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RYAN
DISPERSED SITE FIGHTER BOMBER STUDY

AIRPLANE DESIGN SUMMARY
REPORT NO. 11518-3

CONTRACT NO
AF 18(600)-1641

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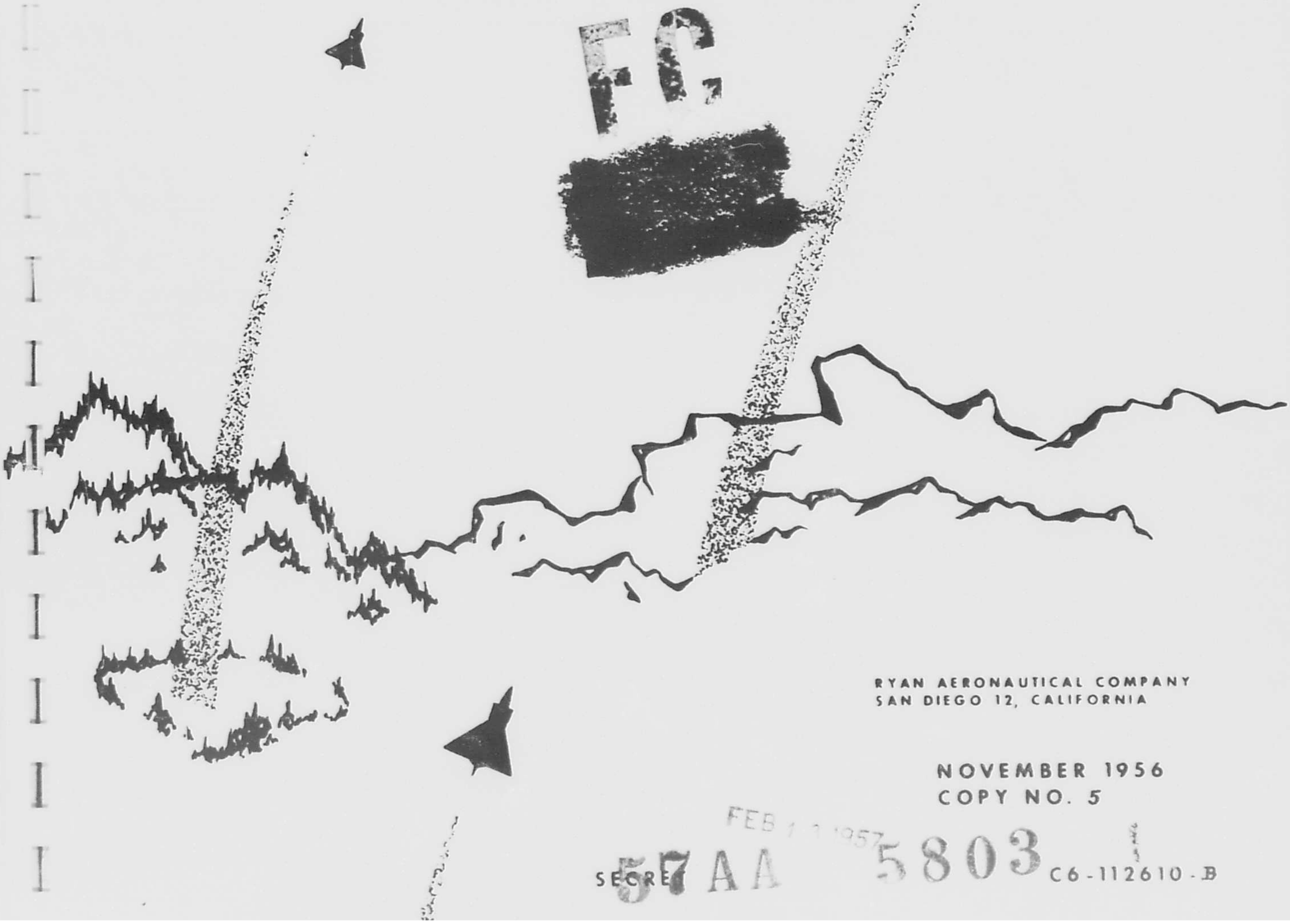

RYAN AERONAUTICAL COMPANY
SAN DIEGO 12, CALIFORNIA

NOVEMBER 1956
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26 NOVEMBER 1956

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AIRPLANE DESIGN SUMMARY REPORT

DISPERSED SITE FIGHTER BOMBER

RYAN MODEL 115

Prepared by: Preliminary Design

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Project Engineer

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1.0 SUMMARY

The Ryan Model 115 airplane design is a twin engine, low delta wing fighter-bomber designed for vertical flight operation from a take-off and landing rig. This airplane is the basic design to which other configurations are compared in the Ryan dispersed site fighter-bomber study.

Airplane performance exceeds by a significant margin the mission requirements specified for the study by Contract No. AF 18(600) 1641 Task No. 27500, reference 1.1 Climb performance, acceleration characteristics and maneuverability are outstandingly good.

The aircraft controls are designed for operation in all attitudes from hovering to normal flight and for a spped range of 0 to Mach 2.

Ryan has been able to achieve a minimum structural weight through the application of research in light weight structures and by eliminating conventional landing gear and high lift devices.

The airplane is well adapted to production and the type of construction proposed is particularly adaptable to Ryan's manufacturing capability. Consideration has been given to maintenance and accessibility in the design of the airplane structure and equipment arrangement.

2.0 INTRODUCTION

The purpose of this report is to present the principle features of the Model 115 airplane design used in the dispersed site fighter-bomber study under Contract AF 18(600) 1641 Task No. 27500, reference (1.1).

It has been determined by Ryan studies that this configuration offers an airplane which meets the requirements presented in Paragraph 2a and 2b of Exhibit "A" to reference (1.1). The Model 115 design has been used as the standard of comparison for the Ryan dispersed site fighter-bomber study, reference (2.1).

This report presents the design features of the aircraft, its performance capabilities, some data on maintenance characteristics, and general information on methods of production.

3.0 REQUIRED CHARACTERISTICS

The required characteristics of the aircraft to be used in the dispersed site fighter-bomber study are specified in Exhibit "A" of reference (1.1). These characteristics may be summarized as follows:

1. Take-off and landing: Vertical take-off and landing at 2,000 feet elevation on a 90° Fahrenheit day with minimum dependence on specialized ground equipment.

2. Military Load: One nuclear weapon of 1,000 pounds weight, 18 inches in diameter, 60 inches long if carried internally, or 180 inches long if carried externally. (Four Sidewinder or GAR-1B type missiles shall constitute an alternate military load.)

3. Bombing Methods: All weather bombing capability not required; visual methods to include "LABS" and dive-toss techniques.

4. Communication: AN/ARC-34 UHF

5. Control and Guidance: AN/ARR-39 Data Link for the defensive mission only; AN/APX-25 IFF; provision for landing through a 300 foot overcast.

6. Navigation Equipment: AN/ARN-21 Omni-range navigator or an APN-79 FAN Navigator.

7. Performance: Speed - Mach 1.0 at sea level (may be reduced to 1,000 fps if significant weight saving can be shown); Mach 2.0 at 35,000 feet;

8. Altitude: 60,000 feet; Radius of Action (with nuclear weapon) - 450 nautical miles, based on the following rules and fuel allowances:

a. One minute warm-up at military power.

b. Take-off

c. Climb on course to best cruise altitude.

d. Cruise out at best speed and altitude to target.

e. Deliver weapon by dive-toss method assuming release at 20,000 feet.

f. Climb on course to best cruise altitude.

g. Cruise back at best speed and altitude.

h. Fuel allowance for reserve and landing sufficient for time to penetrate weather plus that required for 15 minutes endurance at sea level.

i. All fuel consumption increased by 5%.

In addition to the above requirements, it is required that the following missions be presented:

1. A mission identical to the primary mission specified above except that the cruise and delivery portions shall be supersonic.

2. A mission similar to the primary mission except the cruise and delivery shall be performed sub-sonically at 500 foot altitude.

3. Three missions similar to the primary mission except the distance which can be flown at 1,000 fps at sea level when the radius of action is 150 N.M., 250 N.M., and 350 N.M. must be shown. A "LABS" maneuver shall be performed to deliver the weapon.

4. A ferry mission of 2142 N.M. with one in-flight refueling operation prior to the point of no return.

5. A ferry mission of 3,600 N.M. with one in-flight refueling operation at the point of normal maximum range.

4.0 GENERAL DESCRIPTION

Studies have been conducted by the Ryan Aeronautical Company over the past three years to determine the most desirable configuration and design of VTO aircraft. The results of these studies have been reviewed and re-examined in the light of the required military characteristics and mission described in Contract No. AF 18(600) 1641, reference (1.1). The design characteristics of the airplane are described in this report.

Figure 4.1 shows the general arrangement of this aircraft. The delta wing is chosen for its favorable flight characteristics in transition. The delta wing is also suitable for the high speed, high altitude operation. The Model 115 has a moderately high fineness ratio and the area progression has been made optimum for the supersonic speed range. The low wing position represents the best compromise between structural efficiency and stability.

The General Electric J-79-GE-X207 has been chosen as the most suitable power plant. The use of two J-79 engines provides an allowable gross weight of 28,571 pounds at takeoff and with a thrust to weight ratio of 1.05 under 2,000 feet, 90° F conditions. Considering fuel used prior to actual takeoff, the allowable fully loaded gross weight is 28,914 pounds.

The internal arrangement is illustrated in the Inboard Profile Drawing, Figure 4.2. The removable nose cone houses radar gear in the fighter version. The area behind the nose cone and ahead of the cockpit is the main electronic equipment bay. This bay also contains a portion of the automatic stabilization system.

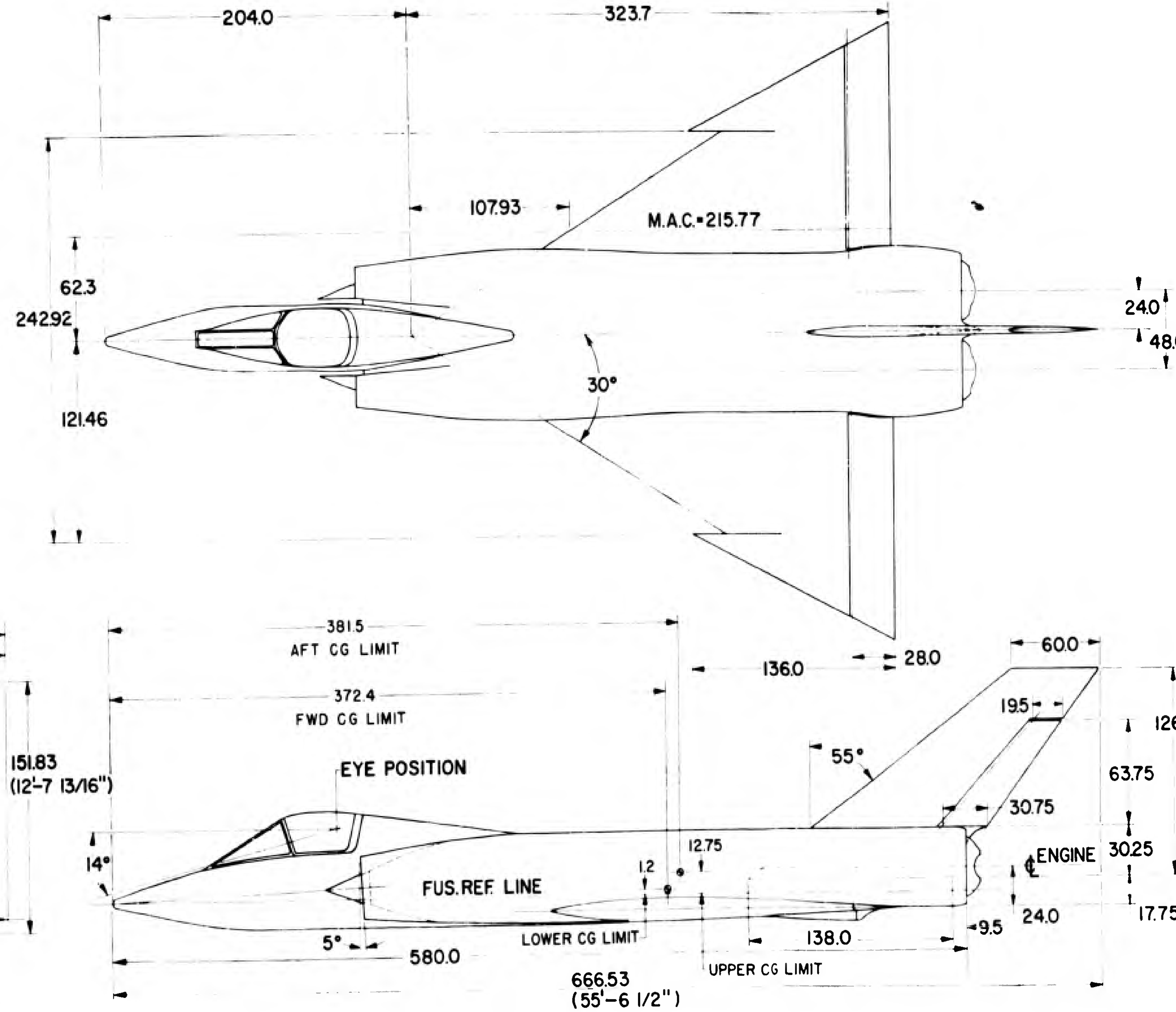
Figure 4.1

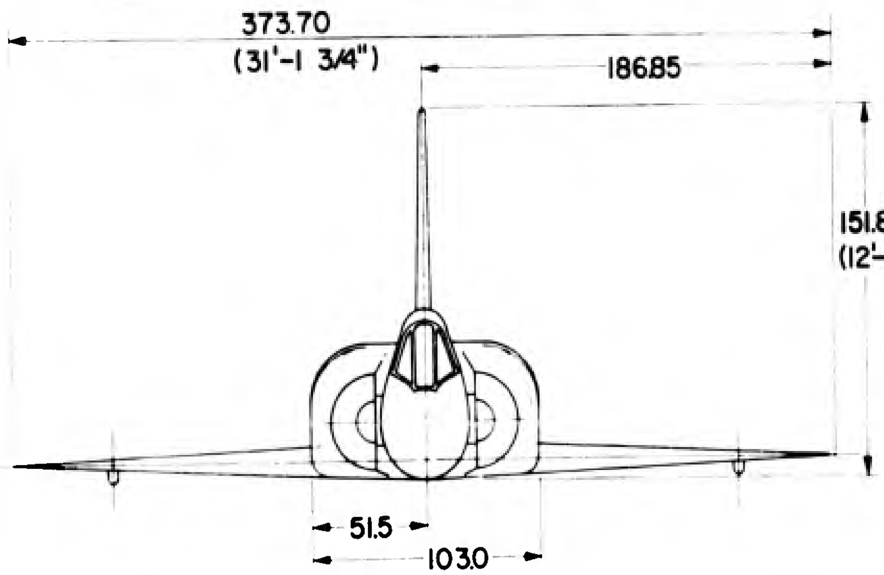
RYAN AERONAUTICAL COMPANY

SAN DIEGO · · · · · · · CALIFORNIA

MODEL 115

WING	
AIRFOIL SECTION	63A005
AVERAGE THICKNESS	5%
INCIDENCE	0°
DIHEDRAL	0°
AREA (TOTAL)	420 SQ FT
ELEVON	
AREA (TOTAL)	53.0 SQ FT
EACH (AFT OF HINGE)	24.8 SQ FT
ANGULAR MOVEMENT	40° UP 20° DOWN
VERTICAL TAIL	
AIRFOIL SECTION	63A005
AREA (TOTAL)	59.5 SQ FT
RUDDER	
AREA (AFT OF HINGE)	11.1 SQ FT
ANGULAR MOVEMENT	25° LEFT-25° RIGHT
DIVE BRAKE	
AREA	12.5 SQ FT
ANGULAR MOVEMENT	80° DOWN
WEIGHTS	
EMPTY	16,471 LB
DESIGN USEFUL LOAD	12,443 LB
TAKE OFF	28,571 LB
MAXIMUM GROSS	28,914 LB
ENGINE MODEL DESIGNATION	J-79-GE-X207





