

*Black Shield Meetings*

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OXCART	

OXC-8815-65  
Copy 6 of 13

18 JUN 1965

MEMORANDUM FOR THE RECORD

SUBJECT : BLACK SHIELD Technical Meeting [ ] 10 June 1965 25X

This report constitutes:

- Part I - General Aircraft Items
- Part II - Propulsion Items
- Attachment I - Agenda
- Attachment II - Decisions and Actions
- Attachment III - SKYLARK II Mission Success Rates

Attention is called particularly to Attachment II for follow-up actions required.

Part I:

1. BLACK SHIELD aircraft modifications are reported by Lockheed as on schedule except for flight test aircraft 121 which is two weeks late.
2. Discussion of the plastics problem was deferred pending Headquarters assessment of Mr. Johnson's letter setting forth his position on the use of silicone-asbestos.
3. Test priorities were established for aircraft 122 and 129 as indicated in Attachment II.
4. Climate-environment testing on aircraft 132 is scheduled to start 7 July at McCoy AFB. Parts availability is scheduled for 15 June. These include a rain remover system, water separator system, and a windshield de-icer system.
5. [ ] is currently paced by an installation relocation of [ ] antennae to improve effectiveness.

GROUP 1  
Excluded from automatic  
downgrading and  
declassification

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6. Mission success rate figures have improved with the SKYLARK II modified aircraft. Current experience reflects a 56% success rate compared to a 25% success rate established in the Fall of 1964 for SKYLARK I. Details are shown on Attachment III.

7. The Minneapolis-Honeywell Family improvement program items listed on Attachment I were discussed with their problem area definitions and corrective actions. Concern was expressed that the availability of instrumented aircraft 132 will be minimized by the climate-environment test program and that the MH program therefore will be delayed and perhaps not be completed prior to BLACK SHIELD deployment. The [REDACTED] Detachment indicated that incompleteness of this program would not constitute a "no-go" for BLACK SHIELD and further indicated that the MH systems were in a "go" condition today. As indicated on Attachment II, aircraft 132 will be held on flight status until its scheduled modification date (and not go down two weeks early) in order to maximize availability for the MH improvement programs.

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8. Mach 2.9 and 3.2 were established as the slow/fast profile for BLACK SHIELD as indicated on Attachment III and as amplified in Part II paragraph 9.

9. General Ledford and Mr. Parangosky stressed the requirement for periodic progress reports covering flight test programs in support of BLACK SHIELD by the contractors and [REDACTED] components involved, and for meantime between failure records of system components in order to better schedule preventative maintenance and improve reliability.

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PART II - PROPULSION

1. Single Engine Performance:

This item was reviewed by Mr. Johnson and results of aircraft 129, flight 115 on 8 June 1965 were presented. The flight was performed with Y engines with J afterburners and single engine performance began at 3.2M at 79,000 ft.

Article weight at start of single engine operation	- 79,000 lbs.
Total single engine distance	- 410 Kn.mi.
Total fuel used during single engine operation	- 14,000 lbs.
Distance covered in descent to 30,000 ft.	- 215 Kn. mi.
Distance covered in cruise	- 170 Kn. mi.
Single engine cruise fuel consumption	- 25 nautical miles per 1000 lb. of fuel.

25X1 [redacted] commented that a single engine emergency rating could be obtained with the J engine by increasing EGT to 845° C. A similar emergency rating for the YJ engine is being investigated. Mr. Brown also related that earlier concern for "freezing up" of engine oil during windmilling operation was unwarranted and a windmilling engine apparently receives enough heat to prevent this.

A relight was obtained on the windmilling engine on this flight at 11,000 ft. with RPM of windmilling engine between 1100 and 1200 RPM. This relight was obtained with the 24 shot TEB system.

