



OPERATIONAL TEST
AND EVALUATION

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MEMORANDUM FOR UNDER SECRETARY OF DEFENSE FOR ACQUISITION,
TECHNOLOGY AND LOGISTICS

SUBJECT: Concerns Regarding Plans for the Joint Strike Fighter (JSF) to Begin Training
Flights and Conduct an Operational Utility Evaluation (OUE)

The purpose of this memorandum is to discuss serious concerns I have regarding current plans for beginning JSF training flights this fall and conducting an OUE (focused on assessing readiness to expand training beyond an initial small cadre of operational pilots) at the Integrated Training Center, Eglin Air Force Base, Florida using conventional take-off and landing (CTOL) JSF aircraft. The JSF program has not yet met the prerequisites it had previously set for reducing air abort rates and resolving other safety-related issues before initiating training. Meeting all those prerequisites could require 10 more months. Initiation of training in an immature aircraft risks the occurrence of a serious mishap. The consequences of a mishap at Eglin would overwhelm the very modest benefits of beginning flight training this fall. Additionally, plans for the build-up of the operational test detachment do not present a demand that should drive a premature start of flying at the training center—the lot 3 and lot 4 aircraft to be used for operational assessments at Edwards deliver in mid-2012. Consequently, I recommend initiation of training at Eglin be delayed until all the program's previously stated prerequisites are met. The remainder of this memorandum discusses my concerns and recommendations in detail.

Background. One of the JSF program's goals for this year is to begin pilot training in low-rate production lot 2 CTOL aircraft at the training center at Eglin Air Force Base, Florida. Towards that end, the program anticipates that the Air Force airworthiness authorities at the Aeronautical Systems Center (ASC) could provide a "military flight release" next month. Monitored "maturity" flight tests have been on-going at Edwards Air Force Base, California in order to collect data on the CTOL aircraft's flight abort rate using test pilots and instrumented aircraft before the release of the lot 2 un-instrumented aircraft for training. During the same timeframe as the monitored "maturity" flights, four of the six lot 2 aircraft ferried from the Fort Worth plant to Eglin on a one-time flight release in July and August and have been parked at Eglin since then. The program and the Air Force have committed to an event-driven start of flying and training of the CTOL aircraft at Eglin; however, the pressure and desire to begin using these "parked" aircraft continues to grow.

Risks versus Modest Benefits of Early Training and the OUE. The knowledge gained from the OUE of the aircraft's progress towards achieving useful operational capability will be minimal because the training flights will be the equivalent of simple familiarization flights. Some may argue the simplicity of the planned training flights reduces the risk of an accident. However, analysis conducted by the Air Force demonstrates that the inherent risk of an accident remains substantial, regardless of the complexity of the flights, because of the significantly



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smaller number of flight test hours that have been accrued in the CTOL aircraft relative to prior newly developed aircraft before the start of unmonitored training flights using operational pilots.

Abort Rates and Risks of a Serious Mishap. Historically, flight training has not commenced for newly developed aircraft until 2,000 hours to 5,000 hours of monitored flight test have been accumulated, because at this point, the air abort rate typically drops below 1,000 aborts per 100,000 flight hours. The JSF program's prerequisite for initiation of training has been a demonstrated flight abort rate no greater than 1,000 aborts per 100,000 flight hours. To date, the CTOL aircraft have accumulated about 1,000 hours of monitored flight test. During "maturity" flight testing conducted at Edwards Air Force Base during July and August of this year (a point at which about 800 flight test hours had accrued), the observed CTOL air abort rate was equivalent to 3,000 aborts per 100,000 flight hours, indicating the relative immaturity of aircraft. Although substantially reduced since July 2009, the "maturity" abort rate still exceeded projections based on historical experience: the historical model predicted one air abort during the maturity flights; four air aborts occurred. That experience indicates that the flight hours accrued solely on the CTOL aircraft are the appropriate measure of its maturity, rather than the 1,900 hours accrued during flight test of all the JSF variants. This is also consistent with the substantially diminished commonality of the three JSF variants relative to initial expectations.

A high abort rate correlates to a higher risk of catastrophic failure, including a Class A mishap (damage greater than \$2 million; loss of aircraft; fatality; permanent total disability). If flight training at Eglin begins soon, while the CTOL flight test program is still around 1,000 flight hours of maturity, the historical model projects at least four ground aborts and four air aborts, including one in-flight emergency. Historical experience also indicates the rate of discovery of new failures during flight follows the air abort rate. Thus, there is a significant risk new failures will be discovered during flight training in an unmonitored environment for which there would be no corrective actions developed for the pilot to implement.