PRELIMINARY DESIGN

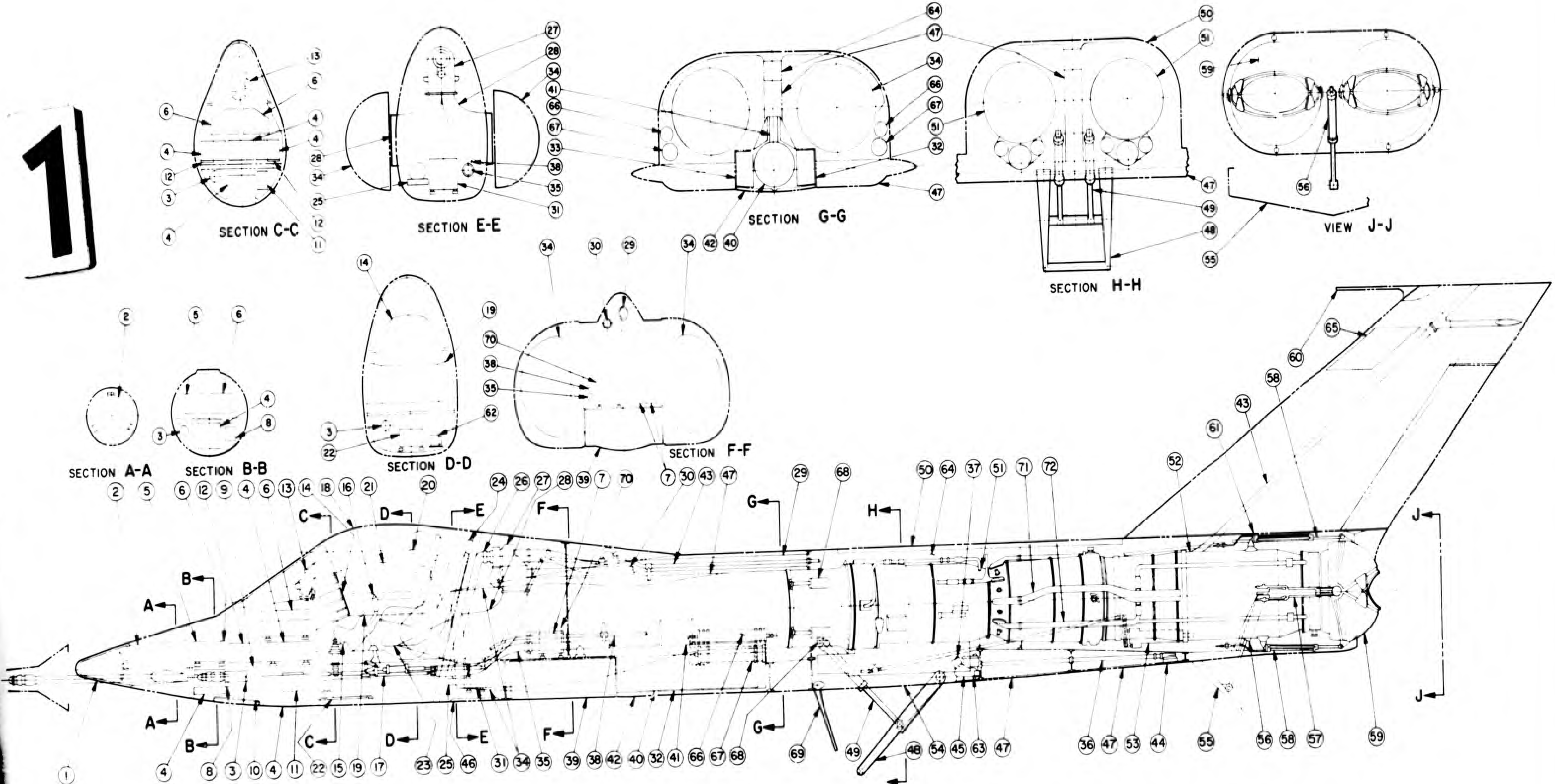
MODEL 115

GENERAL ARRANGEMENT

RYAN AERONAUTICAL CO 8-115V001

SAN DIEGO CALIFORNIA

1


SECTION A-A
SECTION B-B
SECTION C-C
SECTION D-D
SECTION E-E
SECTION F-F
SECTION G-G
SECTION H-H
VIEW J-J

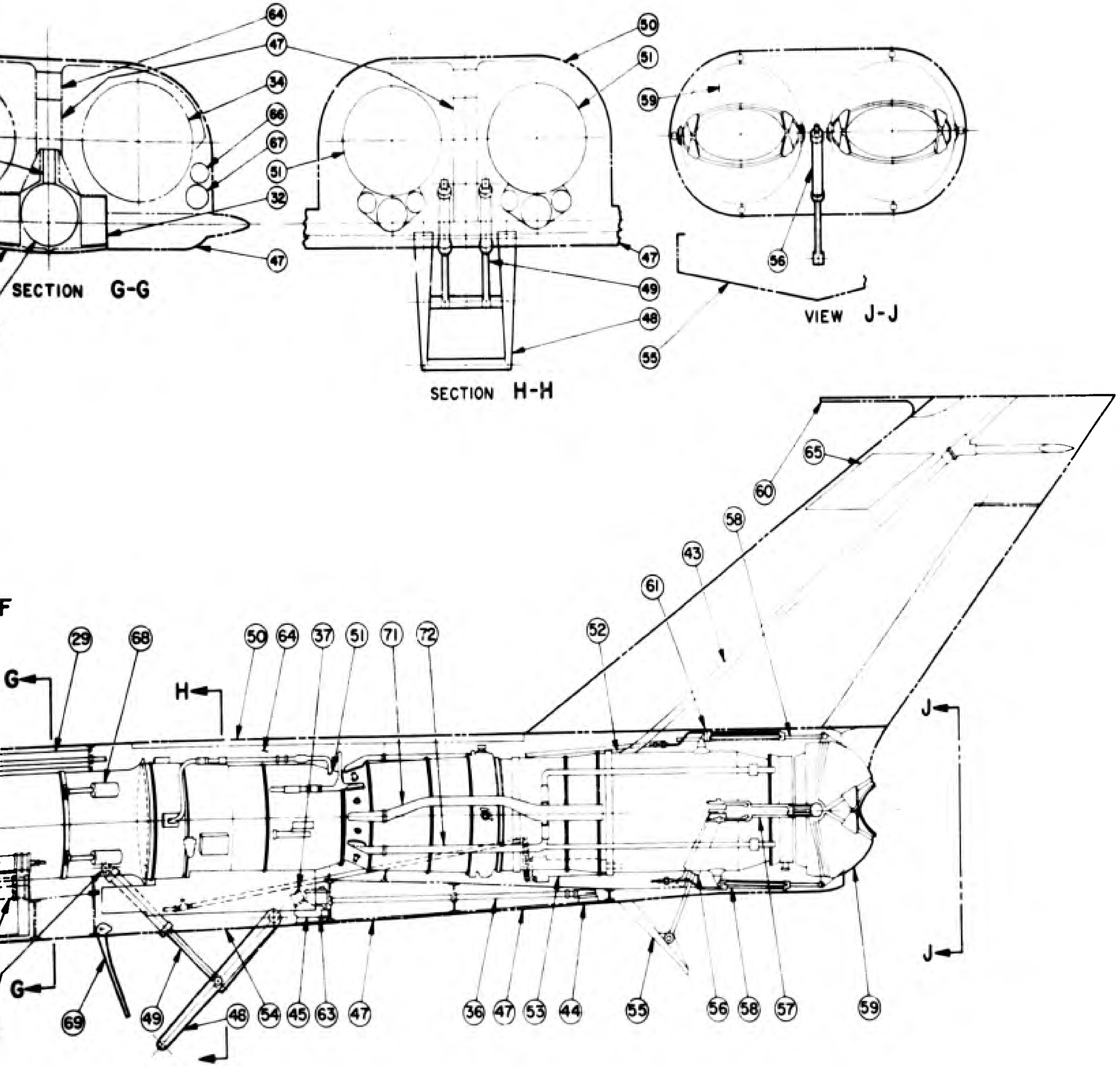


Figure 4.2

1	RADOME (REF.)	38	REFUELING PROBE ACTUATOR LINE
2	AN/APS-67 RADAR (REF.)	39	FWD REMOVABLE FUEL TANK
3	TELESCOPING REFUELING PROBE	40	NUCLEAR WEAPON
4	AN/APN-79 FAN NAVIGATOR	41	EJECTION TYPE BOMB RACK
5	GYRO STABILIZATION UNIT	42	BOMB BAY DOORS
6	STABILIZATION MIXER UNITS	43	FUEL VENT LINE
7	AFCS EX-16 COMPUTER (REF.)	44	FUEL TRANSFER PUMP
8	TRANSFORMER RECTIFIER	45	FUEL BOOSTER PUMP
9	ACCESS MANHOLE	46	OXYGEN SYSTEM ACCESS DOOR
10	ACCESS DOOR	47	FUEL TANK
11	A.C. CONTROL PANEL	48	LANDING MECHANISM
12	VOLTAGE REGULATOR	49	LANDING MECHANISM ACTUATOR
13	MK-11 GUNSIGHT (REF.)	50	ENGINE ACCESS DOOR
14	INSTRUMENT PANEL	51	GE J79-GE-X207 ENGINE
15	RUDDER PEDALS	52	ENGINE AFTER BURNER
16	CONTROL STICK	53	ELEVON ACTUATOR
17	CONTROLS	54	ENGINE ACCESSORY ACCESS DOOR
18	CANOPY	55	SPEED BRAKE
19	SIDE CONSOLE	56	SPEED BRAKE ACTUATOR
20	HORIZONTAL ATTITUDE FLIGHT PILOT'S NORMAL EYE POSITION	57	YAW CONTROL CYLINDER
		58	PITCH/ROLL/AREA CONTROL CYLINDER
21	VERTICAL ATTITUDE FLIGHT-PILOT'S NORMAL EYE POSITION	59	VARIABLE AREA DEFLECTING NOZZLE
		60	PITOT STATIC TUBE
22	AN/ARC-34 RADIO	61	RUDDER ACTUATOR
23	EJECTION SEAT	62	LABS CALIBRATION BOX
24	EJECTION RAILS	63	LABS ACCELEROMETER
25	LIQUID OXYGEN UNIT	64	CONTROLS TUNNEL
26	AIR CONDITIONER MANIFOLD	65	ANTENNA
27	AIR CONDITIONER UNIT	66	HYDRAULIC ACCUMULATOR
28	BOUNDARY LAYER BLEED DUCT	67	HYDRAULIC RESERVOIR
29	AIR CONDITIONER EXHAUST LINE	68	INLET BYPASS DOOR
30	COMPRESSOR BLEED LINE	69	LANDING MECHANISM DOOR
31	AN/APX-25 IFF	70	AN/ARR-39 DATA LINK (REF.)
32	R.H. REMOVABLE FUEL TANK	71	EJECTOR
33	L.H. REMOVABLE FUEL TANK	72	NOZZLE COOLING DUCT
34	ENGINE INLET DUCT		
35	REFUELING LINE		
36	TRANSFER FUEL LINE		
37	ENGINE FUEL LINE		

NOTE:
ITEMS WHICH ARE MARKED (REF.) ARE INSTALLED FOR THE DEFENSIVE MISSION ONLY

PRELIMINARY DESIGN
INBOARD PROFILE
MODEL 115
RYAN AERONAUTICAL CO. SAN DIEGO CALIFORNIA 8-115V002

2

The cockpit has been designed to USAF standards. Conventional cockpit controls are used for both hovering and conventional flight regimes.

The air conditioning system is located immediately behind the cockpit in the upper part of the fuselage. This system provides for cooling or heating the cockpit and electronic equipment, as necessary. The air from the system is exhausted into the engine bay to assist in cooling the power plant.

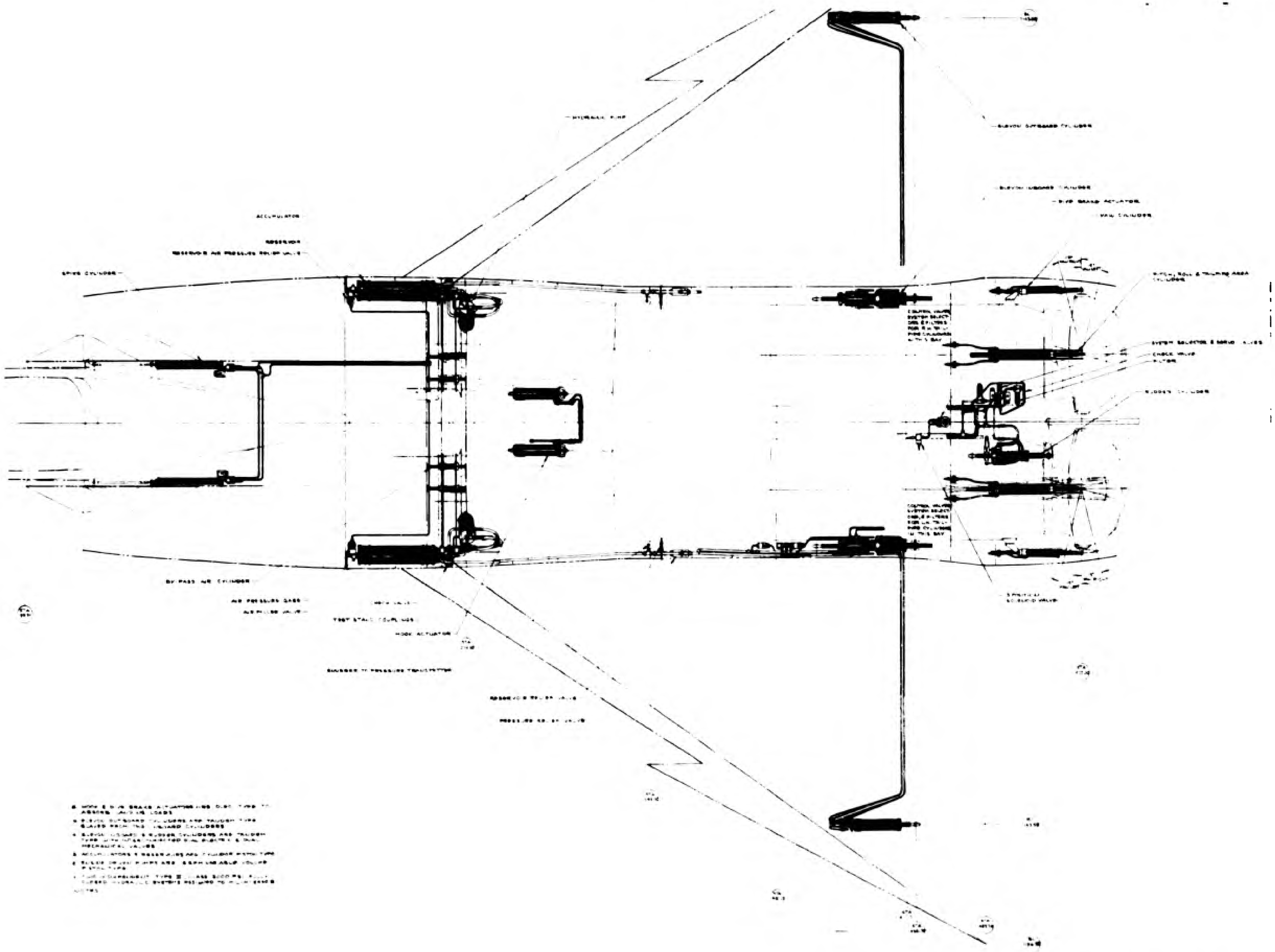
The area below the air-conditioning unit contains the liquid oxygen unit and serves as an auxiliary electronics bay. The AFSC 16 computer is installed in this bay on the fighter version.

The armament bay as shown in Figure 4.2 accommodates a 1,000 pound nuclear weapon and three removable fuel tanks. In lieu of the nuclear weapon and fuel tanks, four sidewinder missiles may be carried in launching tubes.

The hydraulic system installation is illustrated in Figure 4.3. This system is a 3,000 psi, closed center, variable delivery pump control type. It is a completely independent dual system with both parts of the system continuously operating, providing optimum reliability and vulnerability characteristics. The hydraulic reservoirs and accumulators are installed at each side of the fuselage near the rear of the armament bay. The hydraulic system operates flight controls, jet nozzle controls, air brakes, canopy and the landing mechanism.

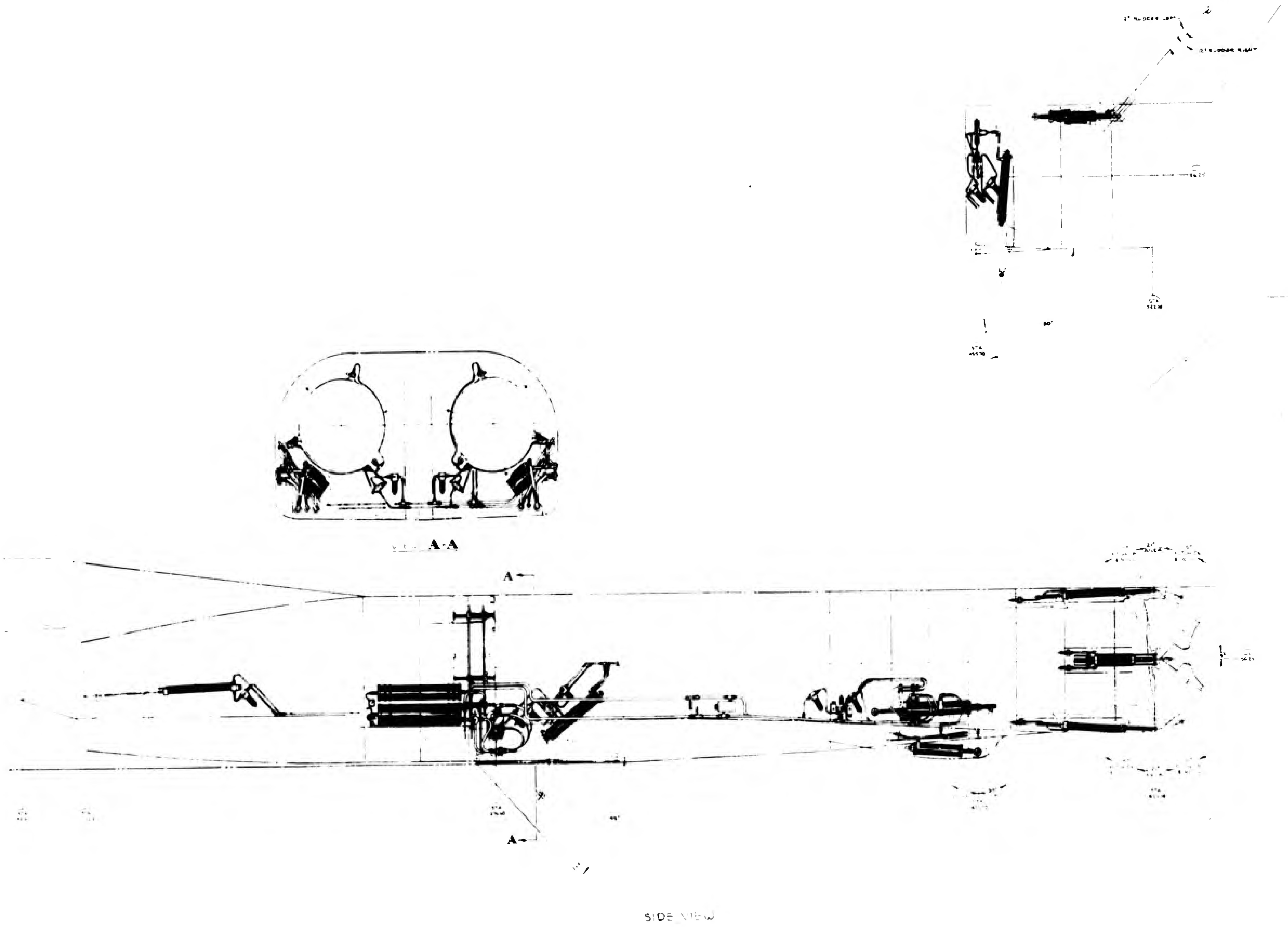
The electrical system derives power from two 20 KVA, 3 phase, 120/208V, 400 cycle generators, one on each engine, driven through a constant speed drive. Electrical power operates the radar, other electronic gear, armament and the stabilization system. The small amount of DC current required for lighting, necessary

Figure 4.3



HYDRAULIC SYSTEM INSTALLATION
SHEET I

Figure 4.3



HYDRAULIC SYSTEM INSTALLATION
SHEET 2

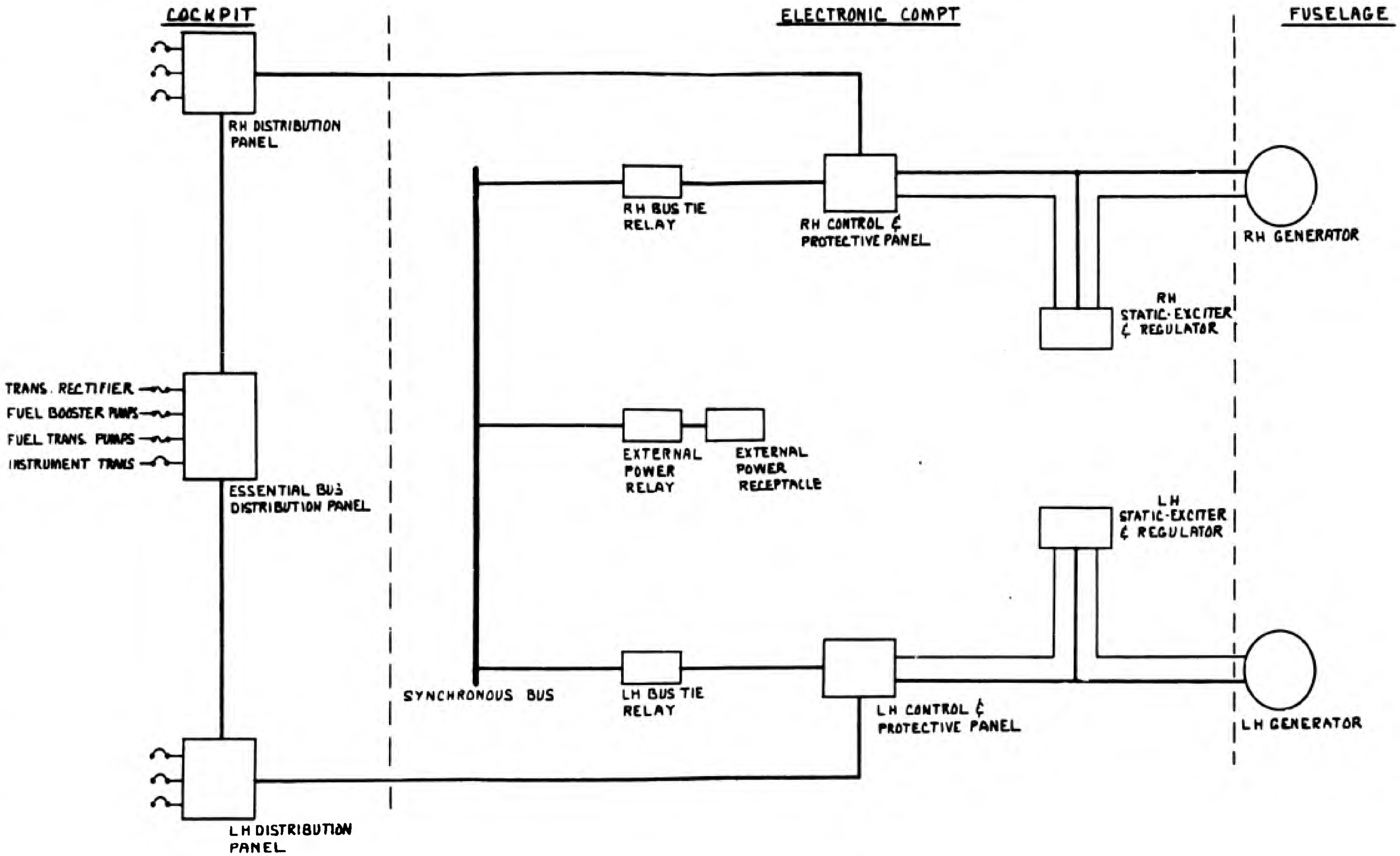
current control, and parts of the electronic system is supplied through a transformer rectifier. A diagram of the power distribution of the electrical system is shown in Figure 4.4.

