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Cost Benefit Analysis of Options to Manage E-2C Hawkeye Aircraft Technical Data

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**NAVAL
POSTGRADUATE
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MONTEREY, CALIFORNIA

EMBA PROJECT REPORT

**Cost Benefit Analysis of Options to
Manage E-2C Hawkeye Aircraft
Technical Data**

**Presented To:
CAPT Shane Gahagan, Program Manager, PMA231**

September 2011

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COST BENEFIT ANALYSIS OF OPTIONS TO MANAGE

E-2C HAWKEYE AIRCRAFT TECHNICAL DATA

Executive Summary

Program Management Aircraft Office 231 (PMA231) is tasked with providing "cradle to grave" acquisition support to the U.S. Navy's fleet of E-2C Hawkeye airborne early warning aircraft. A major portion of this support centers on providing and updating integrated logistics support (ILS) elements, which include technical data. Effective and efficient management of aircraft technical data ensures that the Navy's aviation maintenance personnel have the most accurate, up to date technical manuals available.

Availability of these manuals forms a critical link in providing safe, full mission capable (FMC) aircraft ready for immediate tasking as well as the safety of the maintenance personnel. Source data for both E-2C and C-2A technical manuals is generated by In-Service Support Center at Naval Air Station North Island (ISSC NI). This source data is then incorporated into the manuals and published for use. Incorporation of this validated source data forms the bulk the technical data management process.

Northrop Grumman Corporation (NGC), Bethpage New York, currently manages E-2C technical publications; however, prior to

2007, many of these publications were maintained at ISSC NI. ISSC NI currently manages the C-2A technical publications.

Given the vital nature of these technical publications, CAPT Gahagan, Program Manager PMA231, has tasked Pax River Consulting (PRC) to provide the program office with a cost benefit analysis based on two options:

- Option 1: Retain E-2C technical publications management with Northrop Grumman Corporation.
- Option 2: Transfer E-2C technical publication management to the E-2C/C-2A ISSC at NAS North Island, CA.

PRC obtained data from both ISSC NI and NGC and evaluated the data on three key areas: quality, cost, and schedule. Based on these criteria, there was found to be no quality advantage between NGC and ISSC; however, there was a clear advantage in favor of ISSC NI in both the cost and schedule areas.

Based on this data analysis, PRC recommends that PMA231 transfer the management of the E-2C technical manuals to ISSC North Island.

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I. INTRODUCTION AND BACKGROUND

A. INTRODUCTION

As a member of Naval Air Systems Command (NAVAIR) and ultimately the Naval Aviation Enterprise (NAE), Program Management Aircraft Office 231 (PMA231) is responsible for "cradle to grave" acquisition support of the U.S. Navy's E-2C Hawkeye, E-2D Advanced Hawkeye, and C-2A Greyhound Carrier On-board Delivery (COD) aircraft. Successful sustainment of these aircraft centers on providing and updating integrated logistics support (ILS) elements. At the forefront of these ILS elements is technical data. Effective and efficient management of aircraft technical data ensures that the Navy's aviation maintenance personnel have the most accurate and up to date technical manuals available. Availability of these manuals, in turn, forms a critical link in keeping maintainers safe as well as providing safe and fully mission capable aircraft ready for tasking.

B. BACKGROUND

The E-2C Hawkeye is a twin-engine, all-weather, carrier based aircraft with a crew of five (two pilots, three weapon system operators) whose mission is to provide airborne early

warning and command and control to the Carrier Strike Group of Joint Force Commander. Typical missions include Air Warfare (AW), Strike Control (STK), Surface Search and Control (SSC), Combat Search and Rescue (CSAR), and most recently, Airborne Battlefield Command and Control (ABC2) in support of ground forces in both Afghanistan and Iraq.

The E-2D Advanced Hawkeye (AHE) is a replacement for the E-2C. It features a new glass cockpit with integrated Tactical Fourth Operator (T4O) panel at the co-pilots seat. Improved avionics and communications employing the APY-9 RADAR and ARC-210 radios respectively, along with improved weapons system displays and crew interfaces make the AHE more flexible in its ability to meet the requirements of the dynamic battle space.

The C-2A Greyhound is based on the E-2 airframe and shares many similar and common components. The Greyhound is a twin-engine cargo aircraft whose mission is to deliver its payload (up to 10,000 pounds) to the aircraft carrier while at sea. The interior arrangement can be rapidly configured for passengers, litters, or cargo. The cargo cage and deck mounted restraints protect the crew during catapult launches and arrested landings. The rear of the aircraft consists of a large cargo ramp designed to facilitate the rapid loading and unloading while also providing an airdrop capability.

Both the E-2C and the C-2A, now out of production, were designed and produced by Northrop Grumman Corporation (NGC). Additionally, the E-2D, now in low rate initial production (LRIP) was designed and is being produced by NGC. Fleet replacement of the E-2C is scheduled to be complete in fiscal year 2020 (FY2020).

The Navy's Center of Excellence for engineering and technical support for both E-2C and C-2A is the In-Service Support Center at Naval Air Station (NAS) North Island (ISSC NI). ISSC NI is currently responsible for management of all C-2A Greyhound technical data.

ISSC NI also develops source data and distributes technical publication deficiency reports (TPDR) for E-2C; however, NGC is the current manager of E-2C Hawkeye technical data. Source data for both E-2C and C-2A technical manuals is generated by ISSC NI. This source data is then incorporated into the manuals and published for use. Incorporation of this validated source data forms the bulk the technical manual management process.

C. PROJECT OBJECTIVES

PRC performed a cost/benefit analysis of two options for management and update of E-2C Hawkeye aircraft technical data to

include aircraft organizational, intermediate, and depot level technical manuals.

Option 1 was to retain publication management at Northrop Grumman Corporation, Bethpage, NY. NGC is the original equipment manufacturer (OEM) for the E-2C. Although the E-2C is no longer in production, NGC is currently producing the E-2D which is replacing the C model. The E-2D shares some components and systems with the legacy E-2C aircraft.

Option 2 was to move management of E-2C technical data to the E-2C/C-2A In-Service Support Center at Naval Air Station North Island, CA (ISSC NI). ISSC NI is an organic NAVAIR activity and currently manages C-2A Greyhound aircraft technical data. The ISSC also provides engineering and logistics support as well as technical recommendations to PMA231.

Research questions answered in order to provide this analysis:

1. What is the total current cost for NGC to manage E-2C aircraft technical data?
2. What is the benefit of NGC management of this data?
3. What are the estimated costs of ISSC to manage E-2C technical data?

4. What are the potential benefits of ISSC managing this data?

D. PROJECT SCOPE

The intent of this project was to provide CAPT Gahagan and PMA231 with a cost/benefit analysis for the management of E-2C aircraft technical data. Management options other than NGC or ISSC were not considered. PRC did not address any implementation requirements for either option. Additionally, options considered in this report have limited applicability outside of PMA231, so methodology and metrics will have to be altered for other program offices with similar questions.

