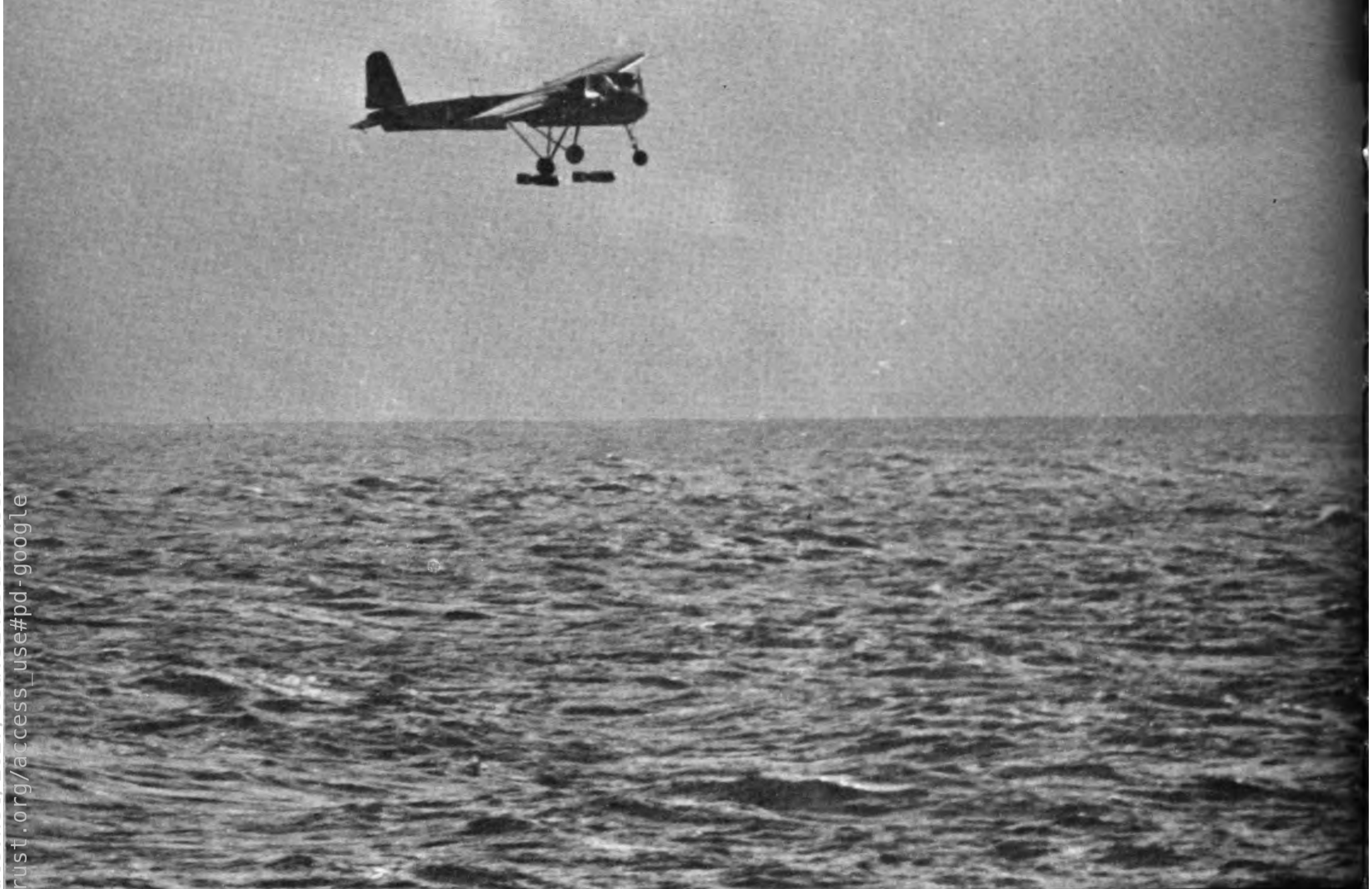
NAVAL AVIATION **NEWS** LOOKS BACK

the armed



You might have read about it in *Naval Aviation News* last January in an article by LCdr. Paul Mullane entitled "The Smart and the Dumb." Or you might have seen it on the tube last summer, the flickering, grainy screen showing the outline of a bridge in North Vietnam. As the announcer informed you that the transmission was from a "smart bomb," the image of the bridge zoomed in larger and larger until the last thing you remember seeing was that small rivet on that simple girder. And then, nothing. End of transmission. The target was hit.

