Flying Aircraft Carriers of the USAF: Project FICON

Section 4: Systems and Operations

By Brian Lockett

August 1, 1950, Project MX-1602 initiation

On August 1, 1950, the Headquarters of the U. S. A. F. issued Development Directive A-6-1 authorizing the Air Materiel Command to initiate project MX-1602. The project was dubbed Fighter Conveyor, which was contracted as FICON.

The ultimate goal of Project MX-1602 was to combine the high speed and maneuverability of the Republic RF-84F *Thunderflash* with the long-range capability of the Convair RB-36. The mission profile of the composite aircraft would consist of long-range, high-altitude flight to the target area and high-speed reconnaissance over the objective. The parasite aircraft system provided three basic advantages; long-range in the logistics zone, high performance in the defended zone, and an aerial base for launching and retrieving the parasite.[1]

Convair designed a hydraulically operated trapeze mechanism to fit inside the bomb bay of the RB-36 carrier airplane. The trapeze mechanism could carry, release, and retrieve a parasite airplane. The carrier could take off with the parasite stowed in the bomb bay, launch and retrieve the parasite in flight, and land with the parasite aboard.[11]

Modifications to GRB-36D

The ten RB-36Ds assigned to Project FICON were extensively modified to serve as carrier airplanes. A trapeze mechanism was installed in the bomb bay to support the parasite. The bomb bay doors were removed and replaced with fairings and doors that were contoured to seal the gap around the parasite. Electronics equipment located in the aft bomb bay was relocated farther aft. Two auxiliary hydraulic systems were installed to operate the trapeze and doors. A jet fuel tank was installed in the aft bomb bay to refuel the parasite.

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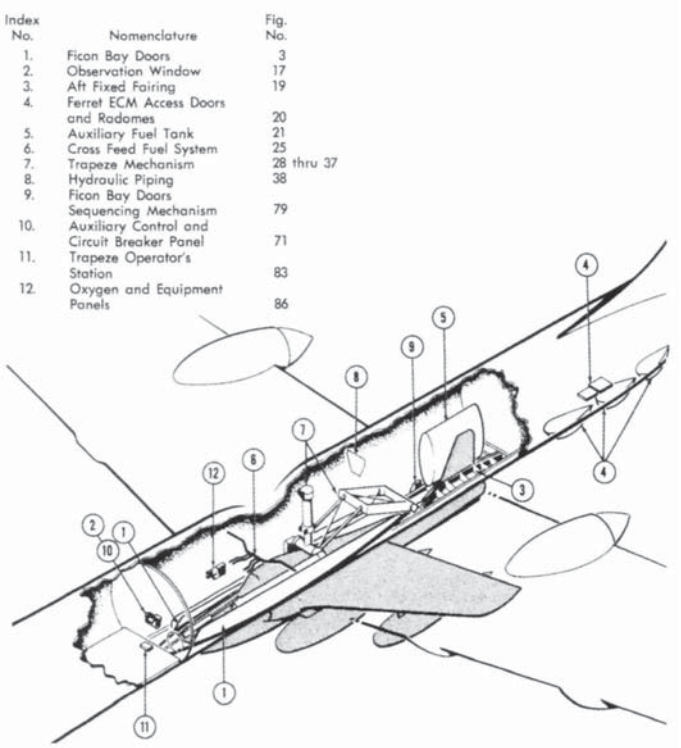
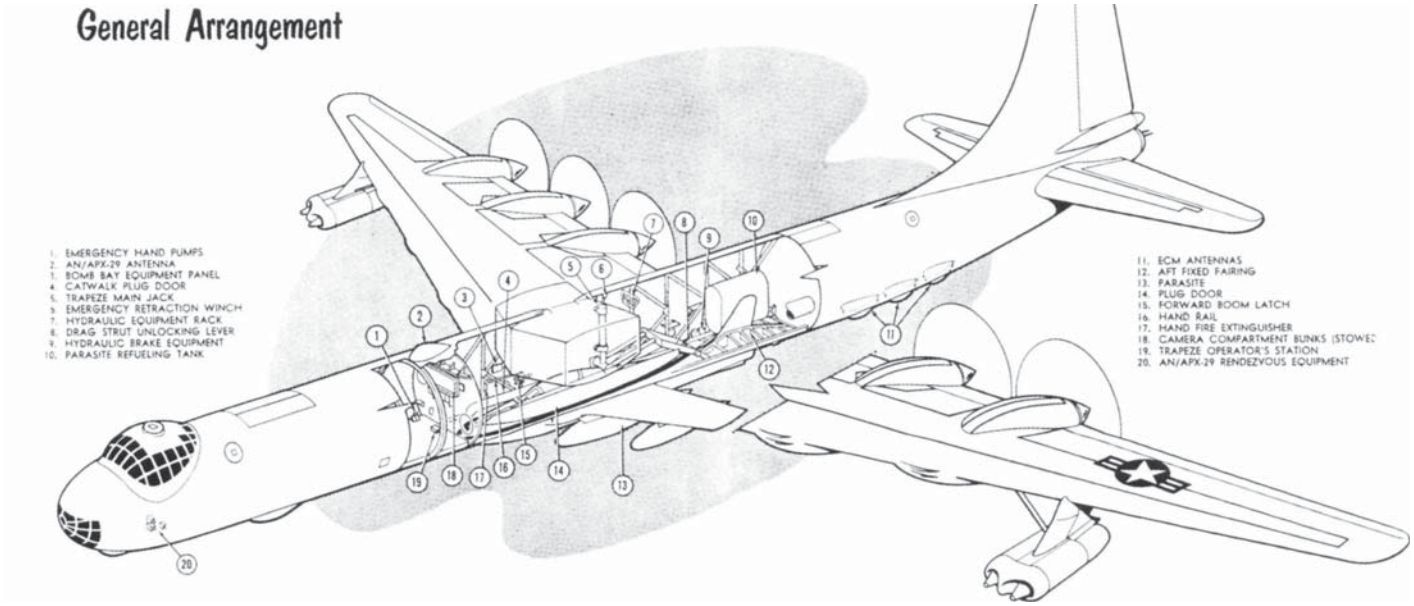
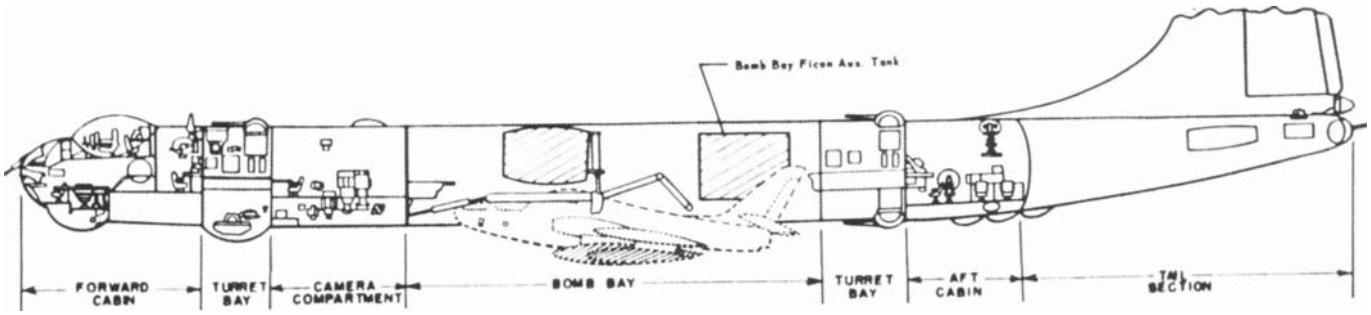


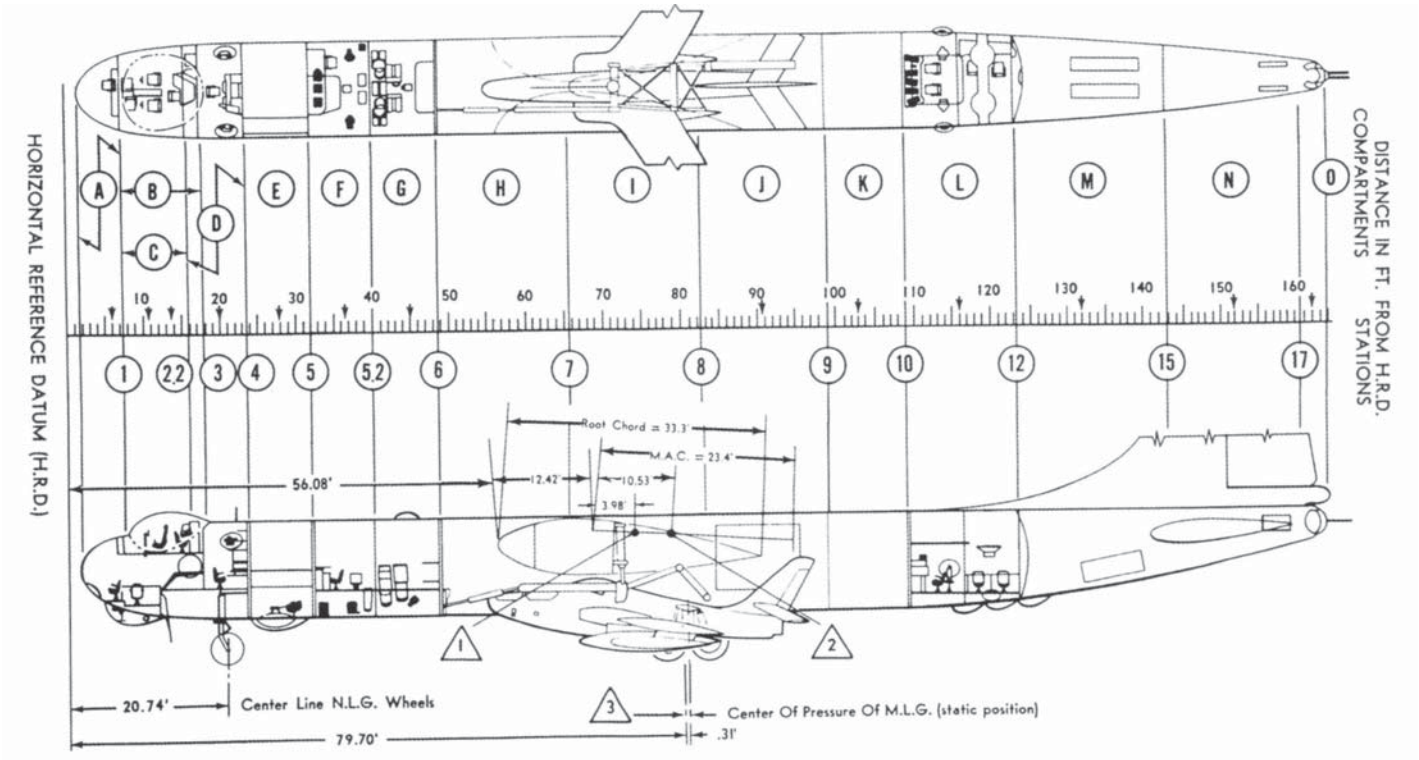
General Arrangement Diagram from the GRB-36D Illustrated Parts Breakdown (United States Air Force Museum)



General Arrangement Diagram from the Utility Flight Handbook for the GRB-36D-III Featherweight Configuration III/RF-84F Composite Aircraft (Roger Cripliver)



Cutaway view from the Standard Aircraft Characteristics Document for the Consolidated GRB-36D and the Republic RF-84F The retractable gun turrets shown were removed from all of the carriers. (United States Air Force Museum)



Weight and Balance Diagram for the GRB-36D from T.O. 1B-36(R)D-5A. (United States Air Force Museum)

A trapeze operator's station with controls for the systems associated with the parasite was installed in the pressurized camera compartment. Additional controls were installed at the carrier pilot's station and in the bomb bay.

Featherweight III

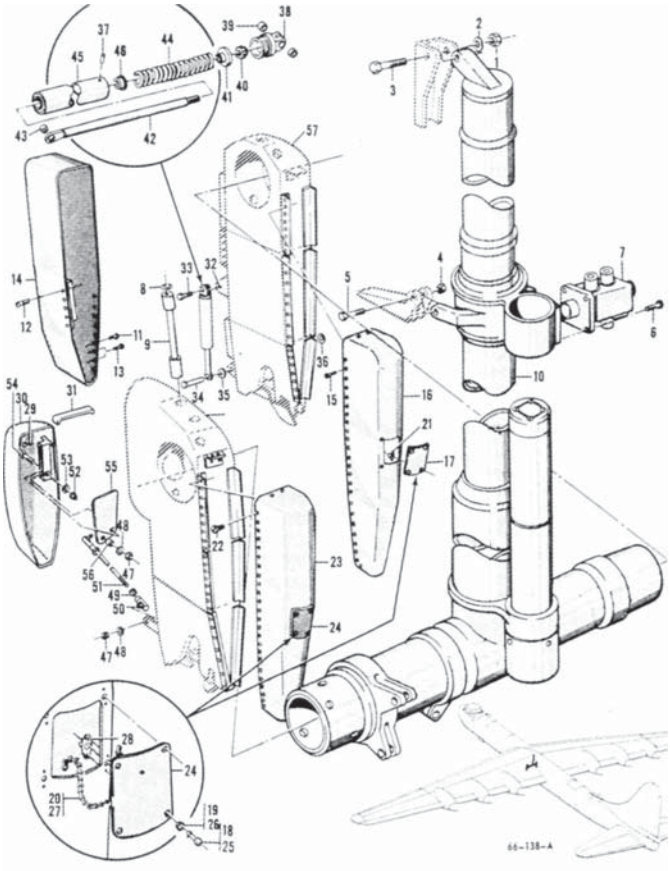
The maximum gross take-off weight of the composite aircraft was 370,000 pounds. Most of the armament and other unneeded articles were removed to reduce the empty weight of the carrier. The weight reduction measures corresponded to those of the Featherweight III modification program.

All gun turrets except for the tail turret were removed, reducing the weight of the carrier by 8,680 pounds. The self-sealing fuel tank pads were removed from the undersides of the wings, reducing the weight of the carrier by another 2,521 pounds.

An additional 4,418 pounds of miscellaneous equipment and furnishings was removed. Six Plexiglas gun-sighting blisters were removed, and the circular openings were faired over. The astrodome used for celestial navigation was removed from the cockpit greenhouse. The hand-fed chaff dispenser chutes were faired over.

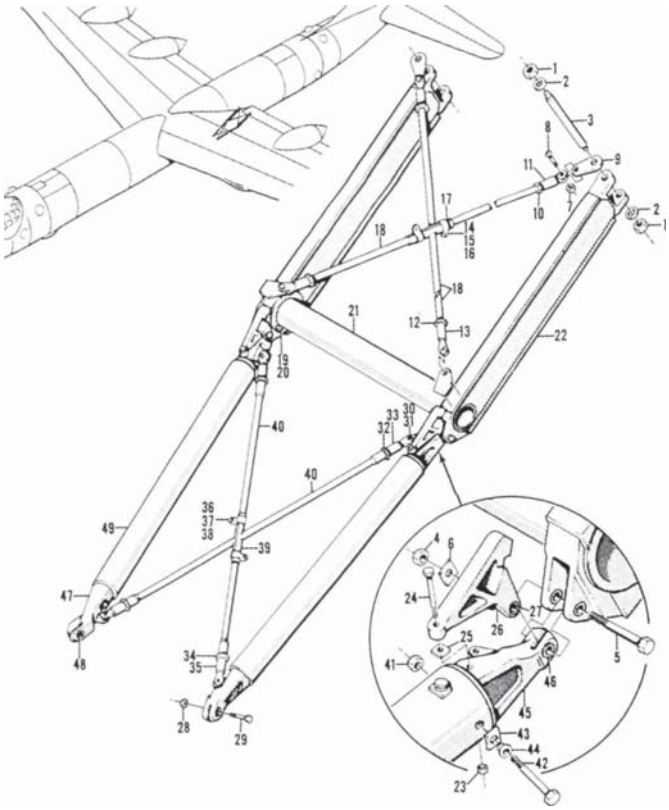
Trapeze

The Hayes Aircraft Corporation in Birmingham, Alabama manufactured the trapeze mechanism.

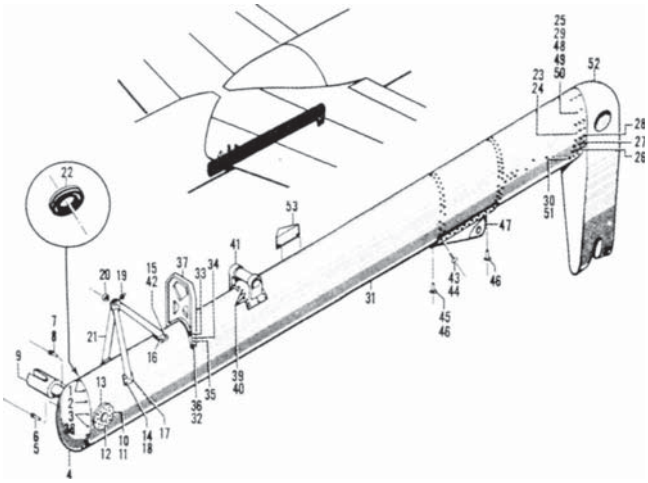


Main Cylinder, Aft Latch Fairings, Spring, and Indicator Diagram from the Illustrated Parts Breakdown for the GRB-36D III. (United States Air Force Museum)

The primary operating components of the trapeze were a main jack that was attached to the rear of the wing spar and a boom assembly that supported the parasite. The boom assembly pivoted about a yoke mounted on the bottom of the main jack. The boom was equipped with a receiver at the front and latches at the rear to engage the nose probe and fuselage pins of the parasite.



