



# Project Pluto

## Introduction

For more than 50 years, the Nevada Test Site has been used as a test bed for a multitude of scientific projects, among which was the Supersonic Low-Altitude Missile (SLAM). The concept was a revolutionary new type of propulsion originated at Lawrence Radiation Laboratory, which eventually became Lawrence Livermore National Laboratory: nuclear ramjet power. Project Pluto was the code name for the project, which also referred to the weapon itself.



*A model of the Supersonic Low-Altitude Missile (SLAM).*

## From Drawing Board to Reality

The principle behind the ramjet was relatively simple: draw in air at the front of the vehicle under ram (great force) pressure, heat it to make it expand, and then exhaust it out the back, providing thrust.

Using a nuclear reactor to heat the air was a relatively new idea. Unlike commercial reactors, which are surrounded by concrete, the Pluto reactor had to be small and compact enough to fly, but durable enough to survive long trips to potential targets.

The success of this project would depend upon a series of technological advances in metallurgy and materials sciences. The motors necessary to control the in-flight reactor had to operate under extreme heat and intense radioactivity. The need to maintain supersonic speed at low altitude in all kinds of weather meant the reactor had to survive temperatures of 2,500 degrees Fahrenheit; conditions that would melt the metals used in most jet and rocket engines.

Launched from the ground using rocket boosters, Pluto would attain cruising altitude far from populated areas, and then the nuclear reactor would engage. Since the nuclear engine could give Pluto unlimited range, it would cruise until ordered to its target. Once it reached the target, Pluto would deliver its payload with pin point accuracy.

The 500-megawatt reactor designed for the experiment was christened "Tory." Because of Tory's operating temperature of 2,500 degrees Fahrenheit, even high temperature alloys would lose structural strength. To overcome this, Coors Porcelain Company, based in Colorado, manufactured parts that could stand the heat and provide even temperature distribution in the Tory reactor, which contained 500,000 pencil shaped fuel elements.

To test Pluto's reactor, the project moved from Livermore, California to new facilities constructed on eight square miles of Jackass Flats at the Nevada Test Site. The complex consisted of six miles of roads, the critical assembly building, the control building, the assembly and shop buildings, and utilities.

Since Pluto's Tory reactor would become intensely radioactive when operated, a two-mile, fully automated railroad was constructed to move the reactor back and forth between its static test stand and the disassembly building at the Nevada Test Site.



For a five- minute, full-power test, approximately one ton of air per second was forced over 14 million one-inch steel balls in four steel tanks at 1,350 degrees Fahrenheit heated by oil-burning heaters. It took 25 miles of oil well casing pipe to store the million pounds of pressurized air used to simulate ramjet flight condition for Pluto.

### Success!

On May 14, 1961, the world's first nuclear ramjet engine, Tory IIA-I, mounted on a railroad car, roared to life for just a few seconds. Almost immediately after its successful test run, work began on Tory II-B, a lighter, more powerful engine. Tory II-B never got beyond the drawing board, but three years after Tory IIA-I, Tory-II-C was tested, and a week later it was run for five minutes at full-power, producing 513 megawatts - the equivalent of more than 35,000 pounds of thrust.



*Tory-II-C on its rail car.*

### Pentagon Pulls Plug on Pluto

Despite its success, the Pentagon and Pluto sponsors were having second thoughts about the project. Military factions worried that Pluto would be dangerous to U.S. allies. Before it even began to drop bombs, Pluto would deafen, flatten, and irradiate people along its flight path. Moreover, the Air Force had already begun deploying ballistic missiles capable of carrying out the missions planned for Pluto.

On July 1, 1964, seven years after its inception, Project Pluto was canceled by the Atomic Energy Commission and the Air Force. The total cost of the project was \$260 million. At its peak, the project employed some 35 people at the laboratory and about 100 at the Nevada Test Site.

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