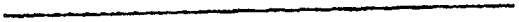


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U.S. GENERAL ACCOUNTING OFFICE
STAFF STUDY

{ F-111 AIRCRAFT }



DEPARTMENT OF THE AIR FORCE

FEBRUARY 1973

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ABBREVIATIONS

MTBF	MEAN TIME BETWEEN FAILURE
SAR	SELECTED ACQUISITION REPORTS
SPO	SYSTEM PROGRAM OFFICE

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STATUS OF MAJOR WEAPON SYSTEM F-111 TACTICAL AIRCRAFT

we reviewed the June 30, 1972, F-111 Selected Acquisition Report (SAR) to determine if it complies with the spirit and intent of Department of Defense Instruction 7000.3, as amended April 12, 1972.

Information on this program was obtained by reviewing plans, reports, correspondence, and other records and by interviewing officials at the F-111 System Program Office (SPO), located at Wright-Patterson Air Force Base.

This report presents the status of the F-111A/C/D/E/F program as shown in the June 30, 1972 SAR. The FB-111, the strategic bomber version, is not included since that program is nearing completion and SAR reporting was discontinued in December 1971.

SYSTEM DESCRIPTION AND STATUS

The F-111A/C/D/E/F are versions of the F-111 which evolved from the concurrent development and production of this two engine, two-man crew, all-weather tactical aircraft. These fighter bombers can deliver nuclear and conventional weapons at subsonic or supersonic speeds. A unique feature of the F-111 is its variable sweep-wing, which pivots back for high speed flight and pivots forward for short takeoff and landing capability. Another unique feature is its crew compartment which serves as an

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emergency escape module. In addition to an all-weather, long-range attack capability, this aircraft also has secondary capabilities in close air support, counter-air and other tactical missions. The F-111C version will be used by the Royal Australian Air Force. The F-111D is the only version which utilizes the complete Mark II avionics system for improved navigation, situation display, and fire-power control. (

As of June 30, 1972, all F-111A/C/E aircraft were delivered. In addition, 29 of the 96 F-111D aircraft were delivered as well as 70 of the 82 F-111F aircraft. The first wing of F-111Fs was declared operational, ready in October 1972. In September 1972, 48 F-111As were deployed to Southeast Asia to enhance all-weather and low-altitude capabilities of the United States tactical air effort.

COMING EVENTS

The Air Force expects final deliveries of F-111D aircraft in February 1973.

The F-111F version was scheduled for final delivery in December 1973, however, this date has been extended until December 1974 since 12 F-111Fs were added to the fiscal year 1973 program. The fiscal year 1973 purchase is the last scheduled purchase of F-111 aircraft.

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COST

With the additional procurement of 24 more aircraft and other minor procurements the reported estimated total program cost excluding certain logistics support and additional procurement costs increased from \$7,091.3 million as of June 30, 1971, to \$7,506.0 as of June 30, 1972. This net increase of \$414.7 million and changes in cost that occurred during fiscal year 1972 are described on Page 4.

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CHANGES IN COSTS AS REPORTED IN SARS (in millions)

Major Program Elements	Current Estimate		Net Change
	June 30, 1971	June 30, 1972	
I. Development	\$1,641.5	\$1,641.5	None
II. Procurement			
Air Vehicle	3,334.1	3,558.5	\$+224.4
Engines	633.0	681.6	+ 48.6
Familiar Support	530.3	540.8	+ 10.5
Initial Spares	509.9	552.1	+ 42.2
Total Procurement	\$5,007.3	\$5,334.0	\$+326.7
III. Construction	19.1	19.1	None
IV. Total Program Cost	\$6,667.9	\$6,994.6	\$+326.7
Program Unit Cost	\$ 15.09	\$ 15.01	-.08
Quantities	442	466	+ 24
V. Reported Logistics Support and Additional Procurement Costs*			
Modifications	\$ 310.8	\$ 393.1	\$+ 82.3
Component Improvement	112.6	118.3	+ 5.7
Total Reported Logistics Support and Additional Procurement Costs	\$ 423.4	\$ 511.4	\$+ 88.0
VI. Total Program Cost plus Reported Logistics Support and Additional Procurement Costs	\$7,091.3	\$7,506.0	\$+414.7
VII. Other Logistics Support and Additional Procurement Costs*			
Replenishment Spares	\$ 338.1	Not reported	\$-338.1
Common Aerospace Ground Equipment (AGE)	74.7	Not reported	- 74.7
Common AGE Spares	4.2	Not reported	- 4.2
Modification Spares	12.8	Not reported	- 12.8
War Consumables	50.2	Not reported	- 50.2
Total Other Logistics Support and Additional Procurement Costs	\$ 480.0	Not reported	\$-480.0