Drag Strut Diagram from the Illustrated Parts Breakdown for the GRB-36D III. (United States Air Force Museum)



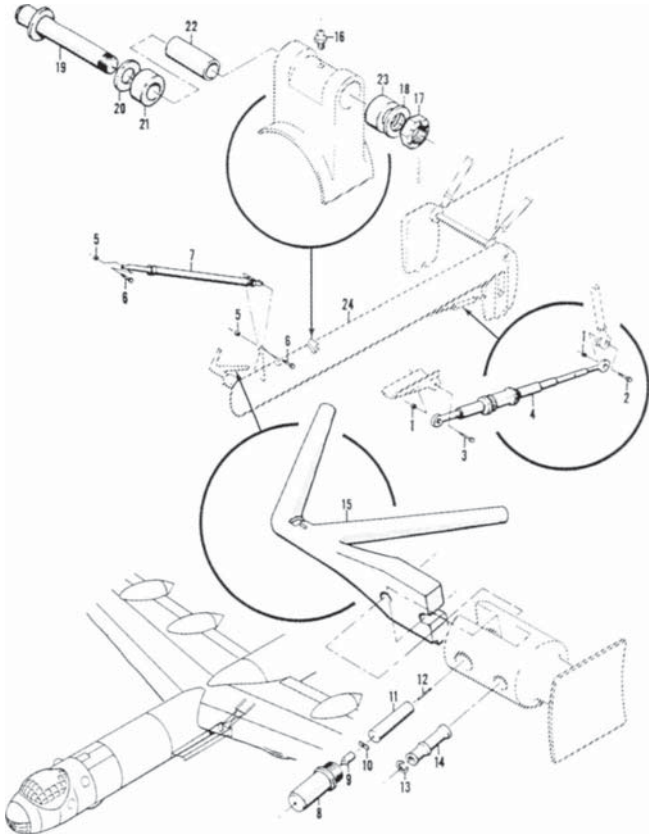
Trapeze Boom Diagram from the Illustrated Parts Breakdown for the GRB-36D III. (United States Air Force Museum)

The jack locked in three positions. It could be fully extended to launch or retrieve a parasite. It was raised to the cruise position to minimize the drag imposed while carrying a parasite. The jack was raised all the way to the take-off position to provide additional clearance under the parasite.

The yoke was attached to the rear of the bomb bay by a drag strut that stabilized the trapeze and locked it in the down position. As the main jack was fully extended, the drag strut straightened out and locked past center.

A hydraulic snubber connected the boom to the front of the bomb bay. The snubber damped out the wobbling of the boom but allowed it to be slowly lowered or raised.

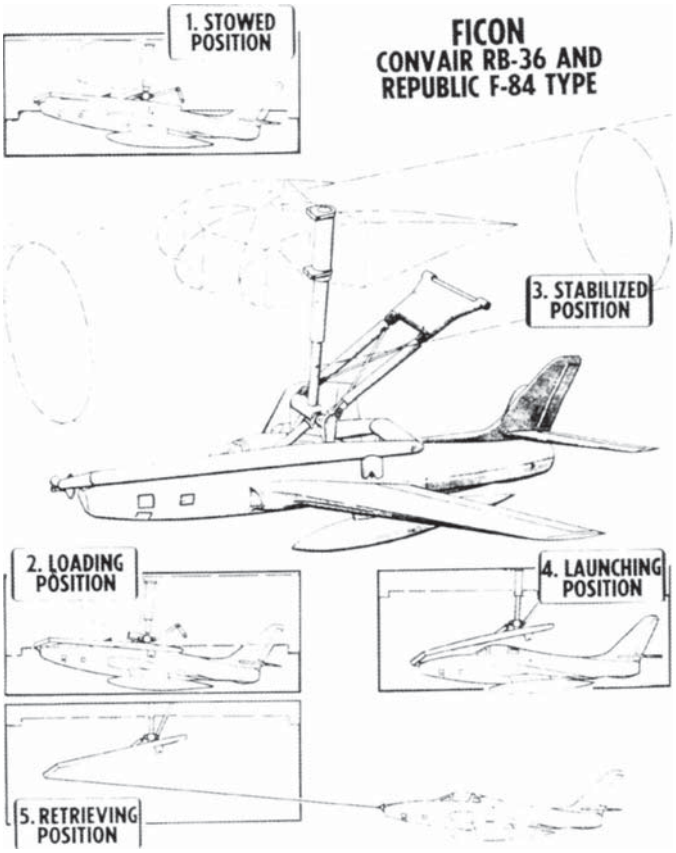
The boom of the production GRB-36D carrier differed from the prototype unit of the GRB-36F. The counterbalancing weights were removed from behind the yoke and the boom was shorter. A redundant lamp was installed on the boom to illuminate the receiver.



Positioning and Snubbing Cylinders. Probe Receiver and Boom Latch Pin Diagram from the Illustrated Parts Breakdown for the GRB-36D III. (United States Air Force Museum)

The snubber of the GRB-36F connected to the cross bar at the front of the trapeze. The snubber of the production trapeze was attached directly to the forward end of the boom. The new location of the snubber allowed the trapeze to be rotated to a greater nose-down angle to move the receiver farther out of the disturbed airflow around the carrier.

A positioning jack was mounted on the yoke to raise and lower the front end of the boom. The boom was lowered to the full down position to launch or retrieve a parasite. It was raised to the horizontal position to secure the parasite's fuselage pins in the aft latches of the boom. The front of the boom could be raised to a position 6 degrees above horizontal to increase the lift generated by the wings of the parasite while raising and lowering the trapeze.



Initial concept for trapeze positions with the FICON RF-84F Thunderflash. Note the cable tow retrieval method and the probe attachment at the tip of the nose of the Thunderflash. From Consolidated Vultee Report No. FZA-36-040; Statement of Work for Modification of RB-36 Airplane, June 9, 1951. (ASC/HO)

It was planned that the trapeze could be placed in a variety of operating positions:

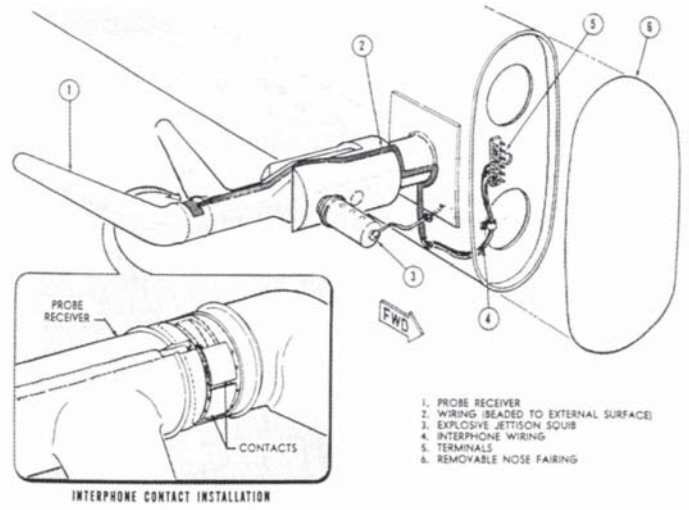
1. Stowed position - fully retracted in the bomb bay, boom six degrees nose up. This position was used for normal storage of the parasite or trapeze during flight. This position was later referred to as the Cruise position.

2. Loading position - twenty inches below the stowed position. It was necessary to lower the parasite for access to the cockpit, because the FICON RF-84F had a cockpit canopy that pivoted up and aft. Because the airplanes used for initial FICON testing were equipped with a sliding cockpit canopy, their pilots had been able to enter the parasite's cockpit while it was in the stowed position.

3. Stabilized position - trapeze extended, boom horizontal with nose probe and aft latches engaged. This position was used for securing the parasite from the launching position during retrieving, or for parasite engine air start and checkout before going to launching point position for launching. Later this position was referred to as the Extended or Three-point position.

4. Launching position - trapeze extended, boom down, only nose receiver engaged. This position was used for parasite initial contact during retrieving or for last contact during launching.

5. Retrieval position - similar to the launching position with a cable unreeled for the parasite to hook on to. The cable retrieval option was not incorporated in the production trapeze.



Trapeze interphone Provision Diagram from Maintenance Instructions Handbook for the GRB-36D III.

The trapeze was equipped with an interphone circuit that connected to the parasite through its nose probe. As the parasite probe engaged the receiver, spring-loaded cylinders in the probe made contact with plates on the receiver to complete the inter-aircraft circuit. Use of the interphone during launch preparations permitted the maintenance of radio silence when operating near enemy airspace.

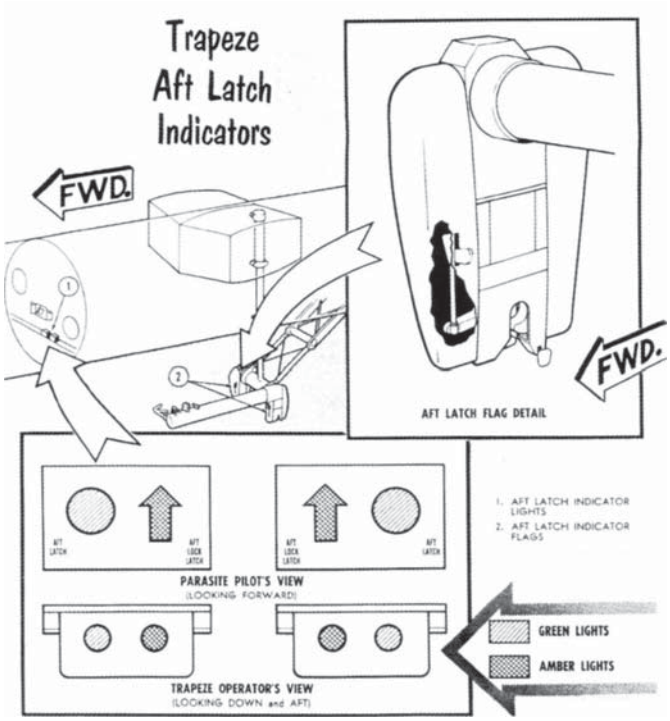
Changing the film in the parasite's camera compartment involved raising the boom to the four-degree nose up position while the main jack was in the cruise position. A latch was provided to hold the boom in this position. A crewmember had to be in the bomb bay while the boom was raised to manually operate the latch.

A boom latch was mounted on the front of the main spar to secure the boom in either the take-off or the cruise position. A separate latch was provided for each position. The latches were operated automatically by the trapeze hydraulic switching system.

A pneumatically operated latch was located on each side of the yoke to engage the fuselage pins of the parasite. A torque shaft extending through the yoke connected the latches to insure that they would operate together. Air pressure for the normal operation of the latches was provided from an air bottle mounted on the right latch housing. A redundant, emergency air bottle was mounted on the left latch housing.

A yellow latch position indicator flag was attached to each latch actuator rod to allow the trapeze operator to observe the progress of the operation of the latches. As the fuselage pins of the parasite entered the latches, the indicator flags extended out of the latch housings. As the latches secured the pins, the indicator flags retracted back into the latch housings.

Two pairs of indicator lamps were mounted in the bomb bay below the trapeze operator's window to indicate the status of the aft latches to the trapeze operator and the parasite pilot. A green lamp in each pair indicated that the related aft latch had closed in the locked position. An amber lamp indicated that the wings of the parasite were generating enough lift to press the fuselage pins against sensors in the top of the latch housing. The amber lamps were mounted inboard and the green lamps were mounted outboard. Looking down from his position, the trapeze operator saw all four lamps through circular ports. Looking forward from his cockpit, the parasite pilot saw the green lamps through circular ports. The amber lamps were visible through ports shaped like upward pointed arrows.



Trapeze Aft Latch Indicator Diagram from the Utility Flight Handbook for the GRB-36D-III Featherweight Configuration 11I/RF-84F Composite Aircraft. (Roger Cripliver)

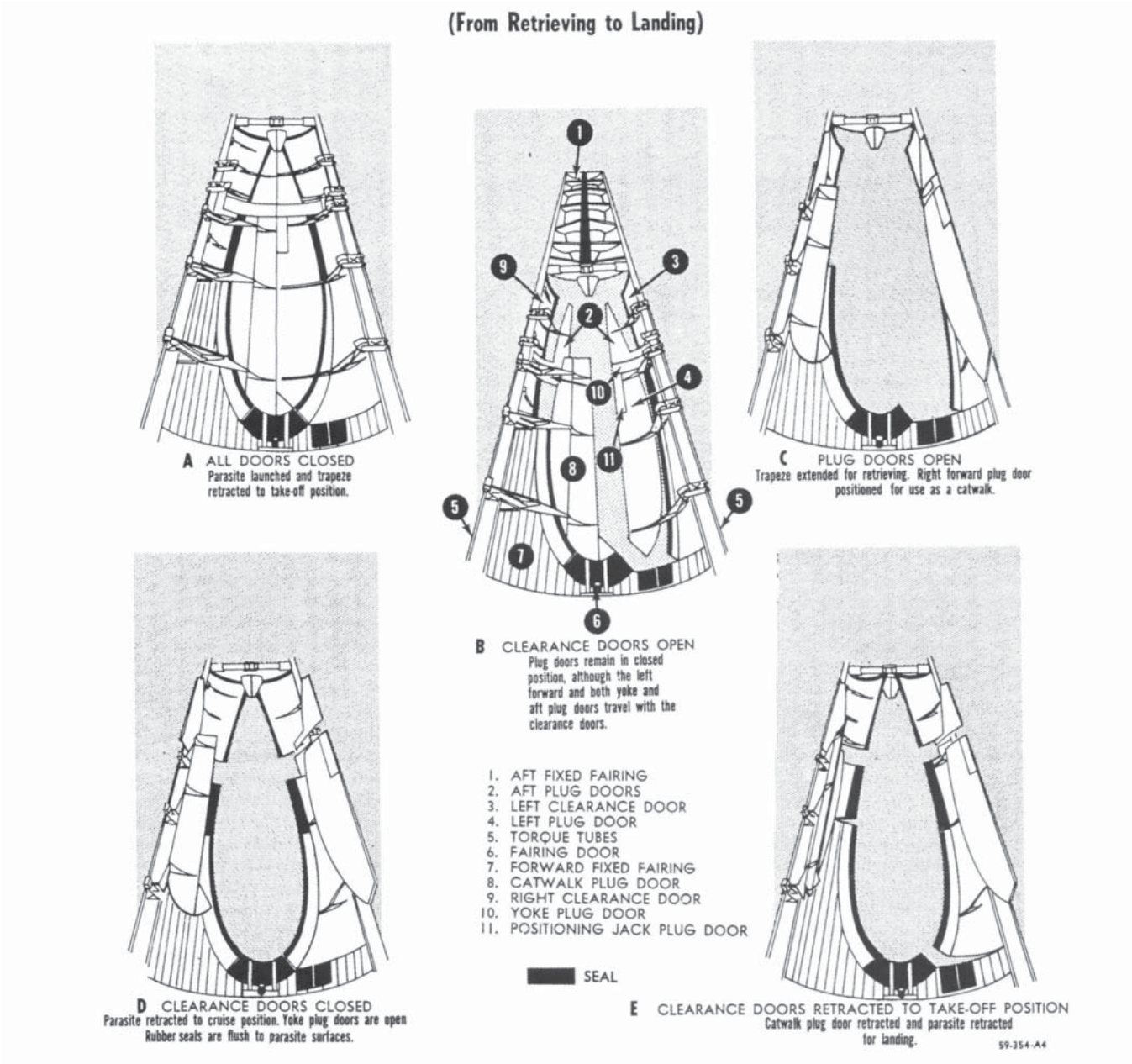
Whenever the carrier took off with a parasite on the trapeze, it was necessary to extend the trapeze to allow for the retraction of the landing gear of the carrier after take-off. An electrically operated interlock prevented the operation of the carrier's landing gear while the parasite's fuselage pins were locked in the aft latches of the trapeze unless the trapeze was extended to the launching position.

A red light on the lower right corner of the carrier pilot's pedestal indicated when the landing gear was inoperative. A landing gear interlock bypass switch was located to the right of the indicator lamp. If the interlock circuit malfunctioned, the bypass switch could be toggled to allow the retraction of the carrier's landing gear after the trapeze operator confirmed that the trapeze was fully extended.

While the carrier was parked on the ground, a safety lock pin was inserted in the main jack mechanism to secure the trapeze in either the take-off position or the cruise position. The lock pin was removed before flight and stowed in a bag in the bomb bay at bulkhead 6.2.

Plug and Clearance Doors

The standard bomb bay doors of the RB-36D were replaced with fixed fairings and two sets of hydraulically operated



Carrier Plug and Clearance Door Operation Sequence Diagram from the Utility Flight Handbook for the GRB-36D-IR Featherweight Configuration III/RF-84F Composite Aircraft. (Roger Cripliver)

doors. A set of clearance doors served to fill the gap around the parasite. A set of plug doors filled the opening in the clearance doors when the carrier did not have a parasite on board.

The plug and clearance doors were equipped with a hydraulic system that operated independently of the trapeze and utility hydraulic systems. The operation of the doors was restricted to outside air temperatures above -65 degrees Fahrenheit.

A hydraulically operated motor drove each set of doors. The motors drove worm gear trains to rotate torque tubes that ran down the sides of the bomb bay. The torque tubes rotated jackscrews that actuated the door linkages.

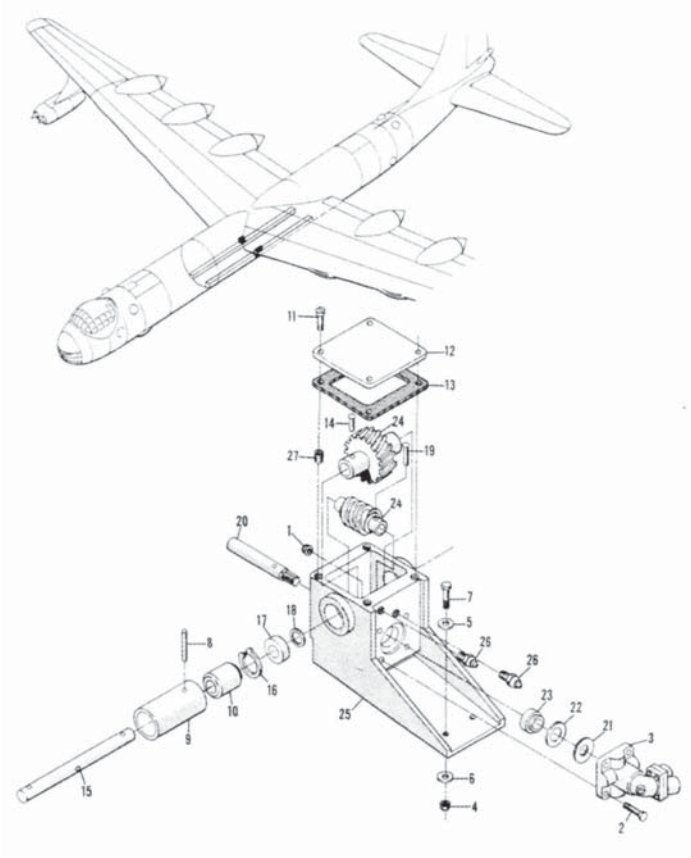
A fixed fairing was installed along the right side of the front of the bomb bay. The right clearance door covered the space aft of the fixed fairing. The left clearance door was longer than the right door, extending to the front of the bomb bay. Another fixed fairing covered the rear bomb bay. The rear fairing had a central slot to accommodate the vertical stabilizer of the parasite.

The fixed fairings and clearance doors fit snugly around the stowed *Thunderflash* while it was stowed in the cruise position to reduce the drag of the composite aircraft and prevent air from blowing through the bomb bay.

