

AFFTC-TIH-09-01



**THE AUTHOR'S GUIDE TO WRITING  
AIR FORCE FLIGHT TEST CENTER  
TECHNICAL REPORTS**

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**AUGUST 2009**

**TECHNICAL INFORMATION HANDBOOK**

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**AIR FORCE FLIGHT TEST CENTER  
EDWARDS AIR FORCE BASE, CALIFORNIA  
AIR FORCE MATERIEL COMMAND  
UNITED STATES AIR FORCE**

This technical information handbook (AFFTC-TIH-09-01, *The Author's Guide to Writing Air Force Flight Test Center Technical Reports*) is a significant revision to AFFTC-TIH-02-01, *The Author's Guide to Writing Air Force Flight Test Center Technical Reports*, and therefore given a new report number. This handbook was submitted by the Engineering Directorate, 412th Test Wing, Edwards AFB, California 93524-6843.

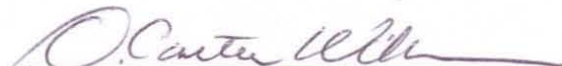
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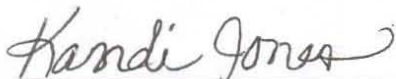
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# REPORT DOCUMENTATION PAGE

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## PREFACE

This handbook provides the established guidelines to assist technical report authors in writing accurate, precise, and clearly written reports. The handbook is a significant revision to the previous version, AFFTC-TIH-02-01, *The Author's Guide to Writing Air Force Flight Test Center Technical Reports*, January 2002 (reference 1), and therefore, given a new report number.

The authors would like to thank all those who wrote and participated in the writing of previous versions of the Author's Guide. Your knowledge and experience were invaluable to the completion of this handbook. Thank you to everyone who participated in the rapid improvement event for the Air Force Flight Test Center technical reporting process. Thank you to O. Carter Wilkinson, Kathy Wood, Walter Gorzoch, Lorrie Miller, Sandra Knoy, Carey Cramer, Diane Wood, Charlene Fletcher, Joy Grandle, Dorothy McCoy, and Ginny O'Brien for lending their editing expertise and reviewing the information contained herein.

For illustrative and instructional purposes, examples of report pages, plots, figures, illustrations, and tables used in this handbook have been modified from their original form.

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## INTRODUCTION

### OVERVIEW

The AFFTC mission is to conduct an independent, objective test and evaluation of aerospace systems and provide the customer with unbiased, technically correct, decision-quality information as soon as practical and as economically as possible. Reporting results to the customer is a vital task because it plays an important role in the decision-making of weapon system acquisition processes. Reports must reach the customer in a timely manner. Thus, it is imperative that all AFFTC technical reports are clearly written, accurate and precise, and follow the established reporting guidelines for consistency in presentation to the customer.

The primary purpose of this handbook is to provide the author standardized report formats to use in preparation of AFFTC reports. This handbook is to be used in conjunction with the approved AFFTC reporting templates and engineers' checklists, which are available from your technical editor and the Technical Publications Office. The AFFTCI 99-3, *AFFTC Technical Report Program* (reference 2), defines the reporting process, policies and procedures, as well as the approved types of reporting products. There are two categories of reporting products: 1) technical reports intended primarily for external customers, and 2) those intended for test enterprise use, such as technical information handbooks (TIH) and technical information memoranda (TIM). This handbook focuses on technical reports; however, guidelines apply to the TIH and TIM.

### **Types of Technical Reports:**

The type of technical report required for your project is usually determined during the program introduction/statement of capability (PI/SOC) process. If not, the report integrated product team (RIPT) and customer can help determine the appropriate type of report. The various types of reports covered by this guide are:

1. **Technical Report (TR):** The TR provides the final documentation of test and evaluation results. The content and size are scalable to support project requirements. The TR is intended to be brief and is not to be interpreted as a science laboratory report to house all the data that were analyzed during testing. The TR is not generally releasable to the public.

**Supplemental Data to TR:** This data can be packaged and provided to the customer with the TR. Plots and tables do not have to be report quality and are approved by the technical experts and the chief engineer (CE) for the program.

An addendum to a report does not go through the same approval process as a TR unless new results to the program occur. This is supplemental data to the TR so only the tech experts need to review and approve. The supplemental data (figures, plots, etc.) do not have to be report quality and can be included on the CD with the report when it goes to DTIC.

Include a cover that has the same TR number with an A at the end of the number, same title with Supplemental Data at the end of the title, signature page with author (prepared by), and technical expert and CE signatures (approved by), standard form (SF) 298, Notice To and Qualified Requestors, and an Executive Summary to identify that this is supplemental data to the TR. Be sure to match the addendum distribution statement to the TR so there is no blow-back from DTIC, especially when both files are included on the same CD.



2. **Preliminary Report of Results (PRR):** The PRR provides timely and concise preliminary results of principal findings pertinent to critical management issues, and is only used when the TR is not available quickly enough for key decisions. The PRR is a short memorandum and/or briefing given to decision-makers in circumstances where the customer needs an immediate answer. The PRR is not intended to take the place of a final TR. The PRR is not generally releasable to the public.
3. **TIH:** The TIH is primarily for test enterprise use to provide instructions or guidance covering subjects with a broad scope. The TIH is also used to document internal processes and archive technical information for future reference. The TIH is generally releasable to the public.
4. **TIM:** The TIM formalizes or validates studies that cover subjects of narrow scope and is intended primarily for in-house use. The TIM is not generally releasable to the public.

### **Purpose of Technical Reports:**

There are numerous reasons why we write technical reports. First, we must answer the customers' question(s), usually stated as critical program issues that prompted their requests for testing in the first place. This information allows customers to make programmatic decisions based on unbiased expert evaluations of both ground and flight test results. We also:

1. Provide an AFFTC position on the evaluation of mission capability (military utility) of a weapon system under development.
2. Provide an independent assessment of system performance that allows higher headquarters (AFMC, USAF, and DoD) decision-makers to better understand, and more confidently approve, programmatic decisions.
3. Provide an independent assessment of weapon system capabilities for higher headquarters. We must reflect an appreciation for the real-world mission of weapon systems in our reports. The operational commands are the ultimate customers of the weapon systems. Their interests in our evaluations focus on how the weapon system capabilities will impact their intended employment of the system. By understanding their missions, we can provide the program office our most significant conclusions, address the impact of our recommendations, and enhance our overall credibility with our readers.
4. Provide historical documentation on weapon systems as they progress through their life cycles. DT&E rarely ends with the conclusion of the full-scale developmental program. The test results documented in your TR will provide a performance baseline against which the next enhancement of the system will be evaluated. What you tested, how you tested it, and what you found, if properly documented, can provide a potential starting point for future evaluations.
5. Document test techniques, procedures, and data analysis methods. Well-written technical reports are excellent sources for on-the-job training of new flight test personnel.
6. Provide data for the basis of various Air Force T.O.s and standard aircraft characteristics charts.
7. Comply with DoD, Air Force, and Materiel Command technical reporting and Scientific and Technical Information (STINFO) Program regulations.

Some reports may be driven by one or more of the above reasons, but the best reports tend to validate all of these reasons for reporting.

### **Characteristics of a Good Report:**

Characteristics of a well-written report include the following:

1. Well-written reports are first and foremost readable. They do not contain insignificant details that readers must plow through to get the point of the report.
2. Well-written reports are concise. The shorter your report, the better it is for your reader. Resist the temptation to turn your TR into a laboratory report. Concentrate on a clear, concise writing style that gets quickly to the point. If you must document a new test technique or new system, use a reference, an appendix, or an entirely different document. The reader is primarily interested in your evaluation and recommendations concerning the system, **NOT** a dissertation on flight test techniques or a system description.
3. Well-written reports are organized around the test objectives. Lead your audience one finding at a time from each objective. You help the reader understand each by describing the test item, the test methods and conditions, and your data analyses that helped you reach your results, evaluations, and conclusions and recommendations (C&Rs). The entire report must carry the same theme and message to a variety of readers, and the various parts of the report should build on the basic message about the test item that you are trying to convey.
4. Well-written reports provide an accurate, unbiased, and balanced assessment of both the good and bad features of the test item. Nothing destroys a reader's confidence in an author's perspective more than to read one sentence that reflects an overall favorable evaluation, followed by endless pages of discussion of undesirable characteristics. Be fair, be neither an antagonist nor a protagonist of the system, be unemotional, and be sure you leave the reader with the correct impression of your message. ***Critical observations about the contractor, the program office or the AFFTC are wholly inappropriate in a TR.***
5. Well-written reports present an analysis and evaluation, not just test results. You must use data to substantiate your conclusions. If you help the reader understand how you reached your conclusions, it is much more likely that the reader will support them. Summarize the substantiating data in a format that is easily understood and clearly illustrates the point. Make comparisons. Comparing results to stated operational requirements, specification requirements, or performance figures for the previous version of the test item helps provide the reader with a sense of perspective and proportion.
6. Well-written reports reflect the fact that aircrew and maintainer comments are test data. Aircrew and maintainer comments may indeed be more important than raw numbers because they reflect an evaluation of the total weapon system including the human operator. Data and numbers should be used to substantiate comments to ultimately provide a comprehensive and convincing evaluation.
7. Well-written reports 'close the loop' and do not leave the reader hanging. Deficiency reports (DRs), T.O. change requests, and formal report recommendations are the most common methods of closing the loop. Any deficiency reported in a TR should always include your proposed resolution. Your C&Rs should clearly and specifically state what actions should be taken to correct, improve, and deploy the test item you have just analyzed and evaluated.

## REPORTING PROCEDURES

The number one objective in writing a report is to get the results of your test to the customer as quickly as possible without sacrificing the quality of the information presented. To help you finish your report on time you should never wait until the last minute to evaluate all of your data or write your report.

The idea is to perform your first flight or ground test, then obtain, analyze, and evaluate your data, and write your report in a continuous loop procedure. This process should continue throughout testing, so that by the time you finish your last test event, about 80 percent of your report is complete! The AFFTCI 99-3 (reference 2), defines the AFFTC technical reporting process and mandates that you have your report to the customer 40 days after the last test event, not 40 days after you get your last set of data to analyze and evaluate! Figure 1 shows the AFFTC technical reporting process.

The following sections should help remind you of what you need to be thinking and doing in each phase of the test program, and when each should be accomplished. Refer to AFFTCI 99-3 (reference 2) to understand what is required in the AFFTC technical reporting process.

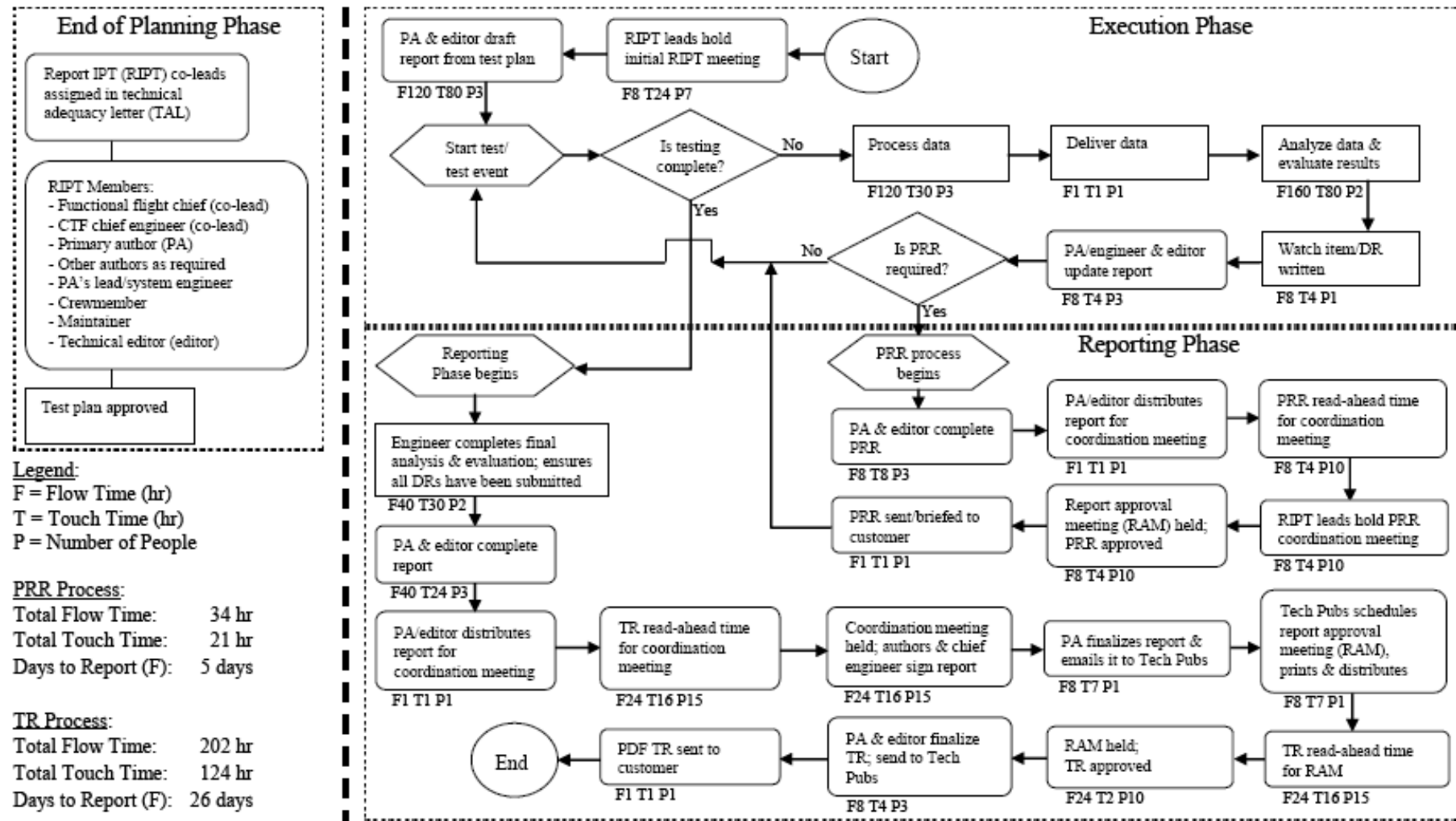
There are three basic phases to your test project: test planning, test execution, and test reporting. The procedures to get your TR approved start in the test planning phase! Think TR when you are writing your test plan (TP)!

### **Test Planning Phase:**

The RIPT will be established at the conclusion of your TP technical review. The RIPT membership should include:

1. RIPT co-leads: your CE and functional flight chief or designated technical expert
2. Author(s): you and anyone also listed as an author
3. Author's lead at the test organization
4. An operator: pilot, loadmaster, appropriate crewmember, or maintainer
5. Technical editor
6. Other personnel as required by the RIPT co-leads

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- Notes:
1. Flow time is the total time it takes to complete the step including delays (i.e., due to multitasking, leave, meetings, etc.).
  2. Touch time is just the time it takes to complete the step.
  3. The number of people and times are NOTIONAL. Actual times for each step should be assessed uniquely for each task when the Theory of Constraints (TOC) project schedule is created. Aggressive but Possible and Highly Probable times will be estimated for tasks when the schedule is developed. Factors such as complexity, team experience, and customer desires will be factors that can impact these times.

Figure 1 AFFTCI 99-3 Technical Reporting Process

Begin discussions with your customer on options for reporting results. Keep the test project manager informed on conversations with the customer since they will also work to help you establish your report requirements (per AFFTCI 99-3, reference 2). The reporting requirements should have been discussed to some extent during the PI/SOC process. The reporting timeline should have been documented in your project's Theory of Constraints Project Management (TOC PM) project schedule.

Note: You should always plan to write a technical report, not a PRR. The PRR should be the exception and not the rule! That way you can write the TR, get it out to the customer and off of your plate, and move on to the next test project.

Once the test plan is approved, you and your technical editor can start the boilerplate for your report. You are ready to move to the next step of the report process and can now begin writing your draft report!

### **Test Execution Phase:**

Milestones have now been established for your project, and the report requirements and type of report you will write have been finalized. Your test plan is approved and you know your objectives.

The customer understands and has agreed to the milestones, the objectives, and report type, and you have consulted with your RIPT co-leads to review the approach you have outlined in your initial draft.

The estimated completion dates for your initial draft, final draft, and the start of the approval cycle were determined by the project TOC schedule.

Schedule and hold the initial RIPT meeting to review and approve your report outline. Note: You do not need to get approval to start writing the report at the beginning of test execution. Do not wait until the end of testing to start your initial draft!

You begin to write the report with the help of your technical editor (e.g., the introduction, objectives, procedures, methods and conditions for the T&E section, the test item description, and any data analyses or maintenance techniques that were unusual for your test project). You capture this data from your test plan, and you begin to logically organize the material that will be presented to the customer in the report.

Throughout testing, you continue to work on your report. Once you have had your first test event, you receive, analyze, and evaluate your data, and draft the results into your report. You now have a feel for some conclusions based on your testing. You keep up with your data reduction and you understand your test item better because you are looking at the results and seeing/analyzing its performance.

You should periodically assemble the RIPT to review what you have written or solicit their comments as your writing progresses. Your RIPT co-leads can help you determine regular intervals to review your report. This will minimize the pain of the coordination process to follow.

Each time you test, you repeat the steps as outlined above. You are now at the last test event and awaiting your final data.

***You have about 80 percent of your report completed, right?***

### **Dedicated Test Reporting Phase:**

In this phase, you should be working with your RIPT as much as possible to complete your draft in preparation for the RIPT coordination meeting. This is done with the following steps:

When your report draft is complete, work with your technical editor to edit and format the report as required. Make sure that you have included everything needed for the final edit. Once you relinquish configuration control of the electronic file to your technical editor, there will be no more last-minute changes prior to the final RIPT review.

The technical editor will edit and distribute the report to the RIPT and review members three days prior to the real-time update coordination meeting, better known as the 'murder board.' Anyone who needs to provide input should attend the coordination meeting or send a representative with his/her comments and suggested changes. Note: The murder board can be a couple of hours in length or last three days or more, if necessary. This part of the process can be laborious, but at the end of this meeting all the changes will have been made so that the report can move forward for final approval.

Your murder board was a success, everyone there agreed to all the changes, and the technical editor has updated the final draft. The report can now begin its final coordination and approval cycle to a level of AFFTC management outlined in AFFTCI 99-3 (reference 2).

The Technical Publications Office can now schedule the senior leadership approval meeting, and is responsible for tracking the report through the 412 TW approval cycle. Note: the author should be aware of where the report is in the event there is a comment or question that needs addressing prior to this meeting.

After the report is approved and signed, the Technical Publications Office will deliver the report to the print plant (if necessary). When printing is complete, the Technical Publications Office will distribute the copies to the appropriate internal and external customers that are on the report distribution list. The AFFTC reporting process with flow time versus actual touch time is shown in figure 1.

### **How to Get Started:**

The reporting process actually begins with a thorough understanding of the customers' need (AFFTC, System Group, AFOTEC, the warfighter, etc.) and knowing when they need the answers. This information is vital to providing a report outline that presents the results your customers want with a substantial answer to the test objectives. A well-written test plan with clearly stated and well-defined objectives, success and evaluation criteria, and supported by a test point matrix will make your test objectives achievable and the reporting process much easier to accomplish. **Plan ahead and think TR at the time you draft your initial test plan!** Table 1 gives you an idea of what to be thinking of and activities to accomplish while you go through the test planning, test execution, and test reporting phases of a project. Once your plan has been approved, much of the background information and the boilerplate that appears in every report will be defined. What will be tested, why it will be tested, how it will be tested, what types of data will be obtained, the data analysis plan, and data presentation are all in sufficient detail in the test plan to help you write the corresponding portions of the TR before the first test is even conducted!

Some helpful suggestions to assist in writing a report are:

Table 1 Technical Reporting Activities

Test Planning	Test Execution	Technical Reporting
During test planning working group meetings, determine WHAT questions need to be answered and WHEN.	Analyze test data real-time, near-real-time, and as soon as possible after each mission.	Finish the analysis.
Draft report outline with help of report team leads and discipline experts. Identify report team members and clarify responsibilities.	Evaluate analytical results to identify potential deficiencies, need for T.O. changes, and places where system meets or does not meet expectations and mission needs.	Finish the evaluation.
Get inputs from customers regarding type of answers needed, WHY (decisions?) and for WHOM. (Generate distribution list.)	Generate deficiency reports and/or draft T.O. (flight manual) changes as soon as issues are identified.	Finish submitting DRs and T.O. change recommendations.
Use customer inputs to generate final report outline.	Draft contents of test and evaluation sections of the report as data analysis progresses.	Finish the T&E section of the report.
Research the system under test. Talk with contractors, customers, past testers and current users. Read system documents, mission documents, manuals, and technical reports.	Review data, DRs, T.O. changes, and T&E section content with report IPT lead and members. Work with lead to draft major conclusions and recommendations (C&Rs).	Finish the C&Rs. Include major C&Rs in the Executive Summary. If there are many recommendations needed, generate a separate recommendations section. Finish the remainder of the report. Schedule a coordination meeting.
Validate your instrumentation and data analysis systems. Review with technical expert.	---	Hold coordination meeting & incorporate changes. Schedule approval meeting.
Use information gathered to build test item description, data analysis sections and to set expectations.	---	Hold approval meeting and incorporate changes. DONE!

1. Read this handbook from cover to cover. Then read it again! Refer to it each time you begin a new report.
2. Refer to and use the 'one stop shop' engineers' checklists and the report writing tools that accompany this handbook (TR instructional templates, etc.).
3. Consult your RIPT leads to obtain guidance on the report content, the report layout, and the data presentation format. Read examples of recent reports on subjects similar to the one you must address. Discuss the strong and weak points of those examples with your RIPT leads.
4. Begin writing the report once the test plan is approved. Your technical editor is there to help you get started. Do not wait until after all testing is completed to begin writing!

5. Use the approved test plan to develop a thorough outline of your report. Your technical editor can help you with the report outline. Discuss your outline with your RIPT leads to ensure the report flow is smooth and logical.
6. Ensure data processing, data analysis and evaluation, and report writing keep pace with testing. This not only prevents a last-minute backlog, but also permits early identification of potential problem areas. Your RIPT leads can only help you resolve problems if they are aware of them before the eleventh hour.
7. Write any DRs as testing progresses and release them to the program office as soon as the reportable condition is identified.
8. Do not forego writing during the test execution phase of the project! Use test down time to work up your data and write sections of your draft report. Approximately 80 percent of the textual matter in a TR can be drafted prior to the completion of the last test for your project. You can even write the test results section because you most likely know the expected results. If the results are not as expected, simply update that portion to the actual results achieved.

