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DOCUMENT NO. & TYPE	SUBJECT/TITLE	DATE	RESTRICTION
16. note	JP to David re: Bud's decision, 2p D 11/16/01 F98-054 #81 D 12/6/95	nd	P1/F1 #29
17. paper	re: other aircraft, 1p D ~	nd ~	P1/F1 #30
18. paper	re: Taiwan Strait, 8p D 2/3/03 F98-054 #83 D ~	4/25/85 ~	P1/F1 #31
19. charts	re: LWDF, 9p D ~ ~ #84 D ~	nd ~	P1/F1 B3 #32

RESTRICTIONS

P-1 National security classified information [(a)(1) of the PRA].
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DOCUMENT NO. & TYPE	SUBJECT/TITLE	DATE	RESTRICTION
1. report	re: Taiwan, 14p D 2/3/03 F98-054 #85 PART 12/6/05 M03-1455 #1	1/15/85	P1/F1 B3
~~2. memo~~	~~Martin Chen to Assistant Secretary re: LWDF, 1p~~ R, 6/29/00 NLSF98-054 #86	~~nd~~	~~P1/F1~~
~~3. paper~~	~~re: executive summary, 2p~~ " " " #87	~~nd~~	~~P1/F1~~
4. paper	re: radar review, 2p P, 6/29/00 NLSF98-054 #88 R 8/24/07 NLRR M1455 #2	nd	~~P1/F1~~
5. chart	re: radar performance, 1p Part 8/24/07 NLRR M03-1455 #3	nd	P1/F1
~~6. chart~~	~~re: Figure 1, 1p~~ R, 6/29/00 NLSF98-054 #90	~~nd~~	~~P1/F1~~
7. chart	re: antenna, 1p R 8/24/07 NLRR M 1455 #4	nd	~~P1/F1~~
8. chart	re: aircraft performance, 1p Part 8/24/07 NLRR M03-1455 #5	nd	P1/F1
~~9. chart~~	~~re: missions, 1p~~ R, 6/29/00 NLSF98-054 #93	~~nd~~	~~P1/F1~~
~~10. paper~~	~~re: comments, 1p~~ " " " #94	~~nd~~	~~P1/F1~~
11. draft memo	Wolfowitz to Armacost re: EAP views [annotated], 5p PART 12/6/05 M03-1455 #6 AND F98-054 #95	nd	P1/F1
12. memo	Wolfowitz/Chain to Armacost re: IDF [annotated], 5p D 5/5/06 NLSF98-054 #96 D NLRR M1455 #7 8/24/07	8/21/84	P1/F1
13. draft memo	Chain/Wolfowitz to Armacost re: assistance [annotated], 4p D " " " #97 D " " #8 "	nd	P1/F1
14. paper	re: assistance, 2p D 9/5/02 NLSF98-054 #98 PART 12/30/05 M03-1455 #9	nd	P1/F1
15. paper	re: timing, 1p D 11/16/01 F98-054 #99 PART 12/6/05	nd	P1/F1 #10

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COMPARATIVE AIRCRAFT DATA

	LAVI	KFIR	F-5E	LWDF	F-20A	F-16/79	F-16A	F-16C	F-18	F-15C	M2000C/RDM
Aircrew	1	1	1	1	1	1	1	1	1	1	1
Engines/Thrust/(Lbs)	1/20,600	1/18000	2/10,000	2/5000* (8350 AUGMENTED)	1/18,000	1/18,000	1/25,000	1/27,000	2/32,000	2/25,000	1/20,000
Maximum Gross Takeoff Weight (Lbs)	42,000	35705	24,722	27,200	26,950	37,500	37,500	37,500	51,900	68,000	37,787
Fuel Capacity (Lbs)											
Internal	6,000	5719	4,400		5,050	6,972	6,972	6,972	10,381	13,455	7,275
External	9,180		5,155		6,435	6,760	6,760	6,760	8,280	11,895	2,270
Tanker Compatible	Yes		Yes		Option	Yes	Yes	Yes	Yes	Yes	Yes
Thrust/Weight Ratio (50% Internal Fuel)	1.09		.75		1.16	0.81	1.16	1.15	1.06	1.23	1.00

* Garrett TFE 1042-70
Same as F5E unaugmented.

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TAIWAN: FIGHTER DEVELOPMENTS (U)

DDB-1300-289-85

Information Cutoff Date: 15 January 1985

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This is a Department of Defense Intelligence Document
prepared by the Eastern Division,
Directorate for Research,
Defense Intelligence Agency

Author: [redacted] B3
China Branch,
Aerospace Forces Section

PREFACE

(S/NF/WN/NC) This report discusses the new lightweight defensive fighter being developed by Taiwan to offset the expected decline in its fighter inventory in the next 10 years. This initiative responds to two of Taiwan's perceived problems for the upcoming decade: (1) an increasing threat from the People's Republic of China (PRC) and, (2) increasing difficulty in obtaining foreign, notably US, weapon systems and components. Also discussed are Taiwan's force structuring problem, aerospace developments in the PRC affecting Taiwan, and Taiwan's other options for acquiring new fighter aircraft.