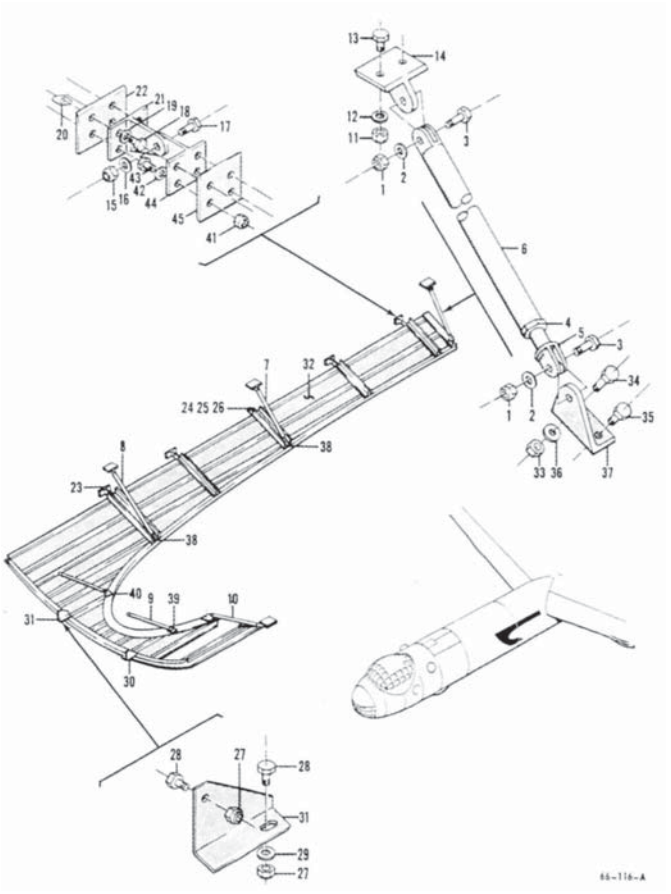
The clearance doors opened outward like conventional bomb bay doors to launch and retrieve the parasite. They could also rotate upward into the bomb bay to provide additional clearance for the parasite in the take-off position.

The clearance doors were originally designed to have rubber strips along their edges to provide a soft seal against the sides of the parasite. Problems with the durability of the rubber seals resulted in their temporary replacement with metal fairing strips. The flexibility of the rubber seals allowed them to flex against the sides of the parasite's fuselage as they were retracted to the take-off position. The rigidity of the metal fairing strips precluded moving the clearance doors to the take-off position.

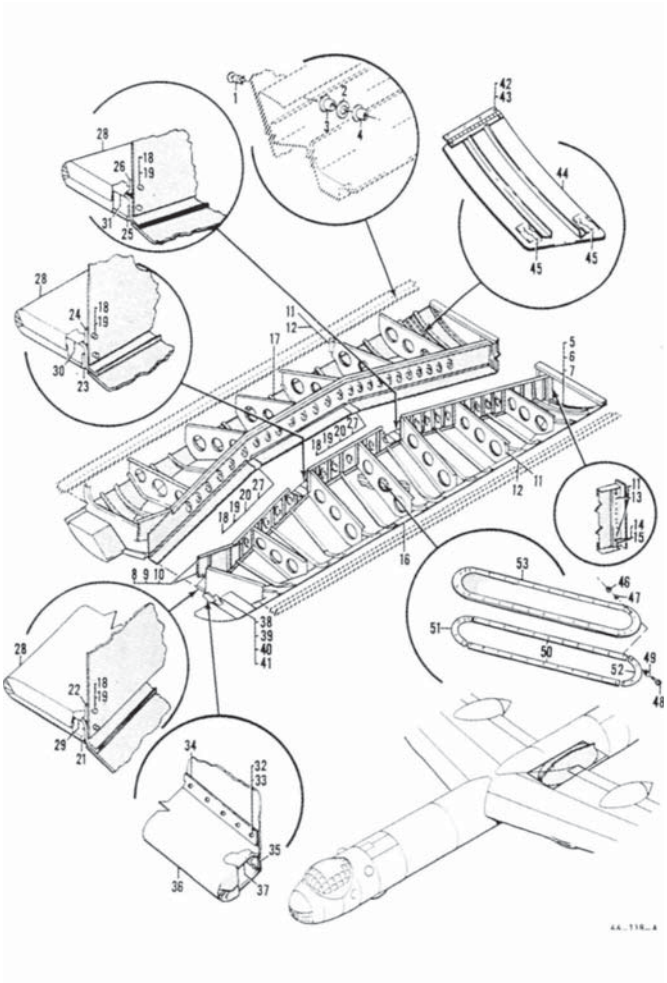
The plug door system incorporated forward and aft doors on both sides of the bomb bay. Yoke plug doors were positioned between the forward and aft plug doors on each side of the bomb bay to provide clearance for the trapeze yoke.



Motor Drive Unit FICON Bay Doors Diagram from the Illustrated Parts Breakdown for the GRB-36D III. (United States Air Force Museum)



Forward Fixed Fairing Diagram from the Illustrated Parts Breakdown for the GRB-36D III. (United States Air Force Museum)



Aft Fixed Fairing Diagram from the Illustrated Parts Breakdown for the GRB-36D III. (United States Air Force Museum)

The plug doors opened upward into the bomb bay. They could be opened only while the clearance doors were open. Each yoke plug door was mechanically linked to the respective aft plug door and slid upward inside the bomb bay as the aft doors rotated inward and upward.

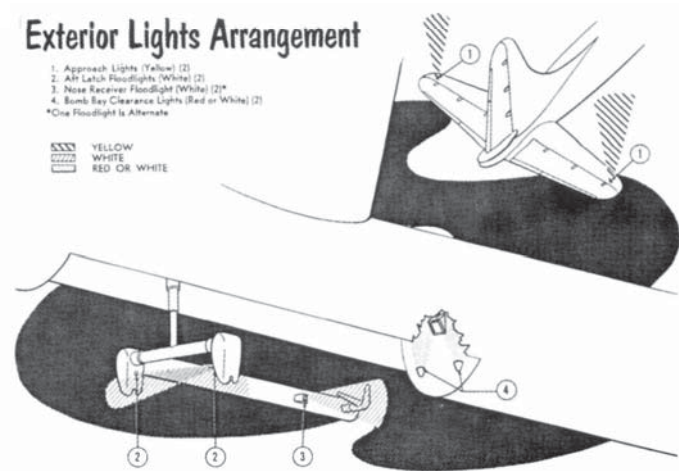
The left plug doors were attached to the inside of the clearance doors. The plug doors were geared so that they translated down and out, but did not rotate, as the clearance doors were opened.

The right forward plug door was hinged at the right edge of the bomb bay. It was divided lengthwise and configured so that the inboard section remained horizontal as the outboard section opened upward. When the plug doors were open, the inboard section of the right forward plug door served as a catwalk for personnel in the bomb bay. When the clearance doors were moved to the take-off position, the catwalk portion of the right forward plug door rotated upward to a vertical position.

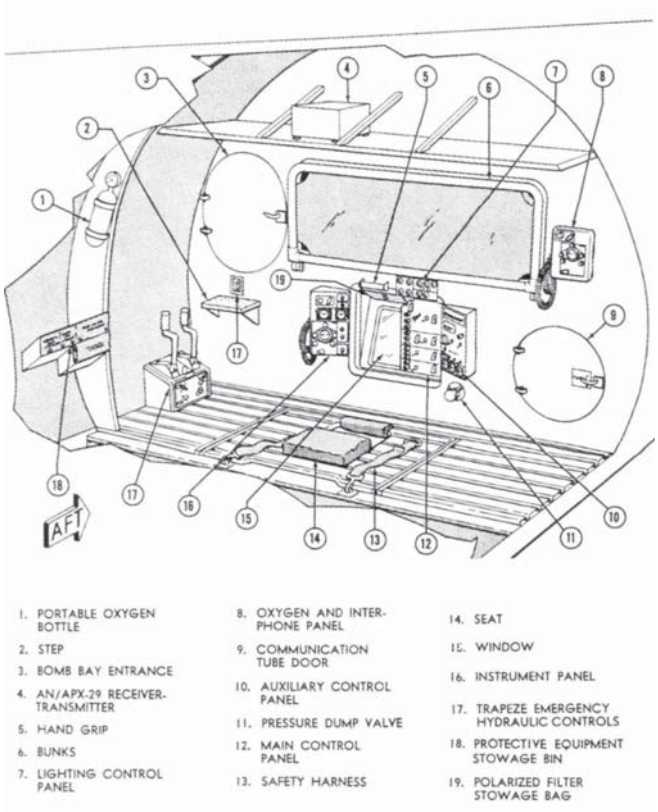
A hand crank located at the rear of the bomb bay allowed the plug and clearance doors to be opened manually in the event of a hydraulic failure.

Auxiliary Lighting

Lights were installed in the bomb bay to illuminate the bay and to provide visual cues for the parasite pilot as he approached the trapeze. Ten dome lights were installed in the bomb bay for general illumination. Each dome light was equipped with a red lamp and a white lamp. The red lamps were selected during night operations to preserve the night vision of the crewmembers.



Exterior Lights Arrangement Diagram from the Utility Flight Handbook for the GRB-38D-III Featherweight Configuration III/RF-84F Composite Aircraft. (Roger Cripliver)



Trapeze Operator's Station Diagram from the Utility Flight Handbook for the GRB-36D-III Featherweight Configuration III/RF-84F Composite Aircraft. (Roger Cripliver)

A pair of lights, similar to the dome lights, was mounted below and to either side of the trapeze operator's window. This pair of lights pointed upward to illuminate the upper part of the bomb bay.

A pair of yellow approach lights was installed on the upper surface of the horizontal stabilizers to guide the parasite to the carrier. As the parasite pilot approached the GRB-36D from higher altitude he would be able to see the approach lamps on the stabilizers of the carrier below him. These lights were not visible to observers on the ground.

White floodlights were installed on the trapeze to illuminate the nose receiver and each of the aft latches. Another floodlight was mounted on the boom, pointing forward to illuminate the receiver. It was equipped with a backup lamp in case the primary lamp burned out. A floodlight was mounted in each aft latch housing, pointing across to the opposite latch.

Trapeze Operator's Station

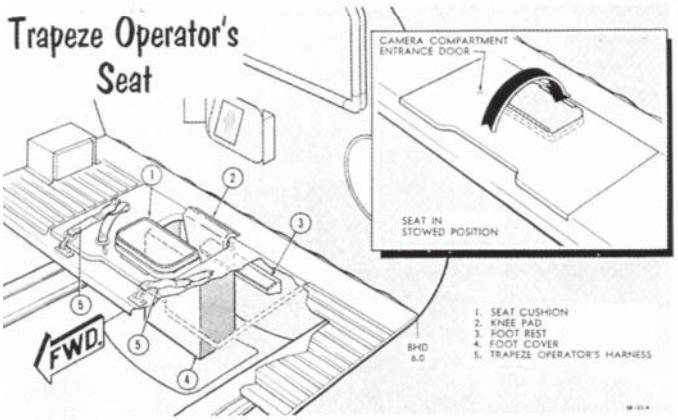
Trapeze operator's controls were installed at a station located on the rear bulkhead of the camera compartment. The trapeze operator could view the parasite and its trapeze through a heated window in the bulkhead.

As the trapeze operator faced the window at the rear of the camera compartment, the main control panel and auxiliary control panel were to his right. The trapeze operator's instrument panel was to his left. A lighting control panel was located directly above the main control panel. Cover doors protected the panels when they were not in use.

The camera compartment entrance door in the floor of the compartment served as the trapeze operator's seat. The trapeze operator sat on a seat cushion mounted on the back of the open door, and his legs hung down into the entry way. A cushioned kneepad fit against the opposite edge of the opening. Metal loops in the floor of the compartment provided attachment points for the trapeze operator's parachute harness. A handhold was installed just above the window.

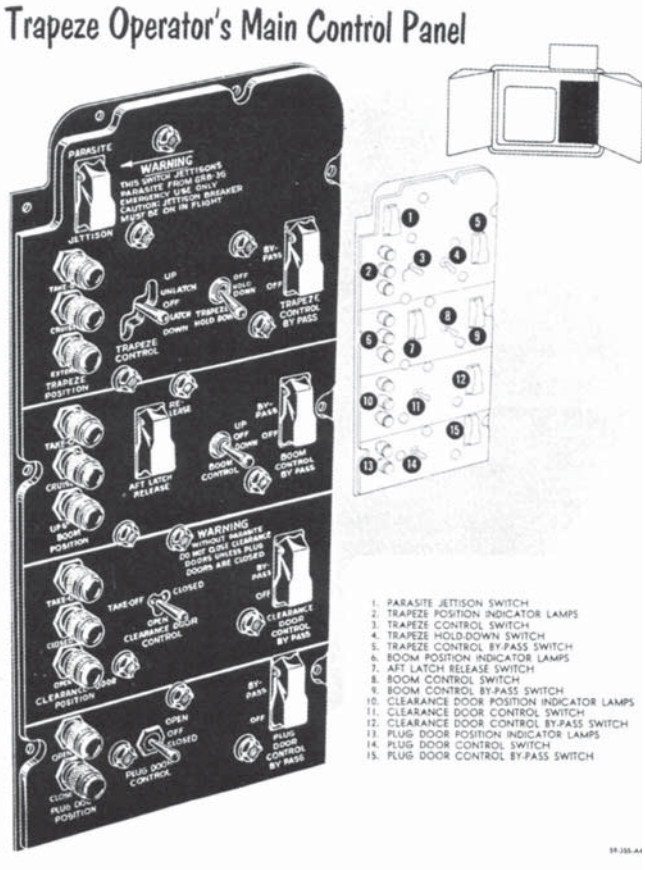
A pair of bunks was mounted on the aft wall of the camera compartment. The upper bunk was located above the trapeze operator's window. The lower bunk was equipped with harnesses and seat belts, and served as a seat for the occupants of the compartment during take-off and landing. When not in use, the lower bunk was detached from the wall and stowed with the upper bunk to permit access to the trapeze operator's station.

The trapeze operator's main control panel contained switches to control the functions of the trapeze and the plug and clearance doors and lights to indicate their positions. 28-volt DC electrical power for the main control panel switches was drawn from the trapeze operator's circuit breaker panel. The toggle



Trapeze Operator's Seat Diagram from the Utility Flight Handbook for the GRB-36D-III Featherweight Configuration IILRF-84F Composite Aircraft, (Roger Cripliver)

switches on the trapeze operator's control panels opened and closed electrical circuits through the relay network to operate the trapeze hydraulic system selector valve. Electrical interlocks built into the relay network prevented the trapeze and plug and clearance doors from being operated in the wrong sequence.



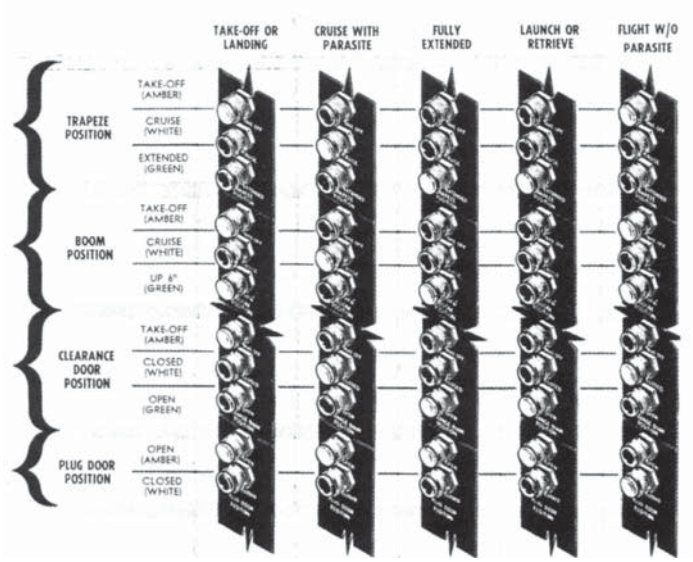
Trapeze Operator's Main Control Panel Diagram from the Utility Flight Handbook for the GRB-36D-III Featherweight Configuration IILIRF-84F Composite Aircraft. (Roger Cripliver)

The trapeze operator's main control panel incorporated a Trapeze Control switch, a Trapeze Hold Down switch, a Boom Control switch, an Aft Latch Release, a Clearance Door Control switch, a Plug Door Control switch, and a Parasite Jettison switch. There were four sets of indicator lamps on the main control panel: Trapeze Position. Boom Position, Clearance Door Position, and Plug Door Position.

The Trapeze Position switch had five positions: Up, Unlatch, Off, Unlatch, and Down. The Up position supplied hydraulic pressure to the lower end of the main jack. The Down position supplied hydraulic pressure to the upper end of the main jack. The trapeze operator placed the switch in either of the two Unlatch positions to release the boom support latches before the jack was moved up or down.

To extend or retract the trapeze, the trapeze operator would move the switch to the associated Unlatch position, releasing the boom support latch and starting the operation of the main jack. Once the trapeze was in motion the trapeze operator would move the switch to the Up position or the Down position.

The movement of the trapeze could be reversed at any time, but it was inadvisable to release the switch to the off position while the trapeze was in motion. That could result in cavitation in the upper end of the main jack. The jack would cease to



Trapeze, Boom & Door Position Indication Diagram from the Utility Flight Handbook for the GRB-36D-III Featherweight Configuration III/RF-84F Composite Aircraft. (Roger Cripliver)

function as an effective shock absorber, and turbulent gusts could damage the trapeze.

The trapeze operator toggled the Trapeze Hold Down switch to maintain hydraulic pressure in the upper end of the main jack while the trapeze was in the fully extended position. An electrical interlock prevented the operation of the Trapeze Control switch while the Trapeze Hold Down switch was in the Hold Down position.

Three lamps indicated the positions of the trapeze. An amber lamp indicated that the trapeze was in the take-off position. A white lamp indicated when the trapeze was in the cruise position, and a green light indicated that it was fully extended. The green lamp was not a reliable indicator of the full extension of the trapeze because it was triggered when the drag strut locked over center, which occurred before the trapeze reached the fully extended position. The trapeze operator was instructed to hold the trapeze position switch in the Down position until the main jack stopped its downward movement. A similar set of trapeze position lamps was installed on the carrier pilot's instrument panel so that he could monitor the position of the trapeze.

The Boom Position switch was located below the Trapeze Position switch. It had three positions: Up, Off, and Down. The Down position was spring loaded so that it returned to the Off position when it was released by the trapeze operator. The boom was placed in the full nose up position while raising or lowering the trapeze, so the Up position of the Boom Position switch was not spring-loaded. The relay network was configured to hold the front of the boom up whenever the main jack was in motion or when the main jack was fully extended with the parasite engaged and the Trapeze Hold Down switch was in the Hold Down position. An electrical interlock prevented the operation of the main jack unless the boom was in the full nose up position.

