



The Wright Stuff

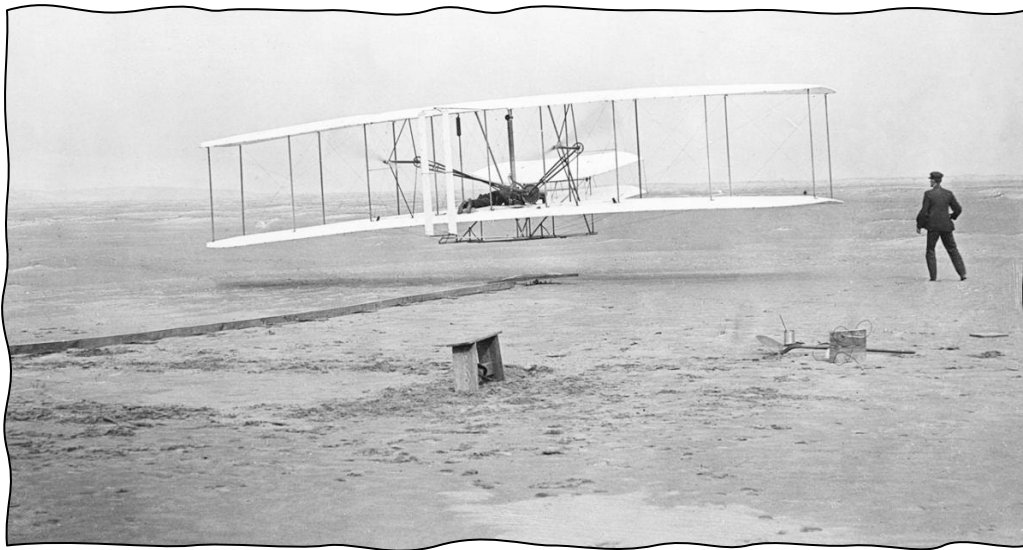
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This Writing Guide is intended as an aid to help Flight Testers involved in the planning for, conduct of, and reporting of results for flight tests conducted under the Type Certification process. This guide is meant as an aid and does not replace any advisory circular or any official FAA policy documents.

If you have suggestions for improving this guide, you may use the form at the end of this document.

*FAA Flight Test & Human Factors Branch
AIR-710*

Revision History

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ACRONYM LIST

ACRONYM	MEANING
AC	Advisory Circular (“one way, but not the only way” to show compliance)
AED	Aircraft Evaluation Division
AEG	Aircraft Evaluation Group (now called AED)
AFM	Airplane Flight Manual
AFMS	Airplane Flight Manual Supplement
ATC	Amended Type Certificate
CAR	Civil Air Regulations (predates current CFR structure)
CFR	Code of Federal Regulations
CFTP	Certification Flight Test Plan
CRI	Certification Review Item (an EASA term)
CS	Certification Specifications (an EASA term)
EASA	European Union Aviation Safety Agency
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FTE	Flight Test Engineer
FTP	Flight Test Pilot or Flight Test Plan
IP	Issue Paper
MOC	Method of Compliance
PD	Passdown
PSCP	Project Specific Certification Plan
RI	Response Item
RFM	Rotorcraft Flight Manual
RFMS	Rotorcraft Flight Manual Supplement
RMP	Risk Management Plan
RTO	Rejected Takeoff
STC	Supplemental Type Certificate
TIA	Type Inspection Authorization
TIR	Type Inspection Report
USAFTPS	U.S. Air Force Test Pilot School
USNTPS	U.S. Naval Test Pilot School
V _{mcg}	Minimum Control Speed Ground

Chapter 1. INTRODUCTION

1.1 Purpose.

The purpose of the “Wright Stuff” is to provide a guide for written communication to be used by flight testers, particularly flight testers involved in FAA certification testing. The goal is to provide a standard format and thought-process to those who desire help in producing consistent and standardized certification-flight-test-related written products.

1.1 Background.

Written communication in flight testing predates the first powered flight test. Wilbur and Orville Wright, for example, made careful notes of their earliest experiments, see Figure 1-1 and Figure 1-2. Today the purpose of clear communication in flight test is just as important, if somewhat more complex. Whether it’s properly writing a certification plan, a test plan, a risk management plan, a Type Inspection Authorization (TIA), or a flight test report...clear communication aids all involved in the effort to reach the goal of flight testing: the proper preparation for and documentation of flight test efforts.

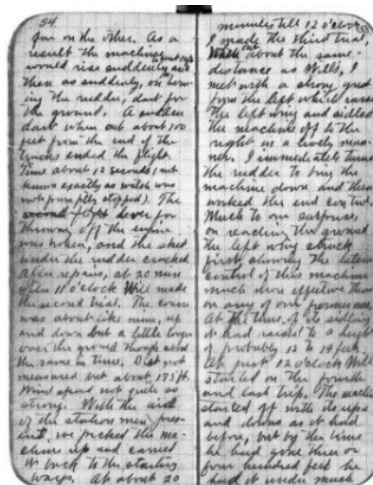


Figure 1-1: Orville's report of December 17, 1903

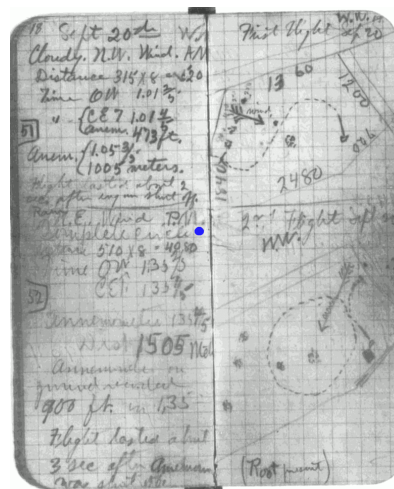


Figure 1-2: Wilbur's report with diagram and data for flight on Sept 20, 1904

1.2 Important Administrative notes when using this guide

1.2.1 Role of this guide.

As with all FAA guidance—formal guidance such as Advisory Circulars or informal such as emails from FAA personnel or documents like the Wright Stuff—this guide represents only one way, but not the only way, to produce written communications. Means for Flight Test communications have been, in many cases, localized, non-standardized and undocumented. In other cases, companies and authority organizations have developed their own standardized, written products and these products work perfectly well. In simple terms, this guide is intended as an aid for those who seek a guide, or who don't have a standard for written products already formed. Some may already have a set of products that they're happy with but might find suggestions in the Wright Stuff that might help them improve existing document formats. For many, this help will not be necessary and, therefore, the contents of this guide should not be taken as “gospel”.

1.2.2 Best way to use this guide.

When applicable, the guide contains tips and information on the various stages of the Certification Flight Test process (described in more detail below), and provides examples where examples do not otherwise exist. By combining the tips, with the examples and with good writing style (discussed in Appendix F) the hope is that the reader will have sufficient background to address the important work of Flight Test Communication. No guide, however, can make someone an expert. The best teacher is experience, using what you learn here, combined with discussions with other flight test experts and a writer's expertise will soon develop.

1.2.3 Changes and Suggestions for Improvement of The Wright Stuff.

This guide is intended as a living document. Errors, where discovered, should be pointed out. Improvements should be suggested. Please send any recommendations for change using the feedback form provided at the end of this document. Please provide comments and, as appropriate, specific suggestions for changes and improvement.

1.2.4 Conflicting information.

In case of conflict with other FAA publications, advisory circulars, orders or other documents, it's likely those other documents should be considered correct. This guide, being informal, should not be considered a singular source on the topic of Flight Test communication.

1.2.5 Best Practices for communication.

All written and spoken communication is more effective when it incorporates “best practices” to provide clear and unambiguous content. Appendix F provides some tips for report writing, largely based on the U.S. Naval Test Pilot School (USNTPS) “The Write Stuff—USNTPS Report Writing Guide”. As with the rest of the Wright Stuff, the information in Appendix F is optional.

1.3 A brief description of the Certification Process from a Flight Tester's perspective

1.3.1 Steps in the Certification Process.

Figure 1-3 is a simplified, notional depiction of the Certification Process. For a more detailed description, refer to FAA Order 8110.4. Beginning after the figure is a very brief

and general description of flight testers' activities during each phase and a qualitative description of the aspects of the process Flight Testers are involved. This figure is purposely simplified and should be used in conjunction with the more detailed process depicted in FAA order 8110.4. This figure does not attempt to define every task or aspect of the certification process in which Flight Testers are involved—it simply attempts to organize the process in terms of the written products that have significant flight test involvement.

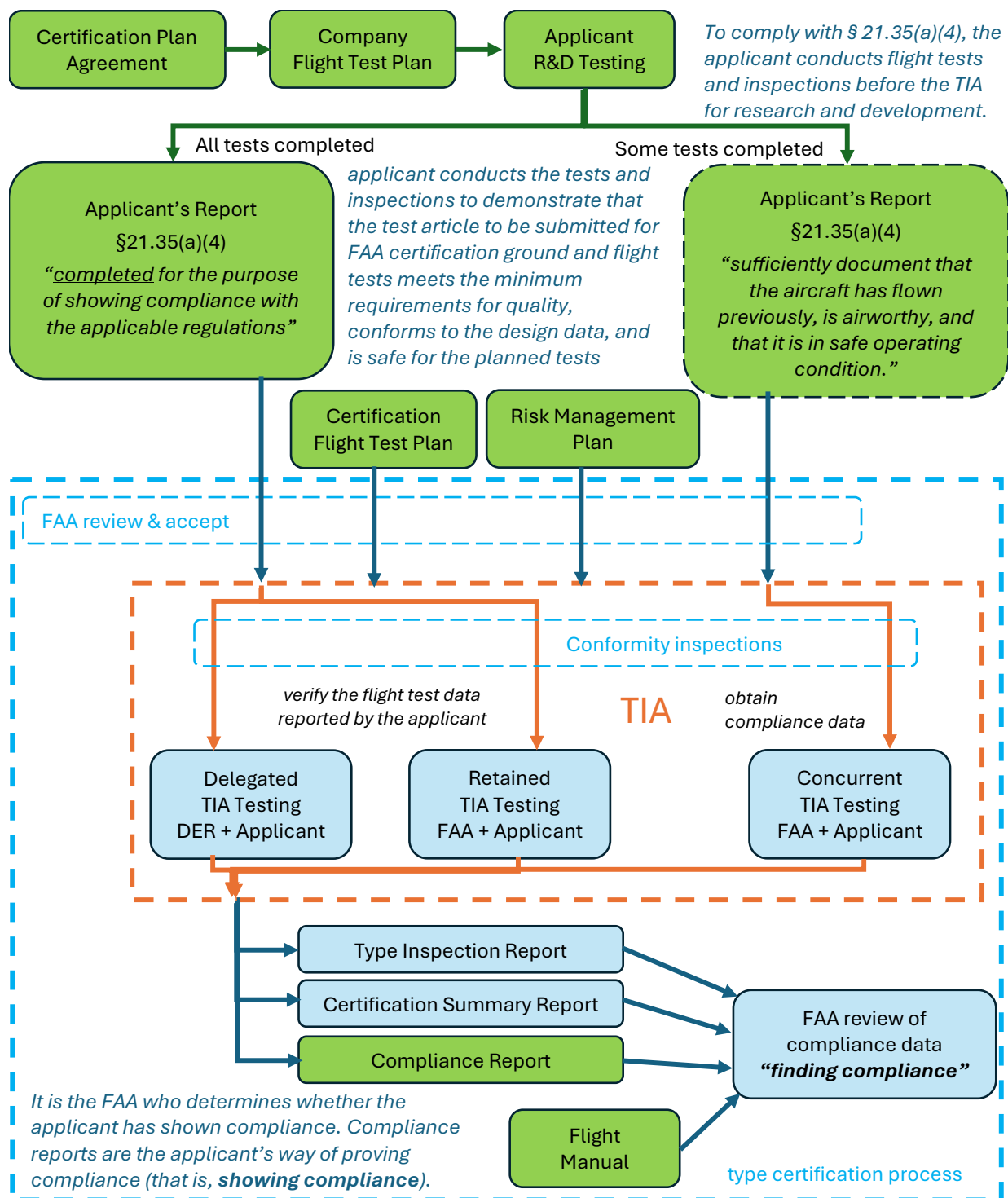


Figure 1-3: Simplified Certification Process related to Flight Test written products

1.3.1.1 Some items NOT mentioned in the process.

The perceptive reader will ask “what about issue papers (and other program documents)?”. The “Wright Stuff” does not attempt to describe the issue paper process or specific Flight Test involvement. That said, Flight Testers should be closely involved in the development of issue papers which pertain to Flight Test aspects and/or areas involving the use of Flight Testing as a Method of Compliance.

1.3.1.2 Certification Plan(s).

Also referred to as the Project Specific Certification Plan (PSCP). During this stage, Flight Testers are involved in establishing the certification basis, the means of compliance and proposing, analyzing and accepting methods of compliance or “MOC” (i.e. determining if Flight Test is the appropriate MOC and, if not proposed as the MOC, is the alternative MOC acceptable?). Because Certification Plans are a multi-disciplinary document, the “Wright Stuff” does not attempt to further define the elements of the Cert Plan. Likewise, Issue Papers (IPs), Certification Review Items (CRIs), Policy Statements and other similarly documented items are not explicitly covered in this guide. However, flight test involvement in these documents is key as a program moves towards specific demonstrations of compliance via Flight Test. The “Wright Stuff” is otherwise silent on Certification Plans, and does not give an example of one. More details discussions of Certification plans and an example can be found as part of the Certification Project Guide at https://www.faa.gov/aircraft/air_cert/design_approvals/dah. However, it cannot be overstated that Flight Test involvement and review of the Certification Plan is a key aspect to ensuring that compliance involving flight test is properly scoped and planned for. Additionally, the Certification Plan often provides information concerning the project that helps flight test prepare by fully understanding the system or aircraft modification which will be the subject of testing. A well-reviewed and thorough certification plan will ease the formulation and processing of the documents that follow.

1.3.1.3 Company Testing

Testing performed by the company or applicant (a.k.a. showing compliance) prior to official TIA testing, and the company report that results, has its roots in 14CFR Part 21.35(a)(4). This guide (The “Wright Stuff”) is not a substitute for training and knowledge of 14CFR Part 21. Part 21 contains the “process requirements” for much of what engineering and manufacturing specialists within the FAA and its applicants do. The “Wright Stuff” does not try to educate its readers on Part 21...however a brief mention of how one aspect of Part 21 fits into the Flight Test process is in order. 21.35(a)(4), shown below in Figure 1-4, concerns what is required prior to conducting Type Inspection Authorization (TIA) flight testing. The phrase “before making the tests” means “prior to the FAA (or their designees, if the testing is delegated) performing the testing specified in the TIA, there’s several things that have to happen.” Those things include the structural requirements being met (on major programs, this would include flutter, etc...in other words, subpart C aspects), completion of “necessary ground inspections and tests” (this might mean certain lab tests or other ground testing required by specialist engineers), that the aircraft is conformed (refer to the paragraph above concerning conformity) and that the FAA (or our designee) has received a report of the company flight test (a.k.a. a showing of compliance). This last aspect (the company report) is sometimes misunderstood. Often associated with the company report may be a company test plan. It is important to understand the distinction between company test

plans and reports and the similarly-named Certification documents (Certification Flight Test Plan, Certification Results Report, and the Type Inspection Report, Part II).