* Includes only those costs reported in the June 30, 1971 and June 30, 1972 SARs. Costs listed in Section VII were reported in the June 30, 1971 SAR, but not in the June 30, 1972 SAR.

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The \$326.7 million increase in procurement costs was due to the fiscal year 1972 and fiscal year 1973 procurement of 24 additional F-111Cs and additional initial spares.

The F-111 aircraft average unit cost decreased from \$15.09 million to \$15.01 million while quantities increased from 442 to 466 aircraft.

The \$88.0 million increase in logistics support and additional procurement cost was due to increases of \$82.3 million to modification cost and \$5.7 million to component improvement cost. The increase to modification cost was due to (1) the inclusion of an additional fiscal year (1977) in the Five Year Defense Plan which accounted for \$37.1 million, (2) an upward adjustment in fiscal year 1974 requirements of \$22.2 million, and (3) an additional \$23.0 million to modify F-111Cs for the Australian Air Force. The increase to component improvement costs was a result of the fiscal year 1973 procurement of 12 F-111Fs.

Five logistics support and additional procurement cost elements were not reported in the June 30, 1972 SAR because of new reporting instructions issued in May 1972 by the Assistant Secretary of Defense (Comptroller). The instructions provided for the reporting of only modification and component improvement costs, and deletion of all other costs previously reported. The period covered by these two cost elements will be through the Five Year Defense Plan period or the last year of the basic system

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procurement, which ever is later. Thus, for the June 1972 SAR, costs for modification and component improvement totaling \$511.4 million were included for years through fiscal year 1977.

The Office of the Secretary of Defense is planning to meet with the House Appropriations Committee in early 1973 regarding the Committee needs for data in the SAR as cited in their report 92-1389, dated September 11, 1972. The Committee stated that considerable improvement was needed to the additional procurement cost section, including the need for firm baselines and the categories of costs to be reported. DOD Instruction 100.7 will be revised to incorporate the results of this meeting.

The June 30, 1972 SAR showed total cost change attributable to "economic change" of \$207 million, an increase of \$26 million since June 30, 1971. The treatment of inflation in program costs estimates can be found in Appendix I.

The estimated total program cost trend for the F-111A/C/D/E/F as of June 30, 1972, is shown in Appendix II.

The funding data for the F-111 program as of June 30, 1972, is shown below:

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FUNDS
(in millions)

<u>Appropriation</u>	<u>Appropriated</u>	<u>Reprogrammed</u>	<u>Obligated</u>	<u>Expended</u>
Development	\$1,486.3	\$150.2	\$1,635.4	\$1,592.5
Procurement	5,204.6	(40.9)	5,019.3	4,530.6
Construction	<u>19.1</u>	<u>-</u>	<u>18.0</u>	<u>18.0</u>
Total	<u>\$6,710.0</u>	<u>\$109.3</u>	<u>\$6,672.7</u>	<u>\$6,141.1</u>

CONTRACT DATA

In December 1962 a firm fixed price incentive contract for the F-111 aircraft research and development was awarded to Convair Aerospace Division of General Dynamics Corporation. The development contract provided for 23 test aircraft--18 Air Force and 5 Navy. All 23 test aircraft were delivered by December 1966. As of June 30, 1972, 98 percent of the development cost had been incurred. Additional work remains in airframe flight test and development of the Mark II avionics.