While the boom was latched in the take-off position, the forward boom latch was automatically released whenever the trapeze operator moved the Boom Position switch to the Down position. When the boom was latched in the cruise or camera loading position, the trapeze operator had to move the Boom Position switch to the Up position to open the latch. When the boom was in the camera loading position, a crewmember standing on the access platform in the bomb bay had to manu-

ally release the camera loading position latch.

Three lamps indicated the position of the boom. An amber lamp indicated that the boom was in the take-off position. A white lamp indicated when it was in the cruise position, and a green lamp indicated the 6-degree nose up position.

The Aft Latch Release switch was located to the left of the Boom Position switch. The switch was guarded to prevent accidental triggering of the latches. Toggling the Aft Latch Release switch triggered the release of pressurized air into the pneumatic latch actuators, unlocking and opening the latches.

Before the trapeze operator triggered the Aft Latch Release, the parasite pilot trimmed his airplane so that it was supported by the lift generated by its own wings. The reduced load on the latches allowed them to operate freely. The fuselage pins would then bear up on sensors, illuminating the amber indicator lamps under the trapeze operator's window. Normal turbulence would cause the amber lights to flicker, even when the parasite was properly trimmed for release.

Once the aft latches had been released, the parasite pilot triggered the release of the nose probe using the Probe Release switch in his cockpit.

The Clearance Door Control switch was a three-way toggle with Take-Off, Open, and Closed positions arrayed around the Off position in the center. While the switch was in the Off position, hydraulic fluid flow was directed through a recirculating system. Moving the switch out of the Off position redirected flow from the recirculating system to the hydraulic selector valve, and activated a solenoid on the hydraulic selector valve to send pressure to the appropriate line. When the doors reached the selected position, limit switches disconnected the circuit to the selector valve solenoid and completed a circuit to the appropriate door position indicator lamp. Moving the switch to the Off position energized the hydraulic bypass valve, directing the hydraulic fluid back to the recirculating system.

When the Clearance Door Control switch was moved to the open position, it also triggered the opening of the upper and lower aft turret doors to vent the air that blew into the bomb bay. The turret doors closed automatically when the clearance doors were returned to the closed position.

The Plug Door Control switch had three positions: Open. Off, and Closed. It was operated in a similar fashion to the Clearance Door Control switch. The plug doors were to be operated only when the clearance doors were open, the trapeze was in the take-off position, and there was no parasite on the trapeze.

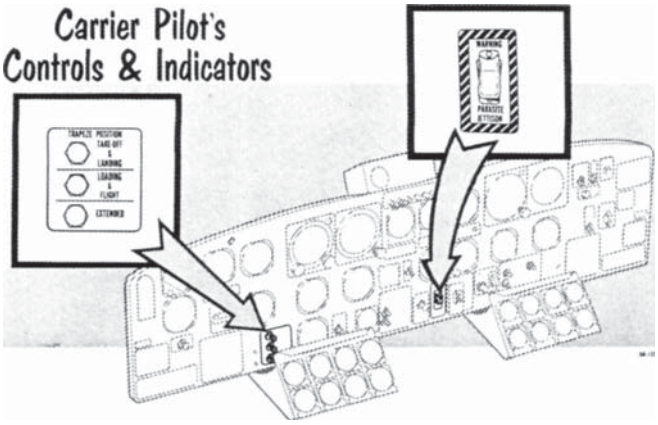
The position of the clearance doors was indicated by another set of three lamps; green for the take-off position, white for the cruise position, and amber for closed. The plug doors had only two indicator lamps. A white lamp showed that the plug doors were closed and an amber lamp showed that they were open.

Interlocks in the relay network prevented the trapeze operator from operating the trapeze and doors in the improper sequence. While a parasite was on the trapeze, the clearance doors could only be opened or closed if the trapeze was in the cruise position. If there was no parasite on the trapeze, the clearance doors could be opened and closed with the trapeze in either the take-off or cruise position. The clearance doors could only be moved to the take-off position when the boom was in the 6-degree nose up position, whether there was a parasite engaged or not.

The clearance doors were operated only when the plug doors were either fully closed or fully open. If the clearance doors were operated with the plug doors partially open, the door jackscrews could run into other aircraft structures.

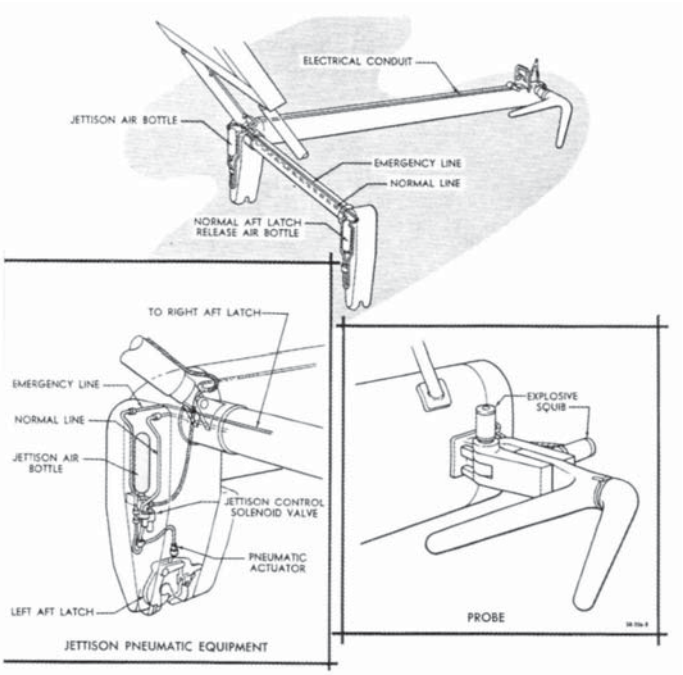
In the event of a malfunction of the relay network, each switch was provided with a bypass that permitted operation of the appropriate trapeze system selector valve. Operation of the hydraulic systems by the bypass switches required particular care to avoid conflicts between the plug and clearance doors, the carrier's main landing gear, and the parasite. Each bypass switch was equipped with a guard that had to be lifted out of the way to prevent accidental triggering.

The trapeze operator and the carrier pilot were each provided with a Parasite Jettison switch. The pilot's Parasite Jettison switch was surrounded by red and white stripes for easy identification. The jettison switches were equipped with guards to prevent the accidental jettisoning of the parasite. Lifting the guard and toggling either Parasite Jettison switch opened the aft latches of the trapeze and fired a pair of explosive squibs that separated the probe receiver from the trapeze. This rendered the trapeze unusable for further parasite operations.

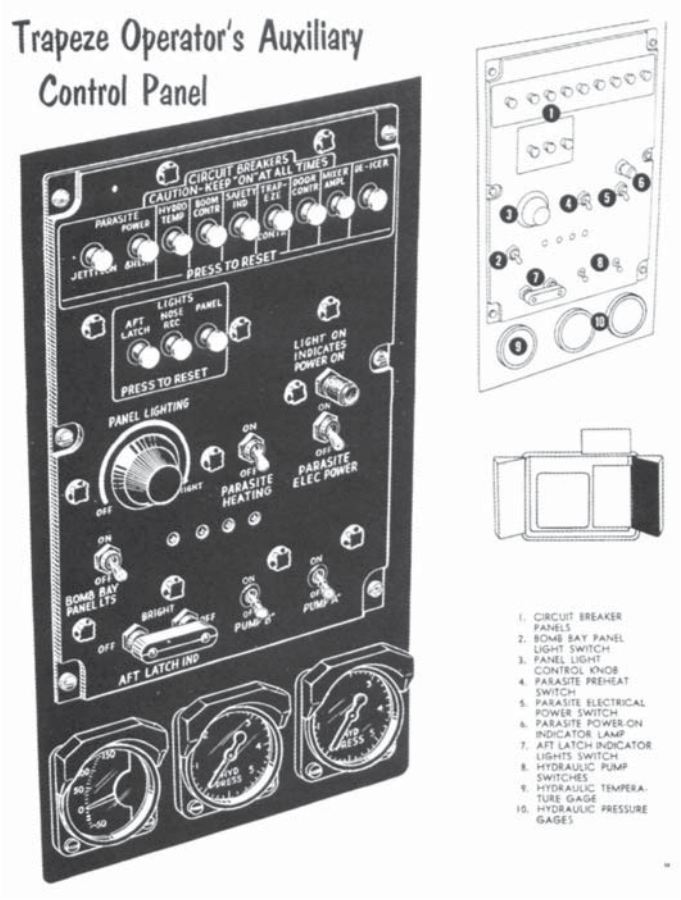


Carrier Pilot's Controls and Indicators Diagram from the Utility Flight Handbook for the GRB-36D-III Featherweight Configuration IILRF-84F Composite Aircraft. (Roger Cripliver)

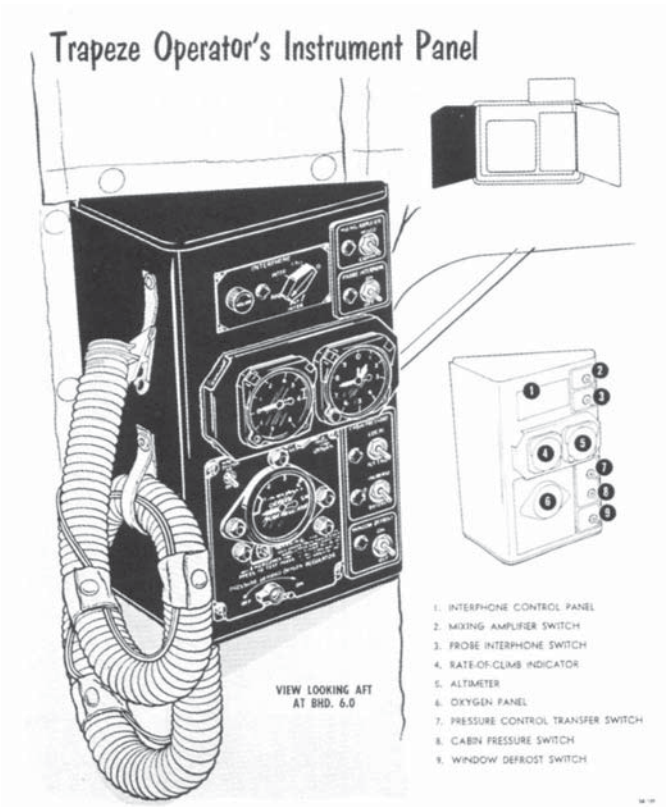
Alternatively, if it became necessary to jettison one parasite in order to retrieve another, the nose latch of the parasite could



Carrier's Parasite Jettison Controls Diagram from the Utility Flight Handbook for the GRB-36D-III Featherweight Configuration III/RF-84F Composite Aircraft. (Roger Cripliver)



Trapeze Operator's Auxiliary Control Panel Diagram from the Utility Flight Handbook for the GRB-36DIII Featherweight Configuration III/RF-84F Composite Aircraft. (Roger Cripliver)



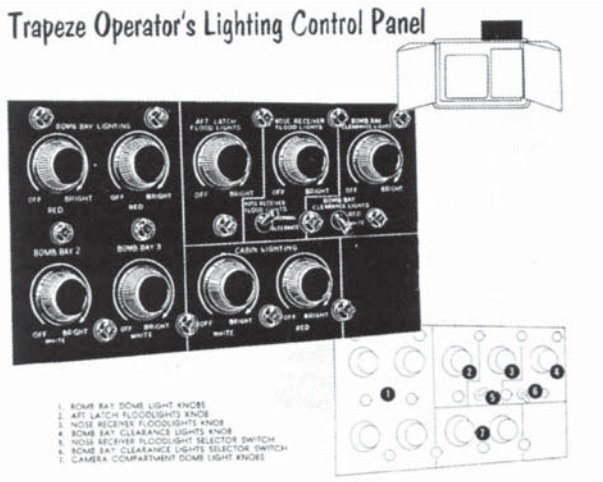
Trapeze Operator's Instrument Panel Diagram from the Utility Flight Handbook for the GRB-36D-III Featherweight Configuration III/RF-84F Composite Aircraft. (Roger Cripliver)

be released manually with a special latch retraction tool. One end of the tool was inserted through a hole in the probe just forward of the latch housing. The other end of the tool rested on the probe latch. Pushing back on the tool released the latch. The parasite was held in place on the trapeze by the fuselage pins. The probe could be locked open by inserting a probe latch lock pin through another hole in the probe. The trapeze operator then toggled the Aft Latch Release switch to jettison the parasite.

The trapeze operator's auxiliary control panel was mounted to the right of the main control panel. It contained the circuit breakers for the relay network, switches to control the lights in the camera compartment and bomb bay, and hydraulic pressure and temperature gauges.

Hydraulic pressure gauges were provided for the two pumps that operated the trapeze and doors. Normal operating pressure was 3,000 pounds per square inch. A Hydraulic Temperature gauge indicated the fluid temperature in the hydraulic reservoir. The maximum allowable hydraulic reservoir temperature was 71 degrees Celsius.

The trapeze operator's instrument panel contained switches



Trapeze Operator's Lighting Control Panel Diagram from the Utility Flight Handbook for the GRB-36D-III Featherweight Configuration III/RF-84F Composite Aircraft. (Roger Cripliver)

to control the interphone, radio, cabin pressurization, and the window defroster. It also contained a pressure altimeter, rate-of-climb indicator, and an oxygen panel.

The Probe Interphone switch was located on the upper right of the instrument panel. The Mixing Amplifier switch was located above the Probe Interphone switch. The switch was set in the Mixed position when the parasite was attached to the trapeze so that the trapeze operator could monitor both the interphone and the command radio. The Command position was used to select only the command radio while the parasite was flying independently.

The Window Defrost switch operated a temperature control unit on the window. When a sensing element in the window detected frosting conditions, 208-volt AC power from the right-forward turret AC-power panel was routed to heating elements in the window.

The trapeze operator's lighting control panel was mounted directly above the main control panel. Nine rheostats provided brightness control for the lights in the camera compartment and bomb bay. The rheostat at the top right controlled the brightness of the bomb bay clearance lights. It was equipped with a toggle to select between the red and the white lamps. The rheostat to its left controlled the nose receiver. The next rheostat to

the left controlled the aft latch floodlights. A pair of rheostats to control the camera compartment dome lights was located below the trapeze floodlight rheostats. One controlled three white lamps and the other controlled three red lamps.

Two pairs of rheostats for the control of the bomb bay dome lights were located at the left side of the panel. The left pair controlled the red and white lamps of the five dome lights in bomb bay 2 and the right pair controlled the five dome lights in bomb bay 3.

The camera compartment could be depressurized independently of the other compartments of the carrier in order to gain access to the bomb bay at high altitude. A Cabin Pressure switch was mounted on the trapeze operator's instrument panel. It had two settings. Increase and Decrease.

The Pressure Control Transfer switch was used to assign authority over camera compartment pressurization. It was normally toggled to the Flight Engineer position. It was toggled to the Local position to give the trapeze operator control over the camera compartment pressure valve.

The trapeze operator monitored the altimeter and rate-of-climb indicator as he pressurized and depressurized the camera compartment.

A manual Cabin Dump valve for venting the pressure in the camera compartment was located below the auxiliary control panel. The valve required fourteen rotations in the clockwise direction to open it fully in order to provide a precise control over the rate of cabin depressurization. A lock nut on the valve shaft secured the valve in the closed position.

Carrier Pilot's Station

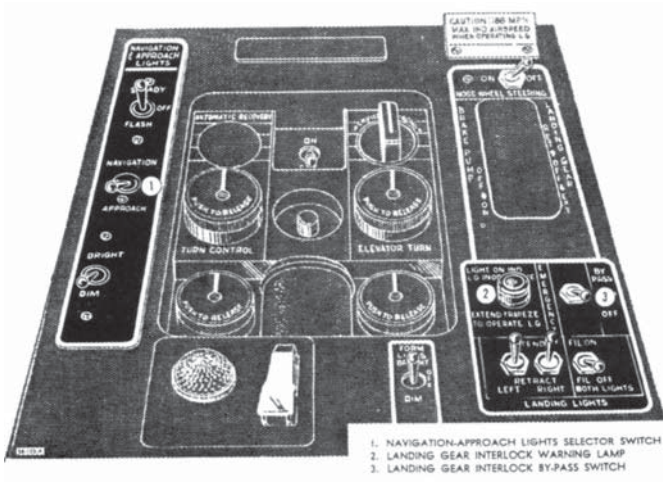
A set of three switches to control the auxiliary approach lights was located on the left side of the carrier pilot's pedestal. The upper switch controlled whether the lights flashed or stayed on constantly. The middle switch selected between the standard navigation lights and the approach lights on the horizontal stabilizer. It was normally left in the Navigation position to illuminate the navigation lights on the wingtips and vertical stabilizer. To assist the parasite pilot in locating the carrier at the end of his mission, it would be set in the Approach position to extinguish the navigation lights and illuminate the yellow approach lights on the upper surface of the horizontal stabilizers. Below the Approach-Navigation toggle was a toggle switch that selected between the bright and dim settings of the approach lights.

AN/APX-29 rendezvous equipment

An AN/APX-29 homing beacon was installed in the carrier to assist the parasite pilot in finding the carrier at the end of his solo mission. The system operated much like the transponders found on aircraft today. The transmitter on the carrier emitted a periodic signal that was received by the parasite. The receipt of the signal from the carrier triggered a brief radio emission from the parasite, which the rendezvous equipment analyzed to determine the range and bearing to the parasite from the carrier.

The receiver-transmitter for the radio was located on a shelf directly above the trapeze operator's station. The antenna was mounted on the top of the fuselage directly above the receiver-transmitter.

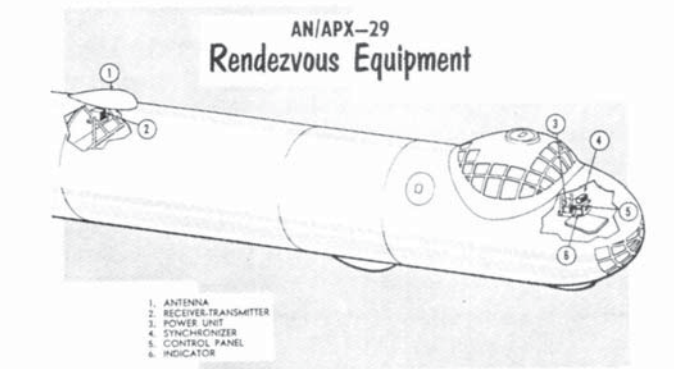
The photo-navigator operated the rendezvous equipment. A power supply unit, range and azimuth indicator, control panel, and synchronizer unit were located at the photo-navigator's station in the forward crew compartment.



