Advanced Aerodynamic Reconnaissance System

Advanced Manned Interceptor

Mission Simulator

Version 0.3 Demo
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Quickstart

AARS: A quick reaction strategic reconnaissance capability survivable primarily in the Soviet block defensive environment through the 1975-1980 period.
This program is designed for simulating different AARS mission types and profiles. Main elements are the mission planner user interface and the dynamic 3D flight and threat simulation environment.

Controls

- Right mouse button : pan view
- Mouse wheel : zoom in/out
- Arrow keys : pitch/roll (not available in unmanned mode)
- Z/X : rudder (not available in unmanned mode)
- Keypad +/- : engine power (not available in unmanned mode)
- B : speedbrake (not available in unmanned mode)
- M : show/hide moving map display
- T : next camera target
- Y : previous camera target
- P : pause/unpause game
- 1 : normal time
- 2 : time warp 2x
- 4 : time warp 4x
- V : mute/unmute sounds
- Q : end mission
- Esc : quit game

Tutorial

The program starts in the mission selection screen. Available missions for each aircraft are listed on the left hand side. Select "Landing test" under Model 192. This displays a brief overview of the mission on the right. Select "Load".
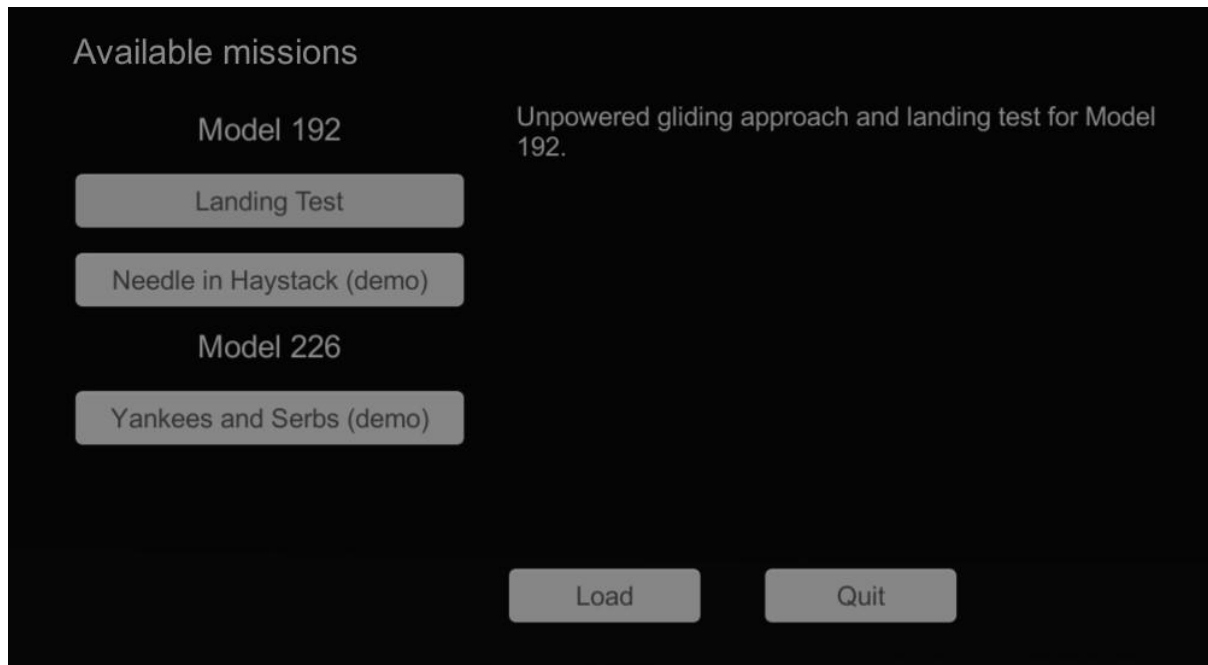
After the mission has loaded the Model 192 mission planner shows up. This is where you program the autopilot for the mission. In this instance there is already a reasonable default program provided, so just select "Start" from the bottom of the button row in the middle.
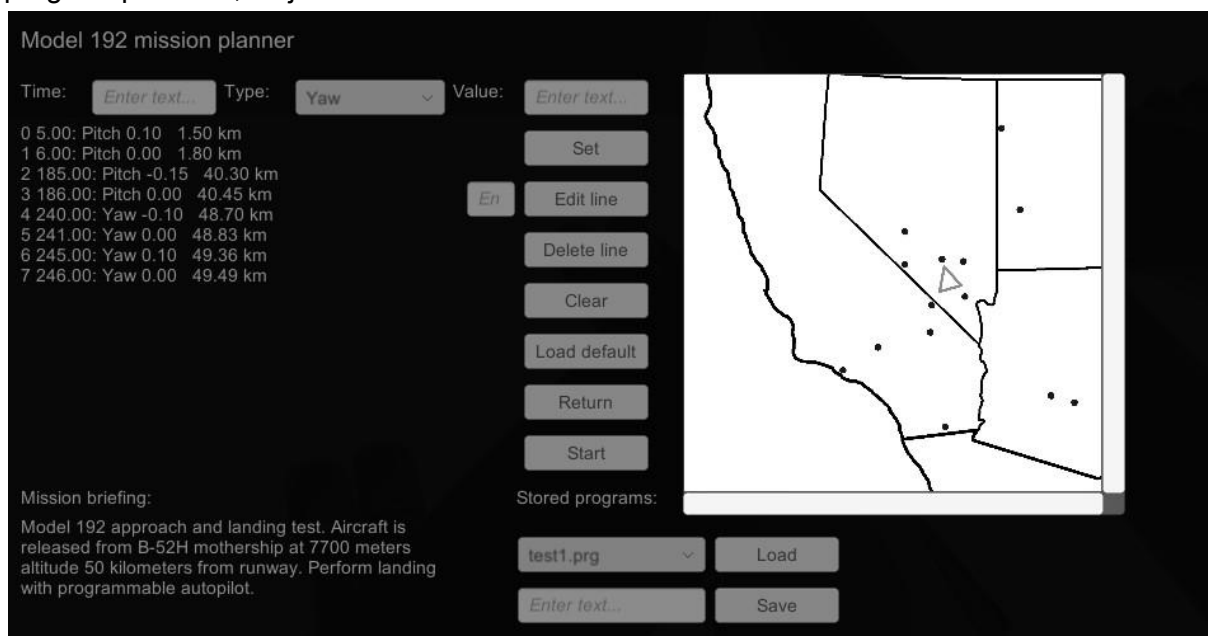
The actual mission now starts. You can follow progress from external views of the involved units, and from the fixed size moving map display at top right (toggle with [M]). You can pause and unpause the game with [P]. Use the right mouse button to rotate view and mouse wheel to zoom in and out. You can cycle camera targets forward with [T] and backwards with [Y].
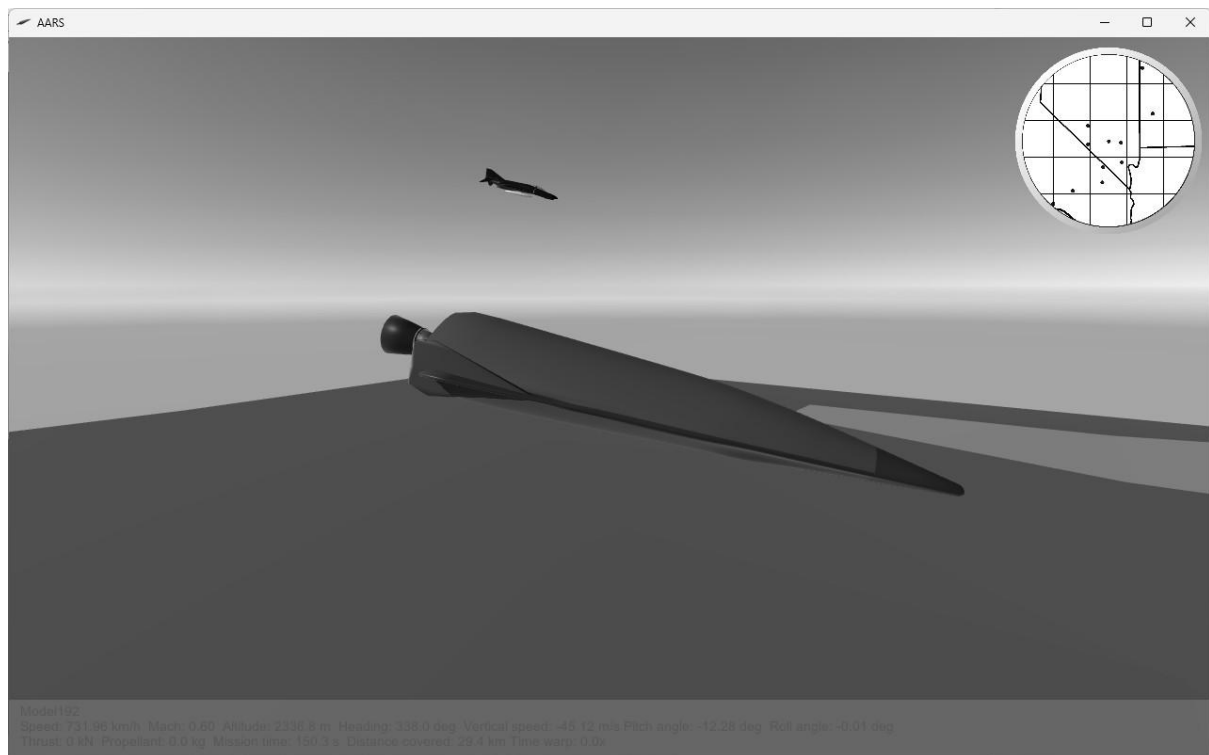
In this mission the Model 192 has just been released from the B-52H mothership and starts its unpowered glide towards the target runway. This will take a while, so you can increase time warp with [2] and [4] keys. [1] returns to normal time. Wait for the Model 192 to descend and approach the runway. The main landing skid and nose wheel will automatically deploy at the right altitude and airspeed.