§ 21.35 Flight tests. (a) Each applicant for an aircraft type certificate (other than under §§21.24 through 21.29) must make the tests listed in paragraph (b) of this section. Before making the tests the applicant must show— (1) Compliance with the applicable structural requirements of this subchapter; (2) Completion of necessary ground inspections and tests; (3) That the aircraft conforms with the type design; and (4) That the Administrator received a flight test report from the applicant (signed, in the case of aircraft to be certificated under Part 25 [New] of this chapter, by the applicant's test pilot) containing the results of his tests.
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Figure 1-4: 14 CFR 21.35 “Flight Tests”

Figure 1-3 shows a plausible sequencing of these “company aspects” with the Cert Process. There are often questions such as “Is the Company Test Plan written?”, and “Does it have to be FAA approved?” and “What about the report of company results...what format, etc.?”. One common misunderstanding is created by reading FAA orders, which refer to the “applicant submitting a test plan”. That reference concerns the test plan intended for Certification use, i.e. the Certification Test Plan, or the Test Plan that will be referenced in the Type Inspection Authorization. This confusion aside, the answer to all of these questions is clear according to the regulations and other materials: very little is actually, REQUIRED by regulation, of the company documents (test plan and report). That said, it’s clear that the more thorough and professional a job is done on all of these “pre-TIA aspects” (which would include not just the company test plan and report, but also “company conformity” processes—i.e. the control and documenting of the configuration of a particular test article), the more likely the FAA will be to use its discretionary authority concerning the scope of TIA testing.

1.3.1.4 Certification Flight Test Plan (CFTP).

After the Certification Plan(s), IPs, CRIs, etc. have established when Flight Test will be the means of compliance, the important work of developing a flight test plan begins. For the flight tester, the CFTP is perhaps the most important document in the preparation stage of a project. It has been said that a good test plan is one that can be picked up by any qualified tester who would then—due to the test plan’s clarity of content—be able to properly conduct a given test. Test Plans are discussed in Chapter 2 and an example test plan is provided in Appendix A. Flight Test Plans typically include a Risk Management Plan:

1.3.1.5 Risk Management Plan.

The Risk Management Plan (RMP), sometimes referred to as a Test Hazard Analysis or Test Hazard Plan, is key in promoting flight test safety. Flight Test, unlike some other engineering disciplines, involves actual exposure of FAA and applicant personnel in the conduct of experimental flight test to hazards. This may involve risks elevated well beyond normal flight operations and, therefore, a robust Risk Management Plan is a key component to keeping flight testers safe. Because this is such an important part of the flight testing process, it is already well covered in other documents, including FAA Order 4040.26 “Aircraft Certification Service Flight Test Risk Management Program”.

Therefore, with a few exceptions, the Wright Stuff contains no further discussion or examples of Risk Management Plans. Those exceptions are simply to discuss the location and source of the RMP. The location of an RMP (i.e. separate from the Test Plan or integrated within it) is optional. However, in many cases, the best practice is to include the RMP as an integral part of the Certification Flight Test Plan, thereby ensuring that all related hazards are properly identified, other aspects of the Risk Management process (such as standardized pre-flight briefings) are addressed, and the combined CFTP/RMP document is most easily used. The source of the RMP can either be the applicant or the FAA. Ultimately, through the TIA process, the RMP is eventually accepted by FAA management (or their designees) and, therefore, the ultimate responsibility for the RMP lies with FAA flight testers or their designees. On the other hand, the applicant is often more familiar with the aircraft or system under test and, therefore, is in a better position to create a thorough and complete RMP in a timely manner. Regardless, the location of the RMP should be discussed early in a program to avoid confusion.

1.3.1.6 **Type Inspection Authorization (TIA).**

The TIA serves several important functions for the tester. These functions are described in Chapter 3. A partial example of the TIA is contained in Appendix B. In addition to specifying the testing to be conducted, the TIA also details the test aircraft's configuration and overall airworthiness. This conformity aspect is specified in Part I of the TIA (aka paragraph 18A):

1.3.1.7 **Conformity.**

Prior to conducting testing, manufacturing inspectors or their designees are required to conduct a conformity inspection. This inspection is typically specified in the TIA. The purpose of this conformity inspection is to ensure the product being tested is in a configuration that has been specified as sufficient for test. In some cases this may be the final type design but, at a minimum, the configuration is sufficient for the tests being conducted and differences from the final design are understood and accepted. This configuration may—at the discretion of the engineering team—include definition of the instrumentation aspects of a test. In addition to configuration aspects, the conformity also ensures the test aircraft is safe for flight. FAA order 8110.4 contains additional information concerning conformity and, while this topic is primarily the purview of manufacturing and airworthiness specialists, a good understanding by flight testers is important.

1.3.1.8 **Conduct of Flight Test and Communication Tools.**

The test conduct phase of a program deserves its own guide. In fact, the guides are called Advisory Circulars, but that's only the start of how a test is conducted. Experience and training are huge factors in the successful and safe completion of any flight test. With a few exceptions, the Wright Stuff does not attempt to extensively cover this portion of a certification program. The role of communication is key in the life of a Flight Tester. Excellent testers must be able to document the results of their test and thoroughly communicate those results, problems discovered and lessons-learned. The Type Inspection report (discussed below) is the final product of a certification flight test program but it often lags after testing is complete so, before that formal certification deliverable is produced, the tester must be able to document their tests and work through issues. Chapter 4 and the associated Appendix C provide alternatives for reporting

methods for those testers interested in developing a reporting system to be used during the conduct of testing.

1.3.1.9 Flight Manual.

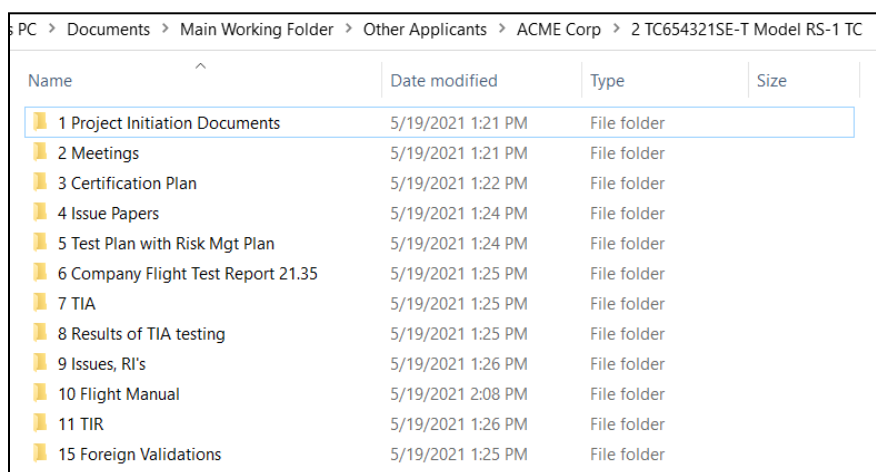
It is interesting to note that the flight manual is one of the few certification documents that are rarely delegated by the FAA. In some senses, this document is the link between the certification tester and the operational pilot and, as such, it is very important. Advisory Circulars for every product type have their own, fairly extensive, guidance concerning flight manuals. However, Chapter 5 of the Wright Stuff provides pointers to useful information about Flight Manuals and Appendix D is reserved for a future example flight manual.

1.3.1.10 Reporting - Type Inspection Report (TIR) Part II.

The last phase of the tester's communication process is typically the Type Inspection Report. Note that there are many other reports and deliverables, such as analysis reports, reports containing detailed aerodynamic calculations, and the like. These reports are all very important to the showing and finding of compliance in a Certification program and, to be sure, Flight Test is often involved in the conduct of the tests associated with these reports, as well as reviewing and approving these reports. However, such reports are typically multi-disciplinary and/or are not necessarily specifically required by FAA orders or regulations. Therefore, this guide does not attempt to discuss such technical reports. We will, however, discuss the TIR Part II. "What about Part I?", you ask...well, just like the TIA has two parts, so does the Report (the TIR) that essentially responds to the TIA and Part I is for the manufacturing/airworthiness community, while Part II is for us, the Flight Test community. Chapter 6 discusses the TIR Part II (we will refer to it simply as "the TIR") and Appendix E is reserved for a future example TIR.

1.3.1.11 Staying organized.

It is recommended that a system be setup to keep organized. One example organizational scheme, involving mock folders that would be contained on a computer, is depicted in Figure 1-5 and shows the steps of a typical project in order.



Name	Date modified	Type	Size
1 Project Initiation Documents	5/19/2021 1:21 PM	File folder	
2 Meetings	5/19/2021 1:21 PM	File folder	
3 Certification Plan	5/19/2021 1:22 PM	File folder	
4 Issue Papers	5/19/2021 1:24 PM	File folder	
5 Test Plan with Risk Mgt Plan	5/19/2021 1:24 PM	File folder	
6 Company Flight Test Report 21.35	5/19/2021 1:25 PM	File folder	
7 TIA	5/19/2021 1:25 PM	File folder	
8 Results of TIA testing	5/19/2021 1:25 PM	File folder	
9 Issues, RI's	5/19/2021 1:26 PM	File folder	
10 Flight Manual	5/19/2021 2:08 PM	File folder	
11 TIR	5/19/2021 1:26 PM	File folder	
15 Foreign Validations	5/19/2021 1:25 PM	File folder	

Figure 1-5: Staying Organized

Chapter 2. FLIGHT TEST PLANS

2.1 Introduction.

Flight Test Plan(s). Certification plan(s), IPs, CRIs, (and possibly Special Conditions), etc. establish how Flight Test will be used as a means of compliance; based on those the important work of developing a flight test plan begins. An example test plan is in Appendix A.

2.1.1 To whom does this chapter apply?

The answer is “anyone searching for information about how to compose a Test Plan for FAA certification projects”. This might include FAA personnel (flight test or otherwise), FAA designees (to include Designated Engineering Representative or DER’s, along with possibly Organizational Designation Authorization (ODA) and their Unit Members (UMs) and companies applying for a Type Certificate (including supplemental or amended type certificates). When referring to “engineering designees”, the intent of this guide includes DERs, ODAs and UMs.

2.1.2 When the FAA says “test plan”, is that a lab test, a ground test, or a flight test?

The all encompassing answer is that it could mean any, or all of these. However, in the context of this guide, it is a plan created to assist flight testers in the planning and conduct of flight testing. Some “flight tests” are conducted on the ground, which sometimes makes things confusing. Good examples are Minimum Control Speed Ground (V_{mcg}) testing or Rejected Takeoff (RTO) testing, where—often—the test airplane never leaves the ground. Any on-aircraft test where the engines are running above ground idle power/thrust and/or the aircraft moves under its own power as part of the test should be considered a “flight test”, even if actual flight is not intended. The point is that, while these are clearly “flight tests” (which therefore requires a [Flight] Test Plan), the criteria for specifying it as such is not whether the airplanes leaves the ground. This guide will discuss Flight Test Plans, as opposed to a “lab test plan”, “software validation test plan”, etc. While such plans are important and may share many of the same attributes of a [Flight] Test Plan, this guide is focused on flight. From this point forward, this guide will simply use the terms “Flight Test Plan” and “Test Plans” interchangeably.

2.1.3 What are the components of a Test Plan (for FAA certification testing)?

Figure 2-1, an excerpt from FAA Order 8110.4C, describes the minimum requirements for a test plan. Though this order says “The applicant must...”; the order technically applies to certification branch personnel and those acting on behalf of the FAA (i.e., engineering designees). The reality is that FAA flight test personnel must ensure that a test plan meets all of these requirements.

c. Applicant Test Plan and FAA Approval. The applicant must prepare a test plan when testing is necessary to show compliance to the regulations. The applicant should also submit the test plan early enough to allow the FAA time to review and approve the test plan before the start of the test. The test plan is used to ensure orderly and complete testing is accomplished. At a minimum, a description of the items to be tested and a list of all equipment necessary to conduct the test should be in the test plan. It is also important to include a description of how the equipment is to be calibrated (when calibration is required) and approved before the test, required conformities of the test article and test setup, a list of the specific airworthiness standards, a description of how compliance is expected to be shown, and a test procedure written in a step-by-step format with defined pass/fail criteria. After the ACO engineer or FAA pilot approves the test plan, they request an FAA conformity inspection of the test article and test setup to ensure conformance to the engineering drawings and test plan.

Figure 2-1: FAA Order 8110.4C Test Plan requirements

2.2 Contents of the Flight Test Plan

According to Order 8110.4C, the test plan requires the following items:

2.2.1 Description of test item and "all equipment necessary to conduct".

This almost certainly would include a description of the test aircraft and specific system under test, with sufficient detail so that the tester can properly assess the scope and content of the test plan. Additionally, test instrumentation (if applicable) should be discussed to an appropriate level, even if only consisting of hand-held devices or external test boxes (e.g. TCAS test set).

2.2.2 Calibration (if applicable).

Larger applicants might refer to a general calibration process or manual, while smaller applicants could state general aspects of calibration of production instruments, for example. The specifics depend on the test (e.g. a propulsion test: The engine gauges are important, as is the airspeed indicator—to ensure it's flown at the proper test speed.) In any case, both instrumentation and aircraft systems (e.g. air data system, control rigging) should be calibrated within a reasonable interval (e.g. within 30 days of testing).

2.2.3 Conformities.

Again, the scope of this section of the test might refer to a general, well-known process (for a larger applicant) or state that an FAA conformity will be issued. If several aircraft configurations (e.g.: different software loads or hardware configurations) are part of the test, the test plan should clearly define which test is done in which configuration. The idea is to make it clear to the reader what the proposed plan will be concerning configuration of the test aircraft for the purpose of the flight tests. Note that the conformity of the test article is according to the intended type design, NOT an as-built configuration.

2.2.4 List of airworthiness standards.

Ultimately, a good test plan stems from a well-thought-out Certification Plan. The Certification Plan's Compliance Matrix or Compliance Checklist lists "Flight Test" as the Method of Compliance (MOC) and is the "pointer" to a test plan. The test plan should list the "Airworthiness Standards" (Regulations...i.e. Part 23, 25, 27, 29 or their older CAR equivalents) down to the appropriate sub-paragraph level, amendment level and be clear about which test point(s) apply to which regulation.

2.2.5 Description of how compliance is shown.

Should be such that any qualified tester could pick it up and understand what was to be done and how. Details involving everything from the configuration to the weight, to the phase of flight, to the test altitude/airspeed/etc.—all as appropriate to the testing being conducted—are spelled out.

