V-750

Surface-to-Air Missile

Title Goes Here!

Photography, writing, design, layout, etc.

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Technical stuff

The photographs in this net.book were taken using a Fujifilm 6900Zoom digital camera, while the computer graphics were created with POV-Ray 3.5 and the KPovModeler 0.20 front-end for it. The document was laid out in Palatino Linotype and **Futura XBlk BT** using QuarkXPress 4.1 for Windows. The PDF was created with Adobe Acrobat Distiller 3.01 and worked on with Adobe Acrobat Exchange 3.0.

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S-75 / V-750

Developed in the 1950s and deployed through much of the world from the 1960s on, the V-750 surface-to-air missile is one of the most widely-used of these weapons. Originally used for the defense of industrial and urban areas in Russia, the missile ended up in service with many Russian-supplied nations with a real or perceived threat of enemy aircraft.

Designations

The first thing to get clear is that many different names are applied to this weapon; so many, perhaps, that the Russian one, V-750, is less well-known than the US/NATO designation SA-2 *Guideline* (see the sidebar). The remaining ones can cause a lot of confusion as well, so first, an attempt to clear this up a bit.

The missile itself is properly the V-750, while the designation for the entire weapon system firing these missiles is S-75. The name V-75 is sometimes also used, variably for either the whole system or just the missile; it is not entirely clear whether this designation was used by the Russians as well, or if it results from confusion in the west between "V-750" and "S-75". Many texts use the three (V-750, S-75 and V-75) interchangably, often also adding "SA-2" and/or "*Guideline*" in the same sentences to further muddy the waters …

Both missile and launcher have various sub-variants, which are outlined on the **S-75/V-750 designations table** (p. 4) for ease of reference. Most of the variants shown are land-based, with each launcher holding a single missile. The M-2 Volkhov-M was a naval variant of the S-75, installed only on the *Dzerzhinsky*, a "Sverdlov"-class cruiser fitted with a large twin launcher replacing a normal turret. It fired the V-753 missile, a derivative of the V-750, the launcher being automatically loaded from an eight-shot magazine. The fact that only one ship was ever fitted with this weapon system is a clear indicator that it did not live up to expectations. (The *Dzerzhinsky* was scrapped in 1988.)

The ground launcher consists of a cruciform mounting, of which the two side arms can be swung back for transport, and carrying a turntable with the actual launcher and missile controls. The missile sits on a launch rail that can be elevated to 80 degrees, while behind the launcher, a blast deflector is set up to prevent the missile's backblast from kicking up too much dust, and/or damaging the surface of the ground. This deflector, however, prevents the launcher from easily traversing, as it

US & NATO designations

During the Cold War, solid data on Soviet-made equipment was often hard to come by, including their proper designations. As a result, western intelligence analysts devised systems to classify observed equipment, but different systems were used by the United States than by NATO.

For seemingly anything that flies, NATO assigned a reporting name whose starting letter indicates the general type, while for some equipment the number of syllables in the name conveys additional information. For example, because *Guideline* starts with the letter G, it is a surface-to-air missile (G probably for **G**round-to-air, because S was already used for missiles of all types used against surface targets). Identified variants were assigned the suffix "Mod" (for modification or model) plus a sequential number, such as Mod 1, Mod 2, and so on, the initial variant being Mod 0.

The United States, on the other hand, assigned missiles a code of two (sometimes three) letters to indicate the basic function, followed by a sequential number to show how many different missiles with this function had been identified so far. (Missiles fired from ships got the addition "N-" between the letters and number.) Any letter behind the number indicated a (known) modification, again assigned sequentially. The US therefore knew the V-750 as the SA-2, as it was the second type of **S**urface-to-**A**ir missile seen in Soviet service.

When it comes to missiles, the two systems are usually combined, so the V-750 is known in the west as the SA-2 *Guideline*.

