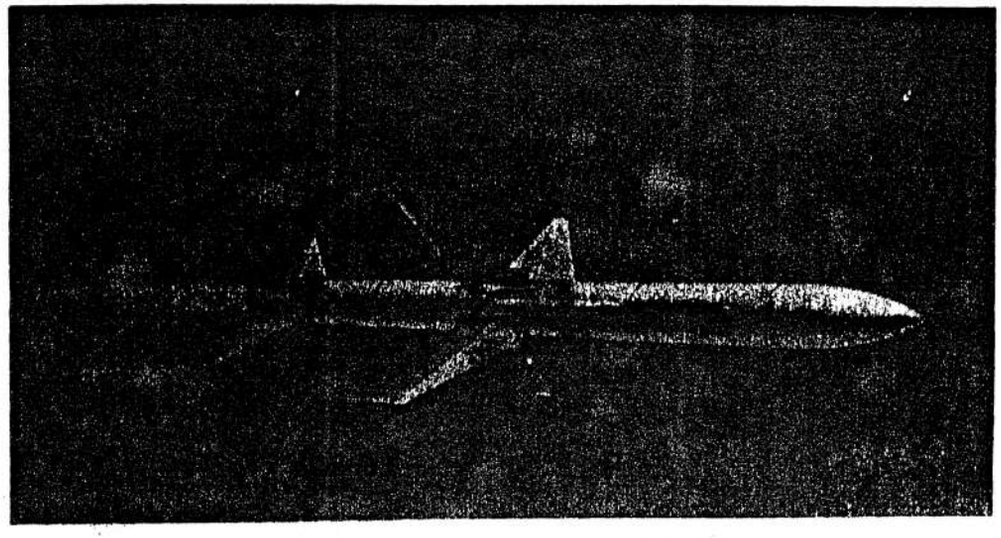
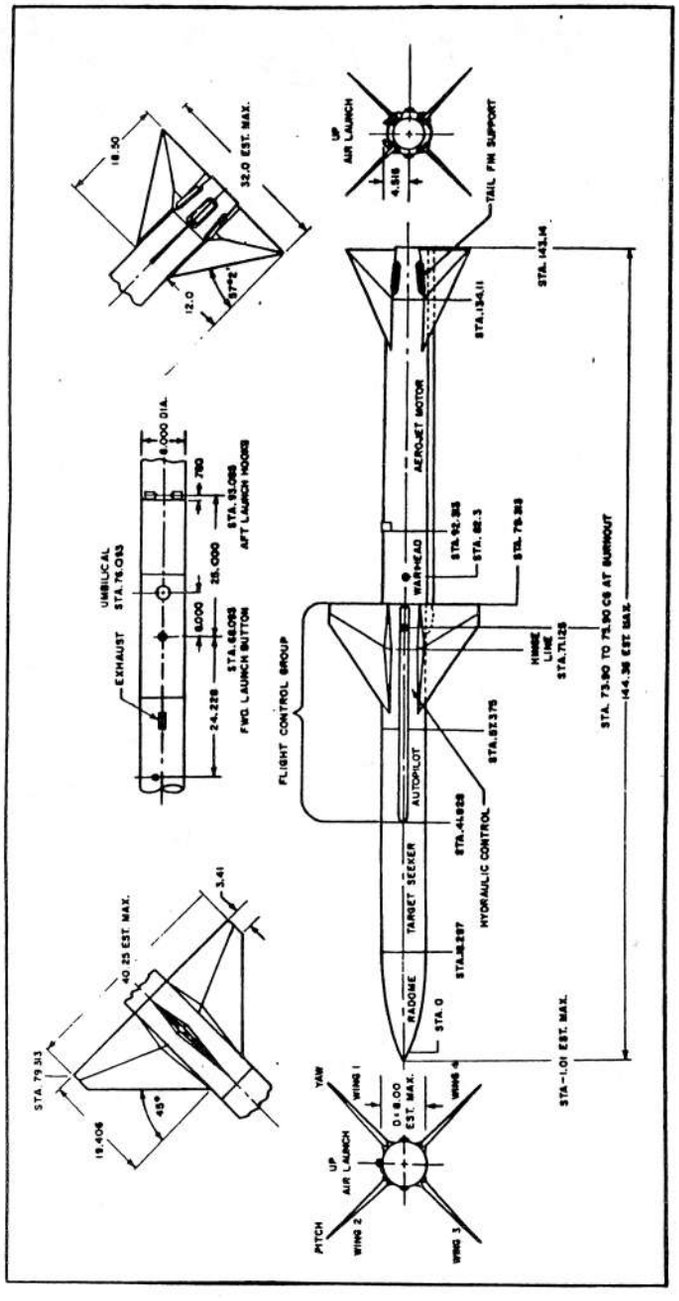