Carrier Pilot's Pedestal Diagram from the Utility Flight Handbook for the GRB-36D-III Featherweight Configuration III/RF-84F Composite Aircraft. (Roger Cripliver)

The SN-133/APX synchronizer unit furnished power and range mark signals to the range and azimuth indicator. A power switch on the front panel of the synchronizer controlled the power to the synchronizer, indicator, and control panel. A range selector switch was used to adjust the scale of the display on the indicator. A control for the brightness of the indicator display was provided on the synchronizer unit. The synchronizer incorporated an On-Off switch to control the rotation of the antenna.

The IP-279/APX Range and Azimuth Indicator displayed a glowing marker that showed the position of the parasite relative to the carrier. Mile markers were superimposed on the display to indicate the distance. The display incorporated controls for light, bias, focus, and centering.



AN/APX-29 Rendezvous Equipment Diagram from the Utility Flight Handbook for the GRB-36D-III Featherweight Configuration III/RF-84F Composite Aircraft. (Roger Cripliver)

The C774A/UPX Control Panel contained a Master Power switch. Mode Selector, a three position Challenge switch, and a Receiver Gain Control. The Master Power switch controlled power to the receiver-transmitter. The photo-navigator selected one of three operating modes with the Mode Selector switch. The Challenge switch controlled the duration of operation of the beacon. It had three positions: Lock On, Out, and On. The beacon could be locked on for continuous operation. In locations where detection of the carrier posed a threat, the photo-navigator could operate the beacon intermittently by moving the switch to the spring-loaded On position. Adjusting the Receiver Gain controlled the brightness of the display on the range and azimuth indicator.

Hydraulic systems

The hydraulic system of the standard RB-36 was equipped with two pumps that provided up to 3,000-pounds per square inch of hydraulic pressure to the main hydraulic system and the brake hydraulic system. These two pumps were identified as Pumps 1 and 2. A second pair of hydraulic pumps, identified as pumps A and B, was installed in each GRB-36D to operate the trapeze and door hydraulic system independently of the primary hydraulic systems.

An electrical override prevented the simultaneous operation of more than two hydraulic pumps at a time. The brake system hydraulic pump was shut down while the trapeze and door hydraulic system was operating. This doubled the landing gear retraction time.

Emergency Systems

If the normal electronic trapeze controls failed to operate the trapeze or plug and clearance door system selector valves, the valves could be operated manually. The selector valves were located on the hydraulic equipment rack aft of the main spar. A crewmember had to enter the bomb bay and work his way aft along the catwalk to get to the valves.

The trapeze system selector valve was equipped with six levers: Boom Up, Boom Down, Trapeze Unlatch, Trapeze Hold Down, Trapeze Up, and Trapeze Down. Each of the levers was spring-loaded. The operator had to hold them in until the desired effect had been achieved. The Boom Up lever was equipped with a latch to supply constant pressure to the up side of the boom actuator.

The plug and clearance door system selector valve was located next to the trapeze system selector valve. It was equipped with a pair of levers for each of the four door circuits. Each set of doors was equipped with one lever to open the doors and one lever to close them.

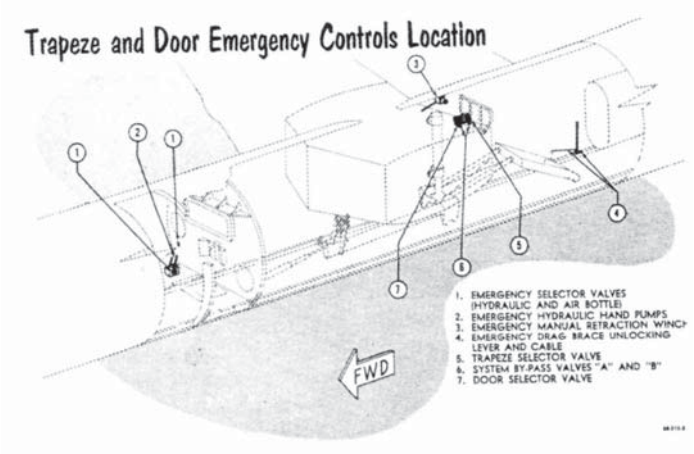
Manual operation of the clearance door selector valves did not automatically open the aft turret doors. The trapeze operator had to toggle the Clearance Door Control switch to the Open position to open the turret doors before the clearance door open selector valves were operated.

In the event of a hydraulic power failure, the trapeze and the plug and clearance doors could be operated with manual hydraulic system selector controls and emergency hand pumps. The controls and hand pumps were located on the right side of the camera compartment. Two hydraulic pump handles were provided. Each handle operated a pair of pumps.

The Hand Pump Control valve was located below and between the pump handles. A Plug Door Control valve and a Clearance Door Control valve were located on the aft wall of the camera compartment next to the hand pumps. A Trapeze Control valve, Latch Control valve, and Boom Control valve were located on a panel at the base of the hand pump pedestal.

The Hand Pump Control valve could be set in three positions: Start, Fast, or Doors. The Doors position was used to direct pressure to the plug and clearance door valves. The Start and Fast positions were selected to operate the trapeze, latch, and boom. The Start position cut out one of the hydraulic pumps at each handle to reduce the force necessary. Once the trapeze was in motion, the valve was switched to the Fast position to utilize the output of all four hydraulic pumps.

The Plug Door Control valve could be set to Close, Off or Open. The Clearance Door Control valve had Take-off, Off, and Close positions. When the Hand Pump Control valve was set in the Doors position, these valves were used to select the appropriate door operation. Except when in use, the normal position for the valves was the Off position.



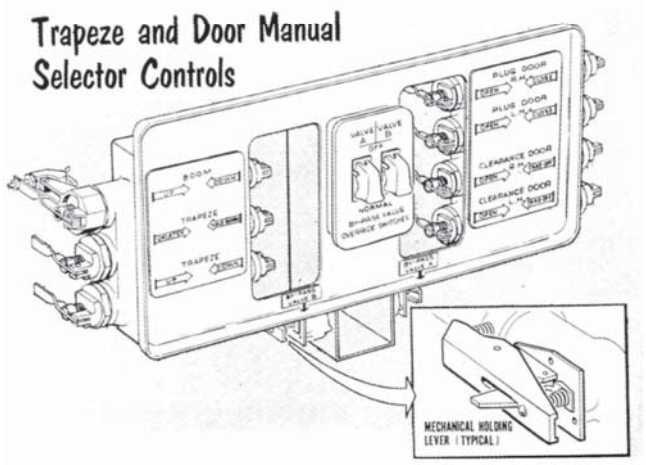
Trapeze and Door Emergency Controls Location Diagram from the Utility Flight Handbook for the GRB3613- III Featherweight Configuration IIVRF-84F Composite Aircraft, (Roger Cripliver)

The Boom Control valve could be set to one of three positions: Up, Off, or Down. The boom was raised to the 6-degree nose up position whenever the trapeze was raised or lowered.

The Latch Control valve had three positions marked Auto, Off, and Unl (for Unlatch). Before raising or lowering the trapeze, the Latch Control valve was set to the Unl position to operate the boom unlatching mechanism. After the trapeze started to move, the valve was switched to the Auto position.

The Latch Control Valve was mechanically linked to the Boom Control valve so that the Boom Control valve would move to the Up position whenever the Latch Control valve was set to the Unl position. This insured that the boom would always be in the full up position when the trapeze was moved. While the Boom Control valve was in the Up position, the Unl Control valve could be positioned as desired. Moving the Boom Control valve out of the Up position caused the Unl Control valve to move from the Unl position to the Off position.

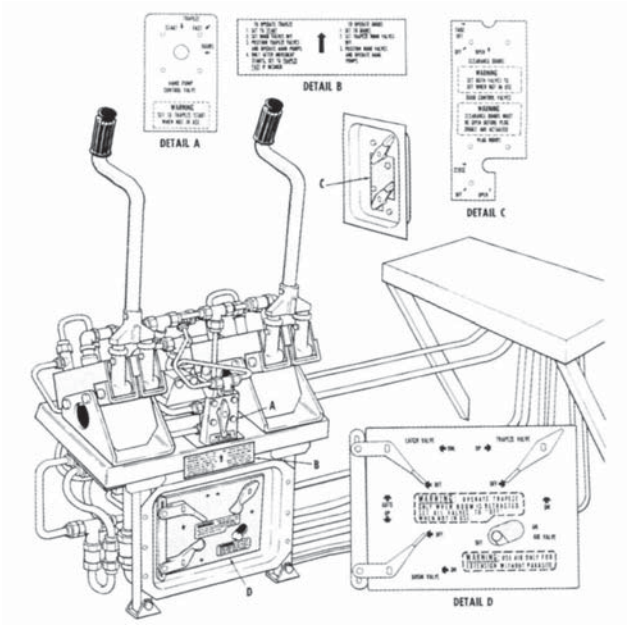
When the emergency hydraulic system was not in use, it was important to set the Latch Control valve to the Off position to bleed off hydraulic fluid as increasing temperature caused it to expand. Otherwise, the buildup of pressure in the emergency system could affect the operation of the primary hydraulic system.



Trapeze and Door Manual Selector Controls Diagram from the Utility Flight Handbook for the GRB-36DIII Featherweight Configuration III/RF-84F Composite Aircraft. (Roger Cripliver)

The three-position Trapeze Control valve was marked Up, Off, and Down. In the Up position, it directed hydraulic fluid to the lower end of the main jack to raise the trapeze. When the trapeze was retracted by the operation of the emergency hand pumps, the air in the upper end of the main jack was vented overboard.

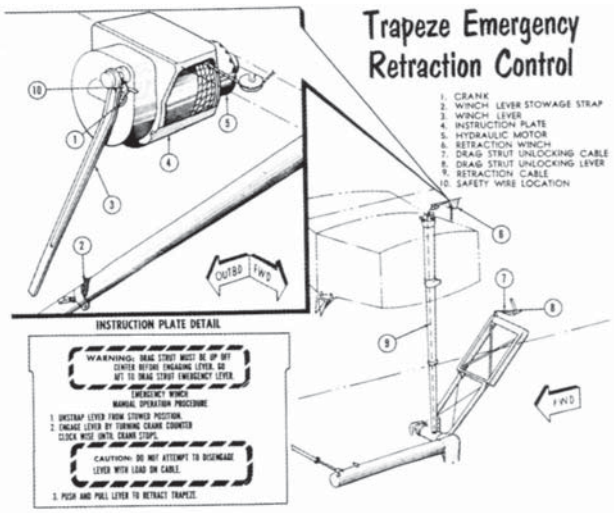
The trapeze could be extended with a parasite engaged by unlatching the boom and the main jack and setting the Trapeze



Trapeze and Door Emergency Hydraulic Controls Diagram from the Utility Flight Handbook for the GRB3613- III Featherweight Configuration III/RF-84F Composite Aircraft. (Roger Cripliver)

Control valve in the Down position. The weight of the parasite would then extend the trapeze. If no parasite was on the trapeze, pressure from the emergency down-pressure air cylinder could be released into the upper end of the main jack to assist in its extension. A lever to release the contents of the air bottle into the main jack was located on a panel below the emergency hand pumps. The bottle provided enough air to extend the main jack only once per flight.

If the trapeze could not be raised by either the primary or emergency hydraulic system, a manually operated winch could be used for emergency retraction. The winch was located at the top of the main jack, at the rear of the main spar in the bomb bay. The emergency winch pulled up a cable that extended to the bottom of the main jack. A hydraulic motor was attached to the winch to keep tension on the manual retraction cable when the trapeze was retracted by the normal operation of the main jack.



Trapeze Emergency Retraction Control Diagram from the Utility Flight Handbook for the GRB-3613-III Featherweight Configuration III/RF-84F Composite Aircraft. (Roger Cripliver)

The emergency winch was not capable of retracting the trapeze with a parasite engaged. An overload clutch would disengage the winch if the load on the trapeze exceeded the capacity of the winch. The maximum allowable airspeed for emergency manual retraction of the trapeze was 170 miles per hour.

Before the trapeze could be raised, it was necessary to unlock the drag strut. An unlocking lever was installed near the right upper end of the drag strut. The overload clutch would disengage the winch if an attempt were made to retract the trapeze without unlocking the drag strut.

To operate the manual retraction system, a crewmember had to enter the bomb bay and work his way to the rear of the catwalk. He would attach a cable from the unlocking lever to the drag strut and pull the lever until it seated in place. The cable held the drag strut in the unlocked position to allow the trapeze to be raised. The crewmember would climb to the to of the bomb bay and cut the safety wire that held the winch crank in place. Winding the crank counterclockwise to the stop engaged the cable drum's ratchet handle. Repeated pulling on the handle wound up the cable and retracted the main jack.

Electronics Intelligence equipment relocated

In the standard RB-36D configuration electronics intelligence equipment was housed in the rear bomb bay. The rear bomb bay doors were replaced by a sealed fairing. Three electronics intelligence antennae were housed in radomes mounted on the underside of the aft bomb bay.

To provide space for the parasite's tail and its auxiliary fuel tank, the electronics intelligence antennae were moved from the fourth bomb bay to a location under the aft fuselage. This modification corresponded to the changes directed by Technical Order 1B-36(R)-216. which was applied to the entire RB-36 fleet in 1954.

Parasite fuel tank in aft bomb bay

The parasite could be refueled while it was stowed in the bomb bay of the carrier. The J-35 jet engines of the GRB-36D were run on the same gasoline that was used for its reciprocating engines, so a 1,200-gallon tank for the JP-4 jet fuel used by the parasite was installed in the aft bomb bay of the carrier aircraft. The fuel tank was equipped with a booster pump to speed the gravity filling of the parasite's fuel tank. It incorporated a high fuel-level sensor and a low fuel-level sensor.

The fuel capacity of the FICON RF-84F with four external fuel tanks was 1,935 gallons. 575 gallons in its internal tanks and 1,360 gallons in the external tanks. It was not possible to completely fill its tanks from the fuel tank in the bomb bay.

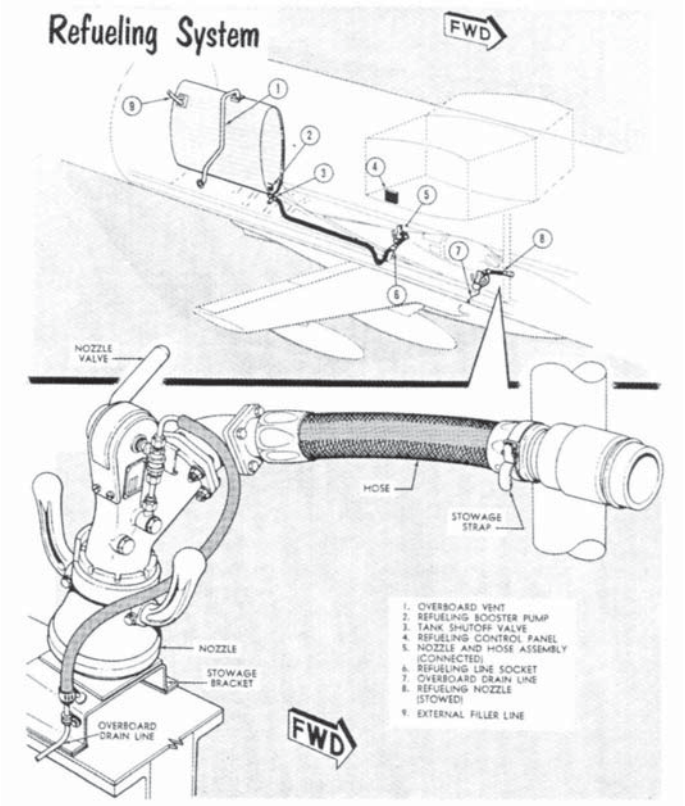
The fuel tank was offset to the right side of the bomb bay to provide clearance for the vertical stabilizer of the parasite. The fuel tank control panel was mounted in the bomb bay near the rear of the main spar.

The fuel fill pipe for the tank extended to a fueling port on the upper right side of the carrier fuselage aft of the wing. The vapor space at the top of the tank was vented through a pipe to a port on the right side of the fuselage.

The fuel shutoff valve was located at the bottom of the for-

ward end of the tank. The refueling hose ran from the fuel valve forward along the right side of the bay. It was equipped with a socket for the refueling nozzle.

The refueling nozzle was stowed at the front of the bay. To refuel the parasite, the nozzle was attached to the socket on the end of the hose. It was inserted in the refueling port on the top of the parasite's fuselage, just behind the cockpit canopy. The nozzle was returned to its stowage location after fueling the parasite. A flexible line was attached to the nozzle to drain any trapped fuel through a port in the right side of the carrier's fuselage.



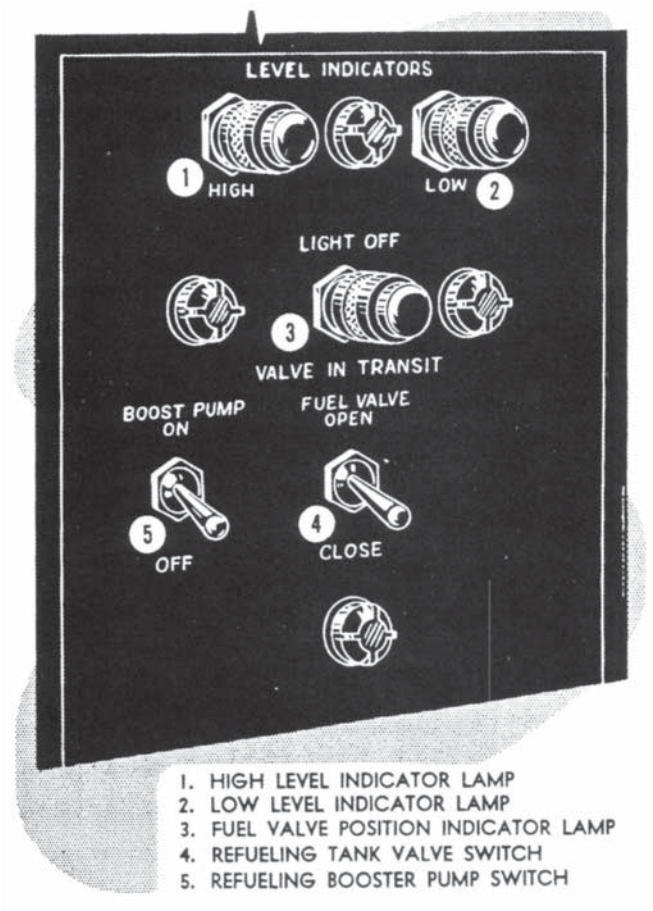
Refueling System Diagram from the Utility Flight Handbook for the GRB-3613-III Featherweight Configuration III/RF-84F Composite Aircraft. (Roger Cripliver)

The booster pump and the fuel tank shutoff valve were controlled by toggle switches on the fueling control panel. Three amber indicator lamps indicated the level of fuel in the tank and the status of the fuel shutoff valve. One lamp illuminated when the fuel in the tank was above the high fuel-level sensor. It extinguished as the fuel was transferred to the parasite. Another lamp illuminated when the fuel in the tank fell below the low fuel-level sensor. The third lamp was illuminated when the fuel shutoff valve was either fully open or fully closed. The fuel shutoff lamp was extinguished while the valve was operating.

