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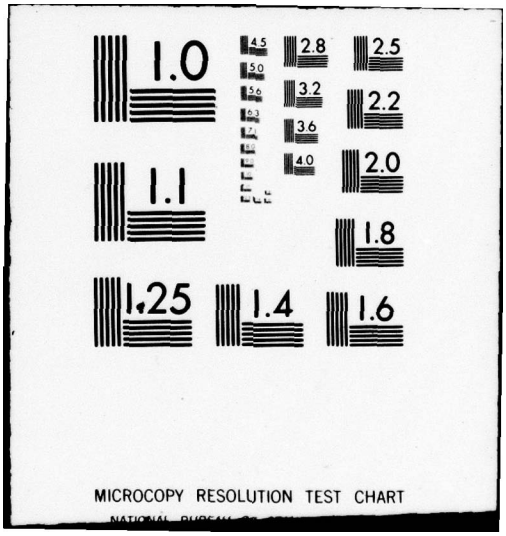
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LEVEL II

AIR FORCE SECTION

U.S. ARMY COMMAND AND GENERAL STAFF COLLEGE

STRATEGIC AIRLIFT: CURRENT CAPABILITIES AND FUTURE TRENDS

BY
Wallace E. Cooper, Jr., Major, USAF

A RESEARCH STUDY SUBMITTED TO THE AIR FORCE FACULTY

May 1979

FORT LEAVENWORTH, KANSAS

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Covers current airlfft capabilities, shortfalls and ways to overcome the deficit. Future trends in airlift are covered in conjunction with airlift ~~air~~lift.

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AIR FORCE SECTION

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(11) May 79

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This research report reflects only the views and opinions of the author. It does not represent official policies of the Department of Defense or the United States Air Force. The report contains no classified material.

SECTION I

INTRODUCTION

The mission of the Military Airlift Command, in broad terms, is to operate both strategic and tactical airlift on a global basis, to deploy and employ United States combat forces and their support equipment and to resupply them once they are in place. Additionally the Military Airlift Command is required to provide special airlift and certain administrative airlift as required by the Joint Chiefs of Staff.

Dr. Henry Kissinger noted the importance of strategic airlift when he stated:

> One of the most urgent tasks of the American military policy is to create a military capability which can redress the balance of limited wars. Limited wars require units of high mobility and considerable firepower which can bring their power to bear with discrimination. The capability for rapid deployment is crucial. (1:156)

The airlift strategy of today allows the United States, through the Military Airlift Command, to apply its military forces, in the right combination anywhere in the world. This option has been adopted by the United States government in place of

keeping large numbers of U.S. troops stationed overseas. This strategy presupposes our ability to deploy forces and equipment quickly to engage an aggressor in the shortest possible time.

This "flexible response" course of action is both realistic, given today's political climate, and relatively economical. It should be noted, however, that the airlift forces are not required to operate continuously, but must be ready to operate at full capacity for short 30 day "surge" periods during war contingencies.

Since the early 1970's the Soviets have put increased emphasis on the ability to exert their influence on affairs anywhere on the globe. The Soviet military airlift arm, Voyenno Transportnaia Aviatsiya (VTA) has been steadily upgrading both capability and equipment for the past ten years.

Currently the VTA is operating the Anontov An-12, roughly comparable to our C-130; the An-22, a turboprop version of the C-5; and the Il-76, almost an exact copy of the C-141. Under current development are a turbofan version of the C-5, the Il-86, a wide-body transport and the new An-72, much like the Boeing YC-14.

These new aircraft are a quantum jump in the VTA airlift capability. Coupled with the Soviet experience in the 1973 Middle East War and the more recent resupply of Ethiopia the Soviet capability for strategic airlift is impressive. The fact that Aeroflot, the Soviet airline, is at the call of the VTA in any crisis makes the total airlift capacity of the Soviet Union a real force in power projection politics.

In this paper I will cover the capabilities of the United States airlift system, the shortfalls in that capacity and the remediesfor meeting these shortfalls. I will also cover the projections for airlift aircraft at the turn of the century and the requirements needed to develop these aircraft. Conclusions will cover both near term solutions to our shortfall and long range measures needed to meet future contingencies.

To help the reader fully understand the meaning of this paper the following definitions are provided:

Bulk cargo--cargo which can be carried by any military or civilian transport aircraft.

Oversize cargo--large cargo which can only be carried by the C-5, C-141, or wide-body civilian aircraft such as the 747, DC-10, L-1011 and A-300.

Outsize cargo--cargo of such extreme size or weight that it can only be airlifted by the C-5. (30:241)

SECTION II

CURRENT AIRLIFT CAPABILITIES

Between January 1946 and October 1975 the United States was involved in 215 incidents, around the globe, in which armed force was used as a political means. (42:22)

Intervention in another nations problems, in the form of power projection, is an instrument of foreign policy that has been used more frequently by big power nations such as the United States and the Soviet Union. In the current East vs. West stalemate there is little danger of a major confrontation over U.S. interests in Europe or Soviet concerns over Eastern Europe. The place where the real danger lies is in the so-called Third World. Here a demonstrated U.S. capability and will to use our projection force would serve as a deterrent to Soviet expansion. (39:4)

Force projection is, however, still a very controversial doctrine within the public sector of the United States. The fact remains that the U.S. has frequently used this ability when our national interests were at stake. Throughout, the

United States airlift capability has played a key role in the effectiveness of our power projection.

The U.S. airlift capability has steadily increased from the end of WW II to today. This capability has been a major element in some of the U.S. interventions but was dramatized best in the Berlin Airlift and the 1973 Middle East War.

Significantly, neither of these cases involved the actual introduction of American troops into the area. Instead airlift was used as a pipeline for vital supplies to the peoples involved. In these cases airlift alone prevented the collapse of a pro-Western area due to external pressure.

Berlin was under economic pressure while Israel suffered both economic and military pressures. Airlift proved to be particularly well suited for supplying relief to these areas.

Airlift has played prominent roles in other force projections. The Dominican Republic saw airlift as the prime mover of U.S. ground forces in a quick deployment. This, however, was due primarily to our close proximity to the Caribbean area.

During the Vietnam War the Military Airlift Command was used to deploy most of the personnel

and a great deal of the high-value cargo needed during the course of the war. The 1973 Middle East War brought into focus the constraints that could be placed against U.S. force projection. Airlift was forced to act in spite of restrictions placed on us by our allies. (26:37) Those restrictions had a significant impact and greatly enhanced the future airlift capabilities of the U.S. in projecting our force into an overseas area.

From the lessons learned in the 1973 war the Military Airlift Command determined and documented the need for airlift aircraft to be air refuelable. MAC also documented the need for a stretch version of the C-141.

The current and projected mid-term organic airlift capabilities for MAC come from the C-5, C-141, C-130 and CRAF aircraft. Appendix A illustrates the current military airlift requirements.

Outsize cargo transportation is handled by the C-5, oversize and bulk cargo is carried by the C-141 and C-130's. Civil Reserve Air Fleet (CRAF) cargo capability is limited since most are passenger aircraft and cargo is loaded in under-belly compartments. Floor strength on the main deck as well as door size are other limiting factors in civilian aircraft.

C-5

The C-5 provides 17 percent of the total airlift requirements and only 70% of the outsize needs. Appendix B shows this relationship. The aircraft serves as the backbone of strategic mobility since it is the only aircraft capable of deploying complete Army combat units. In addition the C-5's air refueling capability reduces the use of overseas refueling bases, increases the payload capacity and increases the outsize cargo capability by about four percent. This is explained in appendix C.

C-141

Currently the C-141 supplies 16.6% of the total NATO contingency airlift needs. It also provides 31% of the oversize requirements. Appendix B graphically shows the breakdown of aircraft capability.