2. Mr. Johnson discussed recent information developed on the inlet system and briefly described plans for inlet investigations

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to be conducted in the immediate future. He indicated that most of the possible modifications to the inlet have been completed and the only two possibilities remaining to be explored are tests to investigate improved spike centering and adding vortex generators to the spike. Current levels of distortion and recovery achieved on aircraft 129 were quoted as 9 to 13% and 77 to 78% respectively at Mach 3.2. The recovery at Mach 3.2 was quoted as 77 to 78% except for the bad area at the north-west quadrant. A modified spike will be tested which is arranged so that its centerline position can be varied. Mr. Johnson described the situation at Mach 2.6 as a condition of maximum q with the spike at its halfway axial position. The pressures associated with the maximum q condition represent the maximum side loads on the spike and when the spike is at its halfway position its centering alignment in the duct is less rigidly determined by possible flexibility of the spike and track. Indications are that this miscentering of the spike at the halfway position can amount to an equivalent difference of 3 inches in axial position of the spike between the northwest and southeast quadrants. Mr. Johnson also indicated that this miscentering effect could be related to the different engine blowout effects at certain flight conditions. Mr. Johnson quoted [REDACTED] as saying that "the flow pattern into the engine is perfectly satisfactory at Mach 3.2," indicating that at the design condition flow conditions into the engine are satisfactory but it is at the intermediate Mach numbers that improvement is needed.

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Mr. Johnson said that the vortex generators will give more angle of attack tolerance at all flight conditions but he does not know as yet just where on the spike (presumably at what portion of the subsonic flow portion of the spike) the vortex generators should be positioned.

In summary, Mr. Johnson described the remaining work on the inlet to be concentrated on more maneuver margin, more engine blowout tolerance, and on making sure that the inlet is not passing on any troubling conditions to the engine below Mach 3.2.

3. A brief discussion was held regarding the A-50 additive to the engine fuel. [REDACTED] was not sure of the status of P&W's tests to find a new carrier fluid for the cesium additive since new government regulations on the detergent industry have eliminated the detergent by-product used previously as the

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A-50 fluid. [ ] will look into this and MD/OSA will also check into the current status of this matter.

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4. The engine relight tests were discussed briefly and [ ] reaffirmed the intent of these tests as determining the relight envelope of the 24 shot system to ascertain that the quoted number of shots of the current 12 shot system can be changed to 16 shots.

5. The designation of priority flight test items on aircraft 122 were discussed at several times during the course of this meeting. Most of the current engine testing is being devoted to roughness investigations with Bendix Main Fuel Controls which is not a priority BLACK SHIELD test item. It does apply to BLACK SHIELD however, insofar as some YJ engines for BLACK SHIELD will have Bendix controls. The two main priority aircraft 122 engine test items for BLACK SHIELD should be the relight tests with the 24 shot TEB system and testing of the "Frosty" Hamilton-Standard Fuel Control. The fuel derichment system should also be added here since this is a BLACK SHIELD item. However, the testing of this system does not necessarily have to be done on article 122 but it would be preferable to test this system on an engine instrumented aircraft. The main objective of these tests will be to ascertain that the system reduces the main engine fuel flow to a low enough value to prevent over-temperatures during inlet unstarts without dropping the main engine fuel-air ratio below lean blowout.

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6. [ ] and D/TECH personnel expressed concern over the problems involved in attempting to equip engines with BLACK SHIELD priority improvements and keeping these engines set aside for BLACK SHIELD aircraft as they come out of the Mod program.

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[ ] also expressed concern over the overall flight program and its relation to the engine management picture. He indicated that with the current engine management procedures flight time may be used on BLACK SHIELD priority engines before they are needed for BLACK SHIELD and that some engines are being held out West as vacuum cleaner engines when they should be returned to overhaul so as not to suffer a loss in overall available engine flight hours. The Florida developed FOD screens were discussed. D/TECH will send P&W a wire in the very near future requesting shipment of the two available screens to the Area in an effort

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to reduce the need for so called vacuum cleaner engines. A question arose here as to whether P&W had received an accounting of the flight hours required for the BLACK SHIELD Validation plan. This matter will be checked further and P&W will be supplied with this information.

25X1 7. [redacted] briefly reviewed his interpretation of what constitutes a proper engine reliability validation flight test program. [redacted] read the applicable portion (Item 14A) of the OPS paper on the BLACK SHIELD Validation plan and [redacted] agreed that this constituted a proper engine validation program. [redacted] concern was that engine validation flights may be clouded by other tests and he was assured that all BLACK SHIELD test flights would be "full blown" mission flights and would be appropriate engine validation flights.

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25X1 8. [redacted] then gave a chart supported presentation on recent engine flight test results and problems. This involved primarily a documentation of substantial improvements in fuel control performance and the status of the Main Gear Box situation which resulted from a hydraulic pump idler shaft bearing failure on Engine #219 outlining the action being taken to prevent further gearbox bearing failures. Copies of the charts included in [redacted] presentation are available in D/TECH. The engine contractor representatives in attendance in addition to Mr.