The media picked up "smart bomb" and added it to their lexicon of Vietnam-era military terminology. Smart bombs were news. But they weren't born yesterday.

They evolved and the evolution began with a strange marriage between the aeroplane, explosive ordnance and remote guidance systems.

From the earliest days, this marriage was known by a number of names: flying bomb, aerial torpedo, assault drone, explosive carriers, aerial rams, guided bombs, controllable bombs, etc. Many even called them guided missiles, which they were if one accepts the definition of guided missile as an unmanned vehicle traveling above earth's surface, guided to a target by remote command signals, sensor equipment from within, or a combination of both.

But there is a difference between these flying bombs/aerial torpedoes/assault drones, or whatever name you choose to call them, and the guided missile with the flaming tail, as we came to know it from 1942 on. The former were armed, pilotless aircraft, bearing little or no resemblance to the latter with its sleek long lines and phenomenal speeds. And it is about the former and their brief but interesting history that this story is told.

The idea came about almost with the first flight at Kitty Hawk, N.C., on

ROBOTS

By Michael McDonell

December 17, 1903. While many optimistically hailed the aeroplane as the eliminator of frontiers, the vehicle which would dissolve nationalism and promote the "world nation," others more pragmatic eyed war clouds on the horizon and made other plans for aeroplanes.

With the outbreak of war in Europe in 1914, the aeroplane made an awesomely spectacular debut. Its bellicose possibilities soon gave birth to an idea: an unmanned aeroplane, a self-propelled missile, a "flying bomb."

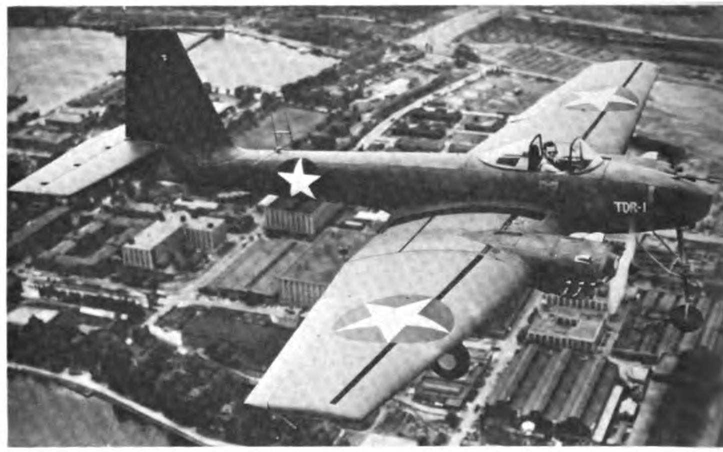
In October 1915, Secretary of the Navy Josephus Daniels established the Naval Consulting Board to advise him on scientific and technical matters and to provide "machinery and facilities for utilizing the natural inventive genius of Americans to meet the new conditions of warfare." Under the auspices of the board, a Committee on Aeronautics was formed. It numbered among its members the inventive genius Elmer A. Sperry, head of the Sperry Gyroscope Company and an expert in gyrostabilization. Sperry and his son, Lawrence, had worked with the Navy before, supplying gyroscope equipment for torpedoes in the early years of the new century and, later, conducting a cooperative test and evaluation of his gyrostabilization mechanism on a Navy flying boat.

Six months prior to the formation of the board, Dr. Peter Cooper Hewitt, another well known inventor, approached the Sperrys with an idea for an "aerial torpedo," an unmanned aircraft that would carry lethal loads considerably further than the ordnance expelled by any earthbound gun. His electronic expertise, Hewitt reasoned, coupled with the Sperrys' gyrostabilization experience, would assure their success. And to make the proposition even more enticing, Hewitt agreed to finance the project and contributed the sum of $3,000.