Other modifications

The hydraulic system for the carrier's brakes, certain fuel system components, and the external electrical power receptacle were relocated to make room for the trapeze and its associated systems in the bomb bay.

A handrail was installed along the right side of the bomb bay, adjacent to the catwalk. Two straps were provided to which crewmembers operating in the bomb bay could clip their



Carrier Refueling Control Panel Diagram from the Utility Flight Handbook for the GRB-36D-III Featherweight Configuration IILIRF-84F Composite Aircraft. (Roger Cripliver)

parachute harnesses. The straps were equipped with rings that slid along the length of the handrail as the crewmembers moved along the catwalk. The loose ends of the straps were snapped into a ring located above the forward end of the handrail when they were not in use.

An additional safety strap was installed on the right side of bulkhead 7.2 for the use of a crewmember operating the trapeze and door manual hydraulic selector controls or the manual retraction winch, which were located behind the wing spar.

A handgrip was installed on the underside of the main wing spar for the parasite pilot to grab while getting in and out of his airplane.

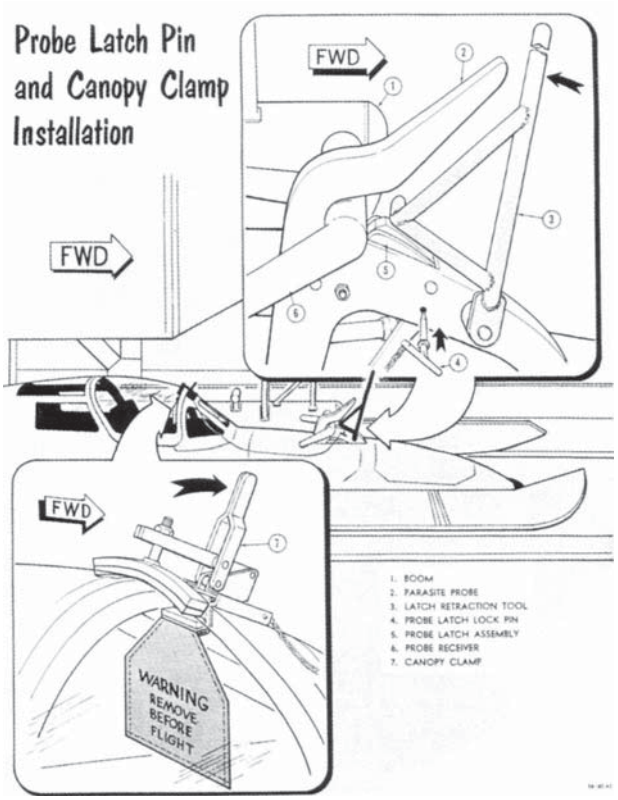
Three equipment panels were installed in the bomb bay for the use of the crewmembers servicing the parasite. Each panel contained an oxygen panel and an oxygen hose stowage container. Extra long oxygen hoses were provided to allow the crewmembers to move about the bomb bay.

Each equipment panel also provided a connection to the carrier interphone system and an electrical power supply for the crewmembers' heated flying suits.

Two extra portable oxygen bottles were carried in the camera compartment and four brackets for stowing additional oxygen bottles were provided in the bomb bay.

Three interphone panels were provided in the bomb bay for the crewmembers working around the parasite.

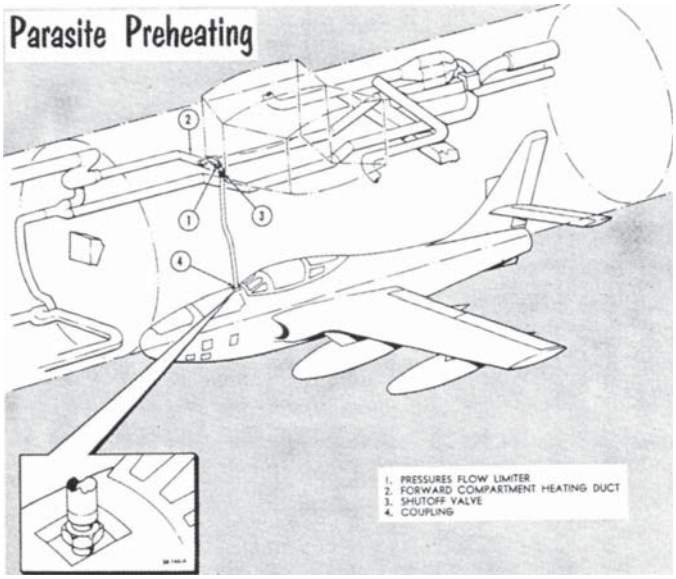
The external canopy lock on the FICON RF-84F parasite was located on the left side of the fuselage, where it was inaccessible while the parasite was stowed in the carrier. A removable clamp was provided to lock the canopy of the parasite in the closed position. After the parasite pilot had exited the cock-



Probe Latch Pin and Canopy Clamp Installation Diagram from the Utility Flight Handbook for the GRB36D-III Featherweight Configuration IIIW-84F Composite Aircraft. (Roger Cripliver)

pit of the parasite, his assistant would retrieve the clamp from its storage location at bulkhead 6.2 in the bomb bay. The clamp fit on the top rail of the windshield. The clamp sported a red "remove before flight" flag that hung down into the cockpit. Rotating a lever on the clamp pressed a pad down on the canopy's forward edge, locking it in the closed position.

The parasite was provided with electrical power from the carrier while it was stowed in the bomb bay. The power cable plugged into an external power receptacle located just forward of the parasite's cockpit canopy. The cable supplied DC power to the parasite's primary bus. This charged the parasite's battery when the battery switch in the parasite's cockpit was set to the On position. It also provided power for pre-flight checks of the parasite aircraft systems before its own engine was started.



Parasite Preheating Diagram from the Utility Flight Handbook for the GRB-36D-III Featherweight Configuration IILIRF-84F Composite Aircraft. (Roger Cripliver)

The electrical supply cable was only long enough to supply power to the parasite in the take-off and cruise positions. A crewmember had to remove the cable from the power receptacle on the parasite before the trapeze was extended to the launch position.

The Parasite Electrical Power switch was located on the trapeze operator's auxiliary control panel. The switch was to be turned on only when the power cable was attached to the parasite. It was to be turned off before the cable was disconnected from the parasite.

The electrical supply cable was to be removed only when the external power relay was de-energized. Occasionally the external power relay in the parasite remained energized after the trapeze operator switched off the Parasite Electrical Power switch, causing the parasite electrical power lamp on his auxiliary control panel to remain illuminated. Turning off the battery switch in the parasite's cockpit momentarily de-energized the external power relay and turned off the lamp. It safe to uncouple the external power cable only after the lamp was extinguished.

An insulated metal duct diverted hot air from the carrier's heating system to the parasite to heat its camera equipment and cockpit. The duct contained an electrically controlled shut-off valve. The valve control switch was located on the trapeze operator's auxiliary control panel. The duct was equipped with a flexible section that connected to a port located just forward of the parasite's cockpit canopy. When not in use. the connector was stowed in a bracket near the parasite.

The heating duct was manually removed from the parasite before the trapeze was extended. Heating air was diverted into the duct for a short while before the parasite was retrieved to heat the duct. The duct became more flexible when it was warm, which made it easier to connect it to the parasite.

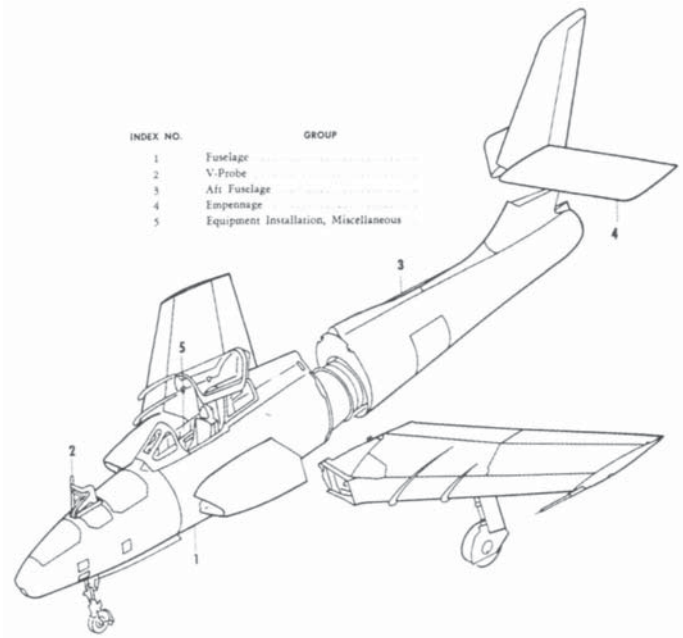
Modifications to FICON RF-84F

Each of the Republic RF-84F-17 *Thunderflashes* converted to the FICON parasite configuration was equipped with a fork-type nose probe and fuselage pins to secure it in the trapeze of the carrier. The horizontal stabilizers drooped downward to clear the sides of the aft bomb bay of the carrier. A homing radio receiver was installed to help the parasite pilot find the carrier at the end of his mission.

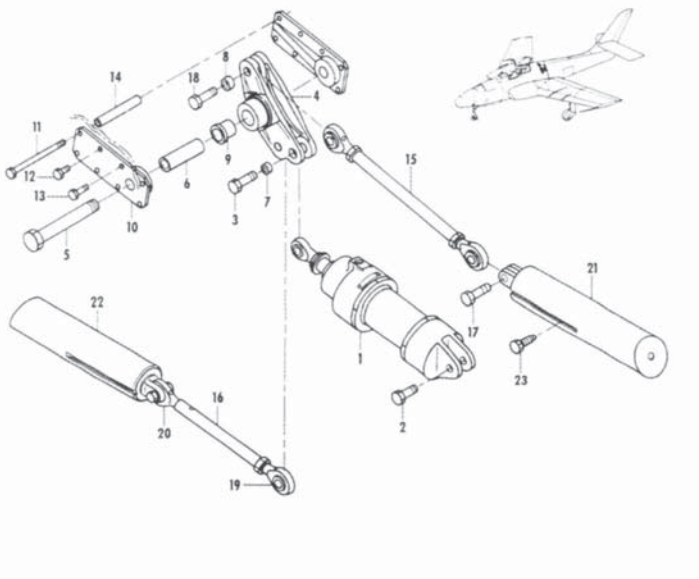
The fork-type nose probe was retractable. A pair of small doors covered the opening when the probe was retracted. As the probe extended, a limit switch disabled the guns of the parasite. This insured that the parasite's guns could not be accidentally fired while it was stowed in the bomb bay of the carrier.

The rear fuselage locking pins of the FICON RF-84F were retractable, reducing the drag of the parasite. The parasite prototype had been equipped with kickers that extended from the sides of its fuselage to trigger the release of the aft latches of the trapeze. The RF-84F pilot could release the *Thunderflash* from the aft latches by retracting the pins.

The push-button Air Refueling Disconnect mounted on the parasite pilot's throttle stick doubled as the nose probe release when the Refueling Receiver switch was in the closed position. Depressing the button triggered a solenoid valve that released hydraulic pressure into the probe latch release line. Setting the Refueling Receiver switch in the open position deactivated the probe latch release.



Exploded View of Complete RF-84F- 17RE Airplane from FICON RF-84K Group Assembly Parts List (United States Air Force Museum)



Rear Fuselage Pin Support Diagram from the FICON RF-84K Group Assembly Parts List (United States Air Force Museum)

The Probe and Pin Control lever was mounted at the left side of the parasite pilot's pedestal just below the instrument panel. The lever could be placed in five positions. From top to bottom, the five positions were labeled Emer Extend (Emergency Extend), Extend, Pin Retract, Latch Rel (Latch Release), and Retract. In the lower four positions, the lever moved a cable connected to the hydraulic selector valve that directed pressure from the parasite's utility system to the selected line.

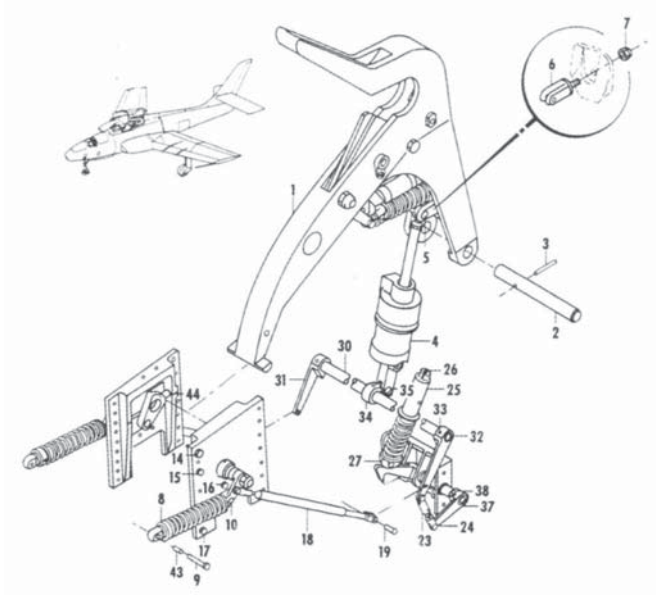
The Probe and Pin Control lever locked into position automatically when it was placed in the Extend position. The lock was released by a push-button mounted on the side of the release control.

If the aft latches of the trapeze fail to release, the Probe and Pin Control lever could be moved to the Pin Retract position to pull the fuselage pins out of the latches. If the Probe Release button on the throttle stick did not succeed in releasing the nose probe, the lever could be moved to the Latch Release position to open the nose probe latch.

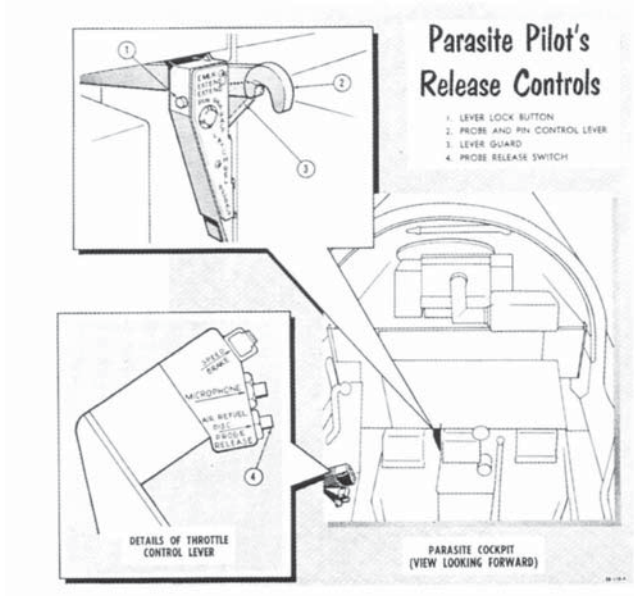
Placing the lever to the Retract position pulled in the fuselage pins and rotated the probe downward into the nose of the parasite.

If the normal hydraulic extension mechanism failed to extend the probe and pins, moving the lever to the Emergency Extend position pulled a separate cable that operated the back-up pneumatic extension system, extending the nose probe and fuselage pins and locking them in position. The pneumatic pressure to operate the probe and pins was obtained from the parasite's landing gear emergency air bottle. It was necessary to hold down a guard to move the lever into the Emergency Extend position. When the lever was moved to the Emergency Extend position, it locked into place for the rest of the flight. The pilot could not release the lock in flight.

As on the YRF-84F, the horizontal stabilizers of the RF-84F



V-Probe Installation Diagram from FICON RF-84K Group Assembly Parts List (United States Air Force Museum)



Parasite Pilot's Release Controls Diagram from the Utility Flight Handbook for the GRB-36D-IH Featherweight Configuration IIIW-84F Composite Aircraft. (Roger Cripliver)

Thunderflashes modified for the FICON project were angled downward by 23 degrees.

A Parasite Intercommunication Change-Over switch was installed to the left of the throttle control. It allowed the parasite pilot to select between the interphone and the command radio.

The AN/APX-29 receiver set was installed in the FICON RF-84F to allow its pilot to home in on the radio beacon on the carrier. Receiver antennae were installed on the top and bottom of the rear fuselage. The upper antenna was just in front of the vertical stabilizer, and the lower antenna was below the trailing edge of the wing. The placement of the antennae insured that the homing signal could be received whether the carrier was flying at a higher or lower altitude than the parasite.

An external heat duct receptacle was provided just forward of the parasite's cockpit canopy. Ductwork directed the hot air to the camera compartment and to the cockpit. A thermostatically controlled valve directed all of the heating air to the camera compartment until its temperature was above 60 degrees Fahrenheit. Heating air was directed to the cockpit only when the camera bay was warmer than that.

An External Heating switch was located on the right console of the parasite cockpit. It controlled a valve in the pre-heat inlet duct. When the switch was in the External Heat position, the valve opened to admit hot air from the external heat duct. While the parasite was receiving heating air from the carrier. the Camera Compartment Air Conditioning Shutoff switch was set to the Off position to prevent the admission of cold air from the parasite's inoperative engine.

The Cabin Temperature Control was located on the right console of the parasite's cockpit. In normal operation it was used to control the temperature of the cockpit. While the parasite was receiving heating air from the carrier, it was moved to the Ram Air position. It was necessary to rotate a stop lever out of the way to move the lever to the Ram Air position.

July 30,1954, FICON Flight Handbook

Wright Air Development Command approved the rough draft of the "Utility Flight Handbook for FICON" on June 7. 1954. The handbook defined the procedures to operate the composite aircraft system for the Air Force personnel who would be flying the airplanes. The final FICON flight handbook was issued on July 30, 1954.[iii]

Typical Mission

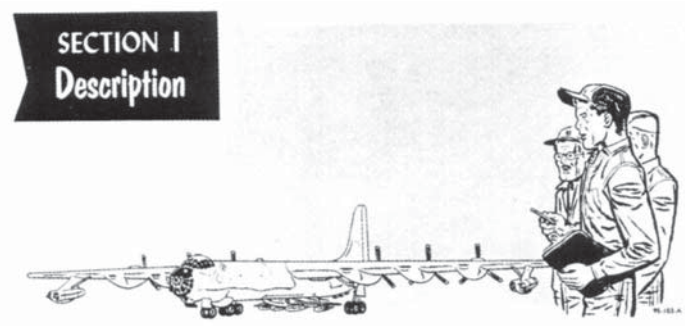
A typical FICON mission began with the ground loading of the parasite onto the trapeze of the earner. Alternatively, the parasite could take off separately and be retrieved by the carrier afterward. After the carrier was airborne, the trapeze was extended to allow the landing gear to be retracted or to retrieve the parasite. The trapeze was retracted and carrier was configured for the cruise portion of the flight.