STANDARD AIRCRAFT CHARACTERISTICS

GUIDED MISSILE
MODEL AAM-N-6-SPARROW III

RAYTHEON COMPANY

25


18.50
32.0 EST. MAX.
12.0
UP AIR LAUNCH
4.818
TAIL FIN SUPPORT
STA. 143.14
STA. 134.11
AEROJET MOTOR
WARHEAD
STA. 92.325
STA. 82.3
STA. 79.313
UMBILICAL STA. 76.033
EXHAUST
6.000 DIA.
.780
8.000
25.000
24.228
STA. 68.093 FWD. LAUNCH BUTTON
STA. 93.093 AFT LAUNCH HOOKS
FLIGHT CONTROL GROUP
HINGE LINE STA. 71.125
STA. 73.90 TO 72.90 CG AT BURNOUT
144.38 EST. MAX.
STA. 87.375
AUTOPILOT
STA. 41.828
HYDRAULIC CONTROL
TARGET SEEKER
STA. 28.287
RADOME
STA. 0
STA. -1.01 EST. MAX.
STA. 79.313
40.25 EST. MAX.
3.41
45°
19.406
YAW
WING 1
D = 8.00 EST. MAX.
UP AIR LAUNCH
PITCH
WING 2
WING 3
WING 4

MISSION AND DESCRIPTION

The Sparrow III AAM-N-6 is a supersonic, air-to-air, boost-glide missile designed to provide effective armament for the Navy's all-weather fighters for defense of the fleet. This missile is capable of operation at all altitudes from deck level to over 60,000 feet and can be launched from aircraft flying at speeds up to Mach 1.3. The normal tactical range of the missile varies from approximately one to six miles, and is a function of altitude and aspect of attack. The missile's target seeker is capable of locking on and tracking small jet fighters at ranges up to 16,000 yards and medium jet bombers up to 24,000 yards.

The following Sparrow III capabilities will be of increasing importance for fleet defense in the period of useful life of the missile:

1. The missile guidance system is capable of effective around-the-clock operation, without the requirement for accurate aiming of the missile prior to launch.
2. The speedgating of the missile's CW radar receiver permits discrimination against ground clutter where the target's speed has a radial component along the line-of-sight.
3. In addition to the excellent high altitude performance of the Sparrow III airframe, provisions have been made to utilize the full snap-up capabilities of the missile in order to insure maximum high altitude effectiveness of the system.

Sparrow III has a cylindrical body eight inches in diameter and twelve feet in length, with a wing span of forty inches. A plastic laminate radome, having an ogive shape, forms the missile nose. The missile body consists of four major sections; target seeker, flight control, warhead, and rocket motor. Four variable-incidence, trapezoidal-planform wings, cruciformly mounted near the missile's center of gravity, control the missile during flight. Four stationary fins are attached to the aft end of the airframe in line with the forward wings.

In order to meet Navy environmental requirements, the guidance sections are sealed to atmosphere. The sections are joined together by Acme no-lead interrupted threads and radial locking screws, with an O-ring providing the seal at each joint. After initial purging with dry gas, the sealed sections breathe through a desiccant at the aft and of the midsection. External tunnels on either side of the airframe contain rear-signal waveguide and interconnecting cables.

Development

The Sparrow III AAM-N-6 now in production, was introduced into the fleet on the F3H-2 "Demon" all-weather fighter in 1958. Improved models of the Sparrow III are also under development for employment on future generations of Navy all-weather fighters such as the F4H-1.

ELECTRONICS OR GUIDANCE

Target illumination for the Sparrow III is provided by injecting CW energy into the AI radar antenna of the launching aircraft.

The missile employs the AN/DPN-24 semiactive target seeker for homing guidance. The target seeker, located immediately behind the radome, utilizes two antennas (front and rear). The front antenna receives the signal reflected from the target and the rear antenna receives the transmitted CW signal from the illuminator in the launching aircraft. Comparison of the two signals yields a Doppler frequency which contains homing intelligence for the missile. A speedgate in the target seeker automatically searches for, locks on, and tracks only coherent target signals. The output of the speedgate is fed to the autopilot which is located immediately behind the target seeker section. The autopilot converts the directional information produced by the conical scanning into deflection of the four wings for control of the missile.

Included as an integral part of the target seeker is a fuzing system which provides a detonation signal to the warhead at intercept. This is made possible by the absence of "blind time" in a CW radar, so that guidance is maintained all the way to intercept.

