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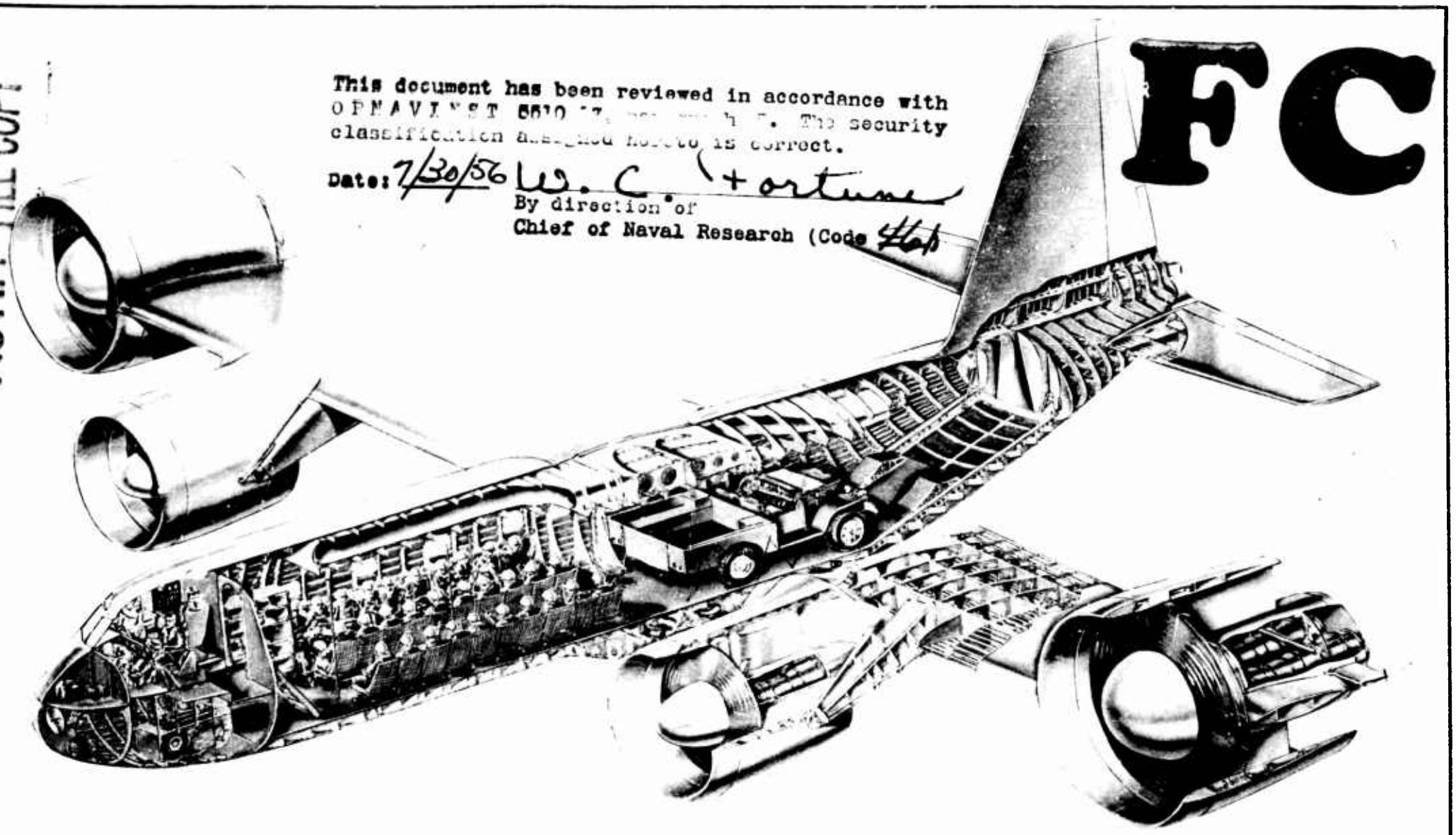
Date: 7/30/56 W. C. Fortune
By direction of
Chief of Naval Research (Code 461)



