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Early Satellite Image Shows Foundation for High Explosive Test Chamber at Parchin Site in Iran: What was the Chamber for?

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The March 13, 2012 ISIS report "Satellite Image of Building which Contains High Explosive Test Chamber at the Parchin Site," identified the location of a high explosive test chamber at Iran's Parchin military site, a site that is of interest to the International Atomic Energy Agency (IAEA). Subsequently, ISIS acquired an earlier image that shows the construction of this building (see figure 1). This GeoEye commercial satellite image taken on March 14, 2000 of the Parchin site shows the foundation of the building that would contain the explosive test chamber.[1] The chamber itself is not yet placed on the foundation in this image. According to IAEA information, the chamber was constructed in 2000 and designed to contain explosions involving up to 70 kilograms of high explosives. Later commercial satellite imagery from 2004 shows the building which contains the explosive test chamