

## Seeing-Eye Bombs

**Television-guided ordnance—not a new idea** BY BARRETT TILLMAN

In 1908, novelist H. G. Wells wrote *The War in the Air*, anticipating aerial fleets scourging enemy populations with weapons of undreamt power and accuracy. As an amateur scientist, he probably knew something about cathode-ray tubes, although he probably did not realize how they would ultimately influence aerial warfare.

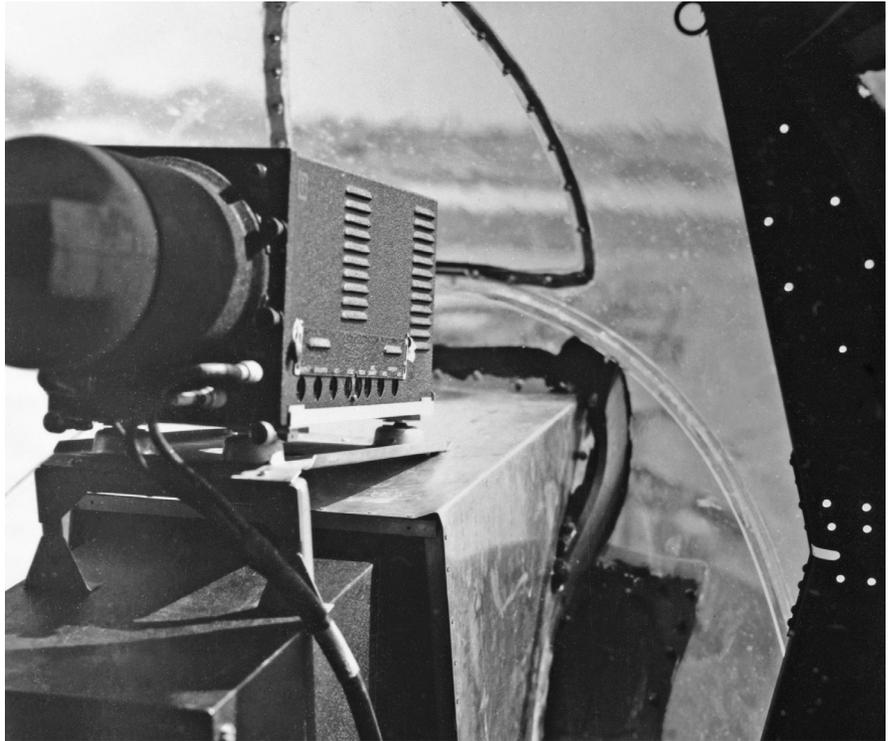
### A century en route

Experiments with cathode-ray tubes began in Europe circa 1897, with the first practical television transmission in Japan in 1926. Germany began thrice-weekly broadcasts in 1935, with America's first commercial broadcast the following year. Regularly scheduled broadcasts in the United States began in 1939.

American ordnance engineers recognized the potential of TV guidance, especially in the era when heavy bombers did well if they put half their bombs within 1,000 feet of the aim point. The U.S. Army Air Force's GB-4 was based on the one-ton GB-1's flight surfaces and warhead with TV camera and remote guidance. First deployed against German submarine pens in France during 1944, it required good weather, but the bomb was insufficient to dent the huge concrete structures.

A better-known alternative was Project Aphrodite, converting war-weary heavy bombers into drones packed with explosives. A pilot and weapons expert took off in the laden bomber, accompanied by a guidance aircraft. Once the plane leveled off, the bomber pilot released control to the "mother ship," whose drone controller viewed the bomber's instrument panel via TV. The ordnance man armed the explosives, and both crewmen bailed out over England, allowing the bomber and controller to proceed as briefed. A nose camera in the bomber allowed the controller to guide the "air vehicle" to the target.

Fifteen Aphrodite missions were launched from Britain between August 1944 and January 1945, targeting German facilities in northern Europe. The missions involved two dozen aircraft, of



**Above:** Television came to combat in the nose of this Aphrodite B-17. Taking advantage of the clear optical glass pane, usually reserved for the Norden bombsight, the camera's unblinking eye gave drone operators a view to a kill, although results were not decisive. (AAF photo via Frederick A. Johnsen) **Below:** Aphrodite B-17F number 0353 bears three German kill signs from its previous life in combat. In addition to the nose-mounted television camera, this B-17's forward crew door has been removed and a wind deflector mounted to ease the exit of the crew while bailing out. Aphrodite Forts were set up to spew a smoke trail from a tank, enhancing the drone controller's view of the drone. The 0353's final flight came on Dec. 5, 1944, in a weather-thwarted attack on the marshaling yard at Herford. Directed to an alternate at Haldorf, the 0353 and one other Aphrodite Fort came to earth outside the target area. (AAF photo via Frederick A. Johnsen)





Interstate TDR-1 "Edna III" assigned to STAG-1 is readied for a practice mission at "Sunlight" fighter strip on Bakina Island. The next day (July 30, 1944), she and three others bombed a Japanese freighter beached on a Guadalcanal beach. Schwinn Bicycle built the steel tube fuselage, wings were wood, and the engines were 220hp six-cylinder Lycomings. The controller was usually in a TBM following behind. (Photo courtesy of Jack Cook)

which about 15 crashed, exploded prematurely, or were shot down by flak. No worthwhile targets were destroyed.

