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OXC - 1298
Copy 1 of 7

7 February 1961

MEMORANDUM FOR : The Record

SUBJECT : JT11D-20 Engine Program Review

REFERENCE : (1) OXC-1258 dated 25 January 1961 titled "Storage and Handling - PWA 523 Fuel"

1. Pratt & Whitney Florida Research and Development Center was visited by the writer during the week of 16 January 1961 for subject review. Findings of this review are summarized in the following paragraphs. Current engine program support status will be covered by a separate memorandum.

2. X Flight Engines:

(a) Due to main fuel control problems and lagging parts deliveries, it is questionable, in the writer's opinion, whether the X flight engine delivery schedule will be met. The first two X flight engines are scheduled for delivery 14 and 28 April 1961 respectively. This reflects a 4 month lead time before the first scheduled flight. These engines will be needed at Burbank by 5 May 1961 for instrumentation building prior to installation in article no. 1 which is scheduled for rollout 30 June 1961. This assumes no further airframe schedule slippage. Concentrated effort is being expended on the fuel controls. Task force teams have been dispatched to help vendors solve magnesium fabrication and processing problems with fair success.

(b) The X engines are expected to differ from the Y prototypes in the following areas:

(1) Louvered afterburner liner instead of rigimesh configuration.

(2) 250 to 300 lbs. over spec. weight.

(3) Engine limits set at Mach 3.0, approximately 82,000 feet altitude, 1850°F turbine inlet temperature, 250°F fuel inlet temperature. The 1850°F T.I.T. will limit sea level static thrust to about 30,000 lbs. These limitations have been coordinated with Lockheed and are not expected to

37

25X1

Approved For Release 2006/11/13 : CIA-RDP81B00879R001000040045-1

Approved For Release 2006/11/13 : CIA-RDP81B00879R001000040045-1

be incompatible with early flight testing.

(4) Different turbine blade and vane coating.

(5) Smaller fuel/oil cooler.

(6) Compressor stages not restaggered for max. airflow.

(7) Main fuel control not equipped with remote trim on delivery. To be incorporated prior to flight.

Some rework may be expected between initial X engine delivery and flight in order to substantiate flighworthiness.

3. Performance:

No standard day performance degredation is expected for the Y engines. Engine specification 3967C will be revised shortly to include nonstandard day and 4500 foot altitude performance.

4. Weight:

The Y engine bill of material weight status as of 16 January 1961 is as follows:

(a)

	Weight (lbs)	Cumulative changes relative to Y engine spec. weight of 5657 lbs.
Current Eng. Estimate	5809	+ 152
Cat. 1 Chgs. Outstanding	-127	+ 25
Cat. 2 Chgs. Outstanding	- 47	- 22
Cat. 3 Chgs. Outstanding	- 4.5	- 26.5

(b) Compressor redesign to eliminate blade tip shrouding and to replace tubular with solid rim dampers is expected to penalize the above weight figures by about 60 pounds. Continuous effort must be expended in proposing new weight reduction changes in order to offset this penalty.

5. Engine Controls:

It is now evident that the main and afterburner fuel controls will be pacing items in the engine program. Endurance runs on

Approved For Release 2006/11/13 : CIA-RDP81B00879R001000040045-1

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development engine FX-112 (the first engine run utilizing the new prototype controls) was aborted 18 January because of main fuel control inability to schedule proper fuel flow and afterburner fuel control leakage. Although control problems are not uncommon in other engine programs during the initial test phase, the tight schedule of this program demands more rapid solutions in order to avoid delay. It is understood that [redacted] 25X1 is insisting upon a maximum engineering effort to reach solutions. Within the last few days, bench tests and engine FX-112 tests indicate fair progress in this area.

6. Ae Rs

Less than initially anticipated additive flow rates have resulted in a fair possibility that the additive may be introduced directly into the fuel. This would eliminate the need for the additive control system and thereby reduce article weight by as much as 150 lbs. In order to verify this possibility, the effect of the additive doped fuel on engine control system and turbine blades must be evaluated by test. These tests are expected to require two to three months before completion. P & W therefore is proposing to stand down on the additive control system detail design for this period. Documentation of this proposal is expected with the January Progress Report targeted for 15 February 1961.

