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# NAVAL ROTARY WING AIRCRAFT FLIGHT TEST SQUADRON FLIGHT TEST APPROVAL PROCESS

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Lawrence J. Mertaugh

Technical Specialist, Naval Rotary Wing Test Squadron, Patuxent River, MD

PUBLIC AFFAIRS OFFICE  
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## ABSTRACT

This presentation will provide a description of the process used by the Naval Rotary Wing Aircraft Test Squadron, at Patuxent River, for minimizing the risk associated with its flight test operations. This process is defined in terms of three basic functions. These functions are: Test Plan, Flight Clearance, and the Aircraft Modification/Configuration Control Sheet. It is through these functions that we provide oversight of the test planning, insure that any required aircraft modifications are sound, and provide controls over the aircraft modification process. Each of these functions play a role throughout the test program in preventing changes in testing that could jeopardize the quality of the test results or the safety of the crew or the aircraft.

## INTRODUCTION

This presentation is intended to provide a description of the process used by the Naval Rotary Wing Aircraft Test Squadron (NRWATS), at Patuxent River, for minimizing the risk associated with the planning and aircraft preparation stages of its flight test operations. Although most of this process is accomplished during the initial stages of a test program, it is emphasized that the components of this process are applied throughout the life of the project. While some aspects of the process may be somewhat unique to NRWATS, the process is essentially common to the other two test Squadrons at Patuxent River. This process does differ somewhat from that used by the Navy flight test facilities on the West Coast. For the most part, these differences are related to organizational differences. No claim is made for the uniqueness or superiority of this process, but

it is felt that this process does provide a reasonable balance between a very rigorous adherence to a formal design hierarchy and a non-structured operation which may minimize the direct test cost, but leaves significant room for error and operational risk. This process is the result of many years of flight test operations. During this period of time the process has remained essentially the same, with only minor refinements being applied. Our process has three main components. These components are: the Test Plan, the Flight Clearance, and the Aircraft Modification/Configuration Control Sheet (the "Pink Sheet"). It is not my intention to go into great detail about any of these components, but mainly to try to show that together they provide a test program structure that minimizes the chance for omissions and takes advantage of the test experience available at our facility.

For those of you that may not be familiar with the flight test organizations at Patuxent River, the former Naval Air Test Center, which operated as a series of functional Directorates, is now organized under the Naval Air Systems Command (NAVAIRSYSCOM) as a combination of competencies (essentially a form of matrix organization). For Test and Evaluation work on rotary wing aircraft the Naval Rotary Wing Test Squadron (NRWATS), under Naval Test Wing Atlantic (which is under the NAVAIRSYSCOM Test and Evaluation Group), the Test Article Preparation Department (also under the NAVAIRSYSCOM Test and Evaluation Group), and the Test and Evaluation Engineering Department, under the NAVAIRSYSCOM Research and Engineering Group (with support from other engineering Departments within this Group) provide the manpower for test and evaluation of helicopters. Similar combinations provide similar capabilities for the other types of aircraft tested at Patuxent

River. To some extent, the competency make up of the current testing organization places greater emphasis on the subject of this presentation as coordination between the different competencies that make up a test team become even more important. It is a testimony to the versatility of this process that it appears to work equally well in our current organizational structure as it did with our earlier organization.

## **FLIGHT TEST PLAN**

The Test Plan is intended to provide a systematic approach to the advanced planning required for the effective, efficient, and safe conduct of a test program. A Test Plan is required for all testing, flight and ground, for which a NAVAIRSYSCOM test team has responsibility. A Test Plan is also required for non-Navy customers that utilize NAVAIRSYSCOM infrastructure or assets. Flight or ground testing that is not in response to a NAVAIRSYSCOM task, has low workload, is of relatively short duration, and does not involve operations that could be considered to be hazardous may be allowed to operate under a Support Plan rather than a full Test Plan. The basic Test Plan and the Support Plan are defined in Reference 1. The preparation of the Test Plan, or a Support plan, is the responsibility of the test team, and is subject to review by the appropriate engineering Competency and Test Squadron personnel. The review process is intended to ensure that adequate planning, preparation, and coordination have been accomplished by the test team. Research efforts are currently underway to provide expert-system software to aid the Test Team in generating the Test Plan. Changes in the testing that might be identified during initial testing or due to changes in test scope do require an appropriate modification to the Test Plan with suitable review by squadron personnel.

