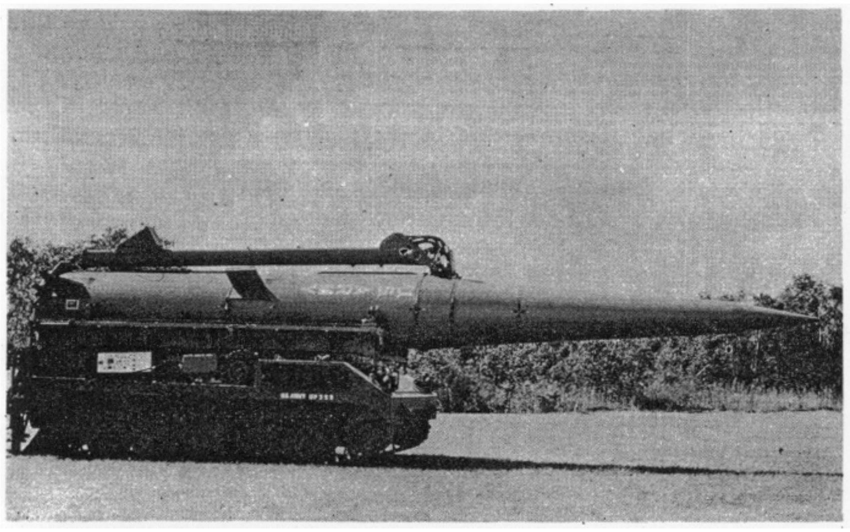
field artillery's newest missile . . .



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The Pershing program, which began in 1958, is rapidly approaching successful completion. Nearly all system design requirements have been met satisfactorily. As has been reported in ARTILLERY TRENDS, the Pershing test series was more successful than any previous series of its kind to be conducted at the Cape Canaveral Test Facility.

CHARACTERISTICS

Pershing is a two-stage, solid-propellant missile with an inertial guidance system. The use of a solid propellant contributes to the short reaction time of the Pershing, since no fueling operations are required during countdown. The missile measures slightly more than 34 feet in length and just over 3 feet in diameter. Although smaller and lighter than the Redstone missile, the Pershing can be fired at a far greater range. When fired, Pershing weighs 10,000 pounds. The inertial guidance system, using the ST-120 (stable table) as a space-fixed reference, is invulnerable to all known electronic countermeasures.

The Pershing system can be air transported by cargo aircraft; fourteen C-123 or ten C-130 loads are required. The system, less track vehicles, can also be transported to a position area in fourteen HC-1B Chinook cargo helicopter loads.

EQUIPMENT

The equipment necessary to fire the Pershing missile is transported on four XM474E2 track vehicles. The XM474E2 vehicle is shown in figure 1.

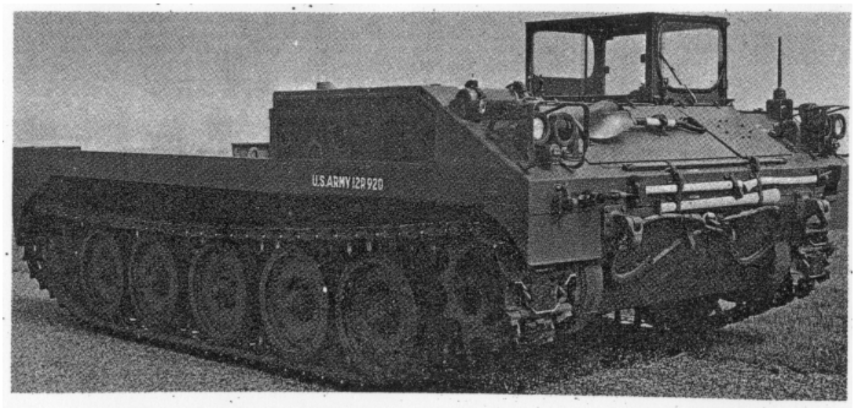

Figure 1. XM474E2, cargo version of the M113 armored personnel carrier.

