



**C-5 the Versatile Giant**

# **Tomorrow's Airlifters Today**

**Lockheed-Georgia Company**

## **A National Asset**

Conceived by the United States Air Force as a necessary and valuable instrument of free world global defense strategy, this magnificent machine, the C-5A Galaxy, represents a substantial financial investment by the United States Government, the Lockheed Aircraft Corporation, and many other members of the U.S. aerospace industry. With its unmatched, operationally proven, cargo airlift capabilities and remarkable alternate mission versatility, including the in-flight launch of intercontinental ballistic missiles, it is truly a national asset of substantial proportions.

A very large part of the investment in the Galaxy is associated with the research, design, development, tooling, testing, and other enormous non-recurring costs which must precede the production of any new large aircraft or the major modification of existing large aircraft. This investment can provide substantial dividends as additional U.S. or other free world needs arise for such a well-proven, capable, and versatile giant.









## **Airlift Center of the World**

The C-5A Galaxy came from a long heritage of proven cargo airlift technology and manufacturing know-how, and as such, properly came into being at the Airlift Center of the World, the Lockheed-Georgia/Air Force Plant 6 facility near Marietta, Georgia.

From its inception, this huge facility, one of the largest aerospace industrial complexes in the world, has been developed to manufacture large airplanes; most recently, the largest in the world, the Galaxy. Over 200 buildings provide seven million square feet of space for research, design, development, testing, manufacturing, and associated support activities for both military and civil aerospace products.

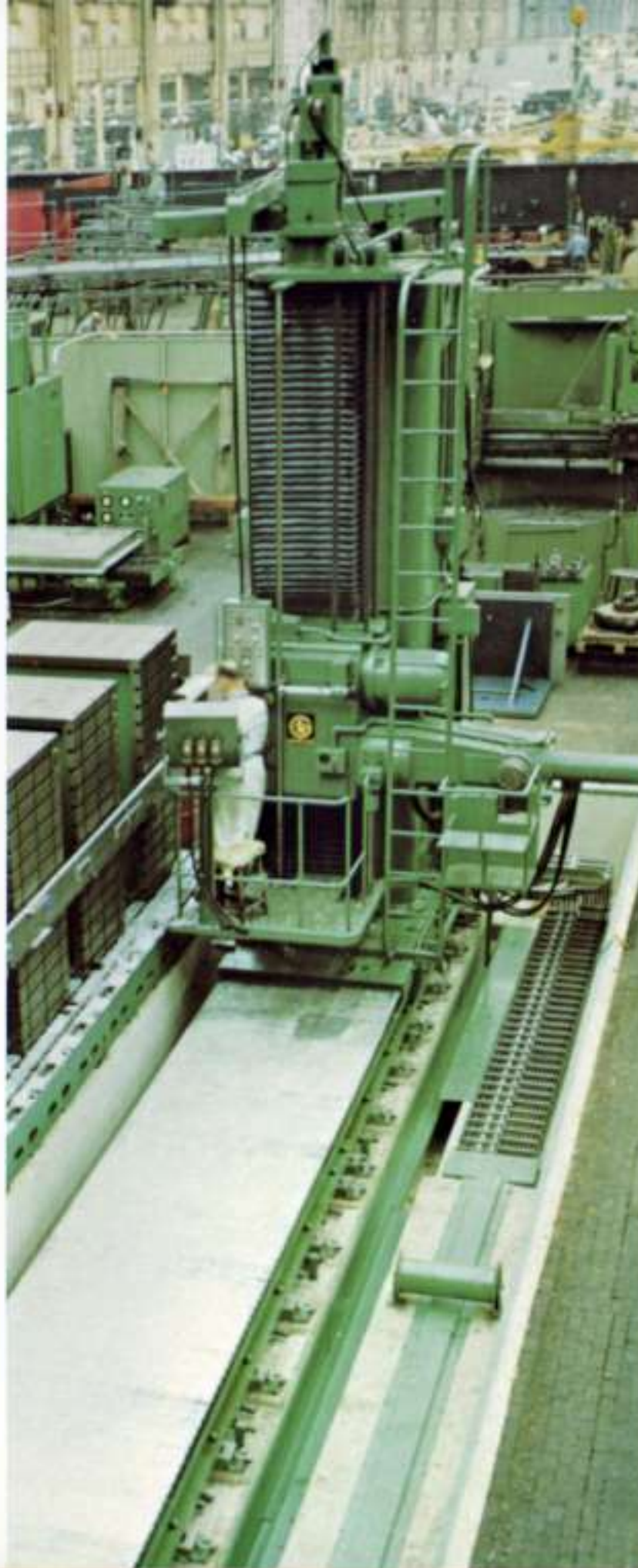
The main manufacturing building, over a thousand feet wide and two thousand feet long, can accommodate several large aircraft assembly lines simultaneously, and for most of the last two decades, it has been doing just that, in producing the unmatched C-130 Hercules, C-141 StarLifters, and C-5A Galaxies for our Nation's military airlift force.

From this Airlift Center of the world have come all of the free-world's modern, long-range military cargo airlifters. It didn't just happen that way. There are reasons.









## Manufacturing

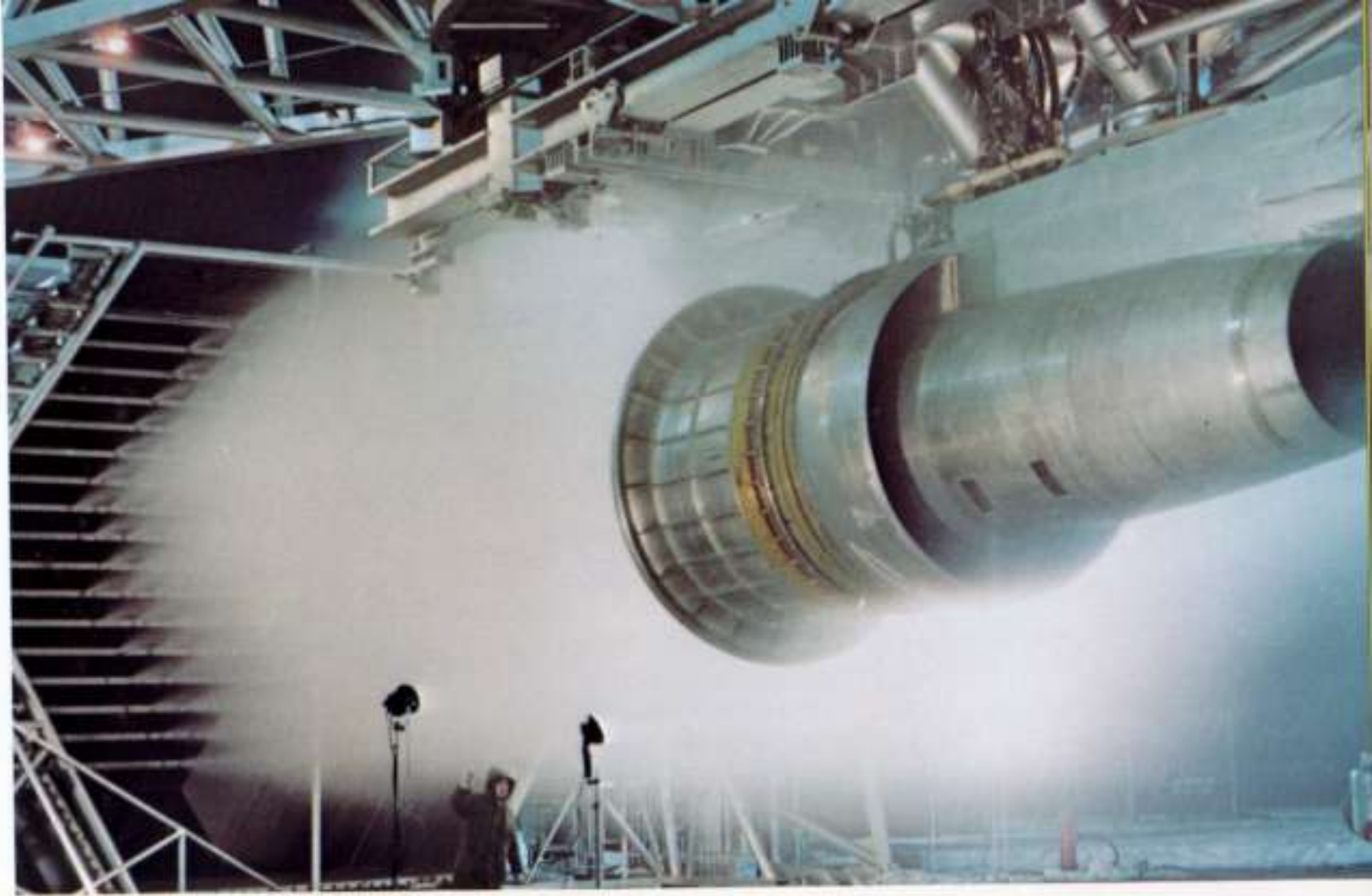
Lockheed-Georgia's industry leading cargo airlifter manufacturing capability is constantly maintained at the forefront of the state of the art through a vigorous program of manufacturing research closely allied with advanced technology engineering activities.

Completely equipped with all of the massive facilities and tools necessary for very large aircraft production, and exploiting the most advanced and proven tooling, fabrication, and assembly techniques, the Lockheed-Georgia manufacturing team has concentrated its ingenuity and energies into military cargo airlifters.



## Technology

Through continuing broad independent research and technology programs, directed at constantly improving the state of the art for cargo airlifters, the Lockheed-Georgia technology/engineering/design team maintains the highest degree of technological and design capability. It's the kind of capability that can come only with experience, and Lockheed-Georgia's experience in the field of cargo airlifters totals substantially more than that of the rest of the free world's aerospace industries combined.

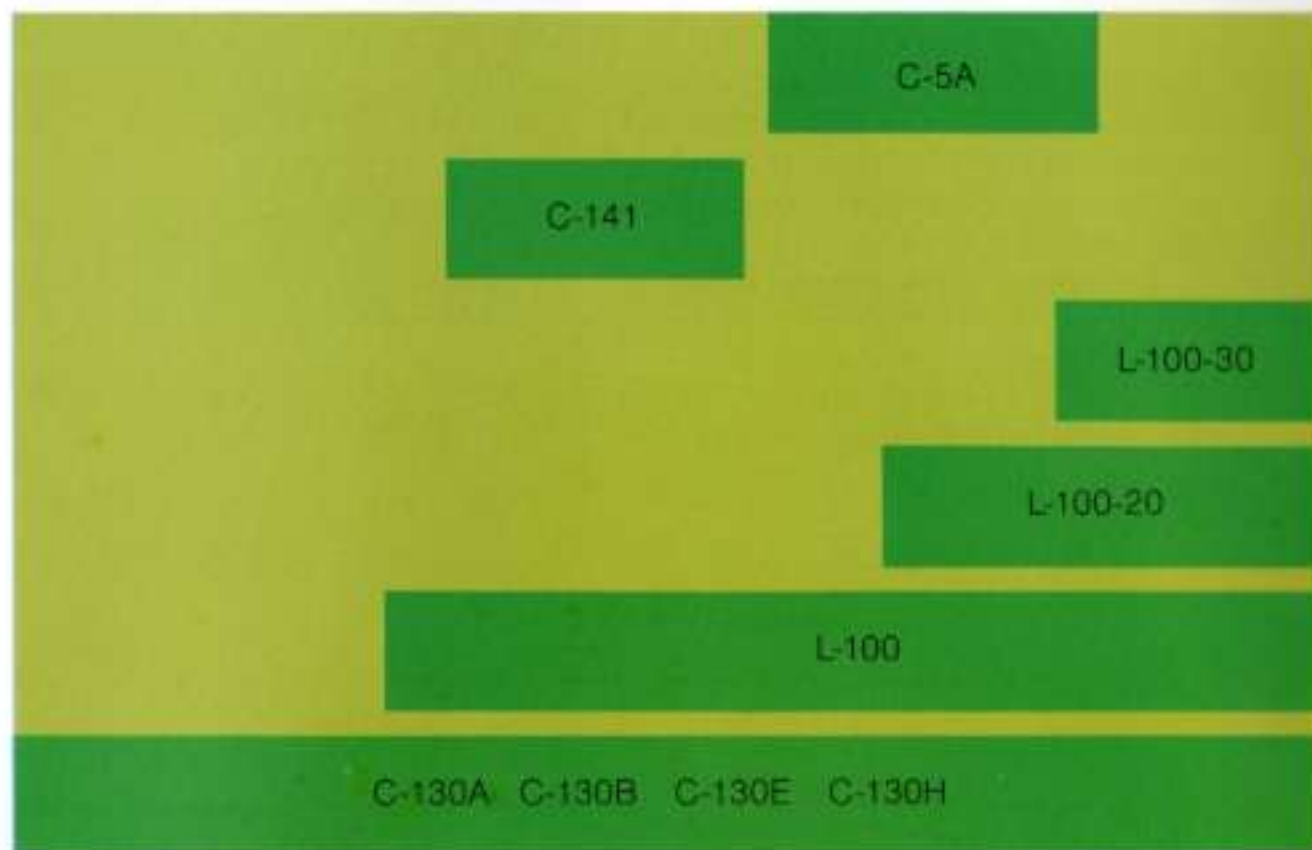




# Chronology

A chronicle of Lockheed's experience in manufacturing airlifters begins with initiation of the C-130A Hercules production program in 1953. Since then, for more than 20 years, Lockheed has been continuously engaged in the specialized research, design, development, test, manufacture, and support of cargo airlifters, often on several programs simultaneously.

