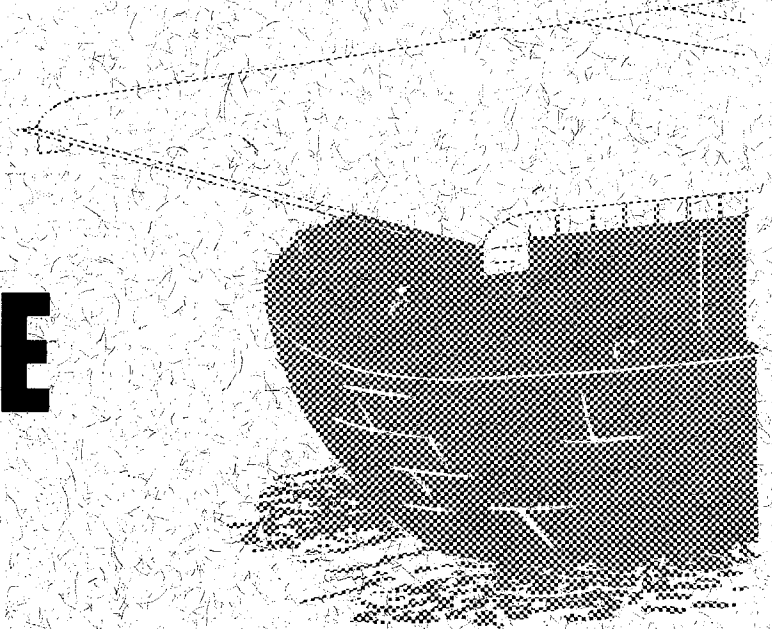


REPORT B029
21 SEPTEMBER 1964

CARRIER SUITABILITY OF



MODEL 188E



MCDONNELL

R.C. Smith



Report No. B029
21 September 1964
Revised 6 November 1964

CARRIER SUITABILITY OF MODEL 188E

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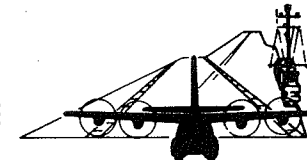
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COPY NO. 44



REVISIONS 6 NOVEMBER 1964

Page i has been added to this report and the following pages have been revised.

10 11 18 19

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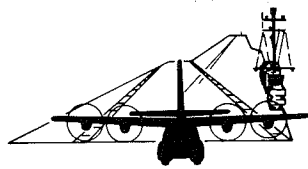
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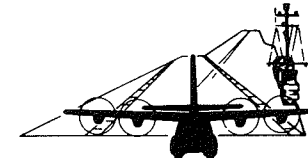
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INTRODUCTION

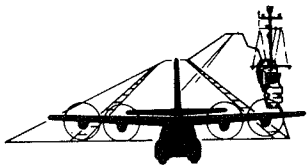
The purpose of this report is to illustrate the carrier suitability of the McDonnell Model 188E STOL aircraft. This aircraft is an Americanized version of the Breguet 941 which has already flown in prototype form. The basic aircraft design is suitable for carrier flight-deck operation. In a 30 Knot Wind-Over-Deck condition on a standard day, the aircraft will land, without brakes, in 180 ft. at maximum landing gross weight of 51,600 pounds. It will take-off in 683 ft. with a TOGW of 56,200 lb., and operate on a pitching deck with no beef-up of landing gear. It requires no arresting hook and no catapult rig.

The radius of the 188E is 400 n.mi. (nautical miles) at maximum payload (17,500 lb.) and 855 n.mi. at 12,000 lb. payload. The range at maximum payload is 1000 n.mi. and maximum range is 2100 n.mi. Ferry range with fuel tanks installed in the cargo compartment is 3040 n.mi.



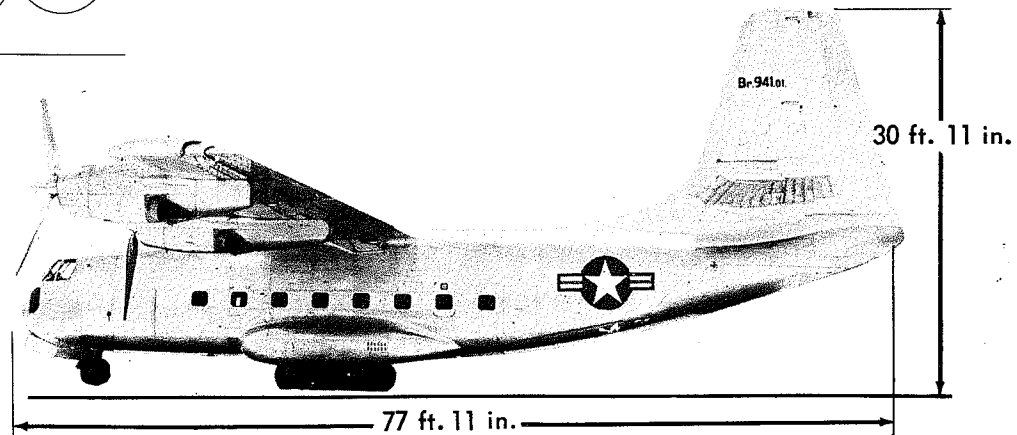
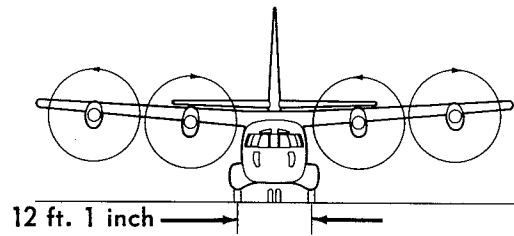
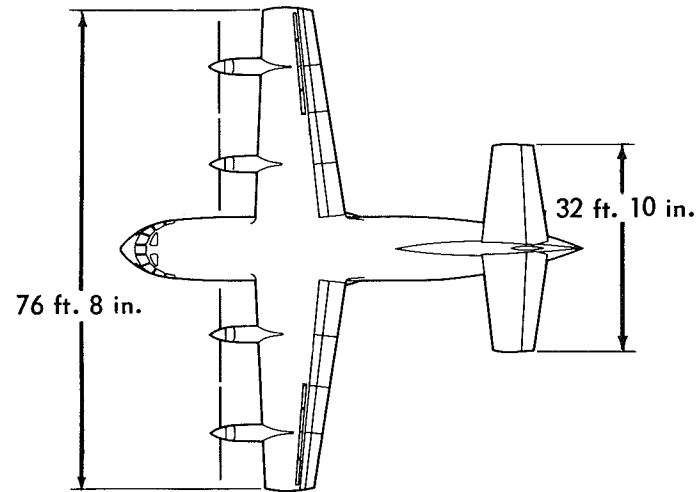
DIMENSIONS AND WEIGHTS

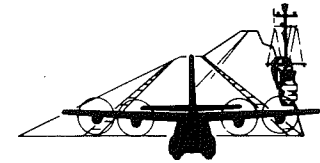
The external dimensions of the aircraft are similar to aircraft currently considered carrier suitable. The wing span of 76 ft. 8 in. is 3 ft. 11 in. less than that of the E-2A whose wing span is 80 ft. 7 in. The maximum take-off gross weight of 58,422 lbs. and the maximum landing weight of 51,600 lbs. are less than that of the A-3B.