The XM474E2 is a lightweight, unarmored, low-silhouette vehicle, which can operate at 40 miles per hour on improved roads and highways. Over rough terrain it is capable of extended travel and can ford to a maximum depth of 42 inches. Figure 2 shows the four XM474E2 vehicles loaded with Pershing equipment. These four basic Pershing prime

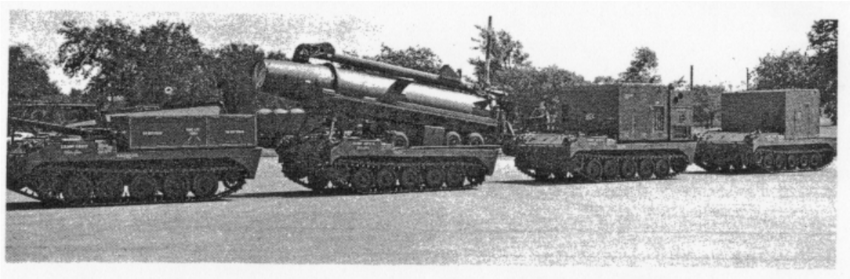

Figure 2. Pershing system transported by four XM474E2 track vehicles.

movers transport the warhead section and azimuth laying equipment; erector-launcher and missile (less warhead section); programmer test station, including a digital computer and power station; and the radio terminal set AN/TRC-80 (see ARTILLERY TRENDS, Feb 62, page 4). The programmer test station and the power station are shown in figure 3. Five wheeled vehicles are also organic to provide transportation for missile crewmen, to act as buffer vehicles for the warhead section carrier, to carry spare parts and tools, and to carry command and on-line cryptographic equipment.

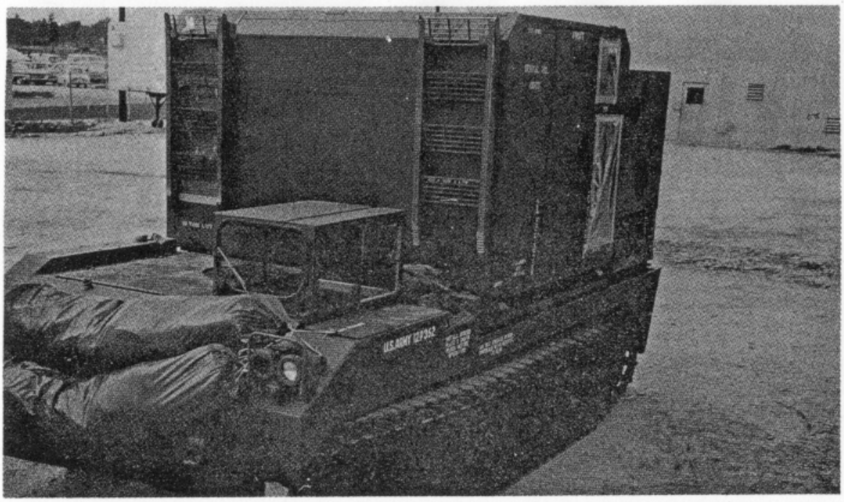

Figure 3. Programmer test station and power station.

Upon arrival at the firing position, warhead mating, missile checkout, azimuth laying, and the establishment of communications occur concurrently. Missile checkout and erection are accomplished as part of the countdown. Near the end of the countdown, control is passed from the programmer test station to a remote firing panel 500 feet from the launcher. It is at this panel that two firing buttons are simultaneously depressed to ignite the rocket motor.

On first-stage ignition, the missile rises vertically. A short time later, the pitch program is begun, causing the missile to tilt toward the target. At this time, the attitude of the missile is controlled by air fins and jet vanes in the exhaust nozzle on the first-stage motor. After the first-stage motor burns out, the missile coasts intact until a signal from the guidance system causes separation and second-stage ignition. The attitude of the missile is then controlled by the air fins and jet vanes on the second stage.

When the proper velocity and displacement from the launcher are attained, a second signal from the guidance system causes the warhead section to separate from the second stage (fig 4). The warhead section follows a ballistic trajectory to the target and the second-stage motor section and the guidance section (still joined) fall short of the target. An ablative coating protects the warhead section during reentry.

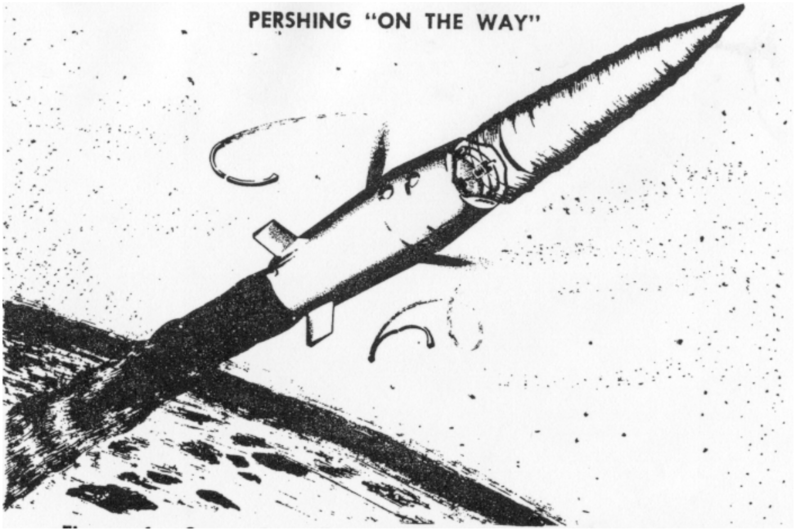

Figure 4. Separation of warhead section from second stage.