FC

Standard Aircraft Characteristics

MODEL D181

AUG 8 1956

DUCTED PROPELLER ASSAULT TRANSPORT AIRCRAFT

REPORT NO. D181-945-008 56AA 46311

Form G650C Rev 655

AFFIX TO DOCUMENT

BELL IDENTIFICATION NO. 0181-945-008

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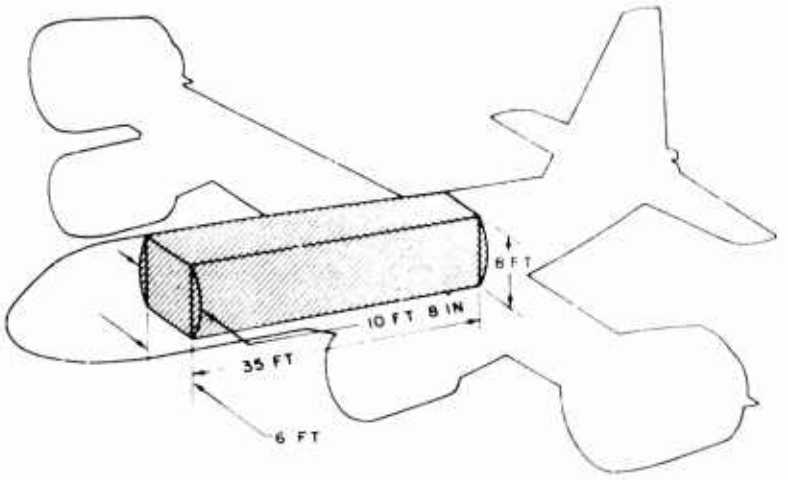
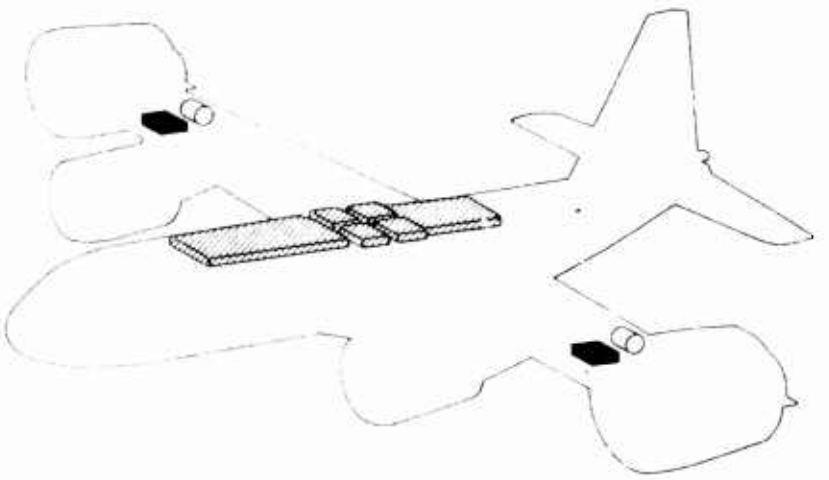
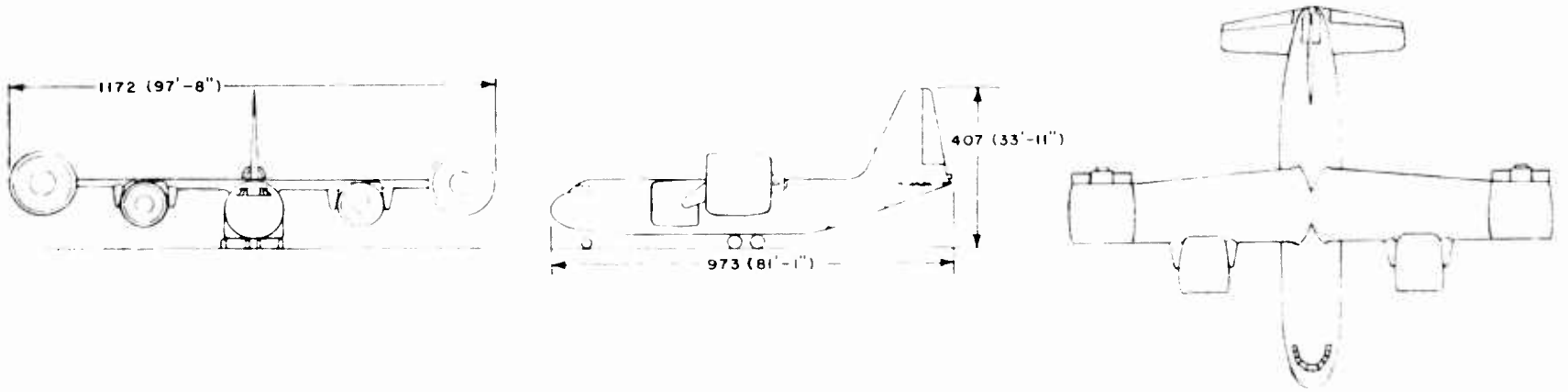


CARGO SPACE



TANKAGE INSTALLATIONS

Fuel (Gal) Water Alcohol (Gal) Oil (Gal)



POWER PLANT

Number: MAIN
Six Turboprop Engines
AUXILIARY
(VTOL Pitch and Yaw Control)
One Turboject Engine
Models: MAIN
Allison 550-B1
AUXILIARY
J85
Manufacturers:
MAIN
General Motors Corp.
AUXILIARY
General Electric Corp.

ENGINE RATINGS

Static Rating at Sea Level - Maximum

Main (Shaft HP - total)	31,008 HP
Jet Thrust	830 lb
Auxiliary	
(Jet Thrust)	2,450 lb
Vertical Thrust - VTOL Cond. (6000 ft - 95° F) with water injection	72,100 lb

DIMENSIONS

Length	81 ft 1 in.
Height	33 ft 11 in.
Span (over-all)	97 ft 8 in.
Wing Area (neglecting ducts)	1220 sq. ft.
Wing Aspect Ratio	5.8
Wing Section	NACA 64A412
Wheel Tread (aft gear)	157 in.
Wheelbase	366 in.