WEIGHTS

Missile (before launch):	389 lbs
Missile (after burnout):	318 lbs
Warhead - Rod Type:	67.1 lbs
Rocket Motor:	65 lbs

ORDNANCE

Naval Ordnance Laboratory - White Oak:
Continuous Rod Warhead, EX-2 MK-11 or MK-12

Elgin National Watch Company:
Safety and Arming Device, MK-5, Mod-0

PROPULSION

Model and Type:
1.8KS-7800 113-C5 and (C8) Solid Propellant

Manufactured by Aerojet-General for US Navy

Engine Spec. No:
BuAer Spec. - XSI-12

Engine Diameter:
8.0 inches

Engine Length:
51.82 inches

Propellant (Type):
Aeroplex

Propellant (Weight):
69.4 lbs.

RATINGS AT SEA LEVEL (60°F)

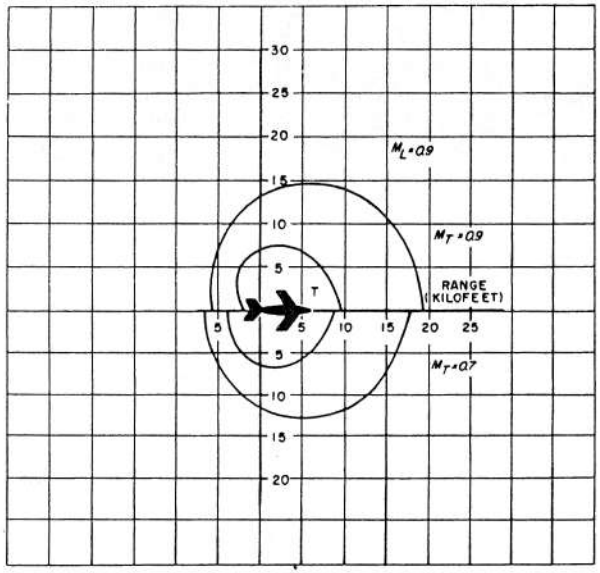
Impulse:
14,484 lbs-sec at Sea Level

Thrust:
7100 lbs. Nominal for 2.04 seconds

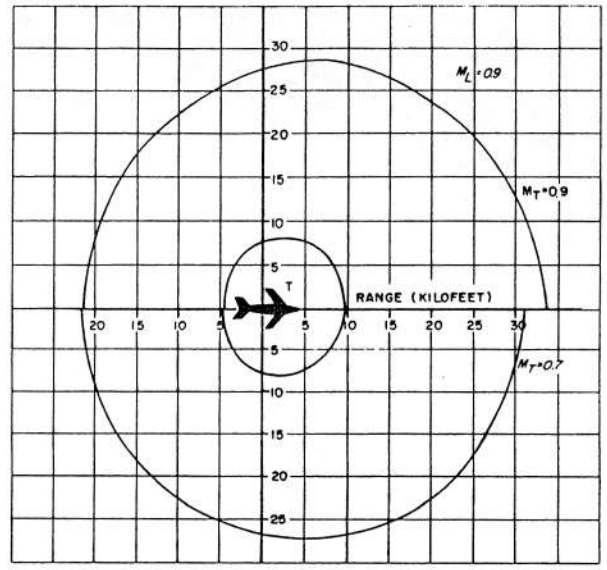
DIMENSIONS

Missile Length:	12 ft.
Missile Diameter:	8 in.
Wing Area (each panel):	1.265 sq. ft.
Tail Area (each panel):	0.77 sq. ft.
Max. Wing Span:	40.25 in.

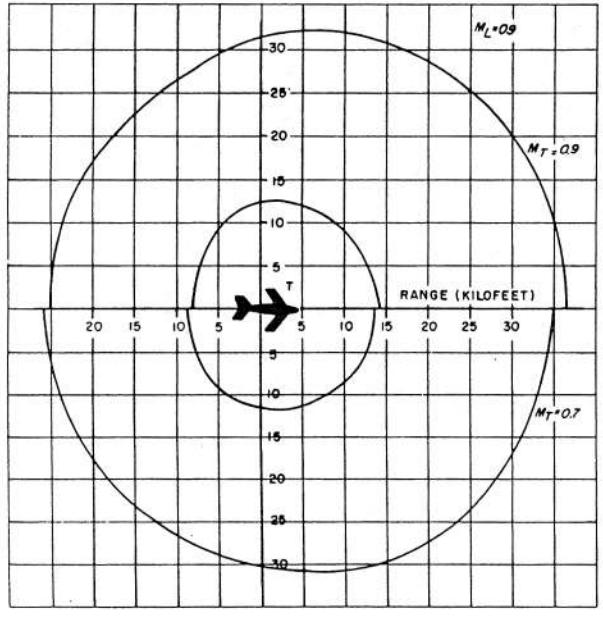
23



EFFECTIVE LAUNCHING ZONE AT SEA LEVEL



EFFECTIVE LAUNCHING ZONE AT 30,000 FT.



