Supersonic Firebee II

TELEDYNE
RYAN AERONAUTICAL



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Introduction

Teledyne Ryan Aeronautical develops and produces the widely renowned family of Firebee aerial jet target systems, offering experience in design, fabrication, test and operation of high performance Firebees which spans 21 years.

Teledyne Ryan continues to supply the United States Air Force, Army and Navy with increasing numbers of these versatile, threat targets.

Today, the military services are operating versions of the adaptable and dependable BQM-34A and MQM-34D Firebee targets and will soon be using supersonic Navy and Air Force versions of the Firebee II. They provide a realistic re-creation of hostile environments encountered by our combat forces, both in air-to-air and surface-to-air offensive and defensive situations.

Firebees serve as prime elements in the evaluation of manned and unmanned weapons systems. Firebees also perform the vital personnel training function for these weapons systems with a high degree of cost effectiveness.

By integrating proven subsystems, the air, ground or shipboard launched Firebee offers a series of formidable, yet economical weapons systems delivering up to 1,000-pound payloads.

Teledyne Ryan has developed, during its 21 years of uninterrupted target-drone experience, the largest pool of management, technical, manufacturing and service talent available in the field today.

The Firebee management organization incorporates the necessary technical disciplines and other specialized personnel resources to meet with outstanding success, the aerial target-drone requirements for any air defense system. This includes systems management, design, development, flight testing, tool manufacturing and flight services.

Firebee production aerial target systems are products of a planned program which evolves from a basic philosophy. This contends that the original concept and subsequent development of Firebee systems and equipment must contain growth potential as well as fulfill the initial requirement. The development of today's weapons inventory has been paralelled by the evolution of the Firebee

target system. Management has carefully anticipated the requirements of increasingly more sophisticated and complex weapons systems.

Teledyne Ryan has transitioned from the subsonic to the supersonic flight regime with the design and manufacture of the Supersonic Firebee II (military designation—BQM-34E [Navy] and BQM-34F [Air Force]). This new product of Teledyne Ryan's design and technical excellence provides the first realistic answer to the requirement for a supersonic, remote controlled, jet-powered, recoverable, aerial target.

Teledyne Ryan is currently under contract to deliver initial production quantities of the BQM-34E to the Navy and BQM-34F to the Air Force. Fourteen prototypes have already been delivered to the Navy. Although the airframe and propulsion system for the Navy and Air Force are the same, there are differences in the scoring and telemetry systems which satisfy the peculiar requirements of each service.



Supersonic Firebee II is slightly longer, slimmer and shorter-winged than subsonic Firebee I.