You will notice the aircraft landed slightly to the right of the runway. Fortunately the dry lakebed and skid landing gear mean this is not fatal. Wait for the aircraft to slow down and press [Q] to quit the mission. A warning will appear if you are too far from the runway for a successful mission but don't care about this. You will be returned to the mission selection screen. Load "Landing test" again, we will next try to modify the autopilot program to actually land on the runway.

On the right there is a list of autopilot commands for the mission. The first number is the command index, second is the time in seconds from mission start to command execution, third is the command type and value, and fourth the estimated distance from starting point at time of command execution. Since the landing occurred too much to the right you will want to increase the amount of yaw at the end of the glide. There is an input field next to the "Edit line" button. Type "4" there and click the button. This will open up that line for editing at the top of the planner. You can edit the time, type and value of the command. Increase the yaw value to -0.15 and select "Set". We will also want to yaw back to align with the runway, so edit command number 6 similarly, changing the value to 0.15.

Go ahead and start the mission again. This time the aircraft may land to the left of the runway, so a good rudder control value might be somewhere between 0.10 and 0.15 percent deflection. You can also try changing the timing of the yaw commands, or alternatively use roll for more aggressive maneuvering. This might be more difficult to offset back in this part of the flight though.

Equipment

Model 192

Length: 23.4 m
Wingspan: 7.98 m
Height: 3.72 m
Glide weight: 10 500 / 11 500 kg
Propellant weight: 43 400 kg
Launch weight: 53 900 / 60 200 kg
Powerplant: One Pratt & Whitney XLR129-P-1 liquid propellant rocket engine
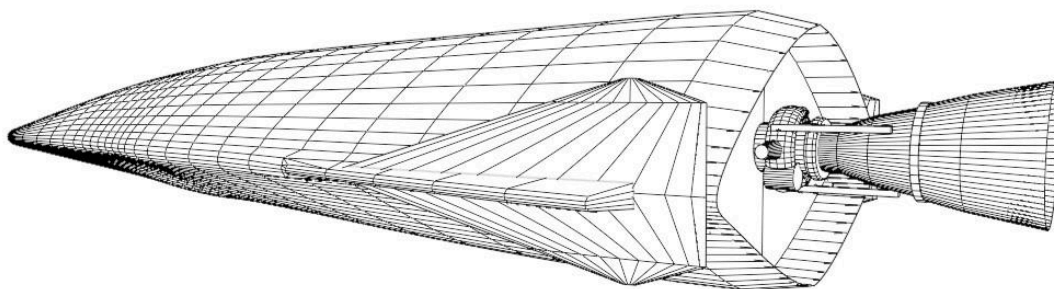Maximum thrust: 1 086 kN
Launch altitude: 7 600 m
Ceiling: 60 000 m
Maximum speed: 20 000 km/h
Reconnaissance range: 12 400 km
Total mission range: 13 900 km

Model 192 is an air-launched rocket-powered hypersonic boost-glide reconnaissance aircraft. First conceived in 1964, it was developed with CIA funding until 1966. Work on hypersonic reconnaissance vehicles resumed in 1970 under the Advanced Aerodynamic Reconnaissance System program. During the initial development period there was debate on whether the aircraft should be manned or unmanned, and while the manned variant was then preferred, advances in both technology and threats meant an unmanned vehicle was both feasible and more survivable by the mid-1970s.

