REPORT NO. A952

MAC 188E PROTOTYPE

TOUR OF THE UNITED STATES FROM 12 JUNE THROUGH 8 JULY 1964

MCDONNELL


MCDONNELL
188

REPORT NO. A952
22 JULY 1964

MAC 188E PROTOTYPE STOL TRANSPORT

MCDONNELL

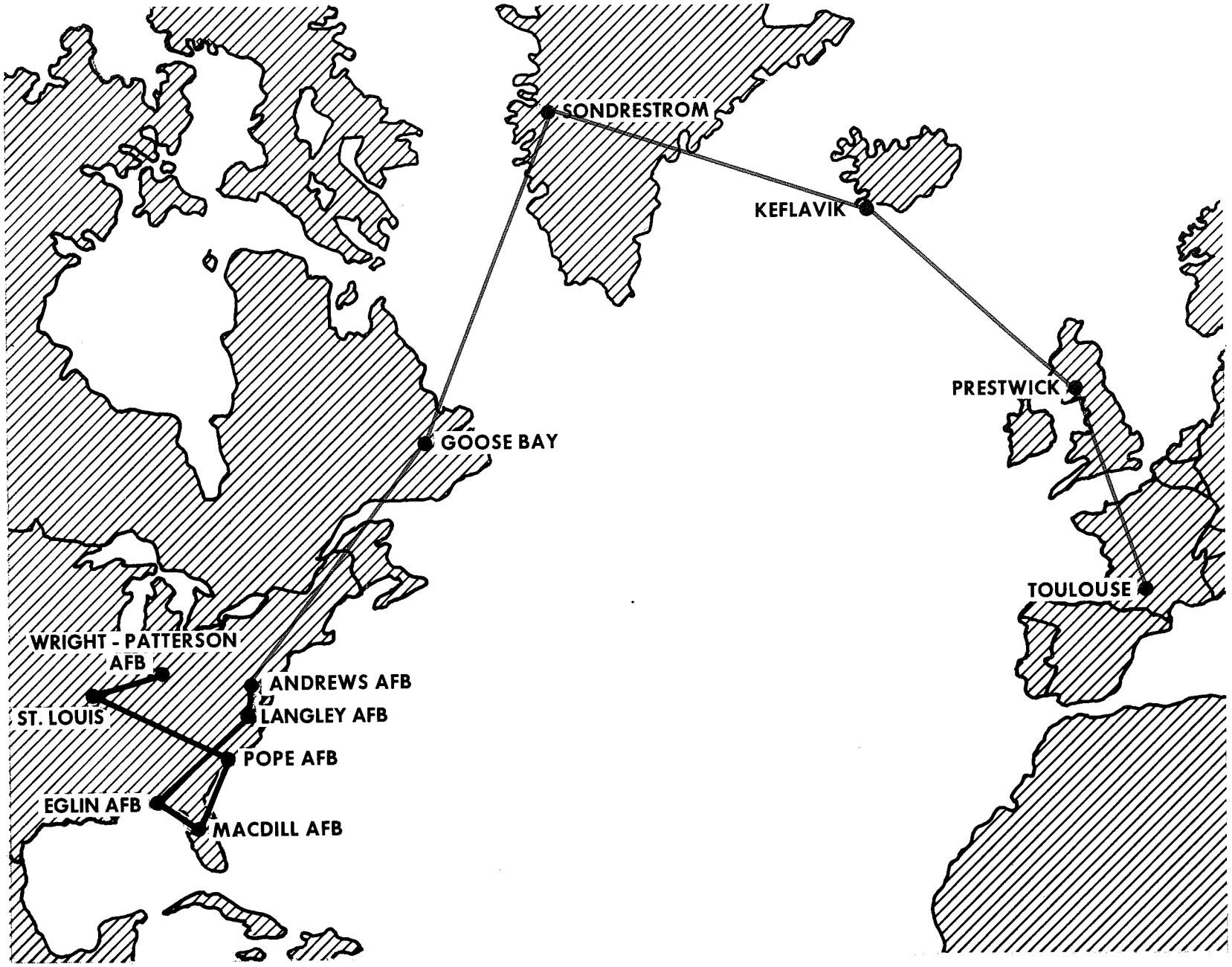
INTRODUCTION

This report presents a brief summary of the tour of the MAC 188E Prototype (Breguet 941.01) to selected USAF installations and the history of the development of this outstanding STOL aircraft. This tour was sponsored by the USAF, The French Air Ministry, McDonnell and Breguet. The principal purpose of the tour was the conduct of a limited operational suitability evaluation of this aircraft by the Air Force's Special Air Warfare Center at Eglin AFB.

The MAC 188E has evolved from three years of close co-operation between Breguet and McDonnell on the 941 aircraft. The 188E will be wholly American produced and qualified to U. S. Military specifications.

IT SHOULD BE NOTED THAT THE AIRCRAFT USED FOR THIS TOUR IS A PROTOTYPE AND THE ONE AND ONLY AIRCRAFT FLYING OF ITS TYPE.

TOUR ROUTE


SONDRESTROM
KEFLAVIK
PRESTWICK
GOOSE BAY
TOULOUSE
WRIGHT - PATTERSON AFB
ANDREWS AFB
ST. LOUIS
LANGLEY AFB
POPE AFB
EGLIN AFB
MACDILL AFB

ITENERARY

June	6	Ferry–Toulouse, France to Prestwick, Scotland
	7	Ferry–Prestwick to Keflavik, Iceland to Sondrestrom, Greenland
	8	Ferry–Sondrestrom to Goose Bay, Labrador
	9	Ferry–Goose Bay to Dulles International Airport
	10-11	Routine maintanence and aircraft preparation
	12	Familiarization Flights, Andrews AFB
	13	Familiarization Flights, Langley AFB
	15	Demonstration and familiarization flights to Special Air Warfare Center, Hurlburt Field
	17-27	Limited perational Suitability Evaluation by 1st Combat Applications Group, SAWC, Eglin AFB
	29	Demonstration and familiarization flights, MacDill AFB
July	1	Demonstration and familiarzation flights, Pope AFB Demonstration, Simmons AAF, Fort Bragg
	2	Familiarization flights, Pope AFB
	4	Demonstration, St. Louis
	7	Familiarization flights, St. Louis
	8	Demonstration and familiarization flights, WPAFB

DEMONSTRATION FLIGHT PLAN

TYPICAL CONDITIONS

Take-off Gross Weight, lbs. 41,000

Payload (M-37 weapons carrier and personnel) lbs. 7000

Temperature, °F 90

FLIGHT PLAN

Take-off from sod field in less than 700 ft.