Father and son agreed; the work

NEWS LOOKS BACK

Right, billed as "The world's first guided missile," N2C-2 is put through its paces by VJ-3 sometime during the late Thirties. Marmon car is used as the test vehicle for Sperry Flying Bomb. Below right, TDR-1 over Naval Aircraft Factory.



began; Hewitt's fund was quickly depleted and the Sperrys found themselves financially involved in the project. It was at this time that the elder Sperry and Hewitt were appointed to the Naval Consulting Board. As inventors and as members of the Committee on Aeronautics (Sperry eventually became its chairman), the two men found themselves in the position of trying to stimulate the Navy's interest in their project while, at the same time, evaluating similar winged missiles by other inventors.

By the summer of 1916, Hewitt and Sperry had persuaded the Bureau of Ordnance to send a representative, Lt. T. S. Wilkinson, to inspect their aerial torpedo at their Brooklyn plant. The lieutenant was shown an aircraft in which was installed a device consisting of a gyroscopic stabilizer, a directive gyroscope, an aneroid barometer to regulate height, aeromotors to control rudders and ailerons, and a mechanism for distance gearing. This aircraft, the inspector was told, could be catapulted or flown from the water, would reach a predetermined altitude, fly a predetermined course and distance, and would drop its bombs or crash onto the target. All of this, he was assured, without benefit of a human pilot.

Wilkinson was unimpressed, judging that the device was not accurate enough to hit a ship. However, because of its range of between 50 and 100 miles, he could foresee an interest by the Army. But the naval officer overestimated the Army's enthusiasm. They did not reply to Sperry's invitation to inspect his new device.

For six months there was little interest in the project and even Hewitt appears to have lost interest in it.

The United States' declaration of war against Germany quickly brought this period of limbo for the aerial torpedo to an end.

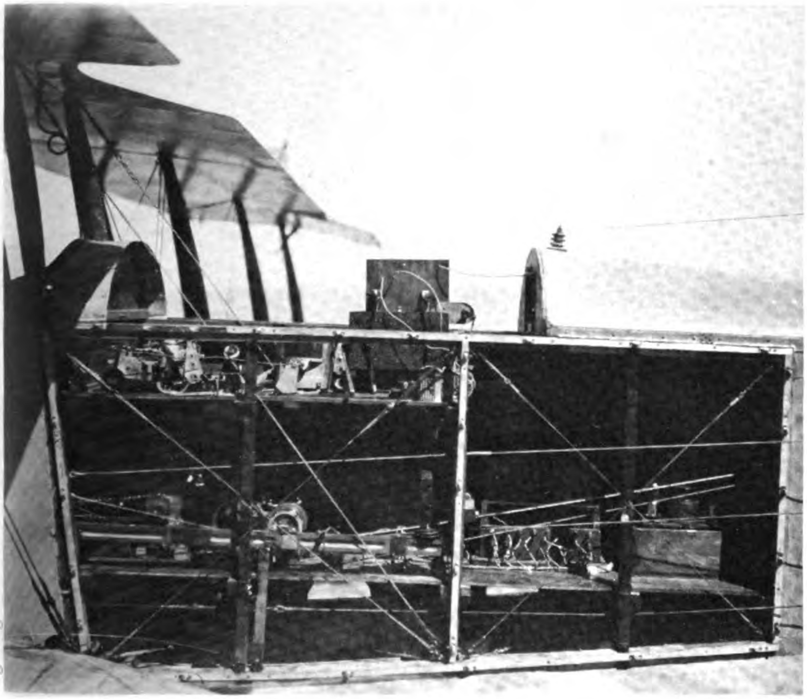
Five days after the declaration, on April 11, Sperry, acting as chairman of the Committee on Aeronautics, submitted a favorable report on the aerial torpedo to the consulting board, which concurred, passed a resolution, and apportioned $50,000 to carry on experimental work.

In May, the Navy agreed to provide five N-9 seaplanes and purchase six sets of Sperry automatic controls.

