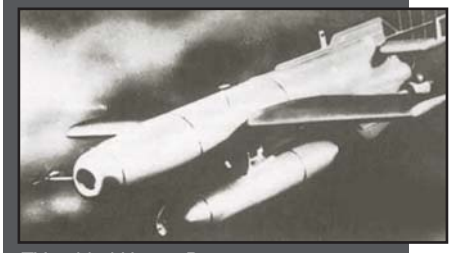
MILE STONES

Early Operations using Smart Bombs

Dr Carlo Kopp

Dornier Do-217K-3 armed with Hs-293A glidebomb.

Heinkel He-111H performing a trial drop of the Hs-293A.



TV guided Hs-293D.

When Saddam's Iraq lost the 'Mother of all Battles' in 1991, under a deluge of coalition smart bombs, the world got its first mass media introduction to the potency of this combat technology, presenting the public at large with images of what was thought to be a development of great novelty. Alas, six decades of history show that smart bombs - precision guided munitions - played a significant role in military campaigns as far back as 1943.

The origins of guided bomb technology fall into the immediate pre-World War II period and the early years of the war when US and German researchers independently pursued their own PGM research. This was the era of vacuum tube electronics, and these farsighted researchers appreciated the potential in a guided weapon, which uses electronics to steer it to impact.

Many experimental or prototype designs were built both in the US and Germany but of these only a handful of designs were deployed operationally, often with remarkable combat effect.

These new arrivals were the Luftwaffe's Henschel Hs-293 rocket propelled glidebomb, the Ruhrstahl PC 1400X armour piercing guided bomb, and the US Army Air Corps' VB-1 Azon radio controlled bomb.

Henschel's Hs-293 Glidebomb

Henschel's Hs-293 family of glidebombs were the first guided bombs to be used in combat, and the first to enter advanced development.

Henschel's development team started development in 1939 using a glidebomb concept devised in 1937 by Gustav Schwarz Propellerwerke. This concept evolved through the Hs-293V-1 and Hs-293V-2/FZ21 to the Hs-293V-3, tested in mid-1940. The unpowered Hs-293V-3 lacked the terminal velocity to punch through the skin of a warship, which was the intended target type for these weapons, and this led to the decision to add a rocket booster to increase speed and range. The Hs-293A-0 was the preproduction configuration using a Walter HWK-109-507B hydrogen peroxide rocket booster pack.

The basic warhead for this weapon was the Luftwaffe's standard 500 kg SC-500 (Sprengbombe Cylindrisch) thin-walled bomb casing fitted with an impact fuse. This warhead was later shown to be a major limitation, with best effect against small surface warships and transports.

In operational use, the launch aircraft would send steering commands via a FuG-203 Kehl III radio transmitter, received by the FuG-230b Strassburg receiver in the bomb, generating steering commands for the control actuators. The HS-293 had the first air launched Command to Line Of Sight (CLOS) guidance system ever used. A red coloured flare on the tail of the weapon was used to cue the operator when steering the weapon. Performance claims include a glide range of 11 km for a 3,300 ft AGL release, and speeds between 235 and 486 KTAS.

The Hs-293 was deployed operationally with KampfGeschwader 100 (KG 100) in the Mediterranean and KampfGeschwader 40 (KG 40) in France for anti-shipping strike operations.

The Luftwaffe's interest in guided bomb technology stemmed from the strategic pressures it was facing, attempting to cripple Britain by maritime blockade. While the U-boot fleet occupied the limelight in the propaganda war, the Luftwaffe played an increasingly important role in providing not only wide area maritime surveillance, but also armed maritime reconnaissance patrols and air strikes against detected shipping.