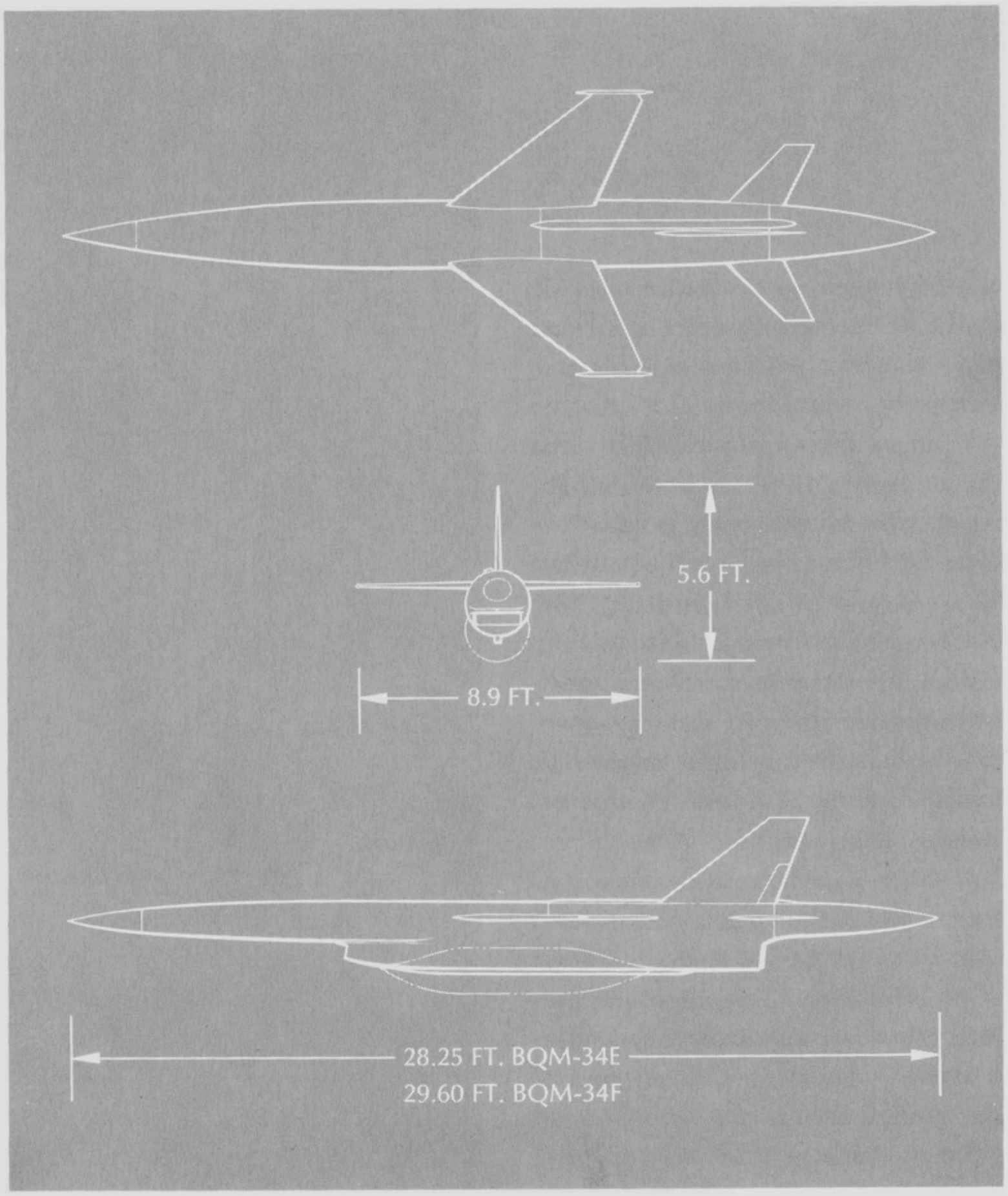
General Description

The BQM-34E (Navy) and BQM-34F (Air Force) are turbo-jet propelled, recoverable supersonic aerial targets. They can be either air or ground launched and are designed to operate at a speed of Mach 1.5 at 60,000 feet.

The target is powered by a Continental jet engine of advanced design, which operates on JP-5 fuel. It carries approximately 663 pounds of fuel in a main tank and in a jettisonable external tank.

Flight control is accomplished by a remote command guidance system which relays signals to the automatic control and stabilization system and throttle actuator.

The primary mission of the BQM-34E/F is to provide a highly realistic aerial target capable of simulating the performance of enemy aircraft, to aid in research, development, test and evaluation of weapons systems employing surface-to-air and air-to-air missiles, and to provide training for operational units. Ground support equipment and special support equipment are modifications of existing BQM-34A designs.



The target is capable of being air launched from aircraft currently being used to launch the BQM-34A Firebee. Ground launching utilizes a zero-length launcher augmented by jet-assisted, take-off (JATO) boosters. The Firebee II can be equipped with active and passive radar augmenters, electronic and photographic scoring systems, electronic countermeasures, low altitude radar sensing systems and infrared flares.

For recovery, Firebee II employs a system of sequential drag and main parachutes which disconnect on surface impact.

Design & Configuration

The supersonic Firebee is a highly streamlined, swept-wing aircraft. It is 28¼ feet in length, with a wing span of 8.9 feet. The fuselage is of conventional aluminum construction, with the main panels of the wings and empennage of honeycomb fabrication.

The nose radome and fin cap, which are used as antenna housings, are constructed of fiberglass. All external attachments and antennas are flush with the skin surface to preserve aerodynamic smoothness. A nose radome, similar to the subsonic Firebee, contains the scoring system antenna and passive augmentation. Directly behind this is the equipment compartment which contains the electrical, electronic and scoring systems.

The central fuselage contains the fuel tank and structure for supporting the wing. The inlet and oil tank assembly is slung under the equipment compartment. The inlet duct passes from the inlet opening through the fuel tank to the engine, which is installed in a fuselage half-shell integral with the central fuselage structure.

The entire aft portion of the fuselage is a removable subassembly which forms the upper shell covering the engine.

The tail section consists of two all-movable horizontal tail surfaces used for both roll and pitch control and a vertical stabilizer with an active rudder. These are driven by a self-contained electro-hydraulic actuator unit. A tail cone houses the parachute recovery system, which is similar to that used in the subsonic version.