### **Where to Go For Help:**

Your engineering home offices (412 TENG and 412 EWG) are there to provide you with technical assistance and guidance. These people are the technical experts so use them! Keep them apprised of any difficulties you are encountering as you progress with your report. Do not wait until the last minute to report obstacles! Let your home office representatives know so they can work any issues that might prevent you from achieving your goal.

The JT3 Technical Publications office is the primary point of contact for all administrative matters pertaining to the TR process. From assignment of a report number through final distribution, this office is there to answer your questions and provide you with the latest guidance and direction of the reporting process.

### **HANDBOOK LAYOUT**

This handbook is constructed in sections to match the three major components of the TR: Front Matter, Body of the Report, and Backup Material. All sections will be presented in the order they would appear from the front cover of the report to the back cover of the report unless otherwise noted. Each of the three major components will be broken down into sections, their purpose, whether or not they are required/recommended, the suggested format, and helpful hints. Considerations will be added to the suggested format section to help determine whether or not you should include a section in your report. If a section is not required for a particular type of report but the information is of value, a recommendation for an alternate format is provided.

Table 2 lists the sections of a report in the order in which they appear, unless otherwise noted. The sections with the asterisks are required for all types of reports. Those without asterisks are optional sections and are used as required to support the report. Refer to the particular section of this handbook to determine if it should be included in your report based on customer requirements.



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Table 2 Report Sections

Section	Is Section Required for TR?	Is Section Required for PRR?	Is Section Required for TIH/TIM?
<b>Front Matter</b>			
Outside Front Cover	Yes	Yes	Yes
Inside Front Signature Page	Yes	Yes	Yes
Standard Form 298	Yes	Yes	Yes
Qualified Requestors & Export Control Statements	Yes	Yes	Yes
Preface or Acknowledgements	No	No	No
Executive Summary	Optional for short reports; required for long reports.	Optional	No, but consider including if body of report is greater than five pages.
Table of Contents	No, but recommended for reports over eight pages.	Use an outline	No, but recommended for reports over eight pages.
<b>Body of the Report</b>			
Introduction	Yes. All formats must address the subsections, as required. Short introductions (less than two pages) do not require section titles.		
Opening Paragraph (no heading required)	Yes; opening paragraph starts Executive Summary	Yes; also in Executive Summary if there is one	Yes; also in Executive Summary if there is one
Background	Provide a brief chronological history pertaining to the test item.		
Test Item Description	Focus on test-unique items. The description should not exceed one page. Place longer descriptions in an appendix.		
Test Objectives	State general objective(s)	Try to fit all objectives on one slide	State general objective(s)
Limitations and/or Constraints	Document major problems that prevented meeting test plan objectives, if any.		As required
Test and Evaluation (T&E)	Yes	Yes	Yes
Opening Paragraph	Yes	Yes	Yes
Overall Test Results	No (optional for longer reports)	No	No
General Objectives	Yes	Yes	Yes
Specific Objectives	As required	As required	As required
Test Methods and Conditions	Yes	Yes	As required
Test Results	Yes	Yes	As required
Test Results Summary	No (optional for longer reports)	No	No
Recommendations (in list format)	No (optional for longer reports)	No	No
<b>Back-Up Material</b>			
References	Yes; for reports less than eight pages, alternate format acceptable (e.g., footnotes).		
Bibliography	No	No	No
Appendices	Yes	No, unless supporting information is required to be included for clarity	Yes
List of Abbreviations, Acronyms, and Symbols	Yes	Yes	Yes
Distribution List	Yes, as the last appendix of report.	Yes, as the last attachment of report.	Yes, as the last appendix of report.

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## FRONT MATTER

The front matter includes much of the boilerplate sections necessary for all reports.

### OUTSIDE FRONT COVER

Purpose: As an official U.S. Government publication, the front cover reflects the professionalism of the AFFTC and the USAF to the world. It is the reader's first impression of your work. An aircraft photo is optional, but cartoons or personalized logos are inappropriate here.

Information Required:

<u>TYPE OF REPORT</u>	<u>REQUIRED?</u>
TR	Yes
PRR	Yes
TIH	Yes
TIM	Yes

Format: You can obtain an outside front cover template from your technical editor or the Technical Publications home office. The front cover contains the following required information:

1. **Report Number:** This number is unique to each report and is assigned by the Technical Publications home office just prior to the first RIPT meeting.
2. **Title:** The title should be brief and clearly describe contents of the report. You should use words like 'program' or 'evaluation,' NOT 'results' or 'report.' If your report is classified, make every effort to ensure your report title is unclassified.
3. **Authors:** This list includes the primary Government civilian author and a project aircrew or maintainer. Authors can be project or discipline engineers (avionics, performance and flying qualities [P&FQ], human factors [HF], and reliability and maintainability [R&M], etc.). Only two names appear on the cover; more than that indicates a committee.
4. **Type of Report:** Indicate if the report is preliminary or final. Alternate formats could be interim or annual updates to the customer.
5. **Report Date:** This is the month and year the report is approved.
6. **Distribution Statement:** The main purpose of the distribution statement is to control secondary distribution of the report. The program office will determine the correct distribution statement for your report. The proper distribution statement will be IAW DoD Directive 5230.24, *Distribution Statements on Technical Documents* (reference 3), as implemented by AF Instruction 61-204, *Disseminating Scientific and Technical Information* (reference 4). The Technical Publications Office will provide guidance on the correct wording of the distribution statements for test and evaluation (distribution statements B, E, or F).
7. **Controlling Authority:** This is the sponsoring or funding agency, typically the systems group.

8. **Warning Statement:** Required on reports containing export controlled data.

**Helpful Hints:**

- Your report is an official AFFTC document. An optional aircraft or test item photo is allowed, but cartoons and personal logos are inappropriate for the cover. Your RIPT will decide whether a picture is appropriate for the outside front cover.
- The Technical Publications home office or in-house editor will help you with the following: assign a TR number for your document, provide the template for your cover, provide guidance on distribution statements, and answer any formatting questions.
- The two names that appear on the front cover are those responsible for the production of the report (military or civilian author and aircrew/maintainer). Authors writing significant portions of the report but do not appear on the cover are listed on the SF 298 form (up to 20 authors allowed), or are mentioned in the preface. Always get aircrew or maintainer input for your report. It is acceptable to have a front cover without an aircrew name on it (very rare), but be prepared to explain why the name is not there. Figure 2 shows an example of an outside front cover.

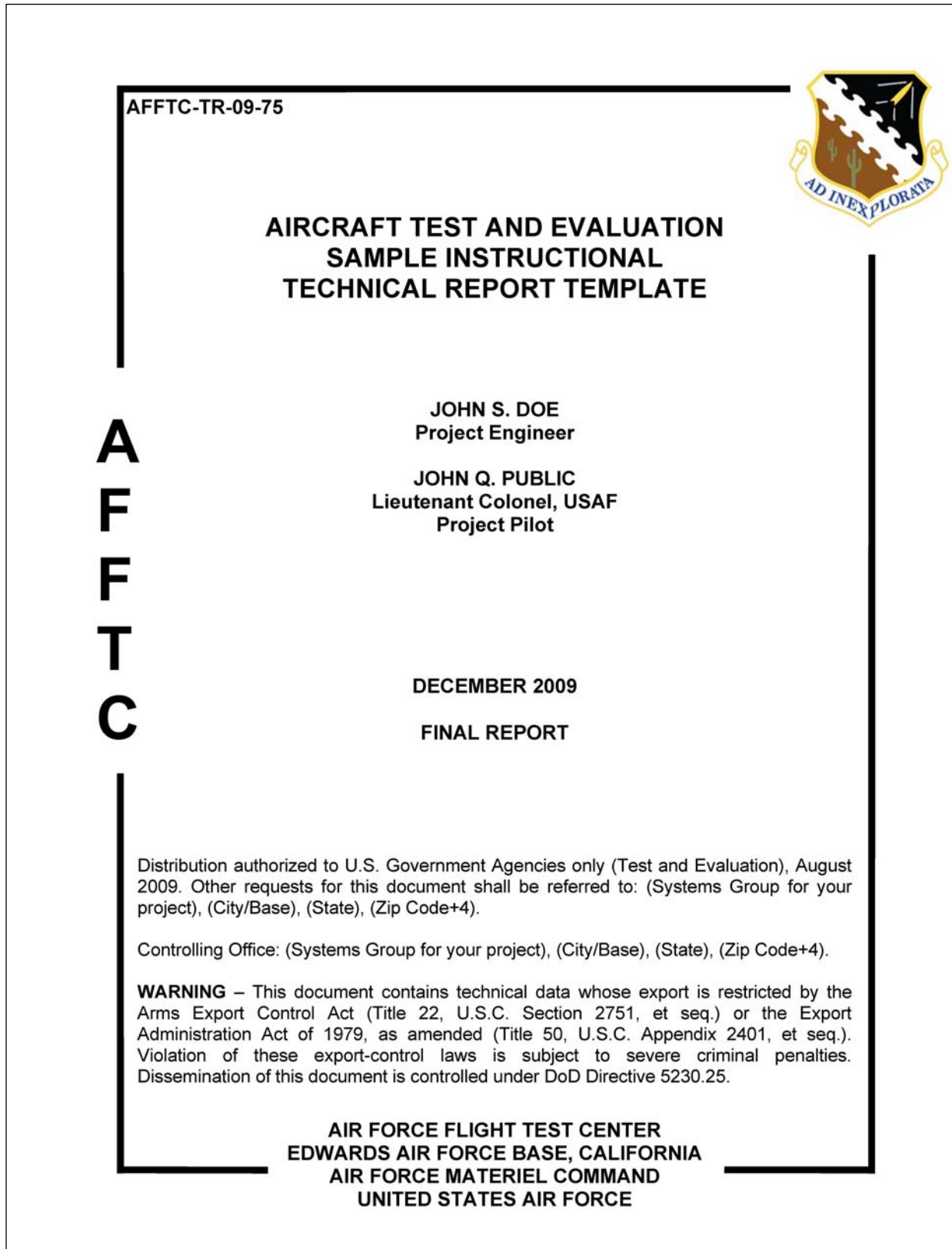


Figure 2 Example Front Cover

## INSIDE FRONT COVER (SIGNATURE PAGE)

Purpose: The main purpose of this page is to document who wrote the report and who approved its publication and release.

### Information Required:

TYPE OF REPORT	REQUIRED?
TR	Yes
PRR	Yes
TIH	Yes
TIM	Yes

Format: Your technical editor or the Technical Publications home office provides the correct template that contains a boilerplate paragraph and formatted signature columns. The signature page appears on the back (inside) of the front cover. The opening paragraph includes the TR number, title, and job order number (JON). It may also include identification of the originating office and its affiliation with the AFFTC, program authorizations, and dates or program management directive, if applicable. Below this paragraph are the signature blocks in two columns. The left column is for the preparer(s) signature(s). The right column is for the approval authority signatures. Appropriate approval authority for your report is listed in AFFTCI 99-3 (reference 2).

### Helpful Hints:

- The list of authors should be limited to those who wrote significant portions of the report. Editorial comments and pilot or maintainer notes do not constitute authorship. You can mention these people in the preface for their contributions to your report.
- One to two authors is considered appropriate. More than two authors indicate a committee, which rarely happens. All others who provided significant contributions to the report appear on the SF 298 form and in the preface.
- A contractor author can appear on the signature page but must be the last signature (author, pilot, and contractor).

Figure 3 shows an example of an inside front cover (signature page).

This technical report (AFFTC-TR-09-75, *Aircraft Test and Evaluation Sample Instructional Technical Report Template*) was submitted under job order number 123456 by the commander, 412th Test Wing, Edwards AFB, California 93524-6843.

Foreign announcement and dissemination by the Defense Technical Information Center are not authorized because of technology restrictions of the U.S. Export Control Acts as implemented by AFI 16-201, *Air Force Foreign Disclosure and Technology Transfer Program*.

Prepared by:

This report has been reviewed and is approved for publication.

\_\_\_\_\_  
JOHN S. DOE  
Project Engineer

\_\_\_\_\_  
NAME  
Chief Engineer  
4XXth Flight Test Squadron

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JOHN Q. PUBLIC  
Lieutenant Colonel, USAF  
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O. CARTER WILKINSON  
Technical Director  
412th Test Wing

\_\_\_\_\_  
WILLIAM J. THORNTON  
Colonel, USAF  
Commander, 412th Test Wing

Figure 3 Example Inside Front Cover (Signature Page)

## STANDARD FORM 298 (SF 298)

Purpose: The SF 298 is required for all reports going to the DTIC. Per STINFO regulations, all scientific and technical reports go to the DTIC, up to and including collateral secret. Reports classified higher than collateral secret do not go to DTIC as they are not equipped to handle that level of classification. The form includes information that would be used in a card catalogue/search capability for a library. If your report is classified, do not include any classified wording on this form.

### Information Required:

<u>TYPE OF REPORT</u>	<u>REQUIRED?</u>
TR	Yes
PRR	Yes
TIH	Yes
TIM	Yes

Format: Contact the AFFTC Technical Library, your technical editor, or the Technical Publications home office for an electronic template. The SF 298 has required blocks and includes instructions for filling out each block. Other than the abstract (block 14) and subject terms (block 15) there is not much discussion needed on this form.

### Helpful Hints:

- The abstract (block 14) should be narrative in nature and limited to approximately 200 words. Be brief and selective on what is included. DO NOT include results or C&Rs. If someone wants to see the results of your project, they will have to at least pass the DTIC screen. The abstract should include the following (in this order):
  1. An overall report purpose statement.
  2. The test requestor (usually the Systems Group [SG]); the responsible test organization (RTO), usually the 412th Test Wing; the test execution organization (TEO), usually the appropriate AFFTC Flight Test Squadron; and the group conducting the test (usually the Combined Test Force [CTF]).
  3. The dates and locations of testing.
  4. The number of missions as well as ground and flight test hours.
  5. A brief test item description (1-2 sentences).
  6. The general test objective(s) and the degree that the objectives were/were not met.
- Consult the AFFTC Technical Library for subject terms to include in block 15.

Figure 4 shows an example of the SF 298 form. Figure 5 shows the SF 298 instructions.

AUGUST 2009

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188		
<p>The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Department of Defense, Executive Service Directorate (0704-0188). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. <b>PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ORGANIZATION.</b></p>					
1. REPORT DATE (DD-MM-YYYY) 04-12-2009		2. REPORT TYPE Final Report		3. DATES COVERED (From - To) Use Day-Month-Year Format	
4. TITLE AND SUBTITLE  Title				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)  John S. Doe, Project Engineer John Q. Public, Lt Col, USAF, Project Pilot				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) AND ADDRESS(ES)  Air Force Flight Test Center Edwards AFB CA 93524-XXXX				8. PERFORMING ORGANIZATION REPORT NUMBER  AFFTC-TR-09-75	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)  Your Systems Group Organizational Information Street Address City/Base, State Abbreviation, Zip Code+4				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION / AVAILABILITY STATEMENT Distribution authorized to U.S. Government Agencies only (Test and Evaluation), Month Year. Other requests for this document shall be referred to: (Systems Group for your project), (City/Base), (State), (Zip Code+4).					
13. SUPPLEMENTARY NOTES SC: 012100                      CA: Air Force Flight Test Center Edwards AFB CA                      Print this document in <b>COLOR</b> .					
14. ABSTRACT This report documents results of the (whatever you tested). Testing was requested by the (Systems Group for your project), (city/base), (state). The responsible test organization was the 412th Test Wing located at the Air Force Flight Test Center (AFFTC), Edwards AFB, California. The test execution organization was the 4XXth Flight Test Squadron, Edwards AFB, California. Testing was conducted by the XXXXXXXX Combined Test Force (CTF). Testing was performed at place, state, from start and last flight dates and consisted of ground, taxi, and flight tests totaling XX test hours (XX ground test hours and XX flight test hours). The overall test objective(s) were to XXX. All test objectives were/were not met.					
15. SUBJECT TERMS F-XX aircraft                      navigation                      AN/APX-99                      terrain following radar                                  offensive avionics                      BDU-123                      human systems integration					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Same As Report
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED			19b. TELEPHONE NUMBER (Include area code) 661-277-8615

Standard Form 298 (Rev. 8-98)  
Prescribed by ANSI Std. Z39.18

Figure 4 Example SF 298



INSTRUCTIONS FOR COMPLETING SF 298	
<p>1. <b>REPORT DATE.</b> Full publication date, including day, month, if available. Must cite at least the year and be Year 2000 compliant, e.g., 30-06-1998; xx-06-1998; xx-xx-1998.</p> <p>2. <b>REPORT TYPE.</b> State the type of report, such as final, technical, interim, memorandum, master's thesis, progress, quarterly, research, special, group study, etc.</p> <p>3. <b>DATES COVERED.</b> Indicate the time during which the work was performed and the report was written, e.g., Jun 1997 – Jun 1998; 1–10 Jun 1996; May – Nov 1998; Nov 1998.</p> <p>4. <b>TITLE.</b> Enter title and subtitle with volume number and part number, if applicable. On classified documents, enter the title classification in parentheses.</p> <p>5a. <b>CONTRACT NUMBER.</b> Enter all contract numbers as they appear in the report, e.g., F33615-86-C-5169.</p> <p>5b. <b>GRANT NUMBER.</b> Enter all grant numbers as they appear in the report, e.g., AFOSCR-82-1234.</p> <p>5c. <b>PROGRAM ELEMENT NUMBER.</b> Enter all program element numbers as they appear in the report, e.g., 61101A.</p> <p>5d. <b>PROJECT NUMBER.</b> Enter all project numbers as they appear in the report, e.g., 1F665702D1257; ILIR.</p> <p>5e. <b>TASK NUMBER.</b> Enter all task numbers as they appear in the report, e.g., 05; RF0330201; T4112.</p> <p>5f. <b>WORK UNIT NUMBER.</b> Enter all work unit numbers as they appear in the report, e.g., 001; AFAPL30480105.</p> <p>6. <b>AUTHOR(S).</b> Enter name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. The form of entry is the last name, first name, middle initial, and additional qualifiers separated by commas, e.g., Smith, Richard, J, Jr.</p> <p>7. <b>PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES).</b> Self-explanatory.</p>	<p>8. <b>PERFORMING ORGANIZATION REPORT NUMBER.</b> Enter all unique alphanumeric report numbers assigned by the performing organization, e.g., BRL-1234; AFWL-TR-85-4017-Vole-21-PT-2.</p> <p>9. <b>SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES).</b> Enter the name and address of the organization(s) financially responsible for and monitoring the work.</p> <p>10. <b>SPONSOR/MONITOR'S ACRONYM(S).</b> Enter, if available, e.g., BRL, ARDEC, NADC.</p> <p>11. <b>SPONSOR/MONITOR'S REPORT NUMBER(S).</b> Enter report number as assigned by the sponsoring/monitoring agency, if available, e.g., BRL-TR-829; -215.</p> <p>12. <b>DISTRIBUTION/AVAILABILITY STATEMENT.</b> Use agency-mandated availability statements to indicate the public availability or distribution limitations of the report. If additional limitations/restrictions or special markings are indicated, follow agency authorization procedures, e.g., RD/FRD, PROPIN, ITAR, etc. Include copyright information.</p> <p>13. <b>SUPPLEMENTARY NOTES.</b> Enter information not included elsewhere such as: prepared in cooperation with; translation of; report supersedes; old edition number, etc.</p> <p>14. <b>ABSTRACT.</b> A brief (approximately 200 words) factual summary of the most significant information.</p> <p>15. <b>SUBJECT TERMS.</b> Key words or phrases identifying major concepts in the report.</p> <p>16. <b>SECURITY CLASSIFICATION.</b> Enter security classification in accordance with security classification regulations, e.g., U, C, S, etc. If this form contains classified information, stamp classification level on the top and bottom of the page.</p> <p>17. <b>LIMITATION OF ABSTRACT.</b> This block must be completed to assign a distribution limitation to the abstract. Enter UU (Unclassified Unlimited) or SAR (Same as Report). An entry in this block is necessary if the abstract is to be limited.</p>

Standard Form 298 Back (Rev. 8/98)

Figure 5 Example Instructions for Completing SF 298

## QUALIFIED REQUESTORS AND EXPORT CONTROL STATEMENTS

Purpose: These statements are required for reports not cleared for public release. The Qualified Requestor's Notice tells readers where to get additional copies of the report and provides instructions for destroying the document. The Export Control Statement tells the reader that the information contained in the report is not to be released to foreign nationals and explains the penalties for releasing the information without proper approval.

### Information Required:

<u>TYPE OF REPORT</u>	<u>REQUIRED?</u>
TR	Yes
PRR	Yes
TIH	Yes
TIM	Yes

Format: The technical editor or the Technical Publications home office will provide electronic templates for inclusion in your report. The format and wording for these statements are governed by regulation.

### **Helpful Hint:**

- Use the Technical Publications office for assistance.

Figure 6 shows an example of the qualified requestors. Figure 7 shows an example of the export control statements.

Qualified requestors may obtain copies of this report from the Defense Technical Information Center, 8725 John J. Kingman Road, Suite 0944, Ft. Belvoir, VA 22060-6218. Department of Defense contractors must be established for DTIC services, or have a "need to know" certified by cognizant military agency for their project or contract.

**DTIC release to NTIS is not authorized.**

When U.S. Government drawings, specifications, or any other data are used for any purpose other than a definitely related government procurement operation, the government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the government may have formulated, furnished or in any way supplied the said drawings, specifications, or any other data is not to be regarded by implication or otherwise, as in any manner licensing the holder or any other person or corporation or conveying any rights or permission to manufacture, use or sell any patented invention that may in any way be related thereto.

**Do not return this copy; retain or destroy.**

**DESTRUCTION NOTICE**

For classified documents, follow the procedures in DoD 5220.22.M, *National Industrial Security Program Operating Manual (NISPOM)*, section 5-705, or DoD 5200.1-R, *Information Security Program*, Chapter VI. For unclassified limited documents (i.e., documents not approved for public release), destroy by any method that will prevent disclosure of contents or reconstruction of the document.