Cruise speed fly-by at 210 kts. and 300 ft.

STOL configuration (85° flaps, gear down) pass at 400 ft. demonstrating high rate of roll at 50 kts.

STOL landing on sod with less than 500 ft. ground roll

Lower cargo ramp and discharge payload in less than one minute

STOL take-off followed immediately by 300 ft. radius turn at 50 kts.

Simulated cargo extraction at 60 kts. at less than 10 ft. altitude

Conversion from landing approach with 800 ft./min. sink to wave-off at 600 ft./min. rate of climb in less than 2 sec.

STOL landing - Touchdown point repeatable within ±25 ft.

Taxi turns with outer wing tip turning on 50 ft. radius

Demonstration of vertical self jacking feature to facilitate cargo unloading (18 in. vertical displacement and 5° tail down floor tilt.)

Two-engine-out characteristics were demonstrated in flight with no change in flight characteristics. With engine-out, all four propellers operate due to cross-shafting.

FLIGHT ACTIVITY SUMMARY
6 JUNE THRU 8 JULY 1964

FLIGHTS

DEMONSTRATION	5
FAMILIARIZATION	39
EVALUATION (SAWC)	40
FERRY	17
TOTAL FLIGHTS	101

FLIGHT HOURS

DEMONSTRATION	2:55
FAMILIARIZATION	16:30
EVALUATION (SAWC)	35:25
FERRY	46:00
TOTAL FLIGHT HOURS	100:50

STOL LANDINGS

HARD SURFACE	168
SOD	95
CLAY	9
SAND	31*
PSP	2
TOTAL LANDINGS	305

**Take off and landings were successfully made in sand, sufficiently soft, such that 14 inch ruts were produced.*

SAWC LIMITED OPERATIONAL SUITABILITY EVALUATION

17-27 JUNE 1964

PURPOSE OF EVALUATION

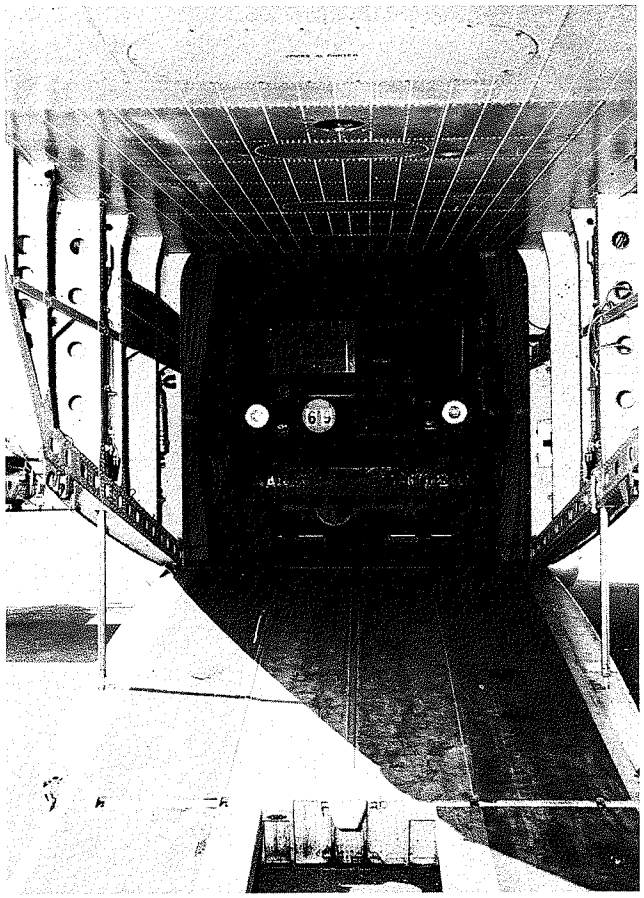
1. Determine pilot training requirement for check-out
2. Determine performance and handling characteristics from hard surface, sod, sand, clay and pierced steel planking
3. Determine instrument flying characteristics
4. Investigate unusual design features
5. Investigate cargo loading and unloading features
6. Investigate acceptability of emergency procedures

RESULTS (35:25 flight hours, 40 flights, 200 landings)

1. Time required for complete pilot check-out is approximately 4 hours
2. Varying field surface conditions have essentially no effect on performance or handling characteristics during take-offs and landings. (For example the maximum difference in take-off distance for the various field surfaces was only 30 ft.)
3. Instrument flight including short field landing and take-off is improved compared to conventional aircraft
4. No special AGE was required for cargo-loading operations. Cargo loading features and turn around time were considered outstanding.
5. Separate flights involving the feathering of an inboard and an outboard propeller showed aircraft control and performance to be excellent. One two-engine take-off was made without effect on aircraft handling characteristics.
6. Night STOL operations with and without lights are easily accomplished
7. Slow speed maneuvering flight at low altitude is accomplished with safety and provides a high degree of pilot confidence