2.2.6 Test procedure in a step-by-step format.

Again, the goal is a clearly-understandable and explicit plan for how the testing will be accomplished.

2.2.7 Defined "pass/fail criteria".

When has compliance been shown? Was a given point or test condition satisfactory (i.e. “compliant”)? In this regard, test plan authors should look first to the regulation. The regulations often give specific wording related to compliance...and the language can be modified for use in the test plan.

- Sometimes the wording is qualitative in nature: “did not require exceptional piloting skill”, “was free of glare that could interfere with the normal duties of the minimum flight crew”, “provided enough light for night operation including hovering and landing”, etc. or,
- Perhaps the regulation gives a specific quantitative requirement.
- Otherwise, an AC might provide information to help define “pass/fail”. For tests that are purely for data-gathering (such as performance testing), the “Pass/fail” may be as simple as gathering the data within defined testing tolerances.

2.3 **Important notes (about Order 8110.4 requirements for the content of a Test Plan)**

The complexity and extent of any given test plan largely depends on scope of the project. Of particular note, the order does not describe administrative aspects, perhaps assuming this is a standard part of any good documentation system.

Note that the order states the test plan should be submitted early. This is highly recommended to avoid delays to the program and allow for early coordination of test assets, including aircraft, personnel, instrumentation, specific test facilities, and to account for weather requirements.

2.4 **Safety and Risk Management**

Consideration of safety, including basic safety processes and focused Risk Management aspects are perhaps the most important pieces of the overall test planning process. FAA Order 4040.26 should be consulted for details concerning Safety and Flight Testing. It is acceptable for the test plan and the Safety/Risk Management documents to be separate from each other. However, this is not considered optimum. It is a best practice to combine and integrate test planning and safety. However, to be clear, this is not required so long as the Safety/Risk Management process is comprehensive and addresses specific/potential hazards associated with the test conduct in the flight test plan. Again, it is important to note that, approval of the test plan does not imply formal acceptance of the RMP.

2.5 Common Errors in Test Plans

Below is a list of some of the common errors made by test plan authors with suggested solutions:

1. **Problem:** Test plans appear to have received only a cursory review.
Solution: Treat a test plan like you would treat a job resume. Don't submit a poorly written document...it reflects poorly on you. Spell Check every test plan; read the entire document word-for-word...others will.
2. **Problem:** Test Plans are often submitted without the appropriate engineers, test pilots, and/or engineering designees (when the applicant chooses to use an engineering designee) having reviewed the test plan.
Solution: ensure the appropriate engineers, test pilots, and/or engineering designees (including flight test and all affected disciplines for which compliance is intended) review the test plan. Engineering designees (when utilized by the applicant) should indicate their review using Form 8110-3 or the ODA equivalent.
3. **Problem:** Insufficient scope of testing.
Solution: ensure pertinent certification regulations and guidance are thoroughly reviewed and the test plan matches those requirements and the requirements listed in the Certification Plan for the project.
4. **Problem:** Test conditions matrix may be incomplete or does not match the description given in the procedures or introductory section.
Solution: be cautious of cut and paste, check the names of all switches, carefully compare the procedure section with the test aircraft, and verify procedures through company testing (when applicable).
5. **Problem:** Success criteria ("pass/fail criteria") vague or omitted.
Solution: attempt to quote, verbatim, from the regulation or advisory material, if applicable. Even if the success criteria is "successfully obtain the data", say that. Similarly, if fail criteria is specific/clear, articulate that as well.
6. **Problem:** Company or research and development test plan is reused as the certification test plan.
Solution: Carefully review the test plan to ensure that it does not include (or clearly excludes from the certification process) test points/procedures from the company test plan that may have exclusively been necessary for development and are not necessary for the certification test plan finding of compliance. Also make sure to exclude all non-project related testing from the certification test plan (e.g., future capabilities, out of scope items).

Remember: PLAN THE FLIGHT, FLY THE PLAN.

Chapter 3. TYPE INSPECTION AUTHORIZATION (TIA) PART II**3.1 Purpose.**

This chapter provides a guide for understanding and utilizing the Type Inspection Authorization (TIA). Important note: this chapter does not attempt to discuss other “authorization” documents, such as the LOA (Letter of Authorization) or FAM (Flight Authorization Memo), because those are considered to primarily affect FAA employees and are discussed in internal FAA process documents.

3.2 Examples.

Because the TIA is a controlled form (which—at the time of the original authoring of the Wright Stuff—had recently undergone an unofficial yet extensive change), the Wright Stuff will not attempt to provide an entire sample TIA but, rather, will provide limited guidance and example text focused on that portion of the TIA detailing the duties to be performed by the Flight Tester. Sample text for “Part II” of the TIA is contained in Appendix B.

3.3 Type Inspection Authorization (TIA).

The TIA serves several important functions for the tester, including:

1. Describing the product
2. Describing existing limitations and possibly invoking test-specific limitations for the conduct of the test
3. Defining the risk level for Management awareness and approval.
4. Specifying what the Manufacturing/Airworthiness group (or their Designee) should ensure is accomplished prior to the conduct of flight test (a.k.a. “TIA Part I” or “Paragraph 18A”).

Perhaps most importantly, the TIA is the “marching orders” for the tester, written down in “Part II” (aka “18B”)...a list of their specific duties as it relates to conducting the flight test. This is accomplished by specifying items such as “receive a briefing from the applicable inspector concerning the results following completion of TIA Part I”, “review company testing results”, “complete the flight testing specified in this test plan (with specifics)”, and “review this Flight Manual”. In addition, there is generally a statement to “Recommend any other test deemed necessary”, which is worthy of an extended conversation with your leadership concerning what this really means (clearly a tester shouldn’t feel as if they can just “do anything they want”; however, this step of the TIA does give the tester latitude to recommend performing additional testing, in a safe, acceptable and consistent way.

The TIA is also a chance for the FAA’s operational world to assess operational suitability and training, in the “Part III” (or “18C”) section, where the Aircraft Evaluation Division (AED), specifies their involvement in the conduct of flight testing.

Chapter 4. TEST CONDUCT AND COMMUNICATION TOOLS

4.1 Purpose.

The purpose of this chapter is to describe a suggested set of communication tools used by Flight Testers involved *in the conduct of* FAA Certification Flight Testing. While written for FAA flight testing use, you will find that much technical reporting has a common underlying philosophy. This chapter introduces these common communication tools used during the conduct of testing. Samples of each are given in various appendices. This chapter is NOT designed to describe HOW to specifically conduct certain tests, that work is left to various advisory circulars and flight test guides. There are many communication tools in use world-wide and you should not feel compelled to change to this format or even use the terms involved. Use what works for you and your organization. This is primarily intended for use by those who are searching for a set of communication tools for use in and around the conduct of testing. This represents the current set of tools used by the FAA Flight Test and Human Factors branch. This chapter of the Wright Stuff does not include the more official "Type Inspection Report" (TIR), which is further discussed in a follow-on chapter.

4.2 Background.

Testers should communicate the results of technical evaluations clearly, concisely, and expeditiously. The presentation must satisfy the needs of a diverse audience:

- Executive/Senior management should be able to derive the essence of the report quickly without wading through a myriad of details.
- Program managers and other decision makers, who use the information and recommendations contained in the report as a basis for program decisions.
- Technical personnel, who require technical data, usually in tabular, graphical, or parametric format, to verify the accuracy of statements made in the text, to provide quantitative rationale for program decisions, and to form a basis for further analysis.

The measure of a report's success is its completeness and accuracy in communicating the results of the test. Too often we become over-focused on format and allow the "medium" to drive the "message". Detailed guidance such as that contained in this manual runs the risk of creating the impression that writing a technical report is a fill-in-the-blanks-type exercise. It very definitely is not. Strict efforts to stick to a specific format will be for naught if the report does not accurately and clearly reflect the results. Determine what it is you want to say and then say it using whatever guidance is applicable.

4.3 Report Types for use during the conduct of testing

The following summary of report types—all of which are optional and simply for consideration by flight test organizations--may be used as a quick reference.

4.3.1 Daily report.

A Daily Report is used to expeditiously capture the results of flight tests conducted. Ideally, this report is at least started soon after the conduct of the test, both to provide information to be used by different test crews who may conduct follow-on testing, and to

allow for the immediate capture of salient information. The daily report is not a required report. The suggested fields for a Daily report are contained in Table C-1.

4.3.2 Response Item.

A Response Item (or “RI”) is a standardized means of documenting Certification non-compliances, potential non-compliances or other topics/issues and communicating these clearly to applicants for Type Certificates, Amended Type Certificates, and Supplemental Type Certificates awarded under the auspices of 14 CFR Part 21 and defined in numerous FAA orders, including FAA Orders 8110.4 and 8100.15. A Response Item is defined as any item identified by FAA Flight Test specialists or their engineering designees that requires Flight Test closure prior to Type Certification. The objective of establishing Response Item procedures is to help identify and resolve technical issues as early and clearly as possible. Response Items may be generated from flight tests or from non-flight activity such as document reviews, technical briefings, review of company flight test data, and any other question or topic that is best handled using a Response Item. Procedures for the coordination and information and interface procedures for communication between FAA flight test and the applicant should be established and standardized. The Response Item is not a required report. The suggested fields for an RI are contained in Table C-2.

4.3.3 Passdown.

The Passdown (or “PD”) is a standardized means of capturing lessons learned to improve Safety and Efficiency in the planning and conduct of Flight Testing, across the Aircraft Certification process. Passdown Items are Flight Test comments and suggestions for items appropriate to future test plan revisions, lessons learned, risk management, and safety items. The reason for sharing Passdown Items is to help improve communication, test efficiency, and flight safety on future programs. Passdown Items also provide Flight Test an opportunity to share knowledge obtained on best practices and lessons learned from test programs outside of specific applicants. In essence, it’s a process through which Flight Test can offer ideas for improvement. The Passdown process is only for suggested improvements, not for items which pose an imminent safety risk or impact to compliance. Applicant response to Passdown Items is completely optional. There is no regulatory requirement or compliance determination required with Passdown Items. Specific procedures for submitting Passdown Items should be coordinated between FAA Flight test and their applicants as appropriate. Consideration may be given to including procedures for PD’s under the auspices of a Safety Management System (SMS). The Passdown is not a required report. The suggested fields for a PD are contained in Table C-3.

Chapter 5. FLIGHT MANUALS

5.1 Purpose.

The purpose of this chapter is to provide a guide for writing Flight Manuals. The word “Flight Manual” in itself can be confusing, as it may refer to an “Airplane Flight Manual” (AFM), or a “Rotorcraft Flight Manual” (RFM) or a “Supplemental Flight Manual” (which is actually a flight manual written for an already-certified aircraft that was certified without the regulations requiring a flight manual and the “Supplemental” manual was later required to be prepared) or a “Airplane [Rotorcraft] Flight Manual Supplement” (AFMS, or RFMS) that are created as a result of Supplemental Type Certificate (STC) projects, or even a manual written for use at the operational level, such as required by 14 CFR Part 121.141, large portions of which are not necessarily part of the engineering certification process.

5.2 Background

Guidance for the content and writing of a flight manual is contained in a variety of AC’s depending on the specific product being certified. For example, some flight manual content is contained in a general AC such as AC 29-2, whereas some flight manual content is contained in some more specific AC such as AC 25.1581. Beginning in approximately 2014, the FAA developed a training course for FAA Flight Manuals and, as of this revision of “The Wright Stuff”, that course—in conjunction with specific AC’s and other documents, is considered the FAA’s best current source of information for Flight Manual content and style. The goal of creating a single-source and consistent publication for the writing of Flight Manuals still remains, including the goal of creating a sample to be placed in Appendix D of “The Wright Stuff”. Until then, it is recommended that readers refer to FAA course 27200163 “Flight Test: Flight Manual Development Overview”.

Chapter 6. TYPE INSPECTION REPORT (TIR) PART II

6.1 Purpose.

The purpose of this chapter is to provide information concerning Type Inspection Reports (TIR) Part II.

6.2 Background

A TIR consists of two parts, Part I for manufacturing and Part II for Flight Test. These sections reflect the Type Inspection Authorization's (TIA) two parts and are essentially intended to report on each requirement contained in the TIA. TIR Part I (for manufacturing...eg FAA CMS, their DAR's, etc) is well discussed and has a number of FAA forms associated with it (eg: 8110-5, 8110-26, etc). However, the format for submittal of TIR Part II is less defined and, over time, has varied. While past versions of FAA Order 8110.4 allowed for "*Locally approved [TIR Part II] formats*" so long as "*all TIA items are addressed*", the current version of 8110.4 directs the use of Form 8110-31 for the TIR. This form is somewhat rigid and may not contain enough space to report the results of a large and/or complex TIA. In practice, many TIR authors: fill in the 8110-31 form as completely as possible; summarize the flight test results in TIR Part II, Section 4 "Flight Test Results and Findings"; and reference other detailed flight test and/or compliance reports in Section 4 and Section 6.

FAA Order 8110.4C contains general information for the TIR, in Paragraph 2-7(b)(1), as well as some specific Flight Test items in Paragraph 2-7(b)(3).

The term "STIR" (Supplemental TIR)—a term used in FAA Order 811.04C—is somewhat confusing. It COULD be interpreted as a TIR for an STC project, but this interpretation—at least in the context of Flight Test (Part II)—is incorrect. A brief word search for "STIR" in the order reveals that it applies ONLY TO MANUFACTURING INSPECTORS (i.e. NOT flight test).

One area of discussion related to TIR Part II's is whether a TIR can apply to multiple TIAs. Technically, each TIA should be closed out by an associated TIR. For large Original Equipment Manufacturer (OEM) projects, typically the OEM (or their ODA) writes the TIR and may well be authorized to use a unique format, so long as the information contained is consistent with FAA orders. On the other hand, projects where the FAA writes the TIR Part II are typically simpler and, therefore, it's more likely that there's a single TIA (and, therefore, single TIR) involved. Applicants should coordinate with the project Certification Branch and Flight Test Section to determine the expectation for the number of TIRs.

6.3 Conclusion

Because the form, format, and content of Type Inspection Report (TIR) Part II has varied widely over time, the *Wright Stuff* does not attempt to provide a thorough example. Reference should be made to FAA Order 8110.4 to ensure that applicable elements are contained and coordinated with the respective FAA offices.

A future revision of the *Wright Stuff* will contain a more standardized approach to the TIR Part II.