At least four Aphrodite fliers died, including the U.S. Navy crew of Lt. Joseph P. Kennedy Jr. and his ordnance man, Lt. Wilford J. Willy. Their Liberator exploded in flight, possibly due to stray voltage.

The Navy's Interstate TDR-1 was an alliance with RCA, and was first flown in 1942: a twin-engine "assault drone" with a cockpit for ferry and training use. About 200 were built with one operational unit, Special Air Task Group One, briefly committed to combat in the upper Solomon Islands in late 1944. Guided by controllers in TBM Avengers, about 50 TDRs were launched, with a claimed hit ratio of some 60 percent. They also dropped ordnance by remote control rather than dive into designated targets.

During the Korean War, drones, such as the modified F6F-5 Hellcat, were briefly used, but they were visually guided. The future beckoned.

## Vietnam

In the jet age, precision guidance became more realistic. The late-'50s Bullpup was first mass-produced guided weapon, a line-of-sight, command-guided rocket that set the stage for other weapons.

Electro-optical guidance meant television, which advanced significantly after World War II. The U.S. Navy's AGM-62 Walleye glide bomb entered service in early 1967, with small wings providing a limited control capability. The Walleye was "an all-up round," intact by itself without an attachment kit to an existing bomb. The 850-pound warhead was expected to penetrate 18 inches of reinforced concrete.

Before launch, the pilot aligned the TV seeker head with the target, achieved a lock-on, and released the weapon. Although requiring a fairly lengthy, straight-in approach, the early "fire-and-forget" weapon was favored by tactical aviators, who did not have to maintain guidance to impact, as with a laser-guided weapon.

The A-4 Skyhawk was the Walleye's "designated hitter," first employed against



Several U.S. Navy and Air Force fighters could carry the AGM-65 Maverick. According to Navy and Air Force records, the AGM-65 hit 85 percent of its targets. They could be used for targets up to 13 nautical miles at medium altitudes. (Photo by Mike Harrison via Warren Thompson)



This F4E from the Third Bomb Wing is dropping a GBU-15A (Mark 84) missile sometime in 1985. It is a glide weapon used to hit high-value targets. This was an outstanding weapon when used in Operation Desert Storm. It came into military service in 1975, too late for Vietnam. (Photo courtesy of Warren Thompson)

the notorious Thanh Hóa Bridge in March 1967. All three AGM-62s released hit within five feet of the aim point, but their warheads were too small to affect the monolithic structure. Used against lesser targets, such as buildings and bunkers, the Walleye was a proven asset.

Commander Jack Woodul, a combat-experienced Skyhawk pilot, recalls, “The predictable flight path waiting for the bugger to lock onto a contrasting point was almost as much fun as flying predictably while trying to guide a Bullpup, which always went ballistic anyway.”

U.S. Air Force fighter wings received the Walleye later that year, but time ran out, with President Lyndon Johnson’s ill-conceived bombing halt in early 1968.

Near the end of the Vietnam War in 1972, the 2,000-pound Walleye II was

employed with considerable success. It still needed, however, the often-dangerous straight approach in the world’s most experienced air-defense net. An answer was found in a data link that allowed a second aircraft to guide the weapon from standoff distance while the “shooter” aircraft evaded.

The U.S. Air Force deployed an electro-optical guidance kit for the Mk 84 one-ton bomb, called “HOBOS” (for Homing Bomb System). Early use in 1969 was promising, and when the war “Up North” resumed in 1972, HOBOS was widely used. The famed Eighth Tactical Fighter Wing claimed more than 100 bridges destroyed with HOBOS and laser weapons, achieving more than than 50 percent hits.

Throughout the war, the United States

dropped nearly 27,000 guided weapons, the huge majority being laser guided.

## Post-Vietnam

The Arab-Israeli War of 1973 involved TV weapons, including the Walleye I and HOBOS, especially against Egyptian armored units. Under sunny skies and frequently a condition of air superiority, Israeli aircrews could optimize their chances for destroying a variety of targets. Postwar Walleye evaluation showed a hit ratio of more than 90 percent, while HOBOS was pegged at nearly 80 percent.

In 1974, U.S. Air Force “ordies” began work on the GBU-15 for adaption to the Mk 84 free-fall bomb. It had improved aerodynamics, affording greater range, and used a data link for more flexibility. Originally developed with TV guidance, it included an imaging infrared seeker, as well. The TV-guided version was deployed in 1980, with ample preparation time for training F-111 crews long before Operation Desert Storm in 1991.

TV-guided GBU-15s were severely limited (fewer than 100 were used) but were credited with shutting down Saddam’s vicious retribution by releasing oil into the Persian Gulf.

During Desert Storm, the U.S. Air Force launched 15,500 precision-guided munitions (PGM) among more than 200,000 total weapons. But the 8.5 percent PGM figure dwarfed the 1 percent figure from Southeast Asia.

Today’s PGMs are mostly laser guided, but television played a significant role in “the precision revolution.” ✚



The AGM-65D replaced the electro-optical guidance with an imaging infrared system, which doubled the practical firing distance and allowed it to be used at nighttime and during bad weather. This weapon became available in 1983 and was used widely in Desert Storm. (Photo courtesy of Warren Thompson)