For missions the Model 192 is air-launched from a modified B-52H strategic bomber. Total mission time is somewhat over one hour. The vehicle is capable of providing quick reaction, wide swath, high quality photography of highly defended denied areas. Propelled by the XLR129-P-1 high performance rocket engine using liquid hydrogen fuel and liquid oxygen

oxidizer. Structure consists of a titanium internal structure and fuel/oxidizer tanks with a thoria nose cap, columbium leading edges, T-D nickel bottom surface, and Rene41 and beryllium upper surface. Water wick thermal insulation. Control is provided by the swiveling main engine nozzle, all-moving wings and rudders. Landing occurs on rear skids and forward nose wheel.

Model 226

Length: 26.6 m
Wingspan: 10.6 m
Height: 4.0 m
Empty weight: 30 000 kg
Fuel weight: 15 000 kg
Maximum takeoff weight: 46 500 kg
Powerplant: Two General Electric GE16 turboramjets
Maximum SLS thrust: 2 x 250 kN
Ceiling: 30 000 m
Maximum speed: Mach 6.0
Combat radius: 2 800 km
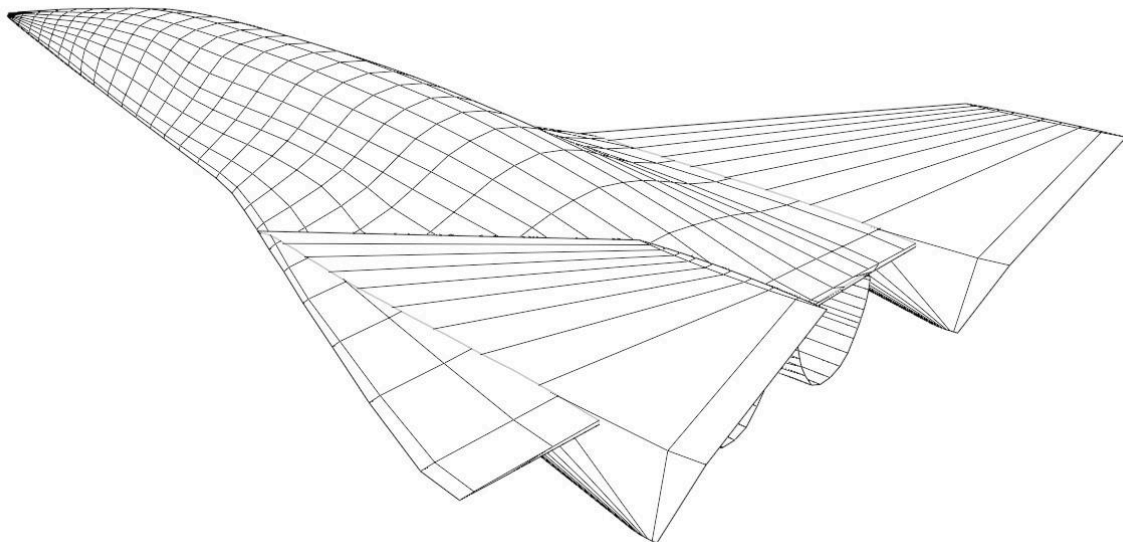
Initially developed under the Advanced Manned Interceptor (AMI) program at the start of the 1970s, this Model 226 variant was also proposed as a GIUK gap interceptor for interdicting Soviet warships entering the middle Atlantic ocean. Launched from an airbase on the US east coast, it could arrive at the last known contact point before the ship had moved out of detection range. This variant also formed the basis for the later Advanced Interceptor Aircraft studies.

The design is a delta wing blended body with main structure and fuel tanks of aluminum construction and thermal protection by insulated metal shingles. Powered by two turboramjet hyperjets with a vertical ramp inlet using subcooled liquid methane (LNG) fuel. Maximum load factor 3.5 g. Armament consists of hypersonic air intercept missiles in a rotary launcher in a payload bay above the fuselage.