C-130

The C-130 accounts for only 4.2% of the total airlift needs and 8% of the oversize requirements as shown in appendix B. Because the Army equipment is rapidly becoming too big for the aircraft the C-130 fleet is projected to be slowly replaced by the AMST.

CRAF

The CRAF provides over 50% of the United States

cargo and passenger airlift capability.

Current Department of Defense strategic airlift requirements show the need for the movement of 370,000 tons of cargo, men and equipment to Europe within a 30 day period. Today's capability of 180,000 tons falls far short of this requirement. Force structuring shows 70 C-5's, 234 C-141's and 234 C-130's in the MAC inventory. Additionally the CRAF adds 81 747's, 7 DC-10's and 129 707's and DC-8's. (37:19)

Long range airlift aircraft and their capability are shown in appendix D while average cargo payloads for strategic airlift aircraft appear in appendix E. Appendix F graphically shows the strategic airlift capabilities based on aircraft and projected into the next century. The need for the C-XX concept aircraft can be seen easily on this chart.

To counter the massive Soviet buildup in Eastern Europe, NATO must rely on the United States to deploy reinforcements of tactical aircraft, tanks and other weapons by air and sea over 3500 miles.

As mentioned earlier, equipment, men and supplies needed to be airlifted to Europe in case of a NATO conflict totals approximately 370,000 tons. U.S.

airlift today can provide only 180,000 tons of total air movement within the first 30 days. This shortfall could increase even further if contingency plans time frames were condensed or if deployment plans were increased.

The airlift of troops is not the shortfall problem. Cargo airlift is the biggest problem faced by our airlift community today. A full scale mobilization would require complete use of all the civil fleet and all of the MAC aircraft. Even this huge effort still wouldn't meet the demand.

Total airlift requirements show a breakdown of 23% bulk cargo, 24% outsize and 53% oversize cargo. As shown in appendix B CRAF Stage III has the capacity to move all of the bulk cargo. However there is a significant shortfall in the ability to move oversize and outsize cargo.

This, then, is the problem that the United States must overcome. Our strategic airlift forces must be changed, reshaped and reordered to meet the growing airlift deficit.

SECTION III

OVERCOMING THE AIRLIFT DEFICIT

In an effort to overcome the airlift shortfall, the United States has designed the Airlift Enhancement Program. Included in this program is the C-5 wing modification, the C-141 stretch/air refueling modification, ATCA, the AMST, and the inclusion of heavy floors and cargo doors in the Civil Reserve Air Fleet. The enhancement program is, however, only designed to be a short to mid-term improvement measure.

C-5 Wing Modification

To achieve its full potential of 30,000 flying hours the C-5 will undergo an extensive wing modification. Although the C-5 wing modification does not directly increase the airlift capability of the United States, it does preserve our present ability to airlift the large, outsize equipment currently in the Army inventory. The C-5 is the only aircraft today that can airlift all the Army equipment. The large, bulky, tracked vehicles today represent about 60% of the weight associated with today's "heavy" Armor and Mechanized Army divisions. (32:228)

Without the C-5 in our strategic airlift inventory the U.S. would not be able to rapidly deploy the men and oversize/outsize cargo needed by the Army combined arms force.

C-141 Stretch/Air Refueling Modification

Modification of the C-141 includes lengthening the aircraft by 280 inches and adding an air refueling capability. The new C-141B would increase its capacity by 30% and have a 13 pallet capacity instead of the current 10 pallet load. This modification would bring about two benefits. First, it would allow more cargo to be carried because the current aircraft traditionally bulks out before reaching its maximum weight. Second, inflight refueling capability will allow worldwide response capability without dependence on foreign base support.

Stretching the C-141 will allow a 30 day airlift tonnage increase to Europe of approximately 16,500 tons. (45:16) This increased capability is equivilent to buying 90 additional C-141's. By stretching the C-141 a greater load carrying capacity is achieved without any large increase in operating expense or manning costs usually associated with the purchase of new aircraft. As illustrated in appendix C the stretch modification increases the

total airlift capability by 4.4%. The addition of air refueling gains another 4% in cargo moving capability.

Advanced Tanker/Cargo Aircraft (ATCA)

Contracts have been let to buy the off-the-shelf wide-body DC-10 for use in the dual tanker/cargo role. The new ATCA has a variety of capabilities for use in airlift mobility. Besides refueling other airlift aircraft it can deploy a tactical fighter squadron by supplying the enroute refueling and carrying the necessary squadron deployment equipment at the same time.

Used in a strictly tanker role the KC-10 will be used for enroute refueling for the employment of fighter aircraft into a war theater and for refueling the return flights of airlift aircraft from the theater.

While the KC-10 can carry oversize cargo, the projected purchase of only 20 aircraft will not be significant enough to fill any oversize shortfall in a NATO war scenario.

Advanced Medium Short-Takeoff/Landing Transport (AMST)

While the AMST is being developed as a tactical airlifter, it has the built-in capability to be employed in a long-range strategic airlift role

since it will be air refuelable. The AMST offers several advantages over the current C-130. Besides being air refuelable, the AMST will be faster, carry more and larger types of cargo, including some of the outsize cargo, and take off and land on shorter runways. The latter will prove particularly important when the aircraft is used in developing countries where the availability of major airports is limited. The increased capabilities of the AMST would give our national leaders better and more flexible control of U.S. power projection capability.

Although not specifically included in the airlift enhancement program, the AMST could increase our strategic airlift capability significantly. Using 234 AMST's during the first 20 days of a NATO deployment, the increase in airlift capacity would be over 50,000 tons of equipment. (25:23)

Civil Reserve Air Fleet (CRAF)

Today a large percentage of the strategic airlift capability is obtained from the CRAF. Currently the long-range portion of CRAF consists of 231 aircraft capable of a European deployment. Cargo aircraft include 34 707's, 65 DC-8's, 21 747's and 13 DC-10's. (27:1) Of these aircraft none can carry outsize cargo. The 747's can carry 86% of the Army's

oversize equipment and the DC-10's can carry 64% of the oversize. The 707's and DC-8's carry bulk cargo only. (31:742) The civilian segment of our total airlift capability comprises about 40% of the total U.S. strategic airlift potential. (33:57)

A combined allied effort in providing the strategic airlift necessary to meet the huge requirements for reinforcing NATO would be much more effective than a unilateral U.S. effort. The airlift shortfall could be virtually eliminated if our NATO allies would modify the civilian wide-body aircraft now in their fleets and make them available for CRAF use. (35:19)

Today there are more than 100 747's and over 50 DC-10's in the various airlines of the NATO countries (17:1003) Negotiations must advance with our allies with the goal of establishing a NATO CRAF program and integrating these forces with those of the U.S. in the event of a European war.

Formation of a NATO CRAF could gain the same advantages as the U.S. CRAF, that is a large number of aircraft and crews available on short notice. Additionally, these aircraft could use civilian airfields, maintenance and cargo facilities to augment

the military system. An equally important facet of setting up a NATO CRAF would be as a signal to the Warsaw Pact of NATO's preparation for defense.

To help decrease the current airlift shortfall there is a proposal to increase the cargo carrying capability of the wide-body CRAF participants. The performance characteristics of these aircraft permit the moving of heavy payloads over long distances very economically. A 747, for example, has the capability to haul a 200,000 pound payload from the East coast of the U.S. to Western Europe, offload and return without refueling. Before we can take full advantage of this airlift potential though some modifications must be made to the aircraft.