All currently operational U.S. Air Force long-range cargo airlifters, and most of those operated by the rest of the free world nations, are Lockheed-Georgia designed, developed, tested, manufactured, and supported.





# World-Wide Recognition



United States  
Abu Dhabi  
Argentina  
Australia  
Belgium  
Brazil  
Canada  
Chile  
Colombia  
Denmark

Gabon  
Greece  
Indonesia  
Iran  
Israel  
Italy  
Jordan  
Kuwait  
Libya

Malaysia  
Morocco  
New Zealand  
Nigeria  
Norway  
Pakistan  
Peru  
Philippines  
Republic of Zaire

Saudi Arabia  
South Africa  
Spain  
Sweden  
Turkey  
United Kingdom  
Venezuela  
Vietnam  
Zambia



# C-130 Hercules





## C-130 Versatility

Lockheed-Georgia airlift know-how is perhaps best illustrated by the remarkable achievements and the unmatched versatility of the C-130 Hercules, first member of Lockheed's family of cargo airlifters. By 1975 over 1400 Hercules were purchased for the military or civil fleets of 37 nations, with over 1300 delivered to accumulate over nine million hours of flight time.

First of the true cargo airlifters, the Hercules helped develop Lockheed-Georgia's unmatched cargo airlifter expertise, and laid the groundwork for the versatility and flexibility ultimately built into all of Lockheed-Georgia's true cargo airlifters.









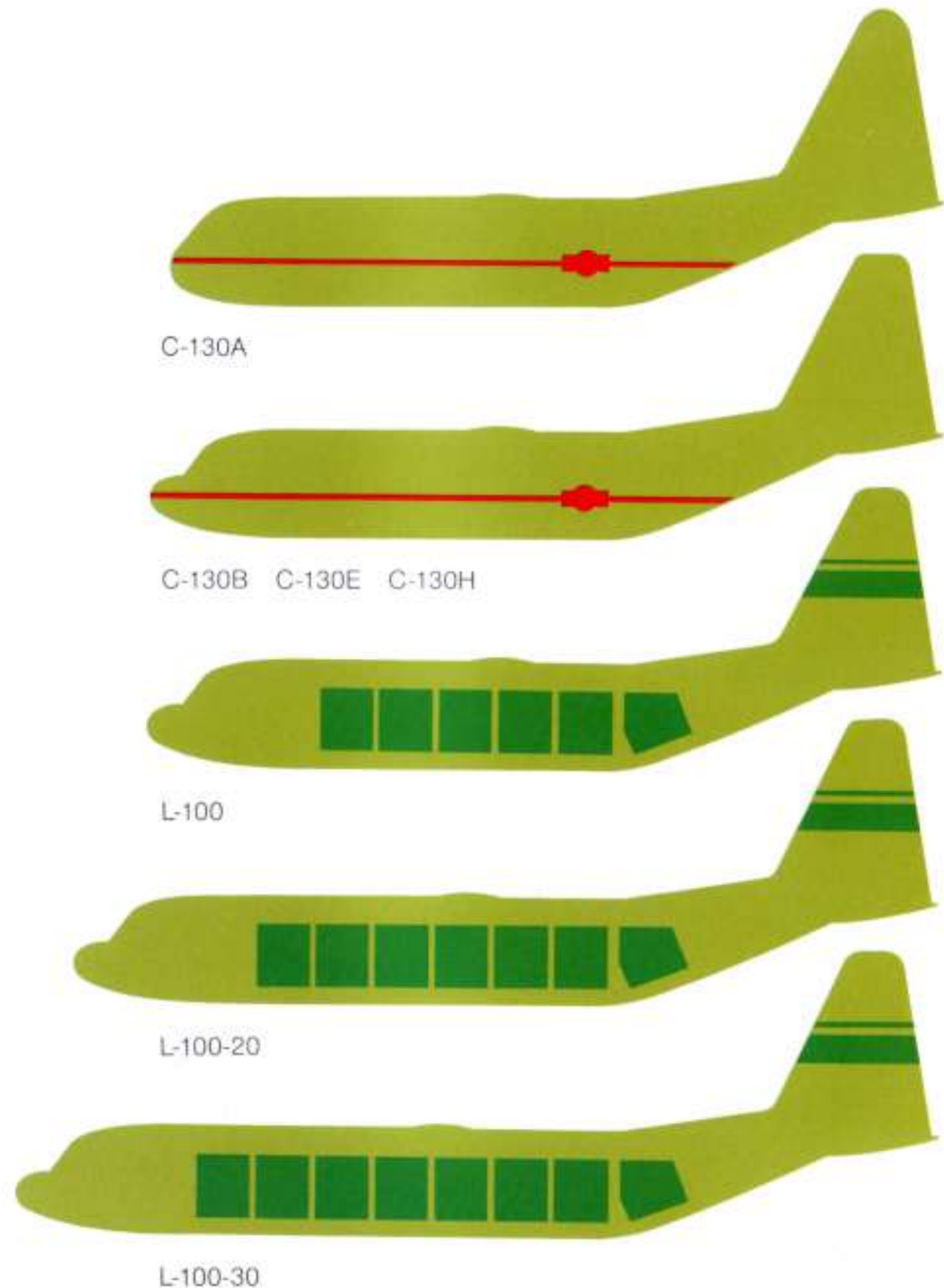
## Product Growth

A concern for product growth and design versatility, inherent in all Lockheed-Georgia cargo airlifters, allows for planned and orderly derivatives which will meet a broad spectrum of follow-on world-wide military and civil customer needs.

The product growth success of the C-130 Hercules family of airlifters is based to a large degree on several unique design features which are necessary to any true cargo airlifter. These features, which distinguish the true airlifter from the converted passenger aircraft, are driving forces in the initial design.

They include:

- Adequate cargo compartment shape and size.
- Adequate cargo floor unit and total strength.
- Built-in cargo handling and restraining provisions, including military vehicle load treadways, cargo pallet rails and rollers, and cargo tie-down provisions.
- Full cargo compartment cross section loading openings – at truckbed height.
- Built-in, self-deployable cargo ramps which do not impinge on cargo loading volume.
- High flotation, rough runway/off runway landing gear.
- Self-sufficiency.
- From the ground servicing.





# C-141 Starlifter

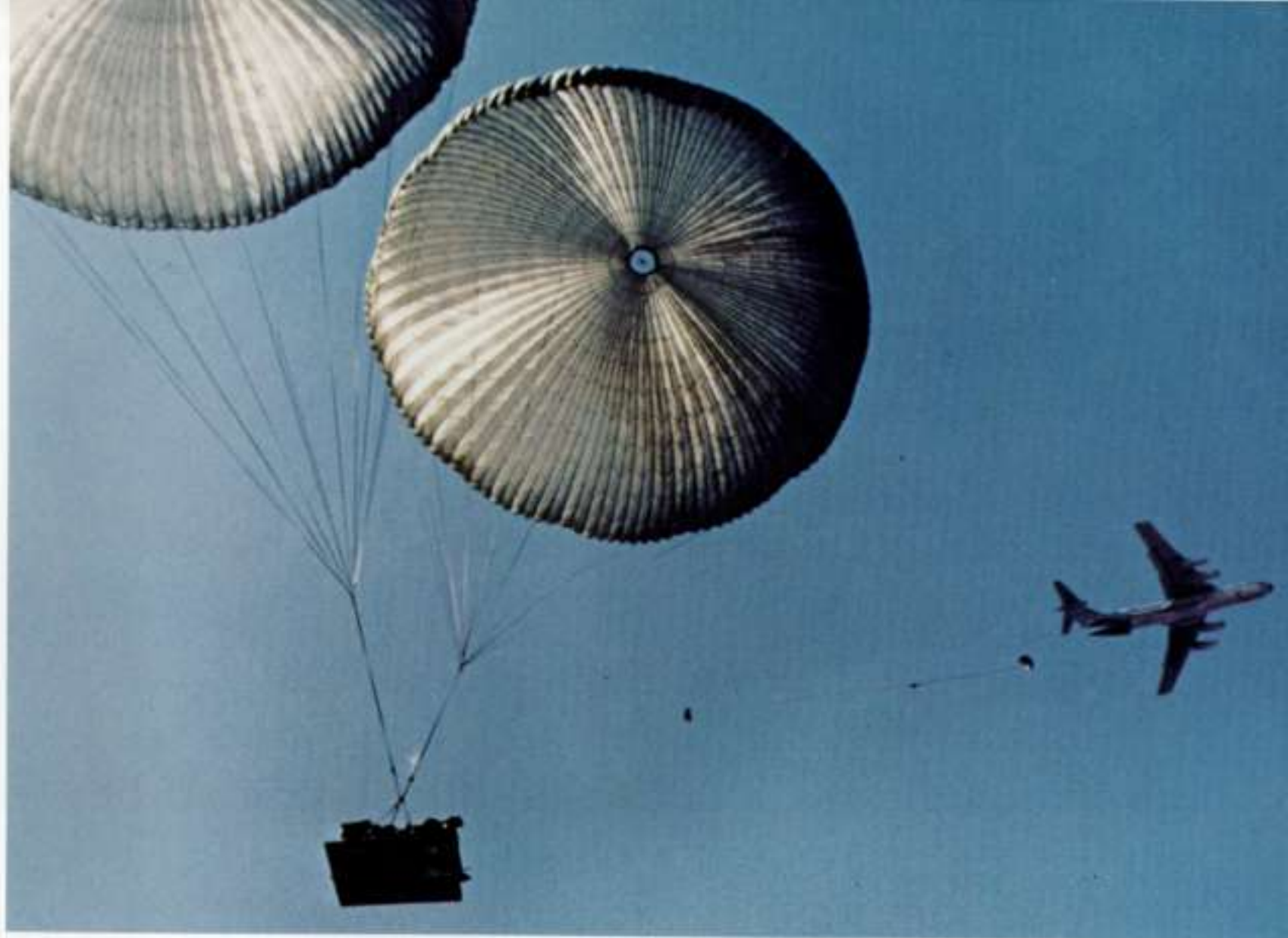




## C-141 Versatility

Second in the line of Lockheed-Georgia cargo airlifters was the C-141 StarLifter. The first pure jet aircraft designed specifically for cargo airlift, it retained all the proven cargo airlift features of the C-130 Hercules, while providing an additional capability for global inter-theatre airlift support of ground combat forces. All U.S. missiles currently deployed overseas can be airlifted by the StarLifter.

As with all Lockheed cargo airlifters, the C-141's exceptionally good takeoff and landing performance allows it to operate into and out of restricted length runways. A perfect complement and natural follow-on to the C-130 Hercules, the StarLifter distinguished itself shortly after entering service with the United States Air Force by drastically reducing airlift delivery time and cost per ton mile, thus adding a new dimension to our Nation's airlift capabilities.