The power plant installation includes two J-79-GE-X207 jet engines mounted side by side in the fuselage over the wing. The engine exhaust nozzles are designed to divert thrust so as to provide control forces in hovering and transition. A variable area, semi-circular, side inlet is provided for each engine. The major part of the fuel is carried in the wings with additional fuel in the fuselage.

The landing mechanism, which attaches the airplane to the rig in landing and takeoff operations, is located in the bottom of the airplane under the forward part of the engine. An actuating cylinder extends and retracts the mechanism and also acts as a shock absorber in landing.

The dive brake is located under the aft fuselage in line with the elevons and is used to assist in controlling air speed. This device is especially reinforced and is extended in landing to prevent the rear portion of the airplane from striking the landing platform.

Figure 4.4



AC ELECTRICAL POWER DISTRIBUTION

5.0 WEIGHT AND PERFORMANCE

5.1 Weights

The principal weight conditions of the Ryan Model 115 are as follows:

Weight Empty	16,471 lbs.
Useful Load	12,443 lbs. (At max. gr. weight)
Maximum Gross Weight	28,914 lbs.
Maximum Take-off Weight	28,571 lbs.
Structural Design Weight	23,071 lbs.
Combat Weight	24,308 lbs.
Landing Weight	19,000 lbs. (with 75% fuel)

The group weight statement is shown in Appendix 9.2. This statement includes an allowance of 88.5 lbs. for an escape capsule. The electronic group weight includes an allowance of 40 lbs. for weather penetration equipment. The structural design weight is the take-off weight minus the weight of the bomb and fuel expended up to the delivery of the bomb.

5.2 Performance

The flight envelope of the Ryan Model 115 is shown in Figure 5.1. The basic mission is shown in Figure 5.2. The radius of action for the basic mission is 684 n.m. The supersonic dash capabilities are shown in Figure 5.3, and the subsonic, sea level dash capabilities are shown in Figure 5.4. The method of calculating performance is shown in Appendix 11.3 of reference (2.1).

The speed and altitude capabilities of the Model 115 exceed the requirements of reference (1.1). The radius for the basic mission exceeds the required radius by 234 miles.

Figure 5.1

MODEL 115
FLIGHT ENVELOPE
TWIN ENGINE CONFIGURATION
MAXIMUM RATING
ICAO STD. ATMOSPHERE

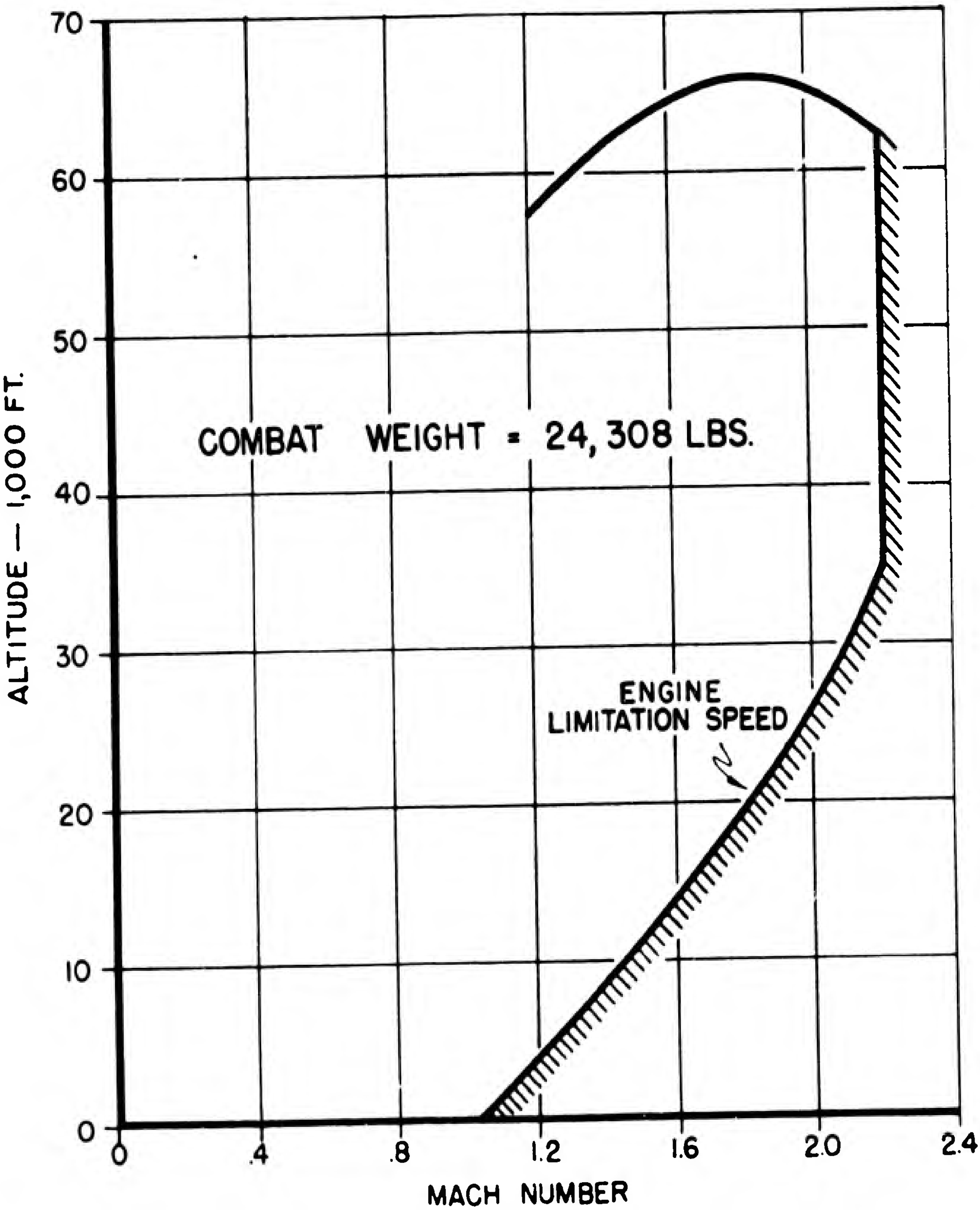
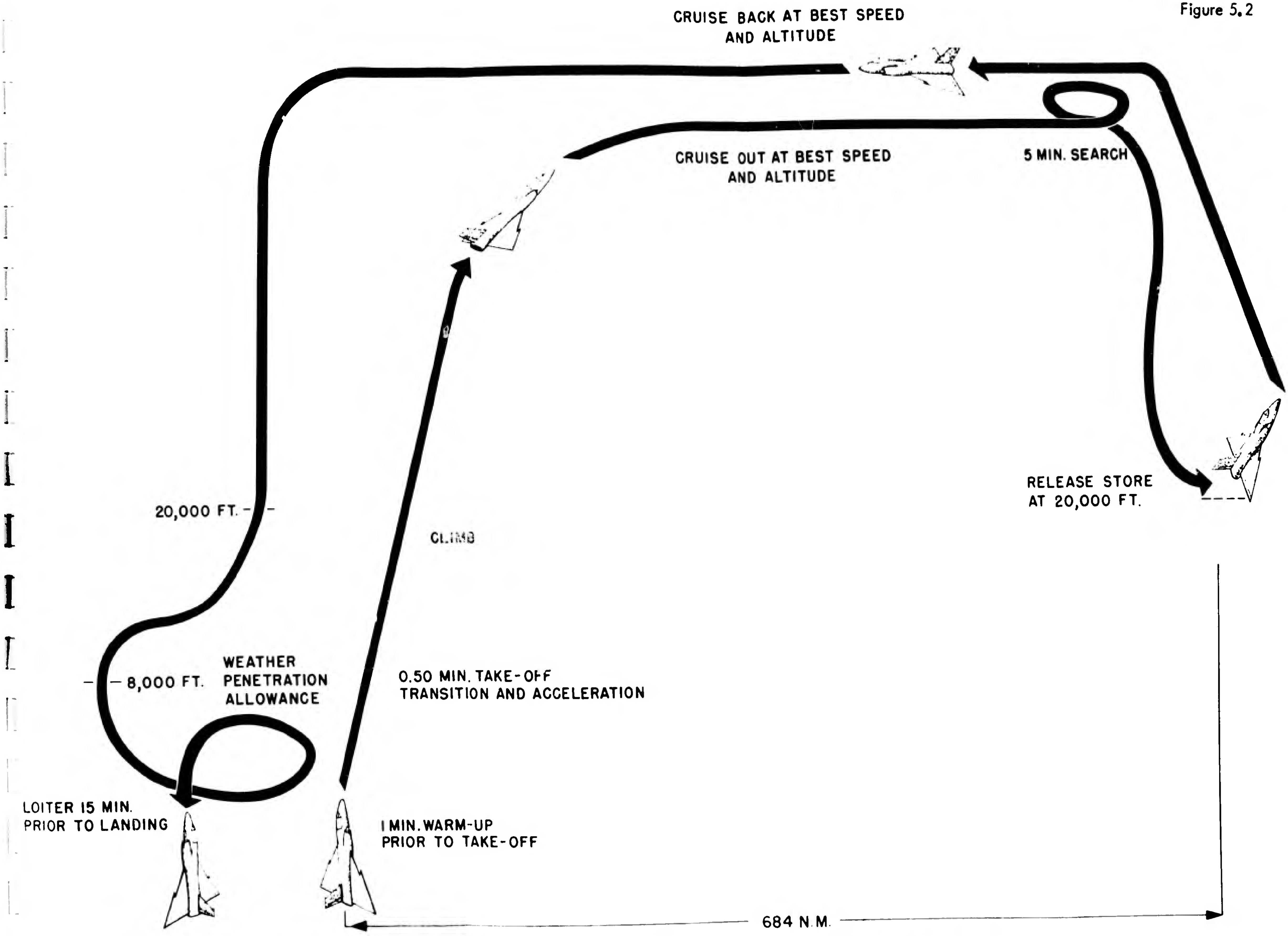


Figure 5.2



BASIC MISSION PROFILE

Figure 5.3

MODEL 115
TWIN ENGINE CONFIGURATION
VARIATION OF DASH DISTANCE WITH CRUISE RADIUS AT SUPERSONIC SPEEDS AT ALTITUDES FOR MAXIMUM RANGE

I.C.A.O. STD. ATMOSPHERE

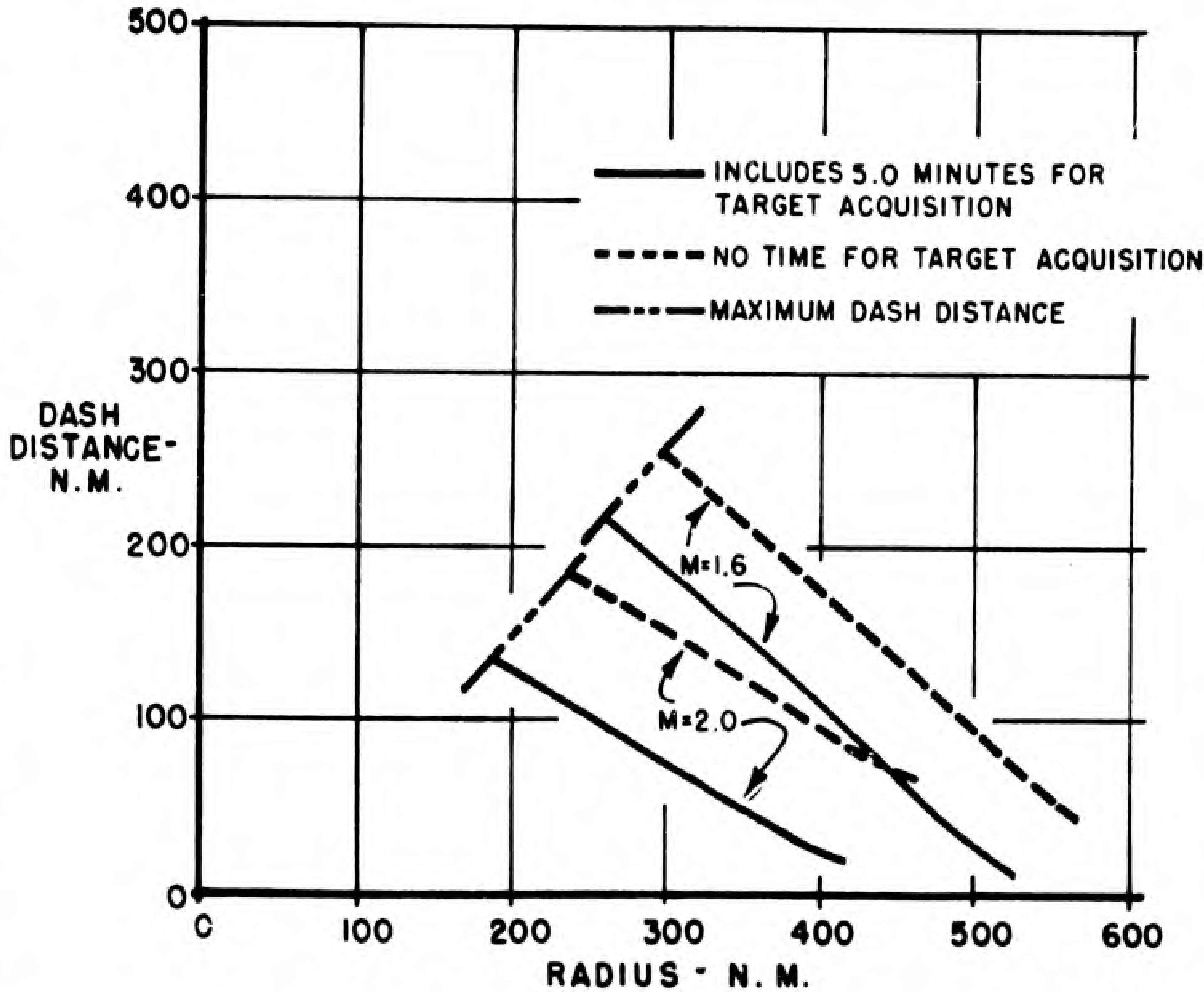
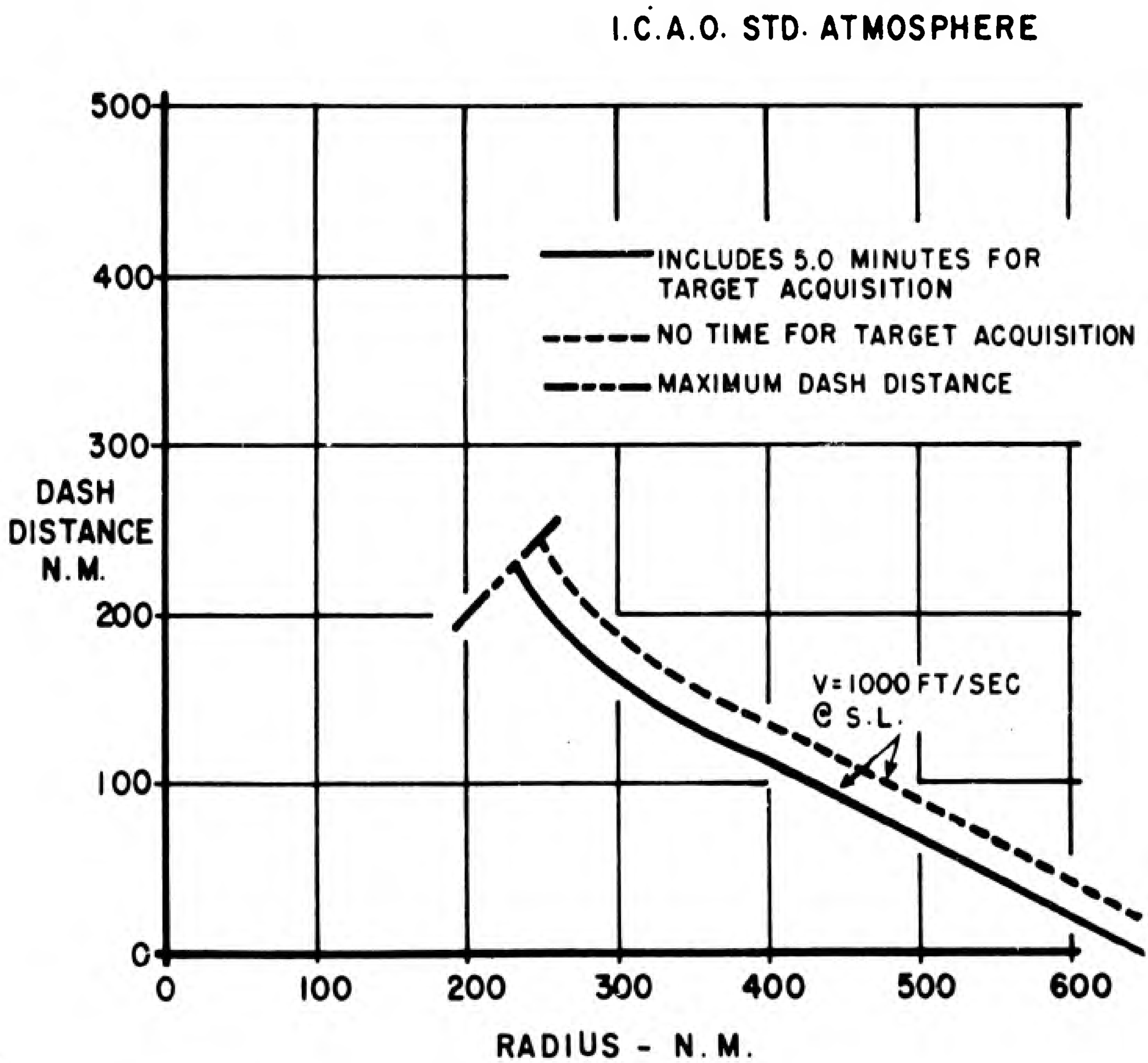


Figure 5.4

MODEL 115

TWIN ENGINE CONFIGURATION

VARIATION OF DASH DISTANCE WITH CRUISE RADIUS AT A SUB-SONIC SPEED OF 1000 FT/SEC AT SEA LEVEL



The supersonic dash distance is defined as that portion of the cruise radius which is conducted at Mach 1.6 or at Mach 2.0. The distance which may be covered at each of these Mach numbers versus total combat radius is shown in Figure 5.3. These curves cannot be used to show the basic mission radius by reducing the dash distance to zero because the acceleration to supersonic speed, the supersonic climb, and the delivery portions of the dash mission cause discontinuities in the curves.