General Dynamics Corporation was awarded a firm fixed price incentive production contract in April 1965, and similar follow-on production contracts in July 1970 and December 1971. The Government-furnished engines are provided by Pratt & Whitney Aircraft Division of United Aircraft Corporation.

The status of the production aircraft as of June 30, 1972, is as follows:

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<u>F-111 Version</u>	<u>On Contract</u>	<u>Manufactured</u>	<u>Delivered</u>
F-111A	141	141	141
F-111B	2	2	2
F-111C	24	24	24
F-111D	96	66	29
F-111E	94	94	94
F-111F	<u>82</u>	<u>70</u>	<u>70</u>
Total	<u>439</u>	<u>397</u>	<u>360</u>

Deliveries of the remaining 79 aircraft, plus 12 additional F-111Fs to be purchased in fiscal year 1973, are scheduled to be completed by December 1974. Disposition of the 439 production aircraft plus development aircraft is shown in Appendix III.

As of June 30, 1972, the status of the development and three production contracts with General Dynamics Corporation including the Navy and FB-111 programs is as follows:

	<u>Development Effort</u>	<u>Production Effort</u>
	(in millions)	
Initial contract target price	\$ 480.4	\$2,067.2
Current contract target price	\$1,540.8	\$4,657.1
Government estimate of price at completion	\$1,674.9	\$5,344.0

The difference between the initial contract target price and the Government estimate at completion for the development effort (\$1,194.5 million) and production effort (\$3,276.8 million) consists of the following matters:

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	<u>Development Effort</u>	<u>Production Effort</u>
	(in millions)	
a. Definitized changes	\$ 759.1	\$1,848.2
b. Undefined changes	(1.0)	38.2
c. Definitized provisioned items	305.4	778.7
d. Undefined provisioned items	4.3	40.3
e. Government share of overtarget	<u>126.7</u>	<u>571.4</u>
Total dollars	<u>\$1,194.5</u>	<u>\$3,276.8</u>

The contractor's system for Cost/Schedule Control Systems Criteria was approved in February 1971 as meeting the requirements of Department of Defense Instruction 7000.2 "Performance Measurement for Selected Acquisitions."

PERFORMANCE

The F-111F was the only version to experience a change in performance during the year ended June 30, 1972. There was a minor reduction in takeoff weight which resulted in small improvements to the combat ceiling, ferry range, and takeoff and landing distances.

In last year's staff study we pointed out that the mean-time-between-failure (MTBF) contract specification for the integrated display set--a component of the Mark II avionics system--was reduced from 270 hours to 25 hours. In addition, early testing demonstrated a five to six hour MTBF. During

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fiscal year 1972 reliability qualification tests were initiated and preliminary results indicated that the 25 hour MTBF requirement would be met.

During this year's review our discussions with Air Force officials concerning other Mark 11 components indicated that the contract specified reliability for the doppler radar and the converter may not be attained.

The doppler radar successfully demonstrated its contract specifications for MTBF of 475 hours during reliability qualification testing in July 1970. However, subsequent reliability acceptance testing completed in December 1971, disclosed a MTBF of 120 hours which is substantially below the 475 hour contract requirement.

Reliability qualification testing for the converter--completed in December 1971--demonstrated a MTBF of only 190 hours as compared to a contract requirement of 350 hours.

SPO officials believe that further technical improvements for the doppler radar and converter will be difficult and expensive to achieve because previous efforts to do so have been unsuccessful and all of the units have been delivered to the prime contractor. They told us that the contractually specified MTBFs for these two components may be reduced to match the MTBFs demonstrated in testing.

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The contract required MTBF for the entire Mark 11 avionics system-- which in 1970 was reduced from 57 hours to 15 hours--will probably be further degraded from 15 hours to 13 hours. It is obvious that the significantly reduced reliability of the integrated display set, doppler radar, and converter as well as the entire Mark 11 avionics system may impair the F-111D operational readiness and also impact heavily on logistics support costs. The Air Force informed us that actions are being taken to improve logistics, for example, that upon completion of the F-111D production program in February 1973 spares availability will significantly increase.