External Dimensions

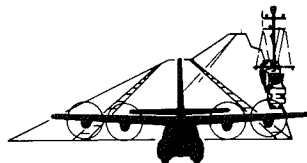
Wing area 897 sq. ft.
Wing incidence 3°
Normal flap deflection
 Take-off 42°-45°
 Landing
 Inboard 98°
 Outboard 72°
Propeller diameter 14.75 ft.





PERFORMANCE SUMMARY

The 188E will be equipped with either four Continental 261-5 engines with 5860 total rated engine shaft horsepower or four General Electric T-58-SIB's having 6000 total rated engine shaft horsepower. The aircraft cruises between 200 and 255 knots.

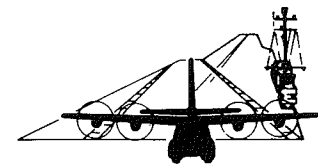


Performance Summary

Continental Model 261-5 (Turmo IIID) Engines*
Rated Horsepower @ Shaft = 1465 Ea.

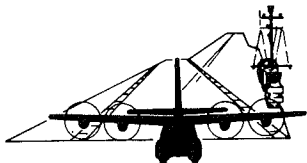
Maximum take-off gross weight (CBR = 4.2)	lbs.	58,422
Maximum payload	lbs.	17,500
Maximum landing weight (CBR = 3.5)	lbs.	51,600
Empty weight	lbs.	28,544
Maximum fuel (2642 gal.)	lbs.	17,173
Mission cruise speed	kts.	200
Cruise speed @ max. continuous power @ 46,000 lb.	kts.	255
Minimum formation or paradrop speed	kts.	65-75
Take-off ground roll @ maximum gross weight - sea level standard day with 30 kt. W.O.D.	ft.	880
Total landing ground roll @ maximum landing weight - sea level standard day with 30 kt. W.O.D.	ft.	180
Ferry		
Range @ best altitude with cargo compt. fuel	n. mi.	3,040
Average cruise speed	kts.	233

*Alternate engines - General Electric T58-SIB with 1500 rated horsepower.

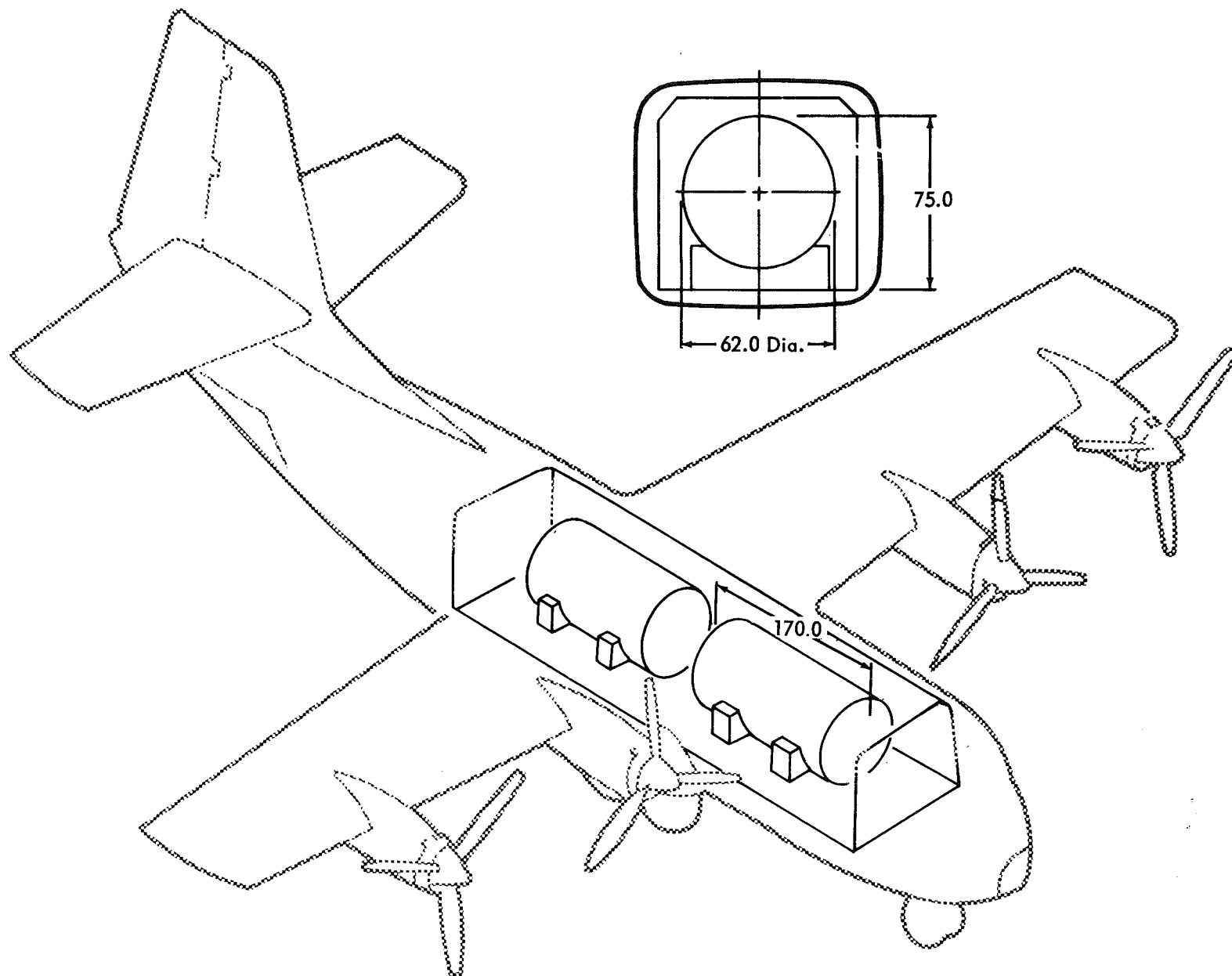


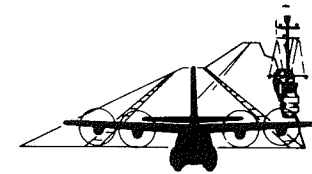
INTERIOR DIMENSIONS

The interior dimensions of the aircraft are 439'' x 102'' x 89'' which are adequate to load, in hermetically sealed cans, any two engines used by carrier based aircraft currently in inventory or under development. These include, among others, the J79, J57, and JTF10A. It is also possible to load (25) Sparrow III missiles, (16) Bullpup "A" missiles, or (31) 500 lb. MK-82 bombs. The sketch on the opposite page illustrates how two J79 engines in cans can be loaded.