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A rather lengthy and involved discussion developed on the overall engine EGT trimming problem. The problem of difficulty in trimming of the engine during and after tanker hook-up due to lack of a CIT gage which reads below 0°C was discussed and [redacted] (LAC) agreed to investigate the possibility of obtaining a better gage. [redacted] also proposed a procedure whereby the tanker crew would read a correct CIT for the existing flight speed and altitude and would read a correct EGT setting to the A-12 pilot. [redacted] said he would establish a proper procedure and check it out at Beale AFB. It would appear that this procedure would improve the trimming situation at the tanker substantially especially if a proper CIT gage for the A-12 cannot be obtained. The problem of proper trimming of the fuel control at cruise was discussed at some length and LAC personnel indicated that the current trim tolerances as outlined by P&W were unacceptable since they could result in a substantial cruise

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range loss. It was decided that a redefinition of proper cruise EGT trimming tolerances would be deferred until after more flight testing of the Hamilton "Frosty" control is completed in aircraft 122. The error gage and auto trimmer are being developed by LAC and P&W respectively but improvement in fuel control trimming procedures is definitely required before and during the period after these systems become available. It would appear that the current cruise trimming procedures outlined by P&W should be used in early BLACK SHIELD practice flights with "Frosty" controls on aircraft 131 and other aircraft as they complete the Mod program until more flight testing is completed on aircraft 122.

9. The proper choice of cruise mach number for the various legs of BLACK SHIELD missions was discussed and it was ascertained that "slow" legs of the mission would be flown at Mach 2.9 and the "fast" leg at 3.2. As well as could be determined at this point is time Mach 3.0 is still the point above which more severe engine distress may be experienced. Mach 2.9 for the slow leg has the following advantages: 1) It is out of the Mach 2.4 - 2.8 duct roughness regime; 2) It results in a substantial reduction in inlet distortion harmful to engine performance and life; 3) It affords better aircraft performance (range). Mach 3.2 is no longer characterized by poor inlet performance and reliability. Choice of the above mach numbers for various portions of BLACK SHIELD missions will allow the BLACK SHIELD mission to be accomplished at as high a mach number as possible without accumulating Mach 3+ flight time on engines at an excessive rate.

10. Engine related items requiring follow-up are as follows:

25X1 a. [ ] (LAC) will investigate availability of improved CIT gage.

25X1 b. [ ] will investigate procedure whereby EGT settings for A-12 pilot will be provided by tanker at refueling

c. Engine flight test priorities will be reestablished for aircraft 122.

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d. The overall engine availability situation will be investigated by P&W and OSA/MD as it relates to BLACK SHIELD. P&W will be supplied with current flight test hour requirements for OXCART, KEDLOCK, and TAGBOARD including the BLACK SHIELD Validation plan.

e. Correct cruise EGT trimming tolerances will be established by P&W following further flight testing of fuel controls on aircraft 122.

D/TECH/OSA has authorized go-ahead on the following:

- 1. Delivery of two FOD screens to [Redacted]
- 2. Go-ahead on auto trimmer development.
- 3. Order for 30 additional derichment devices for BLACK SHIELD support.

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Att. I to  
OXC-8815-65

AGENDA 10 JUNE 1965  
BLACK SHIELD MEETING

General Ledford: Opening Remarks (0900)

1. Lockheed: (0915-1030)

- a. Single Engine Performance
- b. Limited Visibility and Climate Test
- c. Plastics
- d. A-50 Additive Tests
- e. Engine Relight/TEB Capacity Tests
- f. ARC-50 Installation Cooling
- g. Major Modification Progress - Significant slippages or parts shortages such as All Attitude Fuel Probes, Air Data Computer
- h. SKYLARK II Aircraft 125, 128, 132 (Mission Flight and Overall Flight System) reliability figures for period 1 May through 4 June.
- i. Aircraft 121 Modification Progress - significant slippages or parts shortages.
- j. Recent aircraft 129 activity including inlet test and cruise program.
- k. Aircraft 122 activity

2. Pratt & Whitney (1030 - 1145)

- a. Engine Durability Validation Clarification.
- b. Fuel Controls - "Old" Hamilton, Bendix, "Frosty" Hamilton Improvement Statistics.
- c. EGT Trim Procedures.
- d. Main Gearbox Inspection and Fix Status

3. Minneapolis-Honeywell: (1145-1215)

- a. Mach Hold
- b. Steering Needle Bias
- c. Asymmetric Bank

4. Lunch

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5. Minneapolis-Honeywell South: (1315-1345)

- a. INS Turn Program
- b. World Wide Capability
- c. INS/HF Interference
- d. Battery to Isolate INS

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- a. SKYLARK Phase II Aircraft 125, 128, 132  
Mission Success Rate 1 May through 4 June.
- b. BLACK SHIELD Flight Validation Experience Applicable  
to date.