In addition to the expected test description, the Test Plan includes a safety checklist, hazard analysis, test funding and scheduling information, listing of test personnel with the required qualifications, definition of reports to be generated, security considerations, and environmental considerations if required. The Support Plan provides a brief description of: the testing and test equipment, safety-related issues, security precautions to be observed,

funding and manpower requirements, and the test schedule

While the generation of the Test Plan is intended to stimulate the Test Team to consider all of the contingencies that might be encountered during the proposed test, the review of the test plan by personnel not directly involved in the test and who represent the corporate testing history within the Competency and Squadron provides a sanity check on these preparations. The review process can be accomplished through the normal routing of the Test Plan through the appropriate personnel, or through the convening of an Executive Review Board which provides a more expeditious review of the test plan. In general, the final approval of the Test Plan will not be accomplished until the appropriate Flight Clearance for the test flight envelope or modified aircraft is obtained.

## **FLIGHT CLEARANCE**

The basic Flight Clearance process is controlled and regulated by the Airworthiness Team within the Air Vehicle Department of NAVAIRSYSCOM. In basic terms, any Navy aircraft that is being operated in a configuration that is different from a Standard Fleet aircraft configuration or which is to be operated outside of the currently approved operating flight envelope requires a Flight Clearance. The standard configuration for a Navy aircraft and its approved flight envelope are defined by the Naval Air Training and Operating Procedures Standardization (NATOPS) Program Manuals and the various repair manuals for the aircraft subsystems. At the present time, certain kinds of modifications, performed in support of Flight Test, are allowed to be controlled by designated Test Squadron representatives (Local Flight Clearance Authority, LFCA) without the specific action of the NAVAIRSYSCOM Airworthiness Team. These representatives are designated by name and are subject to annual review. A back-up representative is also designated for each of the Squadrons to cover for the primary representative and to provide for possible replacement of the primary representative if required. They are appointed by the Commander, Naval Test Wing Atlantic, as authorized by NAVAIRSYSCOM. Their authority is limited to modifications that do not

directly impact aircraft controls, propulsion, primary structures, or stores management. It should be pointed out that we are talking about "NAVY" aircraft here. NAVAIRSYSCOM does not provide Flight Clearances for aircraft not owned by the Navy. If non-NAVY aircraft are being tested at Patuxent River and the testing requires that Navy personnel work on or fly in these aircraft, the non-Navy custodian of the aircraft must provide some form of clearance for any modifications that are done on the aircraft or for extending the published flight envelope of the aircraft. The Flight Clearance policies for manned air vehicles are defined in Reference 2. Flight clearance for Civil aircraft leased to the Navy and that require modification in support of a test project will have a Supplemental Type Certificate (STC) and an approved Federal Aviation Administration Form 337 for the modification prior to the first flight. Minor modifications may be accomplished with the Form 337 and not require a STC. Public Use Aircraft assigned to the Navy are subject to the same Flight Clearance requirements as for a Navy aircraft.

The required analytical support for any aircraft or equipment modifications are basically the same for a NAVAIRSYSCOM Flight Clearance or delegated Squadron Clearance. Essentially, sufficient information has to be provided to insure that the modification does not jeopardize the flight safety of the aircraft. Structural analysis, flight dynamics and performance analysis, electrical load analysis, human factors considerations (including: egress, survival equipment, restricted motion, etc.), equipment compatibility, EMC, etc. all have to be addressed as appropriate. All of this information has to be provided to the cognizant NAVAIRSYSCOM engineering Competency who, in turn, must attest to its adequacy. Although it is normally left to the Flight Clearance representative to identify the competency participation required for a particular Flight Clearance request, additional participation is often identified as the Flight Clearance request is routed through the competencies. It should be emphasized that configuration modifications, whether hardware of software, may require corresponding changes in the Test Plan to reflect testing changes required to provide further substantiation of the safety of the change. Both on-ground and in-

flight vibration data, for example, might be required to insure that an added piece of equipment has adequate support structure. An aircraft speed buildup might be required prior to clearing the modification for the full standard aircraft flight envelope.

A change in system software is also treated as a configuration change. Any change in software over the configuration that was previously approved, either by means of a Flight Clearance or through the normal Technical Directive process, either requires a new Flight Clearance or an update of the Technical Directive. The basic requirements include: that the head of software development activity has provided a traceable confirmation that the software has passed regression analysis and is safe for flight testing for the hardware configuration intended, that the software upgrade is installed in accordance with the "Pink Sheet" process, and that the software is uniquely identified. In the case of a local Squadron Flight Clearance it is also required that the software change have no effect on flight controls, engine controls, or store release limits.

## **PINK SHEET PROCESS**

The "Pink Sheet" is the control document that authorizes the maintenance Department and the Test Article Preparation Group to start modification and installation of equipment and instrumentation on a test aircraft for a test project. The "Pink Sheet" function is defined in Reference 3. This document serves as a management tool and provides for tracking the initiation of work, the installation of equipment, the inspection of the installation, and when appropriate, the installation and inspection of ordnance systems equipment, weight and balance calculations, verification of EMC testing, and crew station inspection. In addition, a Flight Clearance sign off is required to confirm that an appropriate Flight Clearance is available. This document provides a document trail for the modification work that is done on a test aircraft. This document is used for both NAVAIRSYSCOM aircraft as well as non-NAVAIRSYSCOM aircraft that are worked on by NAVAIRSYSCOM personnel whether the work is accomplished at Patuxent River or at other facilities. The pink sheet becomes a

permanent record that is held for as long as the particular aircraft is in the custody of NAVAIRSYSCOM. At the time that the aircraft is turned over to another organization, the aircraft has to be returned to the published standard configuration, or the receiving controlling custodian must document that they are willing to accept the aircraft in its modified configuration and have obtained an appropriate Flight Clearance for the modified configuration.. At that time copies of the pink sheets will be provided to the receiving organization, along with copies of analysis that would support the modifications that are left on the aircraft. If a modified aircraft is accepted by another organization, it is the responsibility of that organization to obtain an appropriate Flight Clearance for operating the non-standard aircraft.

The pink sheet provides a check list that strives to insure that all of the necessary steps considered to be essential to providing a safe modification of the test aircraft are followed. It is to be emphasized that while the successful completion of the pink sheet provides "certification" that the aircraft is ready for flight, it does not, by itself, authorize the flight of the aircraft in its modified configuration. The presence of an appropriate Flight Clearance in conjunction with the completed Pink Sheet allows the Maintenance Officer to establish that the aircraft is ready for flight. The key to the success of the Pink Sheet process is the Project Liaison Office (PLO). The PLO, in conjunction with the Test Team, are responsible for the mechanization of this Pink Sheet process. The PLO does not allow work to start on the test aircraft until the Pink Sheet has been properly inducted. The PLO makes the initial determination as to what inspections are required, insures that the installers of the modifications identify when the work is completed, insure that the proper inspections are accomplished, insure that proper weight and balance is addressed, that a EMC SOFT check list is available, and sees to the final sign off by the Maintenance Officer. The PLO also maintains all of the current Flight Clearances and provides a up-to-date list of the modifications that each aircraft incorporates. The LFCA provides for a second tier of checks that all of the necessary inspections are complete, that the weight and balance data matches the

corresponding structural analysis, that the modifications found upon inspection of the aircraft do, indeed, match the Pink Sheet description, and that the modifications do match the coverage of the available Flight Clearances. If An appropriate NAVAIRSYSCOM Flight Clearance is not available, and the modification is within the range of modifications defined to be eligible for a local Squadron Flight Clearance, the LFCA, based on the available analysis and suitable supporting information, may issue a Local Flight Clearance covering the modification at that time. In addition, the LFCA provides one additional opportunity to identify that additional inspections are required or that some aspect of the installation need further analysis. The PLO will also add suitable limitations to the aircraft documentation if it is determined that the modification limits safe flight to less than the full aircraft flight envelope.

## CONCLUSION

In conclusion, I have described the process by which Naval Rotary Wing Aircraft Test Squadron in particular and Naval Test Wing Atlantic in general attempts to insure that all aircraft test envelopes and configurations do not subject the test aircraft and crew to unnecessary risk. As with any flight test program, there is always the chance for failure and unexpected results to a test flight, but we feel that the described process provides our best chance of avoiding this outcome.

## REFERENCES

1. NAVAIR INSTRUCTION 3960.4, dated 18 November 1996, PROJECT TEST PLANS FOR TESTS OF AIR VEHICLES, WEAPONS, AND INSTALLED SYSTEMS.
2. NAVAIR INSTRUCTION 13034.1A, dated 6 September 1995, FLIGHT CLEARANCE POLICY FOR MANNED AIR VEHICLES.
3. NAVAIRWARCENACDIV INSTRUCTION 13050.1A, dated 8 August 1996, AIRCRAFT

MODIFICATION/CONFIGURATION CONTROL (PINK SHEET)  
POLICY, PROCEDURES AND RESPONSIBILITIES

**AUTHOR**

Lawrence J. Mertaugh; BSAE, MSAE Purdue University, PHD Mississippi State University; NACA, Lewis Propulsion Laboratory, Ohio; 4929 th. Test Squadron, KAFB NM; Hq ARDC WPAFB, Ohio; The Boeing Aircraft Co, Seattle WA; Vought Aeronautics, LTV, Grand Prairie TX; Aerophysics and Aerospace Engineering Dept. Mississippi State University, MS; Range Directorate, NATC, Patuxent River MD; NRWATS, NTWA, Patuxent River MD; current position Technical Specialist and RW LFCA, NRWATS/TPS.