PROGRAM MILESTONES

The F-111E was the only version to experience a schedule slippage during the year ended June 30, 1972. Its First Wing Operational Ready Date (1st Wing 100% equipped + 100 days) slipped one month due to the need to correct an engine inlet-icing problem. This problem was corrected and the first wing became operationally ready in November 1971.

RELATIONSHIP TO OTHER SYSTEMS

An Air Force official stated that the Navy's subsonic A-6 is the only other aircraft which can perform independantly a night, all-weather, interdiction mission. There are no existing plans for replacing the F-111.

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SELECTED ACQUISITION REPORTING

In our opinion the June 30, 1972 F-111 SAR generally complies with the spirit and intent of Department of Defense Instruction 7000.3 governing its preparation. We believe, however, certain aspects of SAR reporting need improvement.

In accordance with DOD instructions certain logistics support and additional procurement cost elements were excluded from the June 30, 1972 SAR, eliminating a significant portion of the total program costs. For example, five cost elements--replenishment spares, common AGE, common AGE spares, modification spares, and war consumables--were reported in the June 30, 1971 SAR as \$480.0 million. The December 31, 1971 SAR reported the same five cost elements at \$698.8 million--an increase of \$218.8 million during the six month period. The December SAR also reported an additional cost element identified as "other" at \$33.4 million. Thus, the June 30, 1972 SAR did not include certain cost elements which were reported as \$480.0 million on June 30, 1971, and \$732.2 million on December 31, 1971. We believe that these costs should be reported in the SAR.

The SAR does not address the reliability of the Mark II avionics system, used in the F-111D. In 1970 the MTBF for the Mark II was reduced from 57 hours to 15 hours. Due to the reduced reliability of two Mark II

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components--the doppler radar and converter--the MTBF for the Mark II will probably be further degraded from 15 hours to 13 hours. This significantly reduced reliability of the Mark II avionics system may impair the F-111D operational readiness and also impact heavily on logistics support cost.

MATTERS FOR CONSIDERATION

The Congress may wish to request the status of the Mark II avionics system and its full impact on the F-111D operational readiness and logistics support cost.

AGENCY REVIEW

A draft of this staff study was reviewed informally by selected Air Force Officials associated with the management of the program, and their comments were incorporated in the report as we believe appropriate. We know of no residual difference with respect to the factual material presented herein.

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APPENDICES

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ALLOWANCE FOR ECONOMIC ESCALATION
IN PROGRAM COST ESTIMATES
(in millions)




	<u>Planning Estimate</u> ^{1/}	<u>Development Estimate</u> ^{1/}	<u>Cost Changes</u>		<u>Total</u>	<u>Current estimate</u> ^{4/} <u>(\$ million)</u>
			<u>Quantity</u> ^{2/}	<u>Other</u> ^{2/}		
Total program estimate	\$4,686.6	\$5,505.5	\$-2,628.0	\$4,117.0	\$1,489.1	\$4,994.7
Amount for price escalation	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown

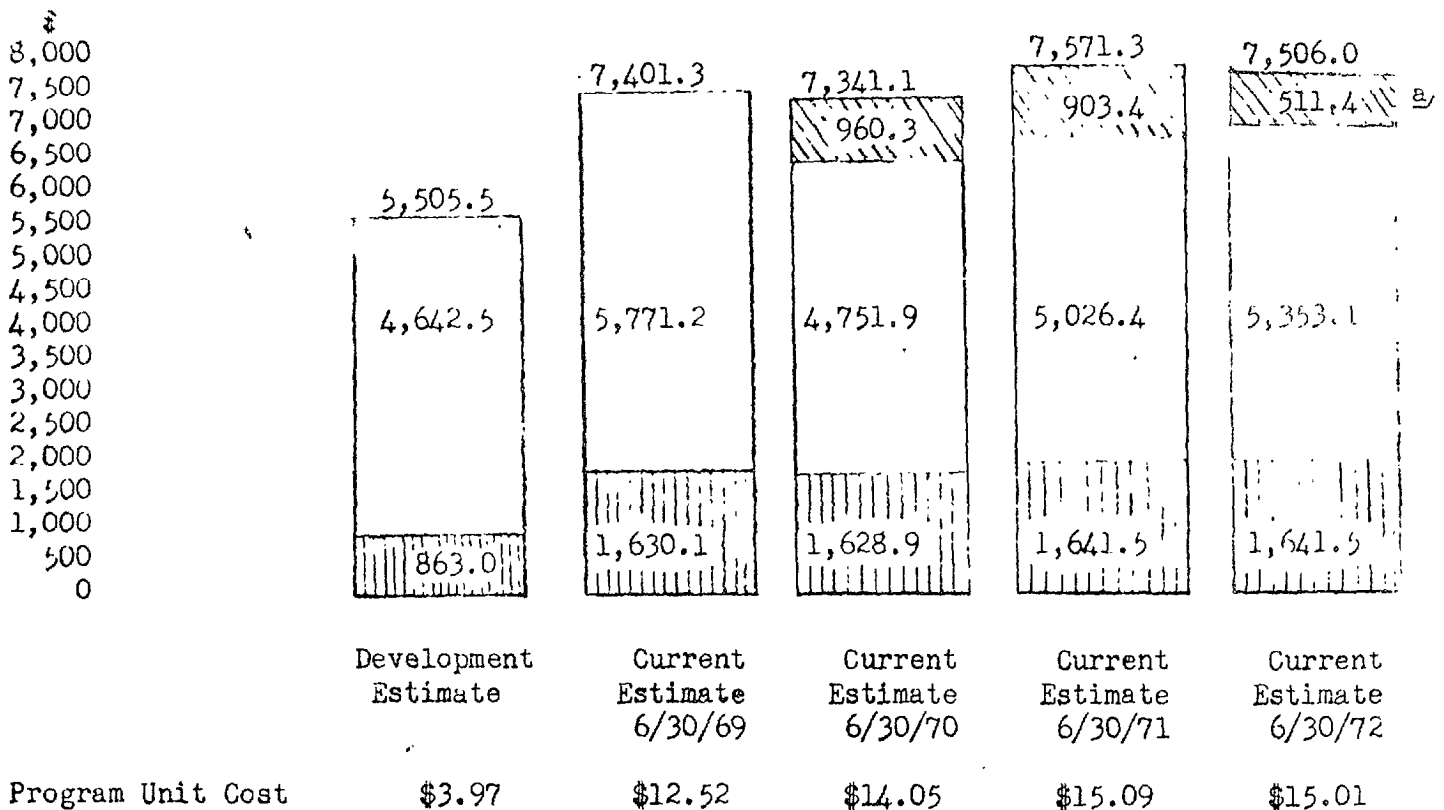
- 1/ SPO officials could not determine whether an inflationary allowance was used in the planning or development estimates.
- 2/ In accordance with Department of Defense Instruction 7000.3, amounts for the quantity column are computed using the original cost-quantity relationships, thereby excluding inflationary cost not originally anticipated. However, SPO officials could not determine whether the original cost-quantity information included an inflationary allowance.
- 3/ The June 30, 1972 SAR reported cost growth attributable to "economic change" amounting to \$207 million for the F-111A/C/D/E/F, an increase of \$26 million since June 30, 1971. SPO officials stated that a good portion of the \$207 million is a result of an increase in engine prices. In addition, the \$207 million does not represent total inflation included in the cost changes. SPO officials stated that it would be impossible to determine the total amount of inflation due to numerous aircraft schedule and quantity changes and the mix of various aircraft models.
- 4/ SPO officials could not identify the amount of inflation included in the total program estimate.

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COST SCHEDULE DATA
F-111 A/C/D/E/F
 (in millions)

LEGEND

-  Additional Procurement Cost
-  Procurement Cost/Construction Cost
-  Development Cost



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Quantity	1,388	591	454	442	466
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a/ Replenishment spares, common AGE, common AGE spares, modification spares, and war consumables costs were not reported in the June 30, 1972 SAR in accordance with new reporting instructions issued by the Assistant Secretary of Defense (Comptroller) in May 1972 (see pages 4 and 5).