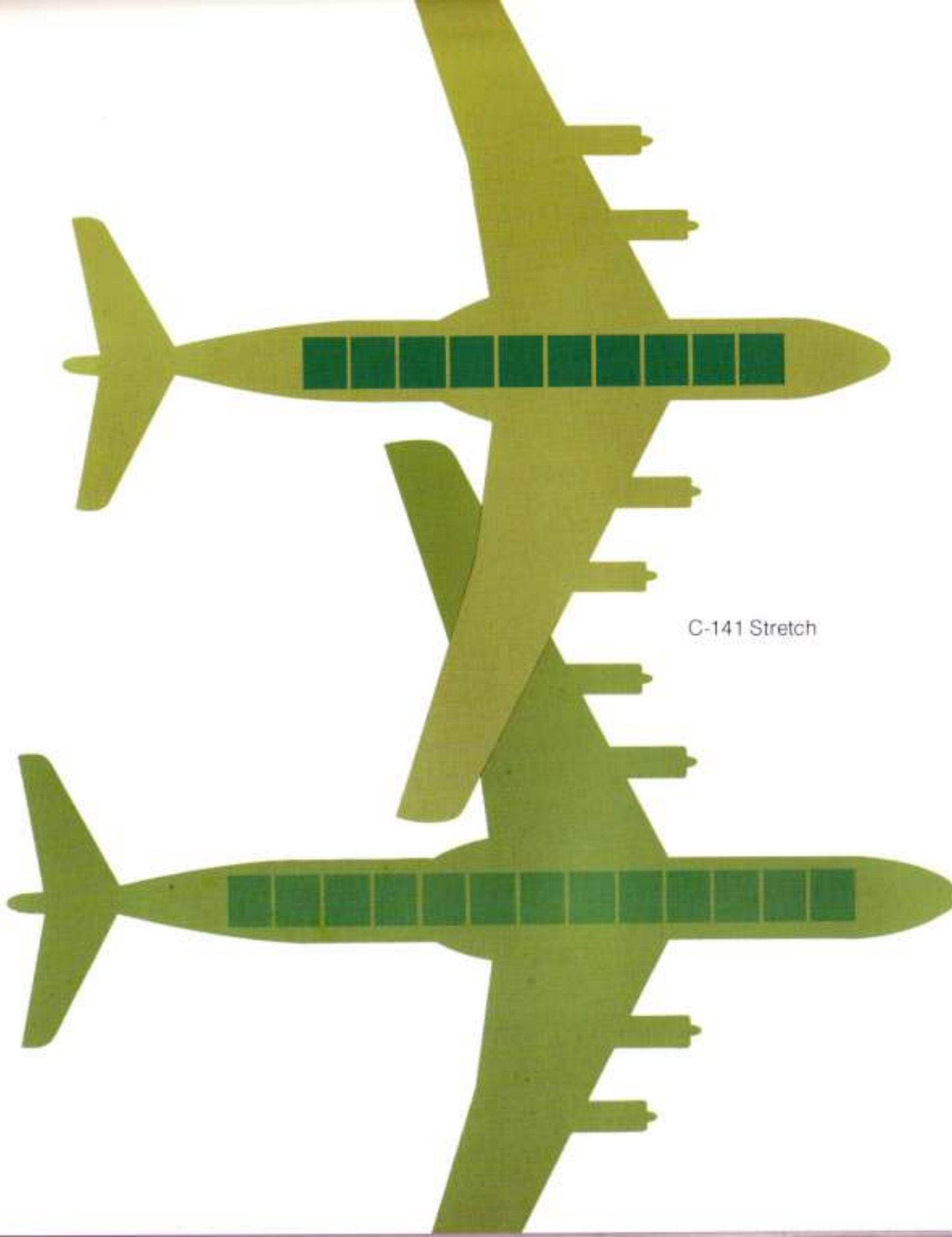


## Product Growth

The United States Air Force and Lockheed-Georgia are cooperating on a C-141 Stretch program. Extensive studies determined that lengthening the airplane by the addition of a 160-inch fuselage plug forward of the wing, and a 120-inch plug aft of the wing produces an even better relationship of volume and payload, while still retaining the same basic C-141 operational features and dependable mission versatility. For extended range missions, aerial refueling capability is added.

Palletized payload airlift capability of the stretched C-141 is increased by 30%, and its service life will continue well into the 1990's.

C-141 Stretch





**C-5A Galaxy**





## C-5A Versatility

Lockheed's C-5A Galaxy, the most versatile of all the Lockheed-Georgia family of airlifters, is the world's largest, most capable, and only operationally proven heavy military cargo airlifter. No other airlifter has had such a dramatic effect on global defense and deterrent strategies.

Capable of airlifting anything the U.S. military forces intended for airlift, even an entire armored division, operating into and out of restricted length, rough or unprepared forward area airstrips, it can fly massive trans-Atlantic/trans-Pacific cargo airlifts without inflight refueling; with IFR, it can deliver its payload anywhere in the world. If landing areas are unavailable, it can airdrop up to 200,000 pounds of cargo with precise accuracy.

The Galaxy's unparalleled capability and versatility has been demonstrated by:

- Delivery on each flight to South Vietnam of three M41 tanks, 54,000 pounds each, or two M48 tanks, 98,000 pounds each, for a total airlift of 1,650,000 pounds to help stem the 1972 communist spring offensive.
- Nonstop, nonrefueled flight from Kadena Air Base, Okinawa to Charleston AFB, S.C., a distance of more than 8,000 statute miles.
- A 20.6-hour nonstop, nonrefueled mission that overflew all four corners of the United States.









## Loadability

C-5A versatility begins with loadability. Full cargo compartment width, fore and aft cargo loading ramps provide the C-5A with true drive-on, drive-off capability. Anything driven in one end during loading can drive out the other end when unloading. No backing or lifting is required.

All C-5A cargo loading, handling, and tie down/restraint provisions are built in and in a way which does not impinge on available cargo compartment envelope.

For example:

- Both fore and aft integral cargo loading ramps stow vertically at the ends of the cargo compartment when not in use. Also, both are self-deployable.
- Vehicular treadways are capable of accepting the heaviest rubber tread military vehicles with no shoring required to redistribute load. For steel tracked vehicles, only plywood is needed to protect the floor.
- Standard 463L cargo pallet rails and rollers and required cargo restraint provisions are integral in the heavy duty cargo floor and fold away when not in use to provide a clear cargo deck.

With these provisions, the C-5A Galaxy can airlift almost everything in anybody's armed forces which doesn't float or fly and much which does.







## **ICBM Launch**

In a spectacular demonstration of versatility, on October 24, 1974, at the Western Test Range, a Minuteman I ICBM was successfully extracted from a C-5A using its Aerial Delivery System, was chute stabilized, and was ignited for a 10-second first stage burn. This convincingly demonstrated the feasibility of using the C-5 aircraft as the launch vehicle in the Air Mobile ICBM basing concept.

The total weight of this missile, its cradle and other equipment was more than 85,000 pounds; during the preceding build-up test program, a dummy load of over 87,000 pounds was successfully jettisoned without extraction chutes.








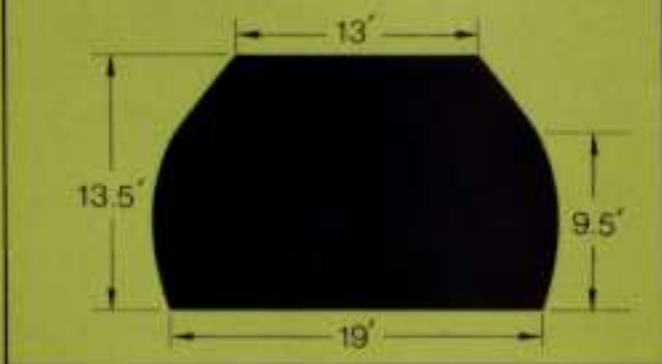
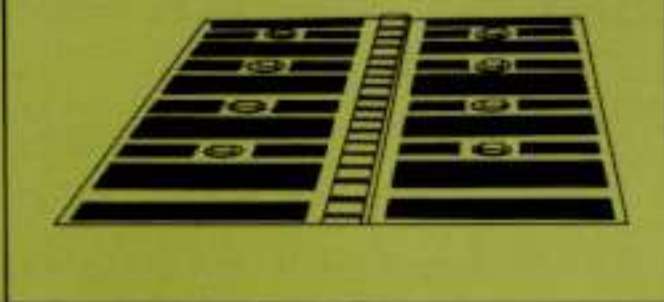
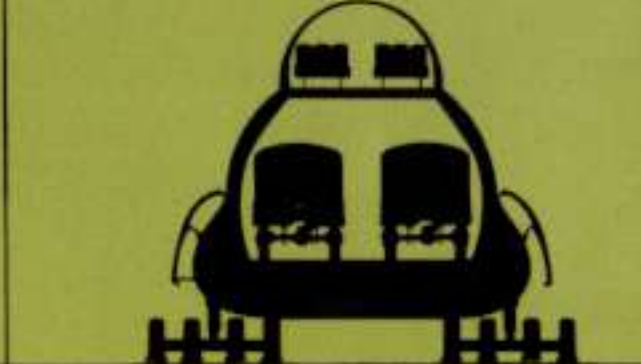