The work began. Confident that his automatic controls would function according to plan, Sperry began the development of the radio control gear with the help of a radio engineer. Unfortunately, Sperry's radio-control experiments met with no success as they were never incorporated in the flying bomb, as the Navy dubbed the project.

The initial phases of the project, besides the radio work, consisted of testing and perfecting those mechanisms which dealt with maintaining course and distance. Test flights began in September 1917 with a pilot at the controls during takeoff. But two-mile errors made the weapon useless against ships and the Navy pondered what to do about the project. CNO decided that, while the flying bomb would continue to be developed for production, the Navy could no longer provide the project with new engines and airframes. Project members were left with the task of obtaining needed parts without interfering with wartime aircraft production.

With the armistice, the flying bomb became the "never never weapon" of WW I. In 1919, Sperry was no longer involved in the program; it had been reoriented. For the next 20 years, development work would be carried out



Inside view of automatic pilot and radio control equipment installed in N-9 seaplane at NAS Dahlgren, Va., November 1924. Below, with human pilot at controls, TDN assault drone is tested.

and controlled by naval officers and the Navy Department. Testing of the flying bomb was transferred to the Naval Proving Ground at Dahlgren, Virginia.

In 1922, the Naval Research Laboratory, together with BuAer and the Bureau of Engineering, began working with radio-controlled flight. With an effective range of approximately ten miles, a radio control set was installed in an N-9 in mid-1923 and flight tests began. By November, 33 successful flights had been made but always with a human "safety" pilot aboard in case the system should fail. It was not until September 1924 that a pilotless flight was attempted.

It lasted 40 minutes and while the radio control was not perfect, the aircraft could be directed to turn left and right, to ascend and descend. Unfortunately, while attempting to land, the plane struck the water hard, bounced back into the air, settled once more upon the water and sank because of a damaged float. A second attempt was made over a year later but the aircraft crashed on takeoff. In spite of the successful 40-minute flight, the crashes eclipsed the accomplishment of radio control and the project was allowed to die. After a period of several years, experimentation was resumed briefly in 1932, only to be shelved once more because of lack of funds. But that would shortly change.

Dive bombing and, with the development of the Norden bombsight, high-altitude horizontal bombing were being touted as effective tactics against ships. Yet, antiaircraft training remained primitive. Planes towing target sleeves on prescribed courses and altitudes offered high scores to gunnery departments but little realistic training.

It was because of this deficiency that the radio-control program received a much needed boost in 1936. CNO, Admiral W. H. Standley, after witnessing the effective training and experience being reaped by the British Royal Navy through its use of the *Queen Bee* radio-controlled target aircraft, called for a similar plane for the U.S. Navy.

Money was appropriated for the design and procurement of a flying target. Aircraft radio had been vastly improved over the years with sets capable of sending both voice and code. It had been over ten years since the Navy's last test of a radio-controlled aircraft and it caught up with a vengeance. A year after CNO's order went out, on November 15, 1937, the first pilotless flight was made at Coast Guard Air Station, Cape May, using an N2C-2. One year later, in August 1938, the drone appeared over the firing line, maneuvered while under antiaircraft fire much to the gun crews' consternation, and revealed the ineffectiveness of the antiaircraft batteries. Admiral C. C. Bloch, Commander in Chief, U.S. Fleet, endorsed the use of the drone in an oblique way when he commented on the results of the gunnery exercise: "It is considered most fortunate that the condition should have been discovered in target practice firing, and not in an actual campaign."

But many could not envision it in any other role than that of a flying target, least of all as an expensive weapon. Late in 1935, Lieutenant Commander Forrest Sherman, destined to become CNO one day, reported to the Bureau of Ordance, "It is out of the question to expect any glider or even any dive-bombing plane to strike with sufficient velocity to carry a large explosive load through a deck without its breaking up. This, incidentally, is the fallacy in the conception of suicide squadrons of dive bombers prepared to dive into the decks of enemy ships. In so doing, they would prevent their bombs from striking with sufficient velocity to penetrate even the weather deck." Unfortunately, the Japanese naval staff did not agree with his evaluation in later years.