EFFECTIVE LAUNCHING ZONE AT 50,000 FT.

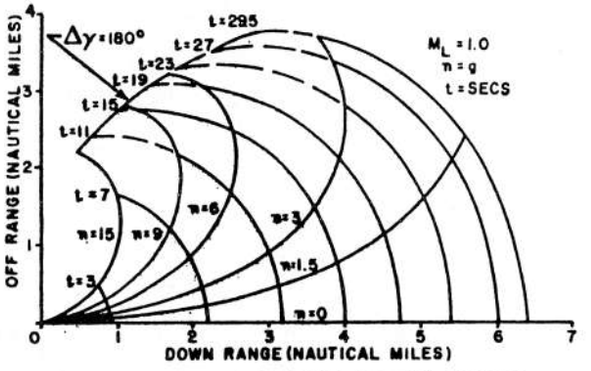
SPARROW III ZONES OF EFFECTIVENESS

The ranges within which the Sparrow III can be launched against a target depend on the speeds of both the interceptor and target, altitude of attack, range capability of the target seeker, and aspect of attack. The range interlock circuits determine the maximum and minimum ranges and interlock the fire control system so that a missile cannot be launched from outside of the zones shown. The range interlock functions are determined by the equations

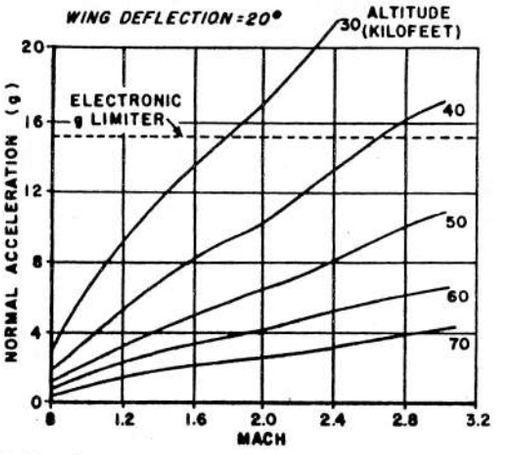
1) $R_{max} = R_1 (h) + T_1 (V_c - V_f)$

2) $R_{min} = R_2 (h) + T_2 V_c$

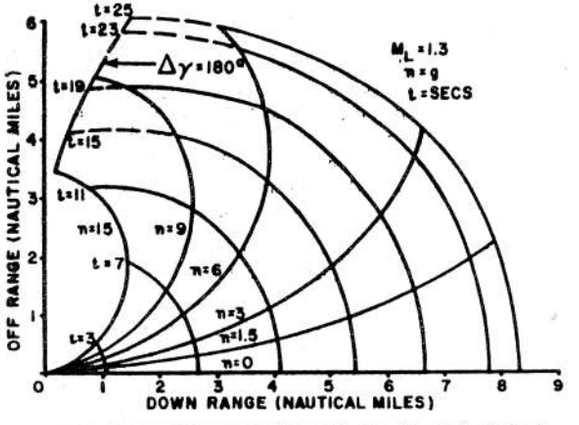
where R_1 and R_2 are functions of altitude, V_c is the closing speed ($V_c = -\dot{R}$) and V_f is the fighter speed. T_1 is 10 seconds for $V_c > V_f$ (interceptor velocity) and is 3.3 seconds for $V_c < V_f$. T_2 is 3.3 seconds for all values of V_c. An in-range light on the edge of the pilot's radar scope indicates time to fire. In these curves, it is assumed that target detection has been accomplished at sufficient range to allow missile launching at the maximum ranges shown.



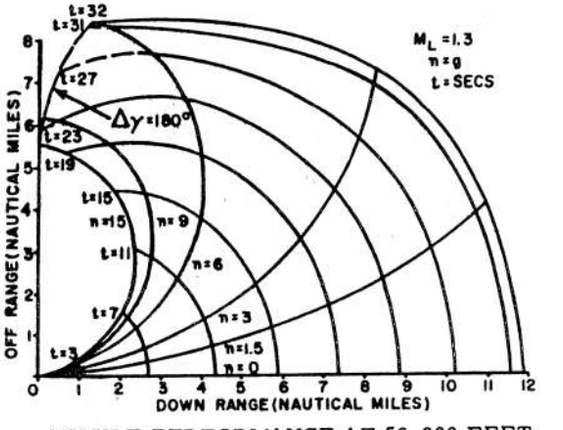
MISSILE PERFORMANCE AT SEA LEVEL



MISSILE MANEUVERS WITH FULL WING DEFLECTION



MISSILE PERFORMANCE AT 30,000 FEET



MISSILE PERFORMANCE AT 50,000 FEET

The graph in the upper right hand corner shows the amount of g the missile will pull at 5 different altitudes within the Mach range shown.