Curves of subsonic, low altitude dash versus total combat radius, with and without target acquisition time, are shown in Figure 5.4. The maximum radii which may be reached when the total mission is performed at subsonic speed and low altitude is slightly under 250 nautical miles.

The thrust required and thrust available curves, shown in reference (2.1) indicate that the Model 115 would have low time to climb, low time to accelerate, and low radius of turn characteristics.

A ferrying mission of 2,610 n.m. may be performed with one in-flight refueling at the point of no return, 790 n.m. from base. This ferry range exceeds the required range by 468 n.m. A ferrying mission of 3,400 n.m. with one in-flight refueling at the point of normal maximum range, 1,580 n.m., may be performed. This range could be increased to 3,600 n.m. by reducing the 15 minute sea level loiter at the destination to a 2 minute sea level loiter. The gross take-off weight for the above missions is established by 90° Fahrenheit, 2,000 foot altitude take-off conditions.

6.0 SPECIAL DESIGN FEATURES

This airplane is designed to take-off and land with the longitudinal axis of the fuselage in a vertical position. Thus, it must be capable of stable, controlled flight at speeds varying from 0 to Mach 2 and at attitude angles from zero to ninety or more degrees. It is evident that stabilization and control systems, power plant installations, pilot accommodations and landing system designed for aircraft capable of only level flight are not suitable for this application. A summary of the design features of this aircraft affected by these and other special requirements are presented below.

6.1 Stabilization and Control

The extreme range in flight speeds and flight attitudes of this aircraft necessitates two control systems. Conventional aerodynamic controls are used for high and medium speed level flight and jet reaction controls are used for hovering and for low speed flight where aerodynamic controls are ineffective. The pilot operates both systems from the conventional stick and rudder pedal cockpit controls. Both control systems are actuated by a fully powered, irreversible hydraulic system and incorporate artificial feel. This control system has been thoroughly demonstrated in the Ryan-built X-13 aircraft.

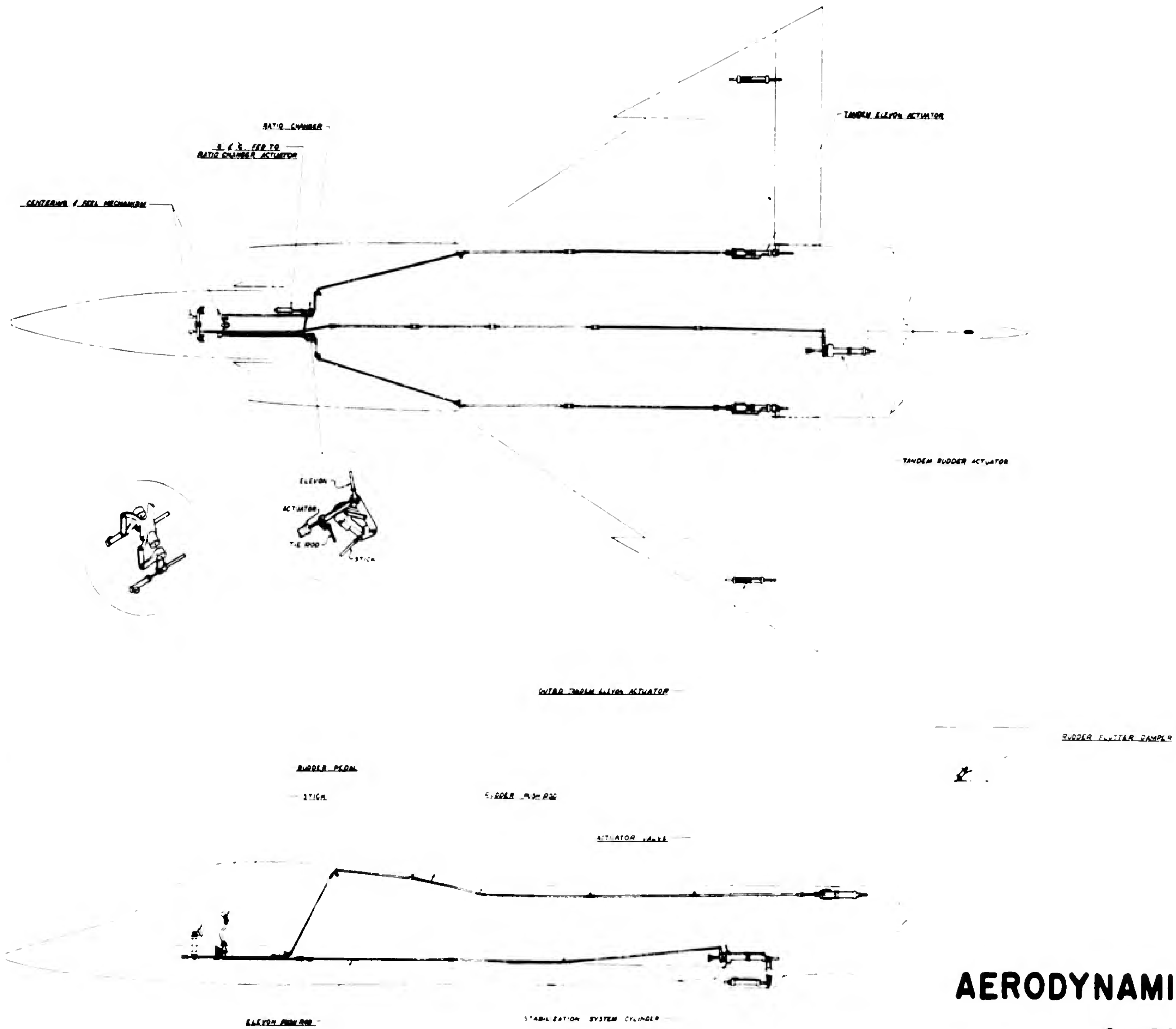
A stabilization system is required for the vertical flight regime to insure adequate hovering control. This stabilization system is also used to provide artificial stability during high speed flight. Ryan Report No. 11254-1, reference (6.1) presents the stability and control analysis of an aircraft which is the same size and shape as the Ryan Model 115. The difference in weight and inertial characteristics of the two aircraft is not sufficiently large to result in a measurable difference in stability and control characteristics. A stabilization system design suitable for such an aircraft is presented in Ryan Report No. 11255-1, reference (6.2).

6.1.1 Aerodynamic Controls. The high speed capability of this aircraft is the primary factor affecting the design of the aerodynamic control system. Roll and pitch are controlled by elevons. The rudder is used for yaw control. A dive brake is provided in an aft position under the fuselage. The elevons and rudder are controlled through a mechanical linkage from the pilot's cockpit controls to hydraulic servo valves at the actuating cylinders. Artificial feel is applied to both the elevon and rudder controls. The aerodynamic control system is illustrated in figure 6.1.

6.1.2 Jet Reaction Controls. In hovering flight, control forces and moments are developed by jet engine exhaust deflection and thrust variation rather than by aerodynamic surfaces. Both aerodynamic and jet reaction controls are utilized in the latter part of transition to level flight, since aerodynamic controls become effective during this portion of the flight regime. Jet reaction control for pitch is accomplished by simultaneous deflection of the nozzles in the pitch plate; for yaw by a simultaneous lateral deflection of the nozzles; and for roll by differential pitch plane deflection of the nozzles. Thrust variation, effected by movement of the engine throttle, is used to control altitude and vertical speed. Figure 6.2 presents a diagram of the jet reaction control and automatic stabilization system.

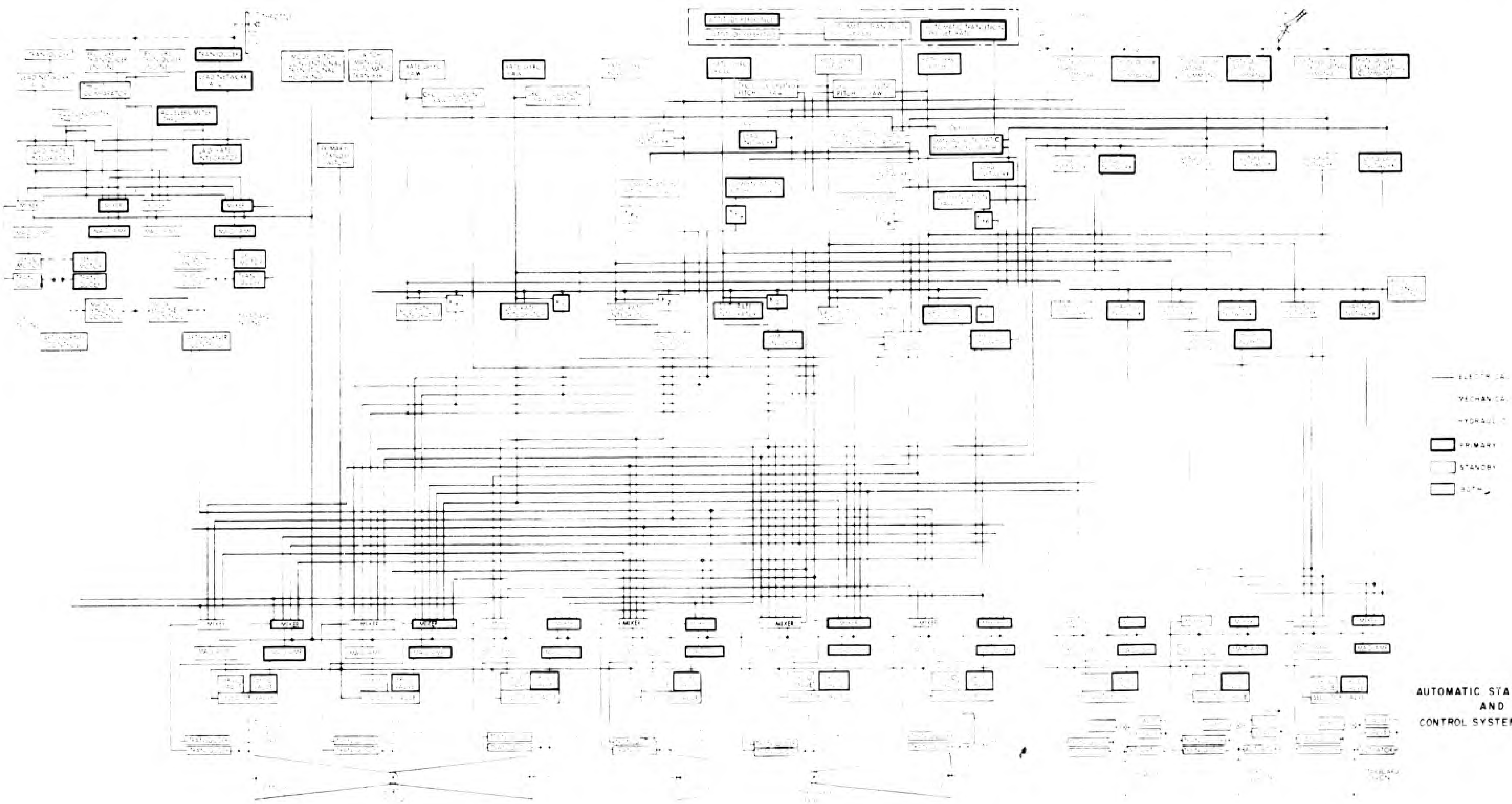
6.1.3 Stabilization and Control System. An integrated stability augmentation system is provided for all flight regimes of the aircraft. During the hovering and

Figure 6.1



AERODYNAMIC CONTROLS SYSTEM

Figure 6.2



AUTOMATIC STABILIZATION
AND
CONTROL SYSTEM DIAGRAM

transition phases of flight, the pitch and yaw axes are stabilized by signals from rate gyros which provide damping, and inputs to lag rate integrators which provide approximate attitude references. Stick deflections generate command signals to the control system causing changes in the direction of the engine thrust. The resulting control moments change the attitude of the airplane, thus producing horizontal components of force for horizontal translation.

Compensation is provided to overcome the effects of the engine gyroscopic moments by providing lead signals from the pitch and yaw commands and cross-feeding these signals into the complementary control channels.

Roll stabilization is achieved by means of a rate gyro, which provides dynamic damping, and also a signal to a roll lag rate integrator to provide roll attitude reference. Roll control is commanded through the pedals in hovering flight. Each time the pedals are deflected, the integrator is neutralized resulting in a steady-state roll rate.

Thrust control is commanded by the throttles and is modified by an acceleration feedback through a lag rate integrator. This system attempts to maintain constant velocity along the airplane longitudinal axis.

During conventional flight provision is made for artificial damping about all three axes. The conventional flight stability augmentation system makes use of sensing components already available in the vertical attitude flight system. These components are used in a conventional manner to provide damping and permit control through mixing networks as required.

6.2 Power Plant

The wide range of speeds and flight altitudes of the Model 115 imposes unique requirements in the design of the inlet nozzle, cooling system, and fuel systems. The power plant installation for this airplane is illustrated in Figure 4.2, the Inboard Profile Drawing. A summary of the design features of the power plant installation is presented in the following paragraphs.

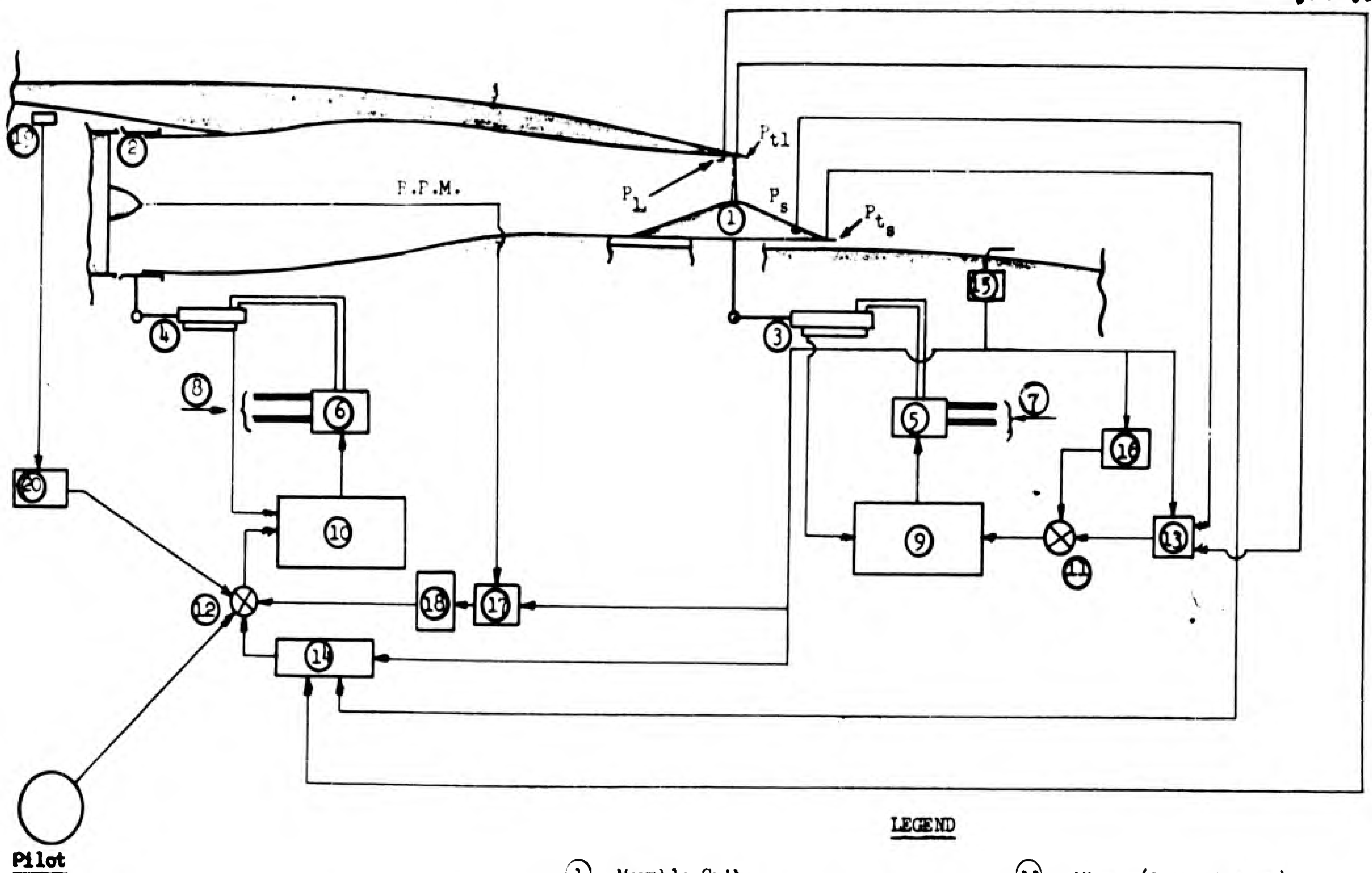
6.2.1 Inlet Design. Each engine inlet consists of a semi-circular side scoop incorporating a fore and aft moving conical spike. The inlet area provides a mass flow ratio of unity at Mach 2 at 35,000 feet altitude and maximum engine rpm. Incorporated in the inlet duct just forward of the front face of the engine is a controlled area, by-pass door which encircles the outside periphery of the engine inlet. A schematic diagram of the inlet duct control system is shown in Figure 6.3.

At supersonic speed the oblique shock wave is positioned by the movement of the conical spike, and mass flow is controlled by the sliding by-pass door. At sub-sonic speed the movable cone is positioned to give a mass flow ratio of unity at maximum engine rpm. At part rpm the by-pass door exhausts excess inlet air past the engine into the engine compartment where it is utilized for engine cooling.

Auxiliary air for static engine operation is provided by allowing air to enter through the landing mechanism door. A portion of this air flows in a reverse direction through the full open by-pass door. The remainder of this air is used for cooling as described in paragraph 6.2.3.