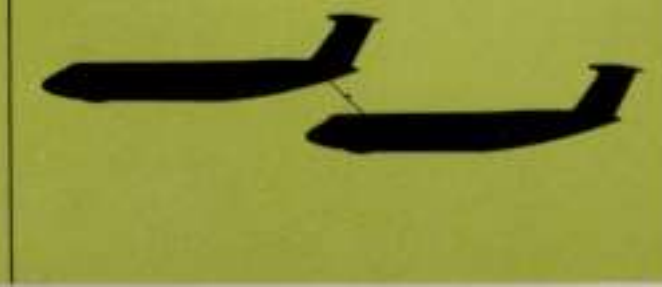

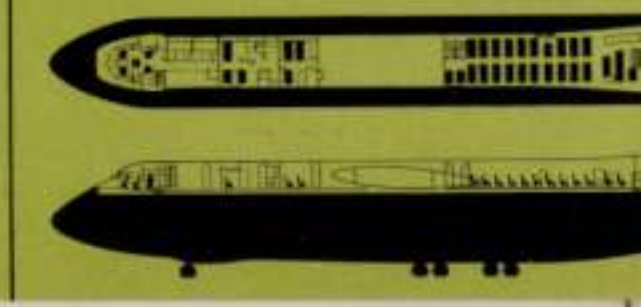




# C-5A Unique Features

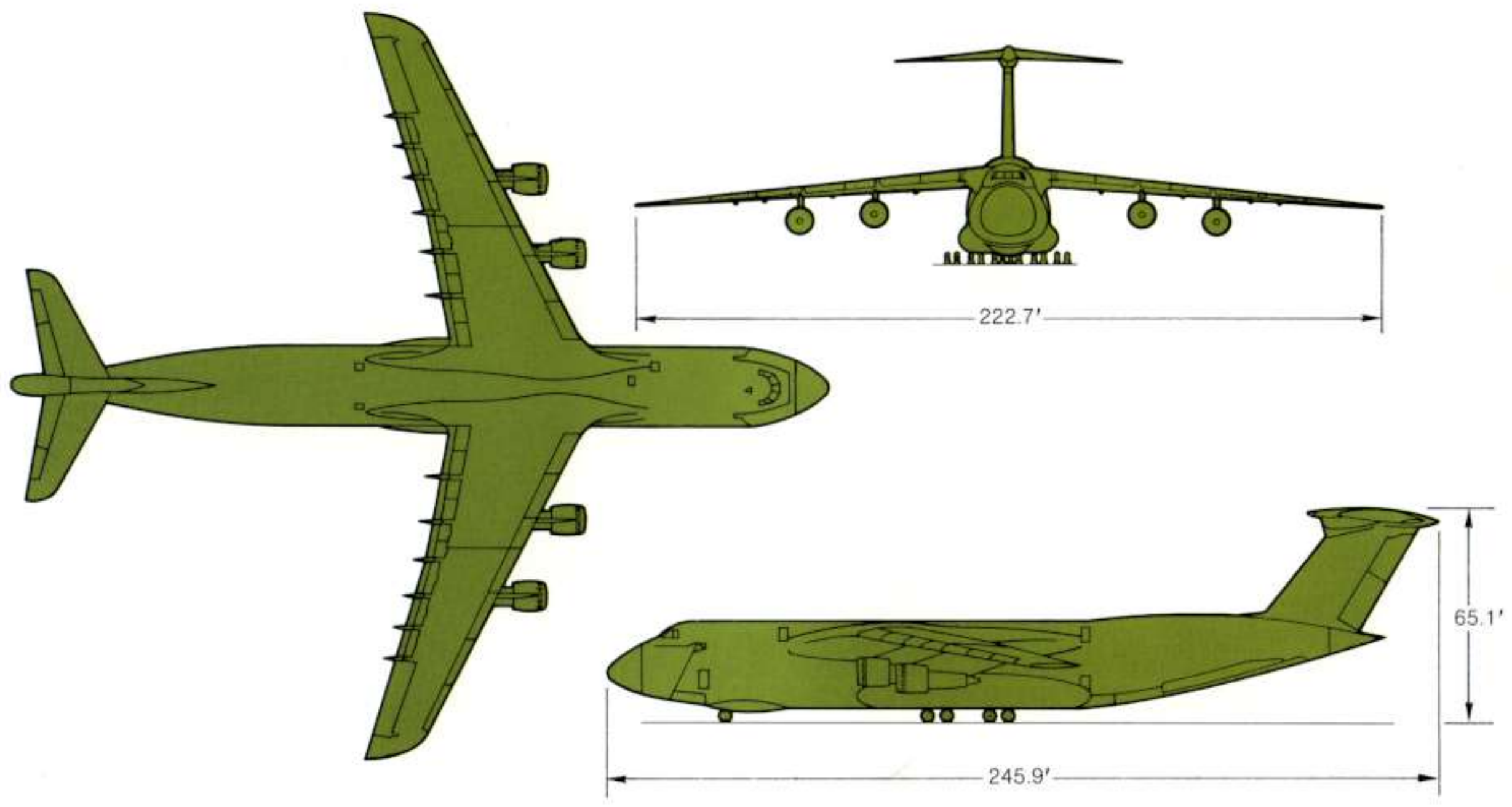
The C-5A provides all the cargo airlifter unique features so well proven by the C-130 Hercules and C-141 StarLifter. Features convincingly demonstrated as necessary and desirable by more than 20 years of Lockheed-Georgia cargo airlifter operational experience with the military forces of the United States and other countries.

None of these unique true cargo airlifter features can be adequately provided by converted passenger aircraft. All are necessary in any true cargo airlifter to provide required cargo mission capability and flexibility of departure/destination planning without the necessity for prepositioning of special loading equipment or other special support activity.

<p>High wing/low cargo floor</p> 	<p>Adequate cargo compartment dimensions</p> 	<p>Adequate cargo compartment floor</p> 	<p>Full cargo compartment cross-section loading openings</p> 
<p>Integral self-deployable cargo ramps</p> 	<p>Kneeling/truckbed height loading</p> 	<p>Realistic ramp angles</p> 	<p>Drive-on/drive-off capability</p> 
<p>High flotation landing gear</p> 	<p>In-flight refueling</p> 	<p>Air drop capability</p> 	<p>Off duty crew/vehicle crew provisions</p> 

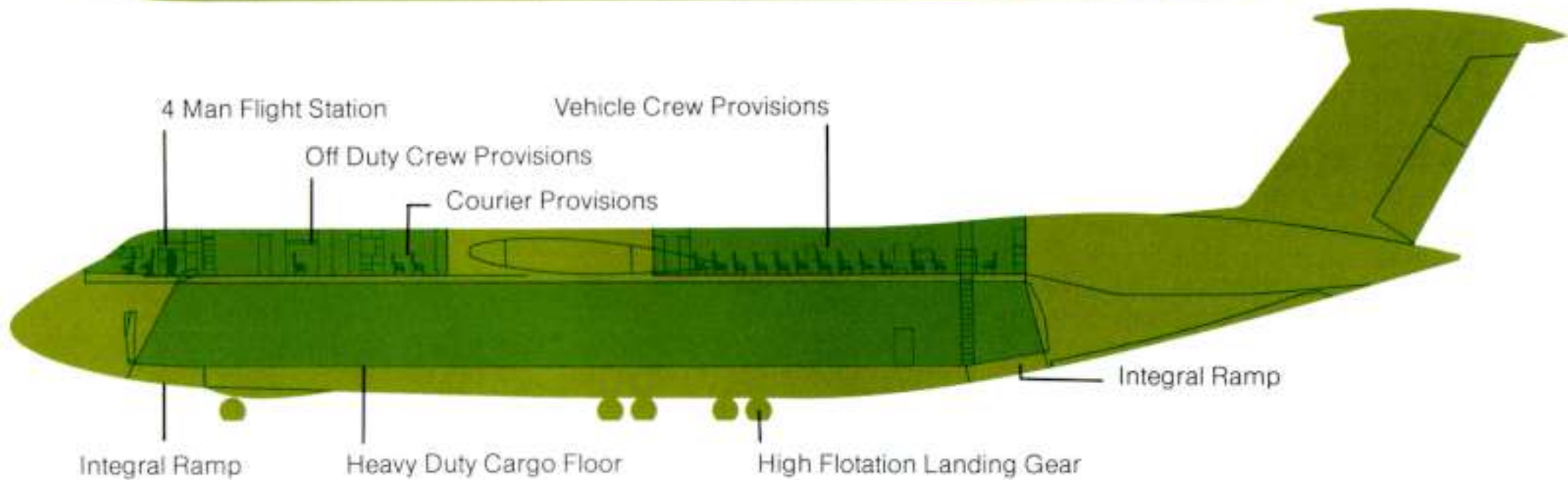
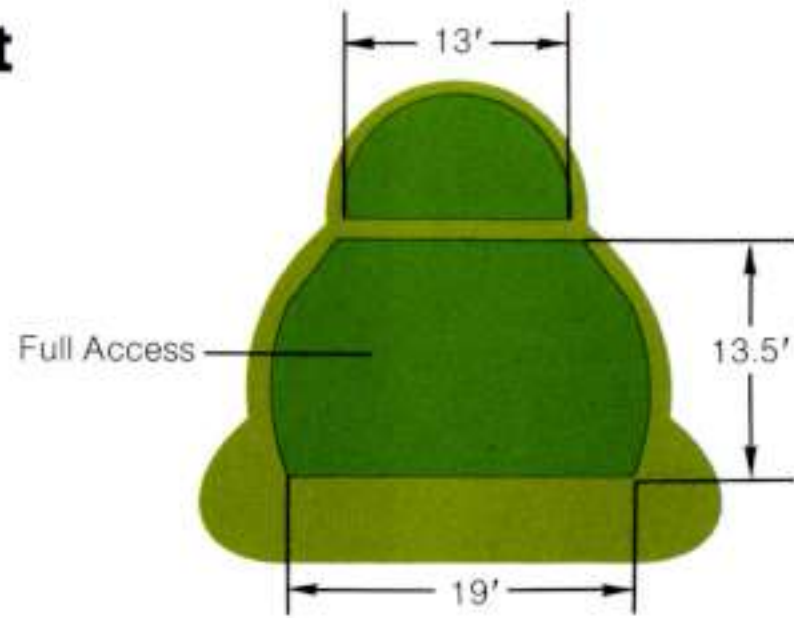


# C-5A General Arrangement





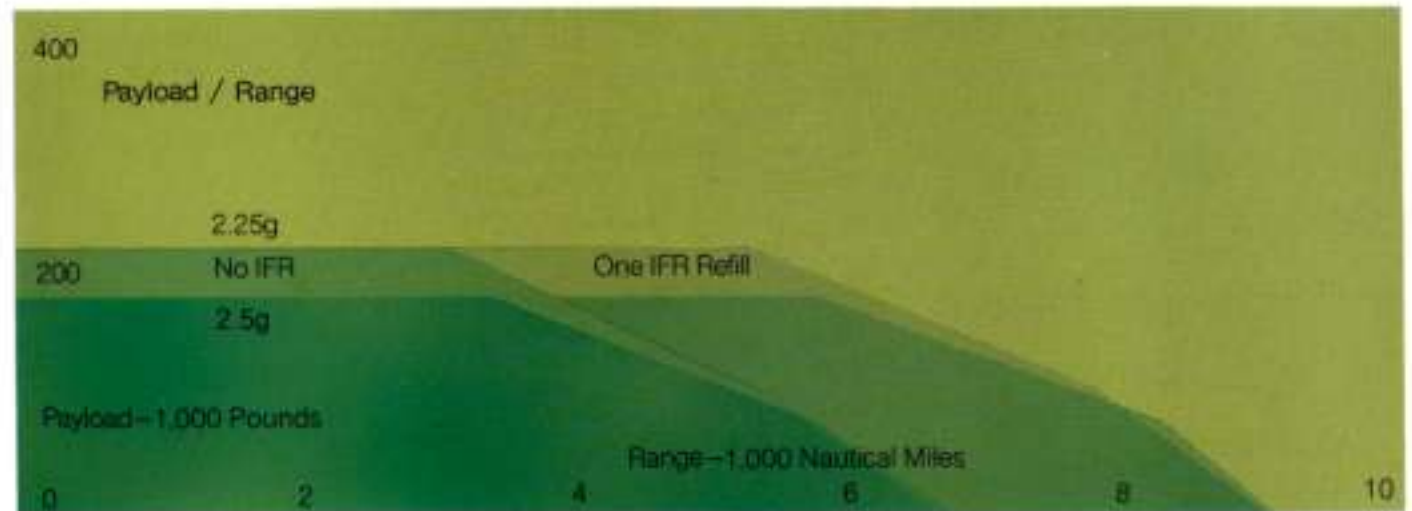
# C-5A Inboard Arrangement





### Weights (Pounds)

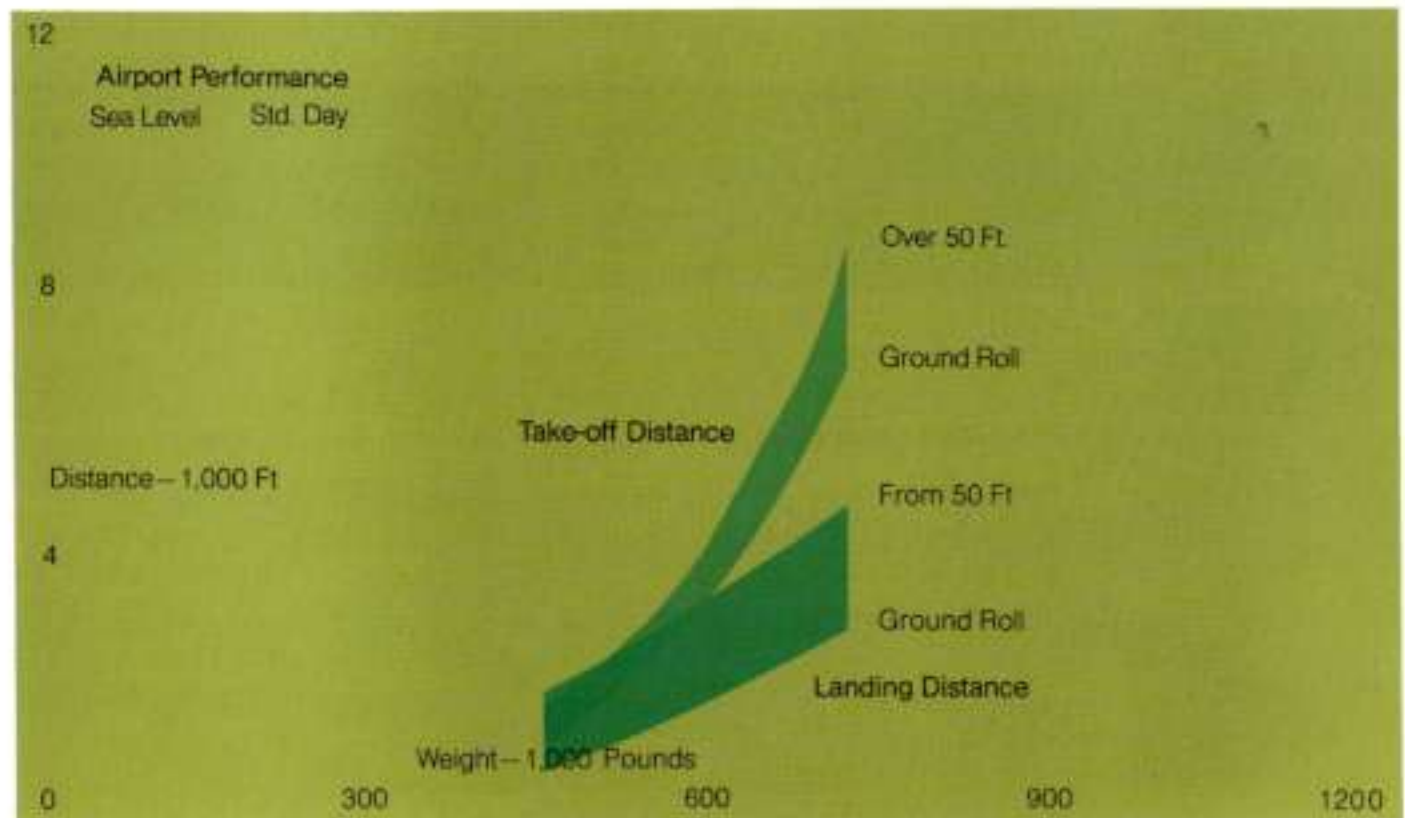
Load Factor	2.5g	2.25g
Operating Weight	338,334	338,334
Maximum Payload	175,570	220,570
Maximum Zero Fuel Weight	513,904	558,904
Maximum Gross Weight	732,500	769,000