Completed BQM-34E airframe awaits delivery to paint shop.

A modified Continental J69-T-29 engine designated the YJ69-T-406 is used. This engine features a rearrangement of accessories to reduce frontal area, a modified compressor design to uprate thrust and material changes in the radial compressor to permit supersonic operations at sea level.

Among the unusual design characteristics of the supersonic Firebee are its "clean" wings. No ailerons are used, since roll control is achieved by differential deflections of the all-movable horizontal tail surfaces. The horizontal and vertical tail are swept as are the wings. 263 pounds of fuel are carried within the fuselage of the BQM-34E. The BQM-34F carries an additional 80 pounds of fuel in an auxiliary fuel cell in the forward fuselage. An external jettisonable fuel tank, slung beneath the fuselage, carries an additional 400 pounds of fuel. In this configuration, the target performs subsonic flight missions with capability, endurance and range similar to the subsonic BQM-34A.

For supersonic flight, the external tank is jettisoned, and utilizing internal fuel, the Firebee II will fly target missions at Mach 1.5 at 60,000 feet, or Mach 1.1 at sea level.

Structure

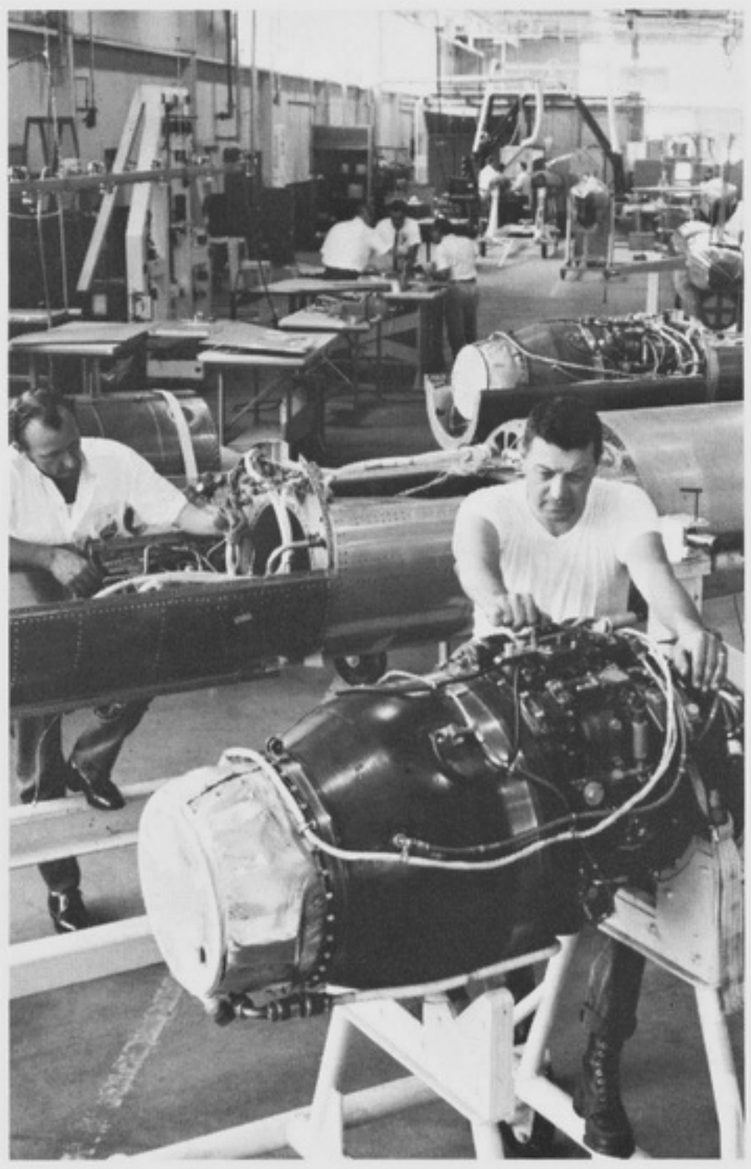
The BQM-34E/F uses a semi-monocoque fuselage structure. It is designed so that shear and torsional forces are carried in the skin.

Structural strength is also enhanced by having longitudinal members such as side longerons, keel, riser, trough and skins carry the fuselage bending loads. Bulkheads, frames and formers act to shape and hold the skin to its prescribed contour.