**WARNING**

This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C. Section 2751, et seq.) or the Export Administration Act of 1979, as amended (Title 50, U.S.C. Appendix 2401, et seq.). Violation of these export-control laws is subject to severe criminal penalties. Dissemination of this document is controlled under DoD Directive 5230.25.

Figure 6 Example Qualified Requestors Statement

**NOTICE TO  
ACCOMPANY THE DISSEMINATION OF EXPORT-CONTROLLED  
TECHNICAL DATA**

1. Export of information contained herein, which includes, in some circumstances, release to foreign nationals within the United States, without first obtaining approval or license from the Department of State for items controlled by the International Traffic in Arms Regulations (ITAR), or the Department of Commerce for items controlled by the Export Administration Regulations (EAR), may constitute a violation of law.
2. Under Title 22 U.S.C. 2778, the penalty for unlawful export of items or information controlled under the ITAR is up to 2 years imprisonment, or a fine of \$100,000 or both. Under Title 50 U.S.C., Appendix 2410, the penalty for unlawful export of items or information controlled under the EAR is a fine of up to \$1,000,000 or five times the value of the exports, whichever is greater; or for an individual, imprisonment of up to 10 years, or a fine of up to \$250,000 or both.
3. In accordance with your certification that establishes you as a "qualified U.S. contractor," unauthorized dissemination of this information is prohibited and may result in disqualification as a qualified U.S. contractor, and may be considered in determining your eligibility for future contracts with the Department of Defense.
4. The U.S. Government assumes no liability for direct patent infringement, or contributory patent infringement or misuse of technical data.
5. The U.S. Government does not warrant the adequacy, accuracy, currency, or completeness of the technical data.
6. The U.S. Government assumes no liability for loss, damage, or injury resulting from manufacture or use for any purpose of any product, article, system or material involving reliance upon any or all technical data furnished in response to the request for technical data.
7. If the technical data furnished by the Government will be used for commercial manufacturing or other profit potential, a license for such use may be necessary. Any payments made in support of the request for data do not include or involve any license rights.
8. A copy of this notice shall be provided with any partial or complete reproduction of these data that are provided to qualified U.S. contractors.

**10 U.S.C. 140c (DoD Directive 5230.25, Encl 5)**

Figure 7 Example Export Control Statement



## PREFACE OR ACKNOWLEDGEMENTS

Purpose: The preface is optional and contains recognition of individuals or organizations that made substantial contributions to your report other than those already listed on the cover and signature page. The preface, while not required, allows you to thank those who helped you with your report. If adding one page to do this seems excessive, the same thing can be done by adding a paragraph at the end of your document or a bullet to your briefing to thank the people who helped you.

### Information Required:

<u>TYPE OF REPORT</u>	<u>REQUIRED?</u>
TR	No
PRR	No
TIH	No
TIM	No

Format: The preface should be short (less than one-half page). Only recognition is included in the preface.

### Helpful Hints:

- When considering people who made substantial contributions, never overlook the technical aid who helped you with your data reduction, the aircrew and maintainers who took time to get you up to speed on a system or talked you through problematic issues, the instrumentation person who gave you a tour of the orange wiring and modification paperwork, contractors, and your technical editor.
- Remember, a kind word goes a long way!*

Figure 8 shows an example of a preface.

## **PREFACE**

Sincere appreciation to authors Tracy Brown, Robert White, Brian Green, and Karen Blue for their contributions to the data analyses and writing of this report. Sincere appreciation also to the following flight controls and structures engineers for their contributions in writing the test planning and execution portions of the report: Steven Star, Tom Stripes, and Fannie Flag.

The authors gratefully acknowledge the contributions of Lieutenant Colonel Tom Airship, USAF, who provided an extensive and thorough technical review of the mission system section of this report. Finally, the editing and quality checks performed by technical editors Ginny O'Brien, Diane Wood, Sandra Knoy, Carey Cramer, Charlene Fletcher, Glenda Chevis, Joy Grandle, and Kandi Jones were instrumental in getting the report ready for final distribution.

Figure 8 Example Preface

## EXECUTIVE SUMMARY

Purpose: The executive summary may be the most important section of your report. It is an overview of your test results and is written for those who may not have time to read the entire report in one sitting (see figure 9). Those who do not have time to read entire reports are usually the decision-makers who determine whether funding will be set aside to continue the program. This section sets the tone for the rest of the report and should not exceed one page. Be brief and to the point, and do not introduce any material that is not presented in the T&E section. Do not include acronyms in the executive summary unless they are program specific and commonly known.

### Information Required:

<u>TYPE OF REPORT</u>	<u>REQUIRED?</u>
TR	Optional for short reports; required for long reports.
PRR	No
TIH	No
TIM	No

Format: This section is required for reports that typically exceed five pages in the body of the text. At that point, you are beginning to present more information than an executive would want to read in one sitting. Your results could be lost on the reader who does not have time to read the entire report. The executive summary should be written in a flowing, narrative style. The following is an outline to make sure you address the necessary information (no paragraph headings are used in the executive summary):

1. **Opening Paragraph:** Include the report purpose statement from your introduction section. Include the RTO, TEO (and participating test organizations [PTOs] if applicable), and mention that testing was conducted by the CTF. State the timeframe and location(s) of testing. Identify the number of sorties, ground test hours, and flight test hours.
2. **Operational Need:** Briefly describe the operational need that drove the development of the test item.
3. **Test Item Description:** Describe only the test article unique to the project (1 or 2 sentences). Describe the system under test and what it was designed to do, not what it actually did (it should not sound like results).
4. **Objectives:** State the general objective(s). Do not list the specific objectives for each general objective. Include a statement regarding the degree of accomplishment of the objective(s). If all objectives were (or were not) met, then say so: "All test objectives were (or were not) met." This statement is the last sentence of this paragraph.
5. **Results, Analyses, and Evaluation:** Summarize significant findings that lead to the major conclusions and recommendations (short paragraph).

## EXECUTIVE SUMMARY

This report documents the results of the C-99 Block 99 AN/APX-99 weather radar system performed in accordance with test plan AFFTC-TP-XX-XX, *C-99 Block 99 AN/APX-99 Weather Radar DT&E*. Testing was requested by the 999th Aeronautical Systems Group, Wright-Patterson AFB, Ohio. The responsible test organization was the 412th Test Wing located at the Air Force Flight Test Center, Edwards AFB, California. The test execution organization was the 499th Flight Test Squadron, Edwards AFB. Testing was conducted by the Global Reach Combined Test Force. Testing was performed at Edwards AFB from 23 June 2008 through 27 July 2009. Testing consisted of ground, taxi, and flight tests totaling 38 test sorties (23 ground test hours and 98 flight test hours).

A new AN/APX-99 weather radar system replaced the existing AN/APX-98 weather radar system on the C-99 aircraft. The existing AN/APX-98 weather radar system was experiencing a diminishing manufacturing source and would no longer support C-99 aircraft production needs.

The general test objectives were to: (1) evaluate the AN/APX-99 weather modes; (2) evaluate the range and azimuth resolution as well as the terrain detection performance of automatic (AUTO) mode; (3) evaluate the usability, lighting, and interpretability of the AN/APX-99; and (4) evaluate military utility. The general objectives were met.

Overall, the AN/APX-99 weather radar system performance was marginal. The AN/APX-99 detected and displayed weather cells, distinguishing between relevant and non-relevant weather; however, the AN/APX-99 in AUTO mode consistently underreported precipitation density at long range (beyond 50 nm). The AN/APX-99 detected and displayed turbulence. The wind shear detection was not rated because no wind shear event was observed with a C-99 test aircraft. The ground mapping modes were an effective aid to navigation, and produced accurate images of terrain features. The usability, lighting, and interpretability of the AN/APX-99 radar control panel were satisfactory. The military utility of the AN/APX-99 weather radar was marginal due to the underreporting of precipitation density at long range.

Despite some shortcomings, the AN/APX-99 weather radar was significantly better than the legacy AN/APX-98 weather radar. Release the AN/APX-99 to operational test.

Figure 9 Example Executive Summary



6. **Conclusions and Recommendations:** In general, was your test item good, borderline, or deficient? Include an overview statement emphasizing the extent that the test article or major subsystem(s) met or could not meet design objectives and whether or not it was cleared for operational release, as applicable. Do not provide recommendations without first stating the relevant conclusion. This section should just discuss significant, mission-limiting deficiencies. Further, only discuss the important C&Rs here, those that are the decision drivers.
7. **What's Next?** At the end of the executive summary, make a clear, simple, declarative statement about what the next step should be or an overall conclusion and recommendation. For example, if fixes were made, what would happen? Go to OT&E, go buy a million of them, do more flight tests, or do not buy any because it will never work.

### **Helpful Hints:**

- You should start drafting this section early so you can keep asking yourself if you have sufficient data to answer the customer's questions. As the T&E progresses, your thoughts will be better organized and you can adjust the executive summary as needed.
- Do not introduce information that is not mentioned in the T&E section of the report.
- Be brief and to the point. Try not to exceed one page in length. In this section, less is best.
- Minimize the use of acronyms in this section. Since this section is so short, excessive acronyms can give your summary the look of alphabet soup. If you must use acronyms, spell them out when initially used followed by the acronym in parentheses. Then you are free to use the acronym for the rest of your report.
- Do not use individual paragraph headings.
- Discuss only your most important findings and give your results to the reader quickly and concisely. You need not introduce your findings in the order they are presented in the T&E section.
- As a tone setter, be sure to emphasize positive features of the system under test as well as negative. Be fair and concise. Write the message you want to get across to your audience in layman terms. Not everyone is an expert in your discipline.
- If you do it right, they may read more!

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## TABLE OF CONTENTS

Purpose: The table of contents presents the hierarchical listing of the headings within the report. It helps the reader find whatever they are looking for easily. Figure 10 shows an example of a table of contents.

### Information Required:

<u>TYPE OF REPORT</u>	<u>REQUIRED?</u>
TR	No, but recommended for reports over eight pages
PRR	No, but use an outline
TIH	No, but recommended for reports over eight pages
TIM	No, but recommended for reports over eight pages

Format: The Technical Publications Office can help you electronically create this section. The hierarchy and headings must exactly match those appearing in the report. It is generally not necessary to list headings beyond the fourth order in the table of contents. Organize the table of contents logically from the reader's (not the test insider's) perspective.

### Helpful Hints:

- Make sure the words in the table of contents heading titles EXACTLY match those in the TR.
- Check, recheck, and triple check that page numbers in the table of contents match those of the sections in the report. Use the automatic Microsoft Word© Table of Contents feature in your TR, and be sure to refresh each time pagination changes to correctly show the page numbers in the report.

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Figure 10 Example Table of Contents

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## BODY OF THE REPORT

### INTRODUCTION

Purpose: The introduction lays the groundwork for the rest of your report. It tells the reader the who, what, when, where, how, and why for the test project. Who requested testing? Who were the customers? What was tested? Where was testing accomplished? How was testing accomplished? Why was testing requested in the first place? What was the operational need? Add any background information and program chronology to further help your reader. This section **does not** contain results, conclusions, or recommendations. Figure 11 shows an example of an introduction section.

Information Required:

<u>TYPE OF REPORT</u>	<u>REQUIRED?</u>
TR	Yes
PRR	Yes
TIH	Yes
TIM	Yes

Format: All formats must address the subsections listed below unless otherwise noted. Use titles to ensure all the information is included and easily found. Avoid long, drawn-out discussions about your test and long system descriptions.

1. **Opening Paragraph:** Required for all reports. This paragraph goes into your executive summary. The first sentence contains the following information and starts with “This report provides the results of... or, The purpose of this report is...” This paragraph introduces the reader to who asked for the test and why, the RTO, the TEO, the PTO if applicable, who conducted testing, when, where, and how the tests were conducted. It includes the number of sorties, ground test hours, flight test hours, and any dates of significant milestones.
2. **Background:** Reference previously related tests, as appropriate, or problems found during operational use, etc. Be sure to tie everything together, i.e., previous builds, blocks, and reference previous technical reports, test plans, or other supporting data, if applicable. Discuss items you want to make note of, items you did not test and why (but were not limitations as those would be addressed in the limitations and/or constraints section), etc.
3. **Test Item Description:** This section describes what was tested. Provide only high-level descriptions in this section. Keep the description brief and concise. If the test item description exceeds one or two pages, place it in an appendix. Describe only the item(s) under test, not the entire aircraft (i.e., the radio or software versus the C-5). Focus on the new software load and matching pod, or whatever you are testing, not the aircraft.

## INTRODUCTION

### GENERAL

This report documents the results of the C-99 Block 99 AN/APX-99 weather radar system performed in accordance with test plan AFFTC-TP-XX-XX, *C-99 Block 99 AN/APX-99 Weather Radar DT&E*. Testing was requested by the 999th Aeronautical Systems Group (ASG), Wright-Patterson AFB, Ohio, via test/work request (T/WR) FXXXX, *Block 99 AN/APX-99 Weather Radar System Upgrade* (reference 1). The responsible test organization was the 412th Test Wing located at the Air Force Flight Test Center, Edwards AFB, California. The test execution organization was the 499th Flight Test Squadron, Edwards AFB. Testing was conducted by the Global Reach Combined Test Force. Testing was performed at Edwards AFB from 23 June 2008 through 27 July 2009. Testing consisted of ground, taxi, and flight tests totaling 38 test sorties (23 ground test hours and 98 flight test hours).

### BACKGROUND

In FYXX, the 999th ASG initiated a weather radar system upgrade to correct deficiencies and implement improvements to the legacy system. The results of previous testing were documented in the following report:

1. AFFTC-TR-XX-XX, *C-99 Legacy AN/APX Weather Radar System* (reference 2).

Based on the results of previous testing, the SG requested further evaluation of this test item.

### TEST ITEM DESCRIPTION

The XXXX system upgrade built upon the XXXX system. Legacy aircraft were referred to as XXX or XXXX aircraft. The two test aircraft were XXX, S/N XX-XXXX, and XXX, S/N XX-XXXX. The XXXX modification included XX upgrades to the legacy AN/APX weather radar system. A detailed description of the XXXX test item is listed in appendix X.

### TEST OBJECTIVES

The general objectives were to evaluate the upgraded legacy AN/APX weather radar system for use in XXXX, and for military utility.

### LIMITATIONS OR CONSTRAINTS

During ground testing, the XXX evaluation was dependent on the availability of XXXX, which limited data collection opportunities. The lack of testing did not impact the outcome of the overall rating.

Figure 11 Example Introduction Section

You should include photos or diagrams to go along with the text for visual confirmation.

Clearly state if the test item is a production, prototype, or modified unit. If not a production unit, describe what was significantly different or similar to the production configuration.

Write about what the item was designed to do, not how it worked (that would be results, and this section does not include results). Appropriate wording would be “The xxx system was designed to... .”

4. **Test Objectives:** State the general objective(s) verbatim from the test plan, if possible. Sometimes you discover as the test progresses that objectives were not written as well as they could have been, or a new objective became obvious based on results. Check with your RIPT co-leads before rewording any objectives because you do not want to redefine your customer’s expectations in the report. If there were primary objectives and also secondary objectives that you intended to accomplish if time allotted, state this clearly. If all objectives were met, the last sentence of the objectives paragraph should read, “All test objectives were met.” Otherwise, indicate any objective(s) not met. Some additional guidelines for listing objectives are:
  - a. TR, TIH, and TIM: If there are a few specific test objectives, enumerate them here. If there are many specific test objectives, only mention the general objective(s) in the executive summary and introduction sections, and discuss the specific objectives in their respective T&E section.
  - b. PRR: If your PRR is in briefing format, you may want to list the objectives so they fit on one slide. If they do not, then list the general objective(s) on one slide and add a number that shows how many specific objectives supported the general objectives.
5. **Limitations and/or Constraints:** Did you meet all of your objectives? If you met all objectives, there is no need to address limitations. If you did not meet all your objectives, then document the major reasons that prevented you from meeting any objectives stated in the test plan and the associated impact. Explain why the objectives were not met in an *objective* manner. If cost, schedule, or asset availability was an issue, then say so. Do not denigrate other organizations for an inability to accomplish the mission. This shows a lack of professionalism and turns off the reader to your assessments. If there were no limitations or constraints, you would simply leave this paragraph out of your report.

Constraints restrict the scope of activity but do not keep you from meeting the objective(s). If the constraints impacted several areas or objectives, then include the information here, right up front. This would help eliminate the need to repeat the constraint several times throughout the report. If only one area was impacted, then consider discussing the constraint in the appropriate T&E section.

### **Helpful Hints:**

- This section does not include any test results, conclusions, or recommendations.
- Avoid using the words problem, anomaly, and trouble.*** A good writing habit to get into is to describe the problem, anomaly, or trouble directly, without using those words. For example, “The XNEW fighter departed controlled flight at lower angles of attack than simulation results predicted” rather than “There was a high angle-of-attack anomaly experienced during testing.” Be careful if you use the word **problem**. Just because you

see it as a problem does not mean the customer sees it as a problem. In this example, the customer may not have an issue with this angle of attack if the aircraft will rarely, if ever, be used there. A flight manual change may be an acceptable solution.

- Use your own words or layman words to describe the system, not the advertiser's words. For example, "a preproduction F-22" versus "premiere fighter of the 21st century."
- Avoid use of proprietary information. If proprietary information is included, ensure the appropriate distribution statements are included in the report.
- If the list of test objectives gets long or does not read well if listed out verbatim, consider categorizing the objectives and talking about them as general objectives. It may be worth mentioning how many specific test objectives support the general objective. For example:
  1. For a ground test: "The general objective was to verify the engine lubrication system maintenance functions and tasks. There were 30 specific objectives that verified removal and replacement times of key hardware (15), verified all-weather and chem-bio gear tasks (10), and evaluated new support equipment developed for this aircraft system (5)."
  2. For a flight test: "The general objective was to verify aircraft operation throughout the flight envelop. There were 36 specific test objectives that verified engine operation (5), structures (5), flight controls (10), subsystems (10), and performance (6)."
- Review your test and evaluation master plan (TEMP). The TEMP details how your test fits in with the overall program and contains the critical issues pertinent to the particular system under test.



**TEST AND EVALUATION (T&E)**

Purpose: The T&E section is the ‘meat’ of your report. This is the section where you provide sufficient detail on what you did, how you did it, and what you found during testing. Write in Air Force terms using simple sentences. Be thorough, yet be concise. Summary plots and tables, which support major conclusions, are appropriate in this section. Highly detailed or complex plots and tables go into an appendix. Avoid excessive use of acronyms and abbreviations. **All results, analyses, conclusions, and recommendations go in this section.**

Information Required:

<u>TYPE OF REPORT</u>	<u>REQUIRED?</u>
TR	Yes
PRR	Yes
TIH/TIM	Yes

Format: There is some artistic license allowed in organizing and presenting your objectives. However, careful consideration should be given to exactly how the T&E section is organized. The organization will determine how clear the report is to the reader and affect how much writing you must do. For instance, if you are evaluating numerous subsystems for specification compliance, organizing by subsystem is probably appropriate. If you are evaluating a combination of radar, weapons system computer, and FLIR as a total package in operationally representative scenarios (air-to-air, high-dive angle, air-to-ground, or terrain following ingress, etc.), it is probably appropriate to organize your report by mission scenario. Organize the objectives to make your case in a logical and readable order to support all your C&Rs. Always begin with positive comments, followed by any negatives, as applicable.

Typically, the flow of the T&E section is as follows:

- Opening paragraph
  - Overall test results (should be limited to one small paragraph; optional for smaller reports)
  - General test objective
    - Specific test objective
    - Test methods and conditions
    - Test results
  - Test results summary (optional for longer reports that need a summary to tie everything together; includes the military utility assessment leading to the overall conclusion and recommendation to proceed or wait for further DT&E [field for OT, more DT&E needed, etc.])
- } } Repeat as necessary

Again, it is useful to group by system or mission area. Where appropriate, add capability-based objectives at all levels of the evaluation (subsystem [mode], system, or system-of-systems). Measures of performance (MOPs) are not usually rated, but can be addressed as paragraph(s) under a specific objective; descriptors should be applied. Satisfactory, marginal, and unsatisfactory ratings are used for specific objectives but are not required for MOPs. Integrate military utility, qualitative pilot comments, or other crewmember comments, as appropriate, into each test results subsection.

Figure 12 shows a sample T&E section.

## TEST AND EVALUATION

This section presents the results of the C-99 Block 99 AN/APX-99 weather radar system test and evaluation. Test results determined how well performance assessments met the requirements or how deficiencies affected the overall operation. When a deficiency was identified, a DR was created to track the issue. The DR numbers are presented in this report when deficiencies are discussed, appendix Y. **Correct the deficiencies documented in the deficiency reports, and evaluate any modifications incorporated as a result of the corrective actions. (R1)** Each test objective was rated using the AFFTC rating criteria (table A1, appendix A).

### OVERALL TEST RESULTS

Overall, performance of the AN/APX-99 weather radar system was marginal. The AN/APX-99 detected and displayed weather cells, distinguishing between relevant and nonrelevant weather; however, the AN/APX-99 in AUTO mode consistently under-reported precipitation density at long range (beyond 50 nm). The AN/APX-99 detected and displayed turbulence, and the ground mapping modes were an effective aid to navigation and produced accurate images of terrain features. The aircrew could visually distinguish discrete returns from reflectors at the specified resolution ranges. The usability, lighting, and interpretability were easy to use and understand and were all satisfactory. The military utility of the AN/APX-99 weather radar was marginal due to the under-reporting of precipitation density at long range. Despite some shortcomings, the AN/APX-99 weather radar was significantly better than legacy AN/APX-98 weather radar. Table 2 presents the C-99 AN/APX-99 Weather Radar System results.

Table 2 C-99 AN/APX-99 Weather Radar System Test Results

Objective	Title	Descriptor	Rating
<b>Overall</b>	<b>AN/APX-99 Evaluation</b>	<b>Borderline</b>	<b>Marginal</b>
1	Weather Modes	Borderline	Marginal
2	Range and Azimuth Resolution	Good	Satisfactory
3	Usability, Lighting, and Interpretability	Good	Satisfactory
4	Military Utility	Borderline	Marginal

### WEATHER MODES

Overall, performance of the weather modes was marginal due to borderline fidelity of the AN/APX-99 in AUTO mode. Weather detection and depiction were marginal due to xxx. Relevance discrimination, turbulence detection and depiction, and terrain suppression in weather modes were all satisfactory. Predictive wind shear detection and depiction were not rated due to xxx. Table 3 presents the results of the weather modes evaluation.