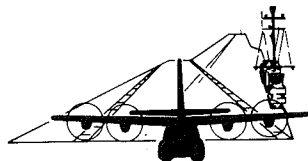
"Canned" J-79 Engine Loadability



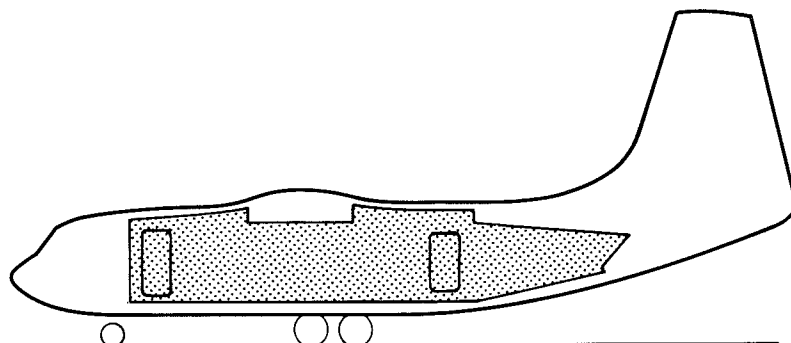


CARGO PERSONNEL COMPARTMENT

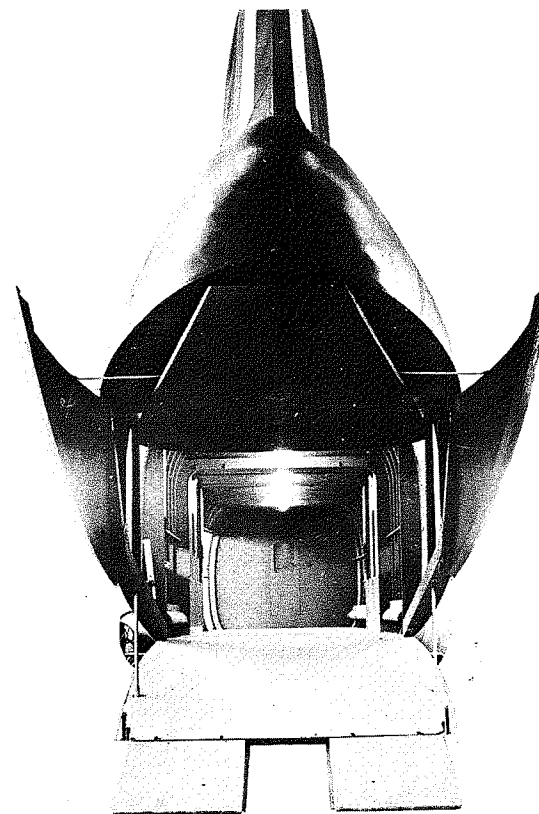
The 188E will be equipped with flight operable, rear loading doors capable of accommodating vehicles as large as a 2½ ton truck.

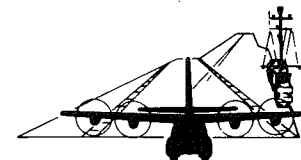


Cargo- Personnel Compartment



Floor length (to ramp hinge line)	439 in.	36.6 ft.
Minimum width	102 in.	8.5 ft.
Minimum height	89 in.	7.4 ft.
Ramp length (load carrying)	186 in.	15.5 ft.
Seating capacity	55	
Litters/attendants	24/8	
Forward entry door (port side).....	75" H, 37" W	
Aft doors (both sides)	72" H, 36" W	
Floor strength	300 PSF	
Ramp angle	8.0° to 11.7°	





PERFORMANCE

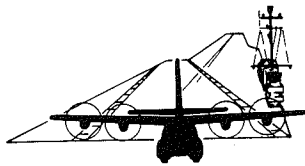
The landing and take-off performance, as illustrated on the following pages, were computed assuming slowdown by use of propeller reversal only, and no slowdown due to friction or braking, even though an anti-skid braking system is installed. The deck space available for landing and take-off from carriers is as follows:

Forrestal Class – Landing and Take-off Distance 683 ft.

Oriskany Class – Landing and Take-off Distance 528 ft.

Essex Class – Landing and Take-off Distance 520 ft.

In a 30 knot wind-over-deck condition the aircraft can land on Essex class carriers in 180 ft. with 340 ft. to spare at 51,600 lbs. carrying full payload of 17,500 lbs. and can take-off at 50,000 lbs. gross weight within the catapult-run distance. In a zero knot wind-over-deck condition the landing roll using brakes is 480 ft. at 51,600 lbs.