Two Luftwaffe units gained prominence in the maritime air war. The foremost of these was KampfGeschwader 40, home based at Bordeaux-Merignac in France, eventually growing to five Gruppe formations. The first, I. Gruppe, was equipped with four-engine FW-200C Condor maritime patrol aircraft, supplemented by twin-engine He-111H bombers and later replaced with four engine He-177 Greif bombers; the second II. Gruppe, initially equipped with twin-engine He-111H and Do-217K bombers, later replaced by He-177; and the third III. Gruppe, equipped similarly to I.Gruppe, IV. Gruppe equipped with FW-200C, He-111H and Do-217K bombers, later replaced by He-177; and finally V. Gruppe equipped with Junkers Ju-88C 'Zerstorers' - a night intruder unit. Most of KG 40's operations were flown over the Atlantic.

KG 40's sibling unit, KG 100, started as bomber formation, with heavy involvement on the Eastern front. Its four Gruppe formations, equipped with a mix of He-111H and Do-217K bombers, deployed to the Mediterranean early in 1943 in an attempt to

cripple increasingly effective Allied naval operations in that theatre. KG 100 was later re-equipped with the He-177.

The statistics of this effort are sobering. KG 40 Condors sank 90,000 tonnes of shipping between August and September of 1940, and a month later crippled the 44,000 tonne transport Empress of Britain. They are credited with 363,000 tons of shipping destroyed by January 1941. Luftwaffe totals between March and May 1941 sit at 179 ships sunk for a total tonnage of 545,000. It is little known that the Luftwaffe mostly outperformed the U-boats in interdicting Murmansk convoys, accounting for up 37 per cent of losses. One oft cited example is an attack in February 1941 when five KG 40 Condors sank five ships in a sixteen vessel convoy, in minutes.

As the Allies suffered increasing losses, increasingly desperate measures were adopted, including 'expendable' catapult launched Hurricane fighters. Anti-aircraft artillery defences were introduced on merchant ships and escorts.

The Luftwaffe saw its new rocket propelled Hs-293 as a weapon that allowed attacks on shipping from well outside the defensive envelope of shipboard artillery defences, with the precision to ensure a hit on a moving and manoeuvring surface target.

The first known combat use of the Hs-293 was on August 25, 1943 when KG 40 Do-217 bombers attacked a Royal Navy U-boat patrol in the Bay of Biscay. This attack damaged the HMS Landguard and HMS Bideford. Two days later a strike by 18 KG 40 Do-217s sank the corvette HMS Egret, killing 194 sailors, making this the first known sinking of a ship by a guided bomb. The HMCS Athabaskan was damaged in this attack.

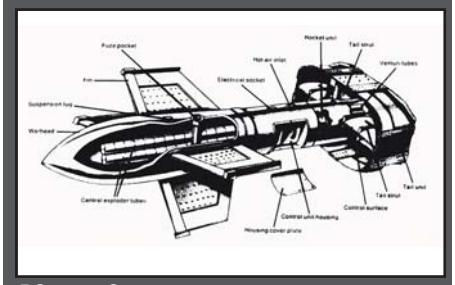
In 1944, after the D-Day landings, Do-217 aircraft used the Hs-293 to attack bridges at River See and River Selume on the Cherbourg Peninsula in an attempt to stall the Allied advance from the bridgehead.

Other claimed casualties for the Hs-293 include the Royal Navy frigate HMS Jervis, damaged in January, 1944; the destroyer HMS Intrepid sunk in the Aegean, September, 1943; the destroyer HMS Inglefield sunk in February, 1944; the destroyer HMS Boadicea sunk in June, 1944; and the Greek destroyer RHS Vasillisa Olga, sunk in September, 1943. The weapon is credited with a total of 400,000 tonnes of sunk shipping, including the Liberty ship Elihu Hale sunk and LCT-35. UK sources claim that 2,300 Hs-293s were launched in combat operations.

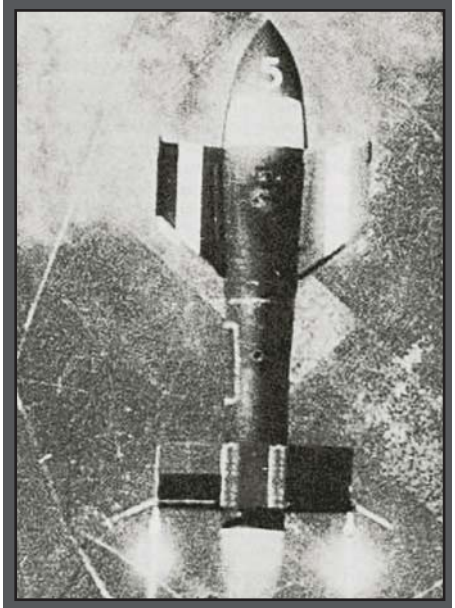
The novelty and complexity of the Hs-293 were reflected in frequent hardware failures and manufacturing faults, resulting in what German sources claim was a dud rate of 28 per cent per launch for KG 40 and 25 per cent for KG 100, against a successful hit rate of 31 per cent for KG 40 and 55 per cent for KG 100. The Fw-200 Condor, He-177 Greif, He-111H and Do-217K carried the Hs-293.

The Hs-293A series was compromised when Allied forces captured, intact, crated Fritz-X and Hs-293 hardware at Foggia airfield, and were able to devise a radio command link jammer, rapidly built and deployed to fleet units.

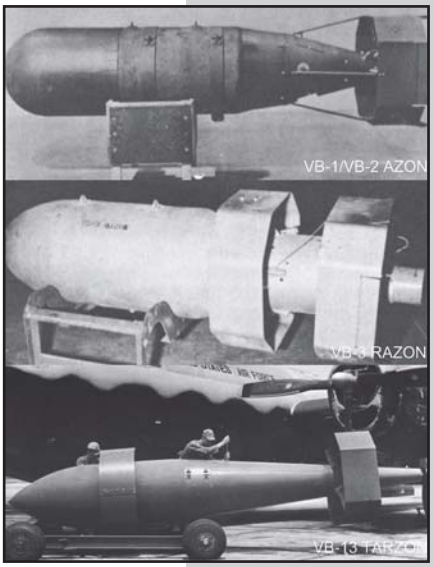
The late model Hs-293D was an important milestone since it introduced a nose mounted television camera and radio uplink to the launch aircraft, the aim being for the bomber to attack through overcast weather conditions. German sources claim 255 were built, and at least one source claims a Royal Navy warship was hit by a Hs-293D. The Hs-293 proved to be a very useful weapon, and it is unfortunate that its major operational contribution to World War II is so frequently overlooked.



PC-1400-Cutaway



Trial drop of an SD-1400X Fritz-X glidebomb.



VB-Series-PGMs.

Ruhrstahl's SD-1400X `Fritz-X' Heavyweight

Development of the SD-1400X started in 1939, led by Dr. Max Kramer of the DVL (German Aviation Research Institute / Deutsche Versuchsansalt fuer Luftfahrt). While the PC 1400X shared the FuG-203 Kehl III / FuG-230b Strassburg guidance package with the Hs-293, it was an entirely different weapon, based on the PC 1400 `Fritz', a 3,000 lb class armour and concrete piercing bomb, which carried 320 kg of Amatol explosive.

The new SD-1400X used a cruciform wing, angled at 28 degrees, and a segmented annular tail, with electromagnetically activated spoilers for pitch and yaw control. The operator tracked the weapon through the standard Lofte 7 bombsight, using a smokeless white/blue tail mounted flare or lamp.

The SD-1400 delivery profile involved typically overflight at 20,000 ft AGL, bomb release after throttling back, with the bombardier then using a joystick to steer the bomb until impact. The Fritz-X proved to be a devastating weapon when used effectively. During the September Salerno landings in Italy, the Brooklyn class light cruiser USS Savannah was hit by a Fritz X, killing nearly 200 crew members and putting the ship out of use for 12 months.

On 16 September 1943 the Queen Elizabeth-class battleship HMS Warspite sustained heavy damage after taking three hits by Fritz X rounds. One of the rounds penetrated six decks through to the No 4 boiler room and produced a hole in the bottom of the hull. This crippled the Warspite, killed nine crew and put it out of action until the Normandy landings.