Open Safety-Related Shortfalls. There are several configuration and support system shortfalls, which were at one point prerequisites for the military flight release, currently cited by ASC that should be closed in order to safely generate and execute training flights. Current projections are that closure of some of these items will not occur until December 2011 or January 2012. In my view, these shortfalls must be resolved before operational flight training begins in the lot 2 aircraft. The shortfalls include the following:

- Implement and verify software modifications to correct failures in the Integrated Power Package that grounded the entire test aircraft fleet for two weeks in August;
- Corrections to the flight manuals and pilot check lists (pilot flight series data) to include information about cautions and warnings, fuel system, speed brake, and envelope expansion;
- Verification of the maintenance technical data (necessary for consistent understanding of aircraft readiness for safe flight by both contractor and military personnel);

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- Update and re-certification of the pilot simulator to incorporate and account for differential braking on a wet runway;
- Implementing a capability for timely recognition and management of flight exceedences (when the aircraft flies outside the approved flight envelope and conditions) consistent with supporting turnaround after flight;
- Developing and verifying software that provides fault detection and isolation capability in order to determine whether an aircraft can continue to be safely operated after each flight (the prognostic health management in the autonomic logistics information system);
- Upgrading the ejection seat with a system that has completed qualification testing and is known to at least meet the full qualification standards for both Services. (Note that this version of the ejection seat (the -23 system) does not include the water-activated parachute release system needed for over-water ejections. I recommend that the next increment ejection seat (the -24 system) be used for flight training when it begins at Eglin because that seat includes the integrated water-activated release system that will reduce the risk of the pilot drowning during an over-water ejection.)

In addition to resolving the above shortfalls, the program should conduct appropriate, operationally relevant testing with pilots to characterize pilot workload and reassess risks in the pilot-air-vehicle interfaces. The evaluation should examine the Integrated Caution Advisory Warning System to determine if time-critical emergency indications are appropriately ordered and displayed so as to make the correct course of action readily identifiable by the pilot. Flight simulations and analyses have highlighted deficiencies with the complex pilot-air-vehicle interfaces and cited insufficient human performance assessments in this area. The program plans to initially accept the risks created by these deficiencies to begin flight training. In my view, before training begins these deficiencies should be resolved to a lower level of risk---remote likelihood of occurrence and marginal consequences---than is currently assessed to exist by the program.

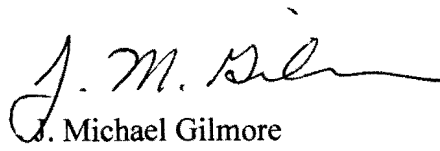
Recommendations. The approach forward with lowest risk would be to defer initiation of CTOL flight training at Eglin until at least 2,500 flight test hours have been accrued on the CTOL aircraft. Maintaining the current flight rate of about 15 hours per month on all six CTOL test aircraft and at least four of the lot 2 aircraft would mean flight training would be delayed by about 10 months.

An approach with greater, but arguably acceptable risk would be to detach the lot 2 CTOL aircraft to Edwards Air Force Base, California this fall, along with the needed contractor logistics support, and begin unmonitored flight there. In a sparsely populated area, and close to the subject matter experts generating and supporting CTOL flight testing, the lot 2 flight operation could begin to demonstrate lower abort rates and less discovery, with substantially less risk to the pilots (and civilians) involved. Depending upon the air abort rate achieved and the schedule desired, flight training and the OUE could then be conducted at Edwards (sooner, with

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a higher abort rate) or at Eglin (later, with a lower abort rate). Conducting flight training and the OUE at Edwards would entail potentially greater costs and some additional complexity relative to Eglin because logistics support would have to be moved from Eglin to Edwards, and pilots would have to return to Eglin to use and demonstrate the utility of the JSF flight simulators. I view these issues to be relatively minor compared to the benefits. Therefore, if the need to announce the initiation of JSF flight training soon is judged to be important, I recommend this approach.

I would be happy to discuss these recommendations with you further if you would find that to be useful. I am, unfortunately, not in a position to approve plans for conducting the OUE of training until the concerns discussed in this memorandum are addressed.

A handwritten signature in black ink, appearing to read "J. M. Gilmore", with a long horizontal flourish extending to the right.

J. Michael Gilmore
Director

cc:
JSF Program Executive Officer