Neither did certain individuals in BuAer. In March 1940, at the Bureau's direction, steps were taken to convert a TG-2 torpedo aircraft into an offensive pilotless vehicle. The plane, formerly used to control drones, was to be radio controlled and carry a torpedo at set altitudes, just clear of the water, to the dropping point.

That summer, VJ-3, which was responsible for operating target drones for the fleet, was directed to prove the feasibility of directing a drone into a target. Using puffs of smoke emitted by smoke-laying aircraft to simulate ships, the squadron flew the drones into the targets time after time, proving that a 100-foot target could be hit by a drone controlled by an operator in an aircraft 3,000 yards astern.

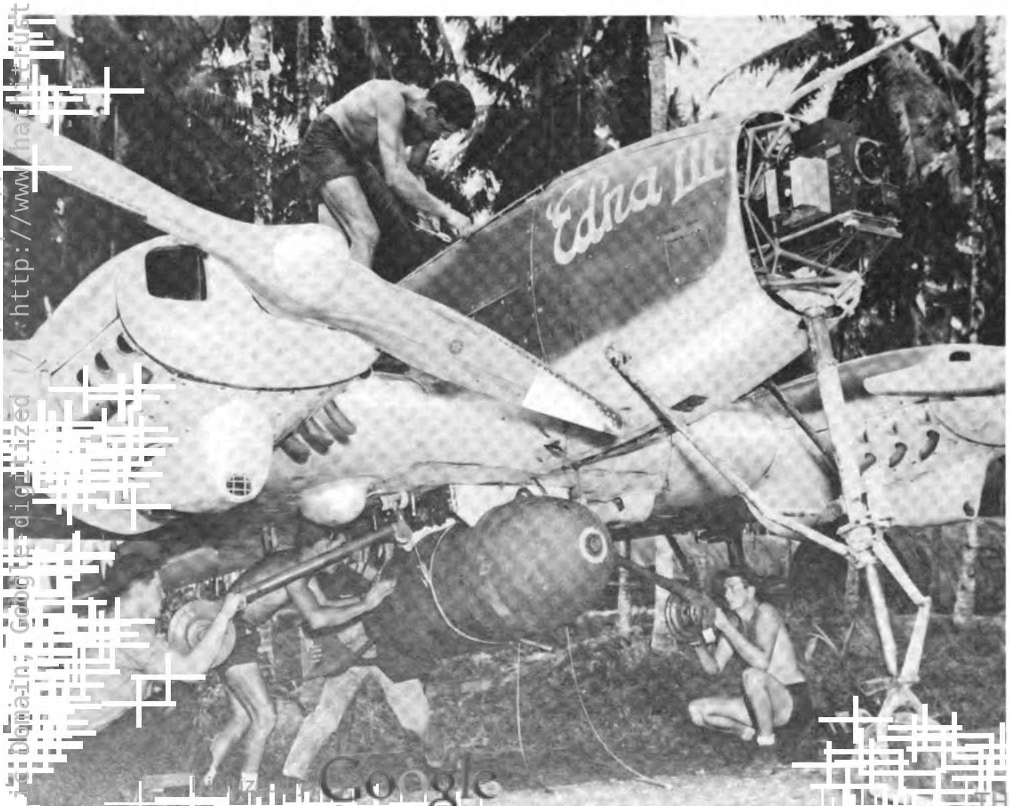
BuAer was impressed, enough so that it directed further experiments toward the development of assault drones using visual, television and radar direction. By August 1941, some 50 simulated torpedo attacks had been made with television-equipped, radio-controlled drones. The controllers, operating at maximum distances of six miles from the drones, reported clear pictures. In April 1942, tests were conducted against the fleet, including a successful simulated torpedo run against the destroyer *Aaron Ward* and an actual crash assault on a towed raft by a television-guided drone.

Prior to the outbreak of war, BuAer had been considering the use of obsolete aircraft for assault drone duties and simple, specially designed, easily manufactured assault drones. With the attack on Pearl Harbor, all available aircraft were needed, precluding the adoption of the former plan. In January 1942, the Naval Aircraft Factory was directed to submit designs and cost estimates for assault drones. The following month, BuAer specified that NAF could proceed with the development of a special radio-controlled, television-directed aircraft.