As the carrier approached the launch position, the camera compartment was sealed off from the other pressurized compartments. It was depressurized to gain access to the parasite in the bomb bay. The parasite pilot entered the cockpit of the FICON RF-84F. The trapeze was extended again to launch the parasite. Then it was retracted and the carrier was configured for cruising flight without the parasite.

The carrier loitered in the vicinity of the rendezvous location while the parasite dashed into enemy territory and photographed its targets. Shortly before the scheduled rendezvous, the carrier's trapeze was extended to accept the parasite.

The parasite pilot engaged the trapeze, and the parasite was retracted into the bomb bay. The film was removed from its cameras and transferred to the camera compartment of the carrier. If another mission was to be flown, the parasite would be refueled from the tank in the aft bomb bay and fresh film would be loaded into its cameras. When the parasite's missions were concluded, the trapeze and bay doors were configured for the cruise back to base.

Before landing, the trapeze was extended to allow the carrier's landing gear to be lowered or to launch the parasite for a separate landing. Once the landing gear had been extended the trapeze was retracted and the bay doors were configured for landing.



Section I Description Diagram from the Utility Flight Handbook for the GRB-36D-III FICON Aircraft. (Roger Cripliver)

Ground Loading the Parasite

Prior to take-off with the parasite aboard the earner, the ground crew secured the parasite in the receiver and aft latches of the trapeze.

A custom dolly was built for the purpose of maneuvering the FICON RF-84F under the GRB-36D. It supported the parasite by the jacking pads under the wings and jack stand attachment points on either side of the forward fuselage. A pair of wheels was mounted at each corner of the dolly. Each pair of wheels was equipped with a swivel. The forward and rear attachments could be elevated independently to lift the *Thunderflash* into position under the bomb bay of the carrier.

The trapeze was lowered to the fully extended position. The boom was placed in the cruise position, and the plug and clearance doors were opened. When the doors and the trapeze were properly configured, the green lamps on the trapeze operator's main control panel that indicated that the trapeze was lowered and that the clearance doors, and plug doors were open would light up. The white lamp that indicated that the boom was in the cruise position would be illuminated.

The ground crew removed the pin that secured the main jack in the fully extended position.

The trapeze operator toggled on hydraulic pumps A and B. He made sure that the Trapeze Hold Down switch was set to the Off position to cut off the pressure that held the main boom in the fully extended position.

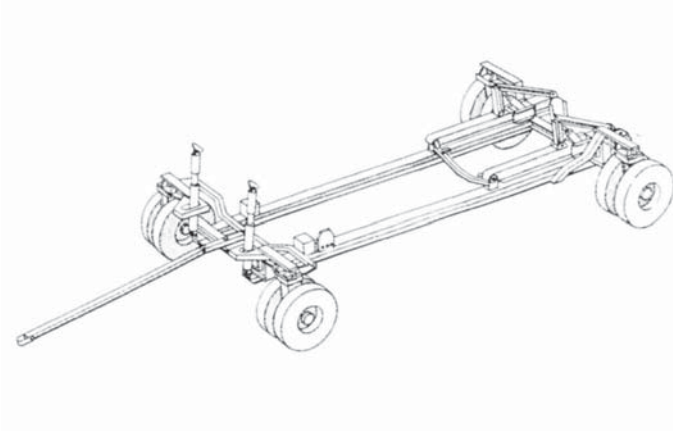
The trapeze operator then toggled the boom position switch to the Up position. The boom was raised to the full 6-degree nose up position, at which point the green lamp that indicated that the boom was in the take-off position lamp illuminated on the trapeze operator's main control panel.

The trapeze operator moved the Clearance Door Position switch to the take-off position until the amber take-off position lamp illuminated.

The trapeze operator moved the Trapeze Position switch to the upper Unlatch position to release the boom latch and the

main jack latches and to start the retraction of the trapeze. Once the main jack began to retract, the trapeze operator moved the Trapeze Position switch to the Up position until the main jack reached the take-off position. The amber lamps on the main control panel that indicated that the trapeze and boom were in the take-off position would light up. The amber trapeze take-off position lamp on the carrier pilot's instrument panel would also turn on. All four amber lamps and the green boom Up-6-degree lamp were illuminated when the parasite was properly configured for take-off.

The Boom Position Control switch was set to the Off position and hydraulic Pumps A and B were switched off.



Parasite loading dolly from the Maintenance Instructions Handbook for the GRB-36D III. (United States Air Force Museum)

Take-off

The minimum aircrew necessary for a composite aircraft flight included an aircraft commander, pilot, two engineers, two scanners, a parasite pilot, and a trapeze operator. In addition to these, a strategic reconnaissance mission might require a weather observer, photo-navigator, radar observer, primary navigator, copilot, two radio operators, as many as four ECM observers, a tail gunner, a photographer, and a helper for the parasite pilot.

Prior to take-off, the covers of the trapeze operator's instrument panels were closed and the entry-way hatch was sealed. The trapeze operator, parasite pilot, and his helper sat on the lower bunk against the rear wall of the camera compartment during take-off. The second radio operator came back from the nose compartment to ride out the take-off in the camera compartment.

After take-off, it was necessary to extend the parasite before the main landing gear of the carrier could be retracted. The carrier was limited to speeds below 188 miles per hour until the landing gear was retracted.

To gain access to the trapeze operator's control panels, it was necessary to remove the lower bunk, stow it on the wall above the trapeze operator's station and open the covers on the control panels.

The trapeze operator toggled the switches controlling pumps A and B to the On position. He held the Trapeze Position Control switch in the lower Unlatch position to unlatch the boom and main jack. Once the trapeze began to move downward, he moved the Trapeze Position Control switch to the Down position until the white, cruise position indicator lamp illuminated.

The trapeze operator made sure that the Boom Position Control switch was in the Up position. He toggled the Clearance Door Position Control switch to the Open position until the green, open position indicator lamp illuminated. As the clearance doors opened, the upper and lower rear turret doors opened automatically to ventilate the bomb bay.

The Trapeze Position Control switch was used to unlatch and move the trapeze down to the extended position. The green, trapeze fully extended indicator lamp illuminated as the drag strut locked over center. The trapeze operator held the switch in the down position until the main jack stopped moving a few moments later. Then he toggled the Trapeze Hold Down switch to the Hold Down position.

When the trapeze reached the fully extended position, the red lamp on the carrier pilot's pedestal that indicated that the landing gear was inoperative went out. The carrier pilot placed the landing gear control switch in the Retract position. Due to the operation of the trapeze hydraulic system pumps, only one pump was available to raise the landing gear. It required two minutes to retract the main landing gear, twice as long as it took in an unmodified RB-36D.

After the landing gear had been retracted, the trapeze operator set the Trapeze Hold Down switch in the Off position. He used the Trapeze Position Control switch to unlatch the main jack and raise it until the white, cruise position indicator lamp illuminated.

The trapeze operator held the Boom Position Control switch in the Down position until the boom latched in the cruise position and the white, cruise position indicator lamp illuminated. He then held the Clearance Door Position switch in the Take-off position until the white, closed position indicator lamp illuminated. As the clearance doors closed, the upper and lower rear turret doors also closed. The A and B hydraulic pumps were switched off for the cruise portion of the flight.

The parasite pilot and his assistant entered the bomb bay and attached the external power cable and the preheat duct to the parasite. The trapeze operator toggled the Parasite Heating and Parasite Electrical Power switches on his auxiliary control panel to the On position.

Refueling

If the *Thunderflash* took off separately from the GRB-36D, the fuel that it had used in the climb to rendezvous would be replaced from the jet fuel tank in the aft bomb bay of the carrier. The parasite pilot made sure that the Battery switch and the Three-Phase Inverter switch were both in the On position. He made set the Intercommunication Change-over switch in the Interphone position so that he could coordinate the refueling process with the refueling operator.

The refueling operator removed the cap from the outlet end of the refueling line and placed it in the holder provided under the socket. He undid the buckle on the belt that held the refueling nozzle in its stowage position and attached the nozzle to the socket on the refueling line.

The refueling operator opened the refueling adapter access door on the parasite and removed the filler cap. He connected the static ground wire in a jack mounted next to the refueling adapter. He inserted the nozzle into the adapter and locked it in position. Then he opened the nozzle valve.

In order to fill the external tanks of the parasite, the refueling operator set the External Tanks Refueling switch, located on the side wall of the parasite refueling receptacle, to the On position. This cut out the tank pressurization circuit and opened the valves that vented the external tanks.

If the External Tanks Refueling switch was not closed after the refueling operation, the tanks could not be pressurized, and the fuel that they contained would not be available. To prevent such an error, the refueling receptacle cover incorporated a bracket that pushed the switch to the closed position as the cover was closed.

Once the refueling operator had completed the preparations for refueling the parasite, he notified the parasite pilot and the aircraft commander that he was ready to start the process. The refueling operator toggled the Booster Pump switch to the On position. He toggled the Fuel Valve switch to the Open position. The amber valve-in-transit lamp extinguished as the fuel valve opened. The lamp illuminated again when the valve was fully open.

While fuel was flowing from the tank in the aft bomb bay to the parasite, the center of gravity of the carrier moved forward. The carrier pilot compensated for the shift by adjusting the elevator trim of the carrier during the refueling.

The parasite pilot monitored the fuel quantity indicator in the cockpit of the parasite and notified the refueling operator when to stop refueling. The refueling operator set the Fuel Valve switch in the closed position. The valve-in-transit lamp extinguished and re-illuminated as the valve closed. He then shut off the booster pump and notified the parasite pilot and aircraft commander that the refueling had been completed.

The refueling operator closed the refueling nozzle valve and disconnected the nozzle from the refueling adapter. He closed the receptacle door, which automatically set the External Tanks Refueling switch in the Off position.

The refueling operator disconnected the nozzle from the refueling line, buckled it into its stowage location, and connected the flexible drain hose to the overboard line. He replaced the socket cap on the end of the refueling line. He replaced the filler cap on the refueling adapter and closed the access door on the parasite.

Camera Compartment De-pressurization

To gain access to the bomb bay at high altitude, it was necessary to de-pressurize the camera compartment. The crewmembers in the camera compartment donned oxygen masks and hooked up to the carrier's oxygen system. The trapeze operator used the intercom to notify the flight crew in the cockpit of the carrier that he intended to de-pressurize the camera compartment. The aircraft commander reported the altitude indicated on his altimeter to the trapeze operator.

The communication tubes were depressurized along with the camera compartment. Crewmembers in the forward and aft compartments closed the doors to the communication tubes leading from those compartments to the camera compartment. The doors to the communication tubes in the camera compartment were opened.

The trapeze operator toggled the Pressure Control Transfer switch to the Local position. He held the Cabin Pressure switch in the Decrease position for about 15 seconds to close the cabin pressure shutoff valve. He loosened the locking nut on the camera compartment Cabin Dump Valve and rotated the valve clockwise, venting the pressure in the compartment.

The trapeze operator monitored the rate of decompression on the rate-of-climb indicator on his instrument panel. De-pressurization was complete when the altimeter in the camera compartment indicated the same altitude as aircraft commander's altimeter.

Preparations for Launch

To prepare for the operation of the plug and clearance doors, the carrier aircraft commander reduced the airspeed of the GRB-36D to below 240 knots. Normal airspeed for the launch of the parasite was between 215 and 230 miles per hour.

During night operations, the trapeze operator selected the red lights in the camera compartment and bomb bay to preserve the night vision of the crewmembers.

The parasite pilot and his assistant attached portable oxygen bottles to their oxygen masks. The assistant opened the bomb bay entrance door and stepped down onto the catwalk in the bay. Each crewmember unclipped a safety strap from the storage ring above the forward end of the handrail and hooked it onto his parachute harness.

The parasite pilot removed the portable canopy clamp and passed it to his assistant, who stowed it in its proper location. The parasite pilot grabbed the handhold mounted on the underside of the main spar and hoisted himself into the cockpit of the parasite. He unclipped his safety strap and handed the free end to his assistant. He connected his oxygen mask to the oxygen system of the *Thunderflash* and passed the portable oxygen bottle to his assistant. The parasite pilot closed and secured the cockpit canopy as soon as he was seated in the cockpit to reduce the wind, noise, and cold.

The parasite pilot's assistant worked his way to the rear end of the catwalk to check that the manual trapeze retraction cable was properly tensioned for the extension of the main jack.

The pilot performed the pre-launch cockpit check. He carried a flashlight to illuminate the switches and gauges in the bomb bay. He connected his microphone and headset and made sure that the intercommunication change-lover switch was set to the interphone position. Then he directed the trapeze operator to turn off the parasite cockpit preheat and the battery charging power with the switches on his auxiliary control panel. Occasionally, the parasite electrical power indicator lamp would not extinguish when the trapeze operator toggled the Parasite Electrical Power switch. In that case, the parasite pilot turned off the battery switch momentarily to de-energize the external power relay.

The assistant uncoupled the external power cable only after it was confirmed that the external power relay was de-energized. He also disconnected and stowed the pre-heat air duct. Then he undipped and stowed his safety strap and climbed back into the camera compartment.

The trapeze operator toggled hydraulic pumps A and B on. He held the Clearance Door Position switch in the Open position until the green, open position indicator lamp illuminated. Then he toggled the boom position control switch to the up position to raise the front end of the boom to the 6-degree nose-up position.

The Trapeze Position Control switch was used to unlatch and move the trapeze down to the extended position. The parasite pilot could feel the buffeting of his tail surfaces as the airplane moved down into the airflow under the carrier.

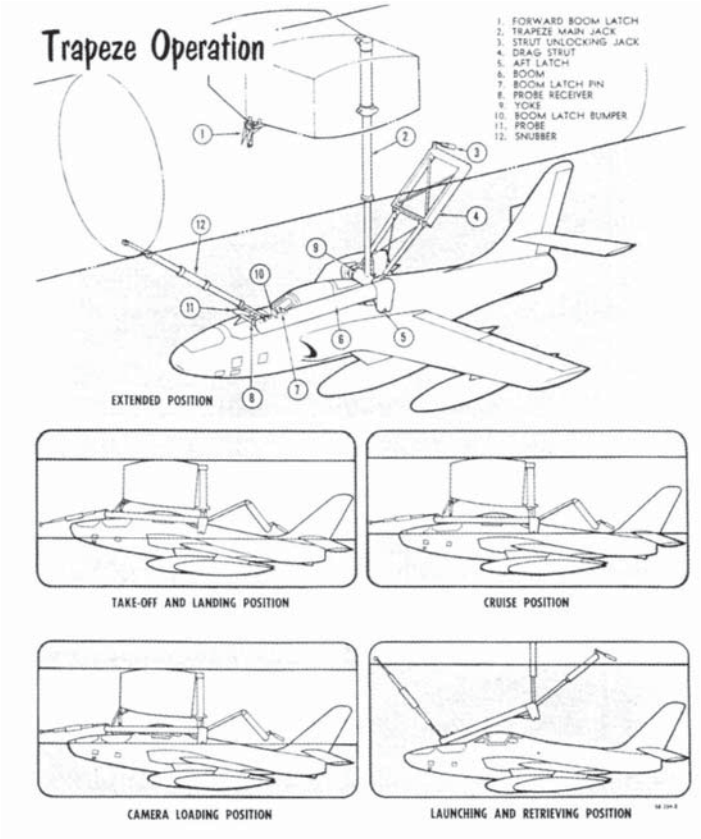
The trapeze operator held the Trapeze Position Control switch in the down position until the green, trapeze fully extended indicator lamp illuminated and the main jack stopped moving. Then he toggled the Trapeze Hold Down switch to the Hold Down position.

Once the main jack was fully extended, the parasite pilot removed the canopy jettison control safety pin. The safety pin was left in place until just before launch because it would be disastrous to eject from the parasite while it was still on the trapeze. If a fire started in the engine of the parasite during the

start sequence, the parasite pilot or the carrier aircraft commander would jettison the parasite. It would not be safe for the parasite pilot to eject from his airplane until the *Thunderflash* had fallen a suitable distance from the carrier.

The parasite pilot air started the J65 jet engine of the FICON RF-84F. 15,000 feet was the maximum altitude at which air starts could be performed reliably. The engine windmilled at 10% to 14% of maximum RPM while the *Thunderflash* was hanging under the GRB-36D.

To prepare to start the jet engine of the parasite, the pilot set his throttle in the closed position and screwed the friction lock down tight to prevent fuel from flowing into the combustion chambers before he started the igniters. He toggled the Emergency Hydraulic Pump to the Off position and the Battery switch to the On position. He set the fuel tank selector to the All Tanks position.



Trapeze Operation Diagram from the Utility Flight Handbook for the GRB-36D-III Featherweight Configuration IILRF-84F Composite Aircraft. (Roger Cripliver)

When the cockpit switches were properly positioned, the parasite pilot momentarily depressed the Air Start button and moved the throttle slightly above the Idle position. To avoid flooding the combustion chamber with fuel, the throttle was kept below the 1/3 open position. Igniters in the combustion chamber sparked for fifteen seconds to get the fire going in the engine. Normally the engine fired up within 3 to 8 seconds, and the turbines began to spin up to idle speed. The parasite pilot closely monitored the exhaust pipe temperature to insure that the fuel was burning properly in the combustion cans and not in the tailpipe.

If the pilot did not properly secure the friction lock on the throttle before ignition, fuel entered the combustion chamber and was blown out the exhaust pipe. Some of the unburned fuel was sucked into the space between the tailpipe and the fuselage skin. When the pilot triggered the engine igniters, this accumulated fuel caught fire. The heat from the fire made the engine overheat light illuminate for several seconds. Normally, the fuel was quickly consumed, and the fire went out before it caused any damage to the skin of the airplane. The pilot monitored the engine overheat light for a few seconds to see if it would go out. If it remained lit, he might have an engine fire that could force him to jettison the *Thunderflash* from the trapeze and eject.

As the engine revolutions stabilized, the parasite pilot observed his cockpit instruments to determine the operating status of the hydraulic system and engine. He made sure that the air start button had not jammed in the down position. If the systems of the parasite were functioning properly, he notified the trapeze operator that the mission would proceed as planned.

In the moments before launch, the parasite pilot set the Hydraulic Bypass switch in the Off position to route hydraulic pressure to the nose probe and pin hydraulic mechanisms. He turned the Power Auxiliary Electric switch and the Emergency Hydraulic Pump switch to the Normal position.