Mission and Description

DESCRIPTION

The basic mission required a radius of 425 miles at 300 mph with an initial vertical take-off. An 8000 pound payload is carried out and 4000 pounds back. The general flight plan of all missions was quite similar to the basic mission:

1. Take-off at 6000 ft and 95°F — VTO or STO depending on initial loading. All landings and subsequent take-offs are vertical. Payload out is 8000 pounds or greater.
2. Climb to cruise altitude; fly 80% of radius.
3. Descend to sea level; fly remaining 20%.
4. Land vertically at 6000 ft and 95° F; remove payload; reload a 4000-pound payload. NO FUEL IS ADDED.
5. Take-off vertically at 6000 ft and 95° F and return.
6. Fly first 20% at sea level.
7. Climb to cruise altitude for remainder of distance.
8. Descend and land vertically at 6000 ft and 95° F holding a 10% fuel reserve.

MISSIONS WITH ALL VTO

BASIC MISSION

1. Minimum vertical take-off gross weight to accomplish this mission.
2. Minimum cruise altitude to accomplish this mission.
3. Highest allowable velocity at altitude and 300 mph at sea level to accomplish this mission.

BASIC MISSION VARIATIONS

4. High-speed mission: Cruise at 455 mph at altitude and sea level.
5. Maximum VTO Radius with take-off at sea level standard; cruise for maximum radius at 300 mph at sea level and altitude.

MISSION WITH INITIAL STO — all other landings and take-offs are vertical.

1. Maximum radius with 8000-pound pay load out.
2. Maximum payload out for 425 miles radius.
3. 450 mph cruise; maximum radius with an 8000-pound payload out.

CARGO CAPACITY

2500 cubic feet
8000 pounds basic
16,720 pounds maximum

WEIGHTS

Max. Vertical Take-off @6000 ft and 95° F	70,000 lb
Max. Vertical Landing @ 6000 ft and 95° F	70,000 lb
Weight Empty	43,815 lb

FUEL

Internal

2308 gal.	6.5 lb/gal	15,000 lb

ELECTRONICS

AN/ARC-34	UHF Radio
AN/ARC-49	VHF Radio
AN/APN-22	Radar Altimeter
AN/ARN-31	Glide Path Rec.
AN/ARN-21	Nav. Radio
AN/APX-25	Transponder (IFF)
AN/ARN-32	Marker Beacon Rec.
618S-1	HF Radio (provision only)

Loading and Performance—Typical Mission

		ALL VTOL					INITIAL STO, All Other Take-off & Landings Vertical		
		BASIC MISSION			IV	V			
		I Minimum Vertical Take-off Gross Wt.	II Minimum Cruising Altitude	III High-Speed Cruise at Altitude and 300 mph at Sea Level	High-Speed Cruise 455 mph	Maximum VTO Radius with S.L. Std. Take-off	A Maximum Radius 8000-lb Payload	B Maximum Payload 425-mile Radius	C High-Speed Cruise 450 mph
TAKE-OFF WEIGHT: OUTBOUND	lb	67,380	70,000	70,000	70,000	75,800	86,150	76,890	83,530
Payload	lb	8,000	8,000	8,000	8,000	8,000	8,000	16,720	8,000
Fuel	lb	13,290	15,920	15,920	15,920	21,720	32,060	14,080	29,290
Wing Loading	psf	55.1	57.4	57.4	57.4	62.1	70.5	63.0	68.5
Stall Speed, Power Off	mph	143	146	146	146	158	162	153	159
Take-Off Ground Run at 6000 ft & 95°F	ft	0	0	0	0	0	770	300	660
Rate of Climb at S.L.	fpm	9,440	9,000	9,000	9,000	8,220	7,160	8,110	7,420
Time: S.L. to 20,000 ft	min	2.51	2.63	2.63	2.63	2.89	3.36	2.93	3.24
Time: S.L. to 30,000 ft	min	4.30	4.54	4.54	4.54	5.06	6.02	5.18	5.78
Service Ceiling (100 fpm)	ft	49,900	49,500	49,500	49,500	48,500	46,500	48,200	47,000
FERRY RANGE WITH PAYLOAD	mi	1,120	950	1,360	920	1,710	2,520	1,640	1,750
Average Cruising Speed	mph	320	300	320	455	320	300	300	450
Average Cruising Altitude	ft	30,000	11,300	30,000	30,000	30,000	30,000	30,000	30,000
COMBAT RADIUS: 20% at S.L.	mi	425	425	425	302	705	987	425	607
Average Cruising Speed-Out	mph	300	300	420†	455	300	300	300	450
*Average Cruising Altitude-Out	ft	24,800	11,300	30,000	30,000	23,900	21,200	23,000	30,000
LANDING WEIGHT - at Radius Point	lb	61,150	62,770	62,700	62,780	65,560	70,000	70,000	70,000
Ground roll at 6000 ft & 95°F	ft	0	0	0	0	0	0	0	0
Total from 50 ft	ft	0	0	0	0	0	0	0	0
**TAKE-OFF WEIGHT: RETURN	lb	56,000	58,620	58,550	58,630	61,410	65,790	57,070	65,790
Payload	lb	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Stall Speed, Power Off	mph	131	134	134	134	137	142	132	142
Take-Off Ground Run at 6000 ft & 95°F	ft	0	0	0	0	0	0	0	0
Rate of Climb at S.L.	fpm	11,710	11,120	11,120	11,120	10,550	9,740	11,450	9,740
Time: S.L. to 20,000 ft	min	2.02	2.13	2.13	2.13	2.26	2.45	2.08	2.45
Time: S.L. to 30,000 ft	min	3.35	3.52	3.52	3.52	3.80	4.17	3.42	4.17
Service Ceiling (100 fpm)	ft	52,000	50,800	50,800	50,800	51,200	50,300	51,300	50,300
Average Cruising Speed: back	mph	300	300	420†	455	300	300	300	450
*Average Cruising Alt.: back	ft	29,000	11,300	30,000	30,000	28,400	26,700	28,600	30,000
LANDING WEIGHT: RETURN	lb	51,560	51,820	51,820	51,820	52,590	53,430	51,670	53,182
Ground roll at 6000 ft & 95°F	ft	0	0	0	0	0	0	0	0
Total from 50 ft	ft	0	0	0	0	0	0	0	0
Reserve fuel (10% of total)	lb	1,330	1,590	1,590	1,590	2,170	3,210	1,410	2,930
††Hovering Time	min	6.24	7.46	7.46	7.46	10.2	15.1	6.61	13.7
††Best Altitude Loiter	min	53.	64.	64.	64.	87.	128.	56.	117.