B-52H

Length: 48.5 m
Wingspan: 56.4 m
Height: 12.4 m
Empty weight: 83 250 kg
Fuel weight: 141 600 kg
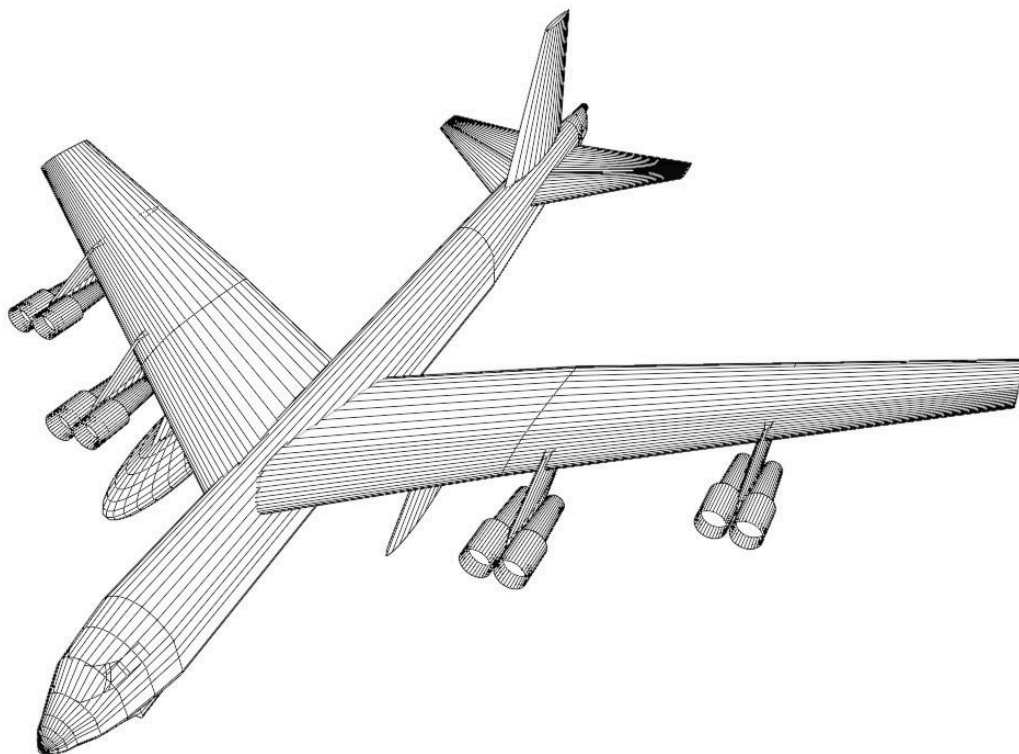Maximum takeoff weight: 220 000 kg
Powerplant: Eight Pratt & Whitney TF33-P-3 turbofan engines
Maximum thrust: 8 x 76 kN
Ceiling: 15 000 m
Maximum speed: 1 050 km/h
Combat range: 14 200 km

First flown in 1952, the B-52 forms the backbone of the USAF strategic bomber fleet. Most significant improvement of the final B-52H variant are the Pratt & Whitney TF33 turbofan engines instead of turbojets of the earlier models. Heavy load capacity and long range make the B-52 a good base for special variants such as a mothership for air-launched vehicles.

Modifications to the B-52H for launching Model 192 include wing structure beef-up, LOX tank in the bomb bay, plumbing for fuel transfer and LH2 tank on the right wing pylon.

AIM-47B

Length: 3.82 m
Diameter: 0.33 m
Weight: 360 kg
Powerplant: Lockheed XSR13-LP-1 solid propellant rocket engine
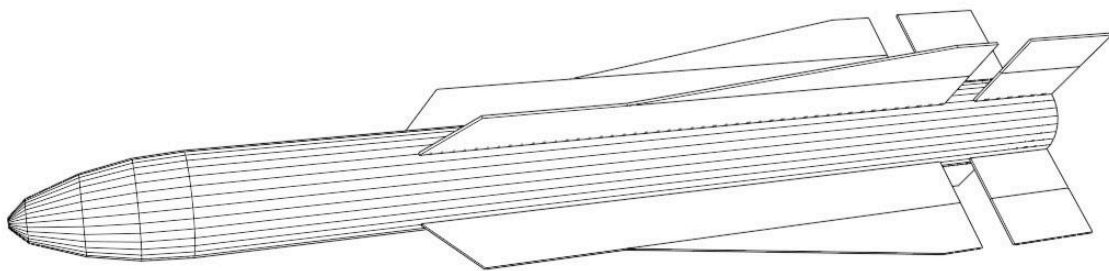Maximum thrust: 70 kN
Controls: aerodynamic surfaces
Intercept altitude: 150 - 30 500 m
Maximum speed: Mach 4
Range: 160 km
Warhead: 45 kg HE

