

Miniature Ascent Vehicles derived from the Navy's Air-Launched Satellite developed in  
1958

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Abstract: This paper describes a planetary sample return launcher based on the formerly-classified PILOT microsatellite launching system developed by the U.S. Navy at the China Lake Naval Ordnance Test Station (NOTS) in 1958. Developed as a crash program in response to the Soviet launch of Sputnik 1, the PILOT launcher was about an order-of-magnitude lighter than conventional orbital launch vehicles developed before or since, and had no moving parts or control system. It was about 15 feet long, dropped from the wing of a fighter plane climbing at about 70 degrees from horizontal, and used a cluster of four solid rocket motors as a first stage to get above the atmosphere. It had fins which were slightly canted to make the rocket roll about its axis, giving it a gyroscopic moment. The atmospheric drag acted on the fins to keep the vehicle axis roughly tangent to the trajectory. About 80 Km up, the trajectory became approximately horizontal. An optical detector sensed the horizon, triggering a pair of stages which together achieved almost the entire Earth orbital velocity of 8500 m/s. A last stage was mounted backwards inside the payload, with a 53 minute timer delay. The gyroscopic moment of this oblate payload kept the payload stabilized inertially in space for enough time to go half way around the Earth. This last stage, which was backwards to the flight direction at launch, kept its inertial direction and was thus pointed forward in the orbital direction on the other side of the orbit. When the timer fired the last stage it gave the apogee kick needed to put the satellite into a long-life orbit. Two successful launches were reported to President Eisenhower in July and August 1958, according to the Navy sponsor, John Nicolaidis (now retired in San Luis Obispo, CA). This approach was declassified in 1984, and it became known to this author since the originator and project manager of PILOT happened to be this author's father.