Appendix A. Sample Flight Test Plan

A.1. General notes on this example test plan

1. It cannot be stressed enough that this example is intended as a guide, as a “help”. It should not be construed the only way to do a test plan. More mature applicants who have a successful track record with test planning should not feel compelled to change the characteristics of their test planning documents. That said, this guide was produced based on a stated need for a good example that could be given to applicants and FAA personnel alike, to supplement the limited verbiage contained in FAA Order 8110.4.
2. Risk Management is a fundamental aspect of safe and proper flight testing. FAA Order 4040.26 defines the risk management process and gives examples. One question that is often asked is how Test Plans (TP) and Risk Management Plans (RM) are integrated. There is no one correct answer. It can be argued that an integrated TP/RM document is preferable, providing “one stop shopping” for the conduct of a test. However, there may be situations in which a combined TP/RM document is not preferred. This example test plan is formulated with the integrated approach, albeit in a fairly limited manner. Refer to FAA Order 4040.26 for more information (all FAA orders are available at: <https://drs.faa.gov/browse>)
3. This example does not contain typical business aspects such as copyrighting, trademark or other legal/business markings or disclaimers.
4. Formatting style (such as document numbers, paragraph numbering) is optional, but should be employed in an organized/structured manner to ease the review.
5. Items shown as “best practices” are simply considered suggestions for consideration by the applicant and should not be considered mandatory.
6. The scope and nature of each project will necessarily drive the best way to organize the project test plan. For example, a simple Amended Supplemental Type Certification (ASTC) project likely needs just a single, relatively simple test plan. By contrast, a new Part 25 Type Certification (TC) project likely will have multiple test plans, perhaps organized into chapters and/or by subject areas.

Wright Brothers Aviation

123 Main Street, Anywhere USA

Certification Flight Test Plan

Installation of something new
in the model RS-1 airplane

Project Number ST1234SE-A, Revision B

Company approved: [optional signature block]

FAA APPROVED: [it may be helpful to indicate FAA approval
on the cover page]

Revision History

REV	DATE	DESCRIPTION	BY	FAA Approval
IR	9/22/2018	Initial release	R. Smith	n/a (internal)
A	11/15/2018	The following changes were made, based on FAA feedback: • Xxx • Xxx • [Note: the level of detail here is optional and situationally dependent; a simple description may be sufficient]	R. Smith	[consider having a place to show FAA approval of a given revision to a test plan. This may be shown here, on the cover or on a “stamp approval” from the FAA.]
B	1/19/2019	Changes made after 12/15/2018 telecon.	R. Smith	“

Optional

- A table of revisions is not required, though it may be helpful in tracking the progress of a test plan towards approval. As an alternative, the cover page could contain review/approval signatures; in this event it is recommended that FAA approval status be clearly marked.
- Similarly, approval signatures may or may not be present. Signatures from company personnel on the cover page is common. It may also be contained in this revisions table, or simply not present at all.
- It is strongly recommended that changes (from previous revisions) be clearly shown using change bars, etc. This helps speed the review of the new Rev.

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A table of contents may or may not be useful or appropriate. Either way, this is an optional element that is recommended as a “best practice” for more complex projects or test plans. Similarly, a “table of figures” or “List of Tables” and/or a glossary may or may not be recommended, depending on the nature of a specific project.

References

1. FAA Type Certificate Data Sheet (TCDS) RS1NM, Rev 5, dated April 1, 1989 for the model RS-1 airplane.
2. 14CFR Part 23—Airworthiness Standards: Normal Category Airplanes [Tip: if a certification basis has been established, reference to the associated document may be more specific]
3. [Consider if applicable: Certification Plan; Rev and date]
4. [Consider if applicable: associated Guidance materials, Advisory Circulars, Policy Statements, etc.]
5. [Consider if applicable: related external documents such as Instrumentation plans, Risk Management Plans, Maintenance Manuals, Company process documents, etc.]
6. [Consider if applicable: Master Drawings, related technical data, basic flight manuals or maintenance manuals, etc.]

References: Possibly Optional

- It could be argued that a “references” section constitutes part of several required aspects for a test plan, including “how compliance will be shown” or “Description of how equipment will be calibrated”.
- However, it may be acceptable to include the same information simply described within the body of the test plan or referenced ad-hoc.

Other optional sections worth considering

- Points of contact
- List of Designees, delegation proposal or delegation plan

A. Introduction

1. Background

[This is an optional section. A brief description of why the project is being conducted. Can be used to “set the stage” for the project.]

2. Purpose

[This is an optional section. Can be used to clearly state why this test plan is necessary.]
The purpose of this test plan is to evaluate something new installed on the RS-1 airplane for compliance to the regulations (Part 23, reference 2).

3. Description of Test Aircraft

The RS-1 airplane is a high-wing, tailwheel design originally fitted with a Lycoming O-320-A2A or –A2B engine developing 150 HP fitted with a fixed pitch propeller. It has been modified, by previous STC SA12345 by installation of an air-cooled Lycoming O-360-A1P engine developing 180 HP with a Hartzell HC-C2YK-BF/F7666A constant-speed propeller. The test airplane, Serial Number 0922, registration N0130, is considered to be per the proposed type design for the purposes of this test.

4. Description of Test System

[again; optional.]

The modified engine cooling system, designed to provide better cooling performance during extremely hot conditions, consists of a cowling system, including baffles, designed to port air to and around the engine. The carburetor heat system utilizes hot air from a “muff” surrounding the engine exhaust. This hot air is ported through a tub to the carburetor mixing box, where it can be combined (through use of a flapper valve) with ambient air to provide heated air to the carburetor. [refer to a diagram as appropriate]

5. Description of Modification

[if you haven’t already described “what new?” in the sections above, now is the time to do it!]

6. Description of Test Instrumentation

[Description of Test Instrumentation—whether this consists of a fully-instrumented aircraft with 1000’s of parameters or a portable camera mounted in the cockpit—is an important part of giving the reader an idea of how the testing will be conducted what is available to aid the flight tester.]

Carburetor temperature heat rise will be measured using the production Carb Air Temp (CAT) sensor and gage. The probe is shown in Appendix A, figure 1, as “Probe 1”. The probe and gage will be calibrated by using Maintenance Test Set LAWS-2 temperature calibration set.

This section's description of the test instrumentation satisfies the requirement for "all equipment necessary to conduct the test", along with "description of how the equipment is to be calibrated", and is part of describing how compliance will be shown. Depending on the scope of the project a full list of instrumentation may be referred to in an external document. Describe—for a given test plan—what parameters are "no go" items should they be unavailable on a given test day.

B. Scope of testing

1. Basic description

Testing is planned to consist of two flights, one on a "hot day" (targeting > 100 deg F) and one closer to standard day conditions.

2. Weight and Center of Gravity

Weight and center of gravity are optional for these tests.

[Note: for many handling qualities and performance tests, weight and c.g. are extremely important, as is clearly defining the scope of such testing—i.e. what the approved wt/cg envelope is and how well it will be covered as part of the testing. In cases where wt/cg are considered important, it is recommended that a graphic of the wt/cg envelope be shown, along with test weight and cg bands. An example of such a graphic is shown below. It may be useful to provide specific corner points, perhaps in a table, or noted on the graph itself if that's not too busy.]

The "Scope" and "Method" of testing sections give the reader an idea about testing, from general information to specific. This section often will refer to a "test conditions" table or an appendix with more specific information. The names of these sections (i.e. "Scope" and "Method" are not as important as simply ensuring the content is complete.

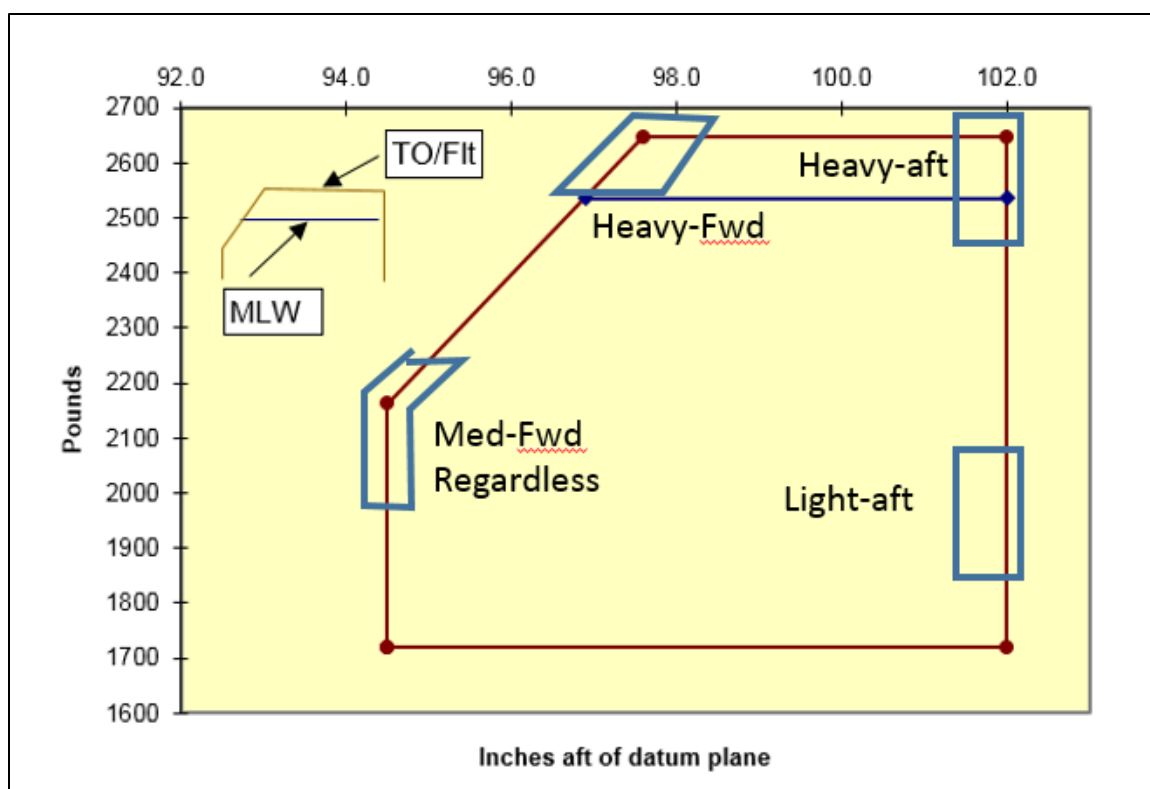


Figure 1
RS-1 Weight/c.g. Envelope and Test Loadings

3. Configurations

["Configurations" may include anything from software configuration, to gear/flaps/speedbrake, etc. They may be listed in tabular form and later referred to or directly defined in a test conditions table.] *The test configurations are defined in table 1.*

Table 1
RS-1 Test Configurations

Configuration	Symbol	Gear	Flaps
Normal takeoff	TO	Down	1/2
Approach	PA1	Up	1/2
Normal Landing	PA2	Down	Full
Cruise	CR	Up	Up

C. Method of Testing

1. Basic description

Tests will be conducted in accordance with the Type Inspection Authorization to be issued by the FAA, utilizing procedures in Civil Airworthiness Manual 3 (CAM 3; reference 4), and AC23-8B (reference 5). The certification basis (CAR 3—reference 1) will be applied. Engine limits, from the Engine TCDS (reference 6), will be adhered to. Tests will be conducted in accordance with the tests and test conditions shown in Appendix A, table 1. Data will be recorded on kneeboard cards and [as applicable] using the [instrumentation system]. Data will be processed by hand and utilizing common computer software. A Type Inspection Report will be prepared following flight test.

2. Deficiency Scale

The topic of a classification scale was debated within the FAA flight test community for many years. In January 2020 the scale below was accepted by the FAA's Flight Test and Human Factors Branch Manager, AIR-710. Other scales are totally acceptable within the context of an applicant-developed test plan.

The following scale will be used to identify potential problems with certification:

- **Certification issue (CI):** an item that is not compliant with FAA regulatory material and must be corrected. The specific regulation or guidance material could be included to show why the finding is non-compliant.
- **Potential certification issue (PCI):** this is an item that may or may not be compliant. Additional information and/or research may be needed by the certification team.
- **Comment (Cmt):** general feedback to the applicant, who may or may not act on it. Acknowledgement of the feedback is required.

3. Conformity

[FAA Order 8110.4C requires discussion of conformity. Depending on the scope of a project, this may be a very complex discussion or very simple. Reference to a process or simple reference to conformity may suffice. The idea is to think through the conformity process to ensure that the test aircraft is in a representative configuration to conduct the test. Additionally, items such as “pre-test inspections” may be discussed here, or perhaps in the safety section.]

4. Test Conditions

Tests and Test Conditions are defined in Appendix A [or alternatively, appendix A1]. [The specified appendices give two examples of how Order 8110.4 “test procedure in a step-by-

step format”, “defined pass/fail criteria”, “list of airworthiness standards”, and “defined pass/fail criteria” may be communicated.]

[NOTE: this test and test conditions table contains a tremendous amount of information, the specific format is optional, the idea is to clearly describe what is tested and how.]

5. Test tolerances

[Also an optional section. May be used to specify testing tolerances to be followed for the successful completion of testing. For example, how far off a specified speed is allowed? How far off specified altitude? Etc.]

D. Safety

1. Flight Test Operations

[This is a good place to specify aspects of the applicant’s “standard test procedures” that relate to safety.]

The following standard procedures used at Wright Brothers Aviation will be observed:

- *A thorough pre-flight briefing, conducted in accordance with the briefing guide contained in FAA Order 4040.26, will be completed prior to each test flight.*
- *other specific SOPs or practices should be specified.*
- *A post-flight debriefing will be conducted using the Wright Brothers Flight Test Debriefing checklist, deficiencies will be documented and lessons learned will be discussed.*

2. Buildup

[An optional section, but may help the applicant at least think through how “buildup”—i.e., requiring that some testing be completed prior to other for the purpose of safety—may be used in a test program.]

Buildup will consist of the following:

- *Gradual buildup in sideslip*
- *Stall speed testing will be completed prior to stall characteristics testing*
- *Etc., etc., etc.*

3. Flight Test Limitations

[An optional section. Reference to a system of temporary, test-related restrictions/limitations may be made. Or, if there are known limitations which will apply to the entire test program, those may be listed here.]

[This may also be a good place to define global weather requirements, if not done in the risk management section or test hazard analyses.]

4. Risk Management

[As noted earlier, this example test plan does not thoroughly discuss various Risk Management practices, as those are contained in FAA Order 4040.26. However, as a place-

keeper—and in the belief that an integrated test plan/Risk Management plan is a “best practice”—reference is included here.]

Associated Hazards and Risk Management Plan are contained in Appendix B.

Tests and Test Conditions

Event: 1-9 Runway Performance (Landing Distance)

Regulation: 23.75

Unique Requirements:

Pre/Post weigh airplane

Wind station

GPS w/ GPS Datalogger

Verify cold tire pressures: nose = 60 psi, mains = 96 psi MTOW / 94 psi Med Wt

Smooth runway required.