E. METHODOLOGY

Data collection and analysis focused on comparing NGC and ISSC management of technical manuals in three principal areas: quality, cost, and schedule. As part of the data collection process, the PRC held separate face to face two day meetings with both NGC and the ISSC.

A. Quality

Information in Technical Publication Deficiency Reports (TPDR) was used as a key measure of quality. TPDRs are submitted by Fleet maintainers and provide a "simplified procedure for reporting safety hazards and routine deficiencies"

found in publications. As indicated in Appendix A, these deficiencies are categorized 1 through 4 based on severity. PRC queried records stored in the Naval Air Technical Data & Engineering Service Command (NATEC) Technical Manual Application System (TMAPS) for E-2C and C-2A related data. To compare relative quality, PRC analyzed over 5800 historical TPDRs for NGC and ISSC NI managed Technical Manuals.

B. Cost

Management of technical manuals is administered primarily through two processes: Engineering Change Proposals (ECP) and execution of annual Technical Publication Plans.

- Engineering Change Proposals (ECP) - ECPs provide a means for planned material improvements to naval aircraft. Updates to technical manuals driven by ECPs are generally priced separately from other efforts and include a count of pages affected. Historical pricing data and page count data for E-2C and C-2A was used to develop an aggregate "ECP price per page updated" metric for both NGC and ISSC.
- Technical Publications Plan (Pubs Plan) - Routine updates to technical manuals are executed through this plan. Data on pages updated each year and funding expended to update those pages was analyzed and used to develop an aggregate "publications plan price per page updated" metric for both NGC and ISSC.

C. Schedule

To analyze cycle times for updates to technical manuals, the following process flow charts were developed:

- Appendix B - E-2C ECP update process contracted with NGC
- Appendix C - C-2A ECP update process performed by ISSC
- Appendix D - E-2C/C-2A TPDR updates

Process flows were then validated and refined through meetings with NGC and ISSC, as well as through review of historical periods of performance.

II. RESULTS

A. QUALITY ANALYSIS RESULTS

Quality Analysis Result in Summary

- Figure 1 below summarizes results from quality analysis.

Figure 1

| | | |
|--------------------------------------|---|--|
| Data Availability - Medium | Analysis Reliability - Medium | Analysis Impact to Recommendations - Low |
|--------------------------------------|---|--|

- No measurable quality advantage is observed.
- Data Availability - Availability of definitive quality metrics useful for comparative analysis is considered marginal.
- Analysis Reliability is rated medium due to limitations of data in the available data set.
- Impact of quality on recommendations: based on available quality data PRC finds no comparative advantage for either management option.

Quality Analysis Results in Detail

Although Technical Publication Deficiency Report (TPDR) historical data is readily available via the NATEC TMAPS system, the PRC team analysis revealed that this data provides only a relative measure of quality. Based on major differences in Type/Model/Series (TMS) makeup (aircraft quantity, numbers of squadrons, systems complexity, etc.), direct platform to platform comparison of raw TPDR numbers was ruled out in favor of analyzing historical trends in TPDR category submission (see data shown in Appendix E for E-2C and Appendix F for C-2A).

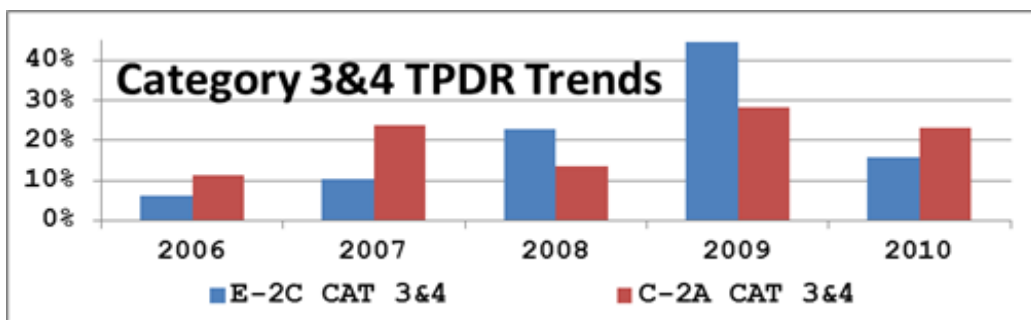
A review of Appendix A and analysis of TPDRs listed in Appendix G shows Category 1 and 2 TPDRs are almost without exception generated to document deficiencies in technical content of manuals. Because all technical content for E-2C and C-2A manuals is developed and generated by engineers at ISSC North Island, Category 1 and 2 TPDRs are not considered relevant to this analysis. As an aside, PRC did note positive trends in technical manual source data quality across the E-2C and C-2A platforms (see appendix G).

Category 3 and 4 TPDRs as described in Appendix A, by nature document technical manual deficiencies relating to

administrative rather than technical content. PRC considers trend analysis of this data to be a reasonable measure of quality. Appendix H provides a comparative trend analysis of Category 3 TPDRs and Appendix I documents Category 4 TPDR Trends.

While analysis shows unfavorable trends in these types of TPDRs, the comparative analysis shows these trends to be similar between E-2C and C-2A, particularly in Category 3 deficiencies. Figure 2 shows trends in average Category 3 and Category 4 rates for each aircraft by year; while trends for both platforms are not favorable, no comparative advantage for either management option was observed.

Figure 2



B. COST ANALYSIS RESULTS

Cost Analysis Results in Summary

- Figure 3 below summarizes the cost analysis results.

Figure 3

| | | |
|-----------------------------------|---|---|
| Data Availability - Low | Analysis Reliability - Medium | Analysis Impact to Recommendations - Medium |
|-----------------------------------|---|---|

- Cost advantage goes to ISSC NI.
- Data Availability for cost is rated as poor due to lack of historical record availability and quality.
- Analysis reliability is rated medium: historical data, while incomplete, includes sufficient data for a comparative analysis.
- Impact of cost on our recommendations is rated medium. Based on available cost data, PRC finds significant price differences between the two management options under consideration.

Cost Analysis Results in Detail

Aircraft Procurement Navy (APN-5) retrofit funding

APN-5 funding is the principal funding source through which Engineering Change Proposal (ECP) technical manual updates are funded. APN-5 funding levels vary from year to year based on aircraft modification requirements. PRC therefore sought to utilize an aggregate price per page to measure and compare costs among E-2C update efforts managed by NGC and C-2A efforts completed by ISSC NI.

ISSC NI charges a flat per page rate of \$125 regardless of number of pages or type of page being incorporated. Conversely, as shown in Appendix J, NGC separately prices and contracts ECP update efforts based on size and relative complexity of pages being updated. Figure 2 notes a difference of nearly \$150 in average cost per page. PRC also notes data suggesting NGC ECP update prices to be inversely proportional to number of pages being updated. PRC attributes this phenomenon in large part to the requirement for discrete contracting efforts for each ECP update. This trend is detailed in Appendix K.