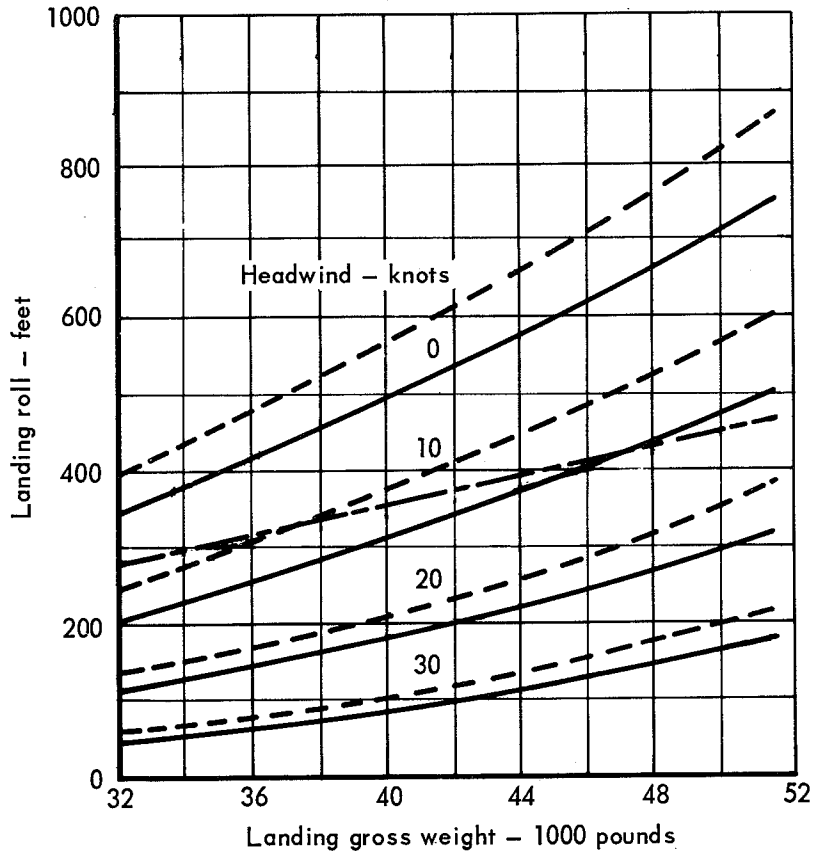


Landing Roll - Touchdown to Stop

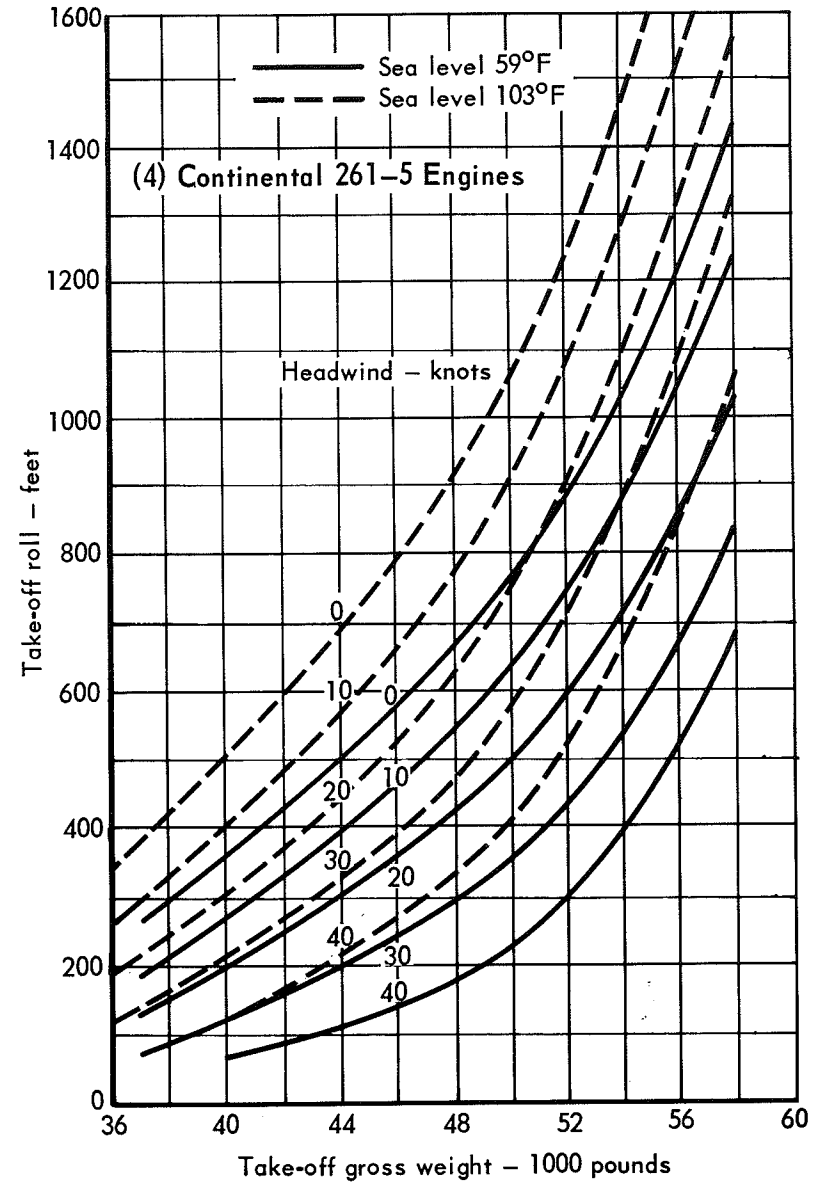
- Sea Level 59°F, No Brakes
- - - - - Sea Level 103°F, No Brakes
- · - · - Sea Level 103°F, No WOD, With Brakes

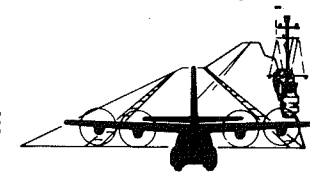
Notes:

1. $V_{touchdown}$ @ $.76 C_{Lmax}$
2. Props reversed one second after touchdown
3. No arresting gear



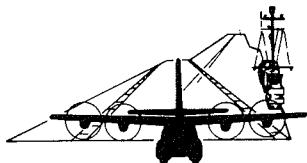
Take-Off Roll to Lift-Off Velocity





PAYLOAD vs RANGE AND RADIUS

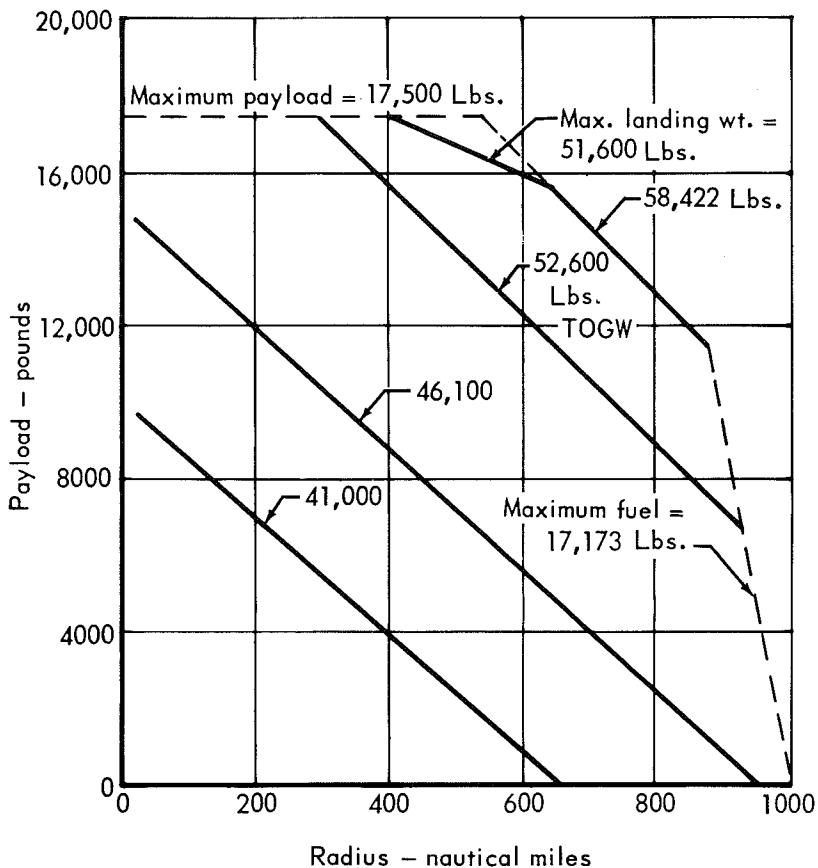
The payload/range and payload/radius curves were determined for best cruise altitude (between 10,000 and 25,000 ft.) at cruise speeds between 205 and 215 knots. Three-engine performance during cruise was used because at low altitudes the 188E cruises more efficiently on three engines than on four. With the cross-shafting drive system, all four propellers are used in cruise even though only three engines are running.