Because these aircraft were designed primarily to carry passengers, the doors are too small and floors not strong enough to accomodate the large vehicles in the Army today. To eliminate these weaknesses and capitalize on the potential of these efficient wide-bodies, the DOD has proposed modifications to reinforce the existing floor structures and to install a large cargo door on the side of the aircraft.

To date the airlines have made more than 80 aircraft available for the modicication. (14:54)

The increase in cargo lifting capability, because of this modification, is impressive. The full modification of 81 wide-body civil airliners would create an additional 91,000 ton increase in cargo airlift over the 30 day period of our initial support of a NATO contingency. (25:7)

SECTION IV

FUTURE TRENDS

The capabilities of civilian and military airlift aircraft today shows a large imbalance. The military has many aircraft but its ability to respond to an emergency lags because of constraints imposed by decreased funding. The civil side, to be managed at the peak of efficiency, maintains only enough capability to support their current operations. The additional aircraft, crews and support equipment are layed off or sold to maintain the desired efficiency level.

Civilian airlines are largely geared toward passenger movement rather than cargo hauling. The civil sector has fewer aircraft and relatively more personnel while the military situation is just the opposite. But in either case the result is the same, they both lack the ability to expand rapidly in cargo airlift capability.

Because of the huge costs of developing a new civil or military aircraft it's vital that both segments cooperate in the development of the next

generation of large cargo aircraft. This aircraft will have to be designed specifically to have a commonality in spare parts, support equipment and operation. This concept, the C-XX concept, will be a carrier-owned, freight configured aircraft capable of airlifting outsize, bulk and oversize cargo economically.

Strategic airlift must be viewed as a cooperation between the military and civilian sectors. This cooperation is a must if economies are to be seen in air cargo movement. If the C-XX concept is successful the resulting aircraft would be produced in large volume, leading directly to lower aircraft prices and lower prices charged by the airlines with increased traffic.

Such an arrangement could save as much as half of what is currently being spent in training and operating military aircraft while doubling the national airlift capability. (28:19) Other benefits to the military would be the ability to buy the next airlifter at a lower cost plus both civilian and military would be operating essentially the same aircraft in case of emergency CRAF requirements.

In conclusion it appears that both the military and the civilian airlines are working at or near

the top end of their capabilities, though for vastly different reasons. Cooperation by the two parties would take advantage of the ecomomy possible in the joint development and purchase of a new cargo aircraft. It would eliminate the duplication and expense that exist in today's operation. An added plus is civil/military cooperation in this area would help formulate a national strategic airlift policy.

SECTION V

AIRLIFT AIRCRAFT INTO 2000

In order for the U.S. to meet the ever increasing airlift requirements a totally new generation of cargo aircraft must be designed, built and put into use. These new airlifters should not be converted passenger aircraft but be designed soley for both civilian and military cargo missions.

Five years ago MAC released the requirements for future airlifter development. The design concept, C-XX, would increase national airlift capabilities and be fully interoperable when used in its CRAF role. The C-XX desired and required military characteristics are shown in appendix G.

Several design studies have been prepared by major aircraft manufacturers based on the C-XX concept and requirements. Following are explainations of each design.

Spanloaders

While no major breakthroughs on the technologcial front are necessary, aircraft designers feel that a quantum change is coming to the airlifters of the future. One of the most talked about designs is that

of an enormous flying wing. Based on the theory that , by balancing the lift forces in the area where they are applied, the structural weight needed to get the lift to the fuselage would be reduced significantly.

The McDonnell-Douglas study, appendix H, shows a spanloader of 40 degree wing sweep with twin outboard empennages. Maximum gross weight of this aircraft is 1.2 million pounds with a payload of 600,000 pounds over a 3000 nautical mile range. McDonnell-Douglas feels no major new technology is needed to build this aircraft but some areas such as winglets, airfoil design and structural material need refinement.

The Lockheed entry, appendix I, is a six turbofan design that employs a supercritical airfoil and reduces operating weight by 46%. This type could carry twice the fuel and fly three times further than current wide-body aircraft. This design would cruise at Mach .75 at 35,000 feet and have a 1.5 million pound takeoff weight. It would accomodate two side-by-side rows of containers and carry a payload of 660,000 pounds over a 3300 nm range.

Growth versions of the Lockheed design have been envisioned and one version is twice the size

of the basic aircraft. This aircraft would have a takeoff weight of 4.8 million pounds and carry a 2.5 million pound payload over a 5000 nm range.

The Boeing version of the spanloader, appendix J, has a wing span of 417 feet and is powered by eight turbofan engines. This 2.0 million pound aircraft would cruise at Mach .79 and carry a 600,000 pound load over a range of 3500 nautical miles.

Megalifter

One of the most interesting designs put forth for future cargo aircraft is a semibuoyant, wing-augmented hybrid known as the Megalifter, see appendix K. Proposed by NASA's Ames Research Center, this aircraft combines some features from an airship, conventional winged aircraft and of a lifting body.

Just in terms of size the Megalifter is incredible. Length of the lifting body style fuselage is 650 feet and the wing span is 530 feet. The ship stands 145 feet high. Power will come from four advanced turbofan engines. Maximum payload would be in the 400,000 pound range. Design cruise speed is 180 knots at 18,000 feet.

Lockheed C-XX

During the C-XX study Lockheed arrived at a

more conventional design aircraft that still met the criteria, see appendix L. Thisdesign uses a super-critical wing technology, graphite epoxy composite materials and a smaller empennage. This aircraft is designed to carry a 330,000 pound load over a 3500 nm range at Mach .85. The cargo compartment is designed to carry 3 main battle tanks, 12 standard 40 foot commercial containers or 51 military 463L pallets. (43:10).

NationBuilder

McDonnell-Douglas is currently studying a single fuselage, three lane wide,conventional aircraft.(see appendix M) It's designed around todays outsize cargo requirements and could handle three main battle tanks. This aircraft has a design gross weight of just over 1 million pounds and could carry a 340,000 pound payload over 3700 nautical miles.

These, then, are the design proposals put forth for the airlift aircraft of the future. There is no lack of ideas or technology but the huge investment needed will require civil and military cooperation in the end product. It will be the new airlifter that is the long-term answer to the strategic airlift shortfall.

SECTION VI

CONCLUSIONS

This paper ~~has attempted to~~ defines current United States airlift capabilities and highlights the shortfall in our total airlift capability. Several short to mid-term solutions ~~were~~ are brought out, including the C-5 wing modification, C-141 stretch and air refueling modification, addition of the ~~AMST~~ Advanced Medium Short-Takeoff/Landing Transport to our airlift inventory and the modification of the aircraft in the ~~CRAF~~ Civil Reserve Air Fleet.

While these proposals do help to alleviate the large cargo hauling shortfall they are, at best, only short-term, stop-gap measures. The real answer is in long term solution of the total problem. This requires two major programs. First is the establishment of a NATO CRAF and second is the development of a civil/military cargo aircraft.

Because of the length of time needed to arrive at a mutually agreeable solution to a NATO CRAF the negotiations should begin in the near future. The many tough issues involved in these talks put this

solution in the long-term time frame. A combined effort, by all NATO allies, in the area of strategic airlift would not only be much more effictive, but would serve as a clear warning to the Warsaw Pact that we are not only willing, but prepared to do all that is necessary to protect our commitments in Europe.

Even with the short-term modifications of the current C-5 and C-141 fleets, these aircraft will need to be replaced in approximately 20 years. Because of this a program to develop the future cargo aircraft must be started soon. The enormous costs and long lead times required for the development of a new aircraft make a joint civil/military partnership the only viable solution. The end result of this consolidated effort is the development of a comprehensive and coordinated policy that outlines our national airlift goals and puts forth programs to meet these goals.