SAWC LOADING EVALUATION

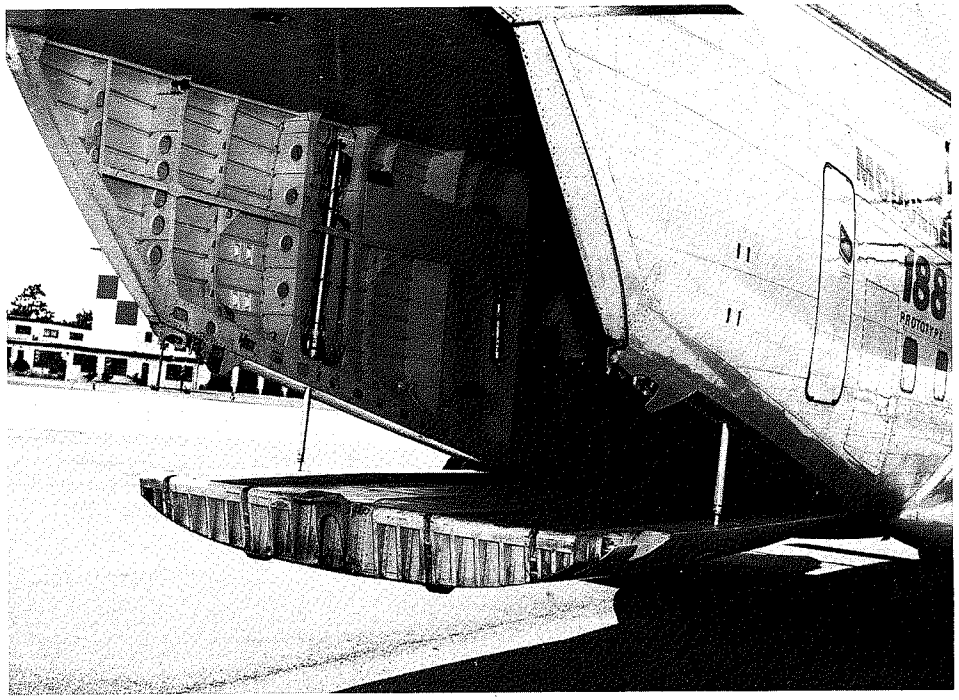
HYDRAULIC ACTUATORS ON RAMP PROVIDE AFT FUSELAGE JACKING DURING LOADING OPERATIONS