Test Procedure:

1. Set Prop Sync: OFF
2. Engine configuration: as required (AEO is all engines normal; OEI is Left engine simulated inoperative)
3. Stabilize in a descent on configuration prior to 50' above the landing surface. Set Condition Lever to HIGH IDLE.
4. At 50' verify stable on speed and FPA.
5. When appropriate bring power to idle and begin flare. Do not allow the nose to drop during power reduction.
6. Minimize float and target a firm touchdown.
7. Apply heavy wheel brakes.
8. Apply max reverse, unless otherwise noted.
9. Maintain directional control using rudder, nose wheel steering, and differential braking as needed.
10. Condition is complete at 10 KIAS.
11. Repeat each condition a minimum of 2 times.

Data: Pilot comments, tower wind, runway, airport, runway conditions.

Test Tolerances:

Airspeed: ± 3 KIAS

Wind Speed: < 5 kts

Risk Management: Medium (see THA 1-9A, 1-9B)

Success Criteria: Data gathered, within test tolerances and in accordance with the specified procedure.

COND	DESCRIPTION	FIELD ELEV (ft)	ENG's	REVERSE	GWt/cg	CONFIG	SPEED
1-9-1	Normal Ldg, low altitude	SL-1000	AEO	Max	Hvy-Fwd	PA2	Vref
1-9-2	OEI Ldg, low altitude	SL-1000	OEI	Max OEI	Hvy-Fwd	PA2	Vref
1-9-3	Min idle, AEO, Low alt	SL-1000	AEO	Idle Rev	Hvy-Fwd	PA2	Vref
1-9-4	Min idle, OEI, Low alt	SL-1000	OEI	Idle Rev	Hvy-Fwd	PA2	Vref
1-9-5	Normal Ldg, Med altitude	3000-5000	AEO	Max	Hvy-Fwd	PA2	Vref
etc			etc				

Be sure to include clean up procedures at the end of the test card/procedure, if applicable, to return the aircraft to a normal configuration. For example:

- (#) Reset engine bleeds to normal position
- (#) Reengage stall pusher system
- (#) Return fuel isolation valves to the normal position

Table 1: Test Point Matrix

Event #	Test Description	Loading wt/cg	Config	Alt (l)	Speed (mph IAS)	M.P. (in Hg)	rpm	Data	Notes	CAR	Success criteria	Risk
1	Takeoff distance	Maximum Takeoff (MTO)/fwd	TO	Ground	Vloff to Vx	Full throttle	2700	Rwy Wind OAT MP/rpm TO Dist Vro Vloff Dist @50 ft	-	~3.84	TO Dist $\leq$ AFM	L
2 a	Takeoff Climb performance	MTO/opt	CR	Low	Vy	MCP	2700	Vi VSI MP/rpm Hp/time	Initial alt as low as safely achievable; May be done concurrent w/cooling climb	3.85(a)	$\geq$ AFM & >300 fpm & $\gamma \geq 1:12$	M (RM1)
2b	Balked landing Climb performance	MTO/opt	PA1	Low	Vx	Full throttle	2700	Vi VSI MP/rpm Hp/time	Initial alt as low as safely achievable; May be done concurrent w/cooling climb	3.85(c)	$\geq 1:30$	M (RM1)
3a	Longitudinal control (flaps up)	light/aft	CR	1000-2000 ft AGL	Vt=Vx	MCP	2700	Pitch rate sat? MP	Slow to stall warning, pitch over	3.109(a)(1) & (a)(3)(ii)	Qual: sat pitch rate & V accel?	L
3b	Longitudinal control (flaps down)	light/aft	PA1	1000-2000 ft AGL	Vt=Vx	MCP	2700	Pitch rate sat? MP	Slow to stall warning, pitch over	3.109(a)(1) & (a)(3)(i)	Qual: sat pitch rate & V accel?	L
3c	Longitudinal control (flap retraction)	light/aft	PA1→C R	1000-2000 ft AGL	1.4Vs1	MCP	2700	Fs	Retract flaps, maintain Vt	3.109(b)(3)	Qual: Fs ok?	L
3d	Longitudinal control (power addition)	light/aft	CR	1000-2000 ft AGL	1.4 Vs1	Idle→TO	Full	Mpi MPf Fs	Quickly apply TO power	3.109(b)(4)	Fs ok?	L
3e	Longitudinal control (flap retraction + pwr addition)	light/aft	PA1→C R	1000-2000 ft AGL	1.1 Vs1	Idle→TO	Full	Mpi MPf Fs	Retract flap and apply TO power; <i>maintain altitude</i>	3.109(c)	Fs ok?	L
4a	Trim (long; flaps up)	Light/aft	CR	1-3K	Vx→1.4 Vs1	MCP	2700	Trim position	Trim across speed range	3.112(a)(2)(i)(a)	Trimmable	L

Event #	Test Description	Loading wt/cg	Config	Alt (1)	Speed (mph IAS)	M.P. (in Hg)	rpm	Data	Notes	CAR	Success criteria	Risk
4b	Trim (long; flaps TO)	Light/aft	TO	1-3K	$V_x \rightarrow 1.4 V_{S1}$	MCP	2700	Trim position	Trim across speed range	3.112(a)(2)(i)(B)	Trimmable	L
5a	Static Longitudinal Stability (slow)	MTO/opt	CR	Any	$V_t = 1.4 V_{S1}$ $V: 1.2 \text{ to } 1.6 V_{S1}$	75% MCP	75% MCP	Fs vs. Vi MP/rpm Alt	--	3.115(b)	Stable, perceptible	L
5b	Static Long stab (fast)	MTO/opt	CR	Any	$V_t = 75\% \text{ MCP}$ $V: 1.3 V_{S1} \text{ to } V_{ne}$	75% MCP	75% MCP	Fs vs. Vi MP/rpm Alt	75% MCP from Heat Rise data analysis	3.115(c)	Stable, Fs < 40 lb	L
6a	Static Dir stability (flaps up)	Opt/aft	CR	> 2K ft AGL	$V_t = 1.2 V_{S1}$	MCP	2700	Alt OAT MP/rpm WxVane?	Flat turn, relax rudder --L & R	3.118(a)(1)	Positive N_β	M (RM2 & 3)
6b	Static Lateral Stability (flaps up)	Opt/aft	CR	> 2K ft AGL	$V_t = 1.2 V_{S1}$	MCP	2700	Alt OAT MP/rpm Wing pickup	SHSS $\rightarrow$ relax Fa L & R	3.118(a)(2)(ii)	Apparent $L_\beta \geq 0$	M (RM2 & 3)
6c	Static Lat-Dir Stability (flaps up)	Opt/aft	CR	> 2K ft AGL	$V_t = 1.2 V_{S1}$	MCP	2700	Alt OAT MP/rpm Fa/ δa Fr/ δr β (est)	Slow sweep, L&R up to 150 lb or $\beta = 15^\circ$ --May combine w/evt 6b	3.118(a)(3)	Steady increase of Fa/ δa & Fr/ δr with β	M (RM2 & 3)
6d	Static Dir stability (flaps land)	Opt/aft	PA1	> 2K ft AGL	$V_t = 1.2 V_{S1}$	MCP	2700	Alt OAT MP/rpm WxVane?	Flat turn, relax rudder --L & R	3.118(a)(1)	Positive N_β	M (RM2 & 3)
6e	Static Lateral Stability (flaps land)	Opt/aft	PA1	> 2K ft AGL	$V_t = 1.2 V_{S1}$	MCP	2700	Alt OAT MP/rpm Wing pickup	SHSS $\rightarrow$ relax Fa L & R	3.118(a)(2)(ii)	Apparent $L_\beta \geq 0$	M (RM2 & 3)
6f	Static Lat-Dir Stability (flaps land)	Opt/aft	PA1	> 2K ft AGL	$V_t = 1.2 V_{S1}$	MCP	2700	Alt OAT MP/rpm Fa/ δa Fr/ δr β (est)	Slow sweep, L&R up to 150 lb or $\beta = 15^\circ$ --May combine w/evt 6e	3.118(a)(3)	Steady increase of Fa/ δa & Fr/ δr with β	M (RM2 & 3)
7a	Buildup stall (fwd cg; power off, flaps up)	Opt/fwd	CR	> 2K ft AGL	$V_t = 1.4 V_{S1}$	Idle	full	Vw Vs Char ($\Delta\phi, \Delta\Psi$) Rec'y ease Alt loss Rec'y θ	1 mph/sec decel If $V_w < 1.05 V_s$, delay rec'y 1 sec	3.120, 3.121 (buildup)	Note 2	L
7b	Buildup stall (fwd cg; power on; flaps up)	Opt/fwd	CR	> 2K ft AGL	$V_t = 1.4 V_{S1}$	MCP	2700	Vw Vs Char ($\Delta\phi, \Delta\Psi$) Rec'y ease Alt loss	1 mph/sec decel If $V_w < 1.05 V_s$, delay rec'y 1 sec	3.120, 3.121 (buildup)	Note 2	L

Event #	Test Description	Loading wt/cg	Config	Alt (1)	Speed (mph IAS)	M.P. (in Hg)	rpm	Data	Notes	CAR	Success criteria	Risk
								Rec'y θ				
7c	Buildup stall (fwd cg, power on, flaps TO)	Opt/fwd	TO	> 2K ft AGL	$V_t=1.4 V_{S1}$	Mpi	Mpi	Vw Vs Char ($\Delta\phi, \Delta\Psi$) Rec'y ease Alt loss Rec'y θ	--If TO=CR config; may delete. --If char's benign, this event may be omitted.	3.120, 3.121 (buildup)	Note 2	L
7d	Buildup stall (fwd cg, power on, flaps LDG)	Opt/fwd	PA1	> 2K ft AGL	$V_t=1.4 V_{S1}$	MPf	MPf	Vw Vs Char ($\Delta\phi, \Delta\Psi$) Rec'y ease Alt loss Rec'y θ	1 mph/sec decel If $V_w < 1.05 V_s$, delay rec'y 1 sec	3.120, 3.121 (buildup)	Note 2	L
7e	Buildup stall (fwd cg, turning)	Opt/fwd	CR	> 2K ft AGL	A/R	75% MCP	75% MCP		1 mph/sec decel, $\phi=30^\circ$	3.122 (buildup)	Note 3	L
8a	Stall (aft cg; power off, flaps up)	Opt/aft	CR	> 2K ft AGL	$V_t=1.4 V_{S1}$	Idle	full	Vw Vs Char ($\Delta\phi, \Delta\Psi$) Rec'y ease Alt loss Rec'y θ	1 mph/sec decel If $V_w < 1.05 V_s$, delay rec'y 1 sec	3.120, 3.121	Note 2	M (RM4)
8b	Stall (aft cg; power on, flaps up)	Opt/aft	CR	> 2K ft AGL	$V_t=1.4 V_{S1}$	MCP	2700	Vw Vs Char ($\Delta\phi, \Delta\Psi$) Rec'y ease Alt loss Rec'y θ	1 mph/sec decel If $V_w < 1.05 V_s$, delay rec'y 1 sec	3.120, 3.121	Note 2	L
8c	Stall (aft cg, power on, flaps TO)	Opt/aft	TO	> 2K ft AGL	$V_t=1.4 V_{S1}$	MCP	2700	Vw Vs Char ($\Delta\phi, \Delta\Psi$) Rec'y ease Alt loss Rec'y θ	1 mph/sec decel --If TO=CR config; may delete.	3.120, 3.121	Note 2	L
8d	Stall (aft cg, power on, flaps LDG)	Opt/aft	PA1	> 2K ft AGL	$V_t=1.4 V_{S1}$	MCP	2700	Vw Vs Char ($\Delta\phi, \Delta\Psi$) Rec'y ease Alt loss Rec'y θ	1 mph/sec decel --If TO=CR config; may delete.	3.120, 3.121	Note 2	L
8e	Stall (aft cg, turning)	Opt/aft	CR	> 2K ft AGL	A/R	75% MCP	75% MCP		1 mph/sec decel, $\phi=30^\circ$	3.122 (buildup)	Note 3	L
9	Long control, takeoff	Opt	TO	Ground	A/R	TO	2700	Char's	To be conducted concurrently w/all takeoffs	3.144	Note 4	L

Event #	Test Description	Loading wt/cg	Config	Alt (1)	Speed (mph IAS)	M.P. (in Hg)	rpm	Data	Notes	CAR	Success criteria	Risk
10a	Landing	Opt	PA1	A/R	A/R	A/R	A/R	Char's	Buildup	Buildup	No usual char's	L
10b	Landing (crosswind)	Opt	PA1	A/R	A/R	A/R	A/R	Char's HQR Rwy, wind	Tgt of Opp'y, $xw \leq 0.2V_{so}$	3.145	No uncontrollable looping tendency	L
11	Cooling	MTO/fwd	CR	Low (max: 14K; w/30 min > 12.5K)	Vy (faster okay due to CHT and anticipated climb gradient)	75% MCP until stable temps TO (1 min), then MCP until peak + 5 min	2700	time Hp OAT CHT (4) Oil temp Cyl Base?? CAT V MP rpm Mixture	--Min oil quan --Alter'r loaded w/all systems --Initial alt as low as safely achievable --Use Nz to get to Vy	3.581 to 3.586	Extrapolated to 100 deg F day (minus lapse rate)	M (RM1)
12	Carb Air Temp Rise	Opt	CR	3 (tgt: low, med, high)	100%, 90%, 80% full throttle speed	Full/90% V/80% V	a/r	Hp OAT CAT V MP rpm	Perform at Carb Heat HOT, repeat Carb Heat COLD	3.606(a)	90deg heat rise for 75% power on 30 deg day (data analysis req'd)	L
13	Vibe and buffet	Opt	CR	> 3K AGL	Vcr→Vne	MCP	2700	Vibration, buffet	Accelerate to Vne	3.159	No unusual vibration	M (RM5)
14	Power plant controls (no creep)	Opt	All	All	All	All	All	Creep?	--	3.627	No creep in prop, mix, throttle or carb ht	L
G1	Gage markings	opt	opt	Grnd	0	0	0	Gage Markings	Review against TCDS		IAW TCDS	
G2	AFM evaluation (basic AFM)	n/a	n/a	n/a	n/a	n/a	n/a	Suitability of existing AFM in light of AFMS.	--	3.778(b) (powerplant markings) 3.76(c) (cg)	Sat	n/a

Notes:

(1) Ft Hp unless otherwise noted

(2) Stall success criteria (1 g):

If $V_w < 1.05V_s$: Recovery delayed 1 sec and: $\Delta\phi, \Delta\Psi < 15^\circ$, $\Delta H_p < 100$ ft, $\theta < -30^\circ$ If $V_w \geq 1.05V_s$: $\Delta\phi, \Delta\Psi < 15^\circ$ $\Delta H_p < 100$ ft (or AFM entry) $\theta < -30^\circ$ (or AFM entry)

In all climbing stall cases, possible to recover w/o exceeding limit speed or load factor (3.121)

(3) Stall success criteria (turning stalls):

Possible to recover w/o uncontrollable ϕ or Ψ , excessive ΔH_p , or spinning tendency.