(U) The author wishes to especially acknowledge the efforts of Major [redacted] in compiling and organizing the basic research materials used in this report, and [redacted] for her analytical comments and support.

B3

(U) For background concerning PRC tactical air forces, including the potential threat to Taiwan, see China's Tactical Air Forces (U), DDB-1300-281-84, December 1984 and Air Sustainability: Fuzhou Military Region (U), DDB-1300-258-84, August 1984. Also reference China: A Campaign Analysis of Force Projection Capability in the Taiwan Strait (U), Vol I, DDB-2200-29-84, May 1984.

(U) Each classified title and heading in this report have been properly marked; all those unmarked are unclassified.

(U) Word processing support was provided [redacted] and [redacted]

B3

(U) Questions and comments concerning this publication should be referred in writing to the Defense Intelligence Agency (ATTN: DB-2), Washington, D.C. 20301-6111. Requests for additional copies should be forwarded through command approval channels, as appropriate, to DIA (ATTN: RTS-2A), using DD Form 1142, Interagency Document Request, in accordance with DIA Manual 59-3, DIA Reference Library.

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SUMMARY

(S/NF) Taiwan is attempting to design a new lightweight defensive fighter (LDF) aircraft for eventual production. Motivation for this program is the knowledge that the quality of PRC Air Forces will increase significantly in the next decade at the same time that Taiwan's military aircraft inventory will be reduced by the phaseout of obsolescent aircraft. While this program emphasizes indigenous Taiwan production, US Government or corporate advice and technical assistance will still be needed in critical areas such as aircraft engines and avionics.

1. INTRODUCTION

(S/NF/WN/NC) Taiwan perceives an increasing PRC air threat to its security over the next decade resulting principally from anticipated improvements in the quality of PRC combat aircraft. [redacted] As more advanced PRC fighters such as the F-8/FINBACK and improved F-7/FISHBED enter the PRC inventory, they will reduce the cost of achieving air superiority if Taiwan's air defenses are not similarly upgraded.

1.4(a)
1.4(b)
1.4(c)
1.4(d)

(S/NF/WN/NC) At the same time, Taiwan's options in acquiring advanced foreign equipment (especially US weapons) to balance expected PRC gains have been sharply restricted as a result of political developments. To respond to the expected increase in PRC capabilities and in the face of continuing foreign restrictions, Taiwan has initiated the development of a new lightweight defense fighter.

2. TAIWAN'S NEW FIGHTER

a. Background

(S/NF) To counter the expected increase in PRC capabilities and to offset the degradation of Taipei's aircraft inventory which will surely occur, Taiwan authorities have decided to proceed with the development of a new lightweight defensive fighter (LDF). The diagram shows Taiwan's timeline for the development of the aircraft. Although Taiwan would like to go it alone on the development of the new fighter, this is clearly beyond its capability at this time. A brief discussion of the salient features of the new fighter is given below and highlights those areas where Taiwan will require assistance.

b. New Fighter Attributes

(1) Airframe

(S/NF/WN) Experience in F-5E/F coproduction and production of its own training aircraft has convinced Taiwan that it could handle LDF airframe development indigenously. Nevertheless, General Dynamics has had a major role in the aircraft's design. Of six original candidates, two airframe configurations are still under consideration: a twin-tail version with widely separated twin engines, and a single-tail version with side-by-side engines. Both versions have a 9.0-meter wingspan and are 13.6 meters long. For comparison, the US F-20 has an 8.1-meter wingspan and is 14.2 meters long. LDF landing gear will be conventional cantilever type, tricycle design. [redacted]

1.4(a)
1.4(b)
1.4(c)
1.4(d)

(2) Engine

(S/NF/WN/NC) Taiwan has chosen a US corporate associate (Garrett Turbine Engine Corporation) to help in developing the LDF engine, despite its stated intention to maximize self-sufficiency. The selected engine will be the TFE 1042-70, a nonafterburning derivative of the Garrett TFE 731-2. The

latter is a commercial turbojet already used by Taiwan to power its AT-3 trainer. The TFE 1042-70 will be a low-bypass-ratio military engine in the [redacted] kiloNewton (kN) thrust class. [redacted] An afterburning version of the engine in the 53.3 kN thrust range is a likely follow-on. The TFE 1042-70 would be used in the LDF in a twin-engine configuration.

(3) **Flight Control Systems**

[redacted]

(4) **Avionics**

~~(S/NF/WN/NC)~~ Avionics is the principal remaining area in which Taiwan evidently still requires considerable foreign assistance and procurement. [redacted] To satisfy these criteria, Taiwan probably will contract with a US manufacturer for development of a new radar.

