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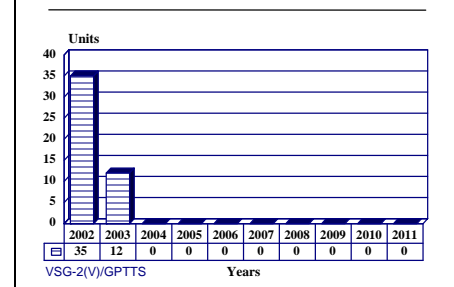
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VSG-2(V)/GPTTS - Archived 03/2003

Outlook

- More advanced systems such as the Commander's Independent Thermal Viewer (CITV) have overtaken market
- Barring any future activity, this report will be archived next year, 2003

10 Year Unit Production Forecast
2002 - 2011



Orientation

Description. Thermal imaging infrared night sights.

Sponsor

US Army

Armament Munitions & Chemical Command

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(Program management)

Contractors

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(GPTTS)

Status. In production and service. An estimated 2,043 GPTTS systems were produced through the end of 2001.

Application. The VSG-2 was designed for installation in M60 tanks to convert them to the M60A3TTS standard. The VSG-2 has also been fitted to Turkish M48A5s. The GPTTS is a newer version of the VSG-2 fielded on South Korea's Type 88 MBT and Taiwan's M48H Brave Tiger conversion. South Korea's K1A1 tanks carry the GPTTS.

Price Range. The unit price of the VSG-2 is approximately US\$97,000, in unadjusted 1988 dollars, based on a General Accounting Office (GAO) report published that year. The price of the GPTTS is approximately US\$230,000, based on a 1993 contract for South Korea.

Technical Data

Design Features. The four major components of the VSG-2(V) are the sensor head (28.86 kg/63.62 lb), the gunner's display (15.23 kg/33.58 lb), the commander's display (16.36 kg/36.07 lb), and the power converter

(11.14 kg/24.56 lb). Total system weight is 71.6 kilograms (157.8 lb).

Daylight channel parameters:

- When using a magnification of 1x (unity power) and a window eyepiece, the field of view is 10° x 21°. When using eight power (8x) and a monocular eyepiece, the field of view is 8°.

Thermal channel parameters:

- Narrow field of view: 2.58° x 5° with an effective focal length of 10.67 inches. Wide field of view: 7.74° x 15° with an effective focal length of 3.56 inches. The detector is a cadmium mercury telluride type with 120 elements and a spectral wavelength of 7.6 to 11.75 micrometers (DT-617/UA). The gunner and commander's displays use a 40 mm image intensifier tube with a bi-ocular eyepiece.

Operational Characteristics. The VSG-2 Tank Thermal Sight (TTS) was developed to upgrade the M60 tank's night and poor-visibility weather fighting capability. It replaces the M35E1 Passive Sight which, while demonstrating tolerable capability at night, was rendered ineffective by fog, mist, and smoke.

The VSG-2 TTS is able to penetrate smog and smoke both night and day, and also is able to see at night regardless of the amount of existing light. The emphasis on night fighting, including the use of organic smoke emitters, makes the VSG-2 a major step in the right direction. The TTS collects the infrared images given off by all natural objects and is able to distinguish between those and hostile tanks. The system is completely passive and thus its use is virtually undetectable.

Variants/Upgrades

VSG-2 Upgrade. The TTS underwent an optical performance enhancement to incorporate advances in thermal imaging and visible optics technology. Central to this upgrade was the replacement of the DT-617/UA detector/dewar assembly with the optically improved 120-channel detector/dewar, designated the DT-636/UA. The DT-636/UA was the latest in a series of improved thermal common modules for US Army electro-optic systems.

GPTTS. The Gunner's Primary Tank Thermal Sight (GPTTS) is derived from the VSG-2. The GPTTS is similar to the VSG-2, but capabilities are enhanced. Differences include two-axis stabilization of the line-of-sight and increased elevation limits (+22° to -60°). Fields of view are basically the same.

There is an option to incorporate a charge-coupled device (CCD) camera, which has a through-the-sight video-recording feature. This capability has application for training purposes and could eventually be used for remote operation of the sight.

The South Korean GPTTSs include a low-cost TI CO₂ laser that can generate up to three pulses per second without overheating. They also feature a multiple target return indicator and first- and last-pulse logic. The target rate can be generated by using the rapid-pulse mode. The GPTTS integrates the laser internally, resulting in a larger aperture/longer range than would normally be possible when using a stand-alone laser. Common boresighting is another advantage of this type of setup.

Program Review

Background. Development of the VSG-2 sight began in 1972. Hughes Aircraft (now Raytheon) offered its Turret Integrated Night Thermal Sight (TINTS), which employed a high-speed serial scan. Texas Instruments offered its TTS, which used a low-speed parallel scan and a different signal-processing technique. After developmental tests in 1976, Texas Instruments (now Raytheon) was awarded a contract to develop the engineering models for the tank sight.

The VSG-2 was adopted for the M60A3 in June 1978, replacing the gunner's M35E1 passive image intensification sight. With the addition of the VSG-2, the tank received the designation M60A3TTS. Fielding of the new gunner's sight began in August 1979. In addition to the TTS, the M60A3TTS featured, among its

several improvements, a new ruby laser rangefinder and a solid-state ballistic computer, designated the VVG-2 and M21, respectively.

The M60 series main battle tank's production ran from 1960 through 1985. A total of 15,914 M60s of all types were produced, with 13,290 remaining in service as of the early 1990s. The US Army originally planned to equip only 3,676 of the 8,900 M60s in inventory with the VSG-2. This was later increased to 7,352, then dropped to 5,400.