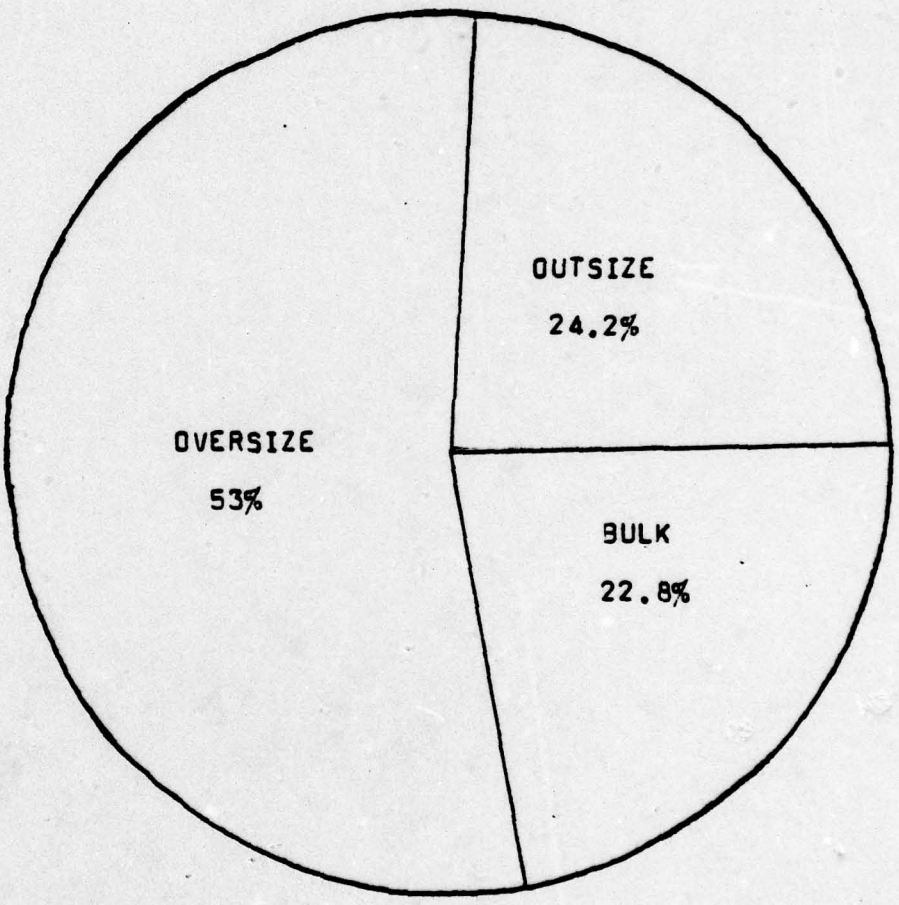
Efficient and rapidly responsive airlift is a national asset that we must be able to rely upon in time of war. Our current deficit in strategic cargo hauling has both long and short term solutions. As a nation we must strive to overcome this imbalance

in our airlift force posture. Improving our current force, modifying the CRAF and designing a totally new cargo aircraft are the only answers to our airlift deficit.

LIST OF APPENDIXES

APPENDIX A

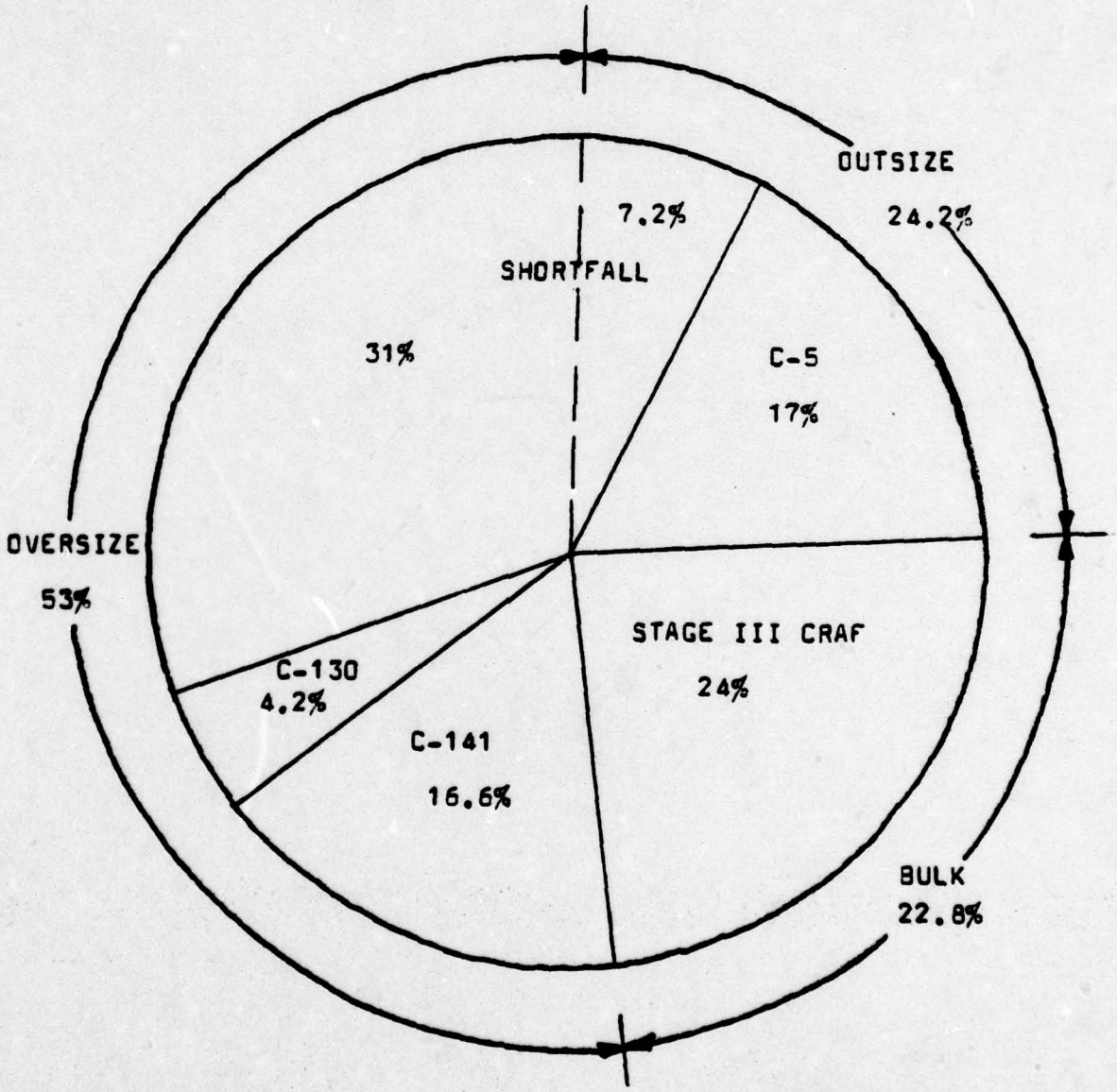
CURRENT MILITARY CARGO AIRLIFT REQUIREMENTS



Source: Report on Potential for Joint Air Cargo System Development, National Defense Transportation Association, April, 1977.