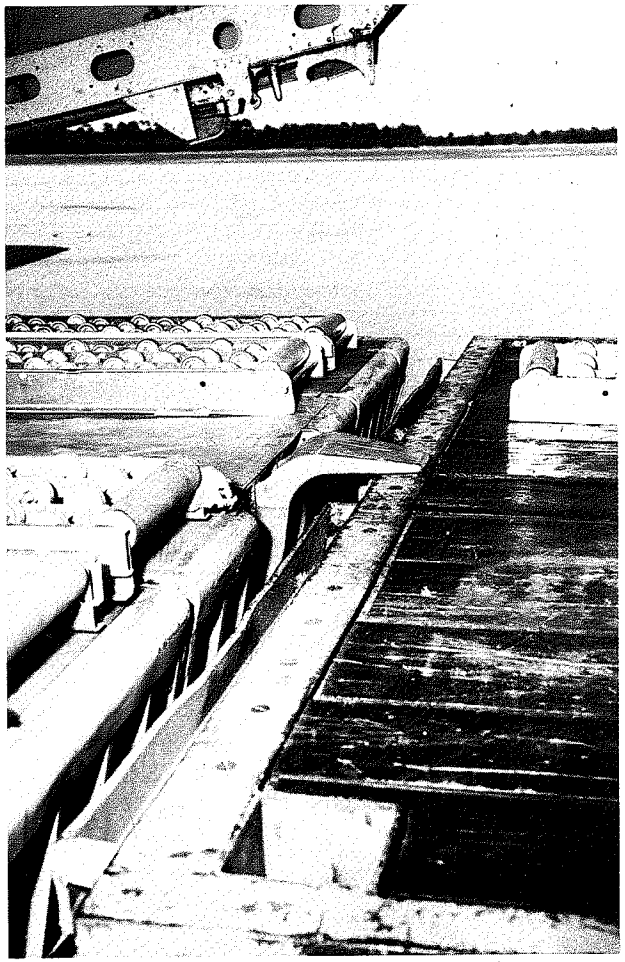


M-37 WEAPONS CARRIER ON BOARD

SAWC LOADING EVALUATION

HYDRAULIC ACTUATORS LOCK RAMP IN THE HORIZONTAL OR ANY DESIRED POSITION

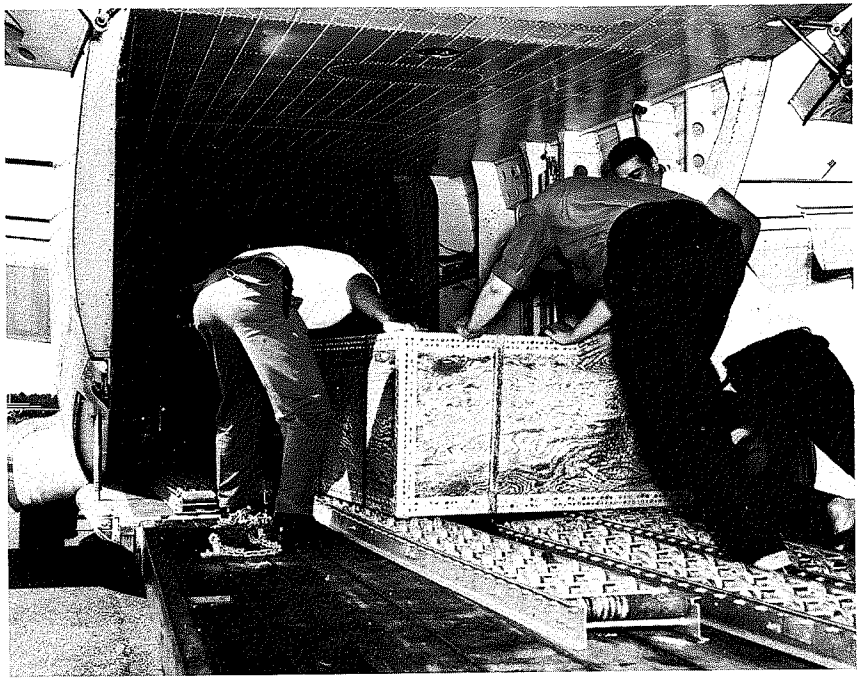


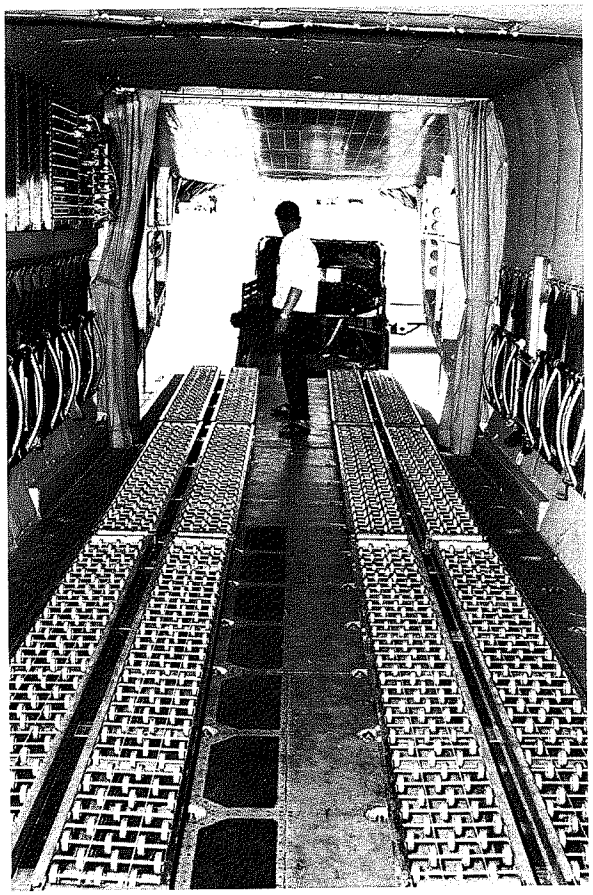


HOOK ON AFT END OF TAIL RAMP RESTS ON TRUCK BED AND PREVENTS RELATIVE MOTION OF RAMP AND BED DURING LOADING OPERATIONS

SAWC LOADING EVALUATION

2500 POUND BOX BEING ON-LOADED

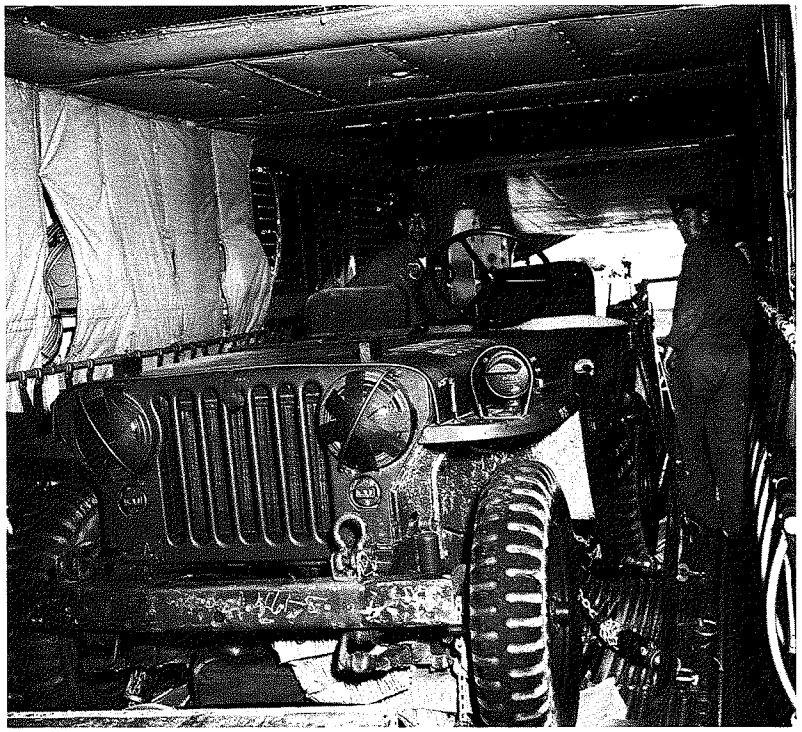




"ROLLER SKATES" INSTALLED. TROOP SEATS STORED

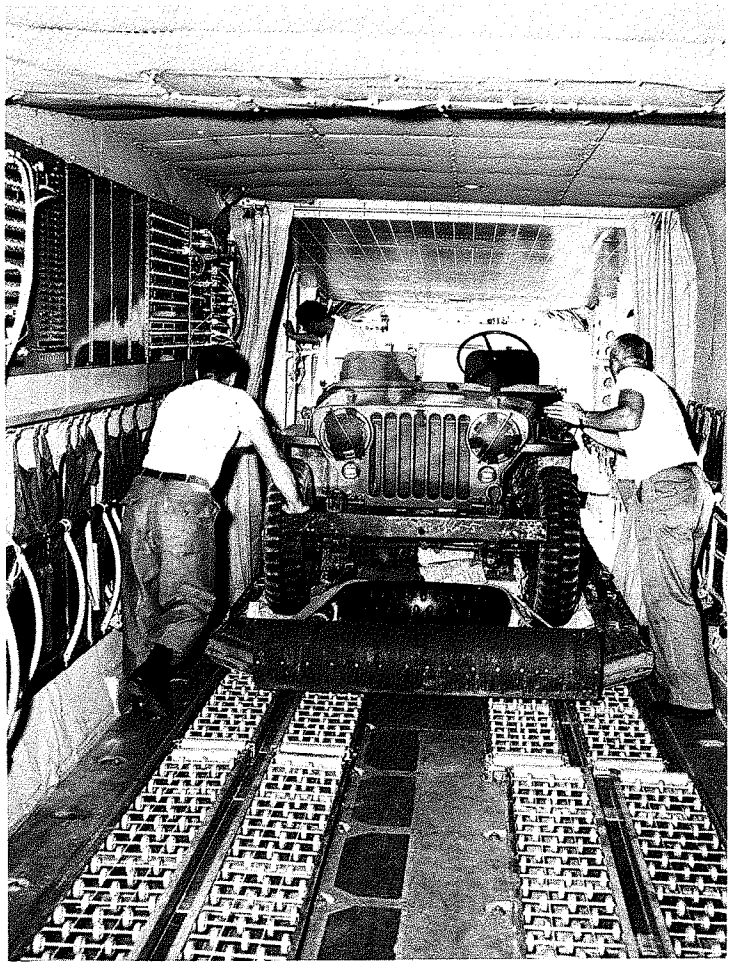
SAWC LOADING EVALUATION

PALLETIZED LOAD PROVIDES PERSONNEL ACCESS



"JEEP" AND 3/4 TON TRUCK LOADED

SAWC LOADING EVALUATION



PALLETIZED "JEEP" BEING OFF-LOADED


188
PROTOTYPE

DEMONSTRATION TOUR LIST OF GOVERNMENT PASSENGERS AND WITNESSES

MEMBERS OF CONGRESS

Mr. Jeffrey Cohelan	Congressman, California (Dem)
Mr. Melvin Price	Congressman, Illinois (Dem)
Mr. Thomas Stafford	Congressman, Vermont (Rep)

FRENCH AIR FORCE

M/Gen. Michel Dorance	French Air Attache

VIETNAMESE AIR FORCE

Lt. Duc	1st Air Commando Wing

ROYAL AIR FORCE

Gr. Capt. D. H. Sutton	Senior RAF officer, ASD

UNITED STATES AIR FORCE

Gen. M. E. Bradley	Commander AFLC
L/Gen. F. A. Bogart	USAF Comptroller
L/Gen. Howell Estes	Vice Commander AFSC
L/Gen. James Ferguson	HQ USAF DCS R & D
L/Gen. B. K. Holloway	Deputy CINC STRIKE
L/Gen. C. B. Westover	Vice Commander TAC
M/Gen. Clyde Box	Deputy for Plans J3, STRICOM
M/Gen. J. N. Ewbanks	Deputy for Operations, TAC
M/Gen. Gilbert Meyers	CG, TAWC
B/Gen. W. G. Daly	Commander 838th Air Division
B/Gen. K. C. Dempster	Dep. Director of Operations J3, STRICOM
B/Gen. T. S. Jeffrey, Jr.	Deputy for Systems Mgs., ASD
B/Gen. H. Manson	Vice Commander ASD
B/Gen. C. G. Peterson	Director of Intelligence J2, STRICOM

UNITED STATES AIR FORCE

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B/Gen. T. H. Watkins	Asst. Deputy for Operations, TAC
Col. D. M. Alexander	Chief Aeronautical Planning Division, DCS/Plans, AFSC
Col. R. J. Broughton, Jr.	Chief of Safety, Pope AFB
Col. F. L. Fischer	Director Ops 4485 Test Wing
Col. Robert Gates	TAWC Deputy for Programs
Col. W. B. Harris	Cdr. 4485 Test Wing