	Designation	
Missile type	**NATO**	**US**
Air-to-air	A…	AA-
Air-to-surface*	K…	AS-
Anti-ballistic	G…	ABM-
Anti-tank	S…	AT-
Battlefield support	S…	SS-
Cruise	S…	SSC-
Strategic	S…	SS-
Surface-to-air	G…	SA-

* Except aircraft-launched anti-tank missiles

For radars and other electronics, the naming system is completely different. The NATO names here seem to be chosen either because the shape of the radar reminds the namegiver of something, or seem totally arbitrary. Sequential letters are used to differentiate between variants.

S-75/V-750 designations

System	Missile(s)	Introduced	US designation	NATO designation
S-75 Dvina[1]	V-750	1957	SA-2A	Guideline Mod 0
	V-750V	1957	SA-2A	Guideline Mod 0
SA-75 Desna	V-750VK	1959	SA-2B	Guideline Mod 1
	V-750VN	1959	SA-2B	Guideline Mod 1
S-75M Volkhov	V-750M	1961	SA-2C	Guideline Mod 2
	V-750SM	mid-1960s	SA-2D	Guideline Mod 3
	V-750AK	mid-1960s	SA-2E	Guideline Mod 4
M-2 Volkhov-M	V-753	1961	SA-N-2	Guideline
S-75M Volga	(unknown)	1968	SA-2F	Guideline Mod 5

rests on a large circular pad directly on the ground.

For transport, the missile is carried on a two-wheeled trailer that is towed behind a standard truck, usually a ZIL-157. It can be transferred from the trailer to the launcher without the need for external cranes or other equipment beyond what is available on the trailer and launcher. To do this, the launcher is depressed until it is horizontal and the trailer is parked in front of it, at a 90-degree angle to the launch rail. The tranport rail on the trailer is swung to the side so that it is in line with the launch rail, and the missile is then slid backward onto the launcher. A crew of about four or five men can perform this operation in about ten to twelve minutes. The photograph on this page shows the missile being loaded by a Russian crew, sometime in the 1960s.

Nearly all countries equipped with S-75 launchers normally deploy them in the same way. They are organised into battalions of six launchers and associated equipment, with the whole battalion deploying to a site that needs defending. Three battalions make a regiment, with additional equipment to more effectively control the fire of its subordinate units.

Each battalion's launchers are placed in a hexagonal pattern with some 60 to 100 meters between launchers. Located centrally between the launchers are the radars, command centre, and trucks carrying spare missiles (normally six, one per launcher). If the unit is intended to be mobile, its equipment will be carried on trucks, but it can also be emplaced more permanently if required. Similarly, the missile launchers can be set up in a variety of ways, ranging from simply set on flat ground to being dug into elaborate, permanent pits for protection.

The regimental headquarters has a P-12 (NATO name: *Spoon Rest*-A or -B) radar[2] with a range of some 275 km, carried on a truck and used to detect and acquire targets at long range, plus a P-15 (NATO: *Flat Face*) radar for searching and tracking targets out to 250 km as well as a PRV-11 (NATO: *Side Net*) height-finder radar with a range of 180 km. When the regimental HQ detects a target and identifies it as hostile, it passes the information on to the battalion in the best position to intercept it.

The battalion's main radar equipment is also a P-12, with which it acquires the designated target. Once this has been established, it is taken over by another radar, the battalion's *Fan Song* (NATO name). This can track up to six targets simultaneously, and guiding three missiles at

[1] Dvina, Desna and Volga are names of Russian rivers; presumably, Volkhov is as well.

[2] Initially, the earlier P-8 Dolphin (NATO: *Knife Rest*-A) or P-10 (*Knife Rest*-B or -C) radars were used instead of the P-12. These had ranges of 75 and 70 km, respectively.

once onto a single target. As soon as a target has been properly acquired by the fire control computer, a launcher is activated and the missile fired. Multiple missiles can be fired at six-second intervals. While missiles are in flight, the Fan Song radar tracks both them and the target, so that the fire control computer can calculate the necessary course corrections and transmit them to the missiles via a UHF radio link. This link is only projected into a relatively narrow beam, with the drawback that the missile must be inside the beam within six seconds of launch, else it will "go ballistic" and fly on without guidance (and will detonates 60 seconds later, as mentioned above).