## C-5A Performance

The only true measure of payload/range capability for any military cargo airlifter must be related to available takeoff and/or runway limitations which include required flotation. Basic C-5A payload/range performance, as limited by available takeoff field length, is substantially better than can be provided by any other large airplane when both utilize the same available power plants.

This outstanding and unmatched ability, and the very remarkable short field performance of the C-5A results from its large wing area, together with its unique, low drag, and very efficient high-lift system. The C-5A is also the only large airplane available today with adequate landing gear flotation to permit wide latitude in destination airstrip selection and/or off-runway operation.







MAC

DANGER

INTERNAL

DANGER OF BLAST







# **Tomorrow's Airlifters Today**

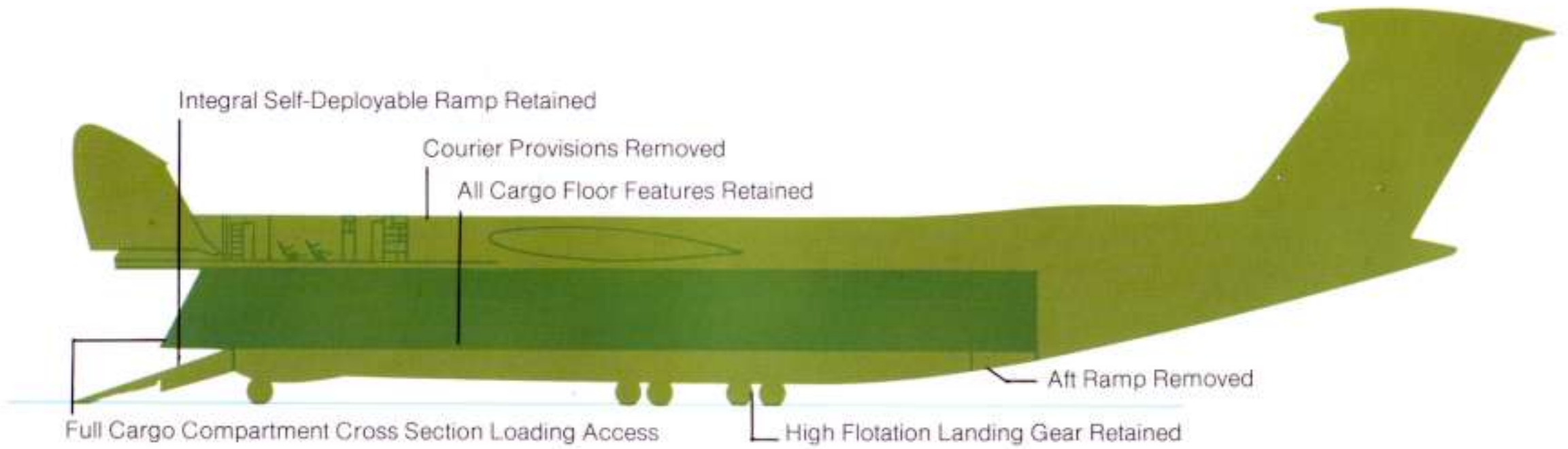


## **C-5 Derivatives**

Three potential C-5 family derivatives—cargo, cargo/tanker, and missile launcher—have each been tailored to conduct a specific basic mission at least total system cost. This is accomplished by first removing some equipment and features originally required for the C-5A but unnecessary for these specific mission derivatives, and then adding those modest design modifications necessary to best tailor each particular derivative for its basic mission.





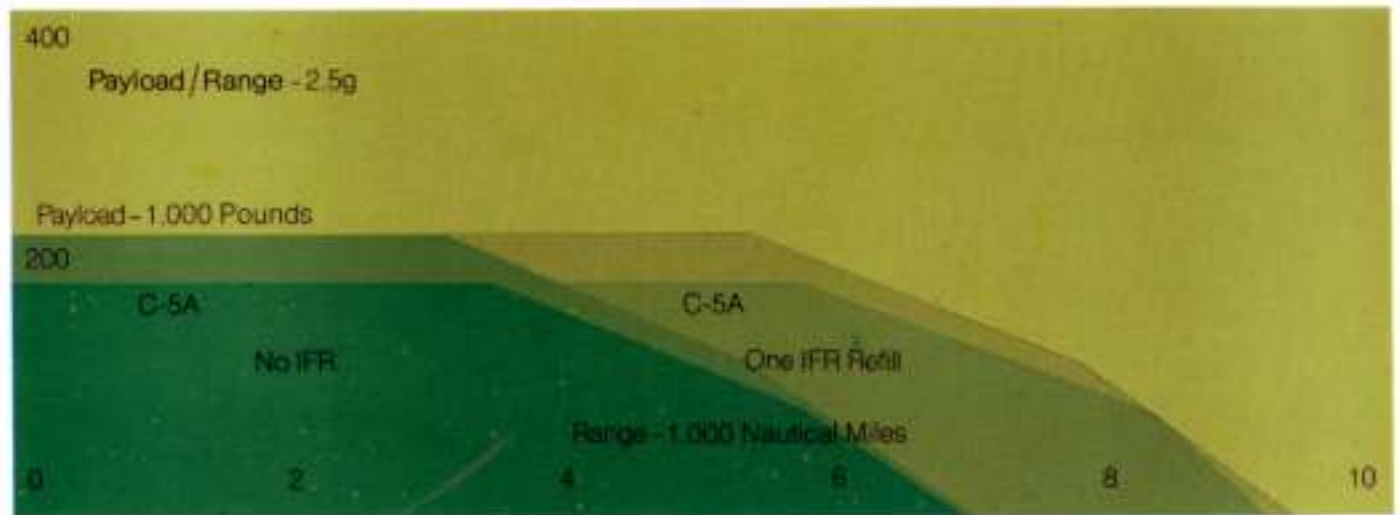


## Cargo Transport

The C-5 cargo airlifter derivative provides improved payload/range performance and better economics while retaining all necessary C-5A proven cargo mission related unique features.

No other large airplane derivative design can so effectively and economically augment present United States Air Force strategic airlift capability.

Weights (Pounds)	
Load Factor	2.5g
Operating Weight	338,000
Maximum Payload	216,000
Maximum Zero Fuel Weight	554,000
Maximum Gross Weight	769,000





## Cargo/Tanker

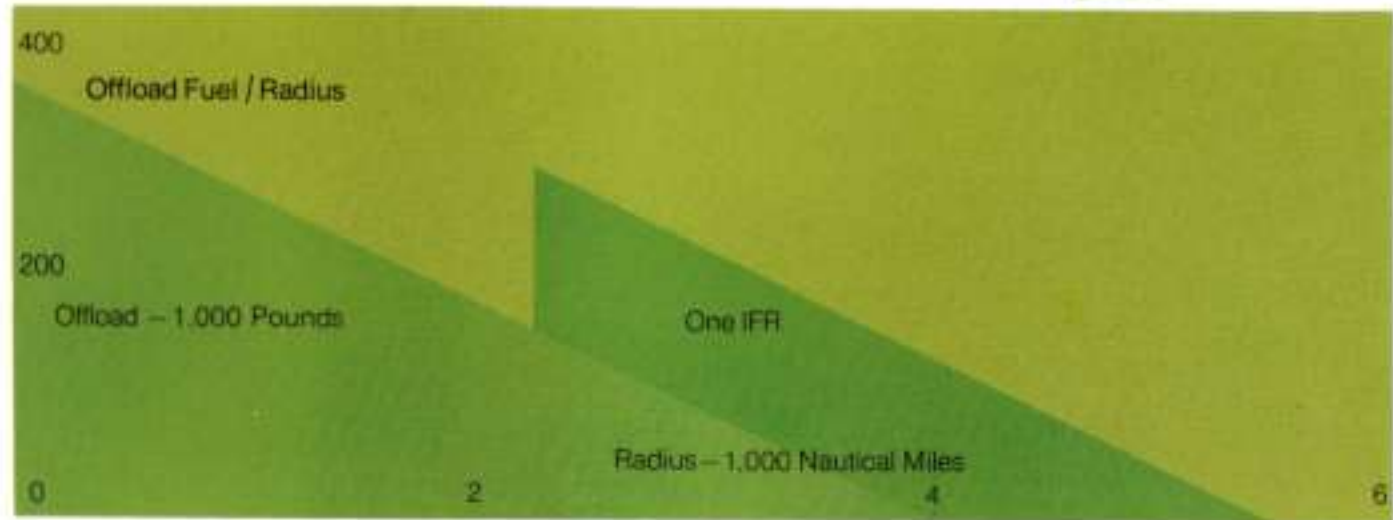
The cargo/tanker derivative, which retains all cargo airlifter features, is further modified only to the degree necessary to incorporate the refueling boom and operator's station in the aft fuselage behind the cargo compartment and to utilize existing wing volume to provide increased, in-wing, fuel capacity.

At the operational weights which recognize the addition of the cargo/tanker derivative modifications, fuel offload capability vs. range, or radius, is remarkable for an airplane also offering such broad alternate mission capabilities.