AZIMUTH LAYING

Pershing, the Army's longest range missile, presents to the artillery a new challenge in the field of azimuth laying. The Pershing system is designed for extreme accuracy, and accuracy in azimuth becomes more critical as range increases. Therefore, greater accuracy in azimuth laying than heretofore required with any other artillery weapon is necessary. Full utilization of Pershing's inherent capabilities depends upon the artilleryman's skill in laying the missile.

The Pershing missile is laid on its firing azimuth using the "lathe bed" method of azimuth laying. This method of laying, developed jointly by the US Army Artillery and Missile School, the Army Missile Command, and the Martin Company, permits the ST-120 to be laid on the firing azimuth before erection and permits the lay of the ST-120 to be verified after erection, just prior to firing.

Preliminary firing position survey includes the establishment of an orienting line (OL) and markers for positioning the erector-launcher (EL) vehicle. The OL may be established either by conventional survey or by use of the ABLE orientor which is organic in the Pershing battery. The following equipment is used to lay the missile: three Wild T2 theodolites (two of which are mounted on special tripods with translation bars called lathe beds), an aiming circle M2, and a remote torque control box, which is used to rotate the ST-120.

The theodolite without the lathe bed is emplaced on the OL. This instrument is called the orienting station theodolite (OST). A second theodolite, with its lathe bed tripod, is emplaced near the window on the side of the missile to permit optical viewing of the porro prism on the ST-120. This prism is a mirrorlike device which is mounted so that a reflection can be seen at exactly 90° from the heading of the ST-120. The second theodolite is called the horizontal laying theodolite (HLT). The control box is initially located at the HLT. A vertical laying theodolite (VLT), also equipped with a lathe bed, is positioned by use of the aiming circle which is located at the center of the launcher position. The OST, by reciprocal collimation, transfers azimuth control from the OL to the HLT and the aiming circle. Positions of the instruments used in azimuth laying are illustrated in figure 5. When the HLT has been oriented

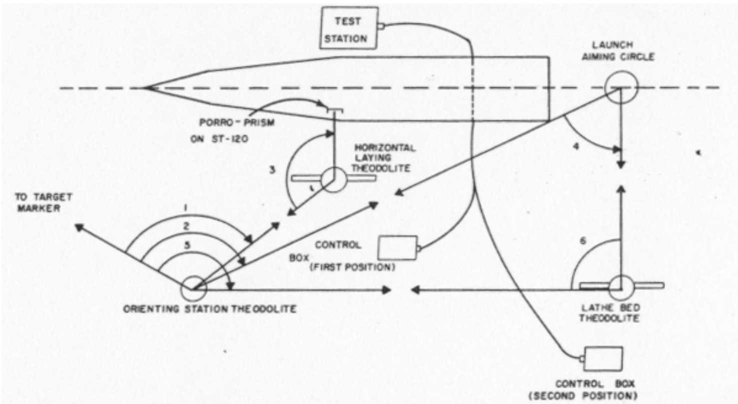

Figure 5. Positions of instruments for laying the Pershing missile.

by the OST, the HLT operator turns the HLT to a direction which is perpendicular to the firing azimuth. He then moves the HLT along the horizontal lathe bed until he can again see into the window on the side of the missile. To insure accuracy, the HLT operator then relevels and requalifies his instrument by again referring to the OST. Following this step, he uses the control box to electrically position the ST-120 until the HLT is autocollimated on the porro prism. The heading of the ST-120 is then coincident with the firing azimuth.

At the proper time in the countdown, the missile is erected and automatically rotated on the launcher until it is alined with the inertial platform. Prior to this time, the VLT was roughly positioned by the aiming circle and exactly oriented by the OST. Therefore, the VLT operator can acquire the porro prism immediately after the missile is erected. After the missile has been raised to a vertical position and rotated to the firing azimuth, the laying procedure used earlier with the HLT is repeated for the VLT and thus a doublecheck on the laying is accomplished. Monitoring to correct for drift is continued until the area is vacated at the last moment before firing. This quick and accurate method of laying the Pershing, combined with the inherent accuracy of the missile system, enables the battlefield commander to influence the tactical situation with swiftness and accuracy never before possible.