RYAN FIREBEE II

Engine

The Continental YJ69-T-406 turbo-jet engine, rated at 1920 pounds static sea level thrust, provides the power for the Firebee II. This engine is an uprated and redesigned version of the J69-T-29 engine used in the subsonic BQM-34A Firebee. It has a dry weight of 360 pounds, a maximum diameter of 23.64 inches, and is 47.03 inches long. It employs two stages of compression, one axial, the other radial, an annular combustion chamber, and a single-stage axial turbine. The engine burns standard JP-5 fuel and uses MIL-C-7808 specification oil in the lubrication system. The fuel system, including tank, booster pump and solenoid shutoff valve, are part of the basic fuselage tank assembly.



Continental jet engine is readied for positioning in Supersonic Firebee II airframe.



Teledyne Ryan remote control technicians guide Firebee on target mission.

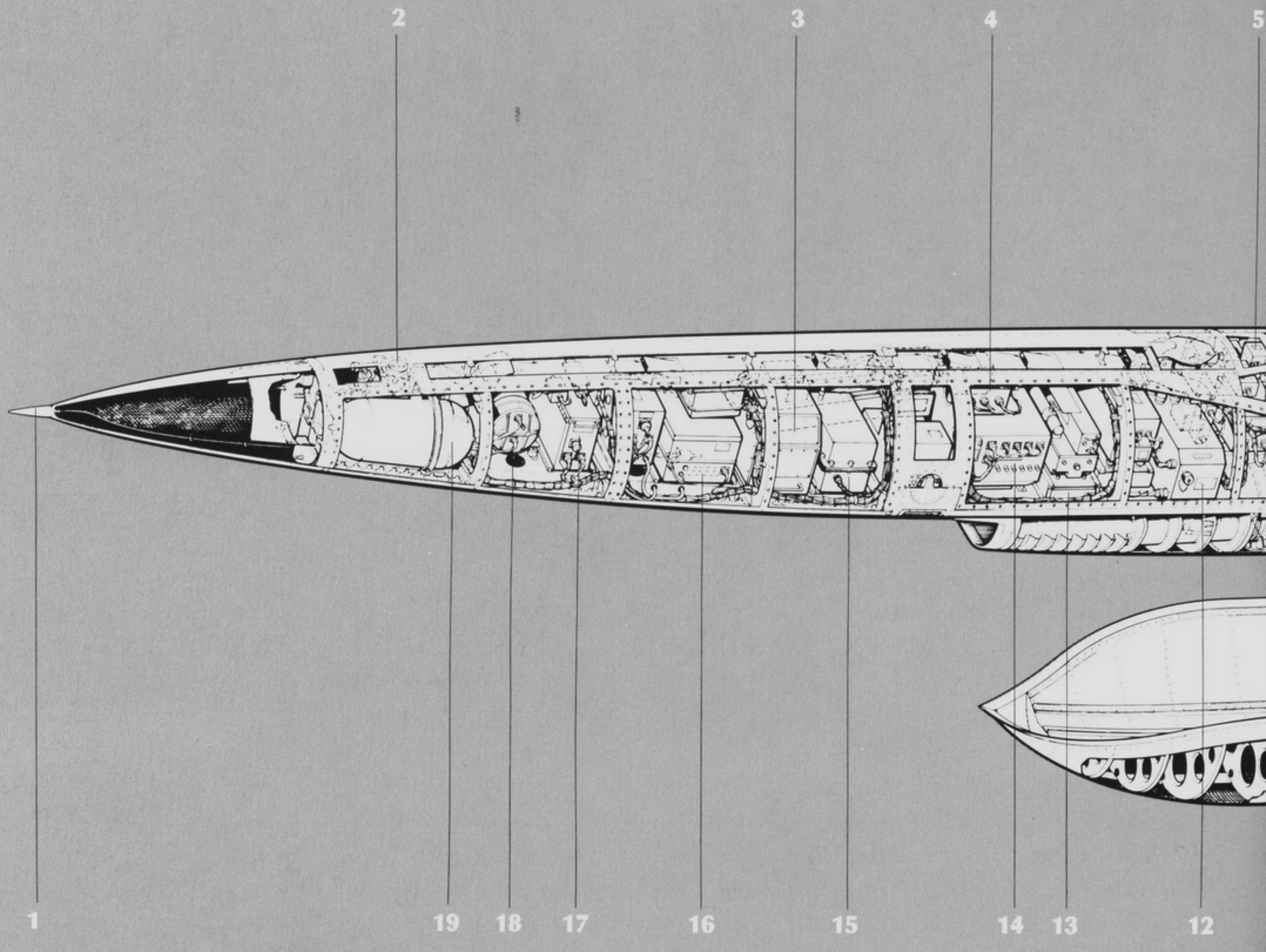
Control Systems