### Weights (Pounds)

Load Factor	2.5g	2.46g
Operating Weight	348,324	348,324
Maximum Fuel	420,676	432,868
Maximum Zero Fuel Weight	554,000	562,779
Maximum Gross Weight	769,000	781,192





# Missile Launcher

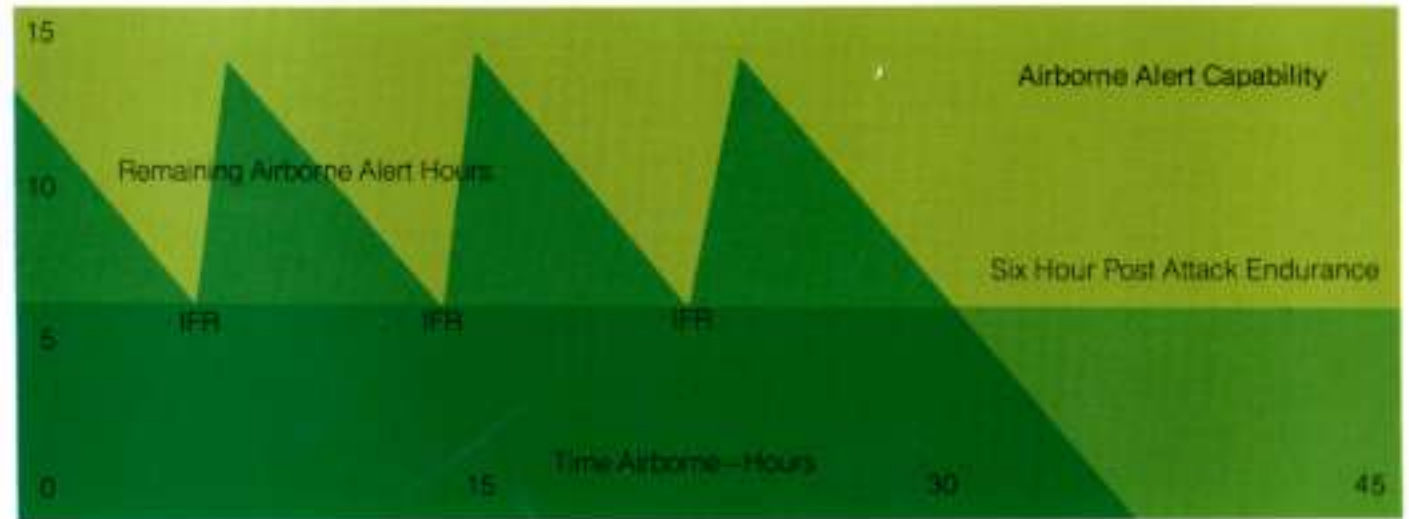
Based on the C-5A demonstrated capability for air launching of 85,000 pound Minuteman missiles, the C-5 missile launcher derivative is a further modification of the C-5 cargo transport, in which aft fuselage air drop provisions are reincorporated and provisions are made for accepting, transporting, and air launching selected intercontinental ballistic

missiles. Its outward appearance does not reveal its strategic mission since its secret is entirely in its deterrent cargo.

With its in-flight refueling capability, the missile launcher derivative can provide, at realistic costs, a massive deterrent capability secure from preemptive enemy action.



Weights (Pounds)		
Load Factor	2.5g	2.0g
Operating Weight	342,000	342,000
Maximum Payload	212,000	288,000
Maximum Zero Fuel Weight	554,000	630,000
Maximum Gross Weight	769,000	795,000



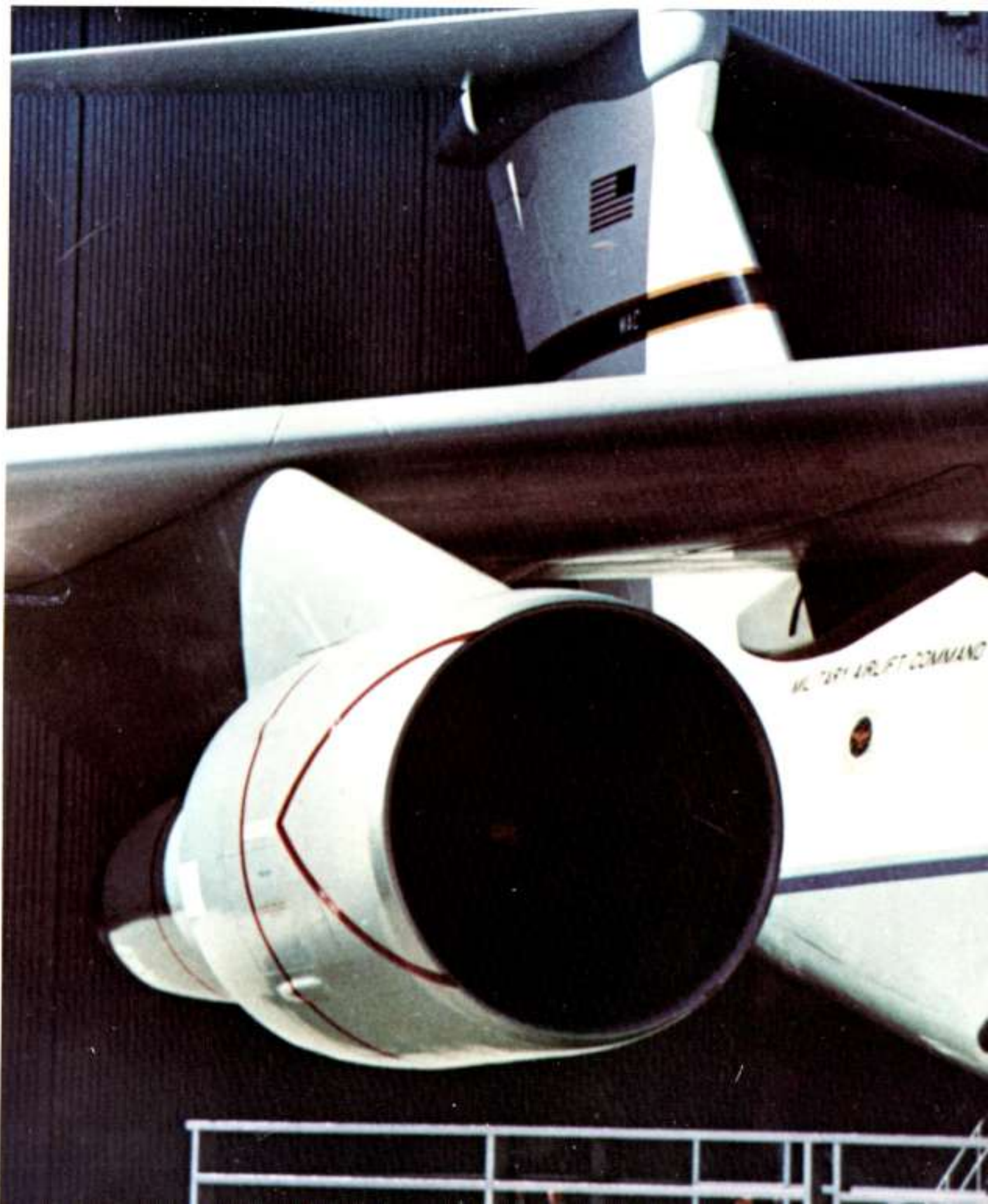


## Product Growth

Design studies of heavier and more capable growth derivatives of the C-5 family, based on the use of higher thrust power plants and exploiting the full weight lifting capability of the basic C-5 aerodynamic configuration, indicate the feasibility and economic advantages of C-5 military and civil growth derivatives approaching one million pounds in weight.

Because of the enormous design, development, and other non-recurring costs associated with any all-new large airplane, these C-5 growth derivatives can provide substantial economies for the 1980-2000 time period.

Tomorrow's best airlifters can become available through planned growth of the advanced state of the art C-5 which incorporates tomorrow's technology today.





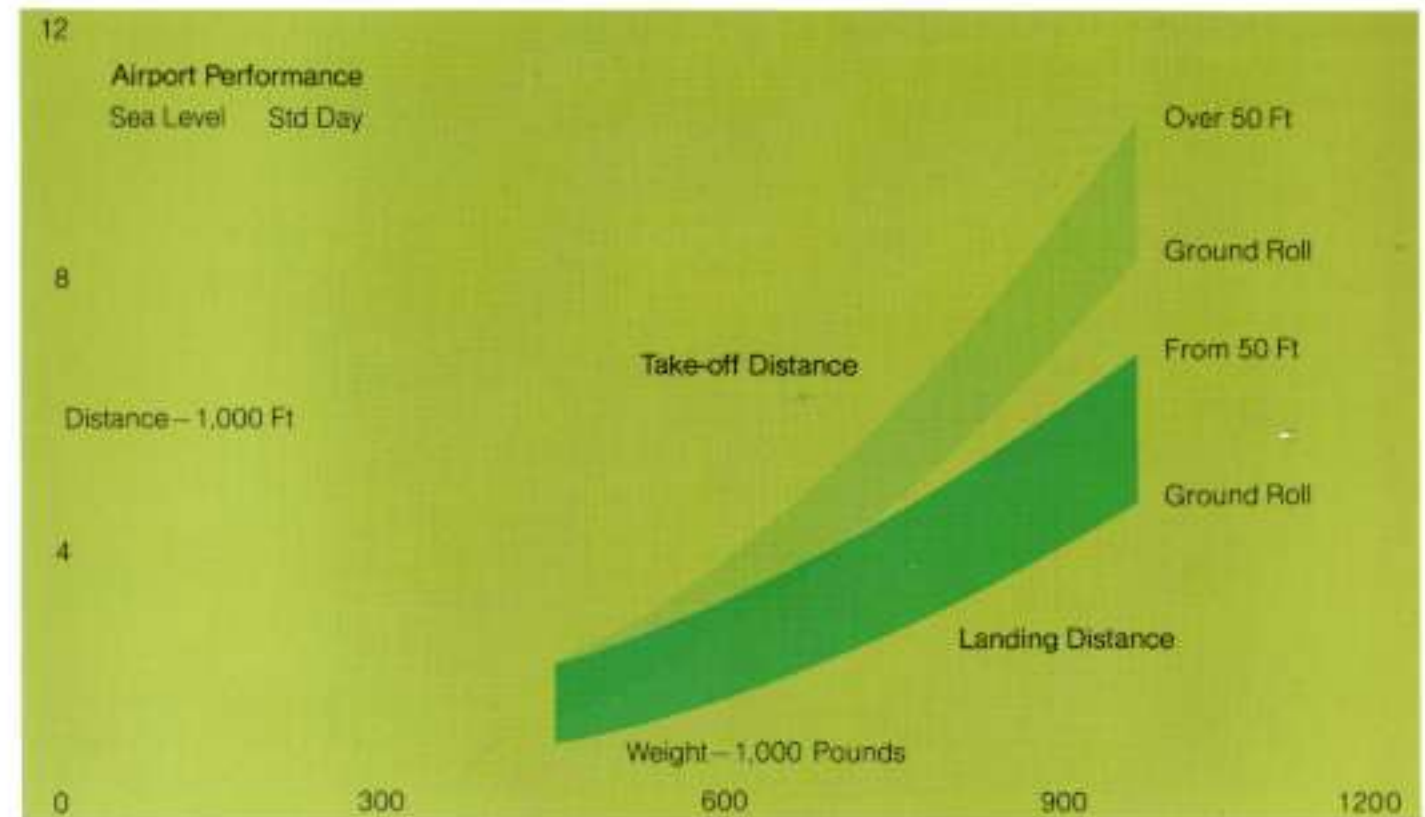
### Weights (Pounds)

Load Factor	2.5g
Operating Weight	399,900
Maximum Payload	325,000
Maximum Zero Fuel Weight	724,900
Maximum Gross Weight	960,000