Development of the AIM-47 air-to-air missile (originally designated GAR-9) began in 1957 as a weapon for the F-108 Rapier long-range interceptor. When that program was cancelled in 1959, development of the missile continued, and in 1960 it found a new platform from the YF-12A interceptor. Test launches from B-58A and YF-12A aircraft were conducted in 1962-1966.

The AIM-47 traces its heritage to the earlier and smaller AIM-4 Falcon AAM family. The fuselage and wings are made of plastic with stainless steel control surfaces. AIM-47B is the production version with folding fins. It uses a programmable autopilot for the initial flight phase with semi-active radar homing terminal guidance. The radar seeker has a lock-on range of 115 km against a 9.3 m^2 target.

S-225 (ABM-X-3) antimissile system

Design of the S-225 system for defense of cities and other strategic point targets against both ballistic and advanced aerodynamic threats was authorized in May 1961. Due to stringent radiated power and scanning time and zone requirements the tracking radar was to be a phased-array design. After preliminary studies the development of a draft project was authorized by a government decree in May 1963. The draft project was completed in 1965, and construction of two prototypes at the Sary Shagan test range was ordered. The system was originally to be ready for testing in mid-1969, however, tests of the RSN-225 radar began only in 1971. Due to the proliferation of decoys in ICBMs an improved version of the system with a modernized radar and an endoatmospheric high speed interceptor was ordered in 1968. Early warning for the system was to be provided by the Dnestr and Dnepr (HEN HOUSE) radar stations.

5Ya26 endoatmospheric interceptor

Length: 10.0 m
Diameter: 1.5 m
Weight: 10 000 kg
Powerplant: 5S73 solid propellant rocket engine
Maximum thrust: 1 000 kN
Controls: gas-dynamic
Intercept altitude: 5 000 - 30 000 m
Maximum speed: 4000 m/s
Range: 100 km
Warhead: AA-84 10 kT nuclear
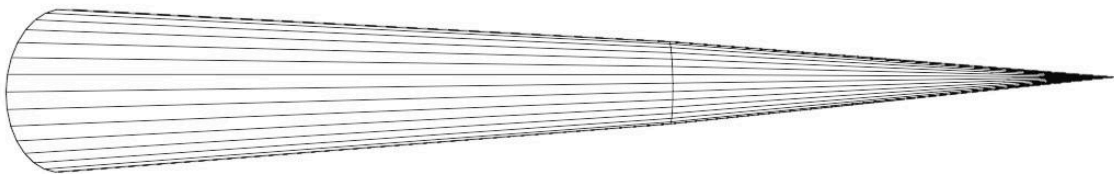
Endoatmospheric short range missile of S-225 ABM system. Launched from an underground silo-mounted container. Cone-shaped missile with a solid-propellant rocket engine burn time of four seconds. Command guidance.

An endoatmospheric interceptor was added to the S-225 system as a measure to overcome decoys. Design work at OKB-2 (Torch) began in 1967, but was transferred to OKB-8 (Novator) in 1969. First test launches were made in 1973, with stable guidance communications obtained only on the 17th launch in 1980. First successful controlled launch occurred in July 1981, and in April 1984 a ballistic target was intercepted.