The 42,000-ton Italian Vittorio Veneto class battleship Roma commissioned in 1940 was much less fortunate than the Warspite and Savannah, and represents the highest value kill achieved by KG 100 using the Fritz-X. The Roma sank on the 9 September 1943 after fires caused by two Fritz-X hits ignited her magazines, killing over 1600 sailors, including the Regia Marina Commander in Chief Admiral Carlo Bergamini.

The Roma has the dubious distinction of being the first capital ship to be sunk by a guided bomb. Other casualties included the Brooklyn class light cruiser USS Philadelphia, which lost several crew to a Fritz-X attack.

The Bellona class light cruiser HMS Spartan was sunk off Anzio on 29 January 1944 after a Fritz-X attack (some sources claim a Hs-293 attack but the extent of the damage makes this unlikely). Forty-six personnel died.

The Fritz-X was also claimed to have been used in an attempt to destroy the Selune river bridge at Pontaubault, a critical link between Brittany and Normandy, to stop the advance of the US 6th Armoured Division, on 7 August 1944.

Most reported deliveries of the Fritx-X were by Do-217K-3 or He-177 aircraft of KG 40 and KG 100.

While the Fritz-X was a far more effective weapon than the Hs-293, it was shorter ranging and demanded higher operator skills. Around 1400 Fritz-X rounds were built, with around half expended in trials and training. The closest contemporary analogues to these weapons are the US EGBU-15 and AGM-130, carried by the F-15E.

ATSC VB-1/VB-2 Azon and VB-3/VB-4 Razon Guided Bombs

The VB-1/VB-2 Azon series were the first US guided bombs to be used operationally. The VB-1 Azon ('Azimuth Only') was a radio command link controlled tail kit attached to a standard M44 and later AN-M65 1,000 lb bomb body. It entered production in 1943.

The Azon could only be steered in azimuth and thus its range error on delivery was similar to a dumb bomb. The Azon kit was produced until November 1944 by which time 15,000 units were built.

The Azon was deployed in the ETO from February, 1944, initially trialled by the 8th AF 458th BG flying B-24Js against Seine river bridges in France. It attacked ammunition dumps at Kropp and the Ravenstein rail bridge in Holland. It was also adopted by the 15th AF, operating primarily in Southern Europe.

The most notable 15th AF attack using the Azon was a 25 March 1944 strike to cut the Avisio viaduct and close the critical Brenner Pass, which connects Italy and Austria, thus cutting a key supply route for the Wehrmacht in Italy. The Azon was used in attacks on the Danube River locks, with repeat attacks on the Ancona-Rimini railroad line.

In Burma, the Azon was deployed on B-24s of the 10th AF. The Burmese campaign was characterised by difficult terrain, and the Japanese relied heavily on the use of wooden bridges to connect their railroad network. These were difficult to hit and heavily defended by guns.

Azons destroyed 27 of these bridges using a total of 493 rounds. The destruction of the famous Kwai River bridge has been credited to Azon armed B-24s but some sources dispute this.

Heavy Japanese defences prompted the USAAF to equip some dual-seat P-38 Lightning 'droop snoot' lead bombers with Azon transmitters. This permitted B-24s delivering Azons to evade fire as soon as the Azons were dropped, with the more survivable P-38 guiding the weapons to impact. This technique was later revived as the 'master bomber' scheme, using laser-guided bombs.

In parallel with the Azon, ATSC developed the more sophisticated Razon, which used a dual channel control link for range and azimuth guidance. The VB-3 was based on the 1,000 lb and VB-4 the 2,000 lb warheads. The Razons used two tandem annular wing assemblies, the aft assembly used for control.

Around 3,000 Razons were built during 1945 but the weapon did not see significant use until the Korean conflict.

The North Koreans had a robust railway network, largely dating to the Japanese occupation. Crippling this network was vital to stopping resupply into the South.