The guidance system for the BQM-34E/F supersonic aerial target differs from that of a manned aircraft. Because the system uses a remote control operator on the ground, in-flight information is transmitted from the drone via a telemetry system and, using a radar plot for positioning data, the operator commands the target via a coded radio transmitter. The automatic flight control system of the target responds to these remote commands to perform the required flight maneuvers. The Automatic Flight Control System (AFCS) for the Firebee II target provides stability and control about three axes. The system provides a sensing computation and actuation functions and consists of six black boxes: rate gyro—three axis, vertical gyro, air data computer, flight control box, low altitude control box and a three-axis electrohydraulic actuator assembly.

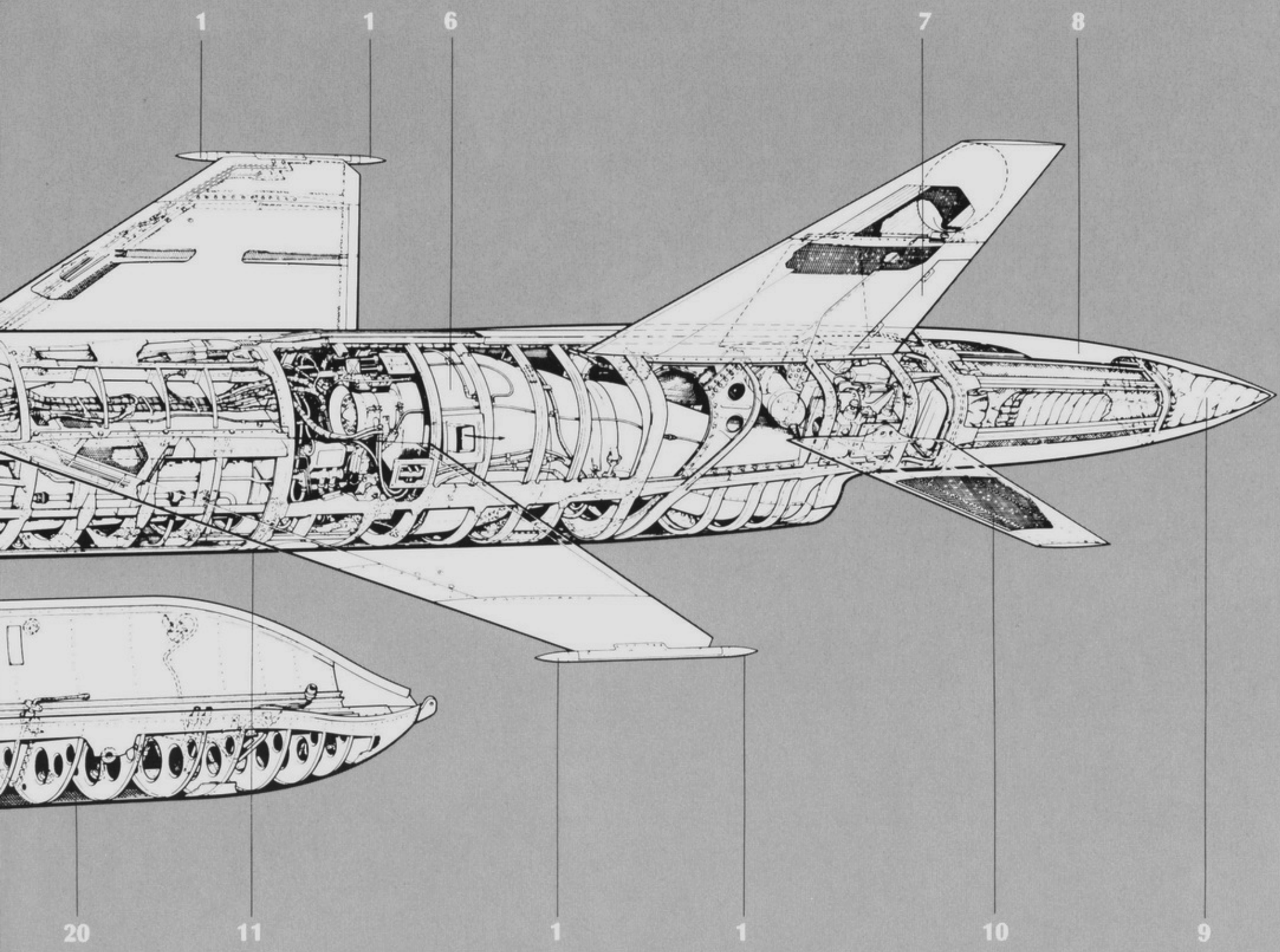
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Antenna radiation pattern measurements are performed on a full scale Firebee II model.