The narrow guidance beam has another drawback in that the computer must keep both the missile(s) within it during their entire flight, which makes maneuvering the missile difficult. During the Vietnam War, for example, US aircraft crews knew they were safe from V-750 missiles if they could see them side-on, even if they were far away.

Service

The S-75 was introduced into Soviet service in late 1957, mostly in the western part of the country for defence of urban and industrial areas, with the exception of Moscow. It was soon in service with most of the Warsaw Pact countries for similar applications.

The first recorded kill by a V-750 missile was the highly-publicised incident in which the U-2 reconnaissance aircraft flown by CIA pilot Gary Powers was shot down over the Soviet Union on 1 May 1960; this took 14 missiles, of which at least one shot down a Russian MiG-19 interceptor aircraft instead.

China also uses the S-75, produced locally as the Hong Qian[3] ("Red Leader") 1 and 2. China was originally supplied with the weapon by the USSR, but due to political differences between the countries in the early 1960s, built a direct copy from Soviet-supplied manufacturing data as the HQ-1. The HQ-2 is an improved model, known to the United States as the CSA-1. Several sub-variants of this missile exist, with a suffix letter indicating the exact type; the HQ-2J is one of the most recent. Throughout the 1960s, these missiles were used against Taiwanese U-2 aircraft and American unmanned reconnaissance drones, shooting down several.

The S-75 was also deployed to Cuba, for the defence of the Soviet missile bases being built on the island in the early 1960s. These shot down another American U-2 in October 1962, at the height of the Cuban Missile Crisis.

In 1963, India had also received S-75 systems from the Soviet Union, and these were used for the defence of New Delhi in the Indo-Pakistan War of 1965; the only kill by an Indian V-750, however, was an Indian Air Force An-12 transport aircraft in an incident of friendly fire. The missiles were used again in the 1971 war between India and Pakistan.

A few years later, in 1965, S-75 systems were being set up in North Vietnam, and was soon shooting down US aircraft on bombing raids (the first being an F-4C Phantom of the US Air Force, on 24 July). However, it was the North Vietnamese missile sites that gave the US the data needed to produce electronic counter-measures against the

[3] Some sources call this weapon "Hong Qi" instead.

V-750 missile data

	V-750 & V-750V	V-750VK & VN	V-750M	V-750SM	V-750AK	*(SA-2F)*
Length	10.6 m	10.8 m	10.8 m	11.2 m	10.8 m	10.8 m
Diameters						
Body	0.50 m	0.50 m	0.50 m	0.50 m	0.50 m	0.50 m
Booster	0.65 m	0.65 m	0.65 m	0.65 m	0.65 m	0.65 m
Span						
Body main fins	1.70 m	1.70 m	1.70 m	1.70 m	1.70 m	1.70 m
Booster fins	2.50 m	2.50 m	2.50 m	2.50 m	2.50 m	2.50 m
Weight	2,287 kg	2,287 kg	2,287 kg	2,450 kg	2,450 kg	2,287 kg
Warhead	195 kg HE	195 kg HE	195 kg HE	195 kg HE	295 kg HE or 15 kT nuclear	195 kg HE
Maximum speed	Mach 3.5	Mach 4	Mach 4	Mach 4	Mach 4.5	Mach 4.5
Effective range						
Minimum	8 km	10 km	9 km	7 km	7 km	6 km
Maximum	30 km	34 km	43 km	43 km	43 km	55 km
Effective altitude						
Minimum	3 km	500 m	400 m	400 m	400 m	100 m
Maximum	22 km	30 km	30 km	30 km	30 km	30 km

V-750, through the use of remote-controlled drones equipped with measuring equipment.