(4) There shall be no uncontrollable tendency for landplanes to nose over in any operating condition reasonably expected for the type, or when rebound occurs during landing or take-off

Appendix B. (Portions of) an Example Type Inspection Authorization (TIA)

B.1. Purpose.

This appendix provides a limited example (concerning the Flight Test Portion) of the Type Inspection Authorization. Refer to Chapter 3 for additional information and introductory material.

B.2. Example of the Flight Test portion of a Type Inspection Authorization (TIA).

Below is an example [with notes in bracketed bold italics] of typical language for “Part II” (aka block 18B) of a TIA.

Part II. The FAA Flight Test & Human Factors Branch representatives *[may include DER’s name/number if the project is delegated; may include both the FAA and a conditional reference to the DER, for example: “DER John Smith, in the event the FAA delegates some or all of the conduct of the TIA testing.”]* is requested to accomplish the following:

1. Verify that Block (Part I), steps 1-X, have been successfully completed. *[Prior to conducting the flight test, the Flight Test team should first determine that—as determined by the CMS or its designees (DARs)—that the test aircraft is both safe for flight and conforms to the required configuration, including test-specific aspects. These requirements are specified in “Part I”. The test team may determine the status of the aircraft in whatever manner they choose, perhaps by reviewing a completed FAA Form 8100-1, or via verbal communication with the DAR. Sometimes this method of communication is specified in Part I but—if it’s not—the test team should advise in advance how they wish to determine airworthiness and conformity.]*
2. Review the results of company testing. *[At the time of the writing of “The Wright Stuff”, the results of company testing—which are required by 14CFR21.35(a)(4)—must be in writing for Part 25 projects only. It has become more and more common to do a written report for all aircraft types. Regardless, this TIA item—which one could argue is redundant to 21.35(a)(4)—is optional but should be considered and coordinated with the authority.]*
3. Confirm correct weight and balance for each test condition. Flight test pilots must receive a copy of the weight and balance manifest prior to each flight. *[Note: for a test which has optional weight/cg—e.g.: an avionics test—the first sentence may be omitted, however a weight and balance must be provided for each flight. Some TIA’s put the requirement to produce weight and balance information in the “Part I” and that is acceptable....so long as the Flight Test crew has the information.]*
4. Conduct flight testing per *[Applicant Name]* *[name/number of document]* Flight Test Plan Revision X or later FAA approved revision.
5. Review the Airplane *[or Rotorcraft]* Flight Manual Supplement draft for completeness and appropriateness. *[Note: optional, depending on whether or not there is a Flight Manual.]*

6. Complete Part II of the Type Inspection Report (TIR). *[Note: this is an optional statement because the Certification Plan may already specify who is responsible for the TIR.]*
7. Determine if other tests are necessary. *[Consult the latest revision of Order 4040.26. .]*

Appendix C. Flight Test Reporting Elements

(See also Chapter 4)

Table C-1: Daily Report (DR) Elements

Report sub-section	Field Name	Description
Report Information	Report Number	Organization specific. Recommend identifying as “DR” with project number and a sequential number
	Daily Report Title	A brief title which can be used to help identify the subject or purpose of the associated test.
	Daily Report Date	This is the date that this report was first created.
	Author	The initial/primary author of the daily report.
	Author's Flight Test Organization	The name of the organization that employs the author.
	Last Updated Date	This is the most recent date that this document has been saved.
Project Information	Project Management Office	The FAA (or ODA) office to which application for type certificate was made.
	Project Category	Optional field, helps organize projects by aircraft cert basis and/or OEM
	Lead Flight Test Organization	The FAA (or ODA) Flight Test Organization (FTO) that is assigned lead on this project. This may be different from the individual lead FTP/FTE FTOs for projects that are staffed by multiple FTOs
	Project Number	CPN (or ODA)-style project number.
	Project Name	Best to match CPN (or ODA) project name. Match with application & TIA.
	Applicant Name	The applicant as it appears on the TC application. For field approvals, list the Owner as shown on the Form 337. For other project types (e.g.: Research project) list the organization involved in the project. Otherwise consider "n/a".
Flight Test Personnel	FAA FTP	The Flight Test Pilot (FTP) and/or Flight Test Engineer (FTE) from the FAA and the applicant, as applicable. “Other key personnel” should include others on the flight test (instrumentation, crew chief, etc). May substitute “DER” for “FAA” if the conduct of the project is delegated.
	FAA FTE	
	Applicant FTP	
	Applicant FTE	
	Other Key Personnel	
Aircraft Information	A/C Serial Number	Test aircraft’s manufacturer’s serial number.
	A/C Type	As used with respect to the certification of aircraft, Examples include DC-7 and DC-7C; 1049G and 1049H; and F-27 and F-27F.
	A/C Reg Number	Registration number of the test aircraft
	A/C Operator	The company that owns or operates the aircraft, such as: the applicant, an airline, flight school, commercial operator, private owner, etc.
	Configuration Notes	Document the configuration of the airplane during this test. Include items particularly germane to this test. For example: 'Production configuration', 'Instrumentation pallet', 'Air data noseboom', 'S/W Version 1.1'. Many applicants provide a configuration sheet (a 1-2 page summary) which may be attached to the report.
	Changes Since Last Flight	Changes to the configuration made between flights during a multi-test-flight campaign. This could include notable maintenance that may not be related to test.

Report sub-section	Field Name	Description
Test Information	Test Number	The test's number, per each organization's process. Multiple test numbers, if applicable, can be entered with a delimiter. For example: '200, 201, 202'. Test number and flight number may be the same or different, depending on the applicant's tracking system.
	Flight Number	The sequential number of this aircraft's flights since new. Typically used with OEMs and not with smaller applicants.
	Date of Test	Date the test was conducted. If a test was conducted over multiple days, consider using the start date here.
	Test Plans Flown	The nomenclature of the test plan(s) flown on this report.
	Test Log	Add Legs as necessary to show individual flight segments.
	Leg	For tests with multiple flight legs, a sequential number ("1", "2", etc)
	Takeoff Location	ICAO identifier or plain language name of the takeoff location
	Landing Location	ICAO identifier or plain language name of the final landing location.
	TO GWt	Aircraft's Gross Weight at takeoff, Include units (e.g.: lb, kg).
	TO CG	Aircraft's center of gravity location at takeoff (may list longitudinal and—as applicable—lateral cg). Include units (e.g.: AD, % MAC, in, cm).
	Flight (hrs)	Self-explanatory, definition per national authority.
	Block (hrs)	Time from taxi to, typically, engine shutdown.
	Notes/Work Area	Free text for where the flight was conducted, may include intermediate airports, etc.
Results and Discussions	Summary	This should be a short executive summary of the test, to allow for a quick scan by other readers and managers.
	Detailed Results	This is where the "meat of the information" concerning the test flight is placed.
	Safety Items and/or Notes to Other Crews	Use this flexible field as desired. For significant safety events or lessons learned, consider creating a Passdown or other safety-related documents/forms as dictated by local or national procedures.
	Aircraft Squawks (gripes not directly related to Cert)	Document any issues discovered that are not project related (e.g.: a handling qualities project/test, but you find a squawk on the engines, which is not part of the project).
	Continued Operational Safety (COS) Observations	Use this field to document any Continued Operational Safety aspects of your test. Examples would include performing tests related to pending AD activity, or a COS issue that is discovered during the test.
	Other Mission Accomplishments	Document mission areas not otherwise covered above. This could include comments concerning currency or proficiency. Example: 'First flight in this model in 14 months'.
Associated Documents	Response item(s) Associated with this Daily	Reference to or Links to related Response Item (RI) or Passdown (PD) documents are shown here.
	Passdown(s) Associated with this Daily	

Table C-2: Response Item (RI) Elements

RI Sub-section	Field Name	Description
Report Information	Report Number	Organization specific. Recommend identifying as “RI” with project number and a sequential number.
	Response Item Title	Enter a brief title which can be used to help identify the subject or purpose of the associated test.
	Response Item Date	This is the date that this report was first created.
	Author	The initial/primary author of the Response Item
	Author's Flight Test Organization (FTO)	The name of the organization that employs the author.
	Last Updated Date	This is the most recent date that this document has been saved.
Project Information	Project Management Office	The FAA (or ODA) office to which application for type certificate was made.
	Project Category	Optional field, helps organize projects by aircraft cert basis and/or OEM
	Lead Flight Test Organization	The FAA (or ODA) Flight Test Organization (FTO) that is assigned lead on this project. This may be different from the individual lead FTP/FTE FTOs for projects that are staffed by multiple FTOs
	Project Number	CPN (or ODA)-style project number.
	Project Name	Best to match CPN (or ODA) project name. Match with application & TIA.
	Applicant Name	The applicant as it appears on the TC application. For field approvals, list the Owner as shown on the Form 337. For other project types (e.g.: Research project) list the organization involved in the project. Otherwise consider "n/a".
Flight Test Personnel	FAA FTP	The Flight Test Pilot (FTP) and/or Flight Test Engineer (FTE) from the FAA and the applicant, as applicable. “Other key personnel” should include others on the flight test (instrumentation, crew chief, etc). May substitute “DER” for “FAA” if the conduct of the project is delegated.
	FAA FTE	
	Applicant FTP	
	Applicant FTE	
Aircraft Information	A/C Serial Number	Test aircraft’s manufacturer’s serial number.
	A/C Type	As used with respect to the certification of aircraft, Examples include DC-7 and DC-7C; 1049G and 1049H; and F-27 and F-27F.
	A/C Reg Number	Registration number of the test aircraft
Response Item Details	Associated Flight Deck Indications	Examples include: CAS messages, unexpected effects observed in controls or displays.
	Response Item Description	Succinctly and clearly defines the problem discovered during the test. For example: "Excessive ground idle thrust", "Unpredictable handling qualities during takeoff"
	Regulation For Non-Compliance	List the regulation that does or might be non-compliant, if known. No entry is required here.

Test Information	Test Number	The test's number, per each organization's process. Multiple test numbers, if applicable, can be entered with a delimiter. For example: '200, 201, 202'. Test number and flight number may be the same or different, depending on the applicant's tracking system.
	Flight Number	The sequential number of this aircraft's flights since new. Typically used with OEMs and not with smaller applicants.
	Date of Test	Date the test was conducted. If a test was conducted over multiple days, consider using the start date here.
	Takeoff Location	ICAO identifier or plain language name of the takeoff location
	Landing Location	ICAO identifier or plain language name of the final landing location.
	Test Plans	The nomenclature of the test plan(s) flown for which the Response Item is applicable (if the RI was written as a result of something observed that was not related to a specific test plan, note this as "n/a").
	Test Plan Condition Number	This is the test point(s) that may be related to the item under discussion. For example: "TP501-002: Rejected Takeoff, Max KE". If the Response Item is not related to a specific condition, use "n/a"
Tracking Information	Response Item Status	Open - must be completed prior to project closure; Closed - topic has been satisfactorily addressed; Defer to Long Term List - may not need to be completed prior to project closure.
	Response Item Level	Certification issue (CI): an item that is not compliant with FAA regulatory material and must be corrected. The specific regulation or guidance material could be included to show why the finding is non-compliant. Potential certification issue (PCI): this is an item that may or may not be compliant. Additional information and/or research may be needed by the certification team. Comment (Cmt): general feedback to the applicant, who may or may not act on it. Acknowledgement of the feedback is required.
	Action for FAA or Applicant	Optional. Used to track who has the current action for this item. This status may be changed at will as the resolution progresses.
	FAA Focal	Optional field. This is the FAA focal for this topic. This does not have to be a flight test person.
	Is the RI Submitted to Applicant?	Select YES upon submittal to the applicant. It is also suggested that the details of the submittal (date, sender, receiver) be included in the update section. Note: Not all RIs need to be sent to applicant.
	Applicant Tracking Number	If the applicant has an internal tracking system for these type of reports, add their tracking number here.
	Applicant Focal	Optional. Main applicant focal for this topic. This does not have to be a flight test person.
Associated Daily Report	Daily Report item(s) Associated with this Response Item	Reference to related Daily report, if applicable.
Update Information	Enter Update Information	Use this field to track the progress and resolution of this item.

Table C-3: Passdown (PD) Elements

PD Sub-section	Field Name	Description
Report Information	Report Number	Organization specific. Recommend identifying as “PD” with project number and a sequential number.
	Passdown Title	Enter a brief title which can be used to help identify the subject or purpose of the associated test.
	Passdown Date	This is the date that this report was first created.
	Author	The initial/primary author of the Passdown
	Author's Flight Test Organization	The name of the organization that employs the author.
	Last Updated Date	This is the most recent date that this document has been saved.
Project Information	Project Management Office	The FAA (or ODA) office to which application for type certificate was made.
	Project Category	Optional field, helps organize projects by aircraft cert basis and/or OEM
	Lead Flight Test Organization	The FAA (or ODA) Flight Test Organization (FTO) that is assigned lead on this project. This may be different from the individual lead FTP/FTE FTOs for projects that are staffed by multiple FTOs
	Project Number	CPN (or ODA)-style project number.
	Project Name	Best to match CPN (or ODA) project name. Match with application & TIA.
	Applicant Name	The applicant as it appears on the TC application. For field approvals, list the Owner as shown on the Form 337. For other project types (e.g.: Research project) list the organization involved in the project. Otherwise consider "n/a".
Flight Test Personnel	FAA FTP	The Flight Test Pilot (FTP) and/or Flight Test Engineer (FTE) from the FAA and the applicant, as applicable. “Other key personnel” should include others on the flight test (instrumentation, crew chief, etc). May substitute “DER” for “FAA” if the conduct of the project is delegated.
	FAA FTE	
	Applicant FTP	
	Applicant FTE	
Aircraft Information	A/C Serial Number	Test aircraft’s manufacturer’s serial number.
	A/C Type	As used with respect to the certification of aircraft, Examples include DC-7 and DC-7C; 1049G and 1049H; and F-27 and F-27F.
	A/C Reg Number	Registration number of the test aircraft
Passdown Details	Passdown Description	Succinctly and clearly defines the passdown topic. For example: "Suggested improvements for takeoff test plan", "Tips for operating in the Offshore Warning Areas".
	Passdown Recommendation	Optional. Proposal to resolve the topic under discussion.