## C-5 Growth Performance

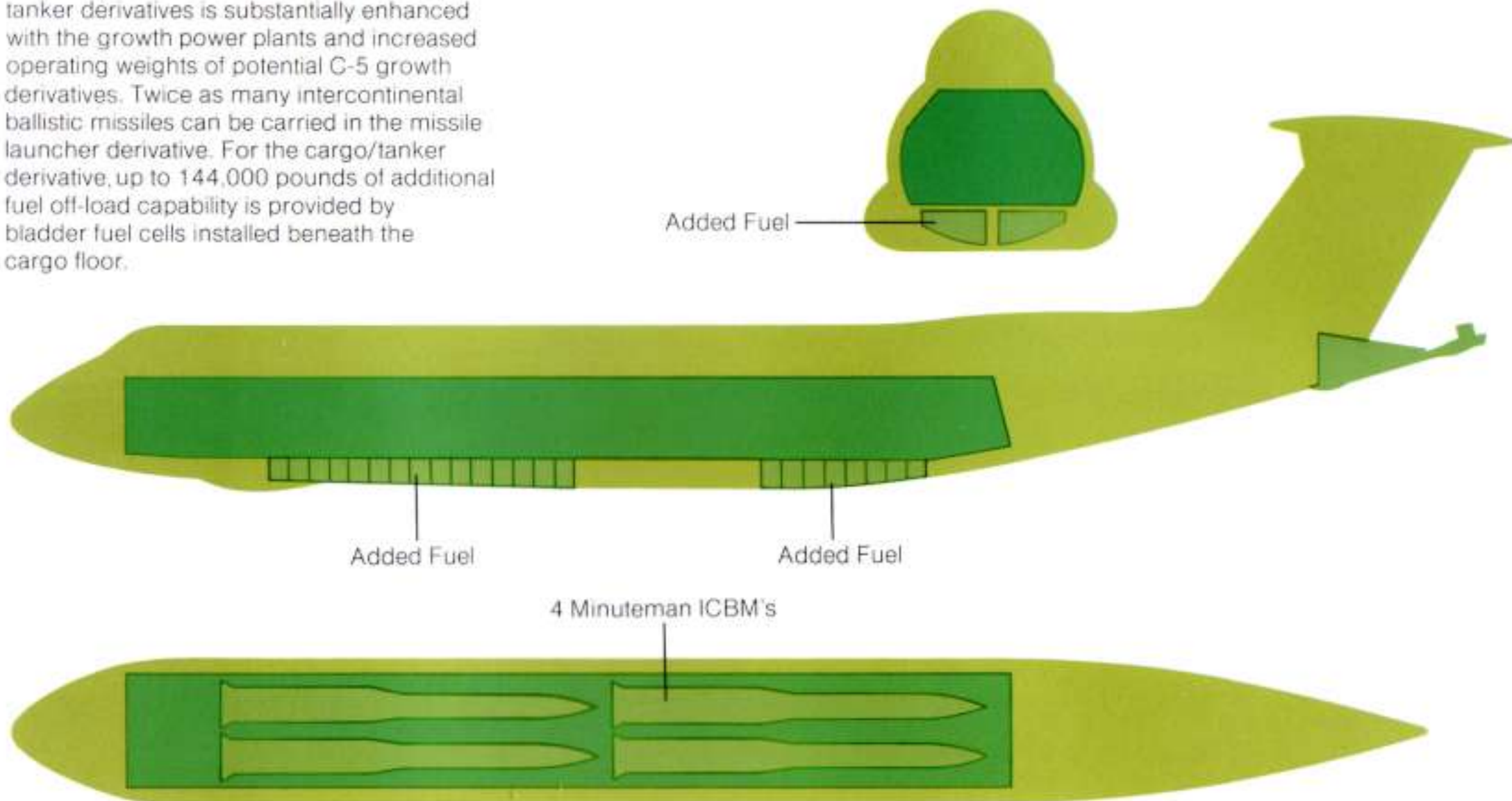
Based on growth power plants and the realistic aerodynamic capability of the baseline C-5 family design, C-5 growth versions capable of operating from conventional intercontinental runways at takeoff weights of well over 900,000 pounds could deliver payloads up to 325,000 pounds to any major runway in the world. For military missions, with IFR, no intermediate stops would be required.





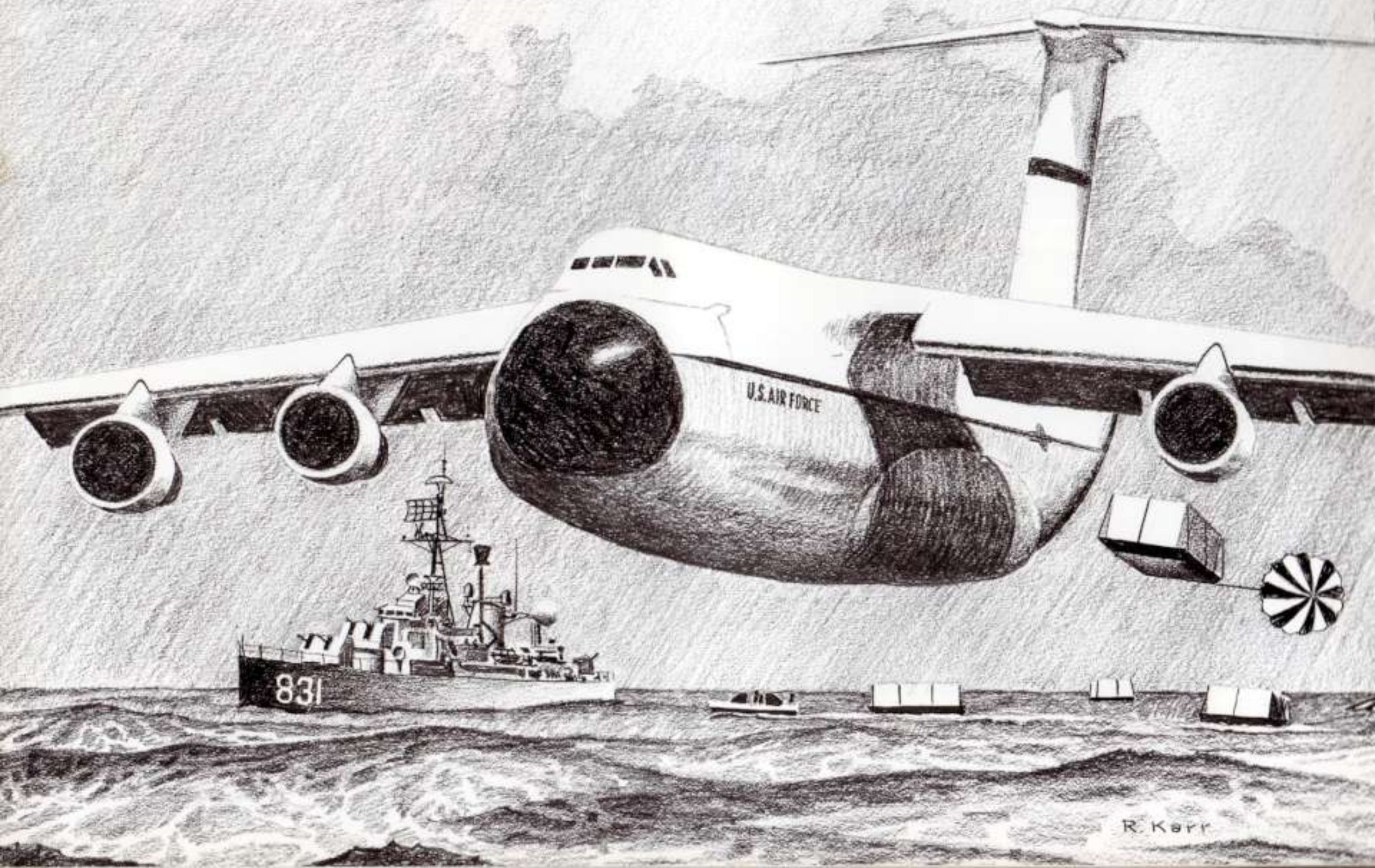
## C-5 Derivative Growth

Capability for missile launching and cargo/tanker derivatives is substantially enhanced with the growth power plants and increased operating weights of potential C-5 growth derivatives. Twice as many intercontinental ballistic missiles can be carried in the missile launcher derivative. For the cargo/tanker derivative, up to 144,000 pounds of additional fuel off-load capability is provided by bladder fuel cells installed beneath the cargo floor.





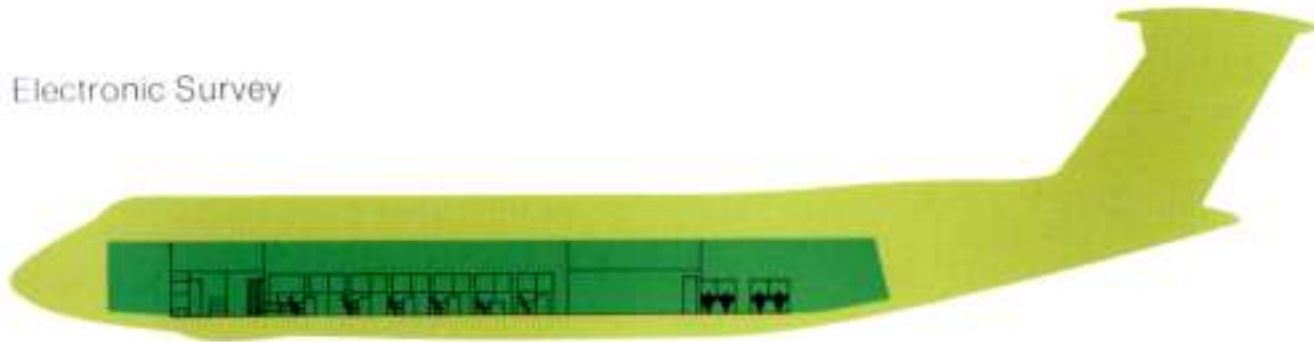
# Corollary Applications



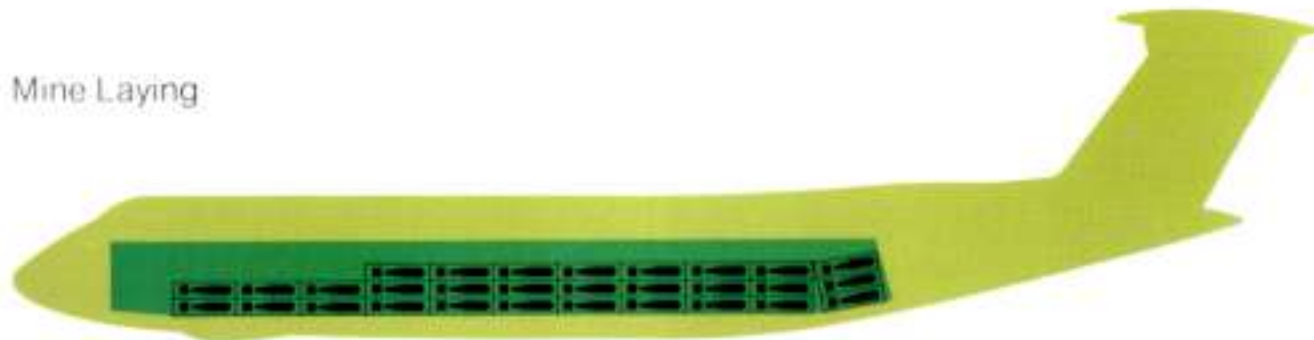
R. Kerr



Electronic Survey



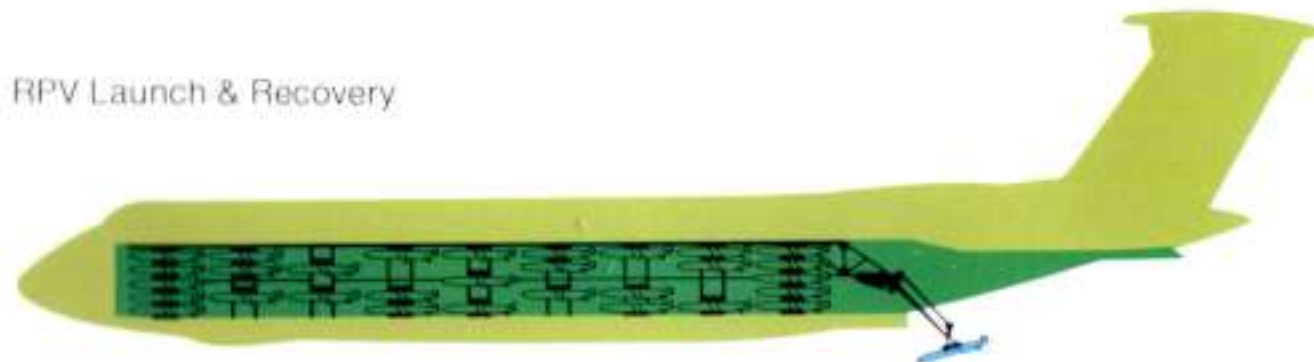
Mine Laying



Distant Defense



RPV Launch & Recovery



## Mission Flexibility

The unmatched capability and mission flexibility of the baseline C-5 family design provides an inherent versatility which can be utilized in many additional corollary missions which may require, or can benefit from, the Galaxy's unmatched:

- Cargo compartment volume, dimensions, access, and features
- Short field/rough field capability
- Air drop capability
- Alternate crew/special crew provisions
- Self-sufficiency





## Project Intact

Intermodal container movement is the real world of future high volume air freight potential. Presently, only the cargo compartments of Lockheed's family of Galaxy airlifters can adequately accept the hundreds of thousands of larger marine type intermodal containers already in use for surface transportation. These units, which are up to 8 x 10 x 40 feet in size, can be accommodated even when still mounted on their over-the-road chassis.