Among the larger foreign customers, Turkey purchased 760 conversion kits for the M48A5s in its inventory in 1985. These kits consisted of VSG-2s, add-on stabilization, solid-state ballistic computers, and associated defense services. The total estimated cost was US\$206

million. A contract for spare parts, valued at US\$8.9 million, followed in July 1991.

Taiwan procured 560 GPTTS kits for its indigenous M48H Brave Tiger program, which combines M60 hulls with M48 turrets. Altogether, some 11,703 M48s have been produced, with approximately 8,627 still in service.

The GPTTS has been fitted on board the Republic of Korea's Type 88 tank, a new vehicle that was developed with the assistance of General Dynamics as a replacement for Korea's old M47/M48 tanks. Although Hughes (now Raytheon) originally supplied a comparable system, based on one used in the M1 tank, the South Koreans awarded TI a US\$50 million contract in September 1987 for three years of GPTTS production. One reason for the Koreans' switch could have been that while both the Hughes M1 Thermal Imaging System and TTS used the same DT-617/UA 120-channel detector arrays at the time, the latter was considered to be superior in image detail.

TI (now Raytheon) had problems integrating the GPTTS with the Type 88's other systems; however,

these were reportedly not caused by any failing of the GPTTS itself. The company was awarded a follow-on US\$61 million three-year contract in April 1993 by Samsung Electronics (responsible for final assembly) for 263 GPTTSs. The contract included two GPTTS kits that were to be modified for testing with the next-generation version of the tank, the K1A1.

The VSG-2's last known US application was a priority upgrade to install the TTS on about 60 M551A1 Sheridan light tanks deployed with the 82nd Airborne Division during Operation Desert Storm. It is assumed that these units were pulled from existing stocks for the Sheridans.

With no new contracts reported since 1993, and production for the South Korean order scheduled to be complete by 2003, it appears that overall production of GPTTS is coming to an end. Any remaining production would be for spares and replacements only. Also, the advent of newer, more advanced systems such as Raytheon's Commander's Independent Thermal Viewer (CITV) have seriously cut into the market for VSG-2/GPTTS.

Funding

Funding for any VSG-2/GPTTS spares activity is not broken out in US Army PEDS.

Recent Contracts

No new contracts have been awarded.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	FY76	Texas Instruments awarded contract to develop tank sight
Mid	1979	VSG-2 replaces gunner's passive night vision periscope on the M60A3
	FY79	M60A1-to-A3 tank thermal sight conversion program initiated
	FY81	First conversion
Dec	1985	DoD announces that Turkey will procure 760 VSG-2 for its M48A5s
	FY86	TI receives US\$69 million contract to supply GPTTS systems for the South Korean K-1 MBT; start of TTS Optical Performance Enhancement Program
	FY87	Last conversion kits for US Army procured; proposed sale of 150 modification kits for upgrade of the Saudi Arabian M60A1 to the A3TTS configuration
	FY87	Congress notified of proposed sale of 150 modification kits to upgrade Saudi Arabian M60A1 to the A3TTS configuration
Apr	1993	US\$61 million follow-on contract for GPTTS
	FY96-97	Three prototype K1A1 tanks delivered to South Korea
	FY97	Texas Instruments Defense Systems and Electronics Group becomes Raytheon TI Systems
	FY98	Production of Type 88 tanks completed
	2003	Production of GPTTS for South Korea scheduled to be completed

Month Year Major Development

Worldwide Distribution

Users of the VSG-2 on M60A3 tanks include the **United States, Egypt, Greece, Saudi Arabia, Spain, and Tunisia**. It has also been fitted to **Turkey's** M48A5 tanks.

The GPTTS is in service with **South Korea** on Type 88 and K1A1 tanks, and with **Taiwan** on M48H Brave Tigers.

Forecast Rationale

The last known contract for the US Army's VSG-2/GPTTS (Gunner's Primary Tank Thermal Sight) was awarded in the early 1990s. While nearly 8,000 VSG-2 systems have been produced and widely distributed among fighting forces in several countries and approximately 272 GPTTS systems have been produced for South Korea, it appears that the line is at long last coming to a halt. While age is certainly one factor in the system's demise, another cause is clearly the rise of newer, more advanced systems.

The VSG-2 is a Tank Thermal Sight that was initially very well received by the US Army because it enabled vehicle operators to see through smoke, haze and night. GPTTS is the newer version of the VSG-2 which was widely distributed in the US and NATO countries as a

component of the M60A3, and has been installed on South Korea's Type 88 main battle tank (MBT) and its next-generation K1A1 tanks, as well as on Taiwan's M48H Brave Tiger conversion.

After a series of 1990s corporate mergers, Raytheon emerged as the lead contractor for VSG-2/GPTTS. Now the company offers the Commander's Independent Thermal Viewer (CITV) which is in the midst of high-rate production and has subsequently overtaken the market for these types of systems. With the possible exception of very low-rate production for spares and replacements, the 10-year outlook for VSG-2(V)/GPTTS is indicative of a system that has largely been replaced. Barring any future activity, this report will likely be archived next year, 2003.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

Designation	Application	Thru 01	High Confidence Level				Good Confidence Level				Speculative		Total 02-11	
			02	03	04	05	06	07	08	09	10	11		
GPTTS	K1A1 (SOUTH KOREA)	272	35	12	0	0	0	0	0	0	0	0	0	47
GPTTS	Prior Prod'n:	1771	0	0	0	0	0	0	0	0	0	0	0	0
VSG-2	Prior Prod'n:	7890	0	0	0	0	0	0	0	0	0	0	0	0
Total Production		9933	35	12	0	0	0	0	0	0	0	0	0	47