6.2.2 Nozzle Design. The engine exhaust nozzles are double gimballed, spherical shaped, area controlling devices which are capable of deflecting the engine exhaust

Figure 6.3



LEGEND

1. Movable Spike
2. Sliding Door
3. Spike Actuator and Follow-Up
4. Duct Door Actuator and Follow-Up
5. Spike Actuator Control Valve
6. Duct Door Actuator Control Valve
7. Hydraulic Supply (Spike System)
8. Hydraulic Supply (Duct Door System)
9. Servo-Amplifier (Spike System)
10. Servo-Amplifier (Duct Door System)
11. Mixer (Spike System)
12. Mixer (Duct Door System)
13. Pressure transducer (Spike System)
14. Pressure Transducer (Duct-Door System)
15. Machmeter
16. Mach Number Transducer (Spike System)
17. Mach Number Transducer (Duct Door System)
18. R.P.M. Transducer
19. Pressure Differential Sensor
20. Pressure Differential Transducer

Duct Inlet Variable Geometry

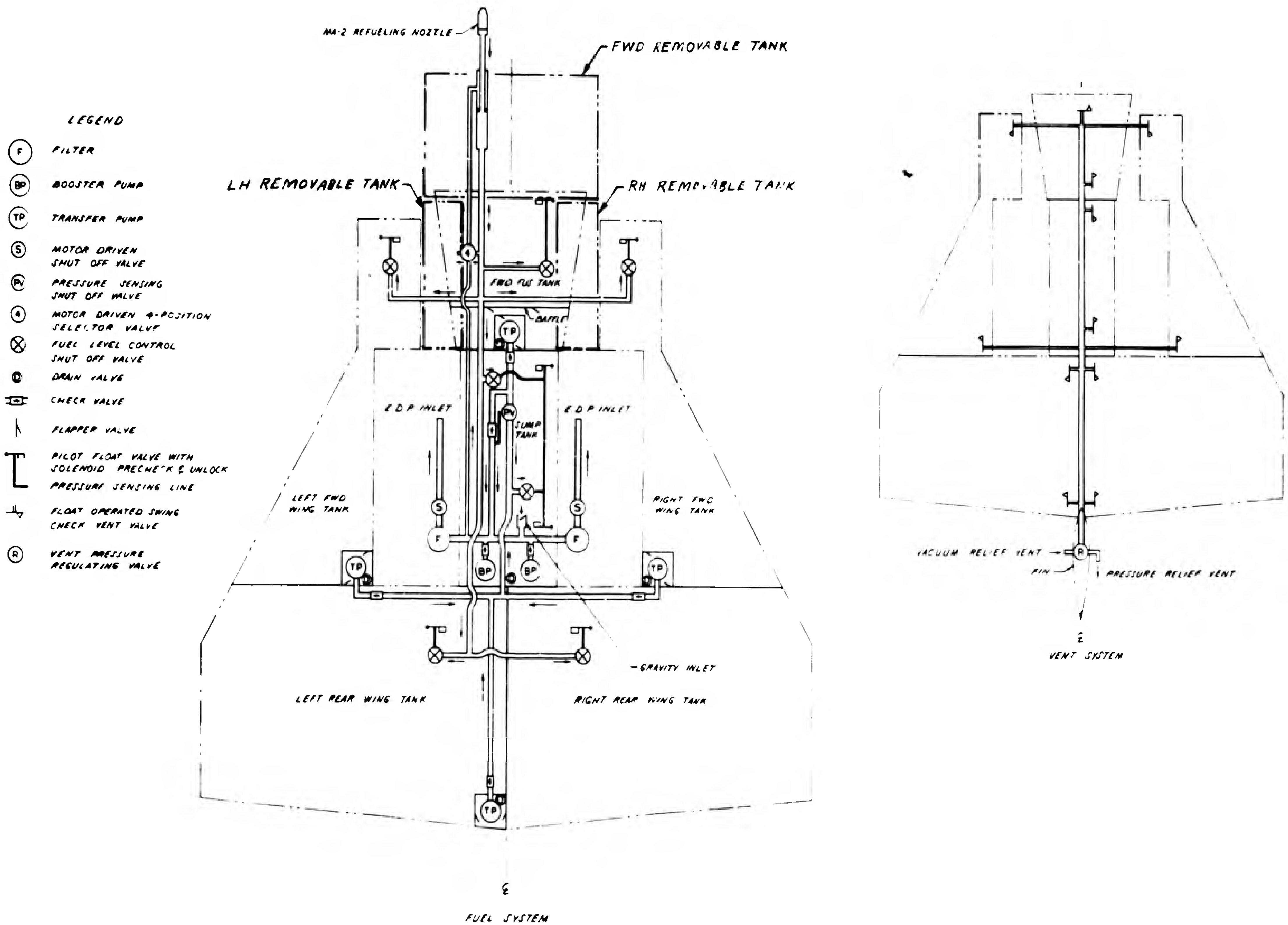
stream in any direction required to maintain flight control during hovering and transition. The amount of deflection provided is based on requirements for control established by analysis of flight conditions and aircraft dynamics in hovering and transition. Bleed air from the engine compressor is directed through the nozzles to provide cooling. The cooling air is automatically directed to the nozzle segment which is immersed in the jet stream.

6.2.3 Engine Cooling System. Engine cooling is accomplished by means of air flow through the engine compartments. Air is introduced into the forward engine compartment from boundary layer bleed ducts and the engine inlet bypass doors. This air is passed through the engine compartment and overboard through constant area ejectors. Blankets varying from .5 to 1.0 inch thick provide insulation for fuel tank areas adjacent to the engine compartment.

The engine cooling air requirements are so high, that a conventional firewall has been eliminated. Instead, the cooling air constantly purges the engine compartment of combustible mixtures. Should an engine fire develop, the high flow of cooling air will tend to prevent the propagation of the flame upstream.

6.2.4 Fuel System. The fuel system is capable of supplying fuel to the engines in all flight maneuvers and attitudes. Automatic fuel transfer and fuel tank sequencing provide airplane center of gravity control. Single point ground and aerial refueling is accomplished with an extendable fuel probe. Figure 6.4 illustrates the complete fuel system. Defueling is accomplished by applying suction to the extended refueling probe which draws fuel out of the tanks through the refueling lines.

Figure 6.4



FUEL AND VENT SYSTEM SCHEMATIC

6.2.5 Engine Modification. The engine oil system is modified to provide engine lubrication in the vertical position for extended time periods. A modified afterburner and a Ryan designed exhaust nozzle are incorporated on each engine.

6.3 Pilot's Compartment

The vertical take off and landing requirement for the Model 115 requires special design features in the pilot's compartment. The following is a summary of these design features.

6.3.1 Pilot's Seat. Taking off and landing with the fuselage longitudinal axis in a vertical position requires that provision be made for rotating the pilot's seat forward 45° from the normal position for horizontal flight to provide optimum pilot position and vision throughout the varying flight attitudes. The seat pivoting mechanism is so designed that the location of the stick and rudder pedals with reference to the seat is essentially fixed throughout rotation.

A conventional rail type ejection seat system has been shown in Figure 4.2. The initial action of the ejection system rotates the seat to a locked position against the ejection rails. From this position conventional seat ejection may be accomplished.

The configuration of this airplane readily lends itself to the use of a nose pod type escape capsule rather than a conventional ejection seat. The determination of the precise shape and stabilization means for a capsule are beyond the bounds of the study which this report supports. A picture of a capsule has, therefore, not been shown. However, the weight estimate includes an allowance of 88.5 pounds over the weight required for a conventional escape system. It has been determined that an escape capsule should initially move forward sufficiently to clear all electrical, hydraulic, and mechanical attachments and then be separated from the airplane by the thrust of a small rocket. The capsule must be stabilized from the moment of separation and decelerated at a maximum rate consistent with the pilot's limitations. Automatic ejection of the pilot and automatic deployment of the pilot's parachute or a means of safe descent in the capsule must be provided.

6.3.2 Pilot's Instrument Panel and Console. The panel and console comply with the standards for aircraft of this class and mission, with the exception of provision for the items peculiar to VTO operation. These items are a flight transition control panel, a vertical velocity indicator, and a seat actuation switch.

6.4 Air Conditioning

In order to maintain the temperature limits necessary for proper functioning of the pilot and electronic equipment, it is necessary to heat or cool the nose compartments depending on the heat loads resulting from the combination of ambient temperature and flight speed. Heating, cooling, and cabin pressurization are accomplished by a single air conditioning unit. This unit is located behind the aft pressure bulkhead, as shown in Figure 4.2.

The air conditioning system is based upon a Stratos NUR-60-1 air cycle refrigeration unit. Engine bleed air passes through an intercooler and expansion turbine, is mixed with additional hot bleed air as required for temperature control, and is then introduced into the cockpit through a control valve and ducting. Boundary layer bleed air is used as a heat sump and passes from the intercooler aft into the engine compartment.

6.5 Structural Design

The Ryan Aeronautical Company's previous work in the VTO field has led to the investigation of materials and methods for attaining minimum weight structures. Details of this investigation can be found in Ryan Report No. G-42-39, reference (6.3).

Incorporation of the results of this investigation has led to the extensive use of light gauge stainless steel corrugated structure in this airplane.

Fuselage skins of .002 to .006 inches in thickness are used in combination with square corrugations of stainless steel .002 to .006 inches in thickness and varying in depth, as loads require, from .080 to .120 inches. This combination is equivalent to a thick skin of relatively low density. Fuselage formers are of the same basic construction.

Wing skins and spar webs of .004 to .010 inches in thickness are used in combination with corrugations of the same gauge. Tapered spar caps of stainless steel are used. All stainless steel material in both fuselage and wing is heat-treated to 200,000 psi. Low power resistance welding is used for fabrication.

The use of this type of material and construction is calculated to afford a structural weight saving of approximately 25% in comparison with conventional structure.

The materials used were selected primarily for high strength to weight properties, ease of welding and availability. However, the inherent ability of stainless steel to withstand high temperatures has simplified many problems associated with power plant design and installation, and will provide an inherent capability to withstand effects of increased aerodynamic heating when engines of higher Mach number limitation are available.

Figures 6.5 and 6.6 illustrate the type of fuselage structure and wing structure, respectively, used in an aircraft similar to the Model 115.

6.6 Armament Installation

The primary armament for this airplane is one 1,000 pound nuclear weapon. This armament package is carried within the lower portion of the fuselage immediately forward of the wing fuselage juncture. The weapon is suspended on an ejection type bomb rack. Three removable fuel tanks, one forward and one on either side of the weapon, are also carried in the armament bay.

The forward tank is not concealed by a door, but forms the lower contour of the aircraft. The aft tanks are concealed by the quick acting bomb bay doors. The aft tanks may be removed when the bomb bay doors have been opened or removed. A 575 pound capacity removable fuel tank may be substituted for the weapon when it is desired to ferry the aircraft. Each of these tanks has quick disconnect fuel connections, but none of the tanks are droppable.

The alternate armament bay installation consists of four separate Sidewinder launching tubes. Each of these tubes is an independent operating unit which is hinged about the lower aft end. Actuation is accomplished by firing the Sidewinder rocket engine which results in a force which rotates the launcher around the hinge point and moves the front end of the launcher into the airstream below the airplane fuselage. A positioning link controls the amount of angular movement of the launcher and pulls the missile retaining pin when the launcher is in correct position for firing. As the missile clears the launcher tube a powder charge is actuated which retracts the launcher to its original position in the aircraft. The time elapsed from beginning of launcher

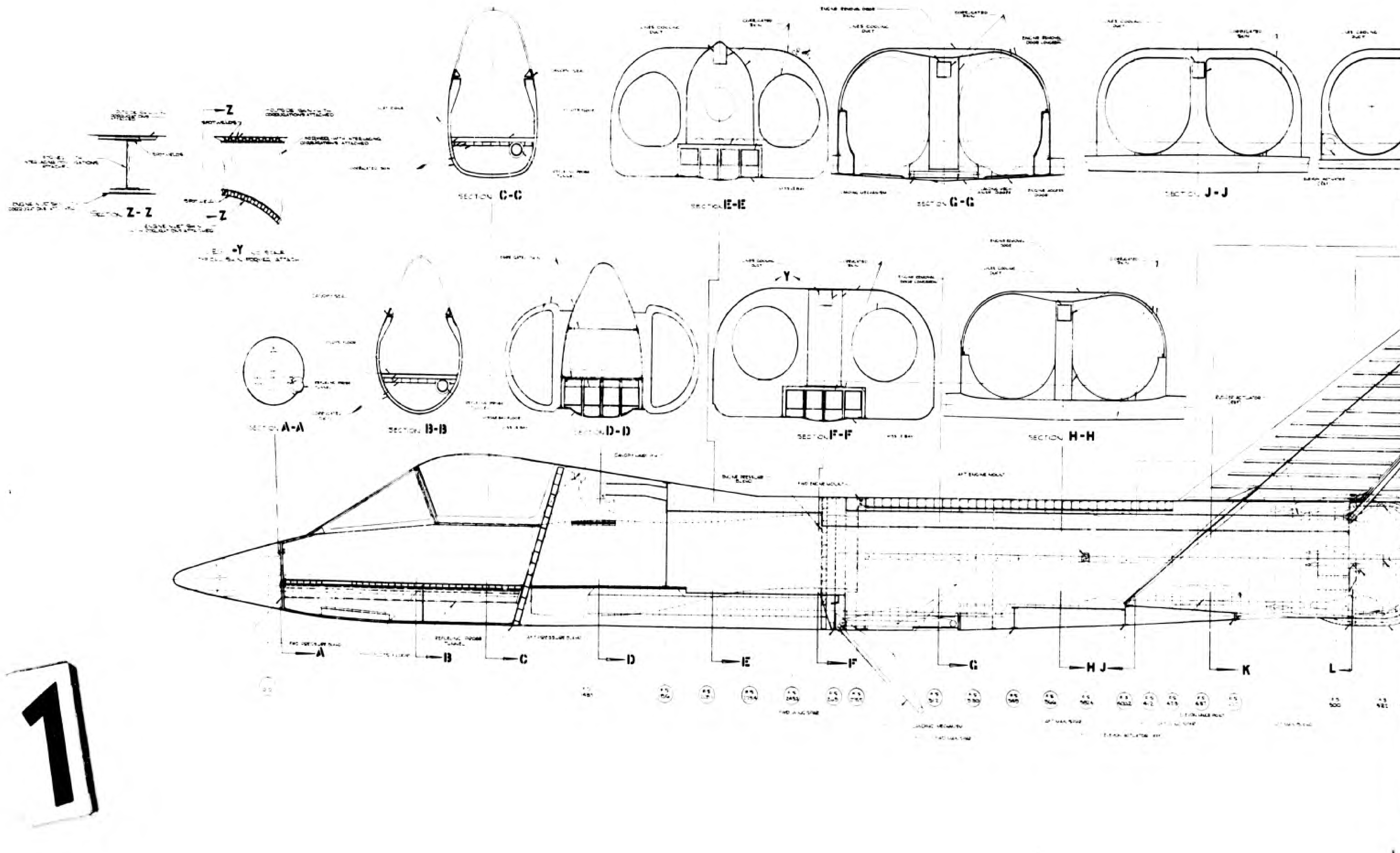
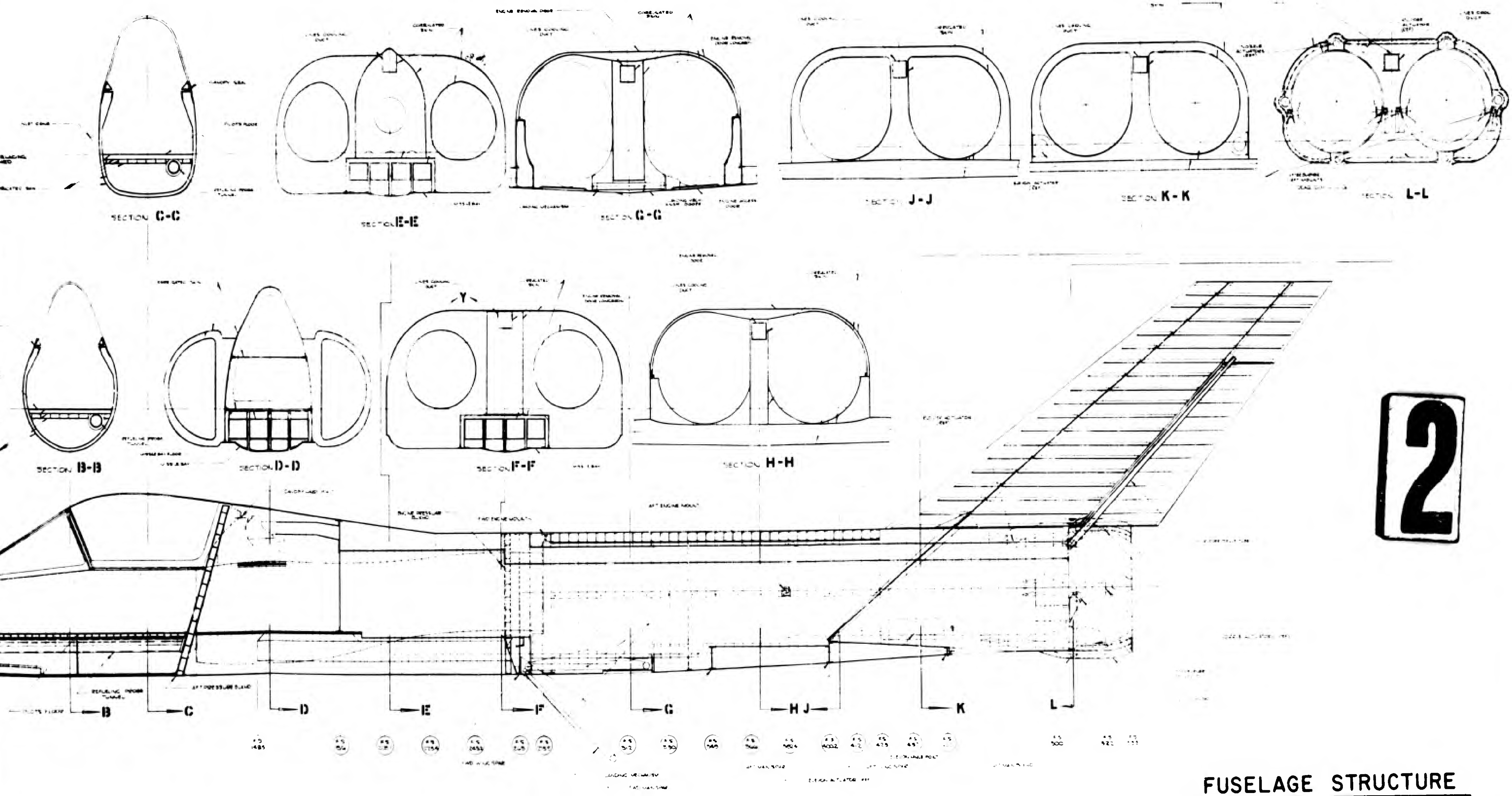
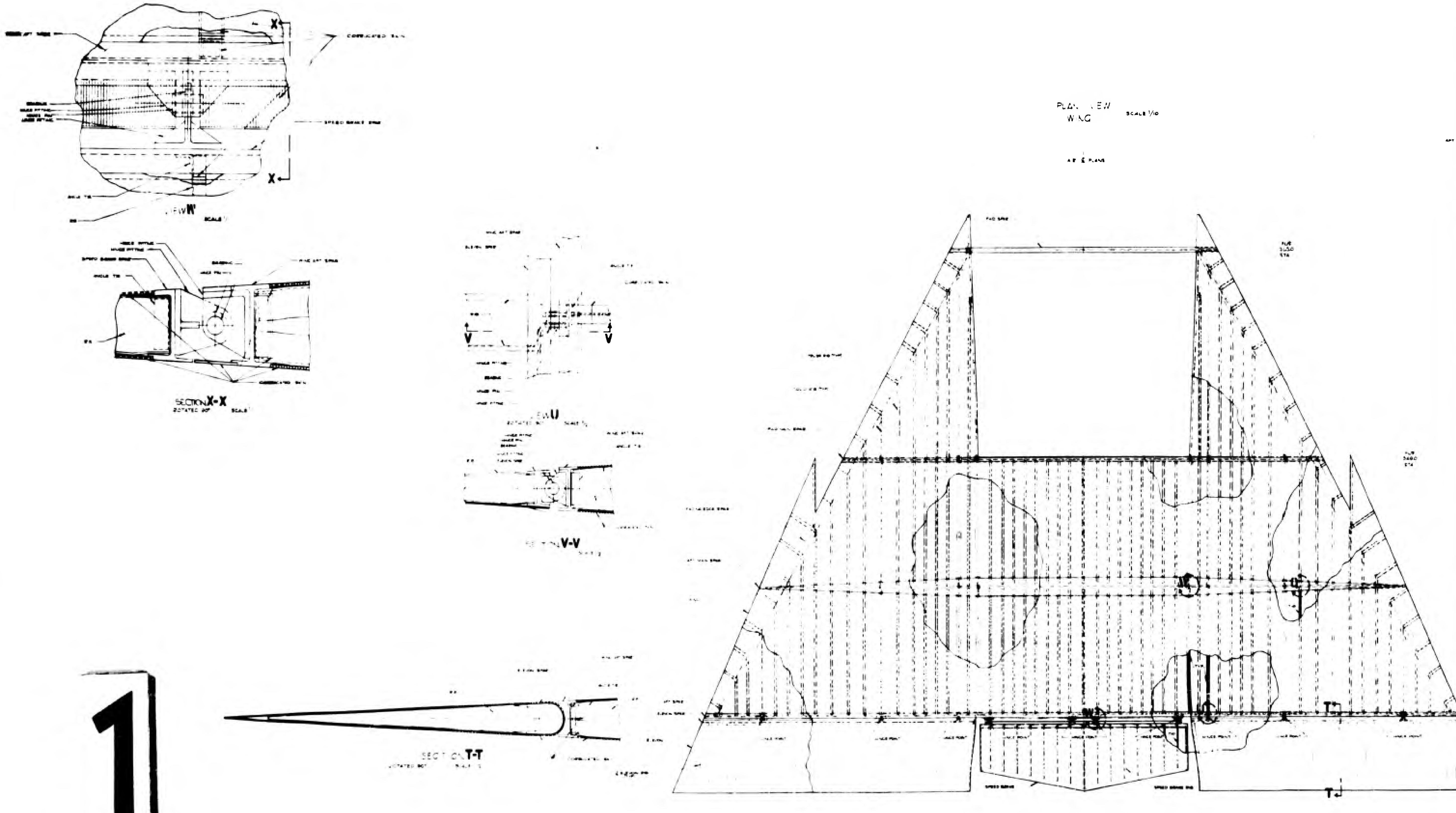