In Korea, B-29s of the 19th BG carrying up to eight Razon rounds were used to attack bridges, until late 1950.

Of the total 489 Razons used in Korea, 32 per cent failed due to reliability problems. Despite this, Razon attacks are credited with destroying 15 bridges, these often requiring multiple hits.

The largest of the early US smart bombs was the Bell VB-13/ASM-A-1 Tarzon, which was a guided derivative of the RAF's 12,000 lb earth penetrating Tallboy bomb. It used tandem annular surfaces, and the guidance used a command link transmitter and guidance receiver, with a flare in the tail. The Tarzon was used during the Korean conflict and is credited with destroying six bridges, for a total of 30 drops claimed. The Tarzon was so large that modified B-29s were required to carry it.

Conclusions

In operational terms, smart bombs made a significant, even if not decisive, contribution to combat during World War II and the Korean War.

Germany's use of the Hs-293 and Fritz-X set the pattern for maritime air strikes and remains the model used today, albeit with more advanced weapons. Allied shipping losses to the Hs-293 and Fritz-X remain a testimony to the devastating effects of air attack on shipping, especially when a new weapon is introduced that defeats established air defence systems.

The use of smart bombs to attack bridges was also pioneered during this early period, and while the Luftwaffe had limited success due to Allied air superiority, the USAAF was able to exploit this technology to good effect, despite the limitations of period guidance.

The subsequent chapter in the evolution of smart bombs was the Vietnam conflict, which saw numerous advances in guidance techniques and delivery methods, and will be covered in a future issue.

PGM stalls future Presidency

John F. Kennedy's older brother, the highly popular and successful Joseph P. Kennedy Jr, was widely expected to bear his famous family's political hopes, but these hopes faded when JPK was killed in action during World War II flying a Liberator bomber configured as a precision guided munition.

With the outbreak of World War II Joe Kennedy left Harvard Law School to become a US Navy aviator. After being awarded his wings he was sent to the European Theatre in late 1943 to fly the PBY4 Liberator maritime patrol aircraft.

In 1944, JPK volunteered for Operation Anvil, the precision-guided countermeasure to German "Vergeltungswaffe" (Vengeance Weapons), focused on the fearsome new V-3 cannon. The V-3 was to have 25 150mm artillery barrels, each 130m long, using multiple booster propellant charges arranged in symmetrical pairs around the barrel. The V-3 complex was to be located near Mimoyecques, France where one round could be fired into London 90km away every 12 seconds.

To protect the V-3 from allied counterattack the system was to be buried under an immense array of protective, reinforced concrete. For the allies to destroy this high threat target they needed an equally powerful but precise weapon. Anvil and its Air Force cousin 'Aphrodite' were conceived to use a modified PBY4 Liberator (for Anvil) stuffed with 9,600 kg (21,170 pounds) of Torpex explosives. US Army Air Force operations would use time-expired B-17 bomber for similar missions.

Two television cameras were fitted in the cockpit of the bomber providing a pilot's eye view of the outside and the instrument panel. The camera images were transmitted by radio to another pilot in the escorting 'mothership' who then relayed flying instructions back to the bomber. The crude system meant the difficult task of takeoff required a pilot and flight engineer onboard the one-way bomber. Their job was to get the aircraft into the air, then arm the warhead and parachute to safety while the mothership would use radio control to guide the 'flying bomb' into the target.

The maiden flight of Anvil was set for 12 August 1944, piloted by JPK. The explosive-filled Liberator took off to engage a V-1 site at Pas-de-Calais. However, on this mission the Torpex exploded before the crew could bail out, instantly killing Kennedy and his flight engineer. The V-3 complex had been earlier destroyed by No 617 Squadron Lancaster bombers while the concrete was still wet, but two of the guns were later used to shell Luxembourg.

The Kennedy family regrouped after the loss of their favourite son and JFK stepped into his older brother's mantle. The rest is history.