[redacted]

1.4(a) 1.4(d)
1.4(d)

3. TAIWAN'S PROBLEMS

a. Background

~~(S/NF)~~ The problems facing Taiwan are two-fold. First, it must find a way of replacing those combat aircraft to be phased out of the inventory in the next 10 years. Second, it must increase the combat capability of its available fighters to better cope with anticipated PRC improvements over the same period.

b. Force Structuring Problem

~~(S/NF)~~ On paper, Taiwan's current air order of battle picture is the brightest in the past 20 years (table 1). The Air Force's strength will peak by mid-year when coproduction of F-5Es ends and the recently acquired F-104Gs (purchased from the US in 1983) are fully assimilated into the combat force. At that time, the Air Force will have about 400 fighters assigned to combat units with an additional 127 combat-capable fighters assigned to training roles. This growth represents a 57-percent increase in the force since 1976.

1.4(c) 1.4(d) ~~(S/NF)~~ In the next 10 years, however, the force will decline about as rapidly as it increased. Except for the [redacted] newly manufactured F-5E/Fs, the remainder of the fighter inventory is obsolete or rapidly becoming so.

1.4(d) ~~(S/NF)~~ The 57 F-100 A/Fs are all 30 years old and are used only sparingly. [redacted]

1.4(c) [redacted]

1.4(a) 1.4(c) 1.4(d) ~~(S/NF)~~ The 62 F-5A/Bs, despite an excellent maintenance program, are plagued by wing and fuselage cracks and corrosion problems. [redacted]

1.4(d) ~~(S/NF)~~ In 1983, Taiwan acquired 66 used F-104Gs from the US. These aircraft had been used as trainers by the Federal Republic of Germany Air Force at Luke AFB, Arizona. Taiwan wanted these aircraft to maintain a high performance fighter capability through 1990. The F-104s previously acquired by Taiwan via the Military Assistance Program are all approaching the end of their service life. Even though an in-country Service Life Extension Program (SLEP) was implemented to extend the F-104s' life an additional 1,500 hours, the TAF continues to experience airframe deficiencies, such as cracked I-beams in the tail section. These aircraft probably will be phased out as the recently acquired F-104Gs enter the combat inventory. Even so, these newer aircraft are still 20+ years old and are not expected to have an extended remaining service life of more than 10 years.

c. Attrition Studies

(S/NF) Since 1982, several studies of TAF attrition have been performed. All of them clearly show a sharp decline in TAF strength over the next 10 years. [redacted] An attrition analysis done by OSD/PA&E* in 1982 considered seven different attrition cases. Results ranged from 93 to 185 aircraft lost between 1985 and 1990. The estimates shown in table 1, [redacted] aircraft by 1990 and [redacted] by 1995, are based on [redacted] F-104G readiness rates could be as low as 50 percent by 1995.

1.4(c)

4. EXPECTED PRC DEVELOPMENTS

(S/NF) Developments in China's Air Force over the next decade will be geared to meeting the increasingly sophisticated Soviet air threat. It is unlikely that China considers TAF capabilities when programming the design and development of new weapon systems and subsystems. While these new developments may or may not be effective against the Soviet threat, they will increase the CPLAAF's air combat capability relative to Taiwan, if TAF forces decline as projected (see table 2 for comparison of current TAF and PRC air combat aircraft). Among anticipated PRC developments in the next decade, the following are highlighted in table 3 as having the most impact on the TAF:

- Significant increase in the number of F-7/FISHBED and F-8/FINBACK interceptors.
- Improved air-to-air missiles.
- Improved air intercept radars.
- Enhanced pilot training programs.

5. TAIWAN'S OTHER OPTIONS

(S/NF) The experience gained in the development of the LDF, even if it is not entirely successful, will be invaluable in establishing a base for the future development of other combat and combat support aircraft. Taiwan officials are pragmatic enough, however, to realize that the LDF is a high-risk venture and that the acquisition of additional fighter aircraft over the next decade is imperative. Table 4 outlines Taiwan's other options for acquiring more fighters.

---

* (C) Unpublished study done at request of DIA. Study used 1982 order of battle but did account for extended F-5E/F coproduction and acquisition of 66 F-104Gs.

6. CONCLUSION

~~(S/NF)~~ If Taiwan is successful in producing its own lightweight defensive fighter aircraft, even with engine and avionics assistance from US corporations, it would be a major step forward in armament self-sufficiency for the island. It seems unlikely, however, that initial efforts in this area will be successful quickly enough to eliminate Taiwan's concern [redacted] Accordingly, further coproduction requests for F-5E/F aircraft or requests to purchase F-20 aircraft or other modern fighters are highly likely.