In the 1967 Six-Day War between Egypt, Syria and Jordan on one side and Israel on the other, Egypt's V-750 missiles claimed two Israeli aircraft before being overrun or destroyed by the Israelis, or evacuated by the Egyptians. In the following years, Egypt received more missiles and used them extensively to shoot down several more Israeli aircraft. By the 1973 Yom Kippur War, both Egypt and Syria had S-75 systems, and used them to good effect until Israeli the counter-offensives either captured or forced the relocation of many sites. The system saw yet more use in the Middle East in the 1982 Israeli "Peace for Galilee" invasion of Lebanon, when Syrian V-750s were launched against Israeli fighter aircraft in the Bekaa valley in Lebanon.

Trumpeter kits box art. Top to bottom: 00204, 00205 and 00206

Iraq was also supplied with V-750 missiles, and used them in the 1991 Gulf War; many were captured by Coalition forces, and photographs of them in the desert abound. Whether any were fired in the 2003 Gulf War is unknown, but it seems likely.

Perhaps the most remarkable use of the V-750 was during the Bosnian civil war of the early 1990s. Due to the lack of aerial targets, Bosnian Serbs modified several missiles for use as artillery, firing them against Bosnian Muslim and Croat positions in late 1994. It is also likely that in the 1999 war in Yugoslavia, some missiles were fired against NATO aircraft by Yugoslavian forces.

Colours and markings

The V-750 missiles were usually painted white or a light metallic colour—note that they were painted this colour, as can be seen on the pictures in this net.book, not left in a bare metal finish. The outside of the weapon was covered in extensive black and red stencilling in Russian, in the same way most missiles and aircraft are. It is not known if the stencilling was adapted to the language of the country deploying the missile or not.

The launchers and transport vehicles were painted with whatever colours and schemes the owning nation used. In Soviet service, this means they were green; the exact shade of green is debatable, but appears to have varied a lot.

Some Iraqi V-750s had a "camouflage" sprayed over the metal colour using swirls of dark-coloured paint in varying patterns. Missiles used in Bosnia during the civil war may also have been camouflaged, possibly by spraying large parts with dark green over the base colour.

Airfix kit box art

The photos

All photos of the real missile in this net.book were taken in the American Air Museum hall of the Imperial War Museum Duxford, United Kingdom, in September of 2002. Although the exact missile type is unknown, they are of a V-750 with Russian markings on its transport trailer, displayed underneath the wing of a B-52 bomber aircraft.

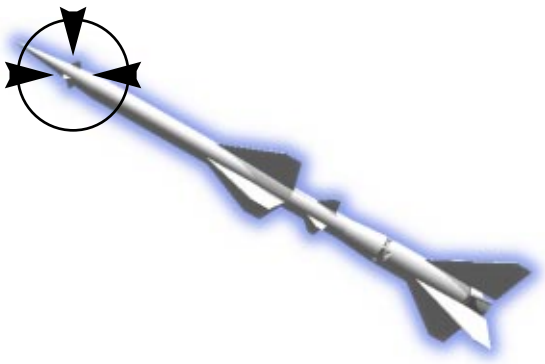
Modelling the V-750

The V-750 is easy to model nowadays thanks to three 1:35th scale kits released by Trumpeter in 2003. One is the missile on its launch platform (kit no. 00206); another the missile on a transport trailer like in the pictures of the real thing in this net.book, with a Russian ZIL-157 to tow it (kit 00204), and the third (kit 00205) is almost identical but has detail changes to represent a Chinese copy of the ZIL-157 truck and the HQ-2 missile. The basic missile kit can be built straight from the box and result in an excellent model that only needs a good paint job.

Staying with 1:35th scale, ADV/Azimut released a resin kit in the 1990s. It looks like a good kit, from photographs, but it is likely no longer in production because of the Trumpeter kits.

In smaller scales, Airfix in the 1960s or early '70s released a 1:76th scale kit that is now exceedingly rare, not in the least because the moulds are apparently either lost or too damaged for use. The kit contained a missile, launcher, truck and trailer, so in effect gave a complete overview of the whole weapon system, except for the radars.