APPENDIX B

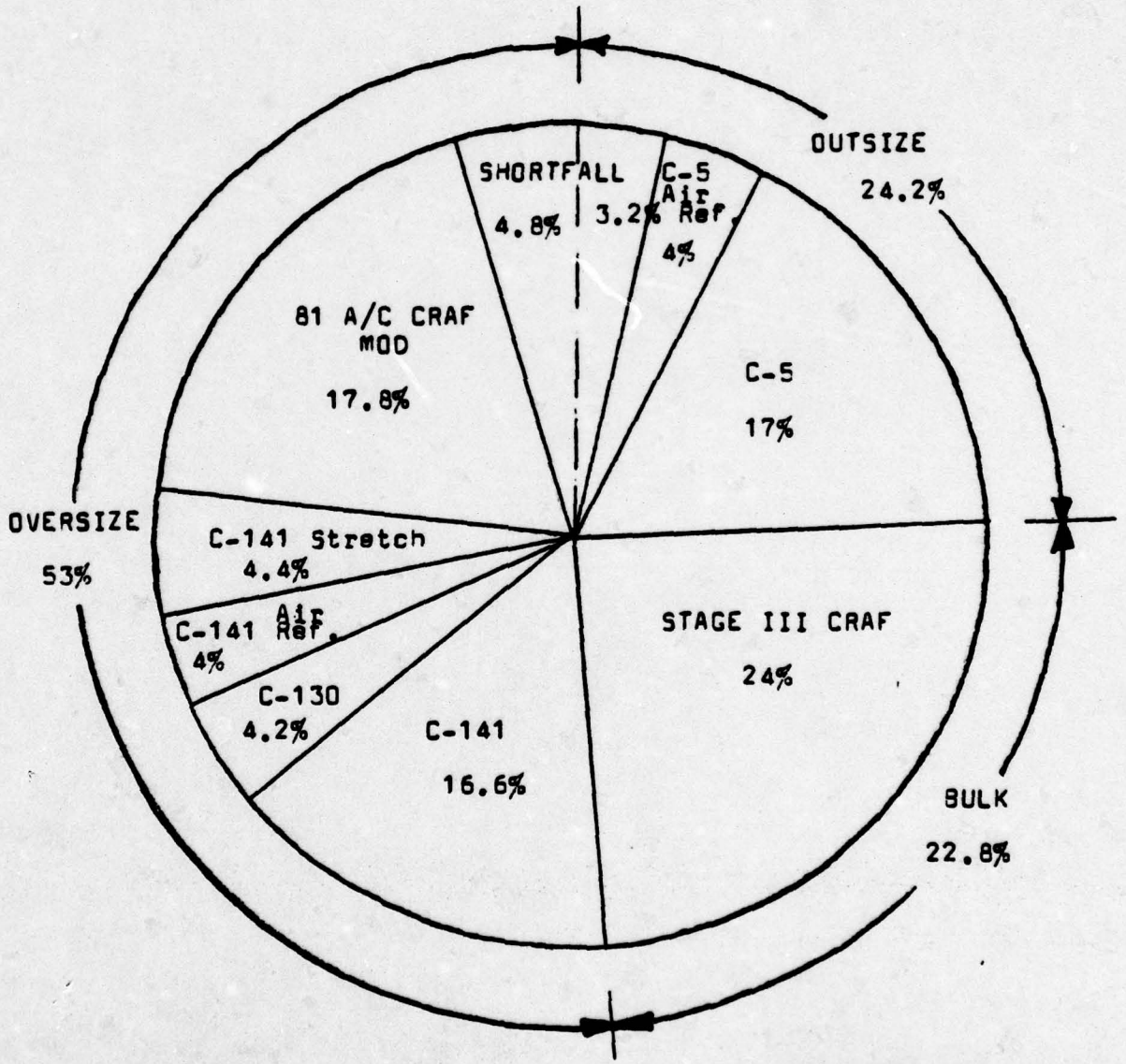
CURRENT AIRCRAFT CAPABILITY VS. MILITARY AIRLIFT NEEDS
(CARGO)



Source: National Defense Transportation Assoc., April,1977

APPENDIX C

CURRENT AIRCRAFT CAPABILITY WITH ENHANCEMENTS
VS. MILITARY AIRLIFT NEEDS (CARGO)



Source: National Defense Transportation Assoc, April,1977

APPENDIX D

LONG RANGE AIRLIFT AIRCRAFT andTHEIR CAPABILITY

Aircraft	Number	Daily Capability (million ton miles)
C-5	70	10.16
C-141	234	9.83
CRAF (Stage III)	131**	13.59**
C-130	488***	Variable

** Includes 29 747's and DC-10's for oversize. Remaining aircraft are 707's and DC-8's for bulk cargo.

*** Includes 234 active and 254 reserve/national guard aircraft.

Source: U.S. Congress, Committee on Armed Services, 94th Congress, 1st Session, 1975

APPENDIX E

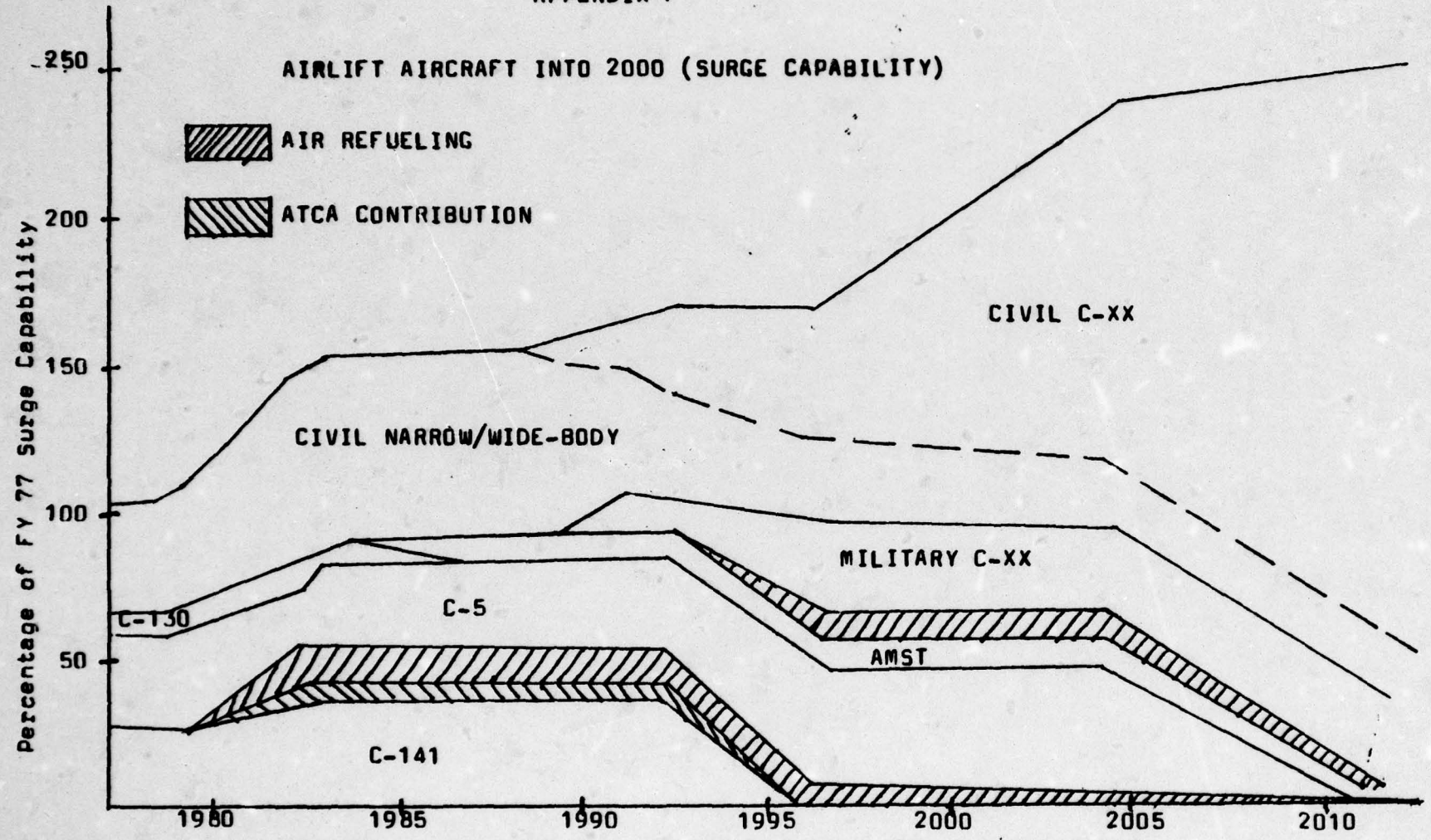
STRATEGIC AIRLIFT AIRCRAFT AVERAGE CARGO PAYLOADS (short tons)