# 5Ya27 exoatmospheric interceptor

Length: 8.15 m (first stage) 10.35 m (second stage)
Diameter: 1.25 m
Weight: 14 000 kg (first stage) 3 900 kg (second stage)
Powerplant: 5S24 solid propellant rocket engine (first stage) liquid propellant rocket engine (second stage)
Maximum thrust: 3 500 kN (first stage) 1 500 kN (second stage)
Controls: aerodynamic surfaces and gas-dynamic
Intercept altitude: 10 000 - 100 000 m
Maximum speed: 1500 m/s
Range: 200 km
Warhead: low power nuclear
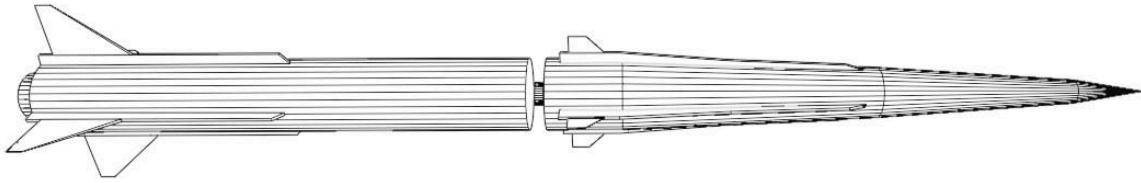
Exoatmospheric long range missile of S-225 ABM system. Launched from a container from a prepositioned above ground launch mount. Designed for a storage life of 10 years. Command guidance.

Development of the V-825 missile began in 1965, with unguided test launches starting in July 1967. Guided tests began in February 1973. The first seven launches were against fixed targets, and the following six launches in 1974-1975 against missile simulators. Tests against actual IRBMs were completed in October 1976, and against ICBMs in July 1977.

FLAT TWIN engagement radar
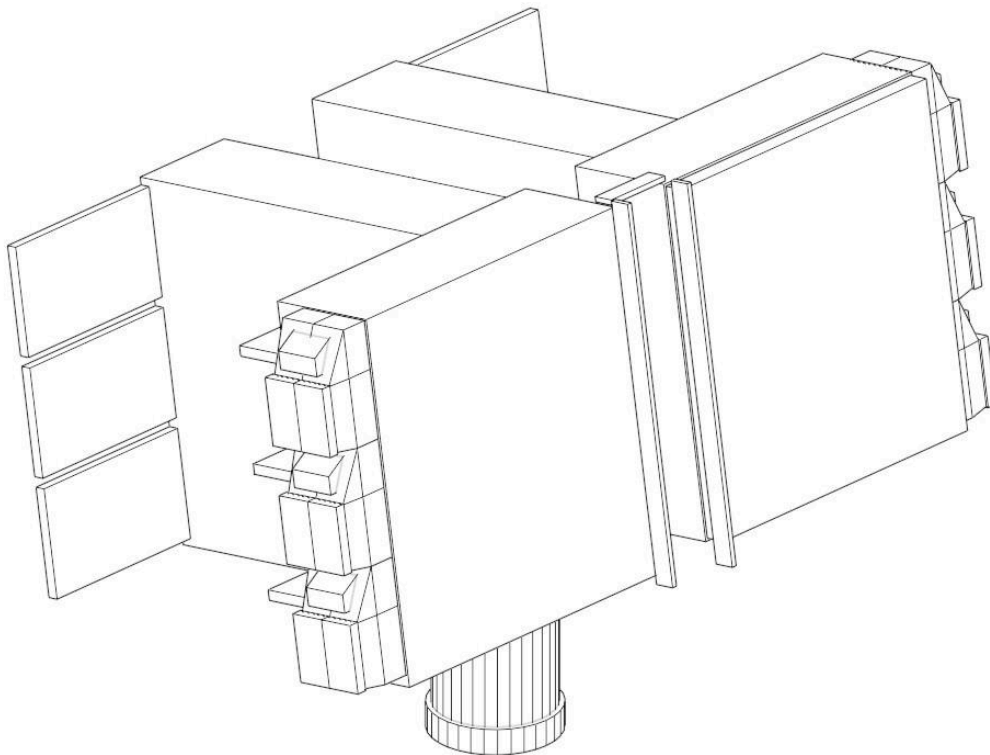
RSN-225 (FLAT TWIN) is a relocatable multifunction phased array radar for the S-225 ABM system. Can be deployed to a concrete pad in 3-6 months. Electronically steered phased array antenna mounted on a pedestal that allows mechanical steering in azimuth and elevation. Supported by about 20 electronics vans for power, cooling and computers. Electronic systems based entirely on semiconductors. The first prototype featured a planar transmitter antenna with a phased array receiver, and a scanning sector of 4 x 5 degrees.

Due to the introduction of decoys into ICBM warheads in the late 1960s, the electronic scanning sector was increased to 20 x 20 degrees with a phased-array transmitter in the second prototype. Single target tracking capacity.