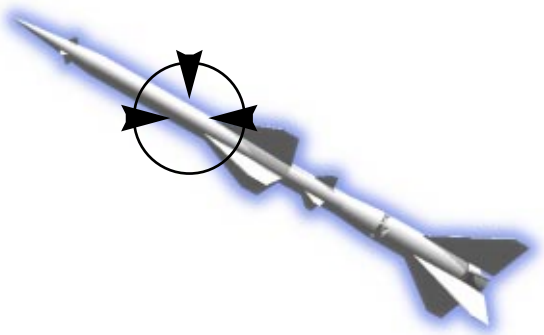
In 1:72nd scale, there is a resin kit by Planet Models (kit MV-16), though this consists of only the missile on its launcher. Going by reviews, it is accurate and well-detailed, and even in this small scale should make a fairly large model.



1 Nose cone

Although most of the missile has a simple tube shape with parallel sides, the nose obviously tapers to a point. A set of small, fixed fins is located close to the missile's tip.

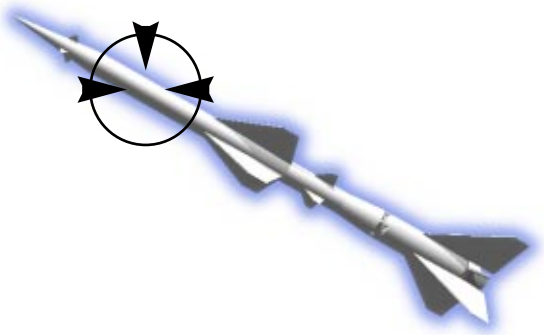
The transport trailer has a set of two tanks at the front; the small one appears to be a compressed air cylinder providing pressure for the larger tank, but their precise contents and function are unknown.



2 Transport clamp

The front end of the trailer's missile rail, with the cradle and bracket that clamps the missile to it. As with most high-tech weapons, the red bands on the missile indicate exactly where it may be clamped.

As can be seen by comparing this picture with photo 6 on page 13, both the booster and missile are marked with the same registration code, 11ДУ И839 (which transliterates to 11DU I839 in Latin letters).



3 Trailer sides

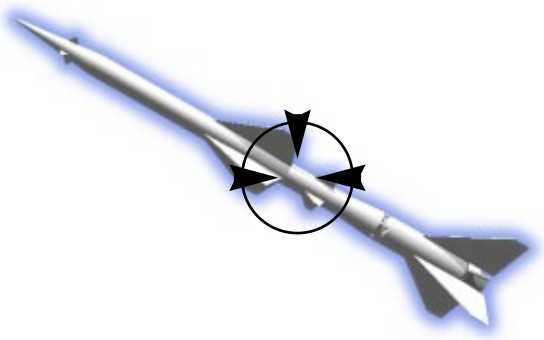
Some details of the transport trailer's left side, including the folding ladder for use by the reloading crew, which gives access to the work platform on the trailer's side.

The small wheels at the lower right of the picture are the front supports for the trailer, for when it is parked by itself.


2
ПДУ ИЗЭ

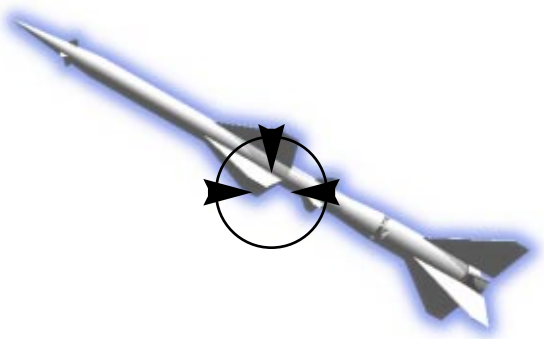

3
ПДУ ИЗЭ

4 Centre and rear fins

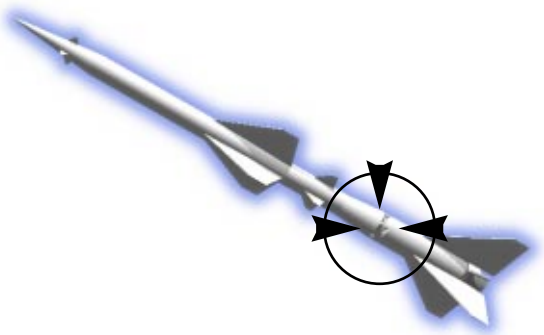


All the missile's fins are so-called cropped delta-wings, which is to say that they would be triangular in shape but have the tip "cut off". The large main fins are fixed, but the rear ones can turn from side to side along the pivot point at the centre of the fin's base, visible in the photo. The missile can be steered toward its target this way, by means of signals sent from the ground via a radio link.