1.4(b)

Table 1

TAF Order of Battle Trend (U)

Combat Fighters	1966	1971	1976	1981	1985	1990	1995
F-86D	14	-	-	-	-	Redacted	Redacted
F-86F	207	79	51	-	-		
F-5A	7	81	48	46	1/	Redacted	Redacted
F-5E	-	-	34	148	248		
F-100A	61	80	79	56	49	Redacted	Redacted
F-104A	15	20	17	16	15		
F-104D	-	-	2	5	4	Redacted	Redacted
F-104G	49	45	29	26	87 3/		
	353	305	260	297	403	Redacted	Redacted
Fighter/Trainers							
F-5A	-	-	-	-	42	Redacted	Redacted
F-5B	2	10	21	20	20		
F-5F	-	-	-	3	52	Redacted	Redacted
F-100F	7	8	10	8	8		
F-104B	3	2	2	2	2	Redacted	Redacted
TF-104G	6	6	3	3	3		
	18	26	36	36	127	Redacted	Redacted
	371	331	296	333	530	Redacted	Redacted

1.4 (a)
1.4 (b)
1.4 (c)
1.4 (c)

1/ Transferred to training role as F-5Es became available.
2/ Production agreement called for [redacted] F-5Es. Attrition of force is estimated at [redacted] aircraft per year.
3/ TAF acquired 66 ex-NATO F-104Gs in 1983.
4/ Phaseout of 26 older F-104Gs by 1990 and attrition of remaining aircraft at [redacted] per year.
5/ Production agreement called for [redacted] F-5F. Attrition estimated at [redacted] aircraft per year to 1990 and [redacted] per year to 1995.

1.4 (a)
1.4 (c)
1.4 (d)

S/NF/WN

Engine (full-scale development began Jun 82)

First test flight engines available Jun 86

Engine certified for production Apr 88

Airframe — Conceptual design complete Aug 84 — Detailed design & manufacture Early 85 — Prototype rollout Mar 87 — Serial production Jan 90

Avionics presently expected to be purchased from US manufacturer rather than indigenously produced

Jan 84 / Jan 85 / Jan 86 / Jan 87 / Jan 88 / Jan 89 / Jan 90

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Figure (S/NF) Timeline for development of lightweight defensive fighter.

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Table 2

Air Combat Comparison (U)

Air Combat Attribute	TAF F-5E vs F-6	PRC F-5E vs F-7	TAF F-5E vs F-8	PRC F-104G vs F-6	TAF F-104G vs F-7	PRC F-104G vs F-8
Speed	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted
Maneuverability	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted
Guns	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted
Missiles*	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted
Aircraft Radar	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted
Pilot Proficiency	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted

X - Superior in this attribute

Blank - Approximately equal in this attribute

NOTES

Redacted

S/NF/WN

1.4 (a) (c) (d)

Table 3

PRC Air Combat Improvements (U)

Expected PRC Improvements	Likely Developments				Affect on TAF
- Increase in F-7/FISHBEDs and F-8/FINBACK		1985	1990	1995	[redacted]
	F-7	240	585	905	
- Introduction of F-8-2 in 1989 with more advanced radar	F-8	35	165	180	
	F-8-2	0	40	300	
		275	790	1,415	
Improved air-to-air missiles	- Longer-range infrared missiles by 1990 with improved seeker heads and more maneuverable than CAA-1b. - Radar-guided missile expected in mid-1990s.				
Improved air intercept radars	- Longer search/track ranges - Search/track capability (KM) - Current F-7: [redacted] - Current F-8: [redacted] - Estimated F-8-2: [redacted]				
Enhanced pilot training program	- More information on foreign capabilities. - Increase in dissimilar air combat training. - Less reliance on GCI ground controllers.				

1.4 (c)

1.4 (a)
1.4 (c)
1.4 (d)

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Table 4

Taiwan's Other Options (U)

Option	Taiwan Preferred	Aircraft Availability	Remarks

Contined F-5E/F coproduction	No	Negotiable	- Taiwan has stated it does not wish to further coproduce this aircraft
			- Taiwan seeks for current force
			  - Improved avionics
			  - AIM-9L all-aspect attack missile

Acquire used F-104Gs	No	400-500 still in European inventories	Interim solution only to longer range problem. - Sufficient numbers around to keep TAF inventory near 100 to 1995. - All aircraft are 20+ years old, maintenance a problem.
Acquire advanced US fighters	Yes	Dependent on US political decision	- Taiwan would prefer F-16/79 but would find F-20 acceptable. - Either aircraft, in quantity, would meet PRC threat for next 20 years. - Favorable US decision could have negative impact on US-PRC relations.