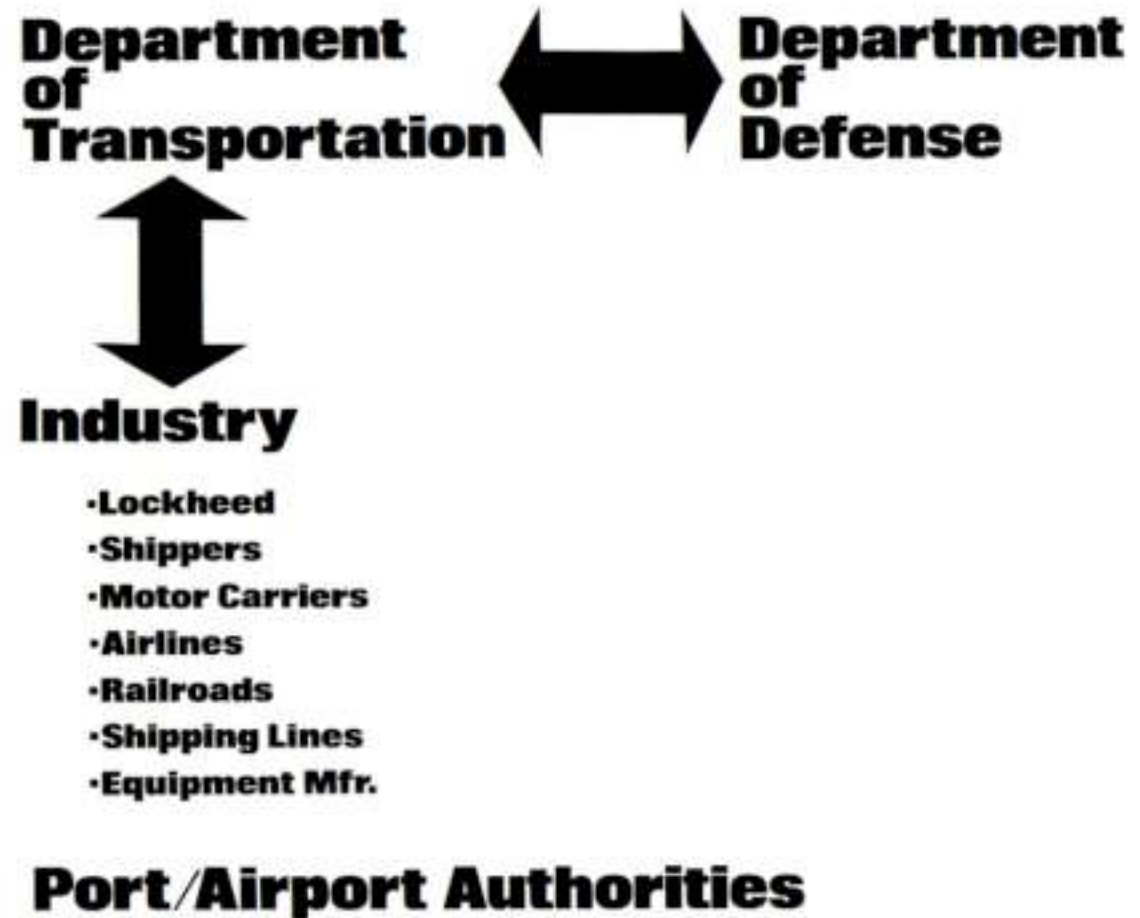
Since present commercially available aircraft cannot adequately accommodate the larger intermodal containers in sufficient quantity, a number of studies by the major aerospace manufacturers and others have been directed toward evaluation of several new basic aircraft configurations and sizes, and toward future cargo market projections, in an effort to determine an optimal approach to this important air freight potential. However, studies alone cannot provide all of the necessary answers.

Project INTACT (Intermodal Air Cargo Test) was conceived as a real hardware demonstration to evaluate the potential for, and the interface requirements of, large intermodal container movement across all modes of transportation. Using C-5 Galaxy aircraft to provide airlift, a major purpose of project INTACT is to establish the necessary standards of equipment, facility requirements and handling techniques which can ultimately provide true intermodal compatibility across all modes of transportation.



## Project Intact

During 1974, a large industry group was formed to initiate a detailed plan for Project INTACT. As initially conceived, the INTACT demonstration, using C-5A Galaxy aircraft provided by the USAF, includes combined surface and air movements of all types of intermodal containers between selected points in the Continental U.S. Cargo, loaded primarily in full size van trailers and large intermodal containers, both on and off their chassis, and provided by designated shippers and forwarders is moved to and from airports by motor carriers for transfer directly to and from the large cargo airlifters.





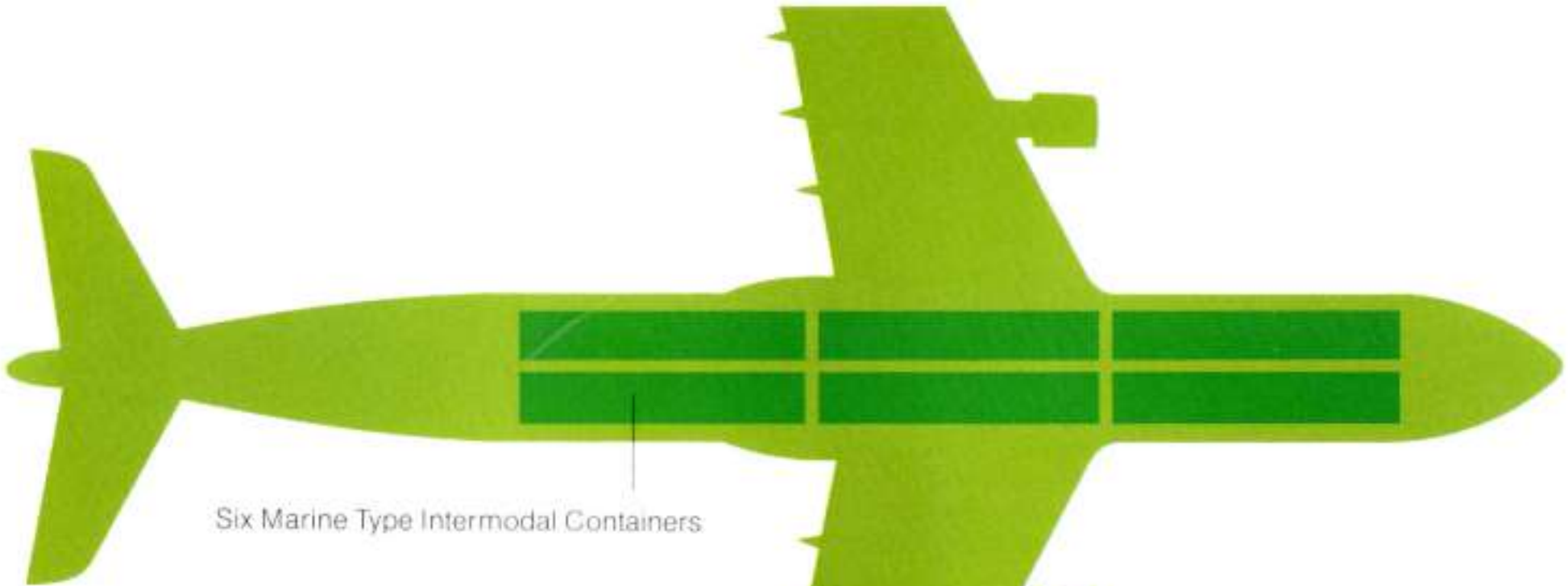


## **C-5XX**

One anticipated output of Project INTACT is an indication that a true intermodal commercial cargo airlifter will have to accommodate at least six or more full size 8 x 10 x 40 ft. intermodal containers to be economically attractive. The present C-5 cargo compartment can easily accommodate six. With modest fuselage stretch, a future C-5XX could accommodate eight and could fly this 320,000 pound plus payload from coast to coast at ton mile costs lower than any other derivative design and, considering the impact of inflation on design/development costs, lower than possible with any near-term, all-new cargo airlifter.

Such a future and more capable C-5XX can be completely compatible with both commercial and military heavy cargo airlifter requirements and its economic performance could provide a solution to combined civil/military 1980-2000 civil reserve air fleet cargo requirements to support national airlift policy.





Six Marine Type Intermodal Containers

C-5 Stretch

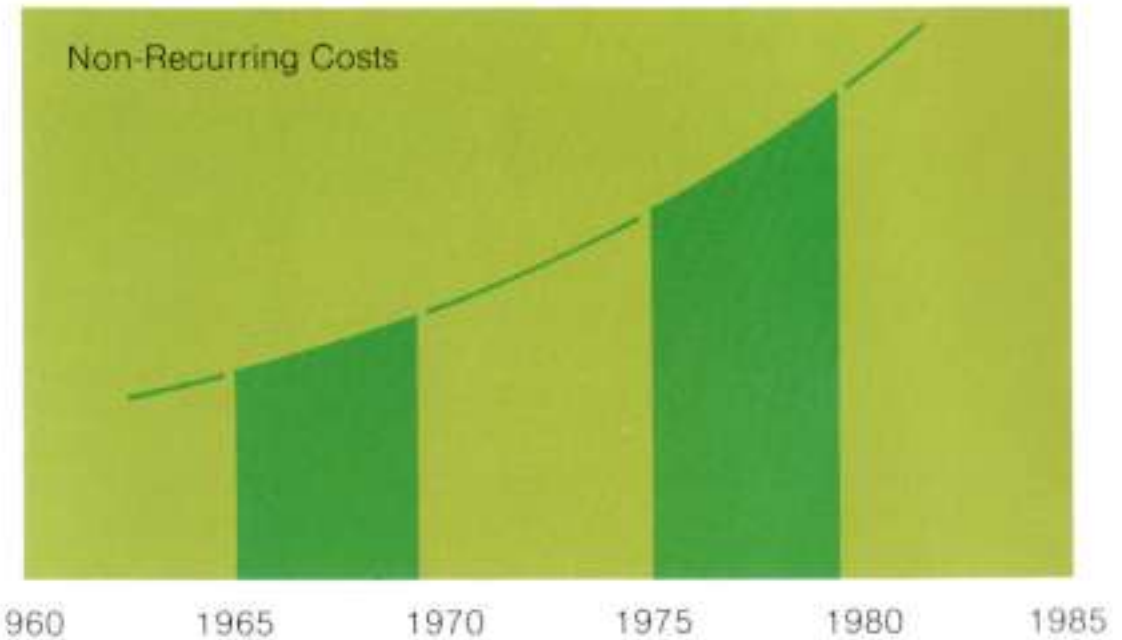


Eight Marine Type Intermodal Containers



## Investment vs. Inflation

The United States Government has many millions of 1965-1969 dollars invested in the non-recurring design, development, test, and tooling costs associated with the preparation for production for C-5A aircraft. Considering interim inflation, this committed and valuable investment would cost much more to duplicate today and can return substantial and beneficial dividends as the need arises for additional free world heavy airlifter aircraft.





## **In-Being vs. New Systems Support Provisions**

The United States Government also has many millions of dollars invested for in-being United States Air Force C-5 training and support programs, equipments, facilities, and spares inventories. This investment, already in use for USAF's C-5A fleet, can easily support additional C-5 heavy airlifter aircraft at modest

added cost. Any different, new heavy aircraft introduced into the system would require additional training and support programs, equipments, and facilities, and an entirely new spares inventory and, because of the interim inflation, at greatly increased cost.









# Tomorrow's Airlifters Today

Today's enormous costs associated with the development of a new aircraft, which can do a variety of missions well, strains the resources of even the wealthiest nations.

Yet the United States has at its disposal now the technology, tooling and facilities to look forward to tomorrow's needs with confidence. The investments already made in the C-5 and in its development, testing and manufacture, are in being national assets. Already proven, and with its versatility expanding whenever a new requirement is made known, the C-5 and its derivatives can effectively and economically meet the new airlift challenges of tomorrow.







Lockheed-Georgia Company • Marietta, Georgia 30063