#### Weather Detection and Depiction:

The specific objective was to evaluate the weather detection and depiction.

#### Test Methods and Conditions.

To evaluate the AN/APX-99 weather detection and depiction, the C-99 aircraft was flown toward...

#### Test Results.

The weather detection and depiction performance was marginal, due to the borderline response of the xxx...

<sup>1</sup>Numerals following an R represent tabulated recommendation numbers.

Figure 12 Example Test and Evaluation

1. **Opening Paragraph.** (No heading is required.) This is an introduction-type paragraph. Mention that system assessments were made according to the AFFTC rating criteria (table A1), or whatever criteria that was used for your test. State the number of deficiency reports generated during the course of testing and that they are included in your DR appendix. State that DRs were written in accordance with T.O. 00-035D-54, *USAF Deficiency Reporting, Investigation, and Resolution* (reference 6). Add this reference to the list in your report and include the standard recommendation to correct the DRs. The standard recommendation is as follows:

**Correct the deficiencies documented in the deficiency reports, and evaluate any modifications incorporated as a result of the corrective actions. (R1)<sup>1</sup>**

Also include the standard footnote regarding the recommendation numbers. The footnote should read:

<sup>1</sup>Numerals following an R represent tabulated recommendation numbers.

The second recommendation should address all publication change requests reported on AF Form 847 and Air Force Technical Order (AFTO) Forms 22 or 27 (flight manual and technical order manuals). These recommendations are the only ones appearing at the front of the T&E section. All other recommendations should follow the discussion leading to your conclusions and recommendations.

2. **General Test Results.** This is a **brief** paragraph of your general results for all of the objective(s) listed in the introduction section. If an objective was omitted, explain why and relate the impact to your evaluation, if appropriate. This paragraph also suffices as the outline of the T&E section, showing the flow of information to be presented. This summary is short and to the point, and stated in one paragraph.

If you have an 'overall' rating rolling up a variety of ratings, explain how you arrived at the 'overall' rating. A general results 'stop-light' table of your general objective(s) is helpful. Remember, keep it **short!**

3. **General Objective.** The heading will be a shortened title for the general objective and should match the title listed in the 'stop-light' table in the general test results section. State the general objective. It should be worded exactly as it appeared in the test plan. If you need to reword the objective for clarity, get permission to do so from your RIPT leads.

If there is more than one specific objective associated with the general objective, and if the specific objectives have various ratings, then include a discussion on how the overall rating for the general objective was obtained. If there are several specific objectives, then a 'stop-light' table is helpful here. The titles in the table should be shortened headings for the objectives.

4. **Specific Objective** (and related sub-objectives, if applicable). If there were no specific objectives for a general objective, then skip this paragraph. Otherwise, the heading will be a shortened title for the specific objective and should match the title listed in the 'stop-light' table for the associated general objective. State the specific objective. It should be worded exactly as it appeared in the test plan. If you need to reword the objective for clarity, get permission to do so from your RIPT leads.

5. **Test Methods and Conditions.** Base this information on the test plan. Briefly summarize your test methods, how the test was conducted, and the actual test conditions. Be brief when discussing standard test maneuvers or instrumentation. If you developed a new technique or data gathering concept, mention it here but consider including a more detailed description in an appendix, TIH, or TIM.

Do not be repetitive. If you did the same thing for three objectives, describe it the first time, then refer to it in subsequent sections as applicable. Further, if a test method, equipment, or a certain configuration was unusable, say so up front, possibly in the limitations or constraints section, to eliminate having to address it several times throughout the report.

6. **Test Results.** This section includes test results, analyses, conclusions, and recommendations. Do not add excess verbiage to dress up this section (or any section for that matter). Be clear and concise, and make sure you close the loop on all your results. Lead your reader from the results and analyses to the conclusions and recommendations. Be sure to back up your analyses with sufficient summary data to justify your results. Remember, this is a technical report, not a laboratory report! Ensure both positive and negative features are addressed (typically positive features are mentioned first). If you discover something during testing that was not an objective, you still need to rate it, provide a conclusion, and, if applicable, a recommendation.

- a. Do not have paragraphs where all that is said, after describing the test methods, was the widget was satisfactory, marginal, or unsatisfactory. Use descriptors to tell the reader how the system performed (the evaluation), and then roll those up to the overall system/subsystem rating (the conclusion). Use the descriptors that match the associated rating from the AFFTC rating criteria (table A1). Descriptors help the reader understand the level of rating. Add a column to the results table listing the descriptor associated with each rating.
- b. The intent is to make the report less repetitive so that not every paragraph reads “System x was satisfactory...”, and to highlight better performance with some superlatives. For example: Rather than saying “detect range was satisfactory,” we would say “Overall radar performance was satisfactory. The detection range was excellent, the R50 (50 percent single scan detection range) was 45 nm.”
- c. **Conclusions.** Conclusions are what results mean. Make sure the conclusions close the loop on your discussions so that the recommendations are logical. With a marginal or unsatisfactory rating, state the reason for the rating (i.e., the performance of xxx was marginal due to ...). Also, if a marginal or unsatisfactory conclusion is reached, include information as to the severity and impact. The closure of many conclusions may be a DR or a publication change request.
  - (1) Use the AFFTC rating criteria (table A1) when choosing your words for overall conclusions. The descriptor adjectives in this table are understood by everyone in the industry. There have been many arguments about how bad is bad and how good is good; this table should apply in most cases. If you feel you have an exception to the rating table, contact the Human-Systems Integration Branch and the Engineering Group management for approval prior to starting your evaluation.

- (2) Other scales that can be used are provided in appendix A and include:

- (a) The Cooper-Harper scale for flying qualities ratings (figure A1).
  - (b) A 6-point general-purpose scale that can be applied to many situations like rating the ability of a given modification or ability of the human in the loop to perform a given task.
  - (c) A 5-point scale to show how much better or worse a modification may be than the original configuration.
- (3) Appendix A explains the AFFTC standards policy on how to apply the scales and the appropriate words to choose when writing your report. The key to these descriptors and scales is that consistency be maintained throughout the squadrons and the AFFTC over time. Money could be easily spent in the wrong place if the relative importance of results, conclusions, and recommendations for various modifications or weapon systems are not reported to the customer with similar and consistent verbiage. The customer should be able to understand update 'A' results compared to update 'F' results 10 years later.
- (4) Some general guidelines on providing ratings include:
- (a) If you could not meet a critical requirement, then the system should be rated unsatisfactory.
  - (b) You cannot have only marginal and satisfactory ratings and then rate the overall system unsatisfactory.
  - (c) When providing an overall rating, and there were several sub-ratings that were different (i.e., some satisfactory/marginal/unsatisfactory), then provide verbiage on how the overall rating was obtained.
- (5) Comparisons.
- (a) Be sure you have baseline data when comparing or stating an improvement.
  - (b) When comparing to baseline performance, use the terms "comparable and/or degraded" vs. "satisfactory/unsatisfactory."
  - (c) If there is no specification or a value to compare data to (i.e., no upper limit, etc.), then state how you determined what was sat/marginal/unsatisfactory and how you came up with the criteria.
  - (d) Do not rate or compare data to past performance if you are not confident in the data due to set up or sample size differences, etc., but do include the data for future reference.
  - (e) If the analysis method has changed from what was done in the past, include the data and state that the data cannot be compared. Consider analyzing the data as it was accomplished previously, and include these results for future comparison.
  - (f) When comparing or referencing specifications, be sure to cite the specification that you are referencing.
  - (g) Be sure to quantify terms like 'sometimes'...how many? 'greatly reduced' or 'quickly'...as compared to what?
  - (h) Recommendations. All recommendations must be preceded by appropriate conclusions. Recommendations indicate what needs to be done based on your conclusions. Who do you want to act? How? When?
- (6) Recommendations are written in active voice. Tell your reader what you want fixed, but not how to fix it. The word 'must' is used for health and safety issues. When using 'must' include information on the potential for harm in order to justify the degree of severity.

- (7) The recommendation always appears after your discussion as a part of the same paragraph. Recommendations are numbered sequentially in the T&E section, starting with **R1**. The recommendation number is listed after the actual recommendation and after the period. The text of the recommendation along with the (**R#**) is boldface font. The first recommendation will have a footnote to explain the general scheme for including recommendation numbers in the text (see the opening paragraph).
- (8) As mentioned in the opening paragraph, typically, the first recommendation states that all deficiencies identified under the DR system be addressed and corrected. If the report does not have a small introductory paragraph, put the DR recommendation after the first DR mentioned. Do the same with the publication change request recommendation.
- (9) Recommendations 1 and 2 (**R1** and **R2**), if made in the opening paragraph, will be referenced as each is brought up to close the loop. If there is a DR, then the DR recommendation should be included. Individual recommendations may be assigned for significant DRs. However, individual recommendation numbers need not be assigned to each DR or publication change. If more than three DRs deal with one situation, try to find a way of writing it into the text to avoid alphabet/number soup.
  - (a) All DRs and publication change requests referenced in the text must be included in an appendix.
  - (b) When referring to a DR in the text, use the last six numbers in the DR. In the DR appendix, use the complete set of report control letters and numbers as entered into the deficiency report data base (e.g., JDRS RCN FB1234-09-0100).
  - (c) DR numbers should be presented within parentheses at the end of the referenced sentence, within the period.
  - (d) DRs are written 'on' not 'against' the system or item.
  - (e) Regardless whether the DR was labeled an 'enhancement' or a 'deficiency' DR when submitted, do not differentiate in your report. A DR is a DR is a DR. Your job is to report on the DR and let the customer work out the rest.
  - (f) Annotate in the report if there are any Category I DRs.
  - (g) The rating associated with that Category I DR will always be unsatisfactory.
  - (h) Watch items (WITs) should either be closed or turned into DRs as they occur and submitted by the time the final report is written.
  - (i) If a WIT/DR is opened and then closed during testing, state that it was retested and the fix was verified.
  - (j) If DRs were closed after a PRR was provided, state that the DRs were corrected, retested, and verified as fixed.
  - (k) Do not project that if you fix all the DRs that the system will work, because the 'fix' may introduce new errors.
  - (l) Do not use contractor discrepancy tracking system numbers in place of a DR. If you want to reference a contractor document include a copy of the document(s) in an appendix.
- (10) When recommending flight manual, T.O. changes, etc., use:
  - (a) "Caution" when there is possible asset damage;
  - (b) "Warning" for a possible safety issue or the possibility of crew injury;
  - (c) "Note" for items without possibility of asset damage.

- (11) If you rate an item under test as marginal, explain why you believe the marginal rating is not significant enough if we are recommending the release anyway.
  - (12) If testing of a system, subsystem, etc., was not accomplished, recommend IOT&E NOT evaluate the system until it has been qualified, or state limitations for IOT&E. The idea is that IOT&E should not rate something the AFFTC has not tested.
  - (13) If workarounds were discovered during testing, you must close the loop – update the appropriate documentation (AFTO 22/AF 847) before you recommend a release to start operational test.
  - (14) If you recommended release in the PRR, the recommendation must be restated in the final report.
7. **Test Results Summary.** Recommended summary paragraph for longer reports to close the loop on the overall results and tie everything together for your reader. Summary includes the military utility assessment and the overall conclusion, with an accompanying recommendation to proceed, or wait until further testing is accomplished (field for OT, more DT&E needed, etc.).

### **Helpful Hints:**

- Write in Air Force terms using simple sentences. Include sufficient detail to allow the reader to clearly understand what you did and what you found.
- Minimize, if not avoid, the use of abbreviations and acronyms. If you need the acronym, spell it out the first time used followed by the abbreviation/acronym letters in parentheses. You are free to use the acronym once it is defined.
- Ensure all objectives contained in the Introduction section are discussed in the T&E section. The same goes for the specific objectives if they were used to support a general objective.
- A summary table of test results at the beginning of the T&E section is an excellent idea, especially for large reports if the tests are complex and many systems were tested. You should also include a column for the associated descriptor.
- Consider using subsections for clarity. The subsections can be organized by test phase, test type, system tested, objectives, or conclusions. Remember to clearly, logically, thoroughly, and concisely lead the reader to the conclusions. Parallel construction of each of the sections should be maintained throughout the T&E section of the report.
- When referencing results, tie them to the test item configuration or flight condition – not the flight number. Flight numbers are usually meaningless to all but you, the tester. The same will be true of flight logs – do not reference them.
- Ensure smooth integration of qualitative comments from aircrew, maintainers, or others as appropriate because they provide validation for your C&Rs. Use quantitative rating scales whenever possible (see appendix A).

- Put enough information in tables and figures so they can be easily understood. Keep the number of tables and figures to an absolute minimum in this section (i.e., those that summarize). Highly detailed and complex tables and figures belong in an appendix. Refer to the correct table and figure numbers in the text. Tables and figures should be placed in the text or on the first page AFTER the first reference to them. See the Backup Material section in this document to get the guidelines on required elements for tables and figures.
- In PRRs, list the recommendations on the briefing slide(s).
- Table 3, Mapping the Technical Report Tool, is provided to assist in the report writing process. (It is not included in the report itself.) Each column represents required information for an objective. Fill out the columns as you progress through the project. Empty blocks will clearly show incomplete areas. This will avoid comments on your report such as “How did you get to this conclusion from this result?” because you will have filled out the blocks for analyses and evaluations and included the information in the report.



AUGUST 2009

Table 3 Mapping the Technical Report Tool

Expected Results	Actual Results	Analyses	Evaluation	Conclusions	Recommendations	Military Utility
These should be from the test plan.  See if/where the actual results diverge from here.	What did you find?  What happened, etc?  Compare actual results to expected results to see if/where they diverge	How do you explain what you found or what happened?  Why did negative results happen?	What is the quality of what you found or what happened?  What was the importance of that result?	Based on that evaluation and using the evaluation scale, are the results satisfactory, marginal, or unsatisfactory as related to the objective?	If the conclusions were marginal or unsatisfactory, what do you recommend to solve the problems identified?	What is the military significance of the results obtained?

## RECOMMENDATIONS

A stand-alone recommendations section is optional for large reports with a lot of recommendations. When using this section list the recommendations verbatim from the T&E section. Also list the recommendation number and the page number where they are located within parenthesis, as in the following example:

- R1. Tabulate recommendation numbers with an R and the number in parentheses at the end of the sentence. (Page 10)
- R2. Correct the deficiencies documented in the DRs, and evaluate any modifications as a result of the corrective actions. (Page 11)
- R3. Use the list of recommendations section when you have a report with a lot of recommendations in it. (Page 12)

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## BACKUP MATERIAL

### REFERENCES

Purpose: This section identifies the sources from which information was extracted. Figure 13 shows an example of a references section.

Information Required:

<u>TYPE OF REPORT</u>	<u>REQUIRED?</u>
TR	Yes; for reports less than eight pages, an alternate format is acceptable (e.g., footnotes)
PRR	Yes; alternate format acceptable (e.g., footnotes)
TIH	Yes; for reports less than eight pages, an alternate format is acceptable (e.g., footnotes)
TIM	Yes; for reports less than eight pages, an alternate format is acceptable (e.g., footnotes)

Format: References must be listed in the order they initially appear in your report. The following are the suggested formats for the different reports:

1. For TRs, TIHs, and TIMs with less than five references, use a footnote for each reference. In the text of the report, include the appropriate footnote number after the information you extracted from that source. If you have multiple references to the same source, include a footnote number when you cite it the second time and each time after that.
2. For TRs, TIHs, and TIMs with more than five references, a separate page is placed immediately after your T&E section listing all references in the order they initially appeared in your report. You will place the complete reference title and reference number after the information is first cited in the text of the report. If you have multiple references to the same source, point to the initial citing of the reference using “(reference #).” A new reference number is given to each new reference in the order used in the report.
3. For PRRs, either format mentioned above can be used.

### Helpful Hints:

- Be careful about the distribution level of the material you are using as references. Ensure material with a more limited distribution is not included in a report with a less restricted distribution. Check with the Technical Library on the level of distribution statements.
- Do not reference classified documents in unclassified reports that are approved for public release. Avoid referencing classified documents in limited distribution unclassified reports, if possible.
- Do not reference a memorandum for record (MFR), instead talk to it and place a copy of it in an appendix.

## REFERENCES

1. Program Introduction Delta (PID) – *B-49H Software Block 02 (BSB02) Program Introduction Delta*, 10 February 2009.
2. *B-52H Software Block Upgrade 02 (BSB02)*, Test Plan (TP): AFFTC-TP-05-21, Edwards AFB, California, March 2009.
3. Jason, Donald E., *B-49H Avionics Mid-Life Installment (AMI) Avionics Integrated Systems Evaluation*, AFFTC-TR-09-10, Edwards AFB, California, August 2009.
4. O’Harry, John J., *B-49H Avionics Mid-Life Installment (AMI) Reliability and Maintainability Evaluation*, AFFTC-TR-09-17, Edwards AFB, California, September 2009.
5. Boss, Paul A., Second Lieutenant, USAF, *B-49H Avionics Mid-Life Installment (AMI) Box System Test and Evaluation*, AFFTC-TR-09-34, Edwards AFB, California, July 2009 (and an addendum to the box system report, AFFTC-TR-09-34A, December 2009).
6. Preliminary Report of Results, *B-49H Software Block Upgrade 09 Test and Evaluation*, AFFTC-PRR-09-21, Edwards AFB, California, July 2009.
7. *Hairdo Segment Specification for the B-52H Avionics Mid-Life Installment (AMI) Program*, S754-30, The Boeing Company, Wichita, Kansas, May 2009.
8. *Software Requirement Labels (SRL) for the Driving Management System (DMS)*, S754-060, The Boeing Company, Wichita, Kansas, April 2009
9. Technical Order (T.O.) 00-35D-54, *USAF Deficiency Reporting and Investigating System*, HQ AFMC/ENPM, Wright-Patterson AFB, Ohio, 1 April 2009..
10. *Gravity Box Delivery (GBD) Software Implementation Insurance Document (SIID)*, The Boeing Company, Wichita, Kansas, 12 May 2009.
11. *Interface Shoe Document, Joint Dress Miniature Attack (JDMA) To Host Box Core*, JIDC-MOA-007, The Boeing Company, Wichita, Kansas, 12 April 2009.
12. *Interface Shoe Document, Tunnel Corrected Dress Designer (TCDD) To Host Box Core*, WIKID-1506-009, Revision A, The Boeing Company, Wichita, Kansas, 13 July 2009.
13. *Interface Shoe Document, Air-Plane Standoff Missile (APSM) To Host Aircraft Paper*, JCOD-1947-012, Revision G, The Boeing Company, Wichita, Kansas, 23 February 2009.
14. T.O. 1B-49H-5 Technical Dialogue, *Basic Height Checklist and Radar Data*, Tinker AFB, Oklahoma, 1 March 2009.

Figure 13 Example Reference Section

- Correspondence and emails should also be reviewed with respect to distribution level, origin, and intent. Was the origin from a government source or a private/commercial source? Was the information intended for a DoD-only audience, U.S. Government Agencies-only audience, or public release? Always ensure the appropriate distribution statements are included in the report.
  
- Reference the AFFTC and Air Force Instruction when mentioned in your report.
  
- Reference information includes:
  1. Who – author and publishing organization
  2. What – document title and number
  3. Where – location (city, state)
  4. When – date of publication
  5. Classification level (if applicable)
  
- The following list contains possible reference types and the acceptable format for listing them. Please note that there are periods at the end of each reference and that there are almost no abbreviations; almost everything is spelled out (e.g., Air Force, Air Force Flight Test Center, California, March, etc). If a reference you use is classified, please see your technical editor for the correct procedures for placing classified references in unclassified technical reports.
  1. **Example Contractor Report Reference:**  
*Flight Test of the Production F100-PW-220 Engine in the F-16*, TIS FA1198, General Dynamics Fort Worth Division, Fort Worth, Texas, revised 2 June 1986.
  
  2. **Example of AFFTC Technical Report Reference:**  
Newell, Keith A., First Lieutenant, USAF, *F-16/F100-PW-220 Production Engine Flight Test Evaluation Volume 1 of 11*, AFFTC-TR-86-44, Air Force Flight Test Center, Edwards AFB, California, March 1987.
  
  3. **Example Prime Item Development Specification (PIDS) Reference:**  
Prime Item Development Specification for Turbofan Engine F100-PW-200, 16PRXXXX, Pratt and Whitney Aircraft Group, West Palm Beach, Florida, 14 July 1980.
  
  4. **Example Reference Manuals References:**  
Altitude Tables, 1962 United States Standard Atmosphere, Air Force Flight Test Center, Edwards AFB, California, April 1962.  
  
Performance and Flying Qualities UFTAS Reference Manual, Air Force Flight Test Center, Edwards Air Force Base, California, October 1984.  
  
DeAnda, Albert G., *AFFTC Standard Airspeed Calibration Procedures*, AFFTC-TIH-81-5, Air Force Flight Test Center, Edwards AFB, California, revised June 1981.

5. **Example Aircraft Flight Manual Reference:**  
Flight Manual, USAF Series Aircraft, F-16C, Technical Order 1F-16C-1, General Dynamics Fort Worth Division, Fort Worth, Texas, 23 July 1984.
6. **Example Book Reference:**  
Parkinson, C., Northcote, *Parkinson's Law and Other Studies in Administration*, Houghton Mifflin Company, Boston, Massachusetts, 1957.
7. **Example Journal Article Reference:**  
Carrier, G.F., "Heuristic Reasoning in Applied Mathematics." *Quarterly of Applied Mathematics*, Vol XXX, No. 1, Brown University, Providence, Rhode Island, William Byrd Press, Richmond, Virginia, April 1972, pp. 11-15.
8. **Example Contribution to Symposium or Conference Reference:**  
Brown, R.C., "Fatigue, Fact or Fiction?" Presented at the Symposium on Fatigue (eds. Floyd, W.F. and Welford, A.T.), held by Ergonomics Research Society, Cranfield, England, 24-27 March 1952, H.K. Lewis and Co., Ltd., London, England, 1953, pp. 24-27.
9. **Example Military Specification Reference:**  
Military Standard Climatic Extremes for Military Equipment, MIL-STD-210B, Hanscom AFB, Massachusetts, 15 December 1973.
10. **Example of Operating Instruction Reference:**  
AFFTCI 91-5, *AFFTC Test Safety Review Process*, Edwards Air Force Base, 1 September 2001.
11. **Example of Letter Reference:**  
See letter in appendix X dated 15 March 2001 from Joseph Engineering concerning minimum ground control speeds. (Place a copy of these letters in an appendix because official files are purged after several years and the reference will be lost unless it is provided in the report.)
12. **Examples of Electronic Source Reference:**  
Email: See a copy of the email in appendix X sent from Bob Project Manager to Joe Engineer, 1 April 2001, concerning bird strike capability of the YNEW aircraft. (Place a copy of email in an appendix because files have either limited access or are purged after several years and the reference will be lost.)  
  