Program Related Logistics Funding (PRL)

Execution of both the E-2C and C-2A technical Publications Plan (Pubs Plan) are funded through the PRL Operations and Maintenance Navy (O&MN) account. As with APN-5, PRL funding levels also vary, albeit in a more predictable way. Appendix L details PRL technical manual updates trends in terms of funding levels and work completed.

Figure 4 summarized difference in prices "per page updated" for both APN-5 and PRL funded updates. NGC has shown a cost per page advantage of \$50 over the three year period from 2008 to 2010. PRC notes that ISSC NI PRL calculations are based on two full work years of effort dedicated to the administration of the C-2A pubs plan. While it is likely this estimate is high, NGC offers a price advantage in execution of PRL funded technical manual update. While NGC is lower on PRL costs, its significantly higher APN-5 costs clearly make NGC the higher price management option.

Figure 4
Aggregate Cost Per Update Page Comparison

| Manager | Aircraft | APN-5 Cost Per Page | PRL Cost Per Page |
|----------------|-----------------|----------------------------|--------------------------|
| NGC | E-2C | \$372.24 | \$75.90 |
| ISSC NI | C-2A | \$125.00 | \$125.58 |

C. SCHEDULE ANALYSIS RESULTS

Schedule Analysis Results in Summary

- Figure 5 below summarizes the schedule analysis results.

Figure 5

| | | |
|---|--|--|
| Data Availability - High | Analysis Reliability - High | Analysis Impact to Recommendations - High |
|---|--|--|

- Schedule advantage goes to ISSC NI.
- Schedule data availability is rated as high due to delivery schedule data and process mapping techniques.
- Analysis reliability is rated high because historical data balanced with process flows is mutually reinforcing.
- Impact of schedule on recommendations is high because schedule provides the strongest differentiator between management of technical manuals at NGC and ISSC NI.

Schedule Analysis Results in Detail

Development and validation of the following process flow charts demonstrates typical cycle times for the update of technical manuals:

- Appendix B - E-2C ECP update process contracted with NGC
- Appendix C - C-2A ECP update process performed by ISSC NI
- Appendix D - E-2C/C-2A TPDR updates

While E-2C manual updates resulting from ECPs are normally contracted with NGC as separate stand-alone contractual efforts, E-2C manual updates resulting from TPDRs and other unplanned requirements are executed through a NAVAIR engineering and logistics sustainment contract with NGC. With this contract in place, process flow and typical cycle times of TPDRs as shown in Appendix D are similar for both E-2C and C-2A TPDRs.

The E-2C sustainment contract with NGC expired September 2010. The lapse in contract coverage with NGC has prevented execution of the FY11 E-2C pubs plan. During this nearly one year gap in coverage, high priority E-2C technical manual

management functions, such as category 1 E-2C TPDR disposition, has shifted to ISSC NI. However, the backlog non-safety related E-2C Technical Manual Source Data Records (TMSDR) continues to build. A replacement contract is currently in negotiation; however, as of August 2011 it has not yet been awarded.

Contracting issues aside, analysis of the TPDR disposition process reveals that generation of source data is the principal driver of cycle time for all TPDRs. As both E-2C and C-2A source data are developed and validated by engineers at ISSC North Island, metrics regarding TPDR cycle time are not considered relevant to this analysis.

There is however, a significant schedule difference in terms of technical manual update delivery times related to Engineering Change Proposals (ECP). Key cycle times in the ECP technical manual process include: 1) Technical manual Rough Order of Magnitude (Pub ROM) initiation through final Manual (or Pub) delivery and upload to NATEC website, and 2) the alignment of Technical Directive (TD) release to final Manual (or Pub) delivery and upload to NATEC website. Figure 6 shows typical differences in these times.

Figure 6

Key ECP Update Typical Cycle Times

| Manager | Aircraft | ROM to final Manual Delivery | TD Release Manual Delivery |
|----------------|-----------------|---|---------------------------------------|
| NGC | E-2C | 24 months | 7 Months |
| ISSC | C-2A | 17 Months | <1 Month |

It should be noted that while PRC utilized a six month contractual Period Of Performance (POP) for its E-2C ECP update process model (Appendix B), actual proposed and contractual POPs typically vary from six to twelve months based on number of pages requiring update, as per Appendix J. Additionally, PRC considers NAVAIR cycle time estimates for current contractual requirements such as the ROM process and contract award to be a best case scenario.

D. OTHER CONSIDERATIONS

Switching costs

- **Nonrecurring** - The potential nonrecurring costs in transferring management from NGC to ISSC NI were considered as part of the estimated total costs for ISSC management of E-2C technical manuals. In 2007, a PMA decision to transfer management of certain E-2C Intermediate and Depot level manuals from ISSC NI to NGC was made. The transition plan for that efforts mirrors requirements of this analysis. No switching costs were identified in this plan.
- **Recurring Costs** - If moved to ISSC NI, increased technical manual management functions will require the addition of 1.5 work years, or \$337,335 at FY2012 labor rates. These additional recurring costs will be offset by a reduction to NGC sustainment contract technical manual funding requirements. As shown in Appendix L, these costs have averaged \$328,333.

Leveraging E-2D Development

The stated purpose of a 2007 transfer of technical manuals to NGC was to "...leverage off the efforts of the production of the E-2D Advanced Hawkeye development". PRC did not observe this phenomenon. Electronic Interactive Technical Manuals (IETM) are currently in development for E-2D. E-2D manuals are managed using the S1000D standard while E-2C manuals are created using Interleaf software.

In 2009 Akimeka Technologies LLC completed a conversion of E-2C technical manuals to S1000D format. This conversion was funded via Congressional Add at a cost of \$1.2M and subsequently used as a baseline for E-2D IETMs. The E-2C S1000D formatted manuals were never introduced to the Fleet maintainers for use and have not received required updates since initial conversion. It is the opinion of NGC that a completely new S1000D conversion of E-2C manuals is required prior to a future Fleet introduction. Additionally, content of E-2C and E-2D manuals has diverged to a point where 13% of content is shared. This percentage is significantly lower than initial estimates.

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III. RECOMMENDATIONS AND CONCLUSION

A. RECOMMENDATIONS

Summary:

1. Move management of E-2C technical manuals to ISSC NI.
2. Create process improvements for contracting ECP driven technical manual updates with NGC.
3. Implement process improvements for: quality metrics, data archival and storage, and technical manual cost tracking at ISSC

Detailed Information about Each Recommendation:

1. **Primary recommendation** - Move management of E-2C technical manuals to ISSC NI.