Test Information	Test Number	The test's number, per each organization's process. Multiple test numbers, if applicable, can be entered with a delimiter. For example: '200, 201, 202'. Test number and flight number may be the same or different, depending on the applicant's tracking system.
	Flight Number	The sequential number of this aircraft's flights since new. Typically used with OEMs and not with smaller applicants.
	Date of Test	Date the test was conducted. If a test was conducted over multiple days, consider using the start date here.
	Takeoff Location	ICAO identifier or plain language name of the takeoff location
	Landing Location	ICAO identifier or plain language name of the final landing location.
	Test Plans Flown	The nomenclature of the test plan(s) flown for which the Passdown is applicable (if the PD was written as a result of something observed that was not related to a specific test plan, note this as "n/a").
	Test Plan Condition Number	This is the test point(s) that may be related to the item under discussion. For example: "TP501-002: Rejected Takeoff, Max KE". If the Passdown is not related to a specific condition, use "n/a"
Tracking Information	Passdown Status	Open - topic has not been addressed; Closed - topic has been satisfactorily addressed; Defer to Long Term List - may be addressed in the future.
	Is Passdown Safety Item?	Optional. Use of this field TBD.
	Action for FAA or Applicant	Optional. Used to track who has the current action for this item. This status may be changed at will as the resolution progresses.
	FAA Focal	Optional field. This is the FAA focal for this topic. This does not have to be a flight test person.
	Is PD Submitted to Applicant?	Select YES upon submittal to the applicant. It is also suggested that the details of the submittal (date, sender, receiver) be included in the update section. Note: Not all PDs need to be sent to applicant.
	Applicant Tracking Number	If the applicant has an internal tracking system for these type of reports, add their tracking number here.
	Applicant Focal	Optional. Main applicant focal for this topic. This does not have to be a flight test person.
Associated Daily Report	FAA Focal	Optional field. This is the FAA focal for this topic. This does not have to be a flight test person.
	Daily Report item(s) Associated with this Passdown	Reference to related Daily report, if applicable.
Update Information	Enter Update Information	Use this field to track the progress and resolution of this item

Appendix D. Example Flight Manual

RESERVED

See explanation in Chapter 5.

Appendix E. Example Type Inspection Report (TIR) Part II

RESERVED

See explanation in Chapter 6.

Appendix F. Report Writing Style Guide

F.1. Purpose and Introduction.

The purpose of this appendix is to present a style guide that may be adopted by Flight Testers involved in FAA Certification Flight Testing. While written for FAA flight testing use, you will find that much technical reporting has a common underlying philosophy. This appendix will attempt to describe this philosophy as well as to provide one set of format guidance regarding the "mechanics" of producing well-organized reports. There are many formats and you should not feel compelled to change your style or contents to meet any specifics contained in this guide. Use what works for you and your organization. Nothing in this style guide should be considered mandatory.

This guide essentially consists of "tips" to help those writing technical reports.

F.2. Approaching the writing task

F.2.1. Know your audience

It is essential for effective communication that you "know your audience." For whom are you writing the document? What is the purpose? Is your audience fellow testers, technical experts on the subject of the report, or less knowledgeable? Technical specialists will be looking for technical details and accuracy. Program managers may be looking for summary information, for the "bottom line". But, don't forget about yourself, about the tester. You want a good document which clearly communicates what we tested, how we tested it, and what we found. We want this information properly documented, to provide the starting point for future evaluations. Well written technical documents also provide excellent references for on-the-job training of new flight test personnel.

A technical report transmits information and ideas from one person to another. As such, the reader and his/her needs are the prime considerations when an author prepares a report. In helping to understand the reader, the writer should establish the answers to the following questions as early as possible:

Who Who will read your report? How well does he or she know the test item and its role?

Why Why are you writing this report? What actions or decisions will it support?

When How soon is the information needed?

F.2.2. Help the reader understand your report.

To help the reader understand your report:

1. Make the title meaningful and brief.
2. Summarize the high points.
3. Provide sufficient background material.
4. Associate the unfamiliar with the familiar.
5. Describe the whole before the parts.
6. List things in descending order of importance.

7. Develop a sound, easily understandable organization that helps the reader understand the material. This is especially important in long or complicated reports.
8. Emphasize the primary ideas. Make a list with plenty of space around it.
9. Separate fact and opinion.
10. Use precise, straightforward language.

F.2.3. Organization.

Because of the varied backgrounds and interests of your readers, the organization of the report should be clear and hierarchical, allowing each reader to find the specific type of information he/she needs. Extremely detailed descriptions of system design, data, and problem analysis disrupt the flow and may be considered distractions by high-level managers who are more interested in the "bottom line". Consideration should be given to placing these data in appendices or publishing them in separate archival reports.

It is a costly mistake to postpone all writing until the test program is finished. The writer then becomes so involved with problems of format and deadlines that he/she is forced to spend more time than is needed to polish the report. Naturally, a report cannot be finished until all tests are completed, but the writer can do many things before and during the tests that will make the final writing easier. The writing process can be broken down into the following functional steps:

1. Planning. Plan the writing when you plan the tests. Schedule the writing intelligently and evaluate the data as you gather it. As early as possible, determine answers to the following questions: What types of reports will be required? When must they be completed? Who will be the primary readers? What kinds of information will they want? How will they use the information? Who will review and edit the report(s)? What is the desired final format?
2. Gathering information. The project notebook (or its digital equivalent) is an excellent place to begin expressing your thoughts. Write periodic summaries and evaluations and include verbal descriptions with your drawings and diagrams. Always direct your remarks to the reader of your final report. Write interim reports with the idea that they are part of the overall report and that you will use many of your definitions, statements, descriptions, and drawings in later reports. In effect, the project notebook serves as a central file for all information bearing on the conduct and results of the tests
3. Organizing the content. Logical organization is essential if the reader is to find the information he needs quickly and to follow the writer's train of thought within a complex discussion. Clear organization must therefore exist both on a "macroscopic" level (the order and content of the report as a whole) and the "microscopic" level (the organization of material within a particular discussion)
4. Writing the draft. A draft enables you to transcribe notes into prose without having to worry about the refinements of language and usage or the mechanics of composition and spelling. The idea is to write the draft as though you were giving a talk from notes. Once started, dictate or write as fast as you can for as long as you can. Don't worry about corrections, spelling, grammar, etc., on first writing. If you

have to stop, one technique to allow an easy "restart" is to stop in the middle of something, like the middle of a sentence in the middle of a paragraph. Then you can get started by coasting into the finish of the sentence and paragraph

5. Self-editing the draft. The following guidelines are presented to assist in editing the draft:

- Do not begin to edit a report the minute you finish writing it. You have a much better chance of putting yourself in the reader's place if you get away from the writing for a while.
- At the outset, review the reader's needs. Any change you make in your manuscript must be justified on the grounds that it will help the reader. If your report was to contain certain answers, make sure that the answers can be found easily.
- Divide the editing job into two parts: check the coverage and organization first; then concentrate on polishing the writing. The first requires a continuous reading at a normal reading rate; the second is a stop-and-go operation.
- As you read for content, mark all discrepancies in the logic and flow of the message, but do not revise until you have finished the entire first reading. You also may mark any errors in composition and mechanics (format, typography, etc.) that catch your eye.
- Reread each spot you marked in the first reading. Place the error in context; then determine whether you need to rephrase, delete, or add material. Correct accordingly.
- Whenever errors are bunched, you may be able to revise more easily by rewriting the entire subsection or paragraph. Try to salvage the original first, but if you don't gain headway, write another version.
- Save the mechanics of format until last. You will have detected most of the flaws but a methodical check will take only a few seconds per page. Any omissions or inconsistencies can be corrected easily.
- Finally, reread to see how everything fits together. Use the following tests to determine if further revision is necessary.

(1) Title and Summary: Give the Summary, without the title, to a colleague unfamiliar with the project. Ask him/her to read the abstract and write a title of his own. Compare with yours. The two should agree in scope and emphasis. If they do not, then either your abstract is faulty or your title does not accurately represent your report.

(2) Conclusions: Have someone with approximately the same background as your intended reader's read your report up to the section containing conclusions. Ask him or her to jot down the conclusions that are justified by the evidence you have presented. Then have the person read your conclusions and comment on any disagreements. Apply the same test to any technical descriptions. It may well save your having to answer a lot of questions later.

(3) Organization: If the reviewer of your draft comments that the organization is faulty, but cannot pinpoint why, outline the draft and compare with your original outline. You may have thrown it out of balance by altering as you wrote. Any flaws in logical order will show up immediately.

F.2.4. Completeness.

Ideally, the test team will report only problems the correction of which is both *necessary* and *sufficient* to ensure a compliant system. In other words, no deficiency would be overlooked, yet no characteristic would be criticized unless the correction was absolutely required for the system to become completely satisfactory. The idea of sufficiency is clear enough, but the idea of necessity is subtler and is discussed in greater detail under the topic, "What Should be Evaluated and What Should Just be Documented?"

Balance. A well-written report provides a balanced assessment of the test item. While it is recognized that favorable aspects of test system performance usually require less verbiage to relate than do deficiencies, the balance of good and bad news must be consistent with the overall assessment. Mixed messages are sent when a writer provides a single sentence reflecting 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 the collective weight of your writing leaves the reader with a correct and unambiguous impression of your message

F.2.5. What should be evaluated and what should just be documented?

A key issue in reporting test results is determining which aspects of the system should be evaluated—that is, which things should have conclusions drawn regarding their effectiveness, compliance or suitability—and which should just be documented.

Performance and control problems are generally the result or reflection of numerous characteristics. If an issue is encountered, both the problem and the deficient characteristic(s) should be described. For example, if a pilot had difficulty making precise glideslope corrections because of a slow-accelerating engine, the problem may be identified as the high workload requirement for glideslope maintenance and the deficiency (i.e. the root cause) may be the "sluggish engine response." Sometimes the precise nature of the deficiency is difficult to describe at the time a problem is revealed. With respect to documentation, the FAA test team should focus primarily on describing those problems that result in a non-compliance. Ultimately, diagnosing and fixing the problem is the responsibility of the Applicant and there is often more than one way to do it. FAA test teams must refrain from prescribing a specific fix to a problem.

F.3. **Writing Style**

F.3.1. Pace

All writing has pace. Sometimes slow, sometimes fast. Usually it's in between. A medium pace satisfies most technical writing. If the pace is too fast, the reader will have to retrace his steps and slow down. If the pace is too slow, the reader will try to anticipate the writer and, consequently, may miss important bits of information. Proper pace is essential to maintaining the reader's interest and thus getting your message across.

A fast pace should be used for summaries, refresher passages, introductory sections, time-based descriptions, and general descriptions. A slow pace should be used for detailed technical descriptions; operating instructions; analytical passages involving formulas; and sections with numerical data in quantity. To control the pace:

1. Format - Use of headings speeds up pace. References and footnotes slow pace. Graphic aids speed overall reading. Their assistance will be weakened, however, if the illustrations are not strategically located in the text. Pace drops to zero each time the reader turns through the text to find the illustration.
2. Paragraphing - The pace through each paragraph affects overall pace. Narrative passages can be read faster than descriptive passages. A descriptive paragraph should not be longer than one-third of a page for a rapid pace. A narrative paragraph can be up to one-half page. In all cases, all paragraphs of technical writing require the topic sentence at or near the beginning to initiate rapid flow and they need smooth transition from sentence to sentence to maintain it.
3. Sentence Structure - Just as a series of short paragraphs will slow the pace in a section, so a series of short sentences will slow the pace in a paragraph. Assume a short sentence as one of 10 words or less, a medium sentence 10 to 20 words, and a long sentence over 20 words. Medium and long sentences favor rapid pace but they should not be in a long series.
4. Punctuation- All marks of punctuation that separate words will decelerate pace. In formal technical reports, the writer should avoid exclamatory remarks. The report message should convey information, not surprises. Use questions sparingly. Three devices are available to set parenthetical material apart. Parentheses are the most emphatic separators, commas the least emphatic, and dashes in the middle. The hyphen is a joiner, not a separator. Using hyphens keeps pace from decelerating unnecessarily; it should be used much more in reports. The worst offenders to clear understanding are unhyphenated compound adjectives. Examples, unhyphenated:

- *We tested the two phase drag cup induction generators.* (Two generators?)
- *The circuit contains a small time delay element.* (Small element?)
- *Figure 1 shows the design of the aluminum flask decorating machine.* (Aluminum machine?)

SAME Examples, hyphenated:

- *We tested the two-phase drag-cup induction generators.*
- *The circuit contains a small-time-delay element.*
- *Figure 1 shows the design of the aluminum-flask-decorating machine.*
or better still: *Figure 1 shows the design of the machine for decorating aluminum flasks.*
- A **colon** “:” means “as follows”. Use a colon after a complete sentence to announce a detailed explanation (which may be a list, another sentence, or even a single word.)
- Use a **semicolon** “;” in place of a period to soften the break between two sentences whose meaning are closely related.

- Use of the **hyphen** “-”
 - (1) Two-word modifiers may need hyphens when two words act as one. Use the hyphen to join two or more words serving as a single adjective before a noun:
“*Rotor RPM decayed excessively in the Category A balked-landing profile..*”
 - (2) Use the hyphen with compound numbers from *twenty-one* to *ninety-nine* and when writing out a fraction (*two-thirds*).
 - (3) Use the hyphen to avoid ambiguity or mispronunciation. Hyphens can change meaning: “*the accident investigation team re-created the afternoon conditions*”; versus “*the accident investigation team recreated during the afternoon.*”
 - (4) The hyphen “-” is also used:
 - With prefixes like “ex-” (former), “self-”, and “all-”:
(*Ex-rotorcraft pilot, self-track, all-weather*)
 - With the suffixes “-elect” and “-designate”:
(*President-elect, self-designate*)
 - to link two numbers that represent a continuous sequence when they are not introduced by the words “from” or “between”:
(*The 1981-85 time frame, between the years 1981 and 1985*)
 - To connect numerals with their units of measure:
Right: *three-inch-wide brakes*
(The number comprises part of a unit of measure and is a part of a compound adjective.)
Right, but different meaning: *three inch-wide brakes*
(The number modifies brakes – there are three. Inch-wide is the unit of measure.)
Wrong: *three inch wide brakes*
(The meaning is unclear.)
- Single **dash** “—”. A single dash is a colon in reverse when the detailed explanation precedes the subject.
- Use **parentheses** “()” to set off explanatory material (word, phrase, or an entire sentence) that is not essential to the main point of the sentence.
The results (see fig. 11) show a shallow positive gradient.

- Use the **comma**,
 - To end an opener.

“During all of the approaches flown, throttle position ranged from idle to max continuous power.”
 - To separate a series of modifiers.

“The F-11 was a single-cockpit, single-engine, carrier-based, supersonic fighter.”
 - To surround unessential interrupters.

“The fuselage design was area ruled, resembling a coke bottle shape, to reduce wave drag.”
 - To separate parallel phrases or clauses.

“The short period response was quick, the thrust response was rapid, and the roll performance was eye-watering.”
 - To separate two or more independent clauses in a compound sentence if they are joined with a simple conjunction such as *or*, *nor*, *and*, or *but*.

“There were four flight control modes, and each mode utilized redundant command paths.”
 - To follow transitional words and phrases such as “however”, “that is”, “namely”, “therefore”, “for example”, “moreover”, and “i.e.”. Use a comma after these terms when they interrupt the flow of the sentence. The type of punctuation used before them is determined by the strength of the interruption.