Website: Government Publications, <http://bookstore.gpo.gov>, accessed 2 July 2001. (It is not a good idea to reference websites since most are updated and the information may not be available at a later date. It is best to download what you are referencing from the website and include the material in an appendix.)

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## BIBLIOGRAPHY

Purpose: The bibliography section lists additional sources of information not referenced in the text. This list will be used by the reader for further reading on your subject and is formatted like the references list, without the numbering (see figure 13).

### Information Required:

<u>TYPE OF REPORT</u>	<u>REQUIRED?</u>
TR	No
PRR	No
TIH	No
TIM	No

Format: The format of the entries will be similar to the types of entries seen in the Reference section. There is no requirement for how the list be ordered. For more information regarding bibliographies, see the following style manuals:

1. U.S. Government Printing Office, Style Manual, revised edition GPO S/N 2100-0068. U.S. Government Printing Office, Washington DC, 2000, pp. 22.
2. University of Chicago Press. The Chicago Manual of Style: For Essential Guide for Writers, Editors, and Publishers, 14th edition, 1993, Chapter 15.
3. NISO Press, An American National Standard: Scientific and Technical Reports - Elements, Organization, and Design. ANSI/NISO Z39.18-1995, March 1995, pp. 15.
4. Franklin Covey. Style Guide for Business and Technical Communication, Salt Lake City, Utah, 1999, pp. 29-30.

### Helpful Hints:

- Do not reference classified or limited distribution documents in the bibliography.
- Complete bibliographic entries include the name of the author, the title, and the full publication history (including the edition, the publisher or press, the city of publication, and the date of publication).

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## APPENDICES

Purpose: The appendix section provides an alternate place for supplemental information that clarifies or supports the report. It minimizes clutter in the report by removing potentially distracting information.

Information Required:

<u>TYPE OF REPORT</u>	<u>REQUIRED?</u>
TR	Yes; there will be an appendix for the AFFTC rating criteria (and other scales used as applicable); the list of abbreviations, acronyms, and symbols; deficiency reports (if there were DRs); and the distribution list. Otherwise no additional appendices are necessary unless supporting information is required for clarity.
PRR	Yes; there will be an appendix for the AFFTC rating criteria (and other scales used as applicable); the list of abbreviations, acronyms, and symbols; deficiency reports (if there were DRs); and the distribution list. Otherwise no additional appendices are necessary unless supporting information is required for clarity.
TIH	Yes; there will be an appendix for the list of abbreviations, acronyms, and symbols and for the distribution list. Otherwise no additional appendices are necessary unless supporting information is required for clarity.
TIM	Yes; there will be an appendix for the list of abbreviations, acronyms, and symbols and for the distribution list. Otherwise no additional appendices are necessary unless supporting information is required for clarity.

Format: Each appendix should focus on one type of information. Typically, the types of appendices included in a report are:

1. AFFTC rating criteria.
2. Detailed description of the test article, instrumentation, maintenance, and or support equipment.
3. Detailed descriptions of test or maintenance techniques.
4. Supplemental data in the form of figures, tables, and plots.
5. Mathematical analyses.
6. Deficiency reports.
7. List of abbreviations, acronyms, and symbols.
8. Distribution list.



## **APPENDIX A – DETAILED TEST ITEM DESCRIPTION**

### **WIND WILLOW EMPORIUM DISPENSER (WWED)**

Four FXXX-GE-100 engines power the B-XX. These engines were in the XX,000-pound thrust class (uninstalled, sea level static). These engines were, dual rotor, mixed flow, and nonaugmented turbofans. The compressor section was comprised of a XXX-stage fan with variable angle inlet guide vanes and a nine-stage high-pressure compressor with four stages of variable stator vanes. A single-stage, high-pressure turbine drove the compressor and a two-stage turbine drove the fan. Aircraft accessory power output and starter power input were provided through a single power takeoff shaft on the engine gearbox.

Two engines were imbedded in each intermediate wing section. The two left engines (numbers 1 and 2) and the two right engines (numbers 13 and 14) shared a common inlet and exhaust. Each inlet incorporated two engine-auxiliary inlet doors on the top of all inlets, which supplied additional cooling to the aircraft engines during ground, takeoff, and landing operations. The auxiliary inlet doors were hydraulically operated. Direct air flowed into the short duct section immediately upstream of each engine back.

The primary throttles provided main electronic control. Each aircraft had five throttle quadrants. The throttles were mechanically linked together and were used to select power setting between idle and maximum thrust. The engine start and stop circuitry controlled a thrust actuator on each engine between idle and cutoff, sensors contained in the right-side throttles were designed to provide secondary electrical control of the engine thrust actuator in the event of primary throttle failure.

### **WGLD VARIANTS**

#### **WGLD CU-10318 (Combined Effects):**

Two engines were imbedded in each intermediate wing section. The two left engines (numbers 1 and 2) and the two right engines (numbers 13 and 14) shared a common inlet and exhaust. Each inlet incorporated two engine-auxiliary inlet doors on the top of all inlets, which supplied additional cooling to the aircraft engines during ground, takeoff, and landing operations. The auxiliary inlet doors were hydraulically operated. Direct air flowed into the short duct section immediately upstream of each engine back.

#### **CU-1015 (Gator):**

The primary throttles provided main electronic control. Each aircraft had five throttle quadrants. The throttles were mechanically linked together and were used to select power setting between idle and maximum thrust. The engine start and stop circuitry controlled a thrust actuator on each engine between idle and cutoff, sensors contained in the right-side throttles were designed to provide secondary electrical control of the engine thrust actuator in the event of primary throttle failure.

A-1

Figure 14 Example Appendix Cover

There is no required order or number of appendices, other than the last appendix is the distribution list. Typically, the second to last appendix is the list of abbreviations, acronyms, and symbols. A required order does not work for every report. It is suggested, however, that the order follow the report (e.g., Appendix A – Detailed Test Item Description; Appendix B – AFFTC Rating Criteria; Appendix C – Special Procedures or Techniques; Appendix D – Data [in plot and table format]; Appendix E – Analysis Techniques; Appendix F – DRs and/or Publication Change Requests, etc.).

Consider the reader when putting the information in order. It may be more user-friendly to have the data in appendix A because you require more flipping back and forth to support the C&Rs. You may not want to include a section for test techniques or maintenance procedures if they were not new. But, then again, you may want to document what was done because you tested a system or used a technique that has not been performed in 30 years and you want to be a better source for someone trying to perform the same test 30 years from now.

The information to be included in an appendix is a judgment call as are the exact types and amounts of data presented. As a minimum, data should be sufficient to substantiate the analyses and conclusions. One hundred percent of the data should not be included unless there is a firm requirement to do so. Your customers will not need or want more than the minimum amount of data to substantiate their decisions. Work with your RIPT to help draw the boundary lines.

### **Helpful Hints:**

- Be careful about the distribution level of the material you are using as references. Ensure the material with a more limited distribution is not included in a report with a less restricted distribution.
- Consider including a table of contents and headings in each appendix if they enhance the presentation and readability/usability. In the case of an appendix containing DRs, include a list of DR control numbers, dates and titles if more than approximately 10 DRs are included; the same rule applies for publication change requests.
- Do not include flight logs.
- Test point matrices are not normally contained in appendices. However, if they are included, they must be tied to the results in your report.
- Acronyms, abbreviations, and symbols are not required to be defined in tables, figures, or plot notes, but they will be included in the acronym list in an appendix of the report. There should be a note directly below the table/figure referring the reader to the appropriate appendix for definitions. Note: When there is room in a table, define or spell out the abbreviations or acronyms whenever possible. This adds clarity for the reader.
- Figures (illustrations, photos, plots, etc.) and tables must be easily understood (i.e., all information necessary to understand the depiction should be included and not implied). Use a consistent layout. Check and cross-check data points and tabular data. Label axes properly (do not use measurand numbers as the label; use the title of the measurand). Delete obvious wild points. Do not be afraid to label, label, label! Avoid the use of flight numbers. They are not an independent variable and are meaningless to all readers. Tables 4 and 5, and figures 15 and 16 show samples of tables and figures.
- Be consistent with the use of initial capitalization throughout the tables and plots presented in the report.

Table 4 Example Portrait Pagination Table

Weapon Location	Parameter	Required Value	Demonstrated Values		Evaluation
			Value	Time (sec)	
GBU-31 FWB-3	Store in IBIT	11T-4 [6] = 1	1	85459.8	Satisfactory
	Store not in IBIT	11T-4 [6] = 0	0	85479.8	
	Critical Hardware Passed	11T-2 [1] = 1	1	85479.8	
	Minimum TDS received	11T-2 [1] = 1	1	85481.2	
	Warm-up Complete*	11T-2 [1] = 1	1	85608.5	
	Minimum TXA Received	11T-2 [3] = 1	1	85608.5	
	Safe to Release	11T-2 [8] = 1	1	85608.5	
	Last BIT Passed	11T-2 [7] = 1	1	85479.8	
	Minimum GPS Data Received	11T-2 [6] = 1	1	85483.4	
	TXA Good	11T-2 [5] = 1	1	85737.5	
	All-up Round (AUR) Ready	11T-2 [4] = 1	1	85737.5	
	Sim Release Mode (Test Control not Valid)	22R-6 [9] = 1 (22R-2 [0] = 0)	1 (0)	87487.2	
	JDAM Status Shows Sim Release Mode	Prior to RC	-124 ms	87487.3	
		22T-10 [9] = 1	1**		
	Release Consent (RC) Received	22T-2 [9] = 1	1	87487.5	
	Command Commit to Separate Store (CTS)	11R-4 [2] = 1	1	87487.6	
	JDAM Status Shows CTS	> 20 ms after CTS	+34 ms	87487.6	
		22T-2 [10] = 1	1		
	Declare Committed to Store Separation (CTSS)	~ 900 ms after CTS	+908 ms	87488.5	
		11T-4 [2] = 1	1		
Send Air Data Message (Last 15R Message)	< 5 sec before RLS	-0.225	87488.9		
Weapon Data Pump Indicates Release (RLS)	~ 1 sec after CTS**	+1.512	87489.1		

Notes: 1. Acronyms in this table are defined in appendix (insert appropriate letter).  
2. All notes here apply to entire table.

\*An asterisk can be used to identify special information in one cell.

\*\*A double asterisk can also be used to identify special information in one cell.

AUGUST 2009

Table 5 Example Landscape Pagination Table

Avionics Location	Global Positioning System (GPS)				22T Received Indications						
	Info Sent	Day	Month	Year	Time (sec)	Almanac (sec)	Ephemeris (sec)	AS/SV (sec)	Minimum GPS (sec)	Weapon Release (sec)	Evaluation
JSO FWB-2	Yes	11	1	2005	81220.0	81255.5	81268.5	DNO	DNO	84816.4	Satisfactory
JSO FWB-8	No	11	1	2005	81201.0	81223.5	81236.5	DNO	DNO	84837.8	
JAM FWB-4	Yes	11	1	2005	88232.8	90751.4	91721.6	DNO	90751.4	91738.1	
JASS FWB-6	Yes	11	1	2005	88255.9	88211.4	91718.7	DNO	90747.5	91777.9**	
GBX MWB-D11	Yes	12	2	2006	88212.9	90726.1	88212.9	DNO	88216.5	91719.3	Satisfactory
GBX MWB-C21	Yes	12	2	2006	88213.0	90724.9	88213.0	DNO	88217.6	91719.3	
GBX MWB-D21	No	12	2	2006	88213.1	90723.2	88213.1	DNO	88217.7	91719.4	
GBX AWB-2	Yes	23	3	2007	50725.4	50730.4	50728.9	50726.2	50730.4	58650.0	Satisfactory
GBX AWB-4	Yes	23	3	2007	50725.5	50734.1	50733.1	50733.1	50731.1	59633.0	
GBX FWB-D11	Yes	23	3	2007	50725.4	50730.5	50729.1	50726.2	50730.5	58644.5	

Notes: 1. Acronyms in this table are defined in appendix (insert appropriate letter).  
2. All notes here apply to entire table.

\*An asterisk can be used to identify special information in one cell.

\*\*A double asterisk can also be used to identify special information in one cell.

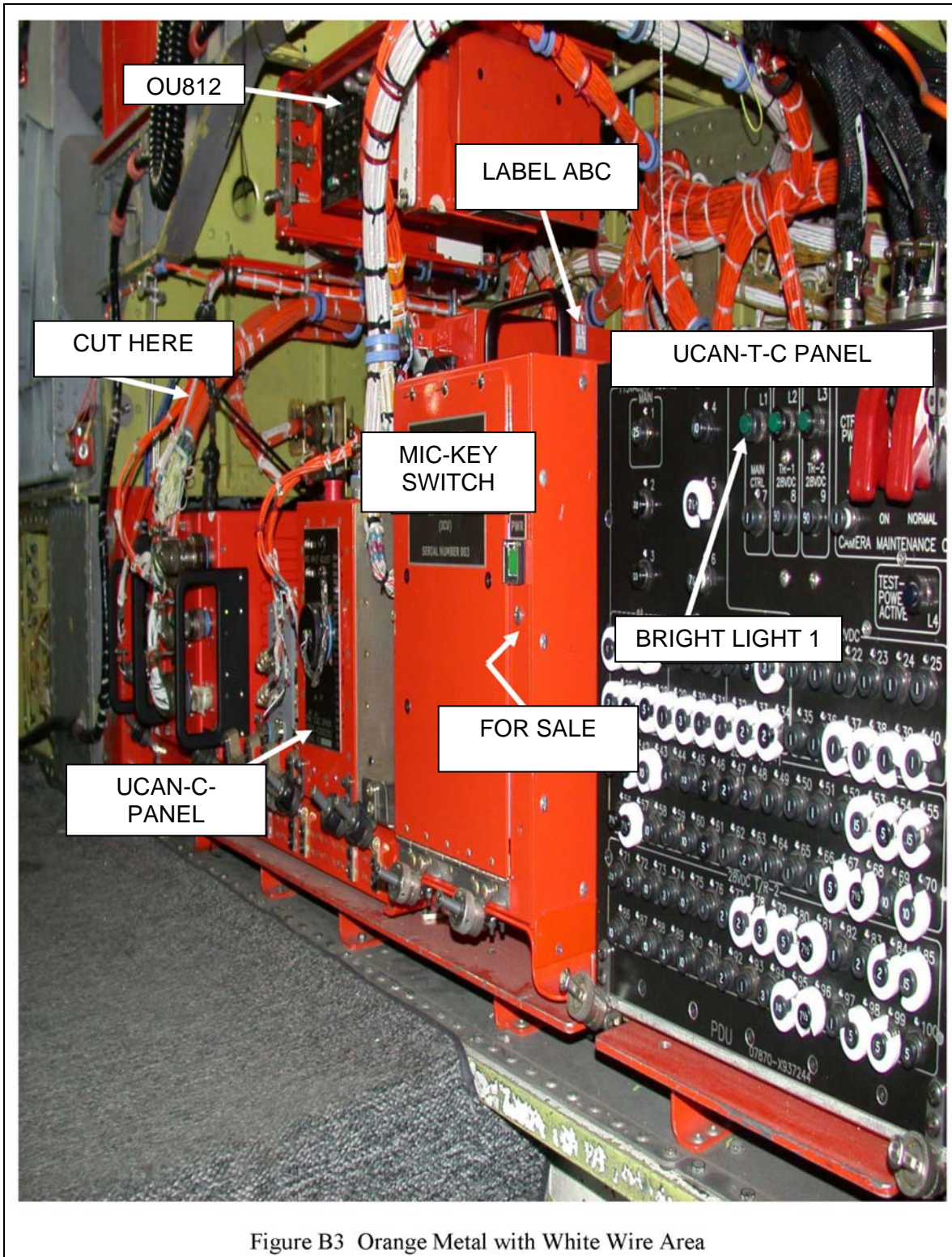


Figure B3 Orange Metal with White Wire Area

Figure 15 Example Portrait Figure



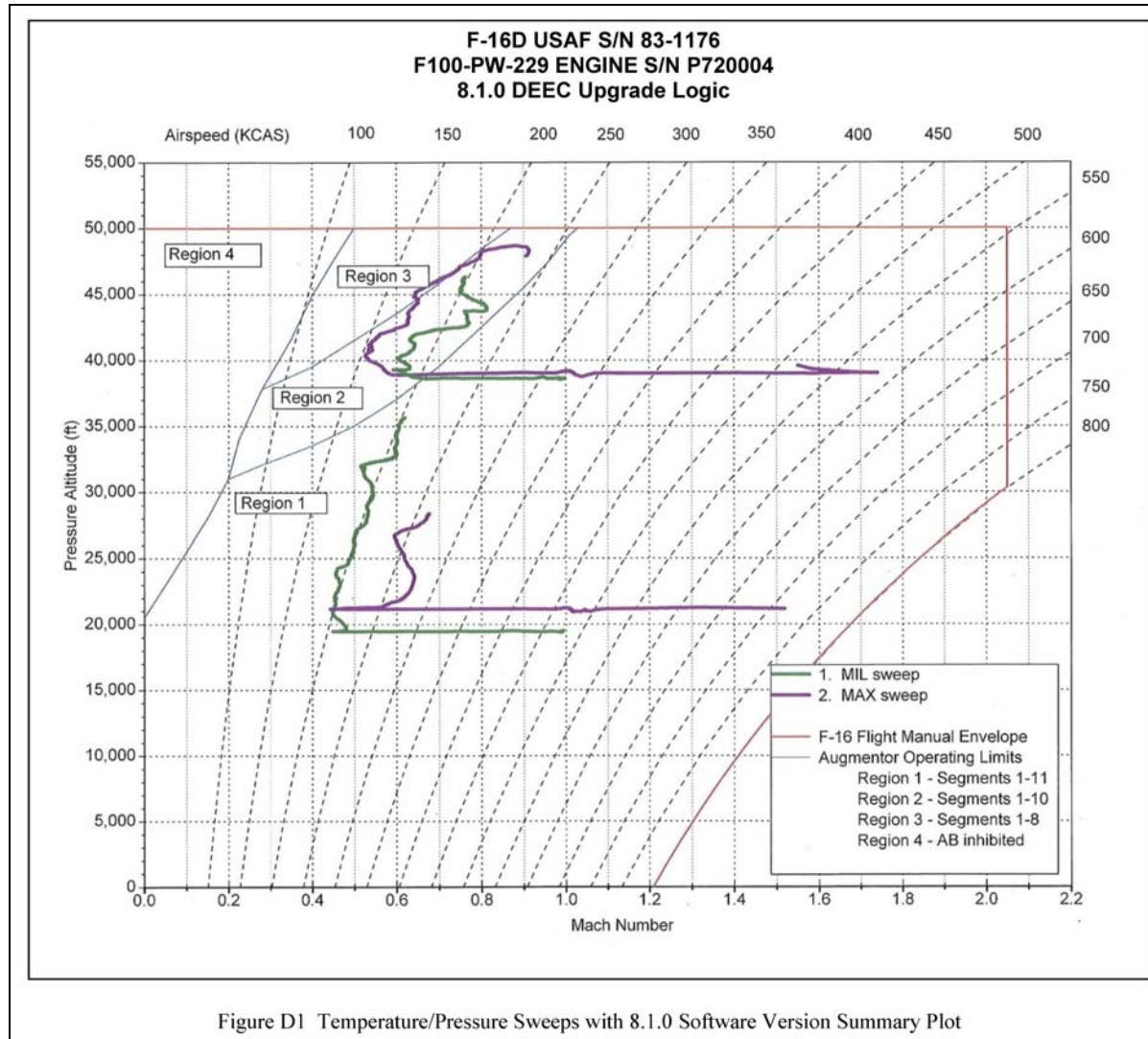


Figure 16 Example Landscape Figure

- ☑ When tabulating or plotting test results, use actual flight conditions, not aim conditions specified in the test plan.
- ☑ All figures (i.e., photos, illustrations, drawings) or tables that are used in a report that were extracted from an already existing document (i.e., T.O.s, manuals, contractor documents, etc.) must contain a reference number on the illustration stating where it was extracted from. See following example.

Extracted from reference X

1. Tables (see table 6)
  - a. Table numbers and titles are centered at the top of the table.
  - b. Use standard headings and be consistent.
  - c. Parameters that do not change or that apply to the entire table should be in the heading, typically listed in parentheses under the title.
  - d. Use standard unit abbreviations (e.g., ft, kt, etc.)
  - e. Fill in all spaces/cells of a table; use “Not Applicable (N/A)” or “---” if necessary.
  - f. Use only enough significant digits to make your point. Never use more significant digits than are justified by the resolution and accuracy of your instrumentation system. All decimals in a given column should be rounded to the same number of significant places with the decimal points aligned. Add trailing zero(s) as necessary to show consistent levels of precision. Use a zero in front of a decimal (e.g., 5.0, 0.82).
  - g. Notes are listed under the table and are applicable to the whole table.

Table 6 Use a Descriptive Title so Reader Understands the Data in the Table

Column Headings	Times New Roman	11 pt	Centered	Vertical Cell Alignment Bottom
Cells should be merged and vertically centered <sup>1</sup>	Cells should be merged <sup>1</sup>			
	n/a	0.10 <sup>2</sup>	n/a	n/a
	n/a	2.00	n/a	n/a
	n/a	0.32	n/a	n/a

- Notes:
1. Notes section should align with edge of table
  2. Table text and notes: Times New Roman, 11 pt (can be smaller to fit)
  3. Table footnotes: 8 pt (or two sizes smaller than table text if table text is smaller than 11 pt)
  4. Table footnote line 0.75 width, 1.5 inches long
  5. Acronyms are defined in the list of abbreviations, acronyms, and symbols.

<sup>1</sup>Cells should be merged and vertically centered as needed.

<sup>2</sup>Numbers should be decimal aligned.