Type Cargo	C-141	C-5	747 Freighter
Infantry Division	18.0	77.7	88.7
Airborne Division	13.9	54.6	76.9
Armor Division	22.0	88.0	91.9
Mechanized Division	22.0	87.8	96.3
Airmobile Division	12.9	30.1	79.3

*Based on critical leg of 3500 nautical miles

Source: Air Force Regulation 76-2, April 11, 1975

APPENDIX F



Source: The Need For A Civil-Military Airlift Partnership, HqMAC, DCS/ Plans, March, 1977.

APPENDIX G

FIGURE 4
C-XX MILITARY CHARACTERISTICS

Characteristics	Required	Desired
Performance		
Range	Intercontinental*	3,500 mi. +
In-Flight Refueling	No	Yes
Payload	110,000 lbs.	220,000 - 330,000 lbs.
Speed	No Limit	.85 Mach +
Altitude	No Limit	30,000 - 40,000 ft.
Takeoff/Landing Distance	10,000 ft.	Under 10,000 ft.
Structural		
Pressurization of Cargo Compartment	No, if operating below 18,000 ft.	Yes, if operating above 18,000 ft.
Outsize Cargo Capability (AFM 76-2)	Yes*	
Floor Strength	2,000 lbs./Linear ft.**	5,000 lbs./Linear ft. (M-60 Capability)***
Front/Rear Aperture & Ramp†	No	Yes
Integral Loading System†	No	Yes
Truck-Bed Height†	No	Yes
Cargo-Handling Capability		
463L System Pallets	Yes	
Rail/Roller System	No	Yes
Mechanized Floor	No	Yes
Overhead Crane	No	Yes
Floor Loading Provisions††	Yes	
FAA/FAR Restraint Criteria	Yes	
Containerized Cargo	Yes (8' x 8' x 20')	8' x 8' x 40' or Longer
Bulk Fuel/Tanker Capability	No	Yes
Avionics		
Navigation/Communications Equipment for Intercontinental Flights	Yes†††	
Mark XII SIF/IFF	Yes†††	
Category II or Better Landing System	No	Yes
In-Flight Crash Avoidance System	No	Yes
Support Compatibility		
Spares Commonality with Military Stock	No	Yes
Ground Refueling	Yes	
Compatibility with Ground Support Equipment	Yes	

*Essential.

**Plus axle loading for vehicles currently moved by C-141.

***60 tank capability desired to include axle loading of 20,000 lbs.

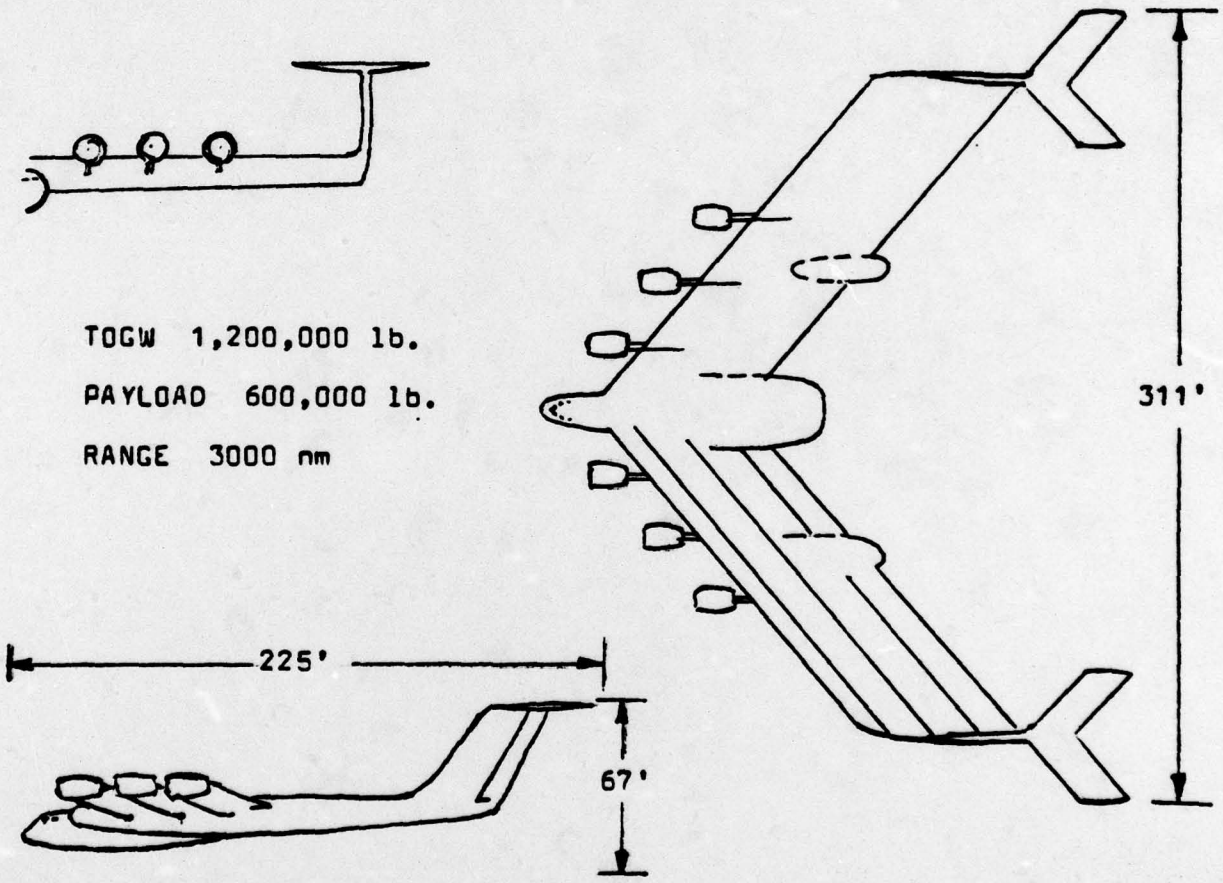
†Not mutually exclusive, but at least one is required.

††Floor must accommodate nonpalletized vehicles and include adequate tie-down points.

†††Not permanently installed, need hard points for later installation.