NOTES

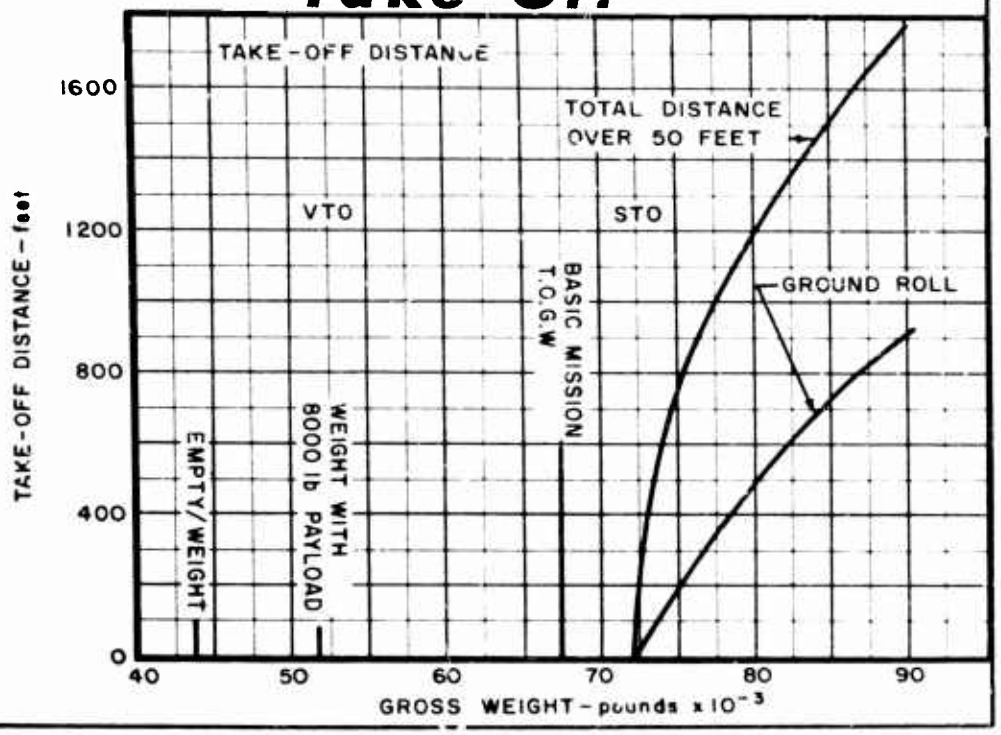
*This is the average altitude which does not include the portion flown at sea level.

**No fuel is added.

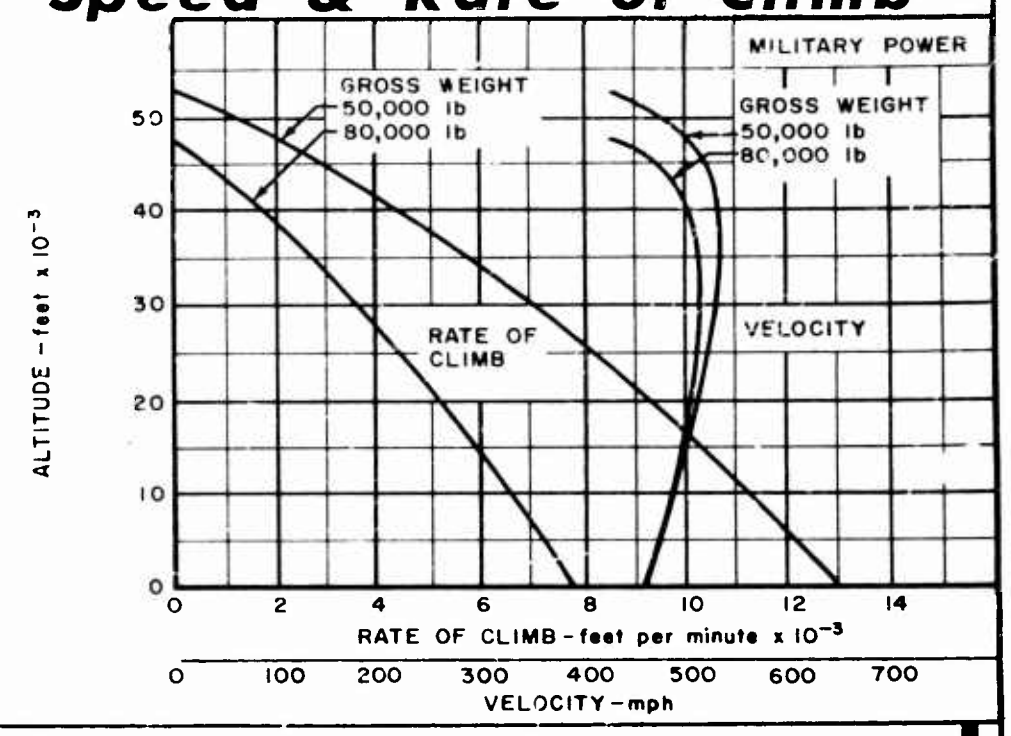
† This velocity at 30,000 feet. Velocity at Sea Level = 300 mph