2. Figures (plots, including strip charts).
  - a. Figure numbers and titles are centered at the bottom of the illustration.
  - b. Use standard headings and be consistent. Headings should include information that is the same for all data presented (i.e., aircraft and engine serial numbers, flight condition, software load, etc.).

- c. Parameters that do not change or that apply to the entire plot should be in the heading, typically included within parenthesis below the heading.
  - d. Use standard unit abbreviations (e.g., ft, kt, etc.).
  - e. Use standard symbols (e.g., ⊙, □, ◇, △, ▲). Keep 'like' data symbols consistent between plots (e.g., all 10,000-foot data use an ⊙). Include a symbols legend that fully explains each symbol.
  - f. Do not run data past scales, scales past numbers, or fairings past data (unless it is an extrapolation, in which case make the extrapolation fairing dashed).
  - g. Fair the data whenever possible. Do not "connect the dots" with straight-line segments.
  - h. When you have large numbers of plots that are nearly identical, box important differences, e.g.,  

25,000 ft
  - i. Put identifiers on complex fairings or fairing families (label, label, label!).
  - j. Make the scales easy to read and interpret (smallest division should be a multiple of 1, 2, or 5, 10, 20, 50, 1,000, 2,000, 5,000).
  - k. Use the same scales for each plot in a series or family of plots.
2. Photographs
- a. Figure numbers and titles are placed at the bottom of the photograph regardless of layout orientation.
  - b. Use color photographs to illustrate a point. Climatic laboratory and other all-weather technical reports require color photographs to clearly display areas of ice buildup and water entrapment. Another example would be cockpit pictures where the color of warning gauges are important.
  - c. Use callouts (labels) to bring attention to significant parts of your photographs (label, label, label!).



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## LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS

Purpose: To act as a decoder ring for the people not in-the-know on your system.

Information Required:

<u>TYPE OF REPORT</u>	<u>REQUIRED?</u>
TR	Yes
PRR	Yes
TIH	Yes
TIM	Yes

Suggested Format: The abbreviations, acronyms, mnemonics (combination of words into letters), and symbols to be included in this list are ones that have been used in your report. Define acronyms at first use beginning with the introduction section of your report. You do not need to redefine them in other sections of the report, or in the appendices associated with your report unless they are presented under separate cover. All abbreviations, acronyms, and symbols used in the report must be included in the list, even the ones that are not required to be defined per appendix D.

Note: The Author's Guide does not include a separate list of the abbreviations, acronyms, and symbols used in it as would normally happen in a document, but are instead defined in the text or in Appendix D, which provides the best example for formatting the list of abbreviations, acronyms, and symbols in your report.

Things to include are:

1. System-specific acronyms and mnemonics (e.g., EGT for exhaust gas temperature or RMAX for maximum range)
2. Common units of measurement abbreviated in tables and figures always spelled out in the text
3. Symbols in tables, figures, or equations used in the text

Appendix D provides a master list of abbreviations, acronyms, and symbols that are commonly used. Those listed do not have to be defined when first used but will be included in the report's list in the appendix in order to help the reader.

The list should be compiled and in alphabetical order (regardless of capitalization) as follows:

1. Capital letters and lowercase letters precede Greek letters
2. Superscripted and subscripted terms are treated as horizontal letters
3. Abbreviations and acronyms with special symbols (i.e., periods, &, /, etc.) are listed in alphabetical order as if no special symbol was included
4. Numbered subscripts follow in order

Order your acronyms per the following example:

C	Centigrade or Celsius
c	length of the mean aerodynamic chord
CAD	computer aided design
cc	cubic centimeters
$C_L$	coefficient of lift
C.O.	carry-over
c/o	checkout
$C_1$	rolling moment coefficient
$C_{1/2}$	number of cycles to damp to half amplitude

**Helpful Hints:**

- Try to minimize the use of abbreviations and acronyms in the report as a consideration to the reader.
- Define acronyms at first use in the verbiage. Always attempt to spell out the acronym in tables and figures. If you cannot, refer your reader to the appendix for the abbreviations, acronyms, and symbols.
- If you did not spell out common units of measurement throughout your report, go back and do it. Words commonly missed: feet, pounds, Mach number, degrees, etc. See appendix D for acceptable abbreviations, if allowed at all.
- Do not use an acronym, abbreviation, or symbol if it is only used once in the report unless the abbreviation is more recognizable than the spelled-out version, (e.g., TACAN or radar).
- Check your plural and possessive forms of abbreviations, acronyms, and mnemonics. A possessive is formed by adding “’s” and the plural by adding “s”. For example, system group is defined as SG, the possessive as SG’s, and the plural as SGs. It is not a hard rule but often violated by report authors.

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1. AFFTC-TIH-02-01, *The Author's Guide to Writing Air Force Flight Test Center Technical Reports*, Air Force Flight Test Center, Edwards AFB, California, January 2002.
2. AFFTCI 99-3, *AFFTC Technical Report Program*, Air Force Flight Test Center, Edwards AFB, California, August 2009.
3. DODD 5230.24, *Distribution Statements on Technical Documents*, 18 March 1987.
4. AFI 61-204, *Disseminating Scientific and Technical Information*, 27 July 1994.
5. ADA423966, *A Reference Guide for Marking DoD Documents*, Department of Defense, Washington, DC, July 2004. Defense Technical Information Center, Ft Belvoir, Virginia 22060-6218.
6. Technical Order (T.O.) 00-35D-54, *USAF Deficiency Reporting, Investigation, and Resolution*, 558 CBSS/BGHA, Tinker AFB, Ohio, 1 May 2007.
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A list of approved reports separated by discipline for excellent examples of good writing.

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#### **ENFH – Human Systems Integration:**

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2. Hansen, Brenda, *C-17A Interior and Exterior Combat Lighting Test and Evaluation*, AFFTC-TR-07-06, Edwards, California, February 2007.
3. Zahn, Otto, *F-35 Chemical/Biological (C/B) Decontamination Environmental, Safety and Health (ESH) Test*, AFFTC TR-06-31, Edwards, California, December 2006.

#### **ENFR – Reliability and Maintainability Integration:**

4. Avis, Dan, *CV-22 Aircraft System Reliability, Maintainability, and Testability Developmental Test and Evaluation*, AFFTC-TR-08-15, Edwards, California, April 2008.
5. Benequiz, Dario, and Brent Poulson, *B-2A Reliability and Maintainability Developmental Test and Evaluation*, AFFTC-TR-95-72, Edwards, California, August 1996.

#### **ENFS – Structures:**

6. Besson, Micah, *F-22A Controlled Sink Rate Landing Test and Evaluation*, AFFTC-TR-08-39, Edwards AFB, California, February 2009.

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## APPENDIX A – DESCRIPTOR TERMS AND RATING SCALES

There are standard types of descriptors and rating scales used at the AFFTC: (1) The AFFTC Rating Criteria (table A1) is used to help you decide the rating based on whether or not the system met the requirements of the mission or task and the level of changes that are recommended for improvement. This is the most commonly used scale; (2) The Cooper-Harper scale is used for flying quality rating assessments; and (3) The 6-point and 5-point general purpose scales are used when the AFFTC rating criteria or Cooper-Harper ratings are not applicable.

The intent of these rating scales is to provide consistency in the individual and overall ratings of systems under test. It is important that there be consistency between squadrons, and between various projects within a squadron, in the use of descriptors and explaining the magnitude of the 'satisfactory' or 'unsatisfactory' situation. Words to describe update 'A' should be consistent with update 'F' 10 years later.

If your test does not benefit from any of the scales discussed in this handbook and you are required to create a different rating scale, consult and obtain approval from the Human Systems Integrations Branch and Engineering Group, the experts in rating scale development, prior to beginning your evaluation.

### AFFTC RATING CRITERIA

**Overall Rating:** The overall rating of a system under test is based on its ability to accomplish the mission or how well the system meets 'critical' requirements. The accomplishment of specific tasks within a mission or a single mode does not necessarily get an overall rating. You may address individual ratings as you deal with each objective and criteria in the T&E section of your report, but it will not necessarily be an overall rating. Attempting to average these individual ratings to arrive at an overall rating is not advised. Review the results and the work to come up with the overall rating and include the rationale in the report.

It is AFFTC policy that when drawing formal conclusions regarding the overall adequacy of a system under test, only the terms satisfactory, marginal, or unsatisfactory are used. If you look at the rating criteria, (table A1), you will notice that there are degrees of satisfactory and unsatisfactory and an associated descriptor to use in your report to describe the rating. The following are guidelines on how to use the ratings as they apply to your system:

**Satisfactory.** In discussing degrees of satisfactory, at the high end of this category, 'excellent' conveys a meaning of 'exceeds requirements.' There are no changes recommended for improvement and no mission/task impact.

The middle range of the satisfactory category uses the descriptor 'good' and conveys a meaning of 'meets all or a majority of the requirements.' The mission/task impact is negligible, and thus any recommended changes fall in the category of negligible changes needed to enhance or improve operational test or field use.

The lowest range of the satisfactory category, approaching the Marginal category, uses the descriptor 'adequate' and conveys a meaning of 'some requirements met; can do the job, but not as well as it could or should.' There is minor mission/task impact. Recommended changes fall in the category of 'minor changes needed to improve operational test or field use.'



Table A1 Air Force Flight Test Center Rating Criteria

How Well Does the System Meet Mission and/or Task Requirements?	Changes Recommended for Improvement	Mission/Task Impact	Descriptor	Rating
Exceeds requirements.	None	None	Excellent	Satisfactory
Meets all or a majority of the requirements.	Negligible changes needed to enhance or improve operational test or field use	Negligible	Good	Satisfactory
Some requirements met; can do the job, but not as well as it could or should.	Minor changes needed to improve operational test or field use	Minor	Adequate	Satisfactory
Minimum level of acceptable capability and/or some noncritical requirements not met.	Moderate changes needed to reduce risk in operational test or field use	Moderate	Borderline	Marginal
One or some of the critical functional requirements were not met.	Substantial changes needed to achieve satisfactory functionality	Substantial	Deficient	Unsatisfactory
A majority or all of the functional requirements were not met.	Major changes required to achieve system functionality	Major	Unacceptable	Unsatisfactory
Mission not safe.	Critical changes mandatory	Critical	Unsafe	Failed

**Marginal.** Of all the words used in table A1, marginal is the most controversial and has the greatest variability of meaning between individuals when applied to a system under test. Typically, the term marginal is used when the collective wisdom of the test team cannot clearly call a system under test satisfactory or unsatisfactory. Or it is used when some items are satisfactory and others are unsatisfactory such that a minimum level of acceptable capability and/or some noncritical requirements are not met. If you use the term marginal, clearly convey to the reader the context in which you are using it so he or she understands the concerns with the system. If some requirement deemed ‘critical’ by the test team is not met, the overall rating will be unsatisfactory.

**Unsatisfactory.** In discussing degrees of unsatisfactory, the descriptor ‘deficient’ implies a system that does not meet one or some critical functional requirements and there is substantial mission/task impact. Recommended changes would be in the category ‘substantial changes are needed to achieve satisfactory functionality.’

For systems that are more severely deficient, the descriptor ‘unacceptable’ conveys a meaning that the system does not meet a majority or all of the functional requirements. With major mission/task impact, the recommended changes would be in the category of ‘major changes are required to achieve system functionality.’

**Failed.** The descriptor ‘unsafe’ forms the negative extreme. The mission is not safe and the mission/task impact is critical. Recommendations associated with this category fall in the ‘critical changes mandatory’ classification.

Remember to apply some common sense when using these ratings. If you found that one of the criteria you had in your test plan changed, needed to be better defined, or was unrealistic, be reasonable on the overall and individual assessments. For example, if the test plan said engine start should take no

longer than 60 seconds but you find the starts were 61 seconds long, your result is not necessarily marginal or unsatisfactory if the overall system mission could absorb 1 second more of start time.

### COOPER-HARPER SCALE

This scale is used to rate the handling qualities of an aircraft based on data and pilot comments. It is standard for its intended purpose. Modified Cooper-Harper scales are not considered standard and should not be used. Figure A1 shows the Cooper-Harper rating scale:

The Cooper-Harper rating is arranged to make the pilot make three sequential decisions:

1. Is the aircraft controllable?
2. Is it acceptable?
3. Is it satisfactory?

When these decisions have been made, the aircraft handling qualities will be assigned to one of four categories, and further resolution is made within each category depending on the pilot compensation required. Table A2 lists the four categories and where they fall on the scale.

### COOPER-HARPER RATING SCALE

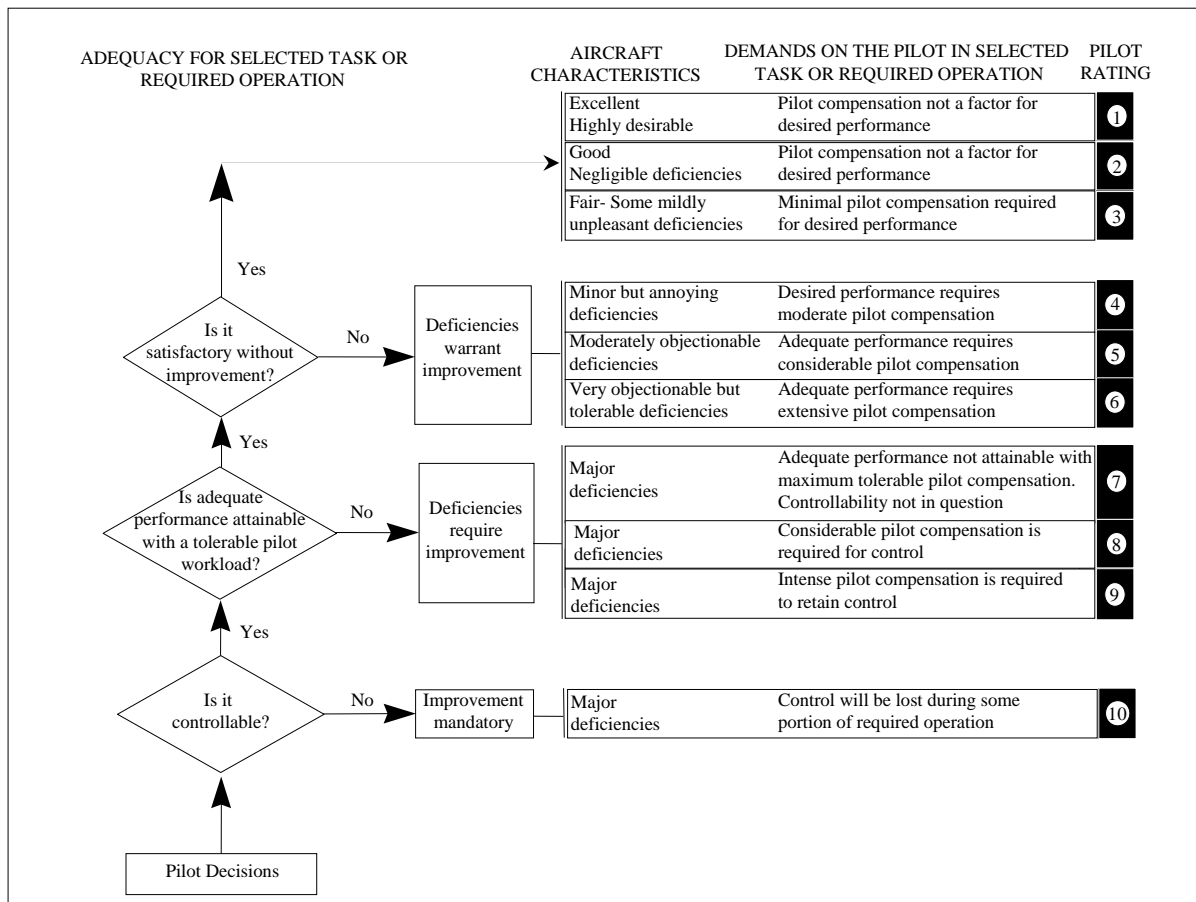


Figure A1 Cooper-Harper Rating Scale

Table A2 Aircraft Handling Quality Categories

Category	Description	Scale
Satisfactory	Good - Does not need improvement	1 - 3
Unsatisfactory but Acceptable	Can do the mission but improvements desired	4 - 6
Unacceptable	Not suitable for the mission, the task cannot be repeatedly performed	7 - 9
Uncontrollable	While attempting to perform the task, control of the aircraft was temporarily lost	10

The Cooper-Harper scale should be used in conjunction with pilot comments. The pilot comments will help you discover and isolate the aircraft control system deficiencies. This scale should not be used for anything else other than flying qualities testing. Consult the Performance and Flying Qualities Flight for more guidance on how to apply this scale and incorporate pilot comments into a proper handling qualities rating.

### THE SIX-POINT GENERAL PURPOSE SCALE

The AFFTC general rule is that the 6-point scale be used as opposed to the 5-point scale. There will be exceptions, and the scale experts should be contacted if an alternate scale is required.

The 6-point general purpose scale can be applied to many situations. It is typically used to rate the ability of a given modification, piece of hardware, or subsystem to support a given mission or given task. It can also be used to rate the ability of the human in the loop (pilot, crew chief, maintainer) to perform a given task or achieve the desired level of performance (roughly equate this to grading students on an exam). The numbers used in this scale are used to convert subjective data into some kind of a numerical database for statistical analysis or graphical presentation and usually come from a questionnaire that is used to solicit aircrew or maintainer opinions. The following list is the significance usually assigned to the 6-point spread:

- 6 - very satisfactory
- 5 - satisfactory
- 4 - marginally satisfactory
- 3 - marginally unsatisfactory
- 2 - unsatisfactory
- 1 - very unsatisfactory

### THE FIVE-POINT GENERAL PURPOSE SCALE

The 5-point scale is one exception, and not the only one, to the 6-point scale. This scale is generally used to show how much better or worse a given modification is than the original configuration. The following list is the significance usually assigned to the 5-point spread:

- 5 - much better
- 4 - better
- 3 - about the same
- 2 - worse
- 1 - much worse

Do not attempt the construction of a questionnaire or rating scale without first consulting the Human Factors engineers (Human Systems Integration Flight) who have studied the subject in considerable depth.

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## APPENDIX B – WRITING STYLES AND FORMATTING

This section describes the AFFTC technical writing and formatting styles. The writing style section is designed to help start you on the right foot by explaining the right voice, tense, grammar, and writing techniques. The procedures section is designed to guide you through the technical reporting process to get your report approved and to the customer.

These two sections of appendix B are dedicated to commonly asked questions and the most frequent changes authors have had to make.

### WRITING STYLE

#### Voice:

There are two types of voices report writers use: active and passive. When the subject of the verb is the doer of the action, the verb is said to be in the active voice (e.g., “The aircraft stalled at 78 KIAS in the power approach configuration”). When the subject of the verb receives the action, the verb is said to be in the passive voice (e.g., “The airplane was stalled by the pilot.”)

Military documents tend to be written in the passive voice. You will find that sentences in easy-to-read books, magazines, and letters tend to be more active voice. There are advantages to both when writing a report. Active voice sentences reach out to the reader, and you can get to the point quickly with active verbs and fewer words. Passive verbs, on the other hand, allow the writer to focus on the test item and not the actor. Passive verbs can allow for smoother transitions between sentences and paragraphs. Be forewarned, though, that passive voice sentences tend to get wordy, long, and roundabout to the point where they can ‘muddy’ your point. Too much passive voice sounds like a bureaucratic lawyer-type writing and loses the reader. The best report writers find a balance between the two voices.

#### Tense:

Verb tense is one of the common mistakes in writing technical reports. When you write the report, keep in mind that the test is over and now in your past. The report is now historical in nature, and will be written in past tense. Your test item description will also be written in past tense because the results of your testing may start to drive configuration changes (e.g., “The system tested was a B-52 with...”).

The only things that will be in present tense are any references you make to other sections of the report (e.g., “Appendix X contains a detailed description of the test aircraft instrumentation.”), titles of DRs, and recommendations.

**Easily Confused Words:**

Many writers and speakers confuse some words. The dictionary is not always clear-cut and adds to the confusion. Here is a small list of some easily confused words. Be on the lookout for others.

Datum	always singular, never plural
Data	always plural, never singular
Affect	verb, to influence or feign
Effect	noun, result; verb, to bring about
All ready	everyone is prepared
Already	adverb, by specific time
Amount	quantity that cannot be counted or measured in units
Number	quantity that can be counted and measured in units
Beside	preposition, next or near
Besides	adverb, in addition; preposition, addition to
Capitol	e.g., Washington D.C.
Capital	refers to the type of letter used
Ensure	to make sure or certain
Insure	take out or issue insurance on
Farther	expresses distance
Further	expresses degree
Fewer	refers to numbers, countable items
Less	refers to mass, items that cannot be counted
Hangar	where airplanes are parked
Hanger	upon which clothes are hung
Imply	to hint at or suggest
Infer	to draw conclusions based on evidence
Principal	adjective, first or foremost; noun, main person or thing
Principle	noun, precept or idea
Then	adverb, used to indicate a particular time in the past or present
Than	used after comparative adjective or adverb to introduce second element of a comparison
Verses	stanza as in a song
Versus	as opposed to

## GRAMMAR 101

### Paragraphs:

Paragraphs are the primary vehicles to develop ideas and to keep one unit of thought from another unit. The guiding principle is to develop one main idea in each paragraph. The generic structure of a good paragraph is:

**Topic sentence:** The topic sentence expresses the main idea of your paragraph and gives you a point of focus for supporting details, facts, figures, and examples. It prepares your readers for your supporting information.

**Supporting information:** Supporting information supports the topic sentence only. Strive for short paragraphs of four to seven sentences. If you follow this practice, you will likely develop easy to read paragraphs.

**Concluding sentences:** These sentences provide closure for the paragraph's topic but also flow into the next topic sentence.

Try to break your information down into smaller paragraphs as a convenience to your reader. One long paragraph can be a sign that you did not put one thought out at a time to the reader. A long drawn out paragraph usually puts a lot of confusing information in one place. Do not do this! Your goal is to 'paint the reader into a corner' to understand the validity and importance of your conclusions and recommendations. Each paragraph is a brush stroke in that direction.

Limit the use of one-sentence paragraphs to only those items that require special emphasis.

### Sentences:

Sentences always have a subject and a verb. They always start with a capital letter. Please ensure that what you use are sentences and not phrases. Other guidelines for sentences are:

**Use everyday words:** Avoid big words when small words will do.

**Be clear:** If you are having trouble describing something on paper, say it out loud to a peer. If he or she understands what you are saying, your meaning is clear. Use the same words you said out loud in your report.