Management of technical manuals by ISSC NI will provide lower costs and faster turnaround times without a measurable difference in quality of service or manuals. While costs to execute the annual publication plan would remain flat, aggregate cost reductions of \$150 per page for ECP driven technical manual updates will equate to more than a 66% savings per effort.

Biggest gains would be made in terms of turnaround times. The ability of an organic Navy activity, such as ISSC NI, to operate without the constraints of the formal contracting process, allow for faster response times under current processes.

2. Alternate recommendation - Develop process improvements to the contracting of ECP driven technical manual updates with NGC.

It is PRC's belief that improving processes in terms of contracting would provide both reductions in lead times and reductions in aggregate costs for ECP driven technical manual updates. While these improvements could make NGC competitive in terms of cost and schedule, additional research would be required to identify the scope of these savings.

3. Additional recommendations - for future research

- a. Implement improved comparative metrics for the quality of technical manual management processes. As noted, no measures of manual quality are currently available. The ability to measure quality across organic activities and private industry drive down prices and increase manual quality through the use of open competition.

- b. Institute within PMA and Contracts formalized processes for storage and archival of contract and other important data. A formalize process for electronic archival and retrieval of program contractual data would provide a dynamic tool for future analysis.

- c. Improve technical manual cost tracking processes at ISSC North Island. Current processes and data archival methods at the ISSC make for difficult and labor intensive tracking of many relevant metrics such as cost structure and page breakout by funding type.

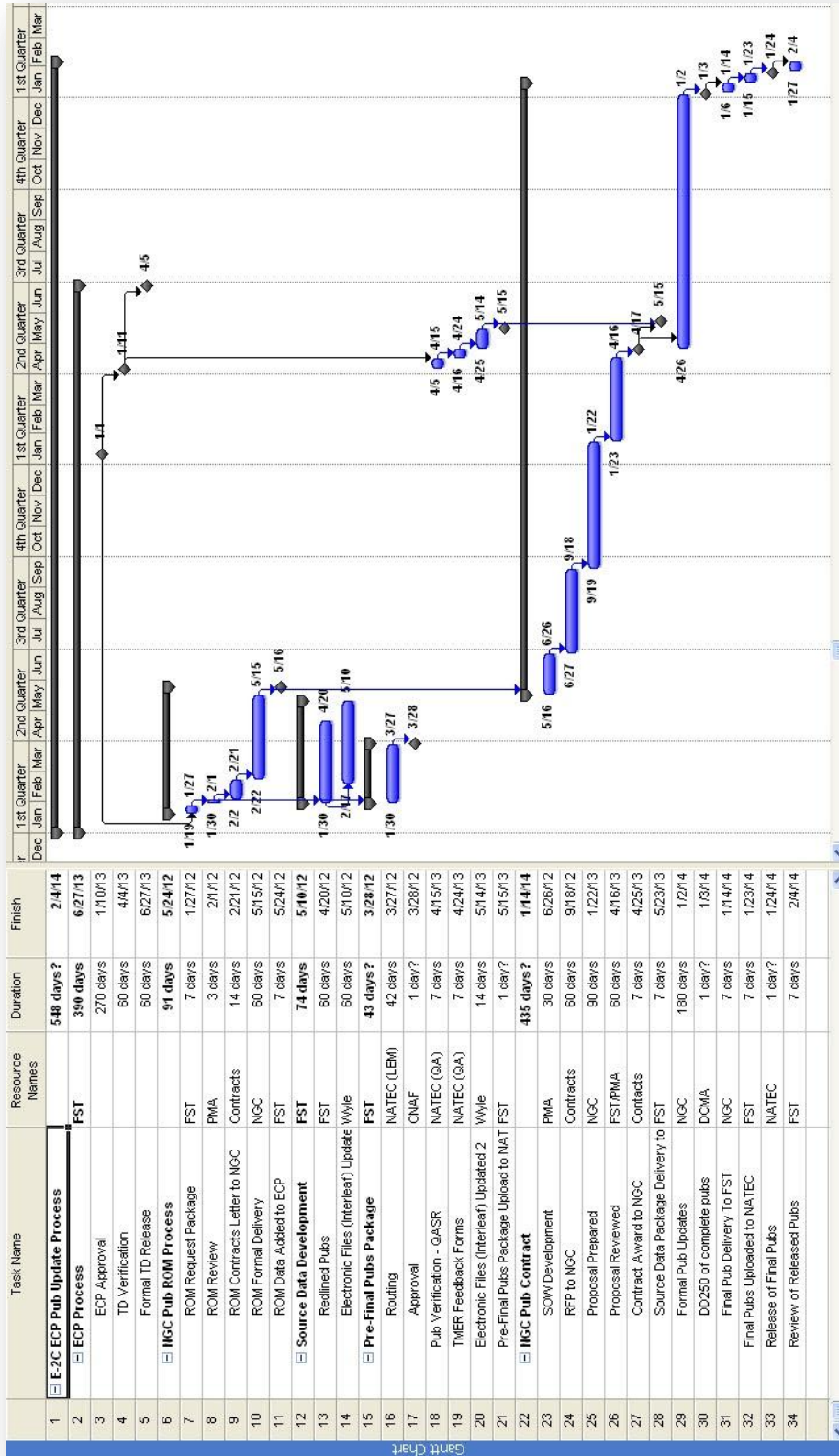
B. CONCLUSIONS

- No measurable benefit could be found to justify NGC management of E-2D manuals. NGC is more expensive and has greater turnaround time with no identifiable benefit in quality.
- Most activities tapped for information for this study had limited or no data management and archival processes in place.
- Management of technical manuals requires an in depth understanding and proficiency in technical manual structure, editing, and processing; however, this management does not (or should not) require an in depth knowledge of the platform being supported.
- By its nature, management of technical manuals by NGC or any private industry partner creates challenges in terms of balancing contractual requirements with program office cost constraints and key program milestones.