Acquire advanced fighters from other Western sources	No	No direct sales likely. Possible availability through 3d parties	- TAF prefers US equipment, but might employ this option if US fighters were not available.
			- TAF has expressed interest in:
			  - Mirage (France)
			  - Tornado (Germany, United Kingdom, Italy)
			  - Piranha (Switzerland)
			  - Kfir, Lavi (Israel)
			- PRC relations with producers could preclude direct sales

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DEPARTMENT OF THE AIR FORCE
WASHINGTON 20330

OFFICE OF THE ASSISTANT SECRETARY

MEMORANDUM FOR ASSISTANT SECRETARY OF DEFENSE (INTERNATIONAL SECURITY AFFAIRS)

SUBJECT: Taiwan's Lightweight Defensive Fighter (LWDF) (Your Memo, Jan 7, 1985) (U) - INFORMATION MEMORANDUM

(S) The results of our initial assessment of Taiwan's LWDF proposal are enclosed for your review (Atch 1-2). Please note that the short suspense precluded a USAF review of the entire LWDF requirements list. Instead, a quick comparison of the Golden Dragon-53 Westinghouse radar and LWDF concept relative to USAF fighter configurations was accomplished. A complete operational assessment could be completed within four months. The comparison draws heavily from US contractor-furnished projected performance data on the engines and radar, since this data was not provided by Taiwan. As such, the Air Force cannot validate this data or the conclusions drawn from them.

(S) The USAF strongly supports the envisaged concept of Taiwan's indigenous fighter aircraft development through US industry license technical assistance agreements. However, continued USAF support to this initiative is contingent upon receipt of the following:

- (U) Formal OSD program direction outlining specific USAF responsibilities and the established operational limitations upon which the aircraft configuration baseline is to be set.

- (S) A Foreign Military Sales administrative case which provides Taiwan funds for USAF manpower, travel and management services attendant with the LWDF initiative.

(S) Unless otherwise prescribed, we envision the USAF's role in the LWDF program as one of oversight and interface with the US prime integration contractor of Taiwan's selection. The Office of the Special Assistant for International Cooperative R&D, HQ USAF/RD-I will serve as the Air Staff focal point and facilitate direction and guidance to subordinate commands needed to properly execute the program. Please advise if we can be of further assistance in this matter.

Martin Chen

[illegible]
[illegible] Assistant Secretary
Research, Development and Logistics

2 Atch
1. Executive Summary (U)
2. Supporting Documents (S)

CLASS BY: Dir, EAPR
DECLAS ON: OADR

SECRET

EXECUTIVE SUMMARY (U)

1. (S/NF) TASKING: Conduct a quick look comparison of the Westinghouse GD-53 radar versus the APG-63, -66, and -67 radars and LWDF aircraft performance versus F-16A and F-20.

2. (U) DATA SOURCES: To conduct this study, data was obtained from the following sources:

a. (U) Partial engine performance data was obtained from Garrett by telephone request.

b. (U) F-5, F-16A, F-20 and F-16/J79 performance was generated using existing in-house data.

c. (U) Aircraft weights were estimated using configuration data from a variety of classified briefing charts, messages, etc.

d. (U) Aerodynamic data was generated for a generic aircraft representing an F-16 type state-of-the-art fighter.

e. (U) GD-53 radar performance was estimated based on Westinghouse Proposal (Volume I) for GD-53 Radar System, dated March 1984.

f. (U) APG-63, -66, and -67 radar performance data was available in-house.

3. (U) AIRCRAFT CONFIGURATION: The LWDF aircraft evaluated was defined as follows:

a. (U) Configuration as described in classified briefing charts.

b. (U) Two (2) Garrett TFE 1042-70 engines each rated at 5000 lb thrust, 8350 lb augmented.

c. (U) Estimated aircraft gross weights (lbs)
Empty - 12,860
Basic Mission T.O. weight - 19,830
Max - 27,200

d. (U) Armament - 2 AIM-7s, 2 AIM-9s, 7 MK-82s, M61 Gun (500 rounds).

4. (U) MISSION PROFILES: The mission profiles used were extracted from in-country briefing material.

5. (U) FINDINGS:

a. (C) RADAR - The performance of the GD-53 radar is equivalent to the F-20's APG-67 and is superior to the F-5's APG-159 which does not have a

Classified by: Multiple Sources
Declassify on: OADR
Atch 1

look-down capability. With an increase in antenna size the GD-53 could provide performance similar to the F-16's APG-66. From a technical standpoint, the proposed GD-53 development program is considered low risk.

b. (C) PERFORMANCE - For the mission profiles provided, the performance of the aircraft falls approximately midway between the F-5 and the F-20/F-16.

~~CONFIDENTIAL~~ NO FORN DISSEM

GD-53 RADAR REVIEW (U)

1. ~~(U)~~ DESCRIPTION:

a. ~~(U)~~ The GD-53 Radar System as defined in the Westinghouse Defense Electronics Center proposal has been reviewed. The GD-53 radar is an outgrowth or derivative of the USAF AN/APG-66 radar utilized in the F-16A aircraft. The GD-53 utilizes a low sidelobe, two channel monopulse, planar array antenna with IFF dipoles. The antenna is 12.36" high by 19.82" wide; and has a gain of 28.5 db. The GD-53 transmitter is a 21.5 KW peak power traveling wave tube (TWT), air cooled transmitter. The transmitter produces higher power than the APG-66 transmitter. The low power radio frequency (LPRF) unit in the GD-53 is similar to the APG-66, but adds a second receiver channel for two channel monopulse operation. The signal and data processing in the GD-53 is provided by the Radar Digital Assembly (RDA). The RDA uses advanced digital technology, such as configurable gate arrays, large scale integration devices, and flat pack packaging. The RDA uses MIL-STD-1750A Instruction Set Architecture Computers and is programmed in MIL-STD-1589 Jovial Higher Order Language.