APPENDIX H

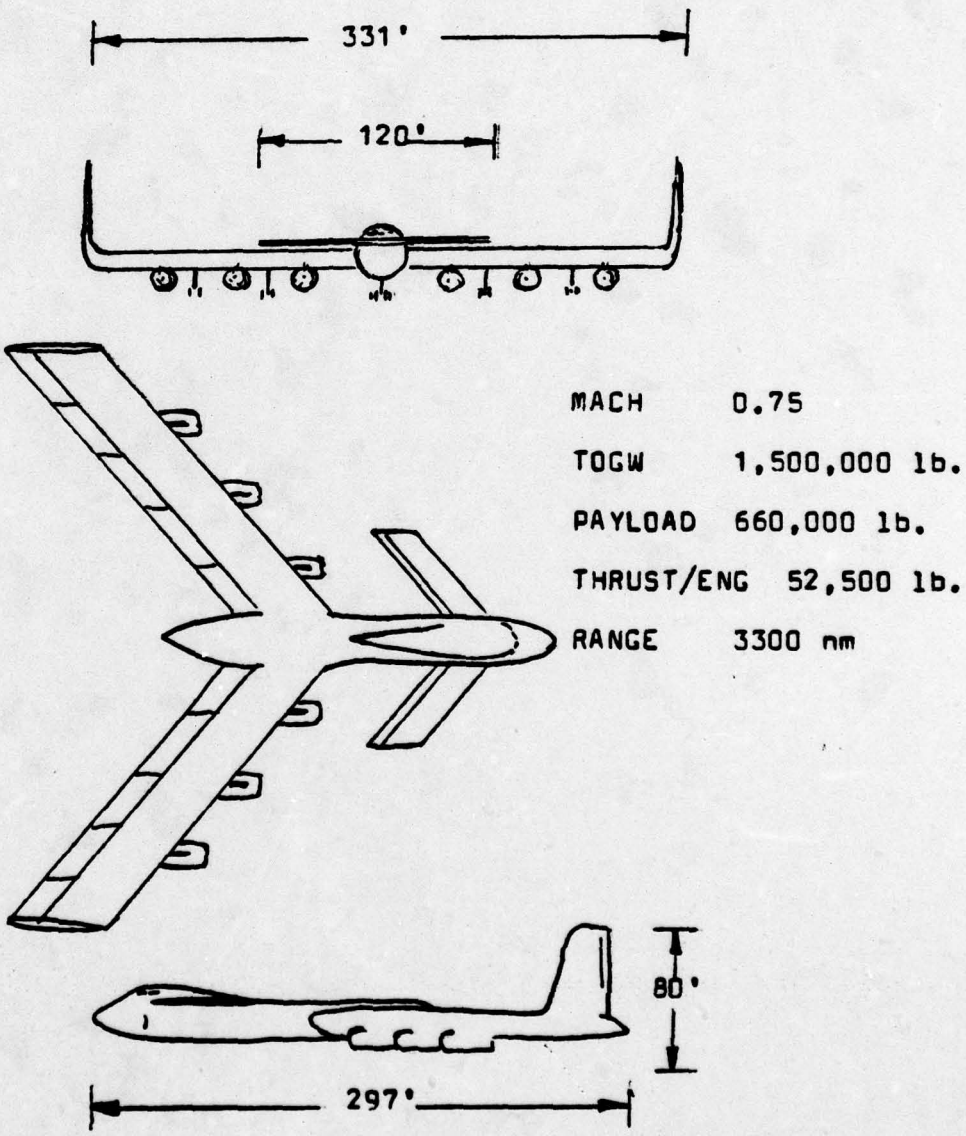
McDONNELL-DOUGLAS SPANLOADER



Source: Technical and Economic Assessment of Spanload Cargo Aircraft Concepts, McDonnell-Douglas Corp.

APPENDIX I

LOCKHEED SPANLOADER

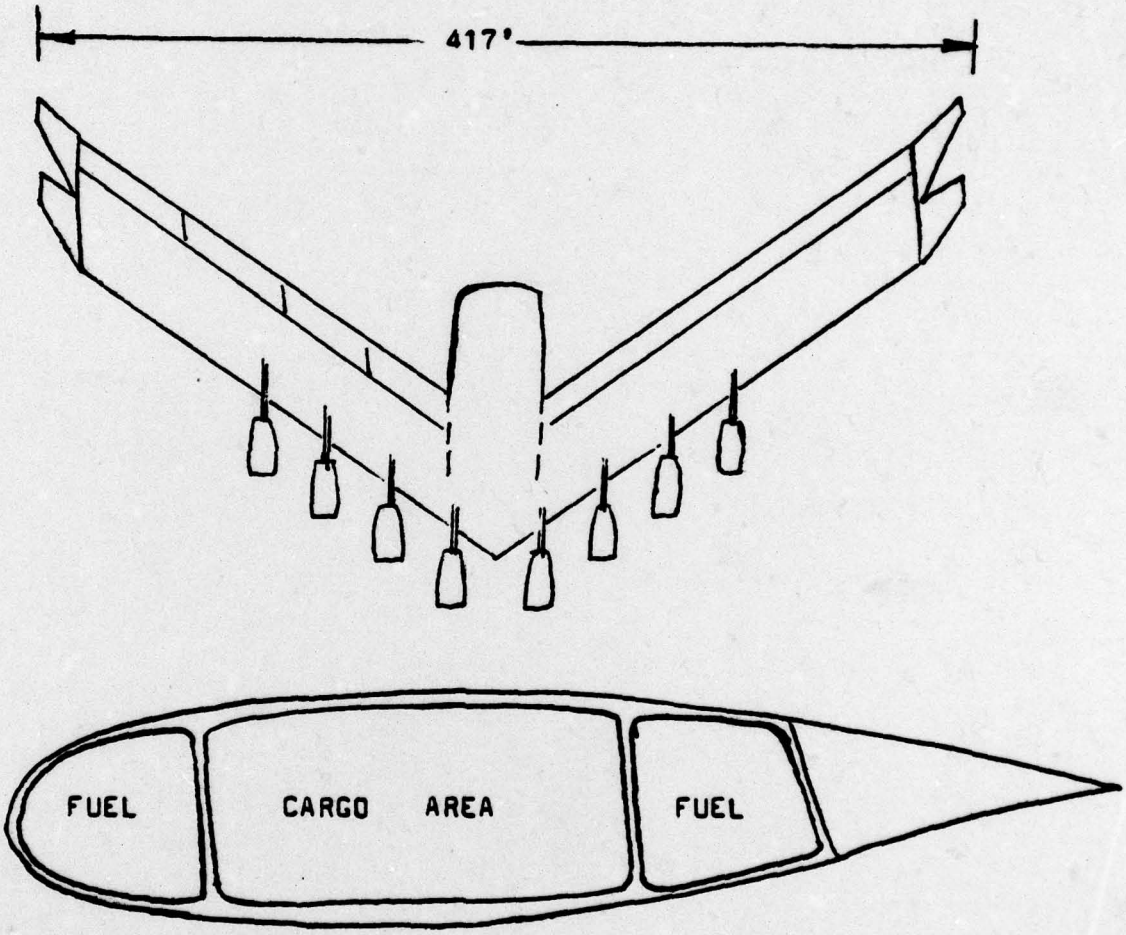


MACH	0.75
TOGW	1,500,000 lb.
PAYLOAD	660,000 lb.
THRUST/ENG	52,500 lb.
RANGE	3300 nm

Source: Technical and Economic Assessment of Span-Distributed Loading Cargo Aircraft Concepts, Lockheed Corporation

APPENDIX J

BOEING SPANLOADER



MACH 0.79

TOGW 2,000,000 lb.

PAYLOAD 600,000 lb.

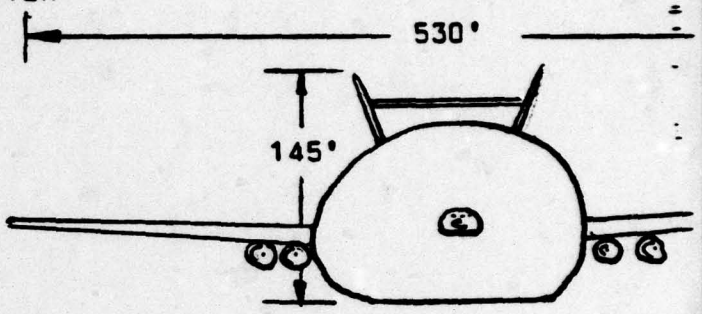
THRUST/ENG 65,000 lb.

