, it should be a part of the overall assessment.

Table 4.1. Sample Cost Analysis for Test Stations.

(Displays cost savings associated with the elimination of a single test station)			
	3LM	2LM	Other
Base level manpower savings			
Depot manpower increased costs			
Increased transportation costs			
Inventory cost changes (+ or -)			
WRM changes (+ or -)			
Total cost change (+ or -)			
Estimated reduction in 463L pallet positions			
Estimated reduction in mobility positions			
Can aircraft availability goal be met with current worldwide assets? Yes/No			

NOTE: If logistics experts decide to leave any repair capability at the base level, as has been done in recent 2LM situations, then costs and manpower impacts should be adjusted accordingly.

4.3.9.2. To date, we have not identified a simple methodology for capturing either the impact of a repair level decision on the in-commission rate for an equipment item, or aircraft availability rate for the weapon system. However, the MAJCOM DMAS model can provide an assessment of the impact on aircraft availability, based on the estimated 2-level repair pipeline for the asset under review and the worldwide asset position. An assessment would only be required if there is a shortage of assets worldwide as determined by using the PRS. In a shortage situation, an assessment could quantify the impact to aircraft availability. If there are sufficient assets on-hand, or resources available to buy the needed assets to support the 2LM requirement, then a DMAS assessment would only serve to tell us what we already knew: no impact to operational capability.

4.3.9.3. MAJCOM DMAS is an automated analysis tool which is used for a number of theater, MAJCOM, or unit-level applications. If the NSNs being evaluated are not already loaded in WSMIS SAM, some manual inputs may be required to use MAJCOM DMAS for the operational capability assessment. WSMIS SAM is the basic database for MAJCOM DMAS RSP assessments. The current MAJCOM DMAS files are squadron specific; however, data and parameters can be changed to mimic a MAJCOM or AF-wide assessment. An experienced analyst should perform the assessment within the MAJCOM DMAS model. Note that MAJCOM DMAS can evaluate only one MDS at a time. Thus, if the asset under evaluation is used on several MDSs, the analyst will run the model for each MDS and make some interpretations and projections about what the impact will be based on transitioning the asset to 2-level repair.

4.4. Step 4: Subjective Issues.

4.4.1. The front end of this process is primarily qualitative in order to quickly screen candidates and allow logistics experts to focus on strong candidates and savings. However, there are other factors besides qualitative data that will strongly impact the final decision to move an asset into a new repair environment. Thus, it is recommended that the following list of repair environment issues be reviewed prior to making a final repair level decision. These focus on depot concerns, mobility issues, and software uploading requirements for avionics. This checklist should also assist logistics experts in developing a transition plan for those assets selected for 2LM.

4.5. Subjective issues for consideration.

4.5.1. When will additional depot manpower, if required, be in place? When will depot technicians be trained to do the repairs and inspections once accomplished at base level?

4.5.2. When will the depot technicians have access to the I-level repair technical data?

4.5.3. When will additional test stations for depot, if required, be in place?

4.5.4. When will bit and piece support be adjusted to meet the new repair level

requirement?

4.5.5. When will SRUs required for 2-level repair be redistributed to the appropriate repair centers?

4.5.6. When will additional inventory, if required, be available to support the 2-level pipeline requirement?

4.5.7. Are current depot facilities adequate for absorbing the 2-level repair workload or would military construction funds be required to provide appropriate facilities?

4.5.8. How will the decision to transition between a 3-level and a 2-level repair process affect test aircraft and special operations missions?

4.5.9. Are there any depot, BRAC or outsourcing/ privatization issues that would affect the transition of this item?

4.5.10. Are there any force structure changes which would impact the repair level decision on this asset?

4.5.11. How will TCTOs and inspections that were previously done through the I-level repair activity be accomplished?

4.5.12. Will a change in the repair level of this asset still meet the unique mobility requirements of different MAJCOMs? (this review is necessary for assets that are used by multiple MAJCOMs)

4.5.13. Are there field level calibrations or alignments required on this asset? If yes, then how will those calibrations and alignments be handled?

4.5.14. Are there any wing retained tasks and support required for contingency taskings?

4.5.15. Will the depot have the required test cell capacity to handle this additional workload?

4.5.16. At this point, managers should list their recommended 2LM candidates and determine if additional analysis is required prior to making a decision to induct the candidates into 2LM. Also, at this point, other repair alternatives could be considered such as regionalization or outsourcing/privatization.

WILLIAM P. HALLIN, Lt General, USAF
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Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

Abbreviations and Acronyms

2LM—Two Level Maintenance

3LM—Three-Level Maintenance

A/C—Aircraft

ACC—Air Combat Command

AETC—Air Education and Training Command

AF—Air Force

AFB—Air Force Base

AFLMA—Air Force Logistics Management Agency

AFMC—Air Force Materiel Command

API—Aircraft Parts Indenture

BCS—Bench-Checked-Serviceable

BRAC—Base Realignment and Closure

BRT—Base Repair Time

CAMS—Core Automated Maintenance System

CANN—Cannibalization rate

CEMS—Comprehensive Engine Management System

C-E—Communications- Electronics

CMRI—Combined Maintenance Removal Interval

CND—Cannot Duplicate

DDR—Daily Demand Rate

DDR1—Depot Demand Rate

D041—Recoverable Consumption Item Requirements System

ERRC XD—Expendability, Recoverability, Retainability Code. ERRC XD means the recoverable asset can only be identified for condemnation by the depot repair activity

FAC—Forecasted Acquisition Cost

HQ USAF/ILMM—Headquarters, United States Air Force, Logistics Maintenance Management Division

I-Shop (I-level)—Intermediate Level Repair Shop

JEIM—Jet Engine Intermediate Maintenance

LCOM—Logistics Composite Model

LRU—Line Replacement Unit

MAJCOM—Major Command

MAJCOM DMAS—Major Command Dyna-METRIC Microcomputer Analysis System

MDS—Mission, Design, and Series

MICAP—Mission Capable Part Missing From Aircraft

MTBF—Mean Time Between Failure

MTBMA—Mean Time Between Maintenance Actions

MTBR—Mean Time Between Removal

MTTR—Mean Time To Repair

NMCM—Not Mission Capable Maintenance

NMCS—Not Mission Capable Supply

NRTS—Not Reparable This Station

NSN—National Stock Number

O&ST—Order and Ship Time

PBR—Percent Base Repair

PCS—Permanent Change of Station

PRS—Propulsion Requirements System

QPA—Quantity Per Aircraft

R&M—Reliability & Maintainability

REALM—Requirements Execution Availability Logistics Module

REMIS—Reliability and Maintainability Information System

RIPDAT—Repairable/Serviceable Item Pipeline Data Analyst Tool

RRR—Remove, Repair, Replace

RSP—Readiness Spares Package

RTOK—Retest Okay

SPD—System Program Director

SPM—System Program Manager

SRU—Shop Replacement Unit

TAV—Total Asset Visibility

T-CAP—Two-level Maintenance Coordination and Activation Process

TCTO—Time Compliance Technical Order

TICARRS—Tactical Interim CAMS and REMIS Reporting System

TNMCM—Total Not Mission Capable Maintenance

TNMCS—Total Not Mission Capable Supply

UMD—Unit Manning Document

USAF—United States Air Force

WRE—War Readiness Engine

WRM—War Reserve Materiel

WSMIS SAM—Weapon System Management Information System / Sustainability Assessment Model