245 in²

b. ~~(U)~~ The modes available in the GD-53 are shown in Figure 1 along with the modes of other US radars.

2. ~~(C)~~ FINDINGS: The proposed radar is an X-band low/medium Pulse Repetition Frequency pulse doppler radar, which will provide good look-down detection of airborne targets in the presence of ground clutter. The look-down detection performance of this radar is depicted in Figure 2 and is compared to the detection capability of other US radars. The GD-53 performance is less than the APG-66 radar because of a smaller antenna. With equal antenna

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sizes, the GD-53 would provide greater detection range than the APG-66. The comparisons of antenna gains and average output powers are shown in Figure 3.

3. (C) CONCLUSIONS: The GD-53 is a state-of-the-art pulse doppler radar utilizing the latest electronic devices and digital design. The GD-53 has improved air-to-ground modes over the APG-66 radar; such as, a higher doppler beam sharpening ratio (16:1 vs 8:1) and Ground Moving Target Indication (GMTI). The radar provides added capabilities over the F-5/ APG-159 radar; such as look-down air-to-air detection capability and provides approximately 40% more look-up detection range than the APG-159. As shown in Figure 1, the GD-53 provides many more air-to-ground modes than the APG-159. The GD-53 is essentially equivalent to the AN/APQ-67 radar which was developed for the F-20 aircraft.

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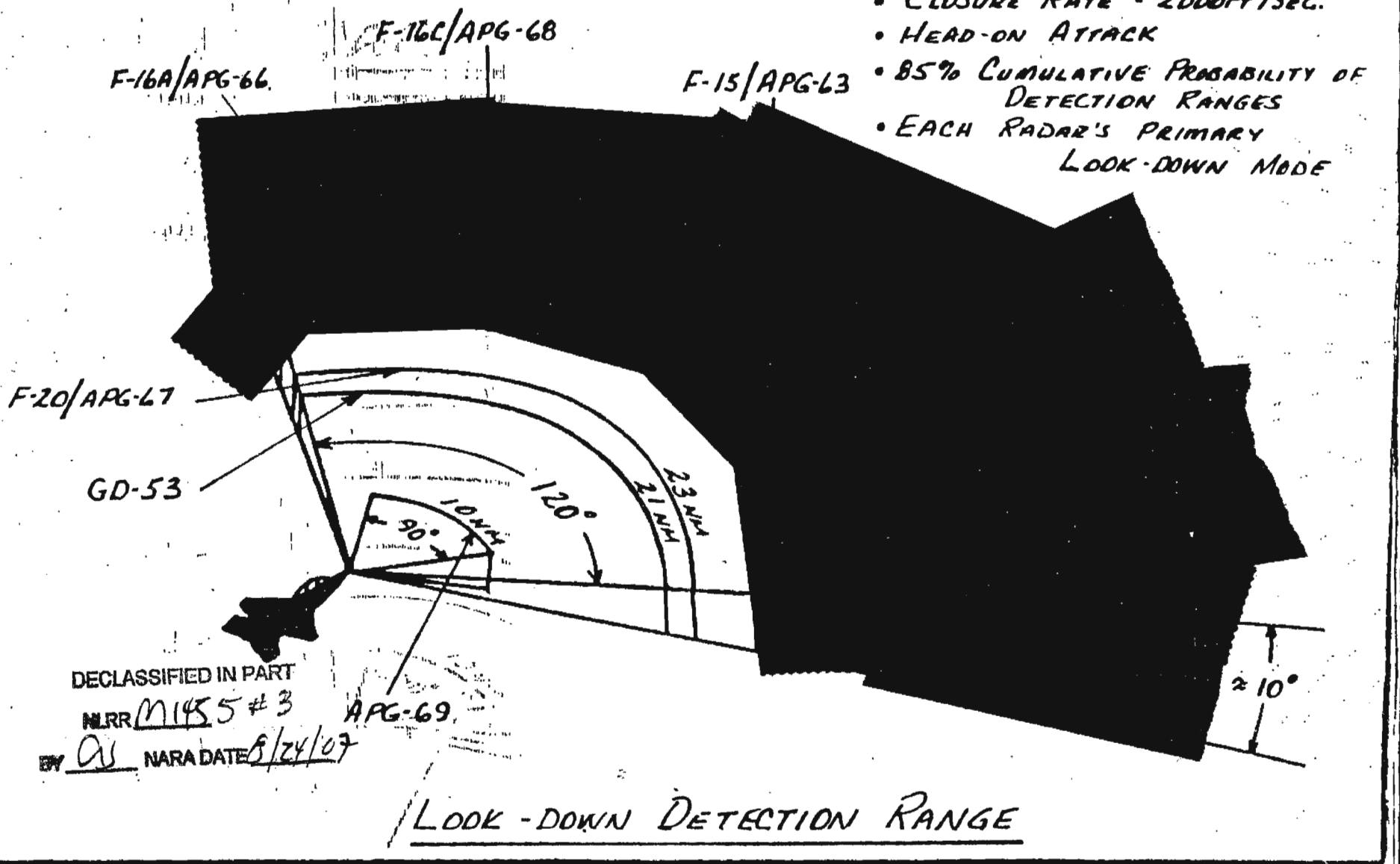
1.40