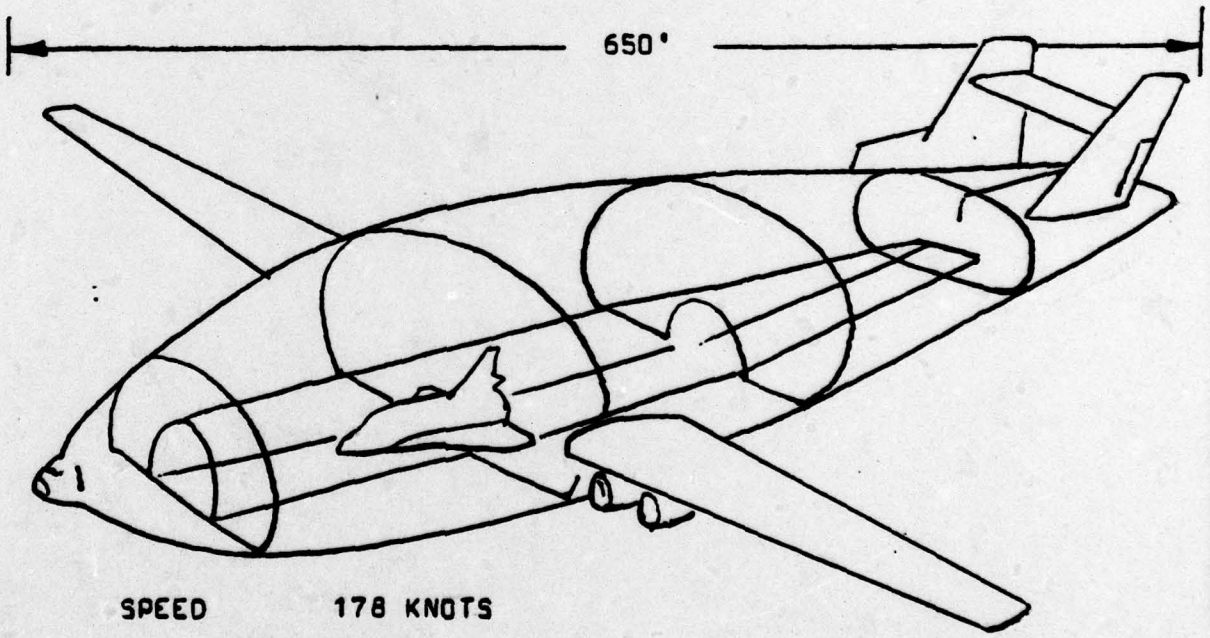
RANGE 3500 nm

Source: Boeing Company Mid Term Oral Report on Span Loading Aircraft.

APPENDIX K

MEGALIFTER



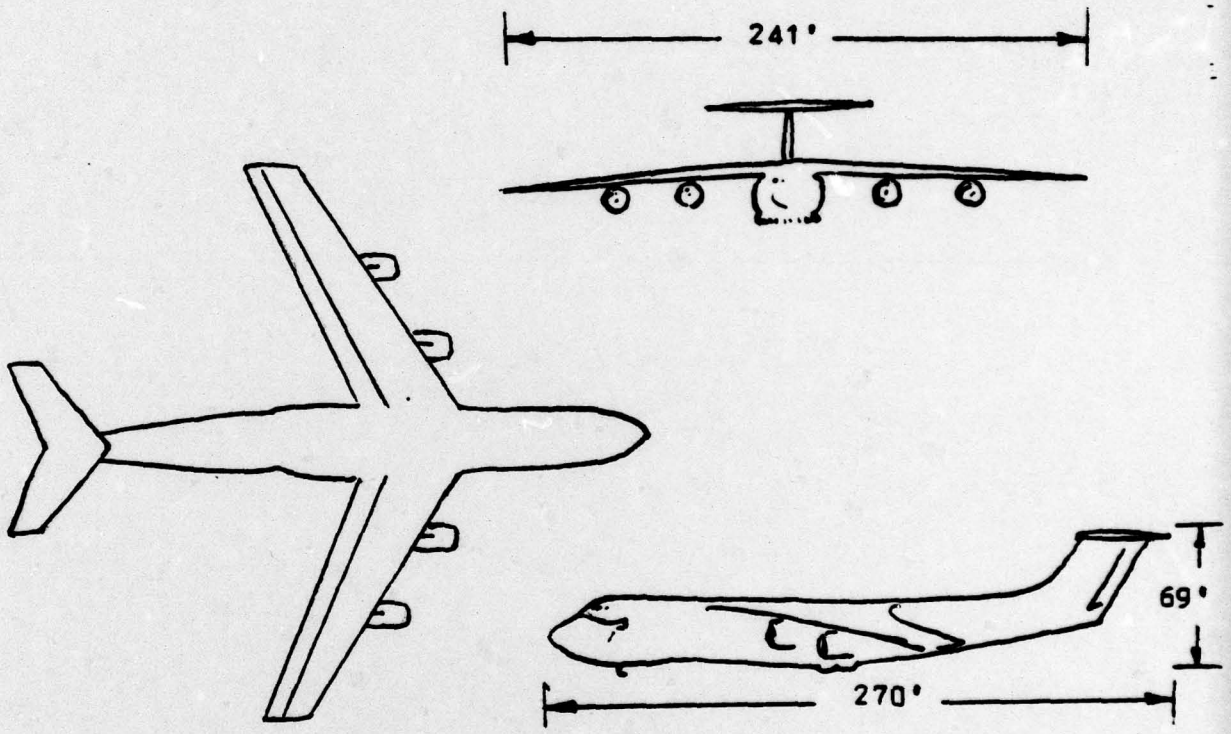


SPEED	178 KNOTS
TOGW (BUOYANCY)	478,000 lb.
PAYLOAD	400,000 lb.
THRUST/ENG	41,000 lb.
RANGE	10,000 nm

Source: Aviation Week and Space Technology, July 29, 1974, p.49

APPENDIX L

LOCKHEED C-XX

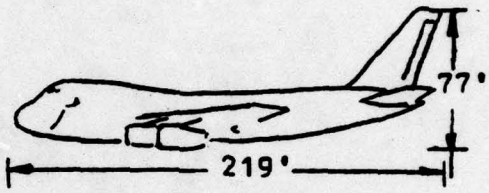


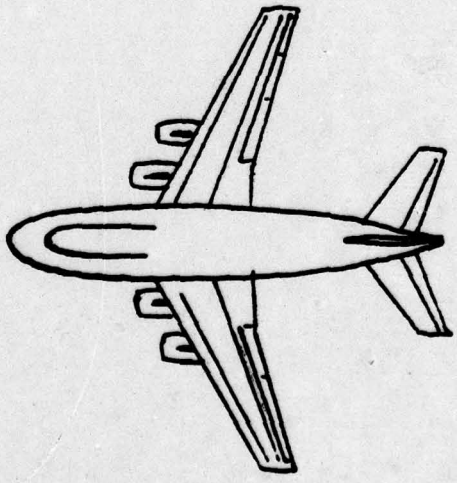
MACH	0.85
TOGW	922,620 lb.
FUEL	241,920 lb.
THRUST/ENG	57,990 lb.
PAYLOAD	330,000 lb.
RANGE	3500 nm

Source: Airlift...Future Requirements and Options, Lockheed-Georgia Company

APPENDIX M

McDONNELL-DOUGLAS NATION BUILDER





MACH	0.80
TOGW	1,015,000 lb.
THRUST/ENG	63,500 lb.
PAYLOAD	340,000 lb.
RANGE	3700nm

Source: The McDonnell Douglas Family of Jet Transports, McDonnell-Douglas Corporation

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