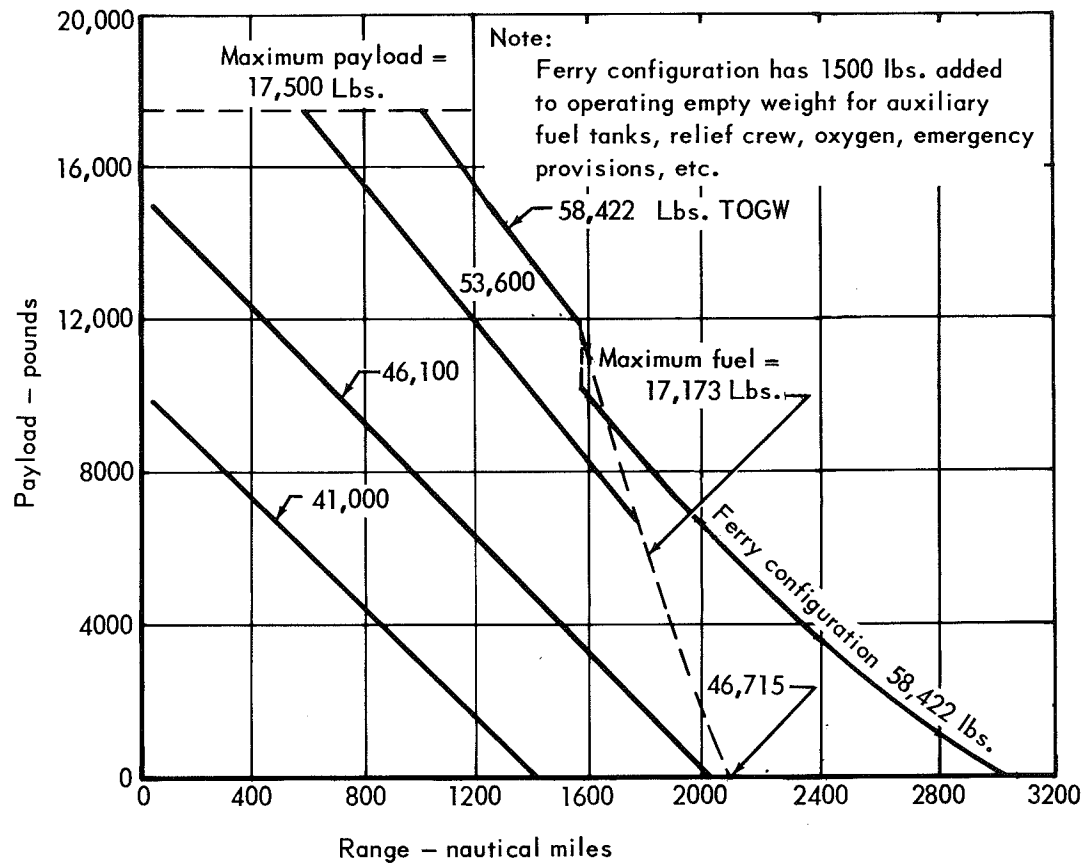
Payload vs Radius

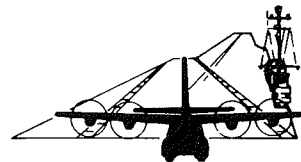
(Payload Outbound Only)

Mission Profile Per MIL-C-5011A
Cruise Altitudes - 10,000 to 25,000 Feet
Cruise Speeds (True) - 205 to 215 Knots (3 - Engines)
(4) - Continental 261-5 Engines



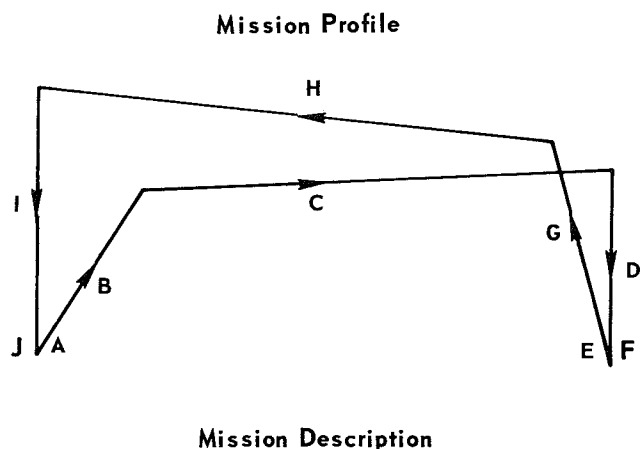
Payload vs Range





MISSION RADIUS VS TIME AND FUEL

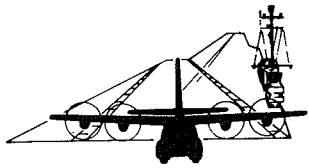
The mission profile for the mission time versus radius was taken from MIL-C-5011A and is described below.



A	Warmup and takeoff at NRP (5 minutes)
B	Climb at max. cont. power to best cruise altitude
C	Cruise out at best cruise altitude
D	Land at mid-point base (no time, fuel, distance)
E	Unload entire cargo (no time)
F	Same as A
G	Same as B (no refueling)
H	Cruise back at best cruise altitude
I	Land at base of origin (no time, fuel, distance)
J	Landing and reserve fuel allowance = 5% of initial fuel + 30 min. sea level loiter at max. endurance

NOTE: Specific fuel consumption increased 5% for service tolerance.