7. Headquarters OXCART Division: (1430-1515)

Outstanding Items from 9 June meeting on BLACK SHIELD  
Validation and Test.

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Att. II to  
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DECISIONS AND ACTIONS

1. The following represents decisions and actions resulting at the 10 June BLACK SHIELD meeting at [redacted] It is expected that these decisions and actions will be followed and/or implemented by the appropriate parties concerned:

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a. Aircraft 122 Flight Test Priorities:

- 1) Engine Relight/TEB Evaluation
- 2) Hamilton-Standard "Frosty" main fuel control evaluation.
- 3) A-50 AR Additive evaluation.

b. Aircraft 129 Flight Testing to focus on:

- 1) Single Engine Performance
- 25X1 2) [redacted] Max: Range Demonstration
- 3) Air Inlet Control Refinement
- 4) Mach Hold Improvement

c. The fuel derichment system available at [redacted] and designed to minimize engine overtemperature during inlet unstarts will be evaluated on the flight test aircraft.

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d. Lockheed generated product rule probability will continue as a subsystem performance diagnostic tool within the confines of OSA.

e. Detachment generated mission success rate concept based on BLACK SHIELD aircraft and on SKYLARK II aircraft will be used for briefing components inside and outside OSA.

f. Lockheed to continue effort to improve ARC-50 installation cooling.

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g. Engines configured with BLACK SHIELD priority improvements as designated by Pratt & Whitney including such items as "Frosty" fuel controls will be earmarked and assigned only to A-12 aircraft at [ ] with priority assignment to aircraft 122 flight test and BLACK SHIELD aircraft.

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h. Pending evaluation of anti-FOD screens, high time engines heretofore assigned and held as vacuum cleaners will be expedited to overhaul in order to improve and maintain proper engine support posture for BLACK SHIELD.

i. In addition to the BLACK SHIELD Validation plan, overall flight planning in terms of expected hours during June, July, August, September, for OXCART, KEDLOCK and aircraft 134 and 135 will be forwarded by Materiel Division OSA to Pratt & Whitney in order that they may assess the compatibility of the current sixty one engines with program requirements.

j. Lockheed will investigate and submit proposal for an improved CIT gage which will increase range to read to minus fifty degrees centigrade, improve accuracy, and legibility.

k. As an interim measure CIT during refueling will be provided to the A-12 by the tanker OAT readings with an appropriate correction applied for RAM. Coordination and procedures will be established by the Detachment, Lockheed, and Pratt & Whitney.

l. "Frosty" control flight testing on aircraft 122 will permit Pratt & Whitney to define exact new EGT limits for cruise with a nominal operating point within these limits. When defined, Pilot Handbook procedures will be established by the Detachment, Lockheed, and Pratt & Whitney for no trim or "hands off" operation unless EGT wanders outside these max and min limits.

m. Aircraft 132 will remain on flight status until its scheduled modification date of 15 August in order to maximize utilization for the Minneapolis-Honeywell Family test program in addition to the climate test program scheduled for 7 July.

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n. The slow/fast BLACK SHIELD mission profiles will be flown at Mach 2.9 (slow) and Mach 3.2 (fast).

o. Materiel Division/OSA will check on A-50 AR additive to insure continued supply source availability and coordinate with Pratt & Whitney.

p. C&FE/OSA to report on critical [REDACTED] antenna delivery schedules.

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q. All concerned concentrate on meantime between failure estimates of system components in order better schedule preventative maintenance replacements to improve overall systems reliability performance and reduce failures.

2. Periodic progress reports to Headquarters covering flight test programs in support of BLACK SHIELD will be implemented or included in currently existing contractual periodic reporting requirements by the Contractors and by [REDACTED] components involved.

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