The three remaining graphs shown above reveal missile aerodynamic performance at three different altitudes with various wing deflections using a C-5 motor. For a co-altitude condition, down range is the distance the missile travels in a forward direction with no resultant yawing moment. Off range is the distance left or right due to a yawing moment.

27

NOTES AND MISCELLANEOUS INFORMATION

MISSILE CONTROL SYSTEM IN F3H-2 AIRCRAFT

AAM-N-6 is used as additional armament in the F3H-2. In order to accommodate the missile, Raytheon designed and developed a missile control system for use in conjunction with the ACS Aero 19 G in the F3H-2. The ACS uses the AI Radar Set AN/APG-51B. The missile control system includes:

1) Radar Set Group AN/APA-127. A computer in this radar set supplies the pilot with aircraft steering signals and contains a range interlock which automatically permits the pilot to launch the missile when in the launching zone. The computer also supplies head-aim, altitude switching, and initial steering information to the missile prior to launch. The modulator is used to frequency modulate the transmitted CW energy for AFC, coding, and range reference use in the missile.

2) Launching Set Group AN/ASA-23 provides such functions and controls as are necessary to give an indication of missile prelaunch operation and to ensure proper launching of the missile.

3) Aero 4A Launcher supports the missile prior to firing and guides its first 3 feet of travel after firing.

EQUIPMENT UNITS, WEIGHTS, AND DESIGNATIONS

RADAR SET GROUP AN/APA-127

UNIT	DESIGNATION	MAX. WEIGHT (lbs.)
Computer, Target Intercept	CP-375/APA-127	19.0
Modulator, Radar	MD-319/APA-127	11.5
Rack, Electrical Equipment	MT-1927/APA-127	23.0
Power Supply	PP 1853/APA-127	58.8
Transmitter, Radar	T-657/APA-127	41.2
Computer, Navigational	CP-376/APA-127	10.8
Computer, Navigational	CP-376A/APA-127	6.5
Rack, Electrical Equipment	MT-1930/APA-127	77.7

LAUNCHING SET GROUP AN/ASA-23

UNITS - 4 EACH	DESIGNATION	MAX. WEIGHT EACH (lbs.)
Network, Pulse Delay	TD-201/ASA-23	0.7
Circuit Breaker	RE-349/ASA-23	10.8
Filter, DC Power	F-369/ASA-23	3.2
Drive, Tuning	TG-56/ASA-23	3.0
Mounting	MT-1931/ASA-23	1.8

The Aero 4A Launcher weighs 79 pounds complete.

SPARROW III TEST EQUIPMENT

The AN/DPM-7 Test Set provides an artificial target source to develop a doppler sideband to the basic X-band frequency which is supplied to check target seeker operation including radar sensitivity. Manually imparted physical motion of the missile and test stand produces recorded deflections of the four wings in response to commands from the autopilot instruments. Rolling the missile about its longitudinal axis checks the accelerometer and roll circuits. Oscillating the missile laterally checks the autopilot rate gyro and head stabilization circuits.

The HD-315/U provides hydraulic pressure for operational testing of the hydraulic functions and provides a measured quantity of oil for servicing the accumulators when required.

The CN-453/U provides control of a compressed gas supply for pneumatically charging the accumulators.

The AN/DSM-32 is a consolidated test equipment designed for conducting periodic system confidence tests on Sparrow III class missiles.

TEST EQUIPMENT FOR RADAR SET GROUP AN/APA-127

Special test equipment designed and developed by Raytheon for operational use aboard aircraft carriers is as follows:

1) RF Monitor, AN/APM-82 for measuring power, frequency, and noise.
2) Spectrum Analyzer, AN/APM-83 for measuring frequency spectrum.
3) Radar Test Set, AN/APM-85, a test bench for checks of all units.
4) Computer-Radar Test Set, AN/APM-86 for computer tests.
5) Simulator Test Set, AN/ASM-9 simulates missile load on the aircraft-mounted launcher and checks missile fire control circuits.
6) Modulation Test Set, AN/APM-84 measures modulation characteristics of CW-RF carrier.