**APPENDIX A. TECHNICAL PUBLICATION DEFICIENCY REPORT
CATEGORIES**

| Technical Publication Deficiency Report (TPDR) Categories |
|--|
| CAT 1: Deficiency of a direct safety nature that could result in death or injury or damage to or loss of aircraft, equipment, or facilities, or one that results in deficient maintenance practices that severely impacts or degrades mission accomplishment, or the removal of the equipment from service. |
| CAT 2: Deficiency that results in ineffective maintenance practices that significantly and directly impact mission accomplishment in an adverse manner, and caused a maintenance delay of 8 hours or more. |
| CAT 3: A non-safety related deficiency that has minimal direct mission impact, and caused a maintenance delay of less than 8 hours. |
| CAT 4: A technical data deficiency of a non-technical or administrative nature that has no safety or mission impact (i.e., misspelled words, typographical errors, "A" Page errors, etc.). |

APPENDIX B. E-2C ECP TECHNICAL MANUAL UPDATE PROCESS



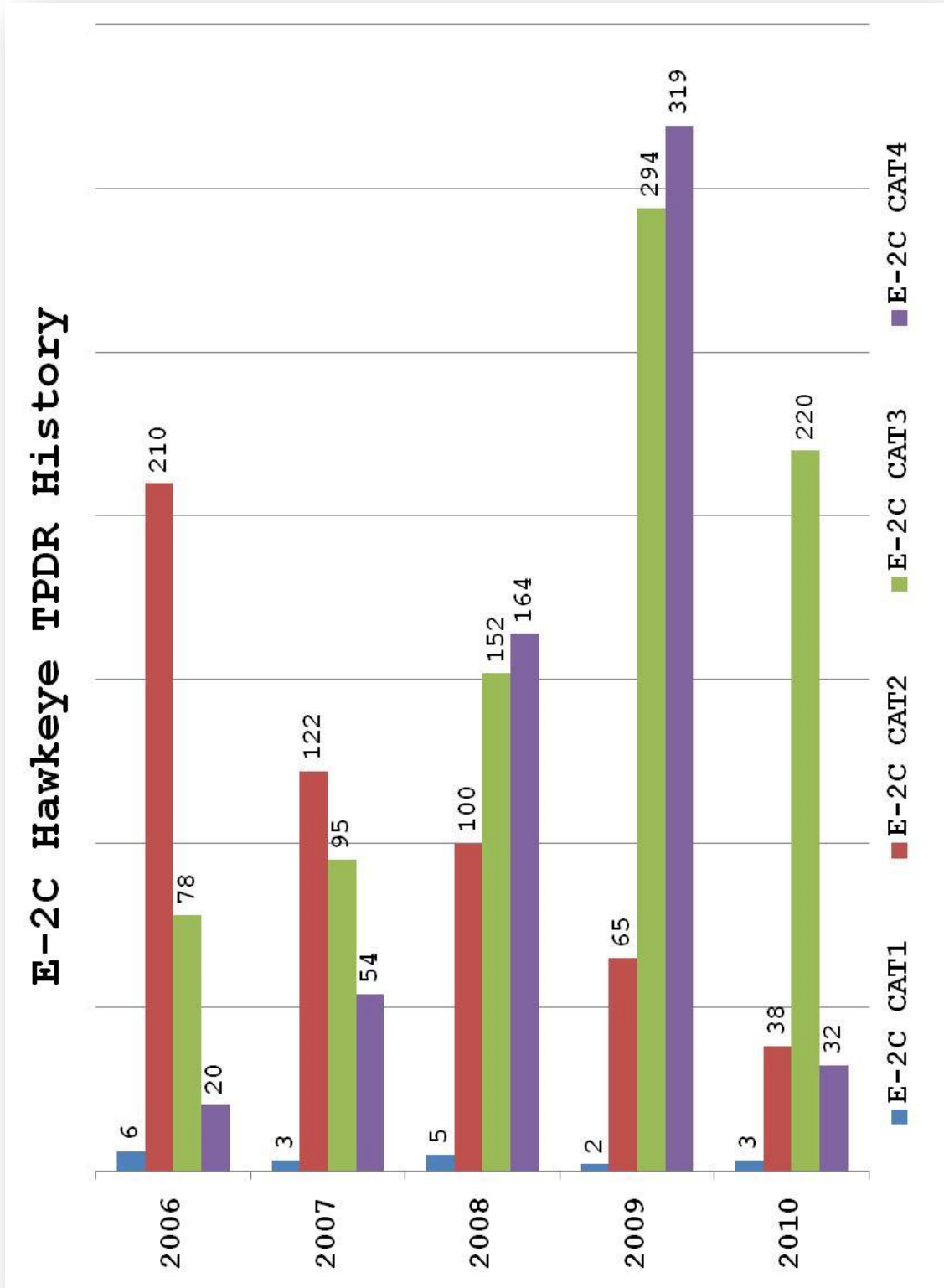
APPENDIX C. C-2A ECP TECHNICAL MANUAL UPDATE PROCESS



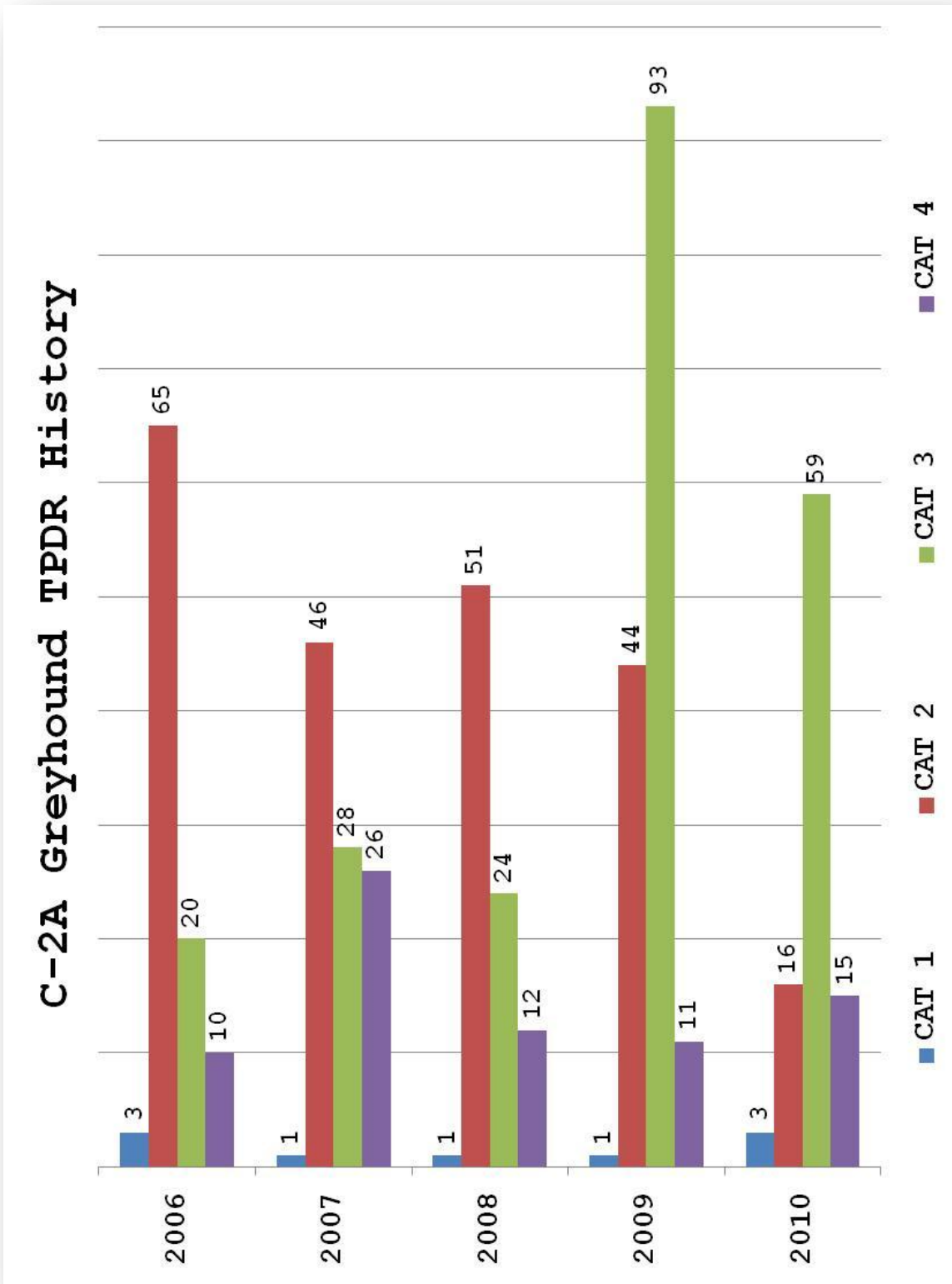
APPENDIX D. TPDR TECHNICAL MANUAL UPDATE PROCESS