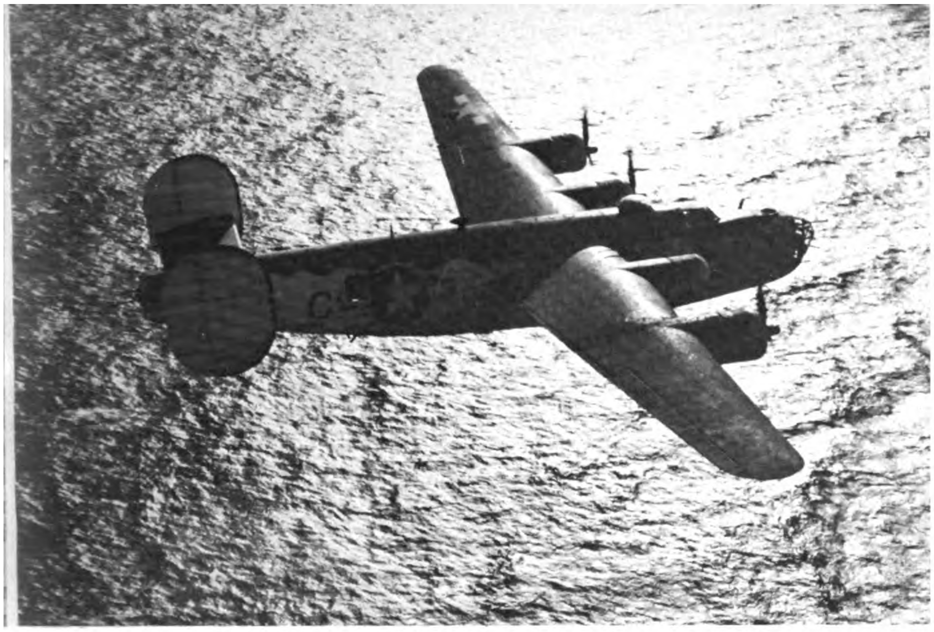
The result was the TDN and TDR assault drones, the former built by NAF and the latter by Interstate Aircraft and Engineering Corporation. Both drones were low-wing monoplanes with tricycle landing gear and were powered by 220-hp Lycoming engines. Their top speed was approximately 150 knots, they had a range of 600 miles and explosive payloads of 2,000 pounds. Two later versions, the TD2R and TD3R, were equipped with 450-hp engines, had a top speed of 230 mph and a 1,700-mile range. Each carried a television camera and a transmitter in its nose which sent a picture to the control plane of what was directly ahead. The flight controls were operated by the controller via radio signals.

A little over a year later, a command was established to form, outfit and train special units for the operational employment of the assault drones. Special Task Air Groups, dubbed STAGs, were composed of squadrons with the designator VK. The first squadrons of STAG-1 were commissioned in October 1943 and quickly began training with the TDRs and TBM control planes. With the backing of Com5thFlt, Admiral W. F. Spruance, STAG-1 prepared to assist in the attack on Eniwetok scheduled for May 1944. Unfortunately for the group, the first phase of the Marshall Islands campaign was so successful that the date for the Eniwetok campaign was changed to February and the island was taken before the drone units could be deployed.

With their combat opportunity lost in the Marshalls, the assault drones were assigned instead to the Russell Islands with the first elements of STAG-1 arriving in June 1944. The group made its combat debut soon after its arrival when it attacked a beached Japanese freighter at South Bougainville used to house antiaircraft gun emplacements in defense of Kahili airstrip. Guided by controllers in TBMs several miles away, four TDRs dove on the ship. Two hit targets. Between September 27 and October 26, STAG-1 expended 46 TDRs against Japanese installations in the Bougainville and Rabaul areas. Twenty-nine were on



A TDR-1 is prepared for an attack somewhere in the Pacific. Note the television camera in the nose.