†† Available with reserve of 10% initial fuel.

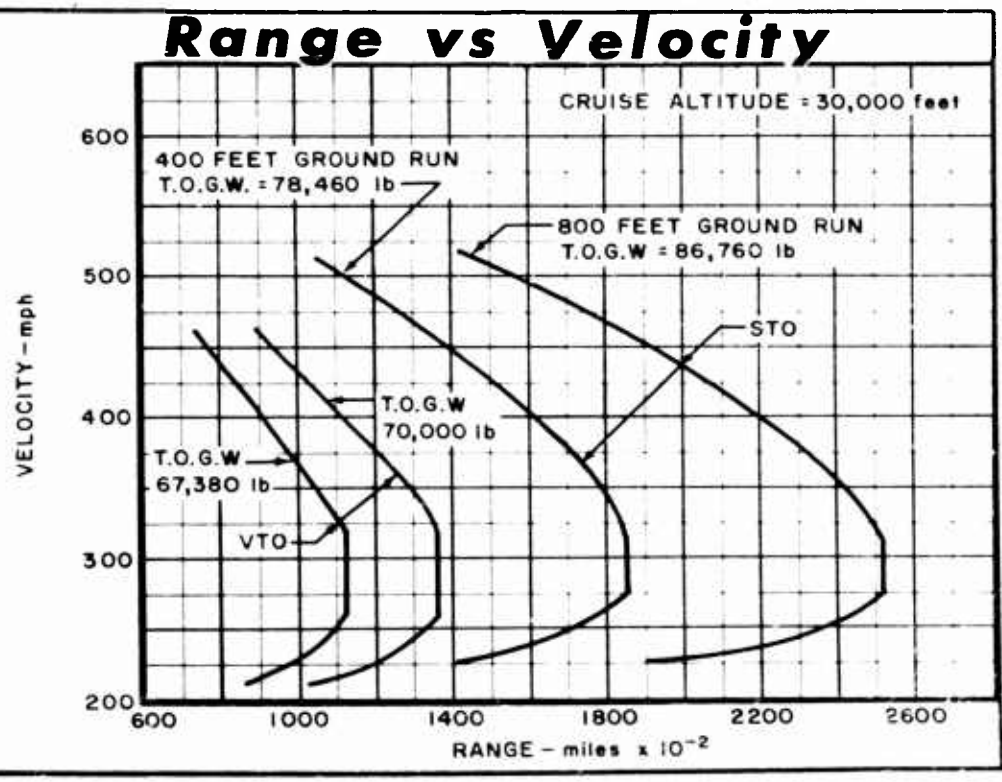
Take-Off



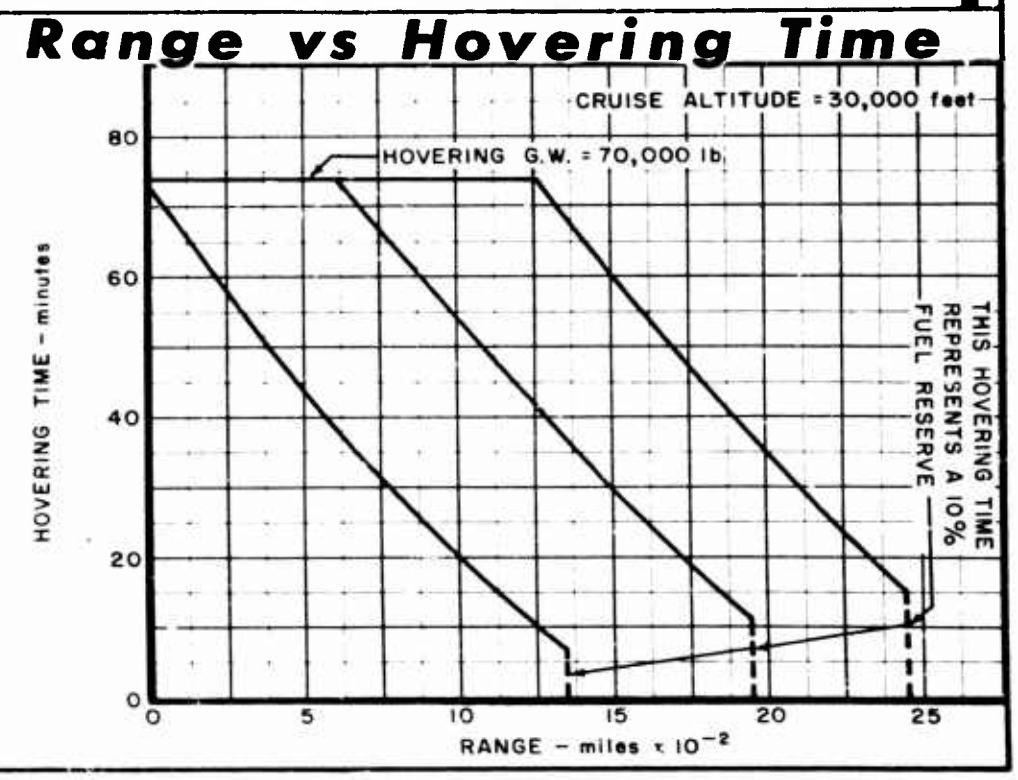
Speed & Rate of Climb



Range vs Velocity



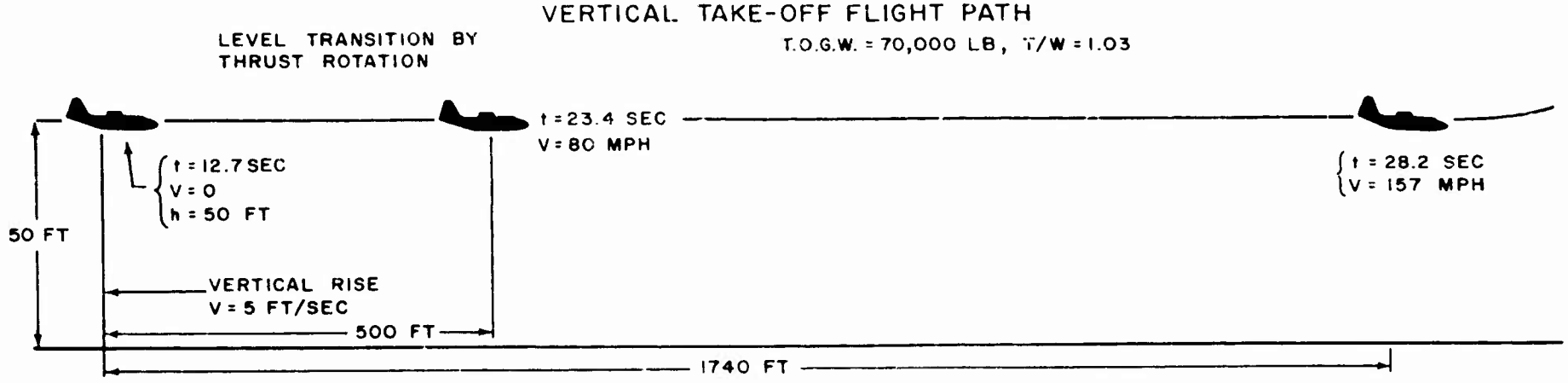
Range vs Hovering Time



SUPPLEMENTAL

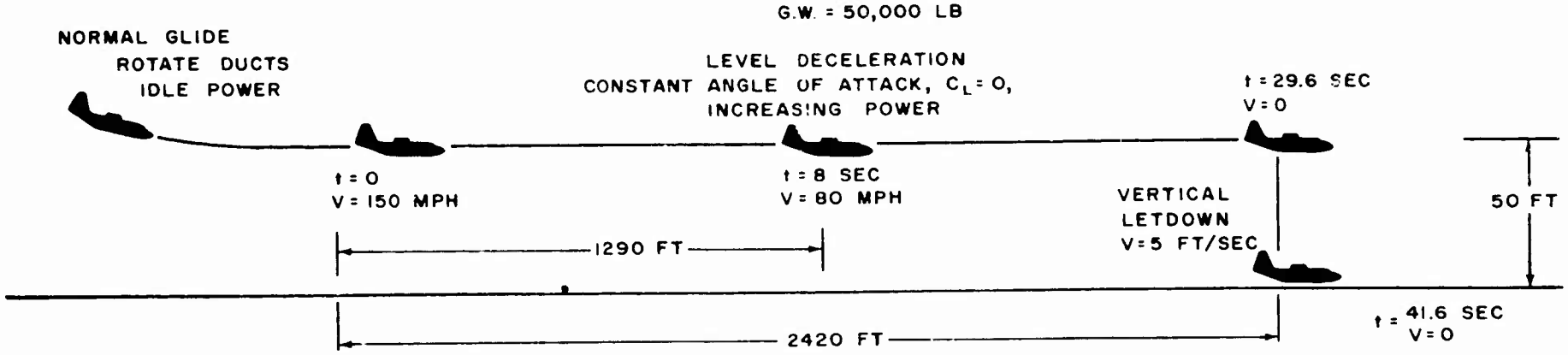
VERTICAL TAKE-OFF FLIGHT PATH

T.O.G.W. = 70,000 LB, T/W = 1.03