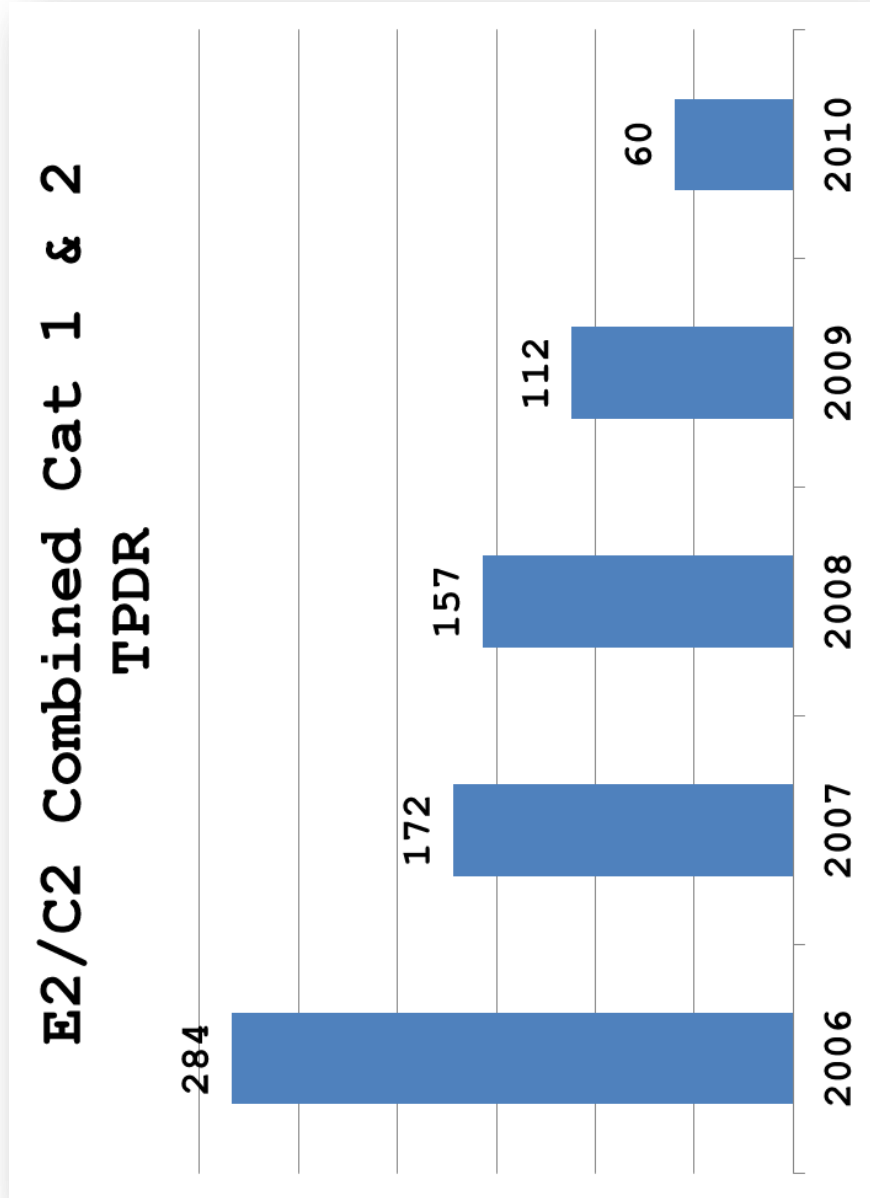
APPENDIX E. E-2C TPDR QUANTITY BY CATEGORY



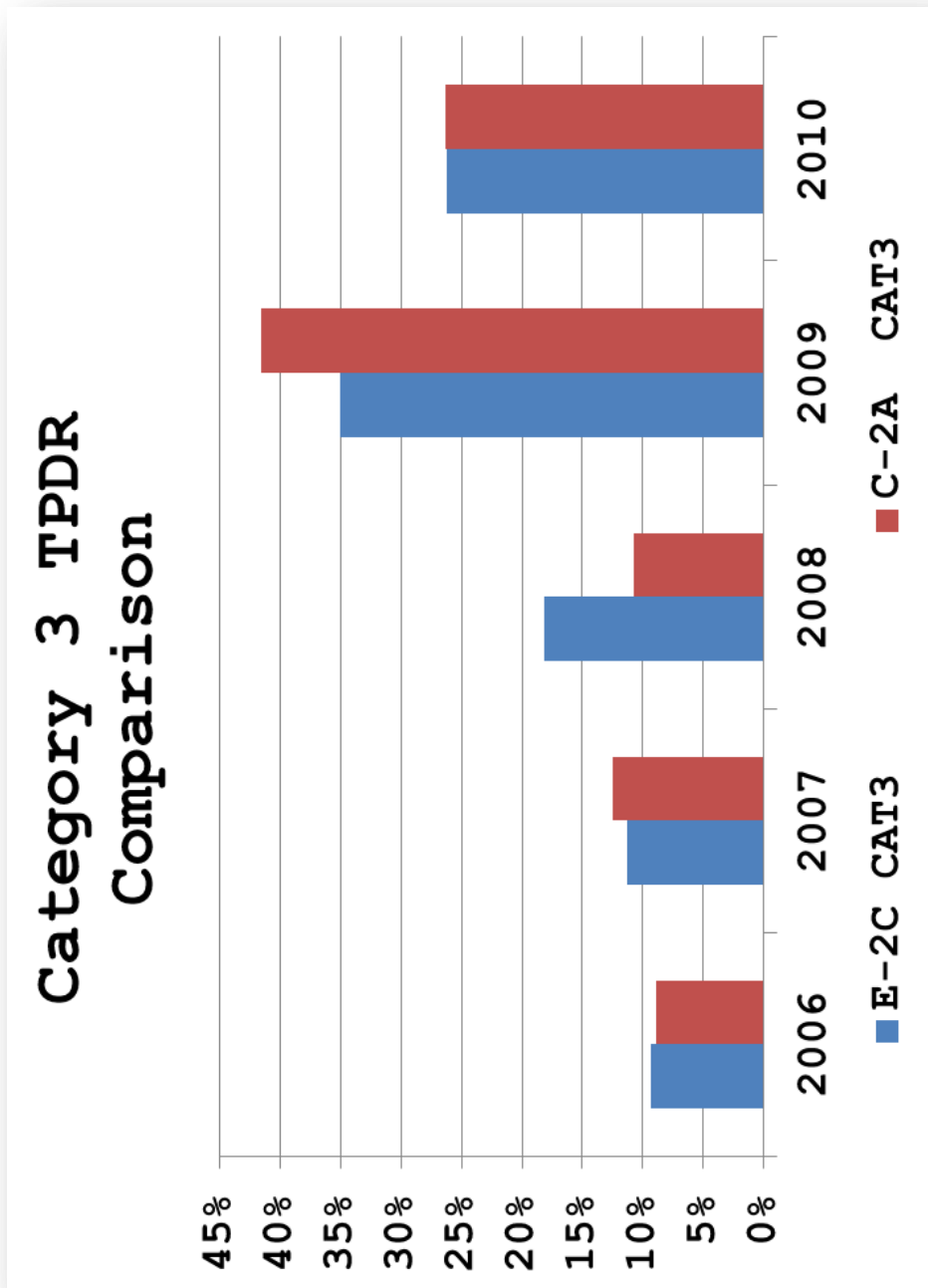
APPENDIX F. C-2A TPDR QUANTITY BY CATEGORY



