Appendix 1

Minuteman and Air Mobility Basing

One of the more unusual Minuteman programs was that of the airdrop of a Minuteman IB from a C-5A on 24 October 1974 off the Pacific Coast adjacent to Vandenberg Air Force Base. A year earlier, on 28 September 1973, Lieutenant General William J. Evans, Deputy Chief of Staff, Research and Development, Headquarters U.S. Air Force, testified at hearings before the Subcommittee on Department of Defense, Committee on Appropriations, House of Representatives, concerning the Department of Defense Appropriations for 1974.[1] In response to questioning by Congressman Robert Giaimo (D-CT), Evans described the advanced ICBM technology effort then underway which included two new ICBM basing modes, air and ground mobility. Evans elaborated on the return to air mobility, likely referring to the canceled Skybolt program, and that a 747-type aircraft could carry three or four missiles. The air mobility concept might involve dropping out of the bomb bay or extracting out of the rear of the aircraft as was already developed for the large loads that the Air Force carried for the Army. Evans foresaw two major problems with air mobility: telling the guidance system where it was upon release from the aircraft and to a lesser extent, getting safe separation between the aircraft and the missile before the ignition of the first stage.

Air Mobile Feasibility Demonstration Program planning began on 24 August 1974 with a meeting of the major contractors at the Space and Missile Systems Organization Facilities (SAMSO) at Norton Air Force Base, San Bernardino, California. The plan was to drop a Minuteman IB missile out the back of a C-5A aircraft and ignite it in the air. The missile would be on a pallet which would be extracted from the aircraft by parachutes, then released from the pallet, brought to a vertical orientation with additional parachutes, the parachutes released and the first stage ignited for a 10-second burn. The second and third stages would be inert.

The SAMSO directive was that the test had to be completed within 60 days. This meant that all the air launch systems had to use existing equipment as much as possible. Of immediate concern to the North American Aviation Autonetics representative, Gene Andreosky, was the fact that the guidance system in the Minuteman IB was not gimbaled to go from a horizontal to vertical orientation while in operation. The SAMSO staff had an answer for this problem in hand. A small company, Space Vector Corporation, had purchased surplus Minuteman IB motors for use as boosters for upper atmospheric research. Guidance was simply an attitude control system placed at the top of the booster as there was no need for inertial guidance for a sounding rocket. Andreosky was given the task of integrating Space Vector's attitude control system with the P89 nozzle control unit used to control the four Minuteman Stage I nozzles.[2]

The Lockheed Aircraft Corporation was responsible for the aircraft and parachute extraction aspects of the project, with SAMSO, TRW and Boeing responsible for the missile portion of the program. Operations were conducted at Edwards, Hill and Vandenberg Air Force Bases and the El-Centro Naval Air Facility. Early in the program it was decided that six dummy loads of increasing increments of weight should be dropped before the drop of three full-sized missiles, with the last being equipped for a live burn. This would allow the already demonstrated air drop capability of the C-5A to be gradually expanded from a 40,000 pound payload on a 28-foot platform, to the required 56-foot, 86,000 pound missile payload on a 46-foot platform.

During the build-up phase, rigging procedures and techniques for aligning and loading the large loads were evaluated. Testing took place at the Navy National Parachute Test Range at El-Centro, California. On 6 September the first significant step in the program was achieved. The build-up and drop of a 45,000-pound dummy load was successful. Four days later the second drop, now 55,000 pounds was made. The load consisted of two 18-foot weighted steel tubs on a 42-foot platform, rigged with a 32-foot extraction chute and ten 100 foot diameter recovery parachutes permitting post-test analysis of the platform structure. During extraction of this load, as in all drops, roller loads, ramp support, link loads, pitch angle and other aircraft response data were measured. During the drop, pilot input was minimal and aircraft response was normal. At an altitude of 20,000 feet and a speed of 172 knots extraction of the load was entirely normal though the pallet flexed from a lack of rigidity where the two tubs were butted together. This flight set a new world record for a single load airdrop surpassing the old C-130 Hercules mark by nearly 5,000 pounds.

On 13 September, the next drop in the sequence, 65,917 pounds took place. The extraction chute inflated properly, providing a successful extraction, but the platform flexed again at the junction of the two tubs. As the recovery chutes deployed, they suddenly blew because they had overreached their load limit. For purposes of the demonstration, the extraction was a success even though the load went into a free-fall and disintegrated upon impact with the ground.

A week later, weight had been built up to 77,484 pounds and the flexing characteristic of the platform had been corrected by welding the two tubs together along the sides and top with steel splice plates. Recovery chutes were eliminated, and loads were now rigged with one 32-foot extraction chute and three 32 foot stabilization chutes on top of the aft tub, thus allowing the platform to hang vertically in the simulated missile launch position.

On 23 September, an 87,800 pound payload, several thousand pounds more than the weight of the Minuteman IB, was successfully dropped at an air speed of 174 knots and an altitude 20,000 feet. The extraction chute failed but previously practiced emergency procedures successfully completed the extraction. The load tumbled excessively and the stabilization parachutes deployed at a 90-degree angle to the platform which caused violent pitching motions and the load disintegrated in midair.

On 26 September the final build-up load of 86,000 pounds was ready. This time extraction used two 32-foot chutes and a new 170 foot, double braided, 10 inch diameter nylon extraction rope instead of 150 foot, 12-ply nylon straps. A smooth, uneventful extraction took place and the three stabilization chutes successfully deployed.