RADAR PERFORMANCE COMPARISON

- TARGET RADAR CROSS-SECTION = 5 M^2
- CLOSURE RATE = 2000 FT/SEC.
- HEAD-ON ATTACK
- 85% CUMULATIVE PROBABILITY OF DETECTION RANGES
- EACH RADAR'S PRIMARY LOOK-DOWN MODE



LOOK-DOWN DETECTION RANGE

FIGURE 1

MODE COMPARISON

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AIR-TO-AIR

	SEARCH			SINGLE TARGET TRACK	TRACK WHILE SCAN	AIR COMBAT MANEUVERING	IFF
	LOOK-UP	LOOK-DOWN	VELOCITY				
GD-53	✓	✓		✓	✓	✓	✓
APG-63 (F-15)	✓	✓	✓	✓	✓	✓	✓
APG-66 (F-16A)	✓	✓		✓	✓	✓	
APG-68 (F-16C)	✓	✓	✓	✓	✓	✓	
APG-67 (F-20)*	✓	✓	✓	✓	✓	✓	
APG-69	✓	✓		✓		✓	
APG-159 (F-5)	✓			✓			

AIR-TO-SURFACE

	REAL BEAM GND MAP	DOPPLER BEAM SHARPENED MAP	GMTI	SEA SEARCH	AIR-TO-GROUND RANGING	BEACON
GD-53	✓	16:1	✓	✓	✓	✓
APG-63 (F-15)	✓				✓	✓
APG-66 (F-16A)	✓	8:1		✓	✓	✓
APG-68 (F-16C)	✓	64:1	✓	✓	✓	✓
APG-67 (F-20)*	✓	40:1	✓	✓	✓	
APG-69	✓			✓	✓	
APG-159 (F-5)	✓					

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ANTENNA / POWER CHARACTERISTICS

ANTENNA =	DIMENSIONS	IN²	GAIN
• GD-53	12.36" X 19.82"	245	28.5db
• APG-63 (F-15)	36" DIAMETER	1018	36.8db
• APG-66 (F-16A)	19" X 29"	551	32.6db
• APG-68 (F-16C)	19" X 29"	551	32.4db
• APG-67 (F-20)	12.5" X 19.8"	248 (350)	29.8db
• APG-69	11.5" X 19"	219	29.5db
• APG-159 (F-5)	11.5" X 19"	219	29.5db

POWER (AVERAGE)* =	
• GD-53	238.6 WATTS
• APG-63 (F-15)	1600 WATTS
• APG-66 (F-16A)	189.6 WATTS
• APG-68 (F-16C)	382 WATTS
• APG-67 (F-20)	200 WATTS
• APG-69	120 WATTS
• APG-159 (F-5)	60 WATTS

* LOOK-DOWN MODE

FIGURE 3

AIRCRAFT PERFORMANCE ESTIMATES (U)

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		PERFORMANCE PARAMETER	UNITS	LWDF	* F-5E	* F-16/ J79	[redacted]	* F-20
AIR-TO-AIR	MISSION I STRIP-LAUNCHED INTERCEPT 2 AIM-7 2 AIM-9 M61 WITH 500 RNDS	A. RADIUS OF ACTION	NM	70	165	140		190
		B. TIME TO CLIMB TO 30,000 FT, MAX POWER	SEC/ MACH	110/.9	90/ .86	75/ .88		50/.86
		C. ACCEL TIME, 0.9M to 1.2M 30,000 FT, 50% INTERNAL FUEL, MAX POWER	SEC	40	75	55		30
		D. MAX SUSTAINED G's M=1.2/30,000 FT, 50% INTERNAL FUEL, MAX POWER	G	3.2	2.1	2.7		3.6
		E. MAX MACH/50% INTERNAL FUEL	M	1.9	1.5	1.7		1.9
		F. Ps 30,000 FT, MAX POWER, 50% INTERNAL FUEL, M=.8/1.4	FT/SEC	240/ 210	180/ 30	190/ 210		310/330
	MISSION II COMBAT AIR PATROL 2 AIM-7 2 AIM-9 2 EXT. TANKS M61/500 RNDS	LOITER TIME FOR 70NM RADIUS OF ACTION	MIN	100	75	115		105
AIR-TO-GROUND	MISSION III 2 AIM-9 M61/500 RNDS 7 MK-82 2 EXT TANKS	HI-LO-LO-HI RADIUS OF ACTION	NM	88	38	120		110