SECTION Z-Z
SECTION C-C
SECTION E-E
SECTION G-G
SECTION J-J
SECTION A-A
SECTION B-B
SECTION D-D
SECTION F-F
SECTION H-H
A
B
C
D
E
F
G
H J
K
L
1

Figure 6.5



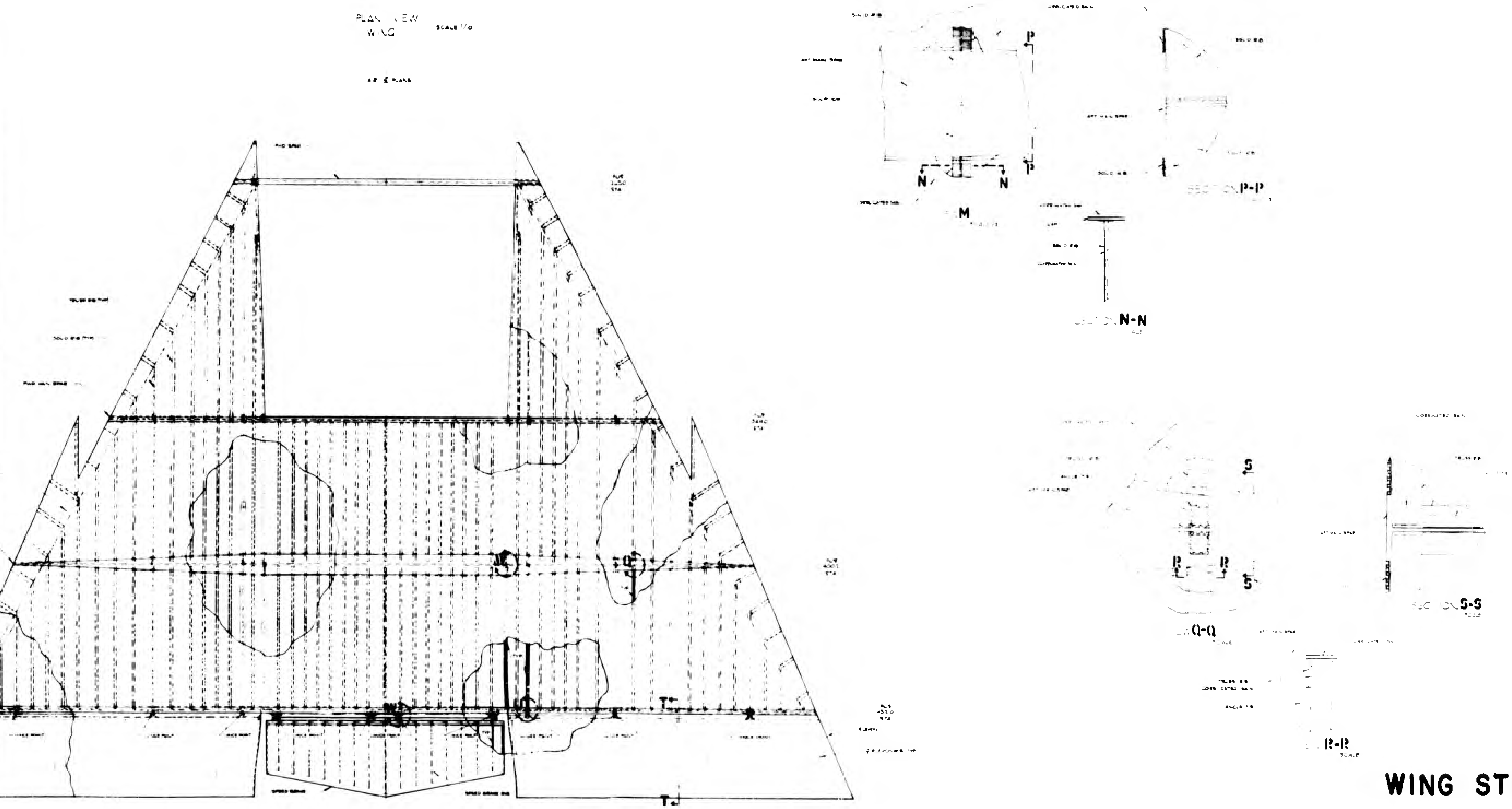
FUSELAGE STRUCTURE



CORRUGATED SKIN
SPEED BRAKE SPAR
SECTION X-X
SECTION T-T
V-V
SCALE 1/10

1

Figure 6.6



WING STRUCTURE

rotation to the completion of retraction is approximately 1 second. The pilot can fire each rocket individually or in any combination required. Provision is made for ducting the exhaust gas of each Sidewinder overboard.

The items noted as (ref.) in Figure 4.2 are equipment which must be installed when converting the aircraft from the bomber to the defensive fighter configuration.

Installation of the GAR-1B missiles has been considered. The low density armament bay which is required to contain these non-folding wing missiles within the fuselage is not consistent with an extremely high performance VTO aircraft configuration. External mounting is also inconsistent with high performance and would perhaps require compromising the landing system. The installation of four GAR missiles has, therefore, not been shown.

6.7 Take-off and Landing System

The take-off and landing system of the Ryan Model 115 has the primary design objective of reducing the airborne system weight. A landing system has been designed which consists of a landing mechanism on the airplane, a landing platform mounted on the ground and a dolly by which the airplane may be placed upon and removed from the landing platform. The dolly also serves the purpose of supporting the airplane during repair, maintenance and servicing.

The landing mechanism on the airplane consists of a cross bar arrangement located on the bottom of the airplane slightly forward of the center of gravity. The cylinders which extend and retract the bar also provide shock absorption normal to the longitudinal axis of the aircraft. The cross bar engages hooks on the ground mounted landing platform. Energy in the vertical plane (i.e., ground reference) is absorbed by the platform.

When the airplane is secured to the landing platform and airplane power is decreased, the aft end of the airplane contacts the landing platform. The speed brake, located on the lower side at the aft end of the airplane has been especially reinforced to serve the added purpose of absorbing the load due to the unbalanced moment and provide airplane stability when the aircraft is attached to the landing platform.

Details of the ground equipment design are presented in reference (2).

6.8 Doppler Navigation Equipment

Presently available Doppler navigation equipment is designed for essentially level flight. The high flight path angle inherent for best climb of aircraft with a thrust to weight ratio near 1.0, exceeds the limits of presently available equipment. The limitation on aircraft attitude is primarily due to the use of a fixed antenna. Development of suitable navigation equipment will apparently increase the volume required for the antenna with very little increase in overall weight. The future development of Ryan designed Doppler equipment which is presently smaller than AN/APN-79 could result in a Doppler navigator suitable for high performance aircraft without exceeding the weight and volume of the AN/APN-79.

7.0 MAINTENANCE, ACCESSIBILITY

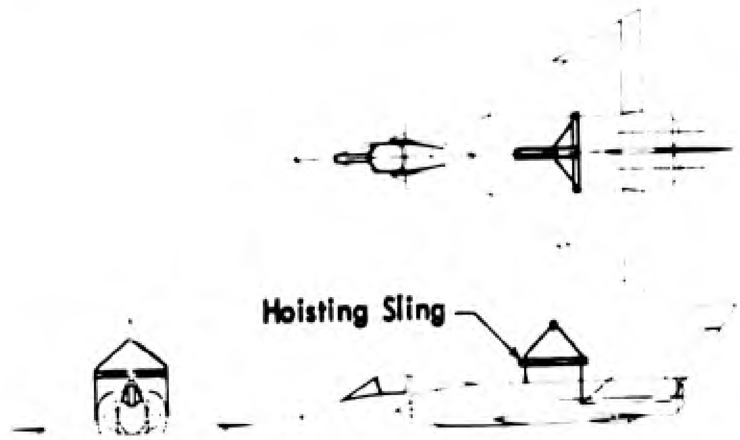
7.1 Maintenance

The Model 115 concept of vertical takeoff and landing operation tends to simplify the aircraft maintenance problem. The absence of complex landing gear, flaps and actuation systems reduces maintenance as compared to equivalent twin engine aircraft designed to operate from runways. This concept does require additional ground equipment. However, the maintenance required for ground equipment is less than that required for the airborne equivalent. The same tendency to reduce the aircraft maintenance problem also applies when comparing the Model 115 with a level lift aircraft or the tail-sitter aircraft.

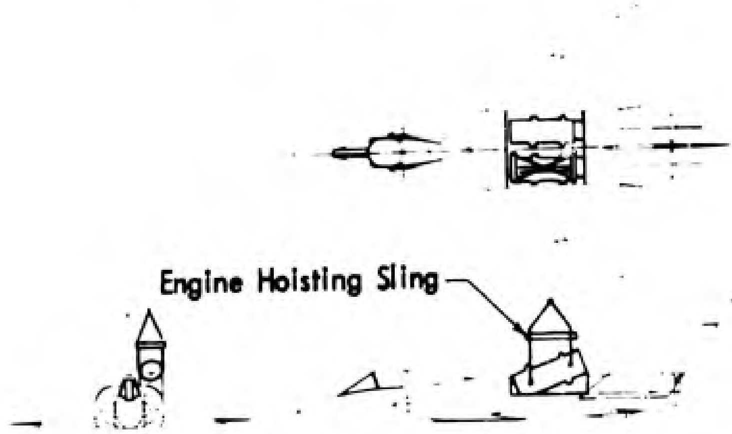
In the design of this aircraft and other elements of the system, consideration has been given to maintenance and serviceability of all items. All major service and maintenance is accomplished while the aircraft is in the level attitude. The landing platform is so designed that the airplane may be lowered to a horizontal position. The ground handling dolly which is used for removal of the aircraft from the platform and for transporting the aircraft about the area is designed to allow access to all portions of the aircraft for maintenance, service or equipment removal. The height of the aircraft when mounted on the dolly is low enough that special stands are not required for most maintenance operations.

Leveling lugs are provided on the aircraft so that it may be placed in level position either on or off the dolly. For removal from the dolly, hoisting provisions are incorporated in the aircraft. A schematic diagram of the hoisting and leveling provisions are shown in Figure 7.1. Jacking is accomplished by raising or lowering the dolly with

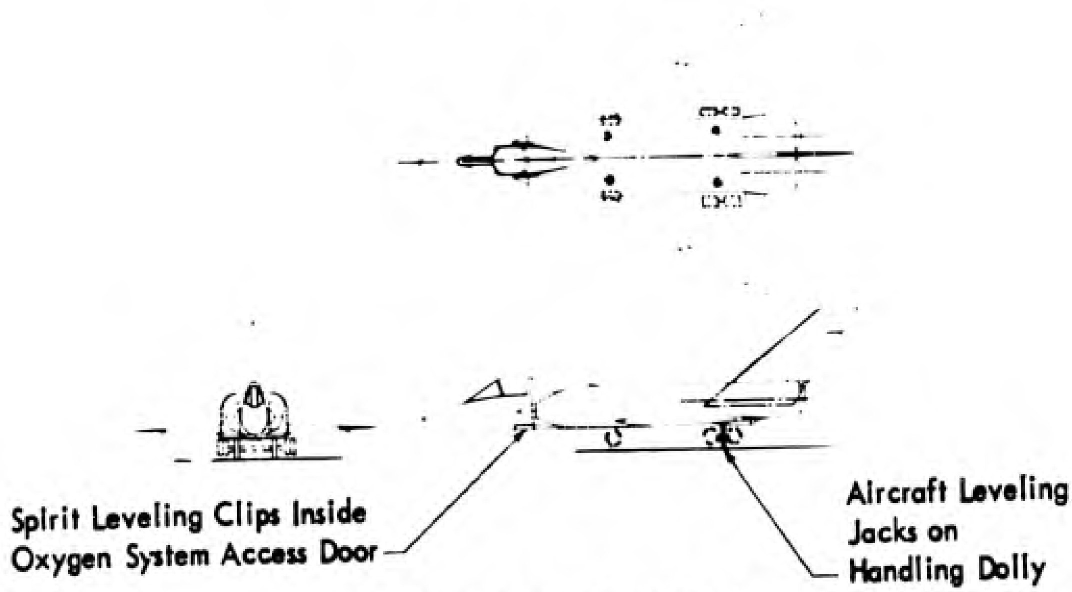
Figure 7.1



AIRCRAFT HOISTING



ENGINE HOISTING



AIRPLANE LEVELING PROVISIONS

AIRCRAFT HOISTING AND LEVELING PROVISIONS

the aircraft in place, using jack points on the dolly. When off the dolly, the aircraft can be supported by the landing mechanism and dive brake.

Repair of the corrugated type structure has been considered. Ryan's investigations indicate that no new or unusual methods are required for the maintenance and repair of the structural components of the aircraft. Repairs can be accomplished by the use of a portable welding machine and by means of standard riveting techniques. Ryan is now using a portable welding machine, which has a total weight of 30 pounds, to fabricate this type of structure.

One of the major maintenance operations is the removal and replacement of engines (see Figure 7.1). The main steps involved in engine removal are as follows:

1. Remove the main engine access door, fuselage rear cowling, and open all other engine access doors, including the inlet gill door.

2. Disconnect all fuel lines, controls, etc. from the engine.

3. Attach the engine removal sling to the engine hoist points.

4. Detach the engine afterburner and nozzle and slide aft sufficiently to clear the engine or if desired remove the afterburner through the opening left by the rear fuselage cowling. (This step is simplified by the use of a special slip joint providing attachment of the afterburner to the engine without the use of bolts).

5. Raise the front of the engine sufficiently to extract the front mounting pin.

6. Detach the rear engine mount and raise the rear of the engine to clear the mounts.

7. Move the engine aft keeping the forward end at a constant height while raising the rear end so that the engine inlet bullet clears the gill door and the rear of the engine clears the fuselage structure.

8. Hoist the engine clear of the fuselage.

7.2 Accessibility

In the design of this aircraft, care has been taken to locate equipment so that it may be readily accessible for inspection, maintenance or removal. Figure 7.2 illustrates the principal provisions for accessibility in this aircraft. Access to specific items is accomplished as follows:

(a) Removal of the nose cone allows access to the AN/APS-67 radar.

(b) A door in the bottom of the fuselage ahead of the cockpit can be removed for access to equipment in the bay forward of the cockpit.

(c) The canopy is detachable to allow removal of equipment from the cockpit.

(d) A door in the bottom of the fuselage aft of the cockpit provides access to the oxygen system.

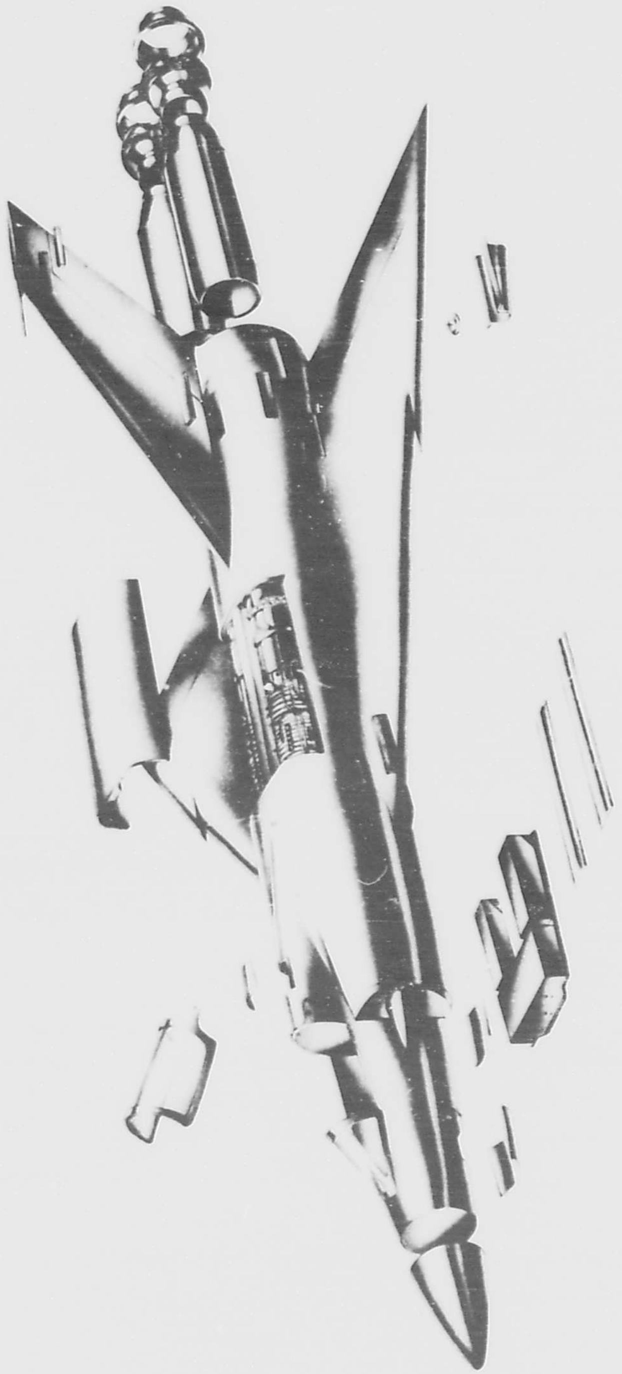
(e) Armament bay is removable for service and maintenance.

(f) A door in the top of the fuselage behind the cockpit provides access to the air conditioning system.

(g) A series of doors in the top of the fuselage provides access to the fuel tank for inspection and repair.

(h) The hydraulic reservoirs and accumulators are reached through doors in the side of the fuselage above the forward part of the wing.

Figure 7.2



ACCESS FOR MAINTENANCE

(i) Doors in the bottom of the wing allow access to the lower part of the engine and accessories as well as to the landing gear trapeze operating cylinders.

(j) The large door in the top of the fuselage permits engine service and removal.

(k) A series of doors in the wing fuel tank area allow inspection and repair of tanks as well as the wing structure.

(l) Removal of the elevon actuator fairing in the outer portion of the wing provides access to the actuator and its related equipment.