Col. M. V. Heath	838th Div. Director Material
Col. P. E. Hoeper	HQ USAF Foreign Developments
Col. F. A. Holm	Director, Development Planning Div., DCS/Plans, AFSC
Col. C. J. Jackson	Chief Airlift Training, TAC
Col. L. F. Johnson	HQ USAF Ops Requirements
Col. H. W. Lanford	ASZXC, ASD
Col. G. B. Leaverton	Vice Commander TAWC
Col. C. N. Liles	HQ Commandant, MacDill
Col. L. P. Lindsay	Chief Airlift Plans, TAC
Col. A. I. Lingard	SEF, ASD
Col. R. D. Maxwell	AFSC
Col. C. S. Parker	Director of Requirements, TAC
Col. A. W. Schinz	Commander Air Division, MacDill
Col. R. W. Soderberg	AFSC
Col. L. M. Stanton	Acting Director of Airlift, TAC
Col. W. L. Welch	Commander 464th T. C. W.
Col. O. E. Winn	Chief, Transportation Div., Director of Logistics, STRICOM
L/Col. D. Brett	Chief Standardization and Evaluation Group, TAC
L/Col. R. L. Flint	STRICOM
L/Col. E. H. Gordon	Chief Special Warfare Div., TAC
L/Col. E. H. Greer	SESOM, ASD

UNITED STATES AIR FORCE

L/Col. N. J. Kasun	AFSC
L/Col. N. T. Lawrence	Chief Allocations Airlift Ops, TAC
L/Col. R. W. Libel	Pope AFB
L/Col. Miller	AFSC
L/Col. J. H. Mohn	STRICOM
L/Col. J. T. Moore, Jr.	C.O. 77th T.C. Sq.
L/Col. W. H. Norris	AFSC
L/Col. Roderick	Commander 775 TCS
L/Col. George Trautman	USAF Legislative Liaison
Maj. R. R. Bleau	Base Operations Officer, Langley
Maj. H. W. Bohannon	CH Stdn Eval 464th TCW
Maj. H. K. Boyd	SAWC
Maj. Gene Deatrick	Aide to L/Gen. Estes, AFSC
Maj. A. G. Limpantsis	Special Warfare Division, TAC
Maj. Bruno Minini	AFSC Foreign Technology
Maj. Warlick	Airlift Plans, TAC
Maj. O. B. White	Demonstration Project Ofcr., Langley
Maj. Ed Wilson	ASD All Weather Tests
Maj. F. E. Zerbe	Aide, General Bradley, AFLC
Capt. R. J. Blair, Jr.	1st Air Commando Wing
Capt. A. P. Blosch	838th Air Div. Ops
Capt. Ralph Haymaker	AFSC Tour Project Officer
Capt. A. L. Huskey	SAWC
Capt. Lamar Kissling	AFSC Limited War, DCS/Systems
Capt. R. F. Klopper	1st Air Commando Wing
Capt. A. D. LaRocco	776th Troop Car. Sq.
Capt. Leuschner	1st Air Commando Wing
Capt. R. E. Ressling	9th AF, DOAL-T
Capt. C. A. Wyrick	464th Air Div. Stand. Eval.
Capt. C. L. Messex	Chief Pilot 319th TCS, 1st Air Commando Wing
Lt. R. F. Smith	1st Air Commando Wing