PAWN SHOP guidance uplink
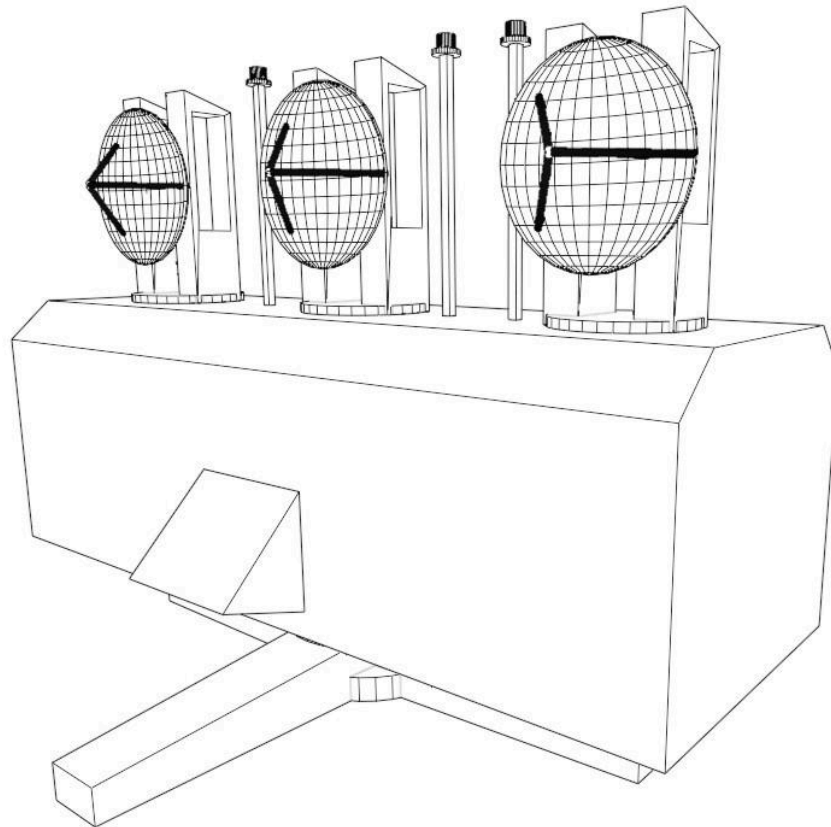
SPK command guidance uplink for the S-225 ABM system. Three mechanically steered antennas for controlling three interceptor missiles. Can be deployed to a prepared site in a few weeks.

MAZ-547 transloader
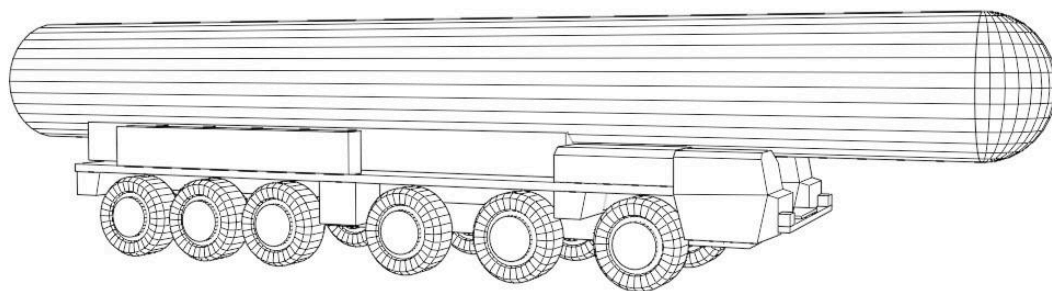
Transporter-loader vehicle for 5Ya27 long range missiles of the S-225 ABM system. Based on the MAZ-547 12x12 heavy truck chassis. Positions missile launch canisters vertically on static launch mounts.

Related reading

- Model 192 survivability assessment, CIA, 1965
- Summary Review of ISINGLASS Program, BYE-2489-65, CIA, 1965
- ISINGLASS Research and Development Program, BYE-2100-66, CIA, 23 February 1966
- Advanced Reconnaissance System - Concept Formulation, CIA, 7 November 1969
- The Flat Twin ABM Radar: Not as Capable as Previously Believed. A Technical Intelligence Report, CIA, October 1991
- A Soviet Land-Mobile ICBM: Evidence of Development and Considerations Affecting a Decision on Deployment, CIA, October 1974