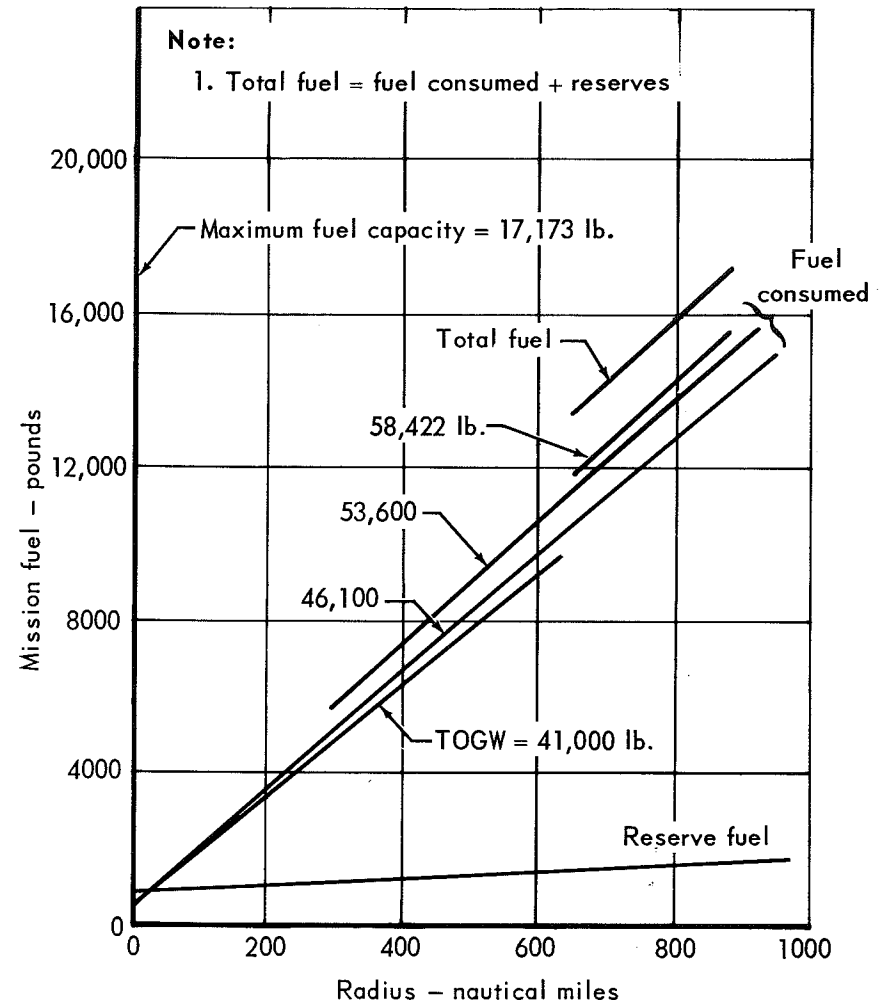
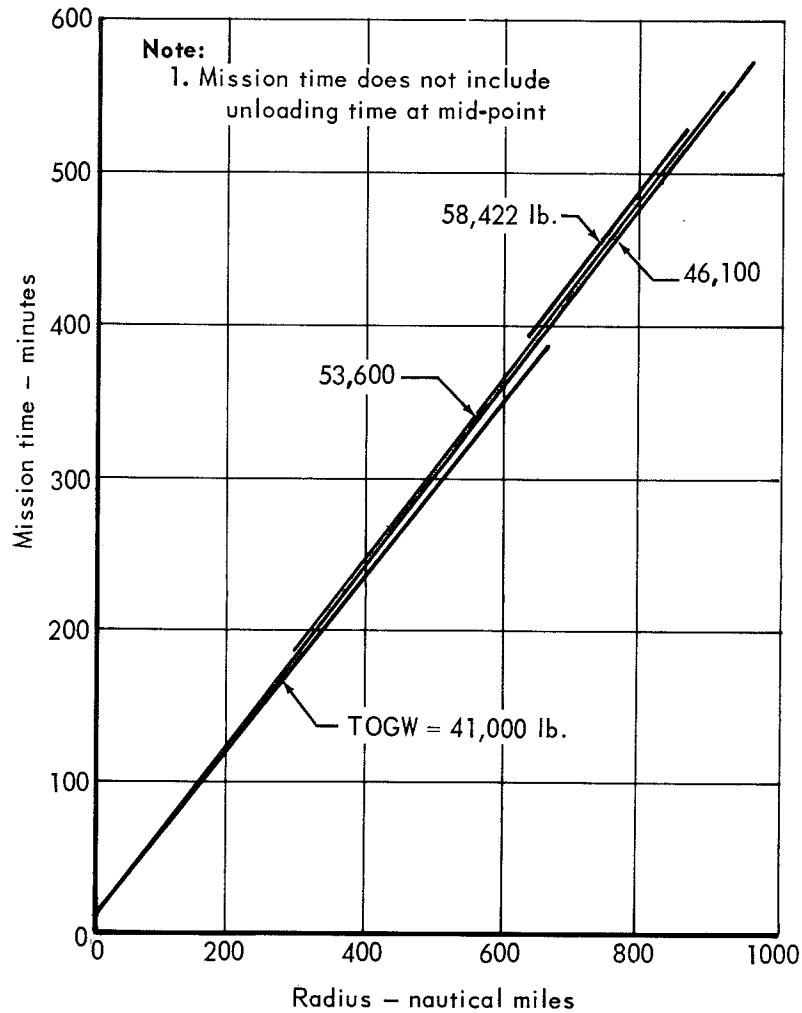
The fuel consumption vs mission radius plot presents the reserve fuel and fuel consumed for various TOGW's (take off gross weights) and a curve of total fuel available for maximum TOGW.

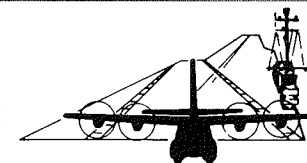


Mission Time vs Mission Radius

Fuel Consumption vs Mission Radius

Mission Profile Per MIL-C-5011A

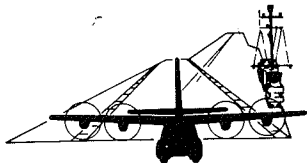




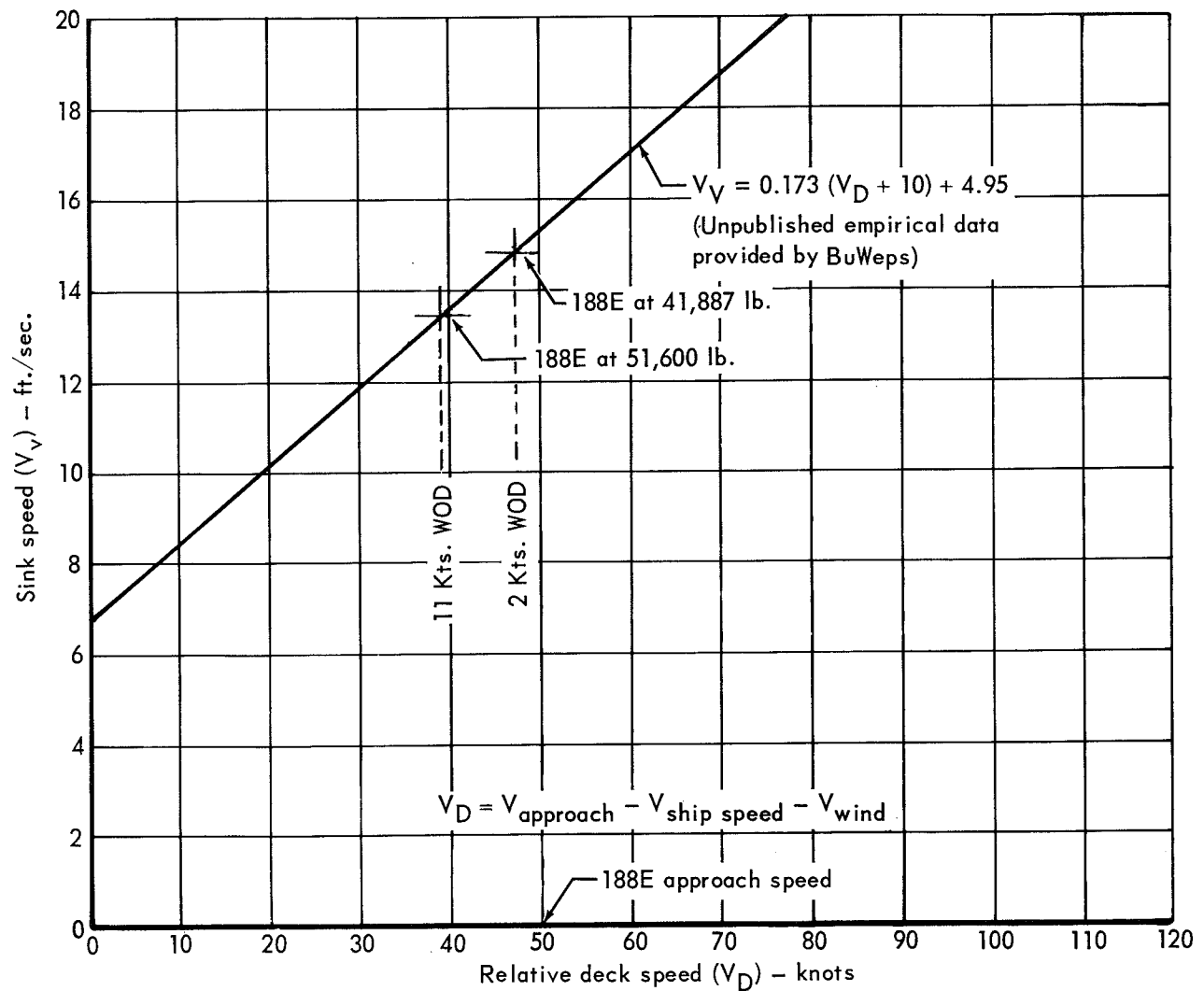
LANDING GEAR COMPATIBILITY

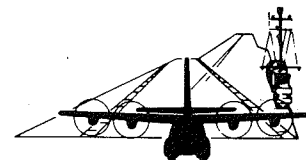
The landing gear of the 188E was designed for a sink speed of 14.9 ft. per sec. at a landing weight of 41,887 lb. This would give it a capability at a maximum landing weight of 51,600 lb. for a sink speed of 13.5 ft. per sec., which is equivalent to an 11 knot wind-over deck condition, as shown on the opposite page.