UNITED STATES ARMY

Gen. Paul Adams	CINC STRIKE
L/Gen. J. W. Bowen	CG XVIII Airborne Corps
B/Gen. J. A. Seitz	CG Corps Artillery, Fort Bragg
Col. R. H. Colwell	C.O. 5th Logistical Command, Fort Bragg
Col. H. S. Cunningham	Cdr. Support Cmd 82nd Airborne
Col. J. Dyson	C.O. 54th Artillery Group
Col. C. P. Hannum	STRICOM
Col. J. J. Hatch	STRICOM
Col. A. J. Rankin	Pres. Army Av. Test Board, Fort Bragg
Col. N. G. Reynolds	Deputy Chief of Staff, XVIII Airborne Corps
L/Col. J. A. Hughs, Jr.	82nd Airborne Div. G-4
L/Col. A. J. Jacobson	Doctrine & Requirements, Director of Plans J3, STRICOM
L/Col. R. C. Kendrick	Brig. Cmdr. 2nd Brig 82nd Airborne Div.
L/Col. W. M. Mahone	Army CDC Liaison Officer, STRICOM
L/Col. F. Oettinger	Div. Inspector General, 82nd Airborne Division
L/Col. J. R. Thurman	STRICOM
Maj. M. E. Jamison	CDC Liaison Officer, AVCOM
Maj. J. S. Johnson, Jr.	HQ & HQ 82nd Airborne
Maj. R. R. Peabody	82nd Airborne

UNITED STATES ARMY

Capt. J. D. Gordon	82nd Aviation Battalion
Capt. D. R. Williamson	82nd Aviation Battalion

UNITED STATES NAVY

Capt. R. G. Freeman III	BWR, St. Louis
Cmdr. R. D. Nye	STRICOM

UNITED STATES MARINE CORP.

B/Gen. L. E. English	Deputy Director of Plans J5, STRICOM

CIVILIANS

Mr. R. J. Baldwin	Vice President, Airplane Engineering, MAC
Mr. John Bauer	Project Engr. CV-2, AVCOM
Mr. R. H. Belt	Engineering Manager, MAC
Mr. D. H. Bennett	Project Engr. Adv. Design, MAC
Mr. John Burg	Ass't. Proj. Engr. CV-2, AVCOM
Mr. John Campoy	Photographer, MAC
Mr. Mathew Chopin	SEJDR, ASD
Mr. T. A. Clark	Ass't Sales Mgr., V/STOL, MAC
Mr. H. H. Cole	Advance Design Project Engineer, MAC
Mr. Jack Conroy	U.S.A. MOCOM, Detroit
Mr. Marty Copp	Ops Analysis, TAC
Mr. G. C. Covington	Vice President, General Engineering, MAC

CIVILIANS

Mr. Joe Dobronski	Chief Engr. Test Pilot, MAC
Mr. R. A. Eberhard	Project Ops. Analy. Engr., MAC
Mr. C. M. Forsyth	Vice President Sales, MAC
Mr. Ted Goss	Ass't Director New Programs, ASD
Mr. G. S. Graff	Vice President, Engineering Technology, MAC
Mr. Bob Graham	Ops Analysis, TAC
Mr. R. E. Hage	Vice President, Advanced Product Planning, MAC
Mr. A. Helle	RD & E, AVCOM
Mr. R. B. Jenny	Proj. Aero Engr. - V/STOL, MAC
Mr. Joe Jordan	ASZXC, ASD
Mr. Paul P. Kelly	Field Service Representative, MAC
Mr. George Kovacich	CV7 Project Office, AVCOM
Mr. Ned Kragness	Director Development, AVCOM
Mr. T. Laird	
Mr. Bill Leathwood	RD & E, AVCOM
Mr. D. S. Lewis	President, MAC
Mr. M. D. Marks	Mgr. Advanced Engr. V/STOL, MAC
Mr. Frank McCabe	CV7 Project Office, AVCOM
Mr. John McCollum	Director New Programs, ASD
Mr. J. S. McDonnell	Chairman, and Chief Executive Officer, MAC
Mr. S. N. McDonnell	Vice President, General Manager, Combat Aircraft, MAC
Mr. C. W. Miller	Chief Aerodynamics Engineer, MAC
Mr. K. Perkins	Vice President, Engineering, MAC
Mr. Sam Polansky	Contracting Officer, AVCOM
Mr. H. C. Rechtien	Sr. Engr. Advance Design, MAC
Mr. W. S. Ross	Chief Test Pilot, MAC

CIVILIANS

Mr. E. R. Shields	Section Mgr. Flt. Test, MAC
Mr. R. B. Short	Project Engineer, MAC
Mr. Charles Slatt	AVCOM
Mr. G. B. Sloan	Advance Product Planning, MAC
Mr. F. I. Steele	Project Engineer, MAC
Mr. Carl Stephenson	RD & E, AVCOM
Mr. C. R. Thielin	SEAEP, ASD
Mr. Gene Varble	Ops Analysis, TAC
Mr. Howard Wilson	Director Engineering, AVCOM

MAINTENANCE

UTILIZATION

FLIGHT HOURS PER MONTH 97.5

MAXIMUM FLOWN PER DAY BY SAWC ..... 6.5 HRS.