(m) Doors are provided in the rear of the fuselage for access to the nozzle actuators, inboard elevon actuator and the dive brake cylinder.

(n) The rudder damper mechanism may be reached through a door in the upper part of the fin.

(o) The cowling at the rear of the nozzle is detachable in order that the nozzle and afterburner may be removed.

8.0 PRODUCTION

This section outlines the overall manufacturing plan for production of the Ryan Model 115. This manufacturing plan is based on an assumed production rate of 25 units per month with a total initial quantity of 300 units.

The structural configuration of this aircraft, as outlined in Section 6.5 of this report, consists of foil thickness steel skins with corrugated steel foil thickness backing attached by resistance welding. The detail production advantages and problems of this type of structure are outlined in the following paragraphs. It is important to note that this type of structure is very adaptable to Ryan's manufacturing capability. It should also be noted that there are potential subcontract companies in this immediate area who would be semi-specialized in this type of work. This ultra-light weight steel structure is a Ryan development. Production studies are proceeding concurrently with structural development and testing.

8.1 Fabrication and Assembly

The material utilized for the structure is 17-7 PH stainless steel with an ultimate heat treat of 200,000 psi. This material is procured in the A (1750) annealed condition. The material is formed in this condition and then transformed at minus 100° F prior to welding. Subsequent to welding, the completed assemblies are aged at 950° to the ultimate tensile allowable noted above. Approximate allowable values of the material under various conditions are as follows:

	Yield	Ultimate	% Elongation
A (1750)	40,000	134,000	18.6
Transformer	114,000	174,000	7 to 11
Aged	180,000	200,000	5 to 6

For production the flat material for the skins will be procured as coil stock in approximately 24" widths in the annealed condition. The corrugated material will be formed on Yoder-type continuous roll equipment and will probably be procured in this condition from an outside source. Conventional type shears, paper cutting shears, and rotary slitting shears will be used for straight cuts. Conventional and paper cutting shears will be used for short cuts (24" and under), while long cuts (24" and over) can be made with rotary slitting shears. The light gauges of material involved will require rotary slitting shears for more economical operation. Blank and pierce dies will be used for trimming flat parts with curved trim lines.

The smooth skins will be formed on horizontal stretch presses with curved jaws and elongation control. The curved jaws will be required to obtain the maximum width skins from the 24" material. Elongation control will be necessary to prevent excessive thinning of the foil gauges. The corrugated panels will be formed on Cyril Bath stretch compression forming presses, utilizing curved jaws and elongation control. Stretch compression forming makes it possible to index the pre-formed corrugations into the correct position in the stretch form die and will produce the accuracy necessary for subsequent mating and welding. This method will hold material thinning to a minimum.

The transformation treatment will be accomplished in mechanically cooled refrigerators of suitable size and capacity. Final aging will be accomplished in conventional furnaces.

The formed skins and corrugations will be assembled in contoured welding jigs which will be grooved to accept the corrugations and will be copper faced to provide one electrode surface as an integral part of the weld fixture. The panels will be welded, utilizing multiple weld wheels. This procedure will assure very accurate panel configurations and will hold the corrugation shape within the limits required for mating and splicing in the subsequent assembly. One of the major advantages of this type of structure is that the welding of the foil thickness is done with very low heat and pressure and the equipment utilized is compact, light and relatively inexpensive.

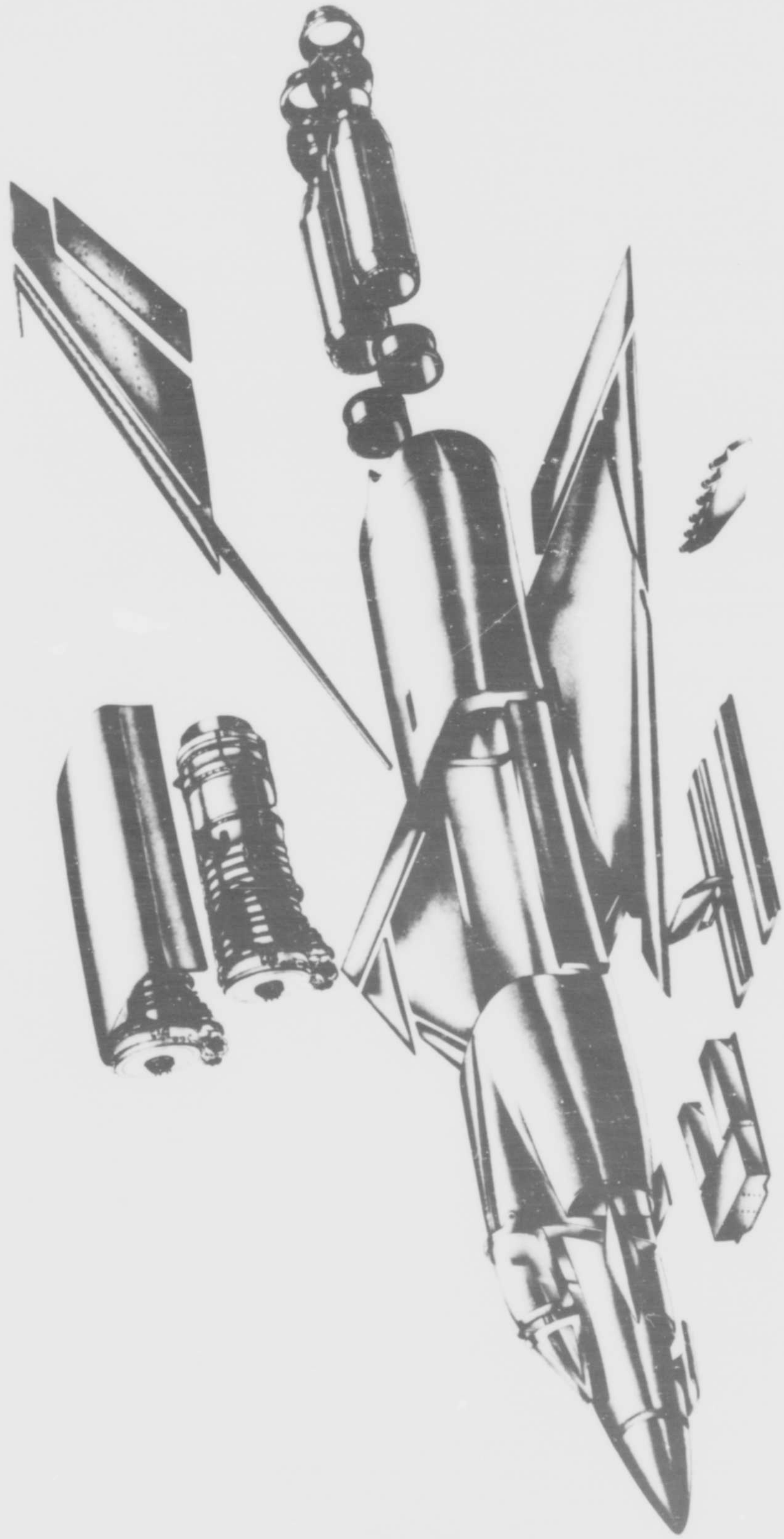
The major production breakdown of this airplane is predicated on the fabrication, heat treating and welding cycle outlined above; i.e., it will allow aging of the assemblies after welding and permit a minimum use of mechanical fastening. This, of course, will contribute to minimum structural weight. The breakdown of the major components is shown in Figure 8.1.

The Assembly Flow Chart, or "Christmas Tree" breakdown, shown in Figure 8.2 indicates the assembly order. The sequence flow chart, Figure 8.3 depicts the sequences and flow of the assemblies by station. On this chart, the assemblies shown in black are the ones being added at each station and the assemblies shown in white are the ones carried through from the previous station.

8.2 Subcontract

It is anticipated that approximately 30% of the airplane would be locally subcontracted including such assemblies as the canopy, windshield, ejection seat, spar milling, landing mechanism, the radome nose, and other selected assemblies. In general specialized fabrication and assembly work would be subcontracted but all major assembly phases would be completed at Ryan.

Figure 8.1



PRODUCTION BREAKDOWN

ASSEMBLY FLOW CHART

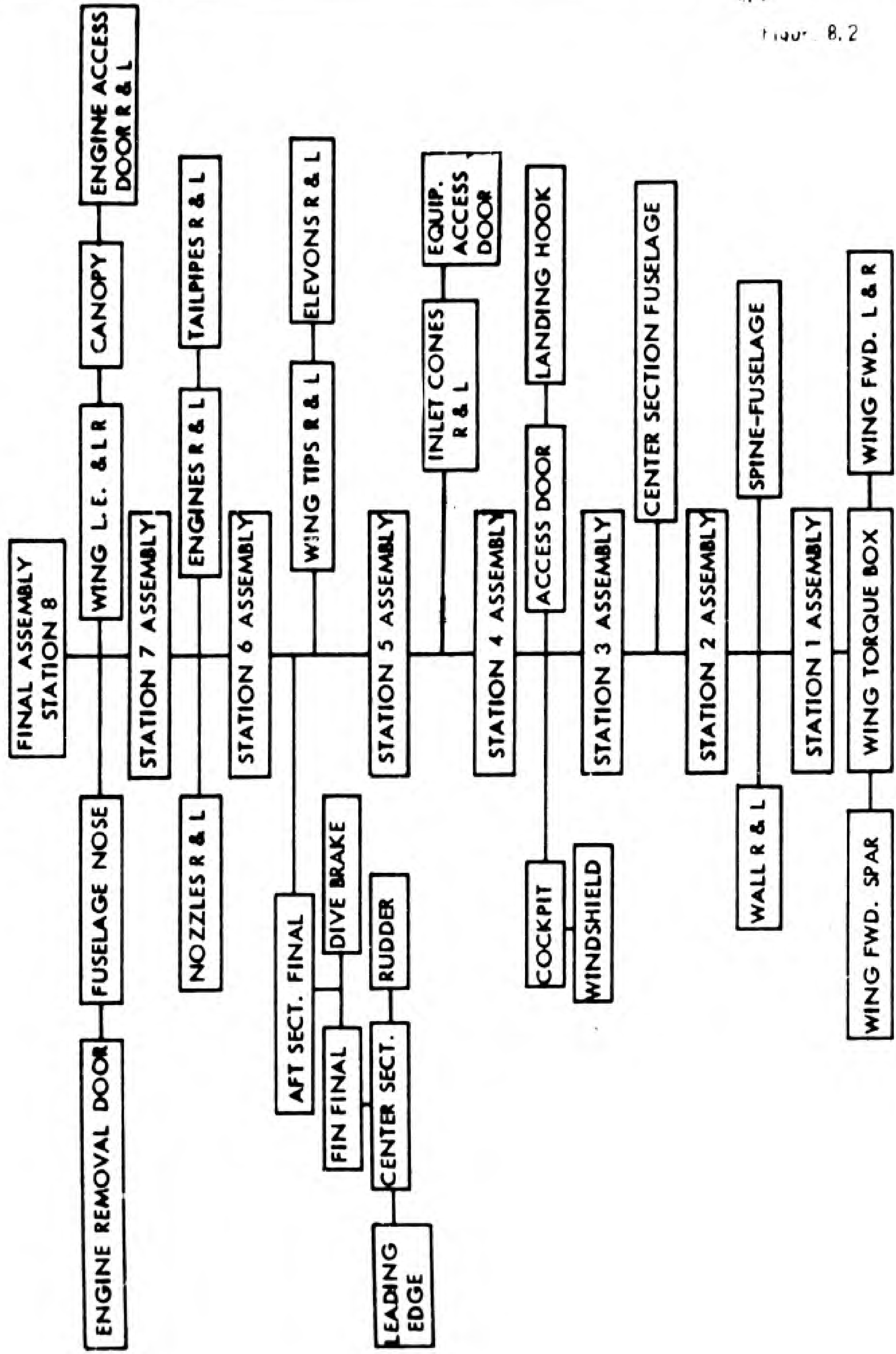
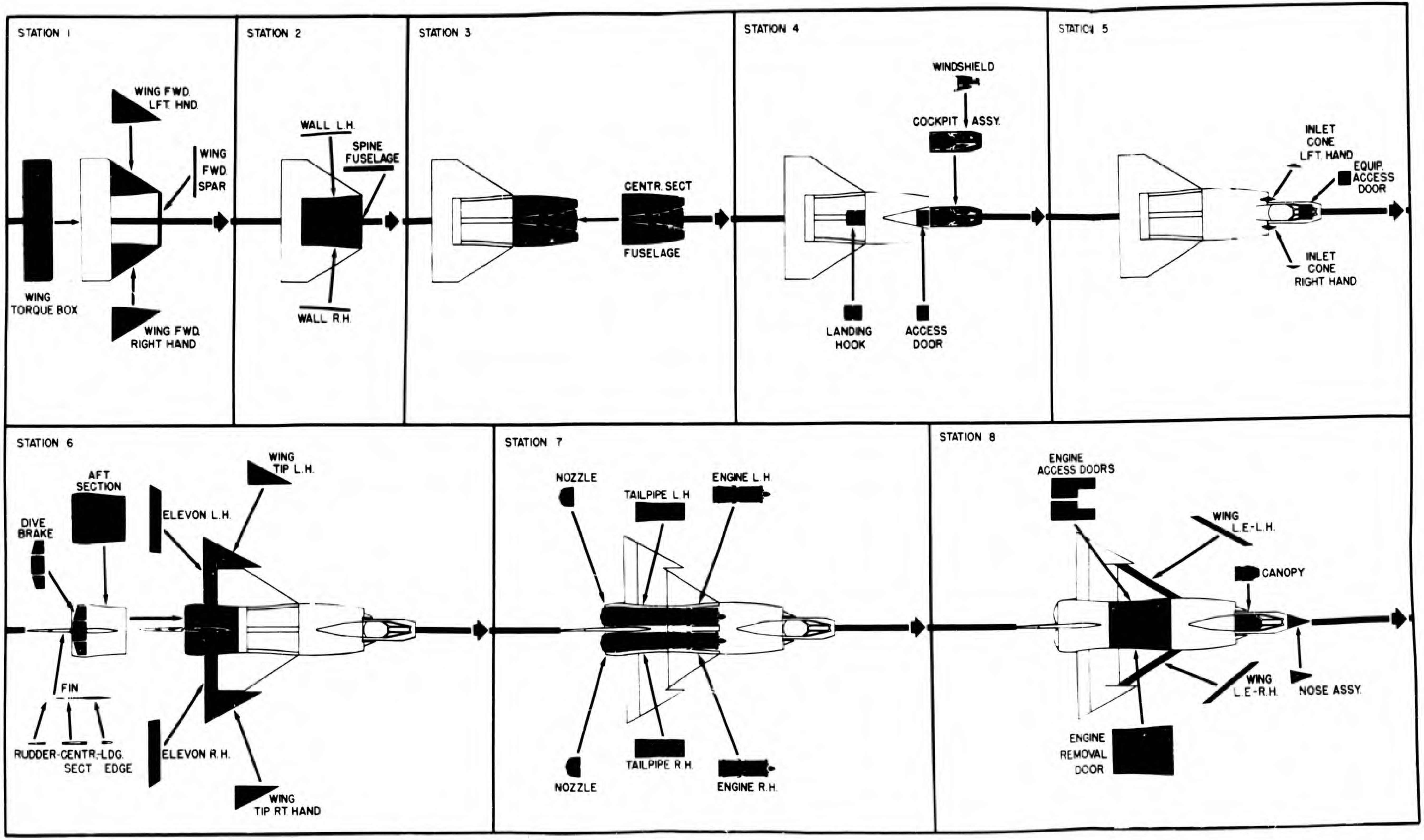


Figure 8.3



SEQUENCE FLOW CHART

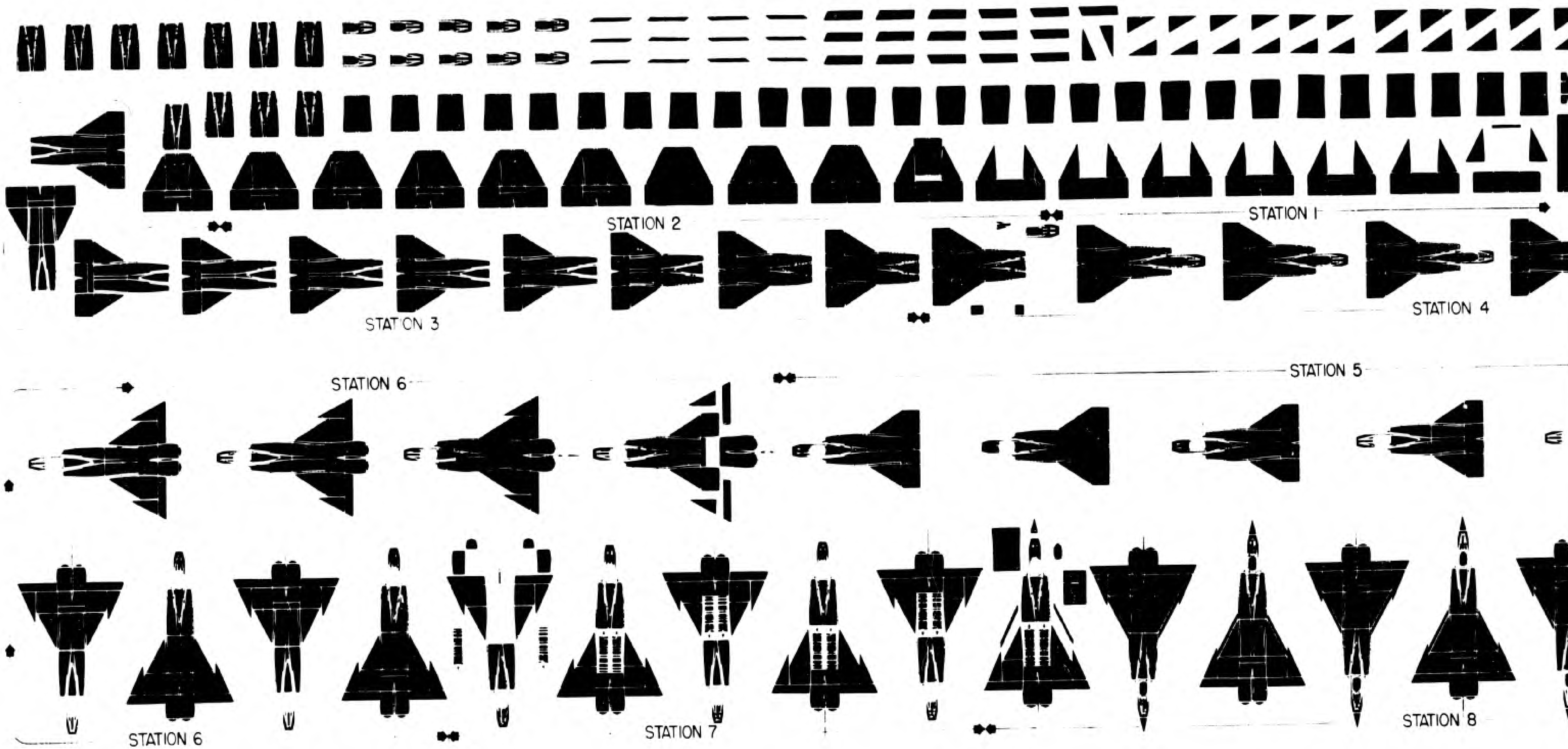
8.3 Space Requirements

Predicated on a 30% subcontract basis, approximately 67% of the present manufacturing floor space at Ryan would be utilized to produce 25 airplanes per month. Figure 8.4 illustrates the utilization of the assembly floor space.