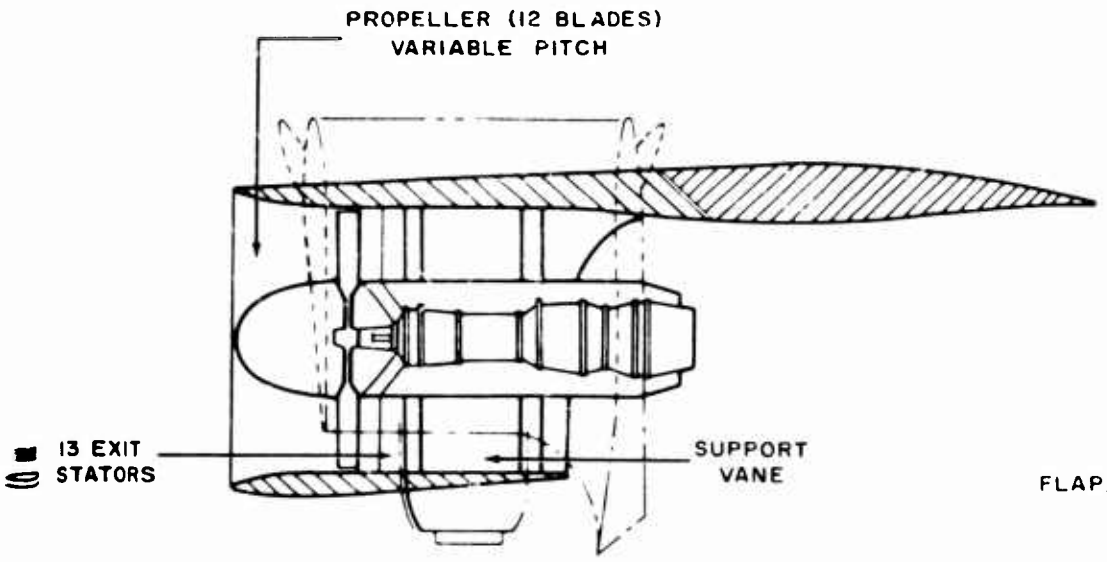


VERTICAL LANDING FLIGHT PATH

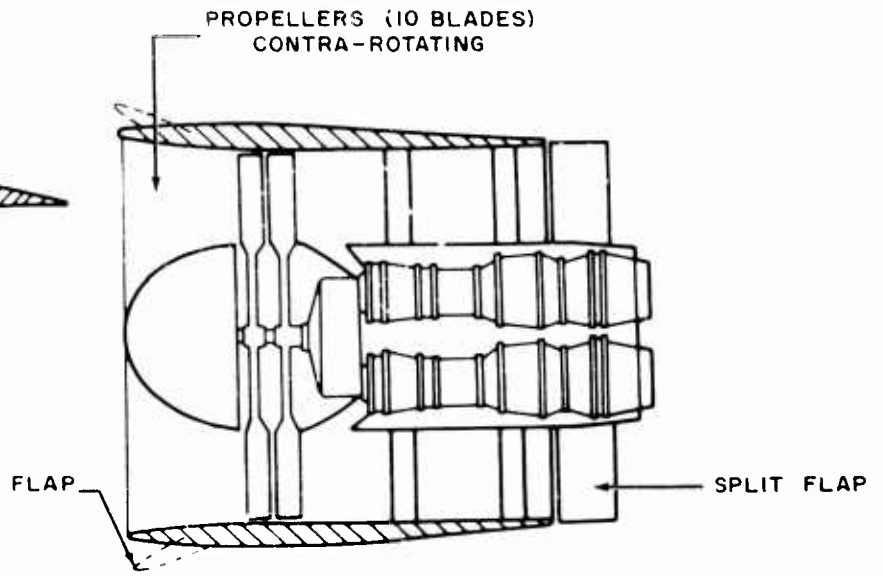
G.W. = 50,000 LB



N O T E S



SIDE VIEW - INBOARD ENGINE



PLAN VIEW-OUTBOARD ENGINES

GENERAL NOTES

1. It was not necessary to comply with Specification MIL-C-5011A by verbal agreement with ONR. For presentation purposes the general format