MANPOWER

ALL MAINTENANCE WAS PERFORMED BY FOUR BREGUET AND THREE MCDONNELL MECHANICS 7

DEVELOPMENT HISTORY

STOL studies initiated by Breguet	1954
First flight of research aircraft, Breguet 940	May 1958
First flight of operational aircraft, Breguet 941.01	June 1961
Technical agreement, Breguet/McDonnell	Fall 1961
License agreement, Breguet/McDonnell	Spring 1962
First MAC 188 design	June 1962
MAC Operations Analysis and Cost Effectiveness Studies	1962-1963
MAC 188E preliminary design completed	Spring 1963
Breguet production contract from French Air Ministry announced	June 1963
U. S. Flight evaluations of 941.01	
NASA/AFFTC (Stability and Control)	May 1963
AFFTC/ASD/NASA (Handling qualities and instrument flying capabilities)	September 1963
AFFTC/ASD/U. S. Army (Off-runway operations)	November 1963
European demonstration tour	October 1963
Depart Toulouse, France for U. S. tour	6 June 1964

COMPARISON OF AIRCRAFT CHARACTERISTICS

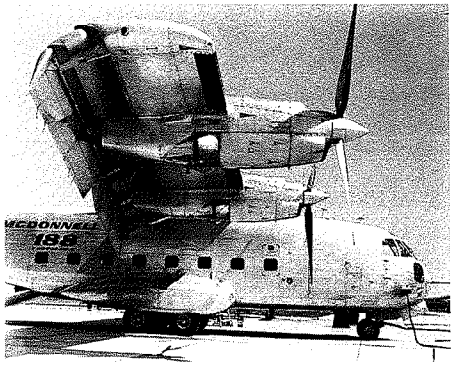
	BREGUET 940.01	MCDONNELL 188E
SHAFT HORSEPOWER (EACH)	1165	1465
MAXIMUM GROSS WEIGHT	52,920 LBS.	58,422 LBS.
USEFUL LOAD (PAYLOAD + FUEL)	25,000 LBS.	29,357 LBS.
MAXIMUM PAYLOAD	14,300 LBS.	17,500 LBS.
CRUISE SPEED @ 10,000 FT.	180-215 KTS.	195-255 KTS.
APPROACH SPEED	55 KTS.*	55 KTS.*
GROSS WEIGHT TO CLEAR 50 FT. IN 1000 FT.		
STD DAY, SEA LEVEL	41,400 LBS.	46,100 LBS.
103°F, SEA LEVEL	35,600 LBS.	42,000 LBS.
MAXIMUM LANDING WEIGHT	44,000 LBS.	51,600 LBS.
LANDING DISTANCE OVER 50 FT. AT		
MAXIMUM LANDING WEIGHT	730 FT.	820 FT.
FERRY RANGE WITH AUXILIARY FUEL	1800 N.M.	3040 N.M.
WINGSPAN	76.1 FT.	76.7 FT.
LENGTH	72.9 FT.	77.9 FT.
HEIGHT	30.7 FT.	30.9 FT.
CABIN		
WIDTH	8.0 FT.	8.5 FT.
HEIGHT	7.4 FT.	7.4 FT.
LENGTH	34.0 FT.	36.6 FT.

The 188E is designed to carry over 90% of all the wheeled and tracked vehicles of a ROAD Airborne Division.

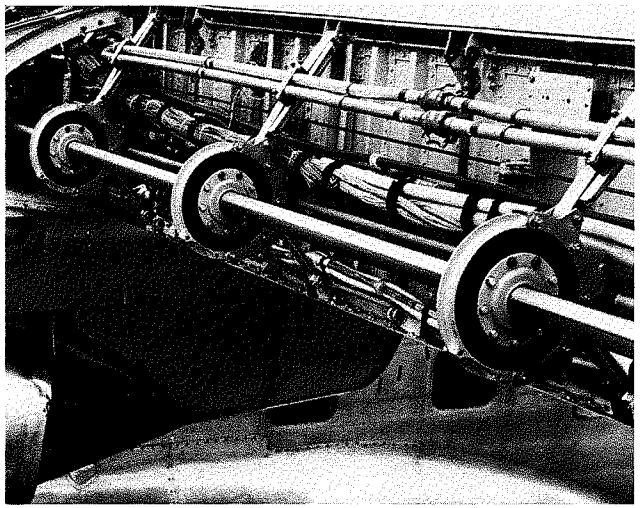
* *Approach speed is essentially independent of gross weight because of the "POWERED LIFT" aspect of this aircraft's design.*

MAC 188 SALIENT DESIGN FEATURES

- DEFLECTED SLIPSTREAM–WING WHOLLY IMMERSED IN PROPELLER SLIPSTREAM.
- CROSS-SHAFT INTERCONNECTION OF THE FOUR PROPULSION UNITS..
- HIGHLY DEFLECTED, FULL-SPAN, TRIPLE-SLOTTED FLAPS.
- RELATIVELY LARGE DIAMETER PROPELLERS DESIGNED FOR HIGH STATIC THRUST.
- STICK ACTUATED DIFFERENTIAL PITCH BETWEEN OUTBOARD PROPELLERS FOR LOW SPEED CONTROL.
- ONE PROPELLER CONTROL LEVER FOR ALL FOUR PROPELLERS.
- ONE THROTTLE TO CONTROL ALL FOUR ENGINES.
- "TRAILING ARM" LANDING GEAR FOR ROUGH FIELD OPERATION.