With guns removed, remote guidance and television installed, PB4Y-1 could have qualified for Anvil.

target. In general, where there was little need for high speed or long range, the assault drones were effective. But, as strike distances and the accuracy of enemy ground fire increased, the speed and range of the drones could not meet the tactical requirements assigned to them. The consequences were the termination of production of TDNs and TDRs, the end of the STAG units when the war was finished, and the turning of experimental attention to new projects of a similar nature.

In Europe, an equally short-lived but no less unique assault drone program was tried in 1944 under the code name Project *Anvil*. Using PB4Ys outfitted with remote control gear and television, loaded with 25,000 pounds of torpex and under the control of a PV-1, as a control plane, Project *Anvil* was based at a secret airfield north of London. Its mission was to destroy a German V-2 installation in occupied France. Because of the urgency of the project, the special air unit assigned to *Anvil* did not have time to install equipment that would assure a pilotless takeoff. Operating procedures called for a takeoff by human pilots who, after checking automatic and radio control, would bail out at 2,000 feet. Thereafter, the control plane, one-half to one mile astern of the PB4Y, would be in control.

An experienced pilot, Lt. Joseph P. Kennedy, Jr., of VB-110 volunteered to fly the PB4Y drone. On August 12, Kennedy and Lt. Wilford J. Willy took off in their explosive-laden aircraft accompanied by the control planes. With a fighter cover of P-51s just ahead, the two pilots began checking the radio controls. Twenty minutes after takeoff, the 25,000 pounds of explosives detonated unexpectedly, killing both men. While no definite clues were available as to how the tragedy occurred, the electrical circuits were suspect and the electrical fuse system was replaced by a mechanical system.

A second pilot from VB-110, Lt. Ralph Spaulding, was assigned to the project. The drone tested out well and was prepared to go against the V-2 site in France when word was received that Allied invasion forces had taken the proposed target. In order that the drone would not go to waste and to prove its ability, a target in Helgoland was chosen for the assault.

September 3, 1944, found Lt. Spaulding flying the explosive-filled drone by himself, checking and adjusting the controls and safely parachuting over the English countryside. The control pilot in the PV signaled the drone to fly at 300 feet, which it did, skimming above the North Sea for nearly three hours with very few adjustments required. When Helgoland was sighted, the drone's television camera was activated. Monitoring the television while flying in an Army B-17 some distance from the drone, Ens. J. M. Simpson, the unit's special gear officer who supervised the remote control system, described the final minutes of the mission, "Almost immediately we could see bursts of flak in the television camera's field of view. In my television screen several miles away at about 5,000 feet, I could see trees, streetcars, automobiles, windows in barracks, an airfield complete with airplanes and the enemy running by the hundreds to take cover. . . . The control pilot in the PV mother plane guided the drone as if he were in it, straight toward the airfield. Just before the hit, flack knocked out the camera too late to help the enemy. When the picture disappeared, I watched the hit from the waist. . . . It was the largest explosion I had ever seen. The column of smoke was above us and the mushroom appeared to be at about 8,000 feet. It was still there when I looked back several minutes later as we were getting away from there fast."

The sight of that mushroom cloud was overshadowed by a still larger one a year later, one which brought WW II to an end and, with it, the assault drone.

The guided missile had arrived from Germany, quickly spawned a variety of American missiles and eliminated the need for an armed pilotless aircraft. Except for a well publicized but brief appearance in 1952 when radio-controlled F6F-5Ks were used against North Korean targets, the "assault" was no longer a drone function. Drones remained principally targets with some reconnaissance functions added to the mission in recent years.

Present-day guided missiles, smart bombs and others of that ilk owe much to the earlier flying bombs, assault drones, etc. The pioneering of remote control and television guidance systems was enough to earn them a place in aviation history, but they may not be dead, only lying dormant waiting for a better day.

Lately, there has been talk of remotely piloted vehicles (RPVs) which in appearance resemble pilotless aircraft more than they do guided missiles and are capable of a number of missions currently performed by manned aircraft. One high ranking Air Force general described his version of the RPVs in part: "They could mount guns, rockets and missiles or, since they are expendable, could be flown directly into the target."

But that is another story — or is it?