In practice, the sink speed is more likely to be about 3 ft. per sec., as discussed on page 18.



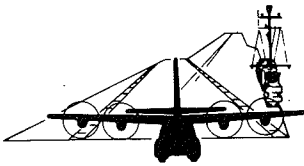
Sink Speed vs Relative Deck Speed





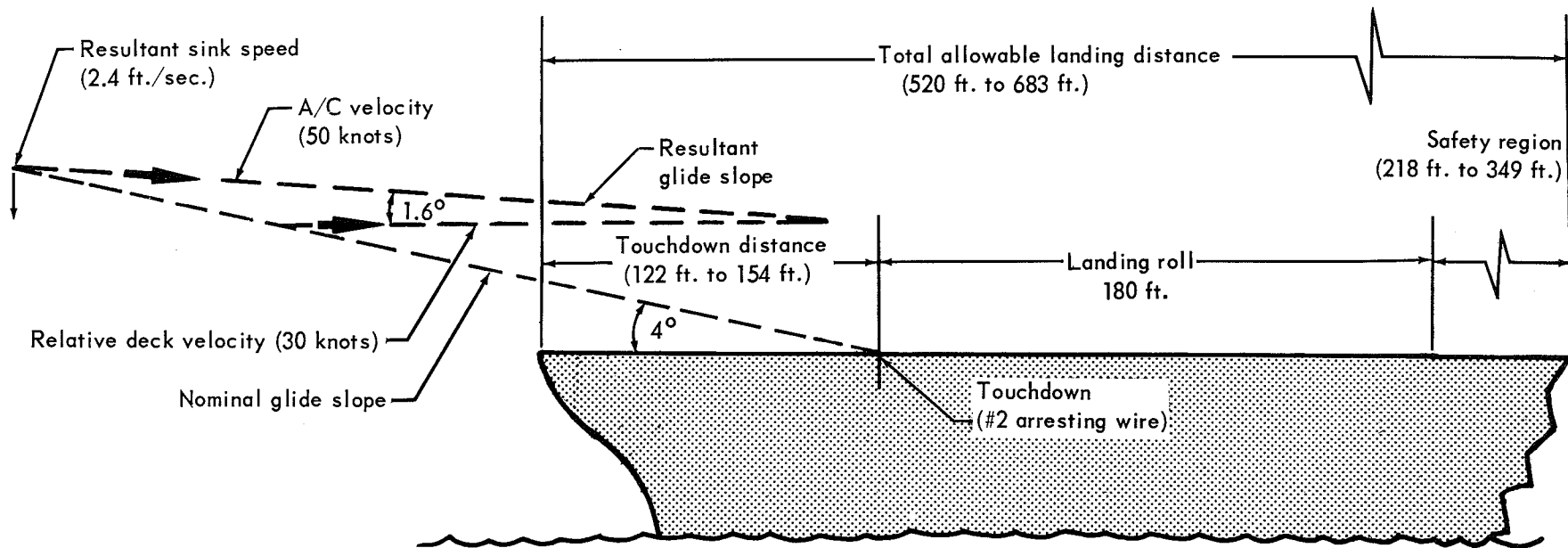
APPROACH AND LANDING

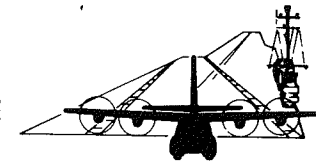
The slow approach speed and effective glide path control of the Model 188E are well suited to the carrier landing operation. The glide slope reference equipment currently utilizes a 4° slope, and the Model 188E can operate at a 4° glide slope at an approach speed of 50 knots. Assuming a 30 knot W.O.D., the resultant sink speed is 2.4 ft./sec., which is well below the maximum allowable sink speed of 10.2 ft./sec. for the 188E landing gear at 51,600 lb. gross weight. The landing roll using reverse thrust only (no wheel brakes) is 180 ft. and the landing space available on the Essex and Forrestal class carriers is 520 and 683 ft., respectively. This results in the 188E coming to a stop with 218 to 349 feet of unused deck runout, assuming touchdown at the number 2 arresting cable. The unused deck runout area provides a safety region which is 72% to 104% as long as the space required for landing.



Approach and Landing Profile

Hot (103°F) Day, 30 Knot Wind-Over-Deck Condition
Essex and Forrestal Class Carriers