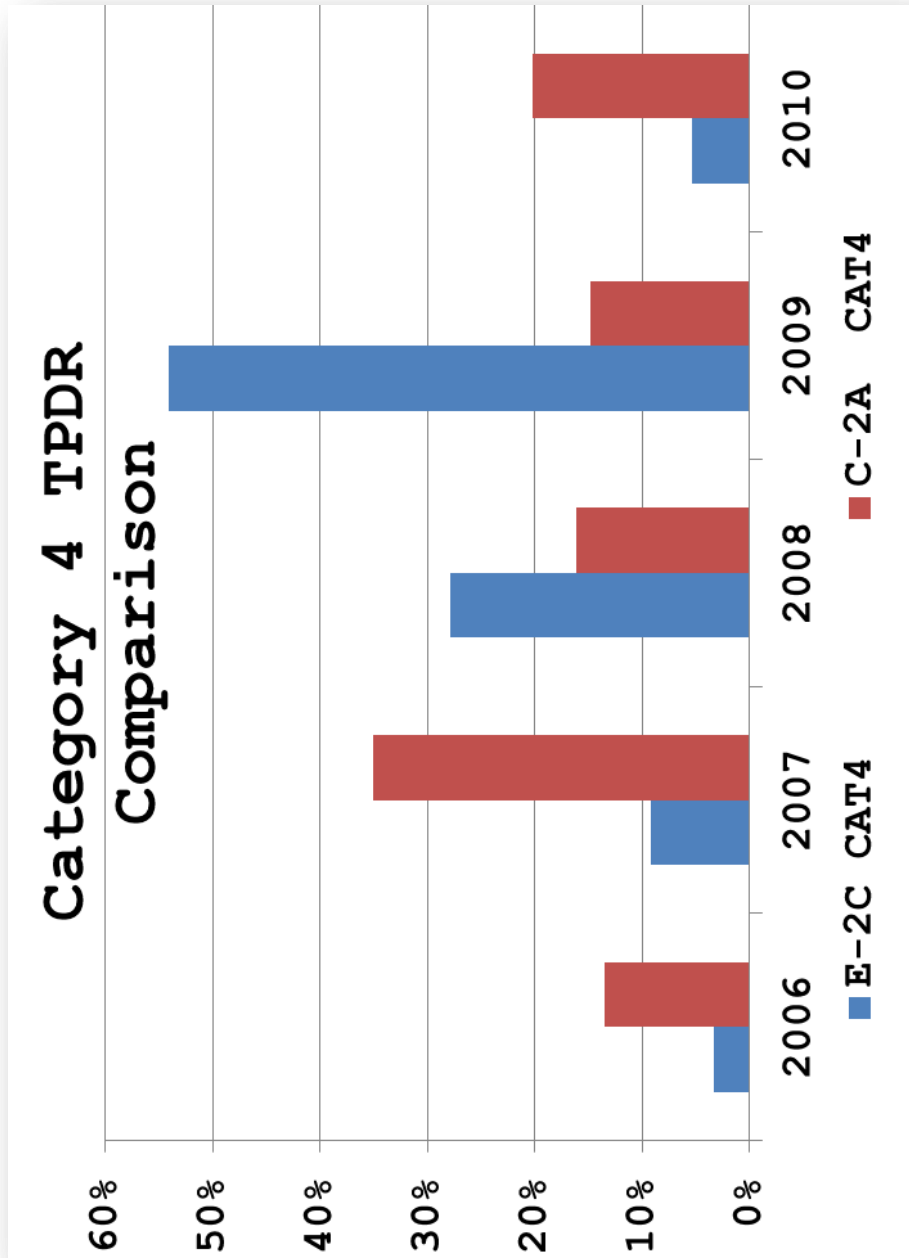
APPENDIX G. E-2C/C-2A CATEGORY 1 & 2 TPDR TRENDS