7. Remote Gearbox:

As of 19 January 1961, 80% of required parts have been delivered for this system which comprises reduction gearbox, shafting, and remote gearbox. Subassembly is in process with fair outlook for meeting the initial I engine delivery date of 14 April 1961. No major problems are anticipated during test.

8. Ejector:

The ejector test rig was received at FGE-PEEC on 19 January 1961. Allowing three weeks for set-up and instrumentation check-out, this unit should be on test by 13 February 1961.

9. Fuel:

(a) Revised proposals covering the candidate fuel for specification PWA 523 are expected shortly from [redacted] 25X1
The revision is due to the addition of the 3.5 psia vapor pressure at 300°F point to the spec. as requested by Lockheed.

Approved For Release 2006/11/13 : CIA-RDP81B00879R001000040045-1

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(b) Due to quality, willingness to undertake development without cost for limited volume outlook, and cooperation in the refinement of testing techniques recent fuel deliveries have been furnished solely by [redacted]. Primary quality characteristics of recent deliveries and recent proposals are presented herewith for comparison: 25X1

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	Spec. JAA-523	[redacted]			
Heating Value Btu/lb.	18,900 min.	18,930	18,950	18,700	18,830
Frz. Point °F	-30 max.	-90	-90	-22	-44
Luminometer Number	100 min.	93.5	100	100	105
Distl. @ 50 % point °F	420 min.	391	infirm	395	416
Delivered Price ¢/gal.	—	*.30	*.30	**.27 to .35	—

* Price based on 1.5 to 5 million gal/year. 3 to 6 ¢/gal. less on larger production quantities.
** Depends on quantity.

The above characteristics reflect a condition prior to incorporation of the vapor pressure described in paragraph (a). For this incorporation, "trade-offs" are expected in these characteristics particularly in the area of freeze point.

25X1

[redacted]

(d) Present planning will require approximately 6 to 9 million gallons per year for article usage (tankers excluded) through 15 September 1962, and approximately 9 to 12 million gallons per year thereafter. P & W requirements may add another 10 to 15 million gallons per year. This would place initial usage at about 15 to 25 million gals./year with an increase to 19 to 27 million gallons per year after 15 September 1962. These figures do not necessarily reflect A3J or AF-12 requirements.

Approved For Release 2006/11/13 : CIA-RDP81B00879R001000040045-1

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B-70 requirements are by no means firm although active interest in PWA 523 has been initiated.

25X1 [redacted] refinery current maximum production capacity is slightly under 50 million gallons per year. A six months lead time is required to reach this rate.

In view of the 30 August 1961 initial flight, it is recommended that an order be placed very soon for the PWA 523 fuel.

25X1 (c) [redacted] has presented the following facts regarding the 19,100 Btu/lb. heating value fuel: large capital expenditure to produce will dictate a price of 50¢ to 75¢/gal.; quantity will be limited by the particular select crude from which it is made; fourteen months lead time required. Further refinement of these facts is underway.

10. Lube Oil:

An engine main bearing (No. 3) was inspected by the writer after 190 hours operation at 550°F (oil inlet temp) with PWA 324 oil. The bearing appeared in good condition with very little wear.

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11. Ground Support Equipment:

The present status of major support equipment furnished by the engine contractor is as follows:

(a) Accessory Test Bench for fuel control check is in fabrication and targeted for June 1961 delivery.

(b) Three fan engine rollover stands for buildup and inspections are being modified to suit JT11D-20. Final fit check scheduled for March 1961.

(c) The engine run up stand design is scheduled for completion by P & W 16 February 1961. These final drawings

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will then be submitted to Lockheed for coordination and manufacture.

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12. Pratt & Whitney has expressed complete satisfaction with Lockheed and [redacted] coordination.

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[redacted]
Development Branch
DPD-DD/P

DPD/DB/RCD:rcw
Distribution:
1-DD/P
2-C/DB/DPD
3-C/TAS/DPD
4-ACH/DPD
5&6-DPD/DB
7-DPD/RI

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