5 Trailer centre



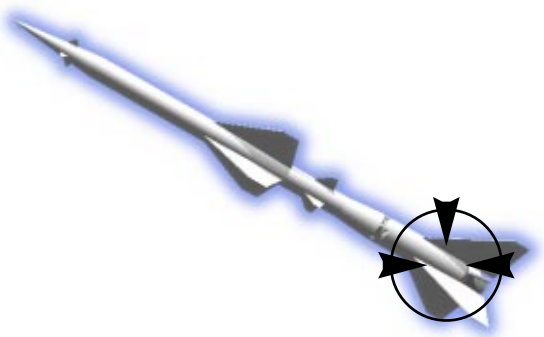
A better view of the trailer below the section of the missile shown in photo 4, above. The circular device, resembling an over-sized bear trap, is the track on which the rail can be swung to the side for reloading the launcher.



6 Booster joint

The missile is initially launched by means of a booster that drops off after 4.5 seconds of flight. It is connected to the main section of the missile by four struts, visible in this photograph. The booster is of greater diameter than the missile's main stage, so a tapered section sits between the two. It appears that this section is released together with the booster, since it is connected to the missile's rear fins by four connecting rods that probably prevent these fins from turning as long as the tapered section is on the missile.

The folding ladder here is not the same one as in photo 3 (on page 9).



7 Booster section

This photo shows all of the booster, with the rear fins. Although they may not seem very large, each fin has a width of over 90 cm, and the total span of the rear fins is 2.5 meters.

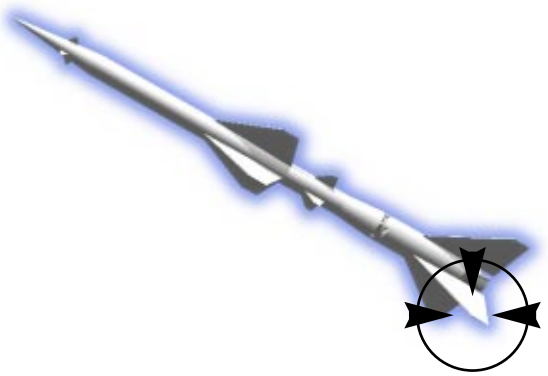

6
ПДУ И039
3917


7
ПДУ И039
15331
451228
A2

8 Trailer wheels

The trailer has only one axle, with a single wheel on either side. The top of each wheel-guard has a ridged, anti-slip surface, as does the work platform that sits behind it.

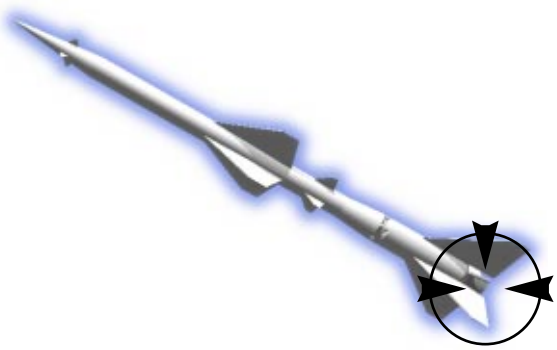
Notice that the wheel hubs have been painted without masking the tyres.