When operating near enemy airspace, it was preferable to maintain radio silence, but for other less hazardous operations, the command radio could be used for communication after launch of the parasite. In that case, the trapeze operator set his Interphone Selector switch to the Radio position and his Mixing Amplifier switch to the Mixed position. This allowed the trapeze operator to monitor the parasite pilot's transmissions on both the interphone and the command radio.

The parasite pilot advanced his throttle to the appropriate power setting. He lowered the flaps of the parasite to increase its lift and make the rear fuselage pins bear up against the aft latches. The amber arrows on the aft boom lock indicators illuminated when the *Thunderflash* was properly trimmed. It was normal for the lights to flicker as the turbulent air under the carrier buffeted the parasite.

When the parasite was properly configured for launch, the parasite pilot signaled the trapeze operator to lower the boom. The trapeze operator lifted the guard over the Aft Latch Release switch and triggered the switch as he pushed the Boom Position switch to the Down position. Pressurized air was released from the aft latch release bottle into the aft latch pneumatic actuators, releasing the fuselage pins of the parasite. The forward end of the boom began to move downward at the same time.

If the aft latches of the trapeze did not release the fuselage pins of the parasite, the parasite pilot would depress the lever lock button of the Probe and Pin Control lever and move the lever to the Pin Retract position. This pulled the fuselage pins out of the aft latches.

Once the parasite was free of the aft latches, it displayed a tendency to Dutch roll unless the parasite pilot applied corrective control inputs. As the main jack extended, the pilot raised the flaps of the RF-84F.

There was no indicator lamp for the boom nose down position used for launching and retrieving the parasite. All of the boom position indicator lamps were extinguished when the boom was lowered to this position.

The parasite pilot set the throttle of the jet engine to a setting appropriate to the airspeed of the carrier airplane. He depressed the Release switch on his throttle, sending hydraulic pressure to a solenoid that released the latch of the nose probe. Aerodynamic drag pulled the *Thunderflash* off the trapeze receiver, and it fell away from the carrier.

If depressing the Release switch on the throttle failed to release the nose probe latch, the pilot could move the Probe and Pin Control lever to the Latch Release position. This directed hydraulic pressure through an alternate valve to the

latch release. The manual cautioned the pilot to avoid moving the control lever past the Latch Release position to the Retract position until he had released the *Thunderflash* from the trapeze. Some parasite pilots inadvertently launched themselves while the trapeze was still in motion this way.

If the nose probe latch still failed to release, the FICON RF-84F pilot could trigger the jettison mechanism to detonate the explosive squib that separated the nose probe from the airplane. Alternatively, the trapeze operator could trigger the squib that separated the receiver from the trapeze mechanism. Either method rendered the *Thunderflash* incapable of hooking back on to the trapeze, so the method could only be used if the parasite did not need to return to the carrier.

After release from the trapeze, the parasite pilot moved the Probe and Pin Control lever to the Retract position. This sent hydraulic pressure to the retract end of the aft latch and probe actuating cylinders, pulling the pins into the sides of the fuselage, retracting the nose probe and closing its cover doors.

Flight without the Parasite

The trapeze and doors of the carrier were reconfigured during the time that the parasite was on its solo mission. The trapeze operator turned off the aft latch indicator lamps. He toggled the Boom Position Control switch to the Up position. When the green, 6-degree nose up position indicator lamp illuminated, he toggled the Trapeze Hold Down switch to the Off position. He used the Trapeze Position Control switch to unlatch the main boom and raise it until the white, cruise position indicator lamp illuminated. He cycled the Trapeze Position Control switch to unlatch the main boom from the cruise position and raise the trapeze until the amber lamps that indicated that the boom and trapeze were in the take-off position illuminated.

The trapeze operator closed the plug doors by holding the Plug Door Position Control switch in the Close position until the white door closed indicator lamp illuminated. Then he moved the switch to the Off position. He closed the clearance doors by holding the Clearance Door Position Control switch in the Closed position until the white door closed indicator lamp illuminated. Then he moved the switch to the Off position.

With the trapeze and bay doors properly configured for flight without the parasite, the trapeze operator set the Boom Position Control switch in the Off position and turned off hydraulic pumps A and B.

Camera Compartment Pressurization

When access to the bomb bay was no longer required, the camera compartment was re-pressurized. The trapeze operator rotated the Cabin Dump Valve counterclockwise until it seated in the closed position. He then tightened the lock nut to secure the valve. He held the Cabin Pressure switch in the Increase position momentarily to open the cabin pressure shutoff valve.

The trapeze operator monitored the rate-of-climb indicator during the pressurization. He adjusted the position of the cabin pressure shutoff valve with the Cabin Pressure switch. If the rate of climb indicator in the camera compartment showed a value more than 2,000 feet per minute, he would partially close the cabin pressure shut off valve to reduce the potential for discomfort or injury to the personnel in the compartment. The trapeze operator monitored the pressure altitude of the compartment on the altimeter on his instrument panel until it was the same as that in the other compartments of the carrier. He notified the aircraft commander that the camera compartment was fully pressurized. He then toggled the Pressure Control Transfer switch to the Flight Engineer position.

The doors to the communication tubes were closed. The doors were normally kept closed when the crew compartments were pressurized to confine any accidental loss of cabin pressurization to one compartment.

Preparations for Retrieval

Shortly before retrieving the parasite, the trapeze operator toggled the Probe Interphone switch to the On position. He set the Parasite Heating switch to the On position to pre-heat the connecting duct so that it would be more flexible when his assistant coupled it to the parasite.

The carrier navigator turned on the rendezvous equipment to assist the parasite pilot in locating the carrier at the end of his solo mission. The parasite pilot turned on his Identification: Friend or Foe (IFF) set to confirm his friendly identity to the crew of the carrier.

If it were not necessary to maintain radio silence, the trapeze operator would set his Interphone Selector switch to the Radio position and the Mixing Amplifier switch at the Mixed position. The parasite pilot would set his Intercommunication Change-over switch in the Radio position.

The trapeze operator depressurized the camera compartment. The aircraft commander toggled the approach lights on, illuminating a pair of yellow spotlights on the upper surface of the horizontal stabilizer.

The trapeze operator opened the clearance doors and then the plug doors. He unlatched the trapeze from the take-off position and moved the main jack down until it latched in the cruise position. He toggled the Boom Position Control switch to the Up position, unlatching the trapeze from the cruise position, and held the Trapeze Position Control switch in the Down position until the main jack was fully extended.

The trapeze operator held the Boom Position Control switch in the Down position until it was positioned to retrieve the parasite. He toggled the Trapeze Hold Down switch to the Hold Down position.

For night retrievals, the trapeze operator set the bomb bay clearance light switch to the red position and adjusted the rheostat to the desired level of brightness. He adjusted the rheostats that controlled the red dome lights in bays 2 and 3 to provide general illumination of the bays. He adjusted the brightness of the white nose receiver floodlight and aft latch floodlights. If the nose receiver floodlight burned out, the trapeze operator could toggle the Nose Receiver Floodlight Selector switch from the Normal position to the Alternate position to illuminate the backup lamp.

As the parasite approached the rendezvous, the carrier pilot concentrated on flying straight and level at a speed between 215 and 230 miles per hour and an altitude of 25,000 feet.

The carrier navigator guided the parasite to the carrier by providing range and bearing information from the AN/APX-29 homing beacon. The parasite approached the rendezvous at a higher altitude than the carrier. The parasite pilot sighted the yellow approach lights shining upward from the carrier's tail and descended toward it.

Retrieval

After his airspeed had dropped below 260 knots indicated airspeed the *Thunderflash* pilot moved the Probe and Pin Control lever to the Extend position. This directed hydraulic

pressure to the extend end of the aft latch and probe actuating cylinders. The fuselage pins extended from the sides of the fuselage. The nose probe doors popped open, and the nose probe rotated forward into position.

If the normal hydraulic mechanism failed to extend the probe and pins, the parasite pilot would raise the lever guard and move the lever to the Emergency Extend position. This released pneumatic pressure from the parasite's emergency landing gear extension bottle into the probe and pin actuators. Because there was only enough gas to extend the probe and pins once, the lever locked into place. It could not be moved out of the Emergency Extend position in flight.

The *Thunderflash* pilot lowered his seat to the lowest position as he approached the carrier. He flew his airplane to a position off the wing of the carrier. While flying in formation with the GRB-36D he noted his indicated airspeed to establish the proper speed for approaching the receiver.

After checking his airspeed, the FICON RF-84F pilot maneuvered the parasite to a position approximately 200 feet behind and below the carrier. He constantly monitored the separation between his airplane and the trapeze through the upper part of the windscreen.

Using the clearance lights in the bomb bay and the floodlights on the trapeze for guidance, the *Thunderflash* pilot approached the trapeze at a closing speed of about one-foot per second until his probe engaged the receiver of the trapeze. According to the flight handbook, the closing speed was not to exceed 3 feet per second. At this point, the advice in the Pilot Procedures document takes on a very Zen quality, "proceed as smoothly as possible making small and smooth control corrections continually, never allowing the fighter to wander from the desired path."

The parasite pilot was subjected to considerable vibration and noise as the cockpit of the *Thunderflash* drew even with the propellers of the carrier. The noise abated somewhat as the parasite passed the line of propellers and approached the receiver. The FICON RF-84F displayed a tendency to float upward at that point of the approach. The changing conditions required the pilot to adjust the stabilator trim nearly constantly.

Overuse of the controls could cause the *Thunderflash* to enter a pilot induced oscillation. The oscillation would increase in magnitude until the pilot abandoned the approach, released the back-pressure on the stick, and dropped away from the carrier to try again.

As the pilot edged his *Thunderflash* forward under the bomb bay, the "up-floating" increased still further. He adjusted the stabilator trim to reduce the stick forces again when he was four to six feet from the v-receptacle.

In the last few feet of the approach to the trapeze, the *Thunderflash* encountered a zone of downwash that forced it away from the receiver. This forced the pilot to make large and rapid movements of the control stick to keep from undershooting the trapeze.

The *Thunderflash* pilot aimed to make contact as close to the center of the receiver as possible. Striking the receiver off-center tended to push the boom to one side. The boom would then spring back, bouncing the probe out of the receiver.

The trapeze mechanism on the carrier was not perfectly rigid. The front end of the boom that carried the probe receiver constantly wobbled two to three inches from side-to-side, adding to the difficulty of hitting the receiver dead center.

If the probe on the nose of the FICON RF-84F did not make contact with the v-receptacle on the initial attempt, it was inadvisable to try to bring the nose back up to the trapeze. There was a strong possibility that the wings and fuselage of the *Thunderflash* might strike the other parts of the trapeze boom during the maneuvering.

When the probe was latched to the receiver, the parasite pilot moved the throttle to the idle position. He set the Intercommunication Change-over switch to the Interphone position. He had to actively control the tendency of the parasite to Dutch roll as long as his airplane was engaged in the one-point position. He adjusted the trim of the stabilators so that the parasite stayed level with the receiver on the trapeze. He then called, "boom up" over the interphone to the trapeze operator.

The trapeze operator held the Boom Position Control switch in the Up position to raise the front end of the boom. He used verbal commands or hand-signals to direct the parasite pilot which way to apply rudder to center the parasite between the aft latches. The *Thunderflash* pilot placed his left hand on the flap handle as he steadied the wings with his right hand on the stick and adjusted the position of the aft fuselage with his feet on the rudder pedals.

When the boom had nearly reached the horizontal position, the trapeze operator signaled the parasite pilot to lower the flaps of the FICON RF-84F. The extra lift of the flaps served to raise the fuselage pins into the aft latches. The trapeze operator monitored the yellow latch indicator flags. The flags extended from the aft latch housings as the pins entered the latches. The flags retracted into the housings again as the latches closed on the pins. If one latch failed to lock, the *Thunderflash* pilot would use the ailerons to lift that side of the airplane and seat the pin in its latch.

The trapeze operator and the parasite pilot checked to see that the green, aft latch indicator lamps were illuminated. Once they had established that the *Thunderflash* was secured in the three-point position, the parasite pilot raised the flaps and trimmed the stabilator to the neutral position.

The parasite pilot shut down the jet engine. He set the Emergency Hydraulic Pump switch to the Off position and the Hydraulic Bypass switch to the Bypass position. He set the throttle in the Idle Stop position for one minute to allow the engine temperature to stabilize before moving it to the Cut-off position. He screwed the friction lock on the throttle down tight. He set the Tank Selector switch and all other switches in the cockpit except the Battery switch to the Off position. As the J65 jet engine spooled down, the *Thunderflash* pilot monitored the engine rotation until it was windmilling between 8% and 147c.

After shutting down the engine of the FICON RF-84F, the parasite pilot instructed the trapeze operator to retract the trapeze. The trapeze operator toggled the Trapeze Hold Down switch to the Off position. He used the Trapeze Position Control switch to unlatch the main jack and raise the trapeze. The operation of the jack was normally somewhat jerky. jostling the pilot in the cockpit of the FICON RF-84F. The trapeze operator held the Trapeze Position Control switch in the Up position until the white, trapeze cruise position indicator lamp illuminated.

He held the Boom Position Control switch in the Down position to lower the boom to the cruise position until the white, boom cruise position indicator lamp illuminated. He used the Clearance Door Position Control switch to close the clearance doors snugly around the parasite, illuminating the white clearance door closed position indicator lamp.

The trapeze operator turned off hydraulic pumps A and B, the boom floodlights, and the bomb bay clearance lights.

The parasite pilot's assistant climbed down into the bomb bay with an extra oxygen bottle and a flashlight. He clipped his safety harness line to the safety rail that ran the length of the right side of the bomb bay. He pulled another safety harness line off its stowage location on the wall and clipped one end to the safety rail.

The *Thunderflash* pilot installed the Canopy Jettison Control Safety Pin to insure that his ejection seat would not fire while the parasite was secured in the bomb bay. He unlocked and stowed his safety belt and shoulder harness. The pilot opened the cockpit canopy. He notified the trapeze operator that he was not going to make further transmissions over the interphone and then disconnected and stowed the microphone and headset cord. His assistant handed him a portable oxygen bottle to connect to his oxygen mask. The pilot disconnected from the parasite oxygen and stowed the connector. He accepted the free end of the extra safety harness line and attached it to his parachute harness.

The parasite pilot reached over his head to grasp the handhold on the underside of the main spar and pulled himself out of the cockpit. Even with the clearance doors closed, the wind blasted through the bomb bay over the cockpit of the FICON RF-84F. The wind was less objectionable down by the side of the *Thunderflash.*

The pilot and his assistant worked to secure the parasite. hunched over in the limited space under the wing main spar. They installed the canopy clamp on the windscreen arch. closed the cockpit canopy, and secured it with the clamp. They opened the access panels over the external power and heating duct connectors and attached the power cable and heating duct. Then the trapeze operator toggled the Parasite Heating and Parasite Electrical Power switches to the On position.

Camera magazine transfer

The film in the parasite's cameras was retrieved immediately after the *Thunderflash* returned to the carrier. The cameras could also be reloaded for a second mission while the parasite was stowed in the bomb bay of the carrier. To retrieve the film the main jack of the trapeze was placed in the cruise position and the boom was latched in the camera loading position. The camera loading position was between the cruise position and the 6-degree nose up position.

A mechanical latch secured the boom in the camera loading position. It was necessary for a crewmember in the bomb bay to operate this latch manually while the trapeze operator manipulated the boom controls. To prepare to move the boom to the camera loading position, the crewmember operating the latch moved the latch lever down to actuate the locking mechanism.

The trapeze operator raised the boom to the 6-degree nose up position first. He then moved the Boom Position Control switch to the down position until the camera loading position latch locked.

The parasite had two access panels into its camera compartment. Each was equipped with a single fastener on the right aft side of the panel. Unlocking the fastener revealed a handhold that was used to pull open the panel. The forward panel was hinged at its forward end and opened to a vertical position. It was secured in the open position by pushing down a lock lever on the hinge. The rear panel was removed by pulling its rear end out and sliding the panel aft. It was secured to the catwalk with a strap.

Once the access panels were secured, the crewmembers removed the exposed film from the cameras. A fresh supply of film could be loaded at the same time. Auxiliary lights were provided to illuminate the parasite's camera compartments. After transferring the film canisters, the crewmembers closed and secured the access panels.

A crewmember in the bomb bay raised the camera loading position latch lever to retract the latch. The trapeze operator held the Boom Position Control switch in the Up position until the green 6-degree nose up indicator lamp illuminated. Then he held the switch in the Down position to lower the boom to the cruise position.

With the parasite secured for cruise in the bomb bay, the parasite pilot and his assistant entered the camera compartment for the long ride home.

Landing Gear Extension

It was necessary to extend the trapeze to lower the main landing gear of the carrier. The process was similar to that used for the retraction of the gear at the beginning of the flight. First, the trapeze operator toggled the Parasite Heating and Parasite Electrical Power switches to the Off position. A crewmember entered the bomb bay and uncoupled the power cable and heating duct from the parasite. The crewmember then climbed back into the camera compartment.

The trapeze operator opened the clearance doors. He extended the trapeze to inactivate the landing gear interlock and extinguish the red landing gear interlock indicator light on the aircraft commander's console. The aircraft commander toggled the Landing Gear Position Control switches to the Extend position.

After the aircraft commander extended the landing gear, the trapeze operator retracted the parasite to the cruise position. He moved the Trapeze Position Control switch to the unlatch position to unlock the main jack from the cruise position. As the main jack was unlatched, the trapeze would drop slightly, causing a jolt that could be felt throughout the carrier. The main jack was retracted to the take-off position, and the trapeze operator closed the clearance doors. If the clearance doors were equipped with rubber seals, they were retracted to the take-off position.

Alternatively, it was possible to launch the parasite for a separate landing rather than landing the carrier with the parasite on board. The manual advised the parasite pilot to check the proper function of his airplane's landing gear prior to launch while the trapeze was fully extended.

After launching the parasite, the main jack was retracted to the take-off position, illuminating the amber trapeze take-off position lamp. The boom was locked in the 6-degree nose up position, illuminating both the amber take-off position indicator lamp and the green 6-degree nose up lamp.

The clearance doors were closed. Then the plug doors were closed to seal the opening of the bomb bay. The two white door closed position indicator lamps illuminated when the doors were properly configured.

Hydraulic pumps A and B were shut off to allow the operation of the brake hydraulic system pump during landing.

Post-landing

After landing and parking the carrier, the ground safety lock pin was installed in the main jack. The clearance and plug doors were opened. Prior to opening the clearance doors, a crewmember turned off the circuit breaker to the turret door interlock so that the turret doors would remain closed when the clearance doors were opened.

Reference:

[1] APG/SAS/97-A Operational Suitability Test of the RB-36/F-84 Parasite Aircraft System (Phase I); Air Proving Ground Command; Page 6; 29 April 1953

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