8.4 Interchangeability

Special consideration has been given to the interchangeability of components in the design of this airplane. The following is a list of those major components which at this time Ryan feels would be interchangeable.

1. All electronics equipment
2. All electrical equipment
3. All hydraulic actuators, reservoirs, and accumulators
4. Engines, afterburners and exhaust nozzles
5. Nose radome
6. Electronic equipment access door
7. Pilot's canopy
8. Movable inlet cone
9. Armament Bay installations
10. Landing mechanism
11. Engine access and engine accessory access doors
12. Rudder, elevons and dive brake
13. Fuselage rear cowling
14. Engine exhaust ejector
15. Miscellaneous equipment, furnishings and access doors (e.g., pilot's seat, control stick, oxygen installation, instruments, etc.)


STATION 2
STATION I
STATION 3
STATION 4
STATION 5
STATION 6
STATION 6
STATION 7
STATION 8

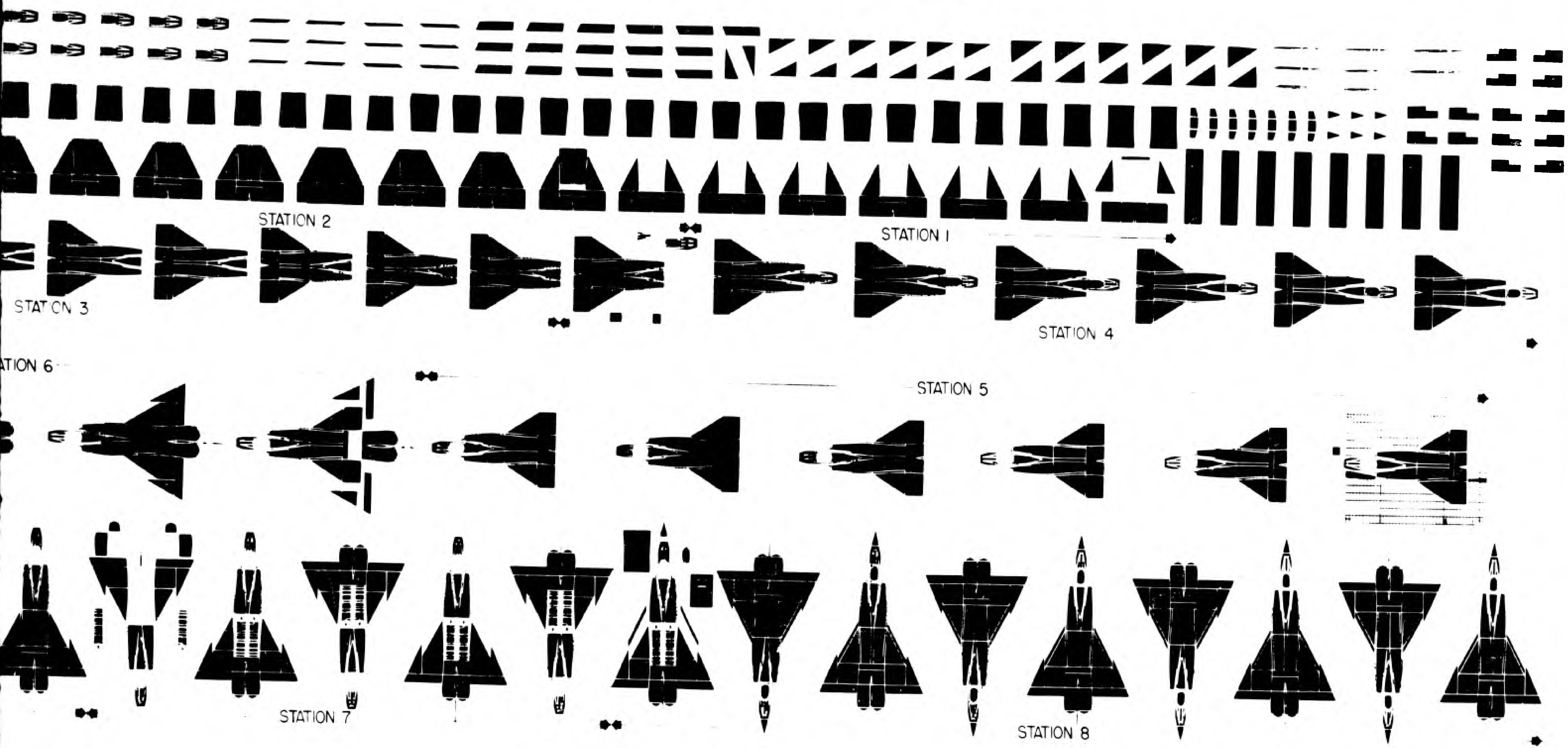
1

AS

SE

2

Figure 8.4



ASSEMBLY FLOOR PLAN

9.0 APPENDICES

9.1 References

1.1	USAF	Contract No. AF 18(600)-1641 Task No. 27500 dated 29 June 1956
2.1	C. Smith	"Dispersed Site Fighter-Bomber Summary Report" Ryan Report No. 11518-2 dated 26 November 1956 (Secret)
6.1	J.M. Forbush P.C. Carroll	"Stability and Control Report VTO High Altitude Visual Fighter" Ryan Report No. 11254-1 dated 1 September 1956 (Confidential)
6.2	R.P. Day R.C. Wood	"Stabilization System Report VTO High Altitude Visual Day Fighter" Ryan Report No. 11255-1 dated 1 September 1956 (Confidential)
6.3	B. Mitchell D.L. Marlin	"Design of Minimum Weight Structure" Ryan Report No. G-42-39 dated 15 September 1956

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Appendix 9.2

GROUP WEIGHT STATEMENT

ESTIMATED - [redacted]
-CROSS OUT THOSE NOT APPLICABLE-

CONTRACT

AIRPLANE-GOVERNMENT NUMBER

AIRPLANE-CONTRACTOR NUMBER

MANUFACTURED BY **RYAN AERONAUTICAL COMPANY**

ENGINE	MAIN	AUXILIARY
MANUFACTURED BY	GENERAL ELECTRIC	
MODEL	J-79-207	
NUMBER	2	

PROPELLER	MAIN	AUXILIARY
MANUFACTURED BY		
MODEL		
NUMBER		

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GROUP WEIGHT STATEMENT
WEIGHT EMPTY

PAGE 9.3
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WING GROUP			1926.5
CENTER SECTION-BASIC STRUCTURE			
INTERMEDIATE PANEL-BASIC STRUCTURE			
OUTER PANEL-BASIC STRUCTURE - INCL TIPS	LBS	1529.0	
SECONDARY STRUCTURE - INCL WINGFOLD MECH	LBS		
AILERONS - INCL BALANCE WEIGHT 0 LBS	ELEVONS	293.9	
FLAPS-TRAILING EDGE			
-LEADING EDGE			
SLATS			
SPOILERS		103.6	
SPEEDBRAKES			
TAIL GROUP			364.4
STABILIZER-BASIC STRUCTURE			
FINS-BASIC STRUCTURE-INCL DORSAL	LBS	279.1	
SECONDARY STRUCTURE-STABILIZER & FINS			
ELEVATOR - INCL BALANCE WEIGHT	LBS		
RUDDERS - INCL BALANCE WEIGHT 0	LBS	85.3	
BODY GROUP			2039.2
FUSELAGE OR HULL-BASIC STRUCTURE		1330.0	
BOOMS-BASIC STRUCTURE		276.4	
SECONDARY STRUCTURE-FUSELAGE [redacted]			
-BOOMS			
-SPEEDBRAKES			
-DOORS, PANELS & MISC		432.8	
ALIGHTING GEAR GROUP-LAND - TYPE VTO	*ROLLING STRUCT CONTROLS		194.7
LOCATION	ASSEMBLY	68.6	
HOOK MECHANICAL		126.1	
ALIGHTING HOOK			
ALIGHTING GEAR GROUP-WATER	FLOATS STRUTS CONTROLS		
LOCATION			
SURFACE CONTROLS GROUP			800.6
COCKPIT CONTROLS		26.0	
[redacted] AUTOMATIC STABILIZATION		188.0	
SYSTEM CONTROLS - INCL POWER & FEEL CONT	LBS	586.6	
ENGINE SECTION OR NACELLE GROUP			
INBOARD			
CENTER			
OUTBOARD			
DOORS, PANELS & MISC			
PAGE TOTAL			5325.4

* WHEELS, BRAKES, TIRES, TUBES AND AIR

AN 9103-D-TAB — GROUP WEIGHT STATEMENT — WEIGHT EMPTY

NAME W. A. McLaughlin
DATE 15 November 1956

PAGE 9.3
MODEL 115
REPORT 11518-3

1	WING GROUP				1926.5
2	CENTER SECTION-BASIC STRUCTURE				
3	INTERMEDIATE PANEL-BASIC STRUCTURE				
4	OUTER PANEL-BASIC STRUCTURE - INCL TIPS		LBS	1529.0	
5					
6	SECONDARY STRUCTURE - INCL WINGFOLD MECH		LBS		
7	AILERONS - INCL BALANCE WEIGHT	0	LBS **ELEVONS**	293.9	
8	FLAPS-TRAILING EDGE				
9	-LEADING EDGE				
10	SLATS				
11	SPOILERS				
12	SPEEDBRAKES			103.6	
13					
14					
15	TAIL GROUP				364.4
16	STABILIZER-BASIC STRUCTURE				
17	FINS-BASIC STRUCTURE-INCL DORSAL		LBS	279.1	
18	SECONDARY STRUCTURE-STABILIZER & FINS				
19	ELEVATOR - INCL BALANCE WEIGHT		LBS		
20	RUDDERS - INCL BALANCE WEIGHT	0	LBS	85.3	
21					
22					
23	BODY GROUP				2039.2
24	FUSELAGE OR HULL-BASIC STRUCTURE			1330.0	
25	BOOMS-BASIC STRUCTURE				
26	SECONDARY STRUCTURE-FUSELAGE XXXXXXX			276.4	
27	-BOOMS				
28	-SPEEDBRAKES				
29	-DOORS, PANELS & MISC			432.8	
30					
31	ALIGHTING GEAR GROUP-LAND - TYPE **VTO**				194.7
32	LOCATION	*ROLLING STRUCT CONTROLS			
33	**HOOK MECHANICAL**	ASSEMBLY		68.6	
34	**ALIGHTING HOOK**			126.1	
35					
36					
37					
38					
39	ALIGHTING GEAR GROUP-WATER				
40	LOCATION	FLOATS STRUTS CONTROLS			
41					
42					
43					
44					
45	SURFACE CONTROLS GROUP				800.6
46	COCKPIT CONTROLS			26.0	
47	XXXXXXX **AUTOMATIC STABILIZATION**			188.0	
48	SYSTEM CONTROLS - INCL POWER & FEEL CONT		LBS	586.6	
49					
50	ENGINE SECTION OR NACELLE GROUP				
51	INBOARD				
52	CENTER				
53	OUTBOARD				
54	DOORS, PANELS & MISC				
55					
56	PAGE TOTAL				5325.4
57					

* WHEELS, BRAKES, TIRES, TUBES AND AIR

AN 9103-D-TAB
NAME W. A. McLaughlin
DATE 15 November 1956

GROUP WEIGHT STATEMENT
WEIGHT EMPTY

PAGE 9.4
MODEL 115
REPORT 11518-3

		X AUXILIARY	XX MAIN	X
1	PROPULSION GROUP			9267.9
2				
3	ENGINE INSTALLATION		5830.0	7826.9
4	AFTERBURNERS-IF FURN SEPARATELY		965.5	
5	[redacted] NOZZLES		1031.4	
6	SUPERCHARGER FOR TURBO TYPES			
7	AIR INDUCTION SYSTEM		655.4	791.1
8	EXHAUST SYSTEM			
9	COOLING SYSTEM		135.7	
10	LUBRICATING SYSTEM			70.2
11	TANKS		46.0	
12	COOLING INSTALLATION			
13	DUCTS, PLUMBING, ETC		24.2	
14	FUEL SYSTEM			484.1
15	TANKS-PROTECTED			
16	-UNPROTECTED		190.9	
17	PLUMBING, ETC		293.2	
18	WATER INJECTION SYSTEM			
19	ENGINE CONTROLS		23.6	23.6
20	STARTING SYSTEM		72.0	72.0
21	PROPELLER INSTALLATION			
22				
23				
24	AUXILIARY POWER PLANT GROUP			
25	INSTRUMENTS & NAVIGATIONAL EQUIPMENT GROUP			135.7
26	HYDRAULIC & PNEUMATIC GROUP			377.8
27				
28				
29	ELECTRICAL GROUP			505.7
30	AC SYSTEM			
31	DC SYSTEM			
32	ELECTRONICS GROUP			360.4
33	EQUIPMENT		273.0	
34	INSTALLATION		87.4	
35				
36	ARMAMENT GROUP - INCL GUNFIRE PROTECTION	LBS		100.0
37	FURNISHINGS & EQUIPMENT GROUP			173.9
38	ACCOMMODATIONS FOR PERSONNEL		55.5	
39	MISCELLANEOUS EQUIPMENT		13.1	
40	FURNISHINGS		95.3	
41	EMERGENCY EQUIPMENT		10.0	
42				
43	AIR CONDITIONING & ANTI-ICING EQUIPMENT GROUP			224.4
44	AIR CONDITIONING		224.4	
45	ANTI-ICING			
46				
47	PHOTOGRAPHIC GROUP			
48	AUXILIARY GEAR GROUP			
49	HANDLING GEAR			
50	ARRESTING GEAR			
51	CATAPULTING GEAR			
52	ATO GEAR			
53				
54	MANUFACTURING VARIATION			
55				
56	PAGE TOTAL			11145.8
57	TOTAL-WEIGHT EMPTY - PG 2-3			16471.2

AN 9103-D-TAB	GROUP WEIGHT STATEMENT	PAGE 9.5
NAME W. A. McLaughlin	USEFUL LOAD & GROSS WEIGHT	MODEL 115
DATE 15 November 1956		REPORT 11518-3

1	LOAD CONDITION			
2				
3	CREW - NO. 1			270.0
4	PASSENGERS - NO.			
5	FUEL	TYPE	GALS	
6	UNUSABLE	JP-5	16.2	111.0
7	INTERNAL		1617.6	10,999.8
8				
9				
10	EXTERNAL			
11				
12	BOMB BAY			
13				
14	OIL			
15	TRAPPED			27.0
16	ENGINE			30.0
17				
18	FUEL TANKS-LOCATION			
19	WATER INJECT. FLUID		GALS	
20				
21	BAGGAGE			
22	CARGO			
23				
24	ARMAMENT			
25	GUNS-LOCATION	FIX/FLEX QUANTITY CALIBER		
26				
27				
28				
29				
30				
31				
32	AMMUNITION			
33	BOMB			1,000.0
34				
35				
36				
37				
38				
39	INSTALLATIONS-BOMB, TORPEDO, ROCKET, ETC			
40*	BOMB OR TORPEDO RACKS			
41				
42				
43				
44				
45				
46	EQUIPMENT			
47	PYROTECHNICS			
48	PHOTOGRAPHIC			
49				
50*	OXYGEN			5.0
51				
52	MISCELLANEOUS			
53				
54				
55	USEFUL LOAD			12,442.8
56				
57	GROSS WEIGHTS - PG 2-4			28,914.0

*IF NOT SPECIFIED AS WEIGHT EMPTY

AN 9103-D-TAR | GROUP WEIGHT STATEMENT | PAGE 9.6
NAME W. A. McLaughlin | DIMENSIONAL & STRUCTURAL DATA | MODEL 115
DATE 15 November 1956 | | REPORT 11518-3

1 LENGTH-OVERALL-FT 55'-6-1/2" HEIGHT-OVERALL STATIC-FT

		MAIN FLOATS	AUX FLOATS	BOOMS	FUS OR HULL	X INBOARD	NACELLES CENTER	X OUTBOARD
2								
3								
4	LENGTH-MAX-FT	48' - 1/3"						
5	DEPTH-MAX-FT	12' - 7-13/16"						
6	WIDTH-MAX-FT	31' - 1-3/4"						
7	WETTED AREA-SQ FT							
8	*FLOAT/HULL DISPL MAX LBS							

9 FUSELAGE VOLUME-CU FT PRESSURIZED

		TOTAL WING	H TAIL	V TAIL
10				
11	GROSS AREA-SQ FT	420'		
12	WEIGHT/GROSS AREA-#/SQ FT	65		
13	SPAN-FT	31' - 1-3/4"		
14	FOLDED SPAN-FT			
15				
16	SWEEPBACK-AT 25% CHORD LINE-DEGREES			
17	-AT 0 % CHORD LINE-DEGREES	60^{o}		
18	**THEORETICAL ROOT CHORD -LENGTH-INCHES	323.7"		
19	-MAX THICKNESS-INCHES	16.1"		
20	***CHORD AT PLANFORM BREAK-LENGTH-INCHES	136.0"		
21	-MAX THICKNESS-INCHES	6.8"		
22	***THEORETICAL TIP CHORD -LENGTH-INCHES	0		
23	-MAX THICKNESS-INCHES			
24	DORSAL AREA, INCL IN FUS - HULL - V TAIL-AREA-SQ FT			60.6'
25	TAIL LENGTH-25% M.A.C. WING TO 25% M.A.C. H TAIL-FT			

26	AREA-SQ FT/AIRPLANE	FLAPS L.E.	T.E.			
27	LATERAL CONTROLS	SLATS	SPOILERS		AILERONS	
28	SPEED BRAKES	WING	[redacted]	15.9	ELEVONS	53.0
29						
30						

31 ALIGHTING GEAR HOOK LOCATION BOTTOM OF FUSELAGE
32 LENGTH-OLEO EXT-C.L. AXLE TO C.L. TRUNNION-INCHES
33 OLEO TRAVEL-FULL EXT TO COLLAPSED-INCHES
34 FLOAT OR SKI STRUT LENGTH-INCHES
35 ARRESTING HOOK LENGTH-C.L. HOOK TRUNNION TO C.L. HOOK POINT-INCHES
36 HYDRAULIC SYSTEM CAPACITY-GALS 12.2

	37 FUEL & LUB SYST		NUMBER	****GALS	NUMBER	****GALS 1617.6
38		LOCATION	TANKS	PROTECTED	TANKS	UNPROTECTED
39	FUEL-INTERNAL	WING			4	741.0
40		FUS/[redacted]			6	876.6
41	-EXTERNAL					
42	-BOMB BAY					
43						
44	OIL				1	4.0
45						

	46 STRUCTURAL DATA-CONDITION	WING FUEL-LBS		STRESS GROSS WT		ULT L.F.
47			5039		23,071	11.0
48	FLIGHT			28,571		
49	LANDING			19,000		
50	MAX GROSS WT WITH ZERO WING FUEL			23,532		
51	CATAPULTING					
52	MINIMUM FLYING WEIGHT			16,909		

53 LIMIT AIRPLANE LANDING SINKING SPEED-FT/SEC 10
54 WING LIFT ASSUMED FOR LANDING DESIGN CONDITION-%W 0
55 STALL SPEED-LANDING CONFIGURATION-POWER OFF-KNOTS
56 PRESSURIZED CABIN-ULT DESIGN PRESSURE DIFFERENTIAL-FLIGHT P.S.I. 6.8
57 AIRFRAME WEIGHT-AS DEFINED IN AN-W-11 -LBS

* LBS OF SEA WATER @ 64 LBS/CU FT
**PARALLEL TO ℄ AT CENTERLINE AIRPL
*** PARALLEL TO CENTERLINE AIRPL
****TOTAL USABLE CAPACITY

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