**Be concise:** Only give the reader the ideas they need with no more words than necessary to get your point across. No fluff, please!

**Be precise:** There are many words in the English language that have multiple meanings. After writing something, ask yourself if your words can be interpreted in a manner other than you intended. If so, select more specific words or phrases so your meaning is not misinterpreted. Some bad examples: "The car hit the deer in spite of its flashing lights and blaring horn" and "Lead-lined coffins termed health risk."

Do not start sentences with common abbreviations, acronyms, or with Arabic or Roman Numerals.

Separate numbers and units ( e.g., 5 hours).

Use conjunctions rather than slashes (/).

Hyphenate unit modifiers (e.g., the 50-foot radius, the 3-mile sector).

When defining abbreviations or acronyms, capitalize proper nouns only (e.g., Armament Division [AD], but not line replaceable unit [LRU]).

Consider using lists to improve the readability of a long sentence. This will help the reader follow your train of thought. There are several methods to write lists correctly into the text. There is no AFFTC-preferred method for writing lists, but you should always use the same style throughout your report for consistency.

The first method is the vertical list with an introductory element and no punctuation. For example:

The following hardware was removed from the aircraft:

1. ejection seat
2. windshield wipers
3. cigarette lighter

Notice a colon was used to start the list, the list items all start with lowercase letters, and there are no commas after the list items or a period at the end of the would-be sentence.

The second method is the vertical list that reads as a sentence because it has punctuation. For example:

The hardware removed from the aircraft for maintenance was

1. the ejection seat,
2. the windshield wipers,
3. the cigarette lighter, and
4. the throttles.

Notice there is no colon to start the list, all of the items start with a lowercase letter, and there are commas after each list item except the last item where there is a period.

A third method for listing items is enumeration. For enumerations, it is preferable to list each item on a line of its own like an outline. For example:

The hardware was removed from the aircraft due to the following deficiencies:

1. The ejection seat for failed initiators
2. The windshield wipers for new blades
3. The cigarette lighter to comply with new Air Force standards
4. The throttles for excessive friction

Notice there is a colon used to start the list, each item is numbered, each item is syntactically part of the sentence, there is no punctuation at the end of each item, and all items begin with a capital letter.

A fourth way for listing involves the semi-colon. For example:

The committee considering engineers for promotion decided that

1. Engineer A was as good as engineer B;
2. Engineer B was better than engineer C;
3. Engineer Dee would get the job because the other three were just letters.

Notice that each item is separated by a semi-colon, and the last item ends with a period.

## **EDWARDS TECHNICAL REPORT WRITING 101**

The following list contains other things to look for in your technical report. This list is based on commonly made comments to reports.

1. Spell out common units of measure in the text of the report such as feet, pounds, inches, degrees, miles, etc., but abbreviate in tables and plots.
2. Be consistent in the use of descriptor adjectives (see table A1) and keep them to an absolute minimum.
3. Do not capitalize the words figure, table, and reference when referring to specific ones in the text.
4. Use the plural form of the verb with the word data (e.g., data were).
5. Express integers whose absolute value is 10 or greater in Arabic numerals. Spell out integers whose absolute value is less than 10. A unit of measurement, time, or money, which is always expressed in numerals, does not affect the use of numerals for other numerical expressions in the sentence (e.g., "A team of four men ran the 1-mile relay in 3 minutes and 20 seconds.").
6. Program specific abbreviations, acronyms, and symbols (those not defined in appendix E of this document) must be defined the first time they are used in the verbiage of the report and must be included in the list of abbreviations, acronyms, and symbols.
7. Round numbers in tables to the level of significance based on the resolution of your instrumentation accuracy.
8. Avoid using the word 'should' in a sentence in the T&E section. Readers will tend to search for a recommendation that may not exist.
9. Only use brand names if they are necessary to clarify meaning. At no time should your words imply AFFTC product endorsement!
10. We often perform regression testing. The word regression by itself implies going backward (in time). So we should not say, for example, avionics regression but rather, avionics regression testing. Also, we do not rate our regression testing, but rather the performance and functionality during the regression testing.



### **Words to Avoid:**

1. “At the time of this writing,” – your TR is dated and therefore, unnecessary.
2. “Felt” – We don’t care how they feel; what did they report? For example, instead of saying the test subject felt the task was difficult, say they had difficulty operating the hoist with arctic gloves.
3. “The pilot said that...” – If it is a fact, report it as a fact. Try to reword the comment as a statement rather than a quote.
4. “Problem” – It may not be a problem to the operator or customer. Just report the deficiency.
5. “Results were satisfactory” – We do not rate the results! Instead, we rate the performance, functionality, etc., of the system. Results are data that are complete, incomplete, consistent, etc. The performance of the system was satisfactory, marginal, or unsatisfactory.
6. “Totally useless” – Too negative.
7. “Extreme” – Nothing is extreme unless it really busts the limits.

### **Better Words to Use:**

1. Instead of acceptable or unacceptable use satisfactory, marginal, or unsatisfactory.
2. Instead of contractor use their proper title. This is like calling the Air Force ‘the Government.’
3. Instead of anomaly state what in particular was inconsistent with expectations or previous results (e.g., instead of “The aircraft exhibited anomalous behavior.” say “The aircraft departed controlled flight at a lower angle of attack than wind tunnel data predicted.”).
4. Instead of nominal use expected or usual.
5. Avoid parenthetical statements when possible. Parentheses are overused and normally not needed with careful sentence structure. Use parentheses when referencing tables, figures, acronyms, appendices, and references.

## **REPORT DRAFT FORMATTING**

Do not waste time putting your drafts into report quality format. Your technical editor will make your report look professional after everyone agrees on the content. You need to worry about the technical content and organization, not the format. Ask your technical editor for a template to use when writing your report.

The AFFTC has selected Microsoft® Word as your word processing software. Use the version on your computer at work. Use other Microsoft® Office software such as Excel, PowerPoint, and Visio for additional data such as charts, graphs, and tables.

The report font style is Times New Roman (TNR), text size is 11 point. Paragraphs are indented 0.25 inch. The report margins are 1 inch, left, right, top, and bottom.

Headings are formatted as follows:

## **SECTION TITLE**

(14 points, TNR, bold, all capital letters, centered, 12 points spacing after)

### **1ST ORDER HEADING**

(12 points, TNR, bold, all capital letters, left aligned, no indent, 12 points spacing after)

#### **2nd Order Heading:**

(12 points, TNR, bold, left aligned, 0.25-inch indent, bold semi-colon, 12 points spacing after, underline)

#### **3rd Order Heading.**

(12 points, TNR, bold, left aligned, 0.50-in indent, bold period, 12 points spacing after, underline)

#### **4th Order Heading**

(12 points, TNR, bold, left aligned, 0.75-in indent, 12 points spacing after, underlined)

#### **5th Order Heading**

(12 points, TNR, bold, left aligned, 1.00-in indent, 12 points spacing after, no underline)

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## APPENDIX C – CLASSIFICATION MARKUP FOR TECHNICAL REPORTS

This section describes the requirements for marking classified reports (AF Pamphlet ADA423966 *Security Guide to Marking DoD Documents* (reference 6), and DoD 5200.1-R, *Information Security Program*, January 1997 (reference 7)). This section is not intended to replace the formal guidance, but is intended to highlight some important items. Also, the AFFTC has a marking guide, prepared by 95 SFS/S511, Edwards AFB, California, which is located on Livelink and has the latest information:

<https://ckm.edwards.af.mil/Livelink/lisapi.dll?func=ll&objId=31763554&objAction=browse&sort=name&viewType=1>

In accordance with these instructions, we have selected certain elements of the TR, explained how to mark the basic page and items on the page and then followed each element with an example. *If the direction in this guide conflicts with current classified marking regulations, use the current regulations!* **Figures and tables in this appendix are for instructional purposes only.**

### FRONT COVER

The following items on the front cover require security classification markings:

**Top and bottom page margins:** The highest overall classification (SECRET/NOFORN, SECRET, etc.), needs to appear in the top and bottom margins of your cover.

**Document Title:** Your document title should be written so as not to require classification. An unclassified title of a classified document will be followed by the symbol (U).

**Classification authority statement:** Show the source and its date, which is used as the basis for classification. It is shown in a “Derived from” line. If more than one source is used, show “Multiple Sources” and list those sources in the references or as a separate statement in the report. In addition, show a “Declassify on: [date], obtained from your source and downgrade date. The author is responsible for supplying this classifying information. Figure C1 shows an example of a classified report cover.

### INSIDE FRONT COVER

**Top and bottom page margins:** This report element is normally unclassified. Figure C2 shows an example of an unclassified inside front cover for a classified report.

### SF 298


**Top and bottom page margins:** The highest overall classification of the material contained on the SF 298 must be marked on the top and bottom margins.

**Block 4 – Title and Subtitle:** The title of the document must be marked with the applicable classification abbreviation enclosed in parentheses (U) after the title.

**Block 13 – Abstract:** Include a brief (maximum 200 words) factual summary of the significant information in the report.

**SECRET**  
(The cover is for instructional purposes only)

AFFTC-TR-09-75



**AIRCRAFT TEST AND EVALUATION  
SAMPLE INSTRUCTIONAL  
TECHNICAL REPORT TEMPLATE (U)**

A  
F  
F  
T  
C

**JOHN S. DOE**  
Project Engineer

**JOHN Q. PUBLIC**  
Lieutenant Colonel, USAF  
Project Pilot

**DECEMBER 2009**

**FINAL REPORT**

Distribution authorized to U.S. Government Agencies only (Test and Evaluation), August 2009. Other requests for this document shall be referred to: (Systems Group for your project), (City/Base), (State), (Zip Code + 4).

Controlling Office: (Systems Group for your project), (City/Base), (State), (Zip Code + 4).

Derived from: A/C Security Classification Guide (SCG), vol 5, rev 2, 4 December 1965.

Declassify on: Date when it can be declassified; comes from source document or SCG.

**WARNING** – This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C. Sec 2751, et seq.) or the Export Administration Act of 1979 (Title 50, U.S.C. App. 2401, et seq.), as amended. Violation of these export control laws are subject to severe criminal penalties. Disseminate in accordance with provisions of DoD Directive 5230.25.

**AIR FORCE FLIGHT TEST CENTER  
EDWARDS AIR FORCE BASE, CALIFORNIA  
AIR FORCE MATERIEL COMMAND  
UNITED STATES AIR FORCE**

**SECRET**

Figure C1 Example Classified Cover Page

**UNCLASSIFIED**

(U) This technical information handbook (AFFTC-TIH-09-01, *The Author's Guide to Writing Air Force Flight Test Center Technical Reports [U]*) is a significant revision to AFFTC-TIH-02-01, *The Author's Guide to Writing Air Force Flight Test Center Technical Reports*, and therefore given a new report number. This handbook was submitted by the Engineering Directorate, 412th Test Wing, Edwards AFB, California 93524-6843.

(U) Prepared by:

(U) This report has been reviewed and is approved for publication:

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Project Engineer

---

NAME  
Chief Engineer  
4XXth Flight Test Squadron

---

JOHN Q. PUBLIC  
Lieutenant Colonel, USAF  
Project Pilot

---

O. CARTER WILKINSON  
Technical Director  
412th Test Wing

---

CONTRACTOR NAME  
Project Lead  
*JT3, LLC*

---

WILLIAM J. THORNTON  
Colonel, USAF  
Commander, 412th Test Wing

**UNCLASSIFIED**

Figure C2 Example Unclassified Inside Front Cover (Signature Page) in Classified Report

**Block 14 – Subject Terms:** These should be selected so that the terms individually or as a group are unclassified without losing meaning.

**Blocks 17, 18, and 19 – Security Classification of Report:** The highest overall classification of the report must be entered in all capital letters.

Figure C3 shows an example of the SF 298 with appropriate portion marking for a classified report.

## PREFACE AND EXECUTIVE SUMMARY

**Top and bottom margins:** The top and bottom margins of the preface and the executive summary must be marked with the highest classification on each respective page.

**Title:** The titles in the preface and executive summary are unclassified and must be marked with the unclassified abbreviation (U) to the right of the title. Example: PREFACE (U)

**Text:** Paragraphs of text must be marked with the applicable classification abbreviation enclosed in parentheses (S), (C), or (U) to the left of the first word of each paragraph.

Figures C4 and C5 show examples of an unclassified preface and an unclassified executive summary in a classified report.

## TABLE OF CONTENTS

The Table of Contents requires the following security classification markings:

**Top and bottom page margins:** The top and bottom margins must be marked with the highest classification on that page.

**Standalone Titles:** Titles are normally unclassified and must be marked with a (U) following the last word of the title. **Avoid the use of classified titles whenever possible.**

**Appendix Titles:** Titles are normally unclassified and must be marked with the applicable classification following the last word of the appendix title.

Portion markings are not required on an unclassified TOC. Only use portion markings if one or more titles are marked with (S).

Figure C6 shows an example of a TOC in a classified report.

## MAIN BODY

The main body of the TR requires the following security classification markings:

**Top and bottom page margins:** The top and bottom margins must be marked with the highest classification on the page.

**Paragraph carryover:** If a paragraph continues to the next page, it must carry its portion marking with it. The marking appears in front of the first word of the first line of the paragraph.

AUGUST 2009

<b>UNCLASSIFIED</b>			<b>REPORT DOCUMENTATION PAGE</b>		<i>Form Approved OMB No. 0704-0188</i>
<p>The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Department of Defense, Executive Service Directorate (0704-0188). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. <b>PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ORGANIZATION.</b></p>					
<b>1. REPORT DATE (DD-MM-YYYY)</b> 04-12-2009		<b>2. REPORT TYPE</b> Final Report		<b>3. DATES COVERED (From - To)</b> Use Day-Month-Year Format	
<b>4. TITLE AND SUBTITLE</b>  Title (U)				<b>5a. CONTRACT NUMBER</b>	
				<b>5b. GRANT NUMBER</b>	
				<b>5c. PROGRAM ELEMENT NUMBER</b>	
<b>6. AUTHOR(S)</b>  John S. Doe, Project Engineer John Q. Public, Lt Col, USAF, Project Pilot				<b>5d. PROJECT NUMBER</b>	
				<b>5e. TASK NUMBER</b>	
				<b>5f. WORK UNIT NUMBER</b>	
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) AND ADDRESS(ES)</b>  Air Force Flight Test Center Edwards AFB CA 93524-XXXX				<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b>  AFFTC-TR-09-75	
<b>9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b>  Your Systems Group Organizational Information Street Address City/Base, State Abbreviation, Zip Code+4				<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b>	
				<b>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</b>	
<b>12. DISTRIBUTION / AVAILABILITY STATEMENT</b> Distribution authorized to U.S. Government Agencies only (Test and Evaluation), Month Year. Other requests for this document shall be referred to: (Systems Group for your project), (City/Base), (State), (Zip Code+4).					
<b>13. SUPPLEMENTARY NOTES</b> SC: 012100      CA: Air Force Flight Test Center Edwards AFB CA      Print this document in <b>COLOR</b> .					
<b>14. ABSTRACT</b> (U) This report documents results of the (whatever you tested). Testing was requested by the (Systems Group for your project), (city/base), (state). The responsible test organization was the 412th Test Wing located at the Air Force Flight Test Center (AFFTC), Edwards AFB, California. The test execution organization was the 4XXth Flight Test Squadron, Edwards AFB, California. Testing was conducted by the XXXXXXXX Combined Test Force (CTF). Testing was performed at place, state, from start and last flight dates and consisted of ground, taxi, and flight tests totaling XX test hours (XX ground test hours and XX flight test hours). The overall test objective(s) were to XXX. All test objectives were/were not met.					
<b>15. SUBJECT TERMS</b> (U) F-XX aircraft      (U) navigation      (U) AN/APX-99      (U) terrain following (U) radar      (U) offensive avionics      (U) BDU-123      (U) human systems integration					
<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b>  SAME AS REPORT	<b>18. NUMBER OF PAGES</b>  16	<b>19a. NAME OF RESPONSIBLE PERSON</b> 412 TENG/EN (Tech Pubs Office)
<b>a. REPORT</b>  SECRET	<b>b. ABSTRACT</b>  UNCLASSIFIED	<b>c. THIS PAGE</b>  UNCLASSIFIED			<b>19b. TELEPHONE NUMBER (Include area code)</b> 661-277-8615

Standard Form 298 (Rev. 8-98)  
Prescribed by ANSI Std. Z39.18

**UNCLASSIFIED**

Figure C3 Example SF 298 in Classified Report



**UNCLASSIFIED****PREFACE (U)**

(U) Sincere appreciation to authors Tracy Brown, Robert White, Brian Green, and Karen Blue for their contributions to the data analyses and writing of this report. Sincere appreciation also to the following flight controls and structures engineers for their contributions in writing the test planning and execution portions of the report: Steven Star, Tom Stripes, and Fannie Flag.

(U) The authors gratefully acknowledge the contributions of Lieutenant Colonel Tom Airship, USAF, who provided an extensive and thorough technical review of the mission system section of this report. Finally, the editing and quality checks performed by the technical publications team of Ginny O'Brien, Diane Wood, Sandra Knoy, Carey Cramer, Charlene Fletcher, Glenda Chevis, and Joy Grandle, Lorrie Miller, and Kandi Jones were instrumental in getting the report ready for final distribution.

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**UNCLASSIFIED**

Figure C4 Example Unclassified Preface in Classified Report

**UNCLASSIFIED**

**EXECUTIVE SUMMARY (U)**

(U) This report documents the results of the C-99 Block 99 AN/APX-99 weather radar system performed in accordance with test plan AFFTC-TP-XX-XX, *C-99 Block 99 AN/APX-99 Weather Radar DT&E*. Testing was requested by the 999th Aeronautical Systems Group, Wright-Patterson AFB, Ohio. The responsible test organization was the 412th Test Wing located at the Air Force Flight Test Center, Edwards AFB, California. The test execution organization was the 499th Flight Test Squadron, Edwards AFB. Testing was conducted by the Global Reach Combined Test Force. Testing was performed at Edwards AFB from 23 June 2008 through 27 July 2009. Testing consisted of ground, taxi, and flight tests totaling 38 test sorties (23 ground test hours and 98 flight test hours).

(U) A new AN/APX-99 weather radar system replaced the existing AN/APX-98 weather radar system on the C-99 aircraft. The existing AN/APX-98 weather radar system was experiencing a diminishing manufacturing source and would no longer support C-99 aircraft production needs.

(U) The general test objectives were to: (1) evaluate the AN/APX-99 weather modes; (2) evaluate the range and azimuth resolution as well as the terrain detection performance of automatic (AUTO) mode; (3) evaluate the usability, lighting, and interpretability of the AN/APX-99; and (4) evaluate military utility. The general objectives were met.

(U) Overall, performance of the AN/APX-99 weather radar system was marginal. The AN/APX-99 detected and displayed weather cells, distinguishing between relevant and non-relevant weather; however, the AN/APX-99 in AUTO mode consistently underreported precipitation density at long range (beyond 50 nm). The AN/APX-99 detected and displayed turbulence. The wind shear detection was not rated because no wind shear event was observed with a C-99 test aircraft. The ground mapping modes were an effective aid to navigation, and produced accurate images of terrain features. The usability, lighting, and interpretability of the AN/APX-99 radar control panel were satisfactory. The military utility of the AN/APX-99 weather radar was marginal due to the underreporting of precipitation density at long range.

(U) Despite some shortcomings, the AN/APX-99 weather radar was significantly better than the legacy AN/APX-98 weather radar. Release the AN/APX-99 to operational test.

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**UNCLASSIFIED**

Figure C5 Example Unclassified Executive Summary in Classified Report

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**UNCLASSIFIED**

Figure C6 Example Table of Contents in Classified Report

**Section or Chapter headings:** Headings must be marked with the applicable security classification abbreviation in parenthesis (S), (C), or (U), placed after the last word of the heading. **Avoid the use of classified headings whenever possible.**

**Untitled text:** Untitled text must have the applicable security classification abbreviation (S), (C), or (U) preceding the first word of each paragraph. If the untitled text is a list, the applicable security classification abbreviation (S), (C), or (U) follows the number designation and precedes the first word of the text.

Each page must carry the highest classification for that page, regardless of the classification shown on the reverse side of a double-sided page. Figure C7 shows an example of confidential T&E section that has been portion marked in a classified report.

## FIGURES

Figures in a classified report require the following security classification markings:

**Top and bottom page margins:** The top and bottom page margins must be marked with the highest classification on that page.

**Figure title:** The appropriate security classification abbreviation (S), (C), or (U) must be placed after the figure number and just before the title, and indicates the classification of the figure title only.

**Body of the figure:** The appropriate overall classification of the figure is typed in all capital letters and placed within or next to the body of the figure per DoD 5200.1-R, para. C5.2.7.1.3.1 (reference 7).

The appropriate portion marking for each listing must be placed between the number and the text, e.g., 1. (U) XXXX.

Figure C8 shows an example of an unclassified figure in a classified report.

## TABLES

Tables in a classified report require the following security classification markings:

**Top and bottom page margins:** The top and bottom page margins must be marked with the highest level of classification for that page.

**Table title:** The appropriate security classification abbreviation (S), (C), or (U) is placed after the table number and at the beginning of the table title, e.g., Table 1 (U) Table title.

**Body of the table:** The appropriate overall classification of the table is typed in all capital letters enclosed in parenthesis and just above the table frame.

**Table notes:** Table notes are portion marked. The appropriate security classification abbreviation (S), (C), or (U) is placed after the note number and at the beginning of the note text.

**Table footnotes:** Table footnotes are portion marked.

Figure C9 shows an example of an unclassified table that has been portion marked in a classified report.

This page is for instructional purposes only.