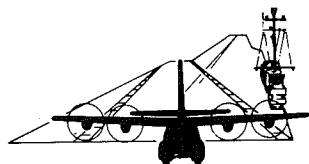


RESUPPLY OF THE FLEETS

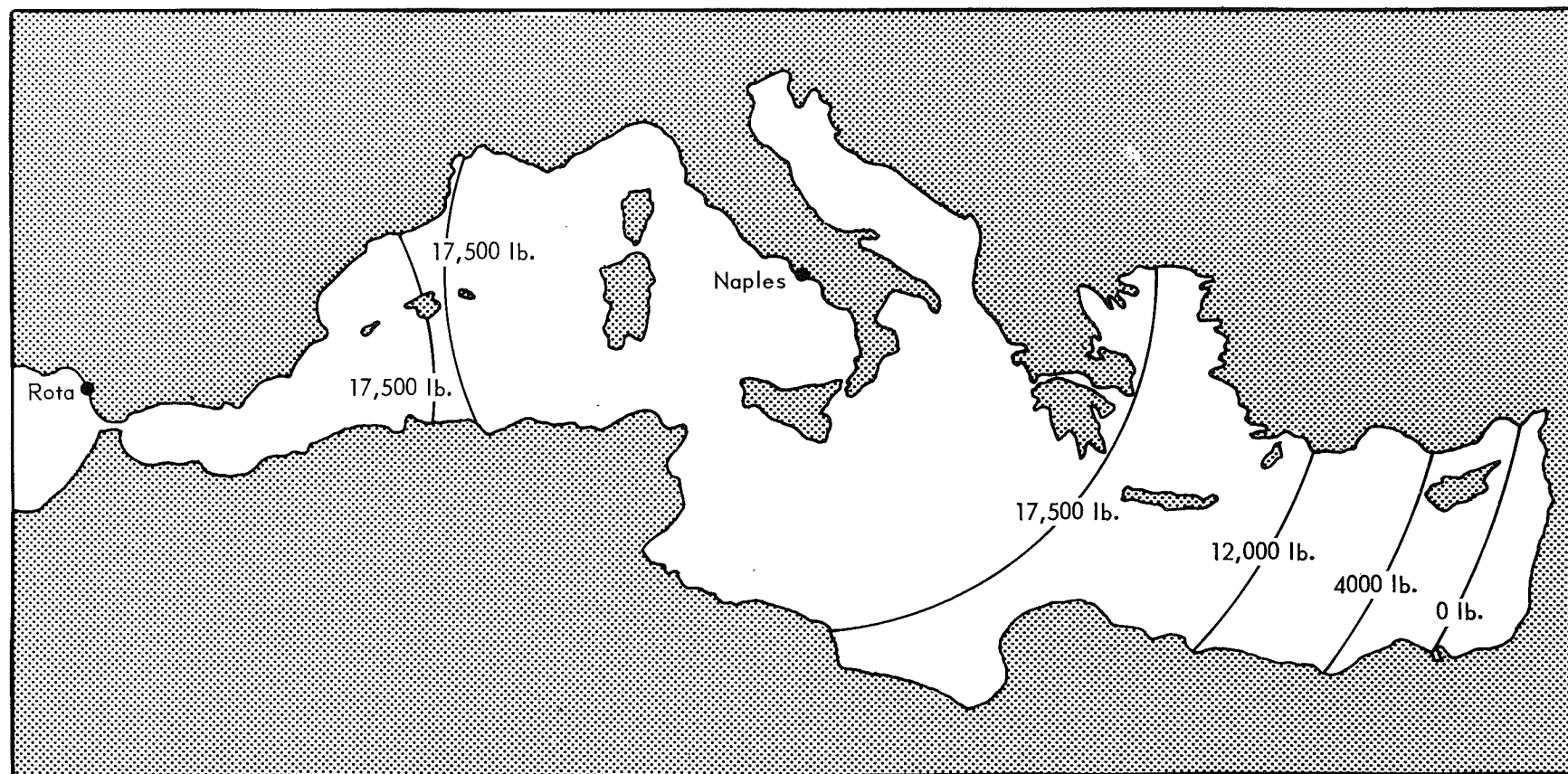
Two likely situations of Atlantic fleet operation are shown on the next two pages – the Mediterranean and Mid-Atlantic. The 188E is capable of resupplying the fleet in nearly all (91%) of the Mediterranean from bases at Rota, Spain or Naples, Italy. From either Bermuda; the Azores; Argentia, Newfoundland; or Rota, Spain it can resupply the fleet during the entire crossing of the Atlantic.

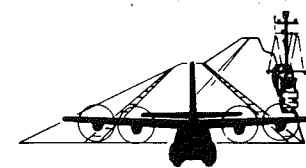
Page 23 shows the resupply coverage of the 188E in the Pacific theater. The 188E can resupply the fleet anywhere between Hawaii, the Phillipines, and Japan. The fleet operating off the coast of California can be resupplied almost anywhere between Alaska and Hawaii.

The radii shown on the maps represent the capability of the 188E to fly out to the carrier with the payload indicated and return to its base of origin without landing on the carrier. Therefore, the operating radii allow for fouled deck conditions with the originating base considered as the alternate (emergency) field. For example, the 17,500 lb. payload arc circumscribed about Rota, Spain represents the unrefueled radius from Rota to the arc and return to Rota.

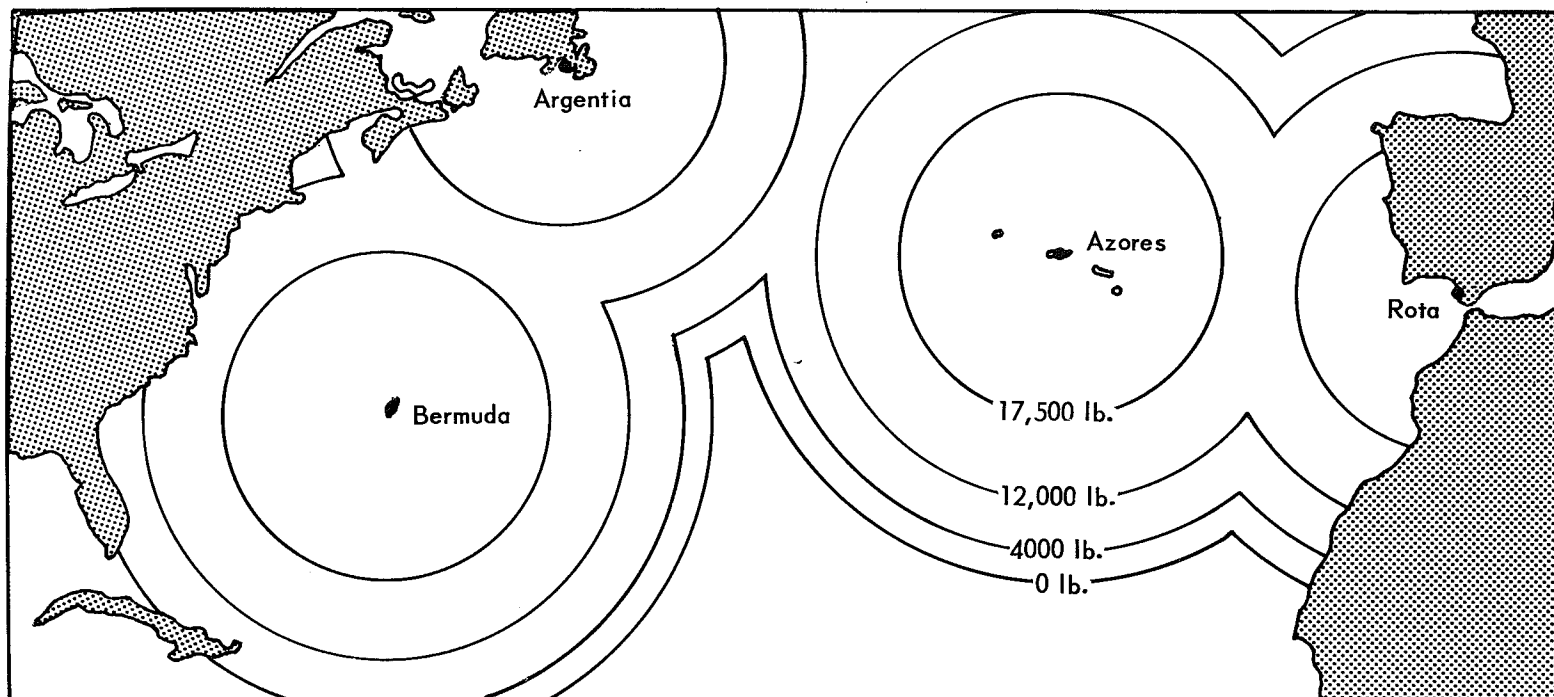


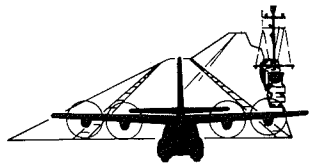
Fleet Resupply in the Mediterranean





Fleet Resupply in the Atlantic





Fleet Resupply in the Pacific