The missile phase of the program called for three missile drops, two inert and one live. The first missile drop made at El-Centro was a Minuteman trainer known as the Iron Bird with a telemetry package for transmitting pertinent data to the ground station. The purpose of this drop was to learn more about missile characteristics relative to loading, missile cradle separation, missile response, timing sequence, stabilization during descent, and extraction trajectory data. Extensive electromagnetic interference tests, and both ground and flight dynamic response vibration tests were then run on the aircraft-missile combination. These tests determined that electrical interference would not detonate explosives on the missile and that dynamic coupling of vibrations between aircraft and missile would not cause damage during taxi or flight.

Extraction of the missile was uneventful and a clean separation of the missile from the cradle was accomplished by the firing of explosive nuts which secured the straps and tension rods holding the missile to the cradle platform assembly. The drop was nearly perfect in every respect. Only one undesirable factor was observed, a rolling oscillation of the missile as it was suspended from the stabilization chutes. This condition was corrected by modifying the rigging on the second inert missile drop, which was successfully made two weeks later at the Western Test Range, Vandenberg Air Force Base, California.

On 24 October, the actual drop with a live first stage and inert second and third stages took place over the ocean adjacent to Vandenberg Air Force Base, just seven weeks from the day of the first test. The first stage provided 10 seconds of thrust with a 20-second tail-off. The timing for separation of the stabilization chutes was set for forty-eight seconds after the missile had cleared the aircraft, with ignition two seconds later. This timing ensured a stable missile attitude and allowed the aircraft to be well out of range at first stage ignition. The extraction went as expected, the stabilization chutes released on time and at approximately 8,000 feet above the ocean the first stage motor ignited and boosted the missile to approximately 20,000 feet after which it fell back into the ocean. Legend has it that films of the final test was quickly taken by State Department messenger to Secretary of State Henry Kissinger for use in strategic arms limitation talks (Figure 1).[3]

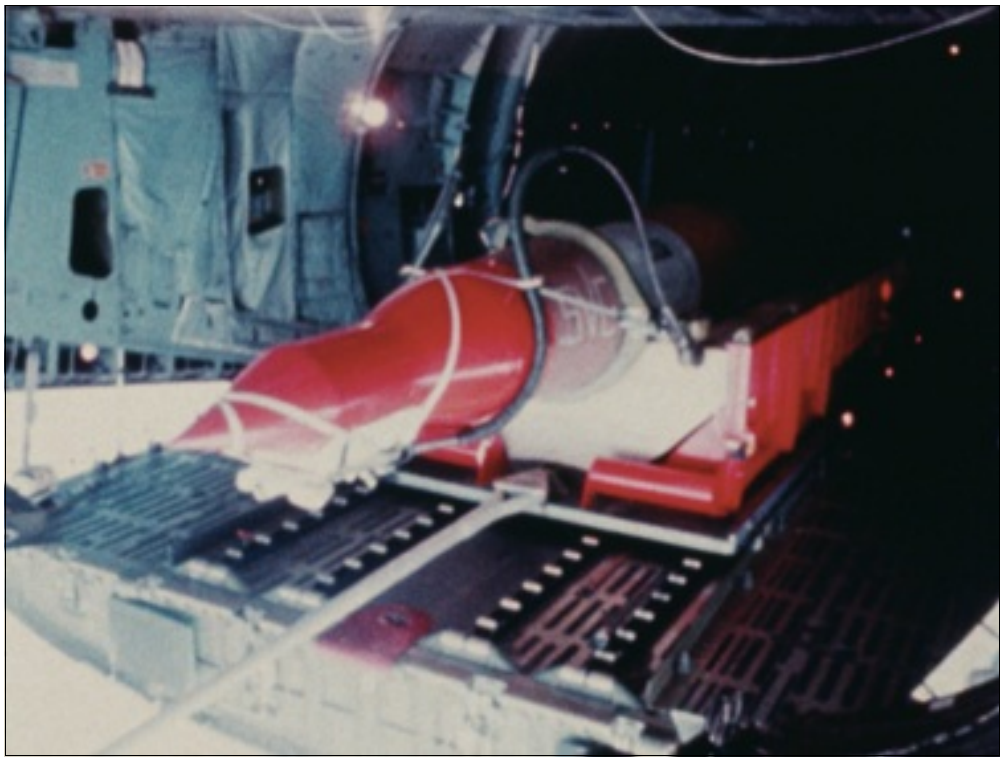

Figure 1. On October 24, 1974, the airborne launch was successful. Here the extraction parachutes are pulling the cradle and missile out of the aircraft. Clearly more than one missile would not fit in the aircraft. Courtesy of Periscope Films.

Endnotes

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1. Testimony of Lieutenant General William J. Evans, USAF, *Hearings Before the Subcommittee on Department of Defense, House of Representatives, 93rd Congress, 1st Session, 28 September 1973,* 1028-1030.

2. Gene Andreosky, "The Minuteman Airdrop, North American Aviation Retirees Newsletter, Summer 2008," 3-5.

3. The detailed description of the drop tests is adapted from a transcript of an Air Force film of the project, "Airmobile Feasibility Demonstration," Periscope Film Company File 45154.