“All original test points were satisfactorily completed; however, several of the amended test points resulted in departure from controlled flight.”
 - Between all parts of a series, including the word before the final *and*, *or*, or *nor*

“Longitudinal, lateral-directional, and spin characteristics were examined.”

F.4. Clarity.

A good test report is clear, concise, well organized, timely, and provides a complete and balanced assessment of the test article. Clarity and brevity are critical. Avoid long-winded, rambling narratives. Make your point and get out. Do not waste time with general background or information that is universally true of all systems of the type tested; keep your discussion focused on results related to the test item specifically. At the same time, since not all your readers are aeronautical engineers or testers, avoid (especially in the detailed portions of the report) the use of highly technical jargon or “pilot-ese.” Plain language will result in the least misunderstanding and the greatest chance for sound program decisions.

If a report has both a complex subject matter coupled with a complex report writing structure, this can be a problem and detract from the clarity of the report. Three principles of clarity are parallel construction, subordination, and coordination.

F.4.1. Parallel construction

Parallel construction involves repetition. For example:

Not parallel - Component A failed after 1,200 hours of continuous operation in the system; the life of Component B and Component C, under similar conditions, was 1,600 hours.

Parallel - Component A failed after 1,200 hours of continuous operation in the system, Components B and C after 1,600 hours.

F.4.2. Subordination

Subordination concerns the responsibility of the writer to indicate through sentence structure the major and minor ideas in his writing. When two ideas are joined with "and" it is assumed they are of equal importance. Should they not be, the "and" has been used improperly. For example:

Original: "The essential feature of the longitudinal flight control system is a bobweight and it is mounted on the lower bellcrank."

Revised: "The essential feature of the longitudinal flight control system is a bobweight THAT is mounted on the lower bellcrank."

Original: "This estimate has been plotted in figure 3 and shows the likelihood that the displays will all fail at the same time."

Revised: "This estimate, plotted in figure 3, shows the likelihood that the displays will all fail at the same time."

F.4.3. Coordination

Coordination involves maintaining a style throughout the technical report. Make sentences of equal value of like structure. Important ideas can be stressed by intentional repetition. *"The uncommanded longitudinal and lateral position excursions required pilot intervention. These excessive position excursions constitute a hazardous flight condition that..."* In a long report, key ideas should be repeated at the beginning of each section or chapter, since the reader may be reading discontinuously and will need to have the major points repeated. A good style will also provide for smooth transition from paragraph to paragraph.

F.5. **Force**

The greatest sin against force is tautology or redundancy. It is not sufficient that there is nothing wrong with a word or words—each word must do something, or it is deadwood to be eliminated.

We say:

in the event that
in order to
in view of the fact that
in case
on account of
the developments are such that
in addition

to mean:

if
to
because
if
because
if
also

More examples are contained on the following pages.

<u>INSTEAD OF</u>	<u>TRY</u>	<u>INSTEAD OF</u>	<u>TRY</u>
accompany.....	go with	eliminate.....	cut, drop, end
accomplish.....	carry out, do	employ	use
accomplish (a form)	fill out	encounter.....	meet
accordingly	so	encourage	urge
accrue	add, gain	endeavor.....	try
accurate	correct, exact, right	ensure	make sure
achieve.....	do, make	enumerate.....	count
actual	real	equitable.....	fair
*additional.....	added, more, other	equivalent.....	equal
adjacent to	next to	establish	set up, prove, show
advantageous	helpful	evaluate	check, rate, test
*advise.....	recommend, tell	evidenced	showed
affix	put, stick	evident.....	clear
afford an opportunity	allow, let	examine.....	check, look at
air vehicle	aircraft	exhibit	show
anticipate	expect	expedite.....	hurry, rush, speed up
a number of	some	expeditious	fast, quick
apparent	clear, plain	expend.....	Pay out, spend
appear	seem	expense.....	cost, fee, price
appreciable	many	explain.....	show, tell
appropriate.....	proper, right	*facilitate	ease, help
approximately... about		factor	reason, cause
as a means of to		failed to	didn't
ascertain.....	find out, learn	fatuous numskull	jerk
as prescribed by under		feasible	can be done
*assist, assistance aid, help		females	women
attached herewith is	here's	final	last
attempt.....	try	*finalize	complete, finish
at the present time	now	for example	such as
benefit.....	help	forfeit	give up, lose
by means of	by, with	*for the purpose of	for, to
cannot	can't	forward.....	send
capability	ability	function	act, role, work
category	class, group	fundamental	basic
close proximity .	near	furnish	give, send
combine.....	join	has the capability	can
comply.....	follow	herein	here
component	part	*however.....	but
comprise	form, include, make	identical.....	same
up		identify	find, name, show
concerning	about, on	immediately	at once

INSTEAD OF TRY

conclude close, end
 concur agree
 confront face, meet
 consequently so
 consolidate combine, join, merge
 constitutes is, forms, makes up
 construct build
 contains has
 continue keep on
 contribute give
 cooperate help
 currently (leave out)
 deem think
 delete cut, drop
 demonstrate prove, show
 depart leave
 designate appoint, choose, name
 desire wish
 determine decide, figure, find
 develop grow, make, take place
 disclose show
 discontinue drop, stop
 disseminate issue, send out
 do not don't
 due to the fact that due to, since
 echelons levels
 effect make
 elect choose, pick
 in view of since
 in view of the above so
 *it is (leave out)
 it is essential must
 it is recommended I/we recommend
 it is requested.. please
 justify prove
 legislation Law
 limited number few
 limitations limits
 locate find
 location place, scene, site
 magnitude size
 *maintain keep, support
 majority most
 maximum greatest, longest, most
 minimize decrease, lessen, reduce

INSTEAD OF TRY

impacted changed, hit
 implement carry out, do, follow
 *in accordance with by, under
 in addition also, besides, too
 in an effort to to
 inasmuch as since
 inception start
 in conjunction with with
 incorporate blend, join, merge
 incumbent upon must
 indicate show, write down
 indication sign
 initial first
 initiate start
 in lieu of instead of
 in order that for, so
 in order to to
 in regard to about, concerning, on
 interpose no objection don't object
 in the amount of for
 in the course of. during, in
 in the event that if
 *in the near future soon
 in view of since
 in view of the above so
 *it is (leave out)
 it is essential must

 provided that if
 provides guidance for guides
 (the) provisions of. (leave out)
 purchase buy
 reason for why
 recapitulate sum up
 reduce cut
 reflect say, show
 regarding about, of, on
 relating to about, on
 relocation move
 remain stay
 remainder rest
 remuneration pay
 render give, make
 request ask
 require must, need

INSTEAD OF TRY

modify change
 monitor check, watch
 objective aim, goal
 obligate bind, compel
 observe see
 obtain get
 operate run, work
 operational working
 *optimum best, greatest, most
 option choice, way
 participate take part
 perform do
 permit let
 personnel people, staff
 pertaining to ... about, of, on
 place put
 portion part
 position place
 possess have, own
 preclude prevent
 prepared ready
 *previous earlier, past
 previously be fore
 prioritize rank
 prior to before
 probability chance
 procedures rules, ways
 proceed do, go on, try
 proficiency skill
 programmed ... planned
 promulgate announce, issue
 *provide give, say, supply

INSTEAD OF TRY

requirement need
 *retain keep
 return go back
 review check, go over
 selection choice
 similar like
 solicit ask for
 state say
 *subject the, this, your
 subject to may be
 submit give, send
 subsequent later, next
 subsequently after, later, then
 substantial large, real, strong
 sufficient enough
 take appropriate measures please
 terminate end, stop
 that (leave out)
 *therefore so
 there are (leave out)
 there is (leave out)
 thereof its, their
 this office us, we
 time period (either one)
 transmit send
 transpire happen, occur
 -type (leave out)
 until such time as ... until
 (the) use of (leave out)
 *utilize, utilization .. use
 validate confirm
 value cost, worth
 verbatim word for word, exact
 via in, on, through
 viable workable
 warrant call for, permit
 whenever when
 whereas since
 with reference to ... about
 with the exception of except for
 witnessed saw

*among the most overworked

F.6. Finish

To achieve a proper "finish" to the report, the writer should check for awkward sentence structure, proper reference of pronouns and phrases, proper reference to figures and tables, dangling and misplaced modifiers, incomplete comparisons, vague references and dangling phrases. All deficiencies should be corrected. Sometimes the only truly effective course of action is to throw out the entire sentence and start from the beginning.

F.7. Make the report rapid to read

To make the report rapid to read, tailor the prose and mechanics appropriately:

1. Use descriptive headings and subheadings freely.
2. Place topic sentences at the beginning of paragraphs.
3. Use simple sentence structure, especially when the thought is complex.
4. Adjust the pace to fit the subject and the reader.
5. Avoid footnoting. If secondary or reference material is necessary, work it into the text.
6. Do not use endnotes. Use a simple, readable, and consistent typeface throughout the report (text inside a figure need not be consistent with the typeface of the body of the report).

F.8. Word choice and usage

In technical writing, do not use figurative language or figurative meanings of words. Use the exact word with a clear meaning whenever you can. If only a formal word will do the job, then use it, but if a less formal word will do, using it will increase the readability of your writing. Don't use synonyms just to use different words for the same thing. If you mean the same thing, use the same word. Jargon should be avoided unless the writer is certain that all potential readers would understand it. Watch out for words ending in "-wise" or "-ize."

F.9. Use Plain Language

Use plain language and simple English; the use of uncomplicated wording will increase comprehension while reducing ambiguity.

<u>Sample</u>	<u>After Writing Principles</u>
In the event of...	If
For a period of...	for
In accordance with...	By, following, per

Additional information on plain language may be found at the FAA's plain language website: https://www.faa.gov/about/initiatives/plain_language/

F.10. Short sentences

Use short sentences. Break long sentences into short sentences with a simple sentence structure.

<u>Sample (actual example)</u>	<u>After Writing Principles</u>
“Do not allow test duration of the ELT to exceed 5 seconds. The ELT will transmit a 404.025 Mhz signal after the ELT is active approximately 59 seconds, the satellite system considers the transmission to be a valid signal.”	To avoid false alerts to national Search and Rescue facilities, ELT test duration must be less than 5 seconds.

F.11. Active verbs

Use active voice instead of passive voice. Sentences with active verbs, such as “Do X” are easier to read and less likely to be misunderstood than sentences using passive verb forms, such as “X should be done”.

F.12. Avoid use of negatives when possible

Imperative commands are direct, they tell someone what to do, and are often used when giving instructions. Avoid negatives when possible. Negative statements are difficult to read and if it is missed, the meaning of the sentence will be misunderstood. When negatives are required, clearly specify what is being negated.

F.13. Use Words Consistently

Word use should be simple and consistent throughout. If possible, avoid creating new terms. Use words in their common English sense unless they have a widely accepted aviation-specific meaning. Match flight deck nomenclature.

F.14. Avoid Using Words with Multiple Common Meanings

Avoid using words with multiple meanings, for example, use “correct” rather than “right”. Avoid using the same words as both nouns and verbs, for example, “display”, “position”; if a word is to be used that could be a noun or a verb, choose one usage and apply it consistently.

F.15. Avoid common meaningless or vague modifiers:

very (most used)
by and large
to some degree
on the whole
for the most part
more or less

quite
to a certain extent
tends to
with reasonable assurance
well under or well over

F.16. Content Guidelines**F.16.1. Abbreviations**

Use abbreviations carefully. Only use abbreviations that are defined and commonly used in the industry, for example, Vertical Navigation (VNAV), and reference landing speed (Vref), and avoid creating new abbreviations whenever possible.

Abbreviations should be defined, at least upon first use, and/or consider a glossary of terms or list of abbreviations.

F.16.2. Use Arabic numbers

Arabic numbers, for example 0, 1, 2, are easier to read than numbers that are spelled out, such as one, two. However, use spelled-out numbers for references when two or more different values must be presented in proximity to other numbers.

F.16.3. Units of Measurement

Include units of measurement. Do not specify numbers in greater precision than is necessary, or than can be read from instruments. Be technically accurate, for example: in aviation, the term “knots” (in the absence of any qualifier) is typically only technically accurate in the context of wind. “What kind of knots?”...groundspeed? calibrated airspeed? Indicated airspeed? True airspeed? Equivalent airspeed? Don’t leave the questions hanging. Similar for altitude (AGL? MSL? Pressure?)

F.16.4. Precision

A technical report needs to use words precisely, especially when results are being compared with specifications. Be as specific as possible, and avoid meaningless or vague qualifiers.

Example:

Bad- “*cost well under \$1,000*”

Better- “*cost between \$600 and \$800*”

Best- “*cost \$705.28*”

Bad- “*use a few drops*”

Better- “*use three drops*”

F.16.5. Accuracy

However, do not imply accuracy greater than you actually achieved. If, for example, you report on rudder forces, which you estimated, it would not be reasonable to claim that a particular force was “11.7 lb”. (“About 10 lb” or just “10 lb” would be more representative of actual conditions.

F.17. Formatting**F.17.1. Type Size**

Use a type size that is large enough to be readable under all conditions likely to be encountered. For example, for documents intended for actual use on a flight deck, in general, a 14- to 20-point sans serif font is adequate. However, this should be tested under all potential operational conditions.

F.17.2. Line Spacing

Place sufficient space between lines of text. Using 25 to 33 percent of the font size between lines (e.g., 3 to 5 points space between lines using 14-point font) will make the text easier to read than if there was less space between the lines. This guideline should be considered in the context of how it will be used. For example, a document intended for use on a flight deck may need to be more readable than a longer publication that may be typically read outside the flight deck.

F.17.3. Font

- Unusual or ornate fonts should be avoided.
- Upper and lower case
- Use standard capitalization rules. Text in all capital letters is harder to read than text in lowercase. Use all capitals very sparingly and only for meaningful emphasis, or to represent labels that are commonly encountered in capitals (e.g., VNAV).

F.17.4. Grouping

Use visual techniques (e.g., white space created by extra lines, indentation) to delineate grouping of steps, lists, and the components of logic statements.

F.17.5. Justification

paragraphs of text should be left aligned. Do not use right and left justified to produce aligned right and left edges, because it adds spaces between letters and/or words that make the paragraph harder to read.

The Wright Stuff Feedback Form

If you find an error in this document, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by emailing this form to the FAA Flight Test & Human Factors Branch at: 9-AVS-AIR-710-PSDPM@FAA.GOV .

Document: “The Wright Stuff” Revision: IR

Please mark all appropriate line items:

☐ An error (procedural or typographical) has been noted in paragraph_____on page _____.

☐ Recommend paragraph_____on page_____be changed as follows:

☐ In a future change to this document, please cover the following subject:
(Briefly describe what you want added.)

☐ Other comments:

☐ I would like to discuss the above. Please contact me.

Name: _____

Date submitted: _____

Contact information (phone, email as desired): _____