Design & Configuration

1. C- or X/C-Band Augmentation System Antenna
2. X- or C-Band Antenna
3. Flight Control Box
4. AN/DLQ-2 Control Programmer
5. Directional Gyro



6. Engine Continental YJ69-T-406
7. Rudder
8. Main Parachute Container
9. Drag Parachute Container
10. All-Movable Horizontal Stabilizer
11. Main Fuel Tank
12. Electrical Power and Distribution Box
13. AN/DLQ-2 Telemetry Modulator
14. AN/DLQ-2 Oscillator Radar Frequency
15. Battery Box
16. TM-4-31A Telemetry Set
17. AN/APX-71 L-Band Beacon
18. AN/USQ-11A Scoring System Transponder
19. Anhydrous Ammonia Tank
20. External Fuel Tank



Operations

The Firebee II, like the subsonic Firebee, is designed to be launched either from a ground launcher or from the wing pylons of an aircraft. For air launches, specially equipped DC-130 Hercules and DP2E Neptune aircraft are currently used. Minor modification adapts them for launching of the supersonic Firebee II.

Ground launching of the BQM-34E/F is accomplished using existing zero-length rails with little modification required. The new target uses the same solid propellant booster used on the BQM-34A Firebee.

Ground launch, from the short-rail launcher, is performed with the launcher inclined 15 degrees. Firebee engine thrust is augmented during the initial launch phase by the solid propellant JATO motor which burns 2.2 seconds and provides a nominal thrust of 11,300 lbs.

For air launch, the Air Force DC-130 Hercules launch aircraft is equipped to carry four Firebees, two on each wing. The DP2E Navy Neptune carries two Firebees. The targets may be launched from altitudes up to 18,000 feet at approximately 200 knots. The remote controller assumes control about five seconds after drop-away.

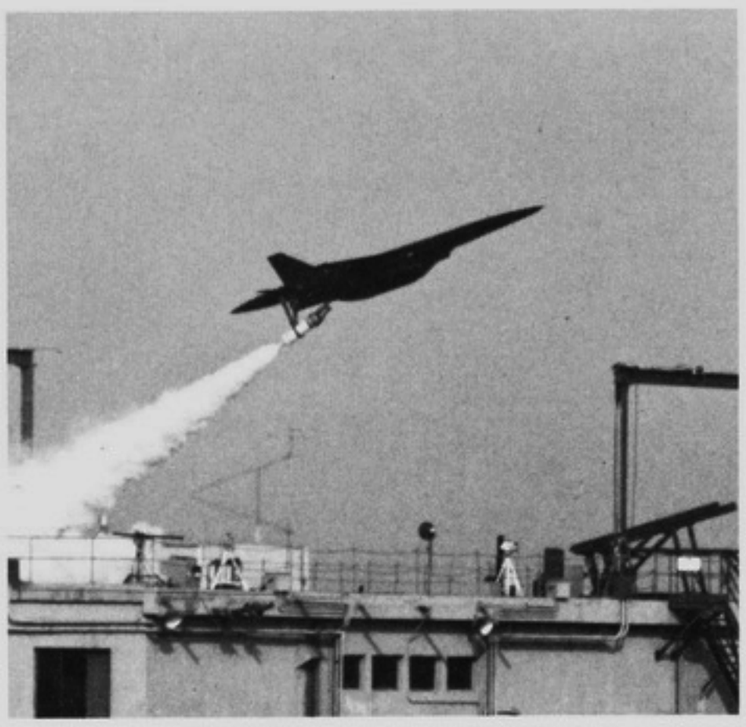
Flight

The supersonic Firebee is a highly versatile aircraft. It is capable of flight in the subsonic and supersonic regimes. The BQM-34E/F can perform its mission requirements at high and low altitudes.

In a typical Navy mission, the supersonic target is launched with its jettisonable fuel tank from a parent aircraft at



Suspended from wing pylon of U.S. Navy DP2E, BQM-34E is ready for air launch.



Equipped with external fuel tank, Firebee II roars skyward from ground launcher.

Skilled Teledyne Ryan field service technicians ready Firebee II for ground launch. →