APPENDIX H. E-2C/ C-2A CATEGORY 3 TPDR TREND COMPARISON



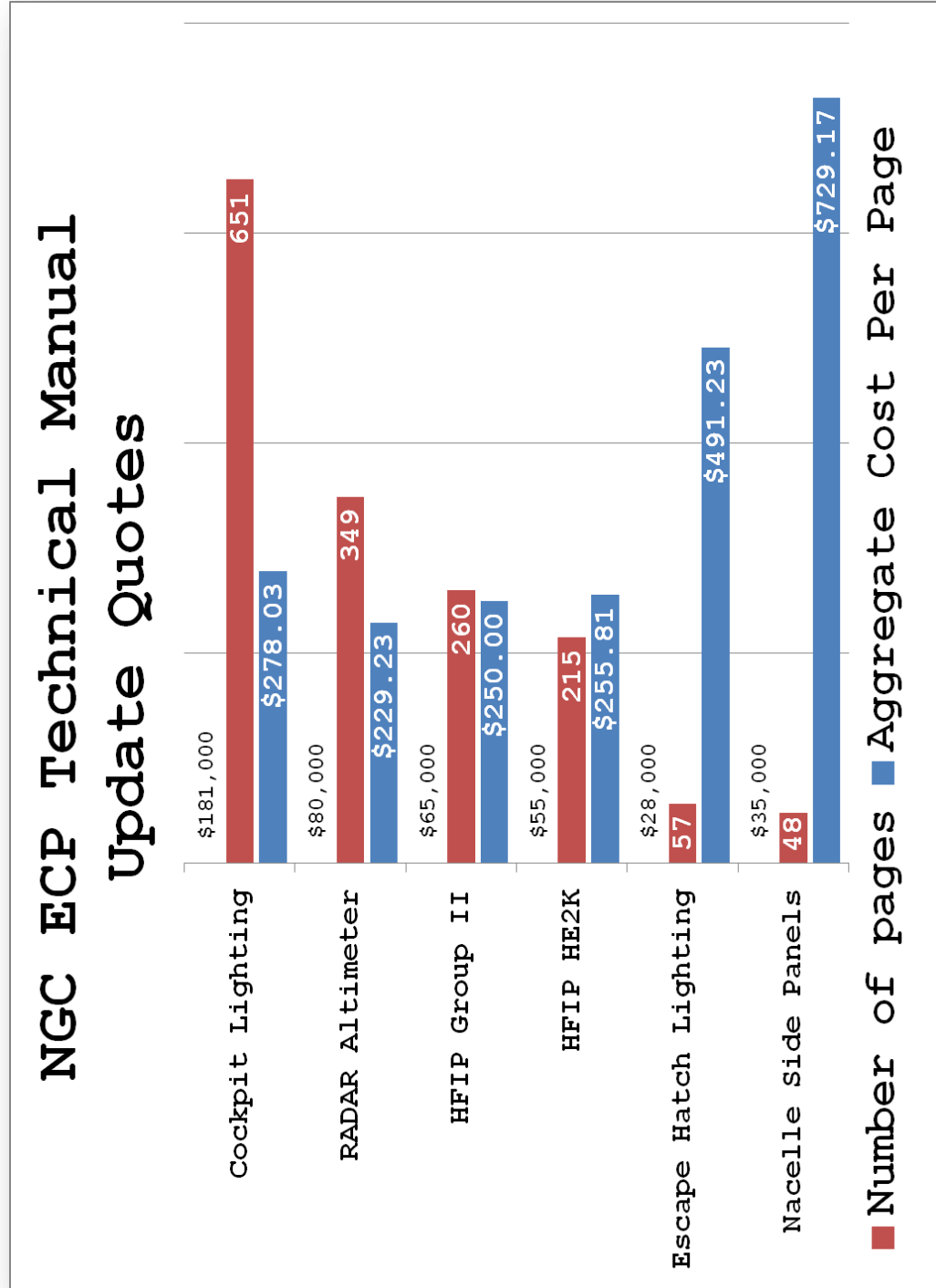
APPENDIX I. E-2C/C-2A CATEGORY 4 TPDR COMPARISON



**APPENDIX J. NORTHROP GRUMMAN ECP MANUAL UPDATE QUOTE
TABLE**

| NGC ECP Technical Manual Update Formal Quote History | | | | | | |
|---|----------------------|---------------------------------------|--------------|------------------------|--------------------------------|--|
| Engineering Change Proposal (ECP) | Date Provided | Period of Performance (months) | Price | Number of pages | Aggregate Cost Per Page | |
| Cockpit Lighting (\$181,000) | 29-Jul-09 | 12 | \$ 181,000 | 651 | \$278.03 | |
| RADAR Altimeter | 16-Sep-09 | 9 | \$ 80,000 | 349 | \$229.23 | |
| Nacelle Side Panels | 17-Jun-10 | 7 | \$ 35,000 | 48 | \$729.17 | |
| HFIP HE2K | 18-Jun-10 | 7 | \$ 55,000 | 215 | \$255.81 | |
| HFIP Group II | 18-Jun-10 | 7 | \$ 65,000 | 260 | \$250.00 | |
| Escape Hatch Lighting | 28-Sep-10 | 6 | \$ 28,000 | 57 | \$491.23 | |
| | | 8 | | | \$372.24 | |

APPENDIX K. NORTHROP GRUMMAN ECP MANUAL UPDATE QUOTE CHART



APPENDIX L. PRL FUNDED MANUAL UPDATE COMPARISON TABLE

| NGC PRL Technical Manual Update Data | | | | |
|---|--------------|-------------------|----------------------|--------------------------------|
| Year | Hours | Est Cost | Pages Updated | Aggregate Cost Per Page |
| 2008 | 2473 | \$ 375,000 | 4920 | \$76.22 |
| 2009 | 1452 | \$ 385,000 | 4508 | \$85.40 |
| 2010 | 1336 | \$ 225,000 | 3405 | \$66.08 |
| Average: | | \$ 328,333 | 4278 | \$75.90 |

| ISSC NI PRL Technical Manual Update Data | | | | |
|---|--------------|-------------------|----------------------|--------------------------------|
| Year | Hours | Est Cost | Pages Updated | Aggregate Cost Per Page |
| 2008 | 2WYS | \$ 356,456 | 3697 | \$96.42 |
| 2009 | 2WYS | \$ 357,779 | 6208 | \$57.63 |
| 2010 | 2WYS | \$ 390,143 | 2016 | \$193.52 |
| Average: | | \$ 376,475 | 4112 | \$125.58 |

APPENDIX M. LIST OF ACRONYMS

| | |
|-----------------|--|
| ABC2 | Airborne Battlefield Command and Control |
| AHE | Advanced Hawkeye |
| APN | Aircraft Procurement Navy |
| AW | Air Warfare |
| CSAR | Combat Search and Rescue |
| CSG | Carrier Strike Group |
| ECP | Engineering Change Proposal |
| FMC | Full Mission Capable |
| IETM | Interactive Electronic Technical Manuals |
| ILS | Integrated Logistic Support |
| ISSC | In-Service Support Center |
| LRIP | Low Rate Initial Production |
| NAE | Naval Aviation Enterprise |
| NAS | Naval Air Station |
| NATEC | Naval Air Technical Data & Engineering Command |
| NAVAIR | Naval Air Systems Command |
| NGC | Northrop Grumman Corporation |
| NI | North Island |
| O&MN | Operations and Maintenance Navy |
| PMA | Program Management Aircraft |
| PMC | Partial Mission Capable |
| POP | Period of Performance |
| PRL | Program Logistics Funding |
| ROM | Rough Order of Magnitude |
| SSC | Surface Search and Control |
| STK | Strike Control |
| T4O | Tactical Fourth Operator |
| TD | Technical Directive |
| TMAPS | Technical Manual Application System |
| TMS | Type/Model/Series |
| TMSDR | Technical Manual Source Data Records |
| TPDR | Technical Publication Deficiency Report |

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