**CONFIDENTIAL**

**TEST AND EVALUATION (U)**

(U) This section presents the results of the C-99 Block 99 AN/APX-99 weather radar system test and evaluation. Test results determined how well performance assessments met the requirements or how deficiencies affected the overall operation. Each test objective was rated using the AFFTC rating criteria (table A1, appendix A). When a deficiency was identified, a DR was created to track the issue. The DR numbers in this report are presented after the deficiencies are discussed (see appendix Y). **Correct the deficiencies documented in the deficiency reports, and evaluate any modifications incorporated as a result of the corrective actions. (R1)<sup>1</sup>**

**OVERALL TEST RESULTS (U)**

(U) Overall, performance of the AN/APX-99 weather radar system was marginal. The AN/APX-99 detected and displayed weather cells, distinguishing between relevant and nonrelevant weather; however, the AN/APX-99 in AUTO mode consistently under-reported precipitation density at long range (beyond 50 nm). The AN/APX-99 detected and displayed turbulence, and the ground mapping modes were an effective aid to navigation and produced accurate images of terrain features. The aircrew could visually distinguish discrete returns from reflectors at the specified resolution ranges. The usability, lighting, and interpretability were easy to use and understand and were all satisfactory. The military utility of the AN/APX-99 weather radar was marginal due to the under-reporting of precipitation density at long range. Despite some shortcomings, the AN/APX-99 weather radar was significantly better than legacy AN/APX-98 weather radar. Table 2 presents the C-99 AN/APX-99 Weather Radar System results.

Table 2 (U) C-99 AN/APX-99 Weather Radar System Test Results

(CONFIDENTIAL)

Objective	Title	Descriptor	Rating
<b>Overall</b>	<b>AN/APX-99 Evaluation</b>	<b>Borderline</b>	<b>Marginal</b>
1	Weather Modes	Borderline	Marginal
2	Range and Azimuth Resolution	Good	Satisfactory
3	Usability, Lighting, and Interpretability	Good	Satisfactory
4	Military Utility	Borderline	Marginal

**WEATHER MODES (U)**

(U) Overall, performance of the weather modes was marginal due to borderline fidelity of the AN/APX-99 in AUTO mode. Weather detection and depiction were marginal due to xxx. Relevance discrimination, turbulence detection and depiction, and terrain suppression in weather modes were all satisfactory. Predictive wind shear detection and depiction were not rated due to xxx. Table 3 presents the results of the weather modes evaluation.

**Test Methods and Conditions. (U)**

(U) To evaluate the AN/APX-99 weather detection and depiction, the C-99 aircraft was flown toward the highest point on the xxx.....

<sup>1</sup>(U) Numerals following an R represent tabulated recommendation numbers.

Figure C7 Example Confidential Test and Evaluation Section in Classified Report

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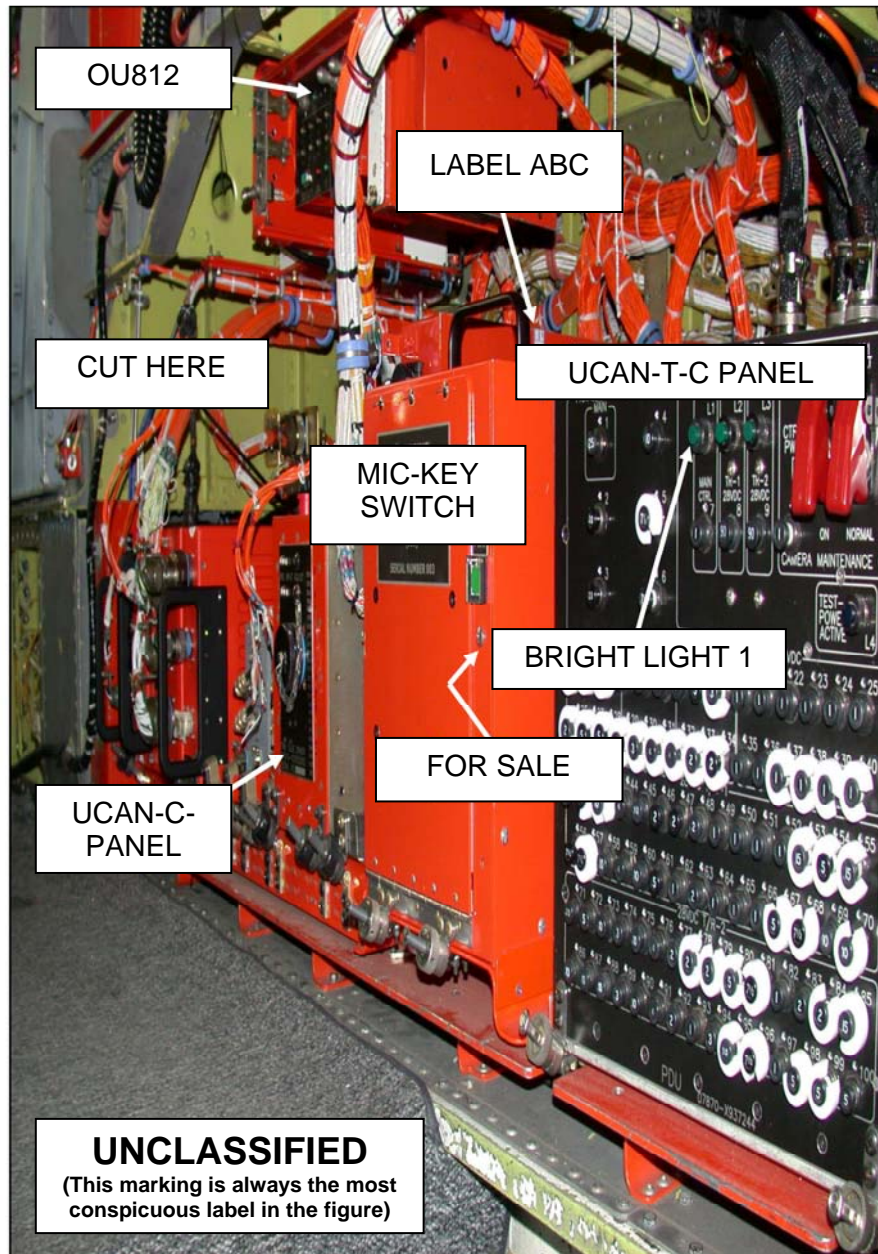


Figure B3 (U) Orange Metal with White Wire Area

UNCLASSIFIED

Figure C8 Example Unclassified Figure in Classified Report

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**SECRET**

Table C20 (U) Example Portrait Pagination Table in Classified Report

(SECRET)

Weapon Location	Parameter	Required Value	Demonstrated Values		Evaluation
			Value	Time (sec)	
GBU-31 FWB-3	Store in IBIT	11T-4 [6] = 1	1	85459.8	Satisfactory
	Store not in IBIT	11T-4 [6] = 0	0	85479.8	
	Critical Hardware Passed	11T-2 [1] = 1	1	85479.8	
	Minimum TDS received	11T-2 [1] = 1	1	85481.2	
	Warm-up Complete*	11T-2 [1] = 1	1	85608.5	
	Minimum TXA Received	11T-2 [3] = 1	1	85608.5	
	Safe to Release	11T-2 [8] = 1	1	85608.5	
	Last BIT Passed	11T-2 [7] = 1	1	85479.8	
	Minimum GPS Data Received	11T-2 [6] = 1	1	85483.4	
	TXA Good	11T-2 [5] = 1	1	85737.5	
	All-up Round (AUR) Ready	11T-2 [4] = 1	1	85737.5	
	Sim Release Mode (Test Control not Valid)	22R-6 [9] = 1 (22R-2 [0] = 0)	1 (0)	87487.2	
	JDAM Status Shows Sim Release Mode	Prior to RC	-124 ms	87487.3	
		22T-10 [9] = 1	1**		
	Release Consent (RC) Received	22T-2 [9] = 1	1	87487.5	
	Command Commit to Separate Store (CTS)	11R-4 [2] = 1	1	87487.6	
	JDAM Status Shows CTS	> 20 ms after CTS	+34 ms	87487.6	
		22T-2 [10] = 1	1		
	Declare Committed to Store Separation (CTSS)	~ 900 ms after CTS	+908 ms	87488.5	
		11T-4 [2] = 1	1		
Send Air Data Message (Last 15R Message)	< 5 sec before RLS	-0.225	87488.9		
Weapon Data Pump Indicates Release (RLS)	~ 1 sec after CTS**	+1.512	87489.1		

- Notes: 1. (U) Acronyms in this table are defined in appendix D.  
2. (U) All notes here apply to entire table.

\*(U) An asterisk can be used to identify special information in one cell.

\*\*\*(U) A double asterisk can also be used to identify special information in one cell

C-12

**SECRET**

Figure C9 Example Classified Table in Classified Report

## REFERENCES AND BIBLIOGRAPHY

Reference and bibliography sections of a classified report require the following security classification markings:

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**Section title heading:** The section titles are marked per the following examples: REFERENCES (U) and BIBLIOGRAPHY (U).

**Titles of listed documents:** Titles of classified documents must have the applicable classification abbreviation (S), (C), or (U) placed after the last word of the title.

The classification of each referenced document must be spelled out at the end of each reference (e.g., SECRET).

## BLANK PAGES

Mark all blank pages in your document (figure C10). In the center of the page include the verbiage, "This page was intentionally left blank." In a classified report, this page would have UNCLASSIFIED marked at the top and bottom of the page, and the statement, "(U) This page was intentionally left blank."

## APPENDICES

Appendices in a classified report require the following security classification markings. However, if an entire appendix is unclassified, a caveat statement appears on the appendix title page below the title stating, "The contents of this appendix are unclassified." Portion markings are then not required.

**Top and bottom page margins:** The top and bottom page margins must be marked with the highest classification level on that page.

**Appendix heading:** The unclassified abbreviation (U) must be placed to the right of the heading and letter designation of the appendix, e.g., APPENDIX A (U).

**Appendix title:** The appendix title must be marked with the applicable security classification abbreviation (S), (C), or (U) following the last word of the title.

**Paragraph headings and untitled text:** Security classification markings for paragraph headings and untitled text in appendices are marked in the same manner as in the main body of the report.

**List of Abbreviations, Acronyms and Symbols:** No portion markings are required unless the list contains a classified abbreviation, acronym, or symbol.

**Distribution List:** The distribution list is always unclassified. The top and bottom margins must be marked with UNCLASSIFIED at the top and bottom margin of each page. No portion markings are required.



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Figure C10 Example Blank Page in Classified Report

## APPENDIX D – LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS

<u>Abbreviation</u>	<u>Definition</u>	<u>Units</u>
3-D	three-dimensional	---
6-DOF	six-degrees-of-freedom	---
AAA	anti-aircraft artillery	---
A/A	air-to-air	---
ac	alternating current	---
A/C	aircraft	---
ACC	Air Combat Command	---
AETC	Air Education Training Command	---
AF	Air Force	---
AFB	Air Force Base	---
AFFTC	Air Force Flight Test Center	---
AFFTCI	Air Force Flight Test Center Instruction	---
AFI	Air Force Instruction	---
AFLC	Air Force Logistics Command	---
AFM	Air Force Manual	---
AFMAN	Air Force Manual	---
AFMC	Air Force Material Command	---
AFOSH	Air Force Operational Safety and Health	---
AFOTEC	Air Force Operational Test & Evaluation Center	---
AFR	Air Force Regulation	---
AFSC	Air Force Systems Command; Air Force Specialty Code	---
AFSCM	Air Force Systems Command Manual	---
AFSCR	Air Force System Command Regulation	---
AFTO	Air Force Technical Order	---
AGL	above ground level	---
ALT, Alt, alt	altitude	ft
AM	amplitude modulation	---
AMC	Air Mobility Command	---
amp	amperes	---
ANSI	American National Standards Institute	---

**Acronyms** on this list do not need to be defined at first use in the technical report. All others are defined at first use starting in the Introduction section of the technical report. **Units of measurement** must be spelled out in the text, but can be abbreviated in tables and figures. Acronyms in tables and figures are defined here.

**APPENDIX D – LIST OF ABBREVIATIONS,  
 ACRONYMS, AND SYMBOLS (Continued)**

<u>Abbreviation</u>	<u>Definition</u>	<u>Units</u>
APU	auxiliary power unit	---
ARINC	Aeronautical Radio, Inc or Aircraft Radio Incorporated	---
ASC	Aeronautical Systems Center	---
ASCII	American Standard Code for Information Interchange	---
ATC	Air Training Command	---
AUTO, auto	automatic	---
avg	average	---
AWACS	airborne warning and control system	---
BARO, Baro, baro	barometric	---
BASIC	beginner's all-purpose symbolic instruction code	---
BIT	built-in-test	---
Blvd.	boulevard	---
C	Centigrade or Celsius	deg
CALOSHA	California Operational Safety and Health Administration	---
CAT	category	---
cc	cubic centimeters	---
CD	compact disk	---
cg	center of gravity	pct MAC
CINC	Commander-In-Chief	---
COBOL	common business oriented language	---
COMM, comm	communications	---
COMSEC	communications security	---
CONOPS	concept of operations	---
CONUS, Conus	Continental United States	---
COTS	commercial off-the-shelf	---
CRT	cathode ray tube	---
CSAF	Chief of Staff Air Force	---
CY	calendar year	---
dB	decibel	---
dc	direct current	---

**Acronyms** on this list do not need to be defined at first use in the technical report. All others are defined at first use starting in the Introduction section of the technical report. **Units of measurement** must be spelled out in the text, but can be abbreviated in tables and figures. Acronyms in tables and figures are defined here.

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## APPENDIX D – LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

<u>Abbreviation</u>	<u>Definition</u>	<u>Units</u>
deg	degree(s)	---
DME	distance measuring equipment	---
DoD	Department of Defense	---
DoE	Department of Energy	---
DR	deficiency report	---
DT	developmental test	---
DT&E	development test and evaluation	---
DTIC	Defense Technical Information Center	---
DVD	digital video display	---
E	east	---
EAR	Export Administration Regulations	---
ECCM	electronic counter-countermeasures	---
ECM	electronic countermeasures	---
EL, el	elevation	ft
ELEV, Elev, elev	elevation	ft
ELINT	electronic intelligence	---
EMC	electromagnetic compatibility	---
EMD	engineering and manufacturing development	---
EMI	electromagnetic interference	---
EMI/C	electromagnetic interference/compatibility	---
EO	electro-optical	---
ESC	Electronic Systems Center	---
ETA	estimated time of arrival	---
ETD	estimated time of departure	---
EW	electronic warfare	---
F	Fahrenheit	deg
FAA	Federal Aviation Administration	---
FLIR	forward looking infrared	---
FLT	flight	---
FLTS	Flight Test Squadron	---

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**Acronyms** on this list do not need to be defined at first use in the technical report. All others are defined at first use starting in the Introduction section of the technical report. **Units of measurement** must be spelled out in the text, but can be abbreviated in tables and figures. Acronyms in tables and figures are defined here.

**APPENDIX D – LIST OF ABBREVIATIONS,  
 ACRONYMS, AND SYMBOLS (Continued)**

<u>Abbreviation</u>	<u>Definition</u>	<u>Units</u>
FM	frequency modulation	---
FOD	foreign object damage	---
FORTTRAN	FORmula TRANslation	---
ftm	feet per minute	---
fps	feet per second	---
FSD	full scale development	---
FSN	federal stock number	---
ft	feet; foot	---
ft/sec	feet per second	---
FY	fiscal year	---
g	acceleration due to gravity	32.2 fps <sup>2</sup>
gal	gallon(s)	---
GCA	ground controlled approach	---
GFE	government-furnished equipment	---
GHz	gigahertz	---
GMT	Greenwich Mean Time	hr:min:sec
gph	gallons per hour	---
gpm	gallons per minute	---
GPS	global positioning system	---
gps	gallons per second	---
g/m <sup>3</sup>	grams per cubic meter	---
HAZMAT	HAZardous MATerial	---
HF*	high frequency	---
Hg	mercury	---
HH:MM:SS	hours:minutes:seconds	---
hp	horsepower	550 ft-lb/sec
HQ	headquarters	---
hr	hour(s)	---
H/W	hardware	---
Hz	Hertz	---

**Acronyms** on this list do not need to be defined at first use in the technical report. All others are defined at first use starting in the Introduction section of the technical report. **Units of measurement** must be spelled out in the text, but can be abbreviated in tables and figures. Acronyms in tables and figures are defined here.

**APPENDIX D – LIST OF ABBREVIATIONS,  
 ACRONYMS, AND SYMBOLS (Continued)**

<u>Abbreviation</u>	<u>Definition</u>	<u>Units</u>
IAS	indicated airspeed	kt
IAW	in accordance with	---
ICBM	intercontinental ballistic missile	---
ID	identification	---
IFF	identification friend or foe	---
IFR	instrument flight rules	---
ILS	instrument landing system	---
IMC	instrument meteorological conditions	---
IMU	inertial measurement unit	---
in	inch(es)	---
Info	information	---
INS	inertial navigation system	---
INU	inertial navigation unit	---
IOT&E	initial operational test and evaluation	---
IP	initial point; instructor pilot	---
IR	infrared	---
IRIG	Inter-Range Instrumentation Group	---
ITAR	International Traffic in Arms Regulations	---
JCS	Joint Chiefs of Staff	---
JFS	jet fuel starter	---
JOVIAL	Military Standard-1589B J73 programming language	---
JPEG, jpeg	Joint Photographic Experts Group (a file extension)	---
K	thousand	---
KCAS	knots calibrated airspeed	---
KEAS	knots equivalent airspeed	---
kHz	kilohertz	---
KIAS	knots indicated airspeed	---
km	kilometer	---
kt	knot(s)	---
KTAS	knots true airspeed	---

**Acronyms** on this list do not need to be defined at first use in the technical report. All others are defined at first use starting in the Introduction section of the technical report. **Units of measurement** must be spelled out in the text, but can be abbreviated in tables and figures. Acronyms in tables and figures are defined here.

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## APPENDIX D – LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

<u>Abbreviation</u>	<u>Definition</u>	<u>Units</u>
kVA	kilovoltampere	---
kW	kilowatts	---
L	left	---
lat	latitude	deg
lb	pound(s)	---
lb/min	pounds per minute	---
LF	low frequency	---
long.	longitude	deg
long.	longitudinal	---
LORAN	long-range navigation	---
LOX	liquid oxygen	---
LRU	line replaceable unit	---
m	meter(s)	---
MAC	Military Airlift Command; mean aerodynamic chord	---
MAJCOM	major command	---
MAX, Max, max	maximum	---
Mc	megacycle	---
MED, Med, med	medium	---
MHz	megahertz	---
MIL	military	---
mil	milliradian(s)	---
MIL SPEC	military specification	---
MIL-STD	military standard	---
MIN, Min, min	minute(s); minimum	---
mini	miniature	---
mm	millimeter(s)	---
MPEG, mpeg	Moving Picture Experts Group (a file extension)	---
mph	miles per hour	---
MSL	mean sea level; missile	---
MUX	multiplex	---

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**Acronyms** on this list do not need to be defined at first use in the technical report. All others are defined at first use starting in the Introduction section of the technical report. **Units of measurement** must be spelled out in the text, but can be abbreviated in tables and figures. Acronyms in tables and figures are defined here.

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## APPENDIX D – LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

<u>Abbreviation</u>	<u>Definition</u>	<u>Units</u>
N	north	---
N/A	not applicable	---
NASA	National Aeronautics and Space Administration	---
NATO	North Atlantic Treaty Organization	---
NISPROM	National Industrial Security Program Operating Manual	---
nm	nautical mile(s)	---
No.	number	---
NORAD	North American Aerospace Defense	---
NTIS	National Technical Information System	---
O <sub>2</sub>	oxygen	---
OFP	operational flight program	---
OMB	Office of Management & Budget	---
Ops	operations	---
OPSEC	operational security	---
OSD	Office of Secretary of Defense	---
OSHA	Operational Safety and Health Administration	---
OT	operational test	---
OT&E	operational test and evaluation	---
PACAF	Pacific Air Forces	---
PC	personal computer	---
PCMCIA	Personal Computer Memory Card International Association	---
pct	percent	---
PN, P/N	part number	---
POC	point of contact	---
POL	petroleum oil and lubricants	---
pph	pounds per hour	---
ppm	pounds per minute; parts per million	---
psf	pounds per square foot	---
psi	pounds per square inch	---
QT&E	qualification test and evaluation	---

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**Acronyms** on this list do not need to be defined at first use in the technical report. All others are defined at first use starting in the Introduction section of the technical report. **Units of measurement** must be spelled out in the text, but can be abbreviated in tables and figures. Acronyms in tables and figures are defined here.



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## APPENDIX D – LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Continued)

<u>Abbreviation</u>	<u>Definition</u>	<u>Units</u>
R	right	---
RAM	random access memory	---
Rd	road	---
R&D	research and development	---
Ref, ref	reference	---
RESP	responsible	---
Rev, rev	revision	---
RF	radio frequency	---
R&M	reliability and maintainability	---
ROM	read only memory	---
rpm	revolutions per minute	---
R&R	remove and replace	---
S	south	---
SAC	Strategic Air Command	---
SATCOM	satellite communications	---
SCSI	small computer system interface	---
sec	second(s)	---
SIPRNET	secret internet protocol router network	---
S/N	serial number	---
SOP	standard operating procedure	---
St	street	---
Std	standard	---
S/W	software	---
TAC	Tactical Air Command; terminal access controller	---
TACAN	tactical air navigation	---
TAS	true airspeed	kt
TBD	to be determined	---
TCTO	time compliance technical order	---
TDY	temporary duty	---
Temp, temp	temperature	deg

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**Acronyms** on this list do not need to be defined at first use in the technical report. All others are defined at first use starting in the Introduction section of the technical report. **Units of measurement** must be spelled out in the text, but can be abbreviated in tables and figures. Acronyms in tables and figures are defined here.

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**APPENDIX D – LIST OF ABBREVIATIONS,  
 ACRONYMS, AND SYMBOLS (Concluded)**

<u>Abbreviation</u>	<u>Definition</u>	<u>Units</u>
T.O.	technical order	---
TV	television	---
UHF	ultrahigh frequency	---
U.S.	United States	---
USA	United States of America; United States Army	---
USAF	United States Air Force	---
USAFE	United States Air Forces Europe	---
USB	universal serial bus	---
U.S.C.	United States Code	---
USMC	United States Marine Corp	---
USN	United States Navy	---
Ver, ver	version	---
VFR	visual flight rules	---
VHF	very high frequency	---
VHS	very high speed; video home system	---
VOR	VHF Omnidirectional Range	---
Vs, vs	versus	---
W	west	---
w/	with	---
WGS	World Geodetic Survey	---
WIT	watch item	---
ZULU	Greenwich Mean Time	---

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**Acronyms** on this list do not need to be defined at first use in the technical report. All others are defined at first use starting in the Introduction section of the technical report. **Units of measurement** must be spelled out in the text, but can be abbreviated in tables and figures. Acronyms in tables and figures are defined here.

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