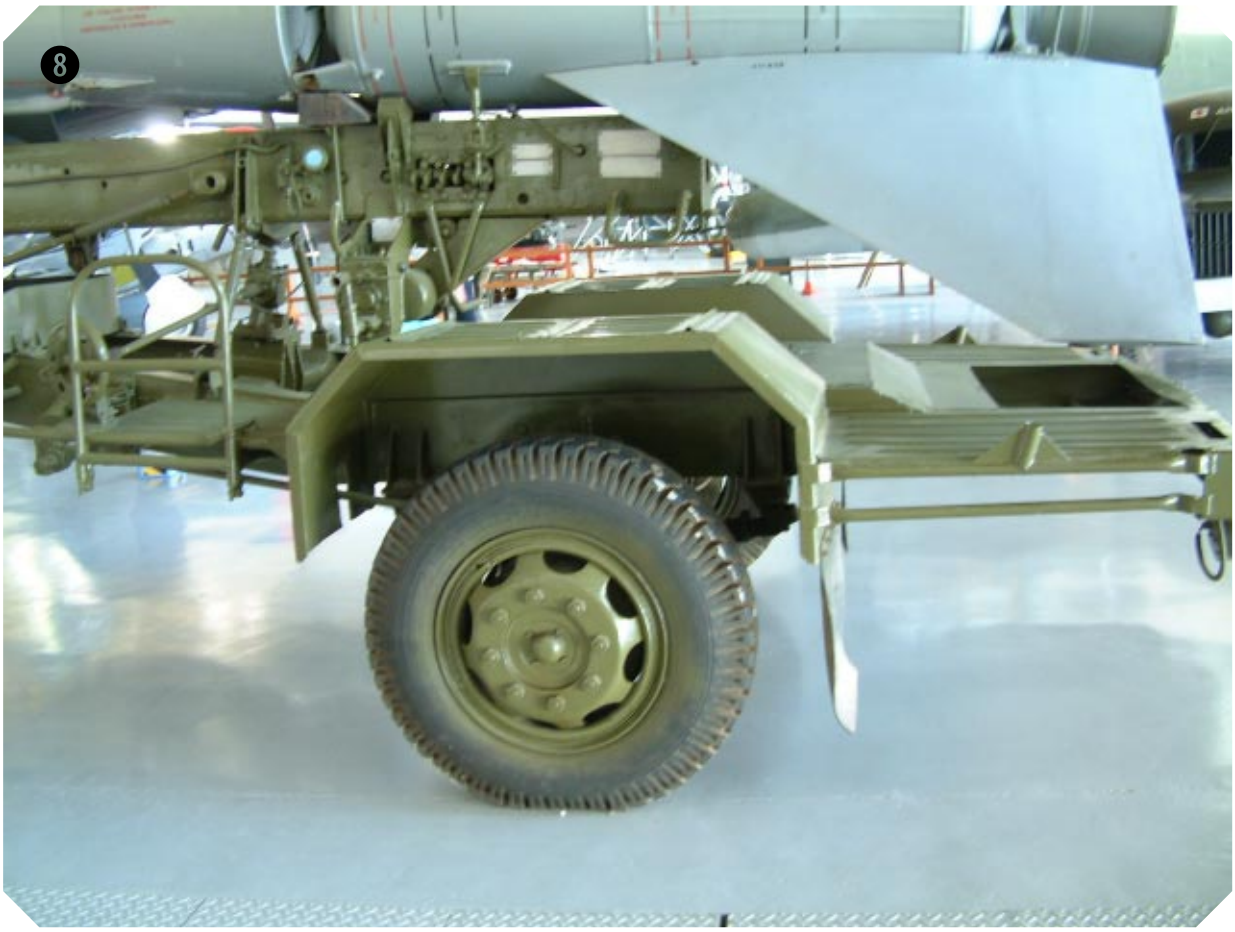


9 Tail end

The solid booster has a conventional exhaust for a rocket motor, with a bell- or cone-shaped nozzle. Note the control linkages set around it, and that only two of the booster's fins have movable control surfaces. The two are virtually identical apart from small details; the actuator rod visible on the top left fin is also present on the lower right one, but on the opposite side.

The black aircraft above and behind the missile is a US Air Force B-52 bomber, one of the main targets of the V-750 in the skies over Vietnam in the 1960s and '70s.




8


9