DISPOSITION OF F-111 AIRCRAFT
as of June 30, 1972

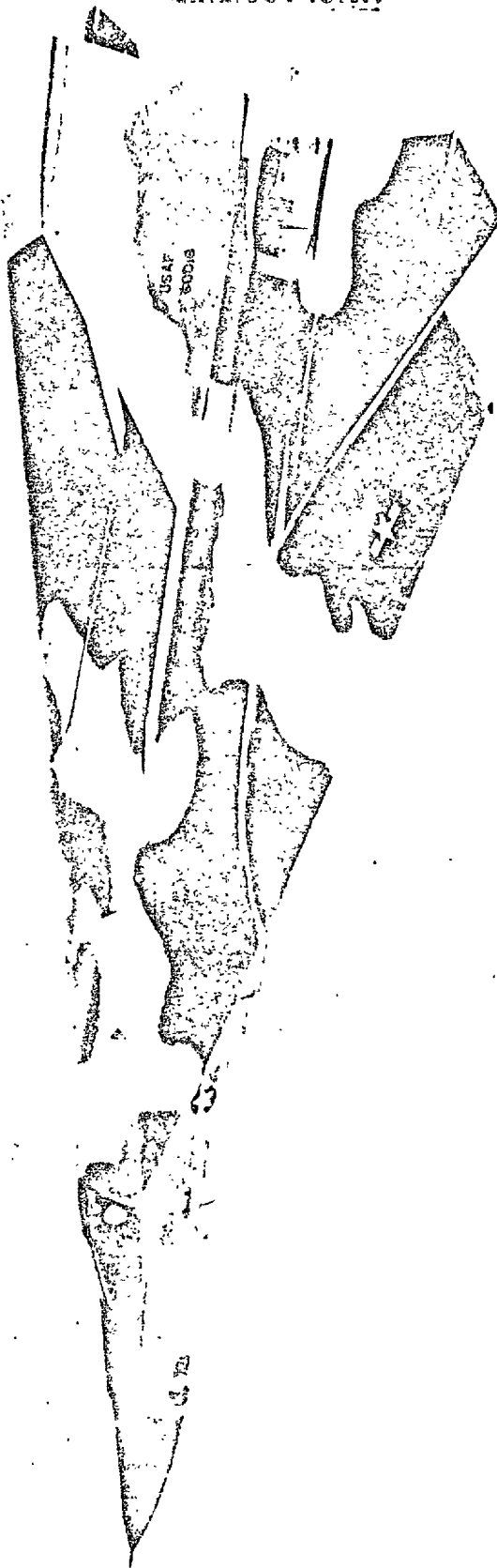
<u>F-111A</u>	<u>F-111B</u>	<u>F-111C</u>	<u>F-111D</u>	<u>F-111E</u>	<u>F-111F</u>
94-Nellis	1-Davis Monthan	24-Convair Aero-	26-Cannon	70-Upper Heyford	67-Mt. Home
15-Sacramento	(storage)	space Div.	3-Edwards	10-Sacramento	2-Convair Aero-
Air Materiel	1-China Lake	(modification)	(test)	Air Materiel	space Div.
Area	(training)		37-Convair Aero-	Area	(1-retrofit
(maintenance)	1-Moffett		space Div.	(maintenance	1-storage)
5-Edwards	(training)		(19-storage)	and	12-In production
(test)	2-Lakehurst		(18-pre-	modification)	1-Attritted
12-Davis Monthan	(storage)		acceptance	9-Nellis	
(storage)	2-Attritted		tests)	2-Edwards	
7-Cannon			30-In production	(test)	
1-Eglin				1-Eglin	
(test)				(test)	
2-Convair Aero-				2-Attritted	
space Div.					
(test)					
5-Sheppard					
(training)					
1-Chanute					
(training)					
1-Lowry					
(training)					
16-Attritted					
(Includes 18	(Includes 5	(To be delivered			
development	development	to Government of			
aircraft)	aircraft)	Australia)			
<u>159-Total</u>	<u>7-Total</u>	<u>24-Total</u>	<u>96-Total</u>	<u>94-Total</u>	<u>82-Total</u>

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