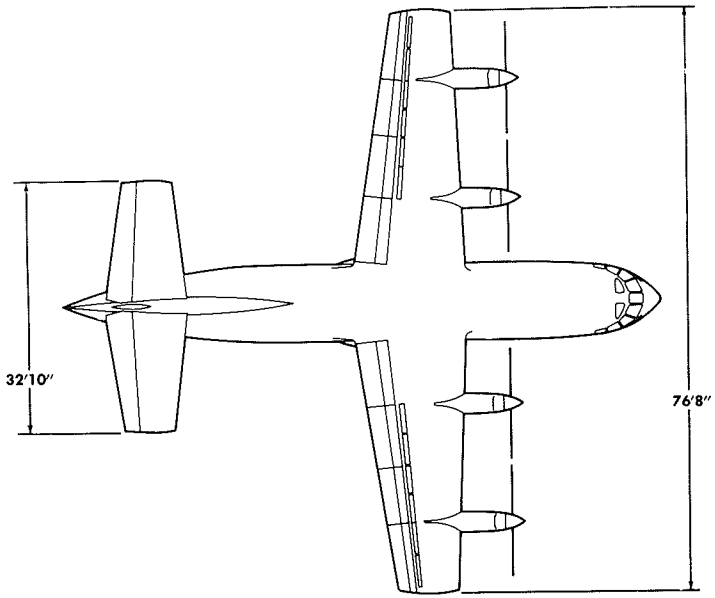
Inboard flaps deflected 98°, outboard 72°

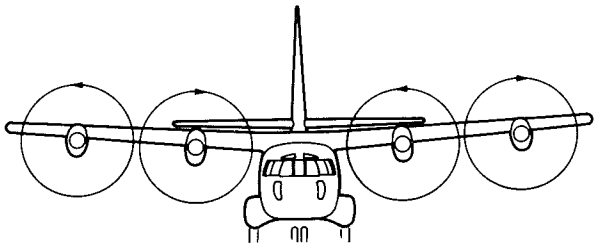


Propulsion system cross-shafting

TRANSPORT DIMENSIONAL COMPARISON

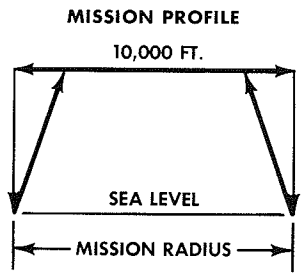
MODEL	WING SPAN	LENGTH	HEIGHT
188E	76.7′	77.9′	30.9
C-130B	132.6′	97.8′	38.0′
C-123	110.0′	76.2′	34.5′
CV-2A	96.4′	72.6′	31.8′
CV-7A	96.0′	76.9′	28.7′

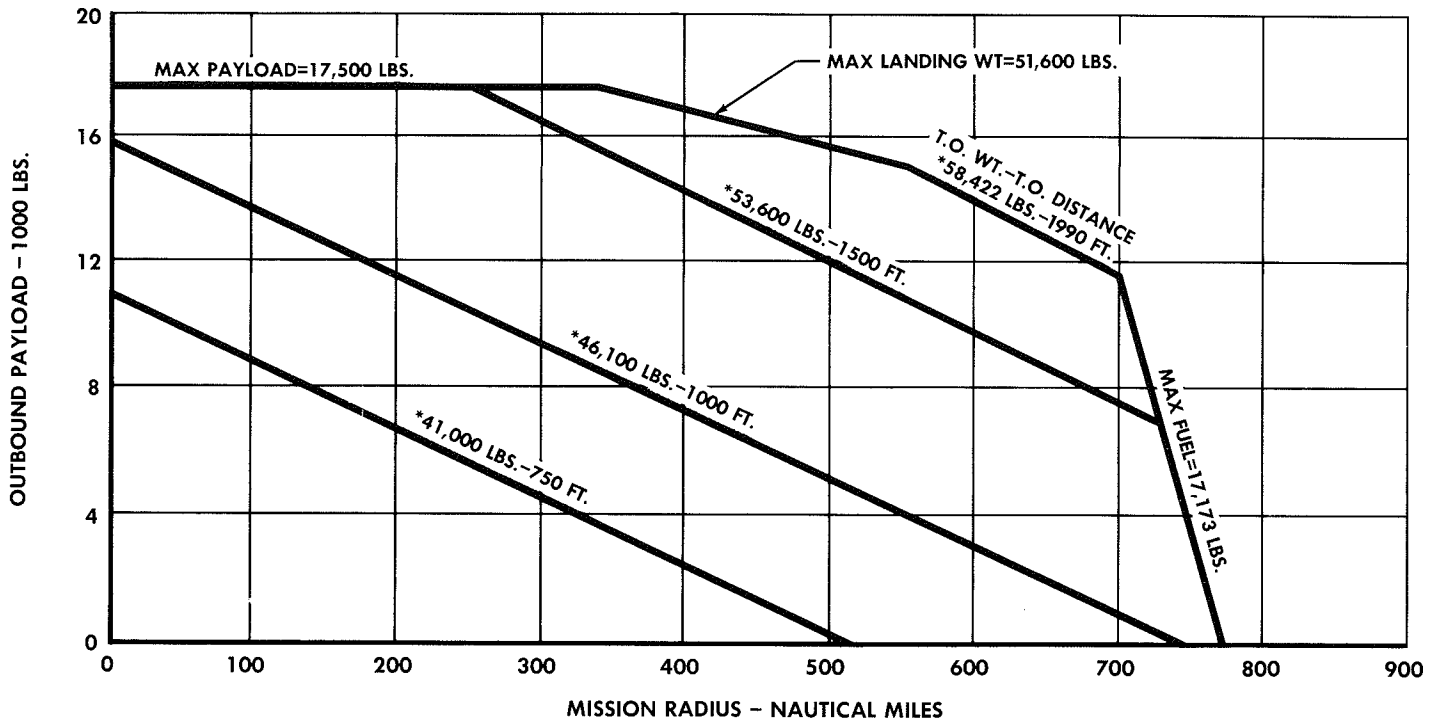




MAC 188E
PAYLOAD vs RADIUS
10,000 FT. CRUISE

4 ENGINES CRUISE • ENGINES 1465 HP EA.
RETURN ½ OUTBOUND PAYLOAD • CRUISE SPEED = 200 KNOTS





INITIAL TAKE-OFF CONDITION

NOTE: CRUISE ON 3 ENGINES @ 200 KTS. INCREASES RADIUS APPROX. 6.5%