of the specification was used and the intent was followed with the following deviations:

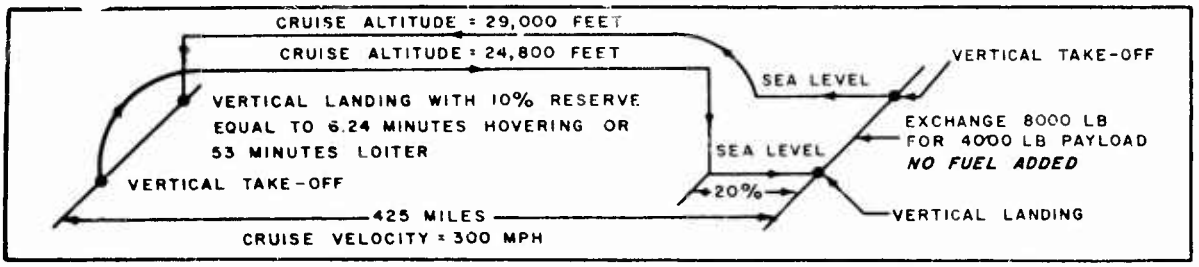
   a. The actual fuel used to take-off and accelerate to climb speed, as determined by a numerical integration was used.

   b. The reserve used was 10% of the total fuel on board at take-off. No fuel was added during the mission.