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*2 AIM-9s Only
See comments on Performance Estimates

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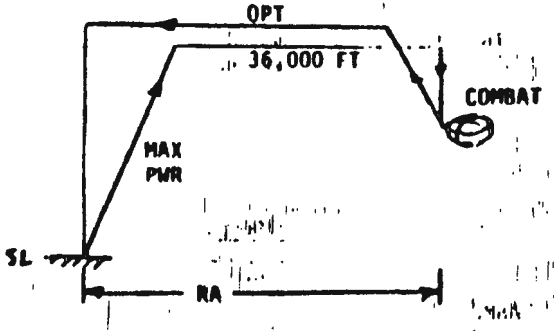
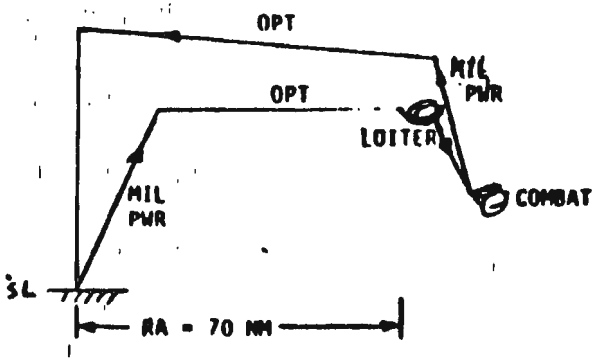
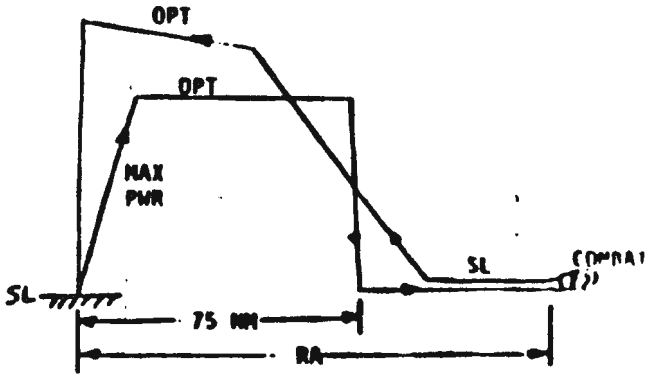
Classified by: Multiple Sources
Declassify on: OADR

MISSIONS
STANDARD DAY ATMOSPHERE

	I BASIC	II CAP	III AIR-TO-GROUND
ARMAMENT:	M61A1 20mm gun w/500 rds 2 AIM-7 2 AIM-9	M61A1 20mm gun w/500 rds 2 AIM-7 2 AIM-9	M61A1 20mm gun w/500 rds 2 AIM-9 7 MK-82 Bombs
FUEL:	Internal	Internal 2 External Fuel Tanks	Internal 2 External Fuel Tanks
TAKEOFF:	Max Power	Max Power	Max Power
CLIMB:	Max Power	Mil Power	Max Power
CRUISE ALTITUDE:	Out at 36,000 ft In at optimum	Optimum Optimum	Optimum Optimum
COMBAT:	15,000 ft/M=0.8 5 minutes at Max Power, Fire Missiles	15,000 ft/M=0.8 5 minutes at Max Power, Fire Missiles	Sea Level/M=0.9 5 minutes at Max Power, Drop Bombs
FUEL RESERVES:	10 minutes endurance at sea level	10 minutes endurance at sea level	10 minutes endurance at sea level







COMMENTS ON PERFORMANCE ESTIMATES

1. Mission profiles developed by the Air Force are normally task oriented to maximize performance with the least amount of fuel. The LWDF Mission Profiles are unique in that they require max use of afterburner for take-off and climb due to the short radius of action requirement and five minutes of afterburner for combat at midpoint. Consequently, the use of these same profiles for the comparative aircraft results in a large expenditure of fuel due to their bigger engines (e.g., for the F-16A, over 50% of the internal fuel is used for the 5 minutes combat time in Mission I). The result is that the performance numbers shown are significantly reduced from the capabilities normally associated with these aircraft.

2. The conditions specified for the performance parameters were selected on the basis of the estimated engine data handcarried to ASD by Garrett. Due to the time constraint, no attempt was made to determine the validity of this data.

3. For the Radius of Action parameter, only two AIM-9s were used for the comparative aircraft, since they are not currently authorized the carriage of AIM-7s.

4. P_S (Excess Specific Power) is defined as a value representing the aircraft's ability to accelerate and/or climb at a specific point in time along the velocity axis.

5. Comparative aircraft data used were representative of current production aircraft configuration and existing flight manual limitations. No attempt was made to optimize the comparative aircraft configuration for the three basic missions.

6. Estimates for the LWDF were based on the in-country briefing data package for weights, wing area and configuration and aerodynamic drag trends based on F-16 drag data.