2. Alterations in the prescribed format were made to present more satisfactorily the VTOL features of this aircraft.

3. The technical summary report presents complete performance information on this airplane. But due to the nature of the contract, does not contain details of method and sample calculations.

Characteristics Summary Basic Mission



PERFORMANCE

COMBAT RADIUS	FERRY RANGE	MAXIMUM SPEED
425 miles at 300 mph; 20% at sea level	1120 miles at 320 mph Cruise at 30,000 ft.	520 mph at 35,000 ft.
CLIMB	**CEILING**	**TAKE-OFF**
9440 ft per min at sea level, take-off weight, and military power 11,710 ft per min at sea level, radius point take-off weight, and military power	49,900 ft at 100 ft per min, take-off weight, and military power 52,000 ft at 100 ft per min, radius point take-off weight, and military power	No ground run Vertical take-off
	HOVERING ENDURANCE	**STALLING SPEED**
	Maximum — 70 min Minimum -- 6.24 min	143 mph at take-off weight 131 mph at radius point take-off weight

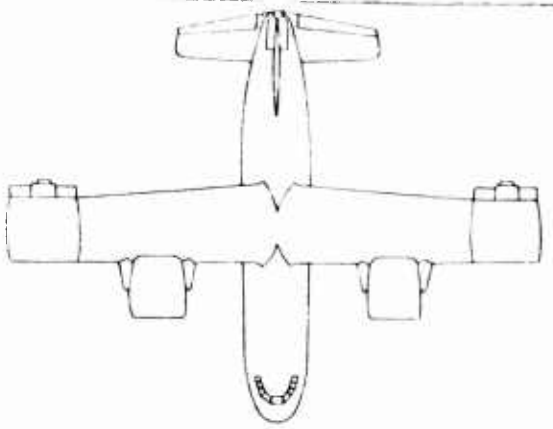
LOAD		WEIGHTS		TIME TO CLIMB	
Crew (3)	645 lb	Initial take-off	67,380 lb	To 20,000 ft at T.O.G.W.	2.51 min
Oil	328 lb	Radius point take-off	56,000 lb	To 30,000 ft at T.O.G.W.	4.30 min
Fuel	13,290 lb	Maximum VTO at 6000 ft and 95°F with 3% thrust margin	70,000 lb	To 20,000 ft at radius point G.W.	2.02 min
Payload	8,000 lb			To 30,000 ft at radius point G.W.	3.35 min

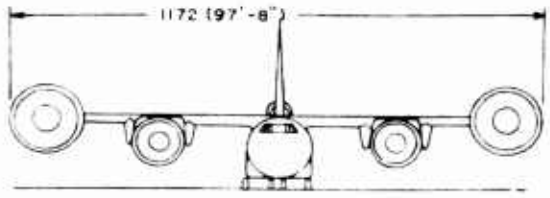
NOTES

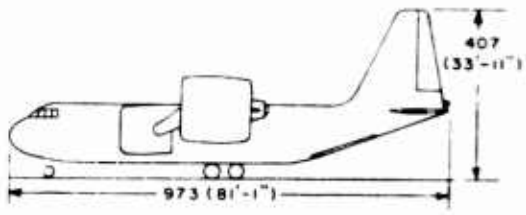
1. Performance Basis: ICA standard atmosphere no wind, except for take-offs and landings, which were at 6000 ft and 95°F. Fuel consumption corrected for installation and increased 5% per MIL-C-5011A.
2. Missions: Vertical take-off and landing at all points.
   - II Minimum cruise altitude for basic mission, 11,300 ft.
   - III High-speed cruise at altitude and 300 mph at sea level for basic mission, 420 mph at 30,000 ft.
   - IV High-speed cruise of 455 mph at sea level and 30,000 ft radius = 302 miles.
   - V Max. VTO Radius with sea level standard take-off and cruise at 300 mph: R = 705 miles.
3. Missions with initial STO; all later take-offs and landings vertical.
   - A. Max. Radius. Initial Ground Run = 770 ft. Rad = 987 mi.
   - B. Max. payload with 425-mile radius, initial ground run = 300 ft, payload = 16,720 lb.
   - C. High-speed radius at 450 mph, Rad = 607 mi., initial ground run = 660 ft.

Characteristics Summary

MODEL D181 Ducted Propeller Assault Transport Aircraft







AVAILABILITY			PROCUREMENT			
ACTIVE	RESERVE	TOTAL				

STATUS

FEATURES

1. Vertical take off and landing in horizontal attitude.
2. Can make overload short take off for increased radius, range, and payload.
3. High speed in excess of 500 mph. and hovering capability of 70 minutes.
4. Superior stability during hovering and transition due to ducted propellers.
5. Good handling and maintenance characteristics.
6. Proven reaction control during vertical take off and landing.
7. Manual pilot control without automatic stabilization or control during vertical take off and landing.
8. Maximum fuel load—wings plus fuselage (32,670 pounds)

CARGO

1. Max load (16,720 pounds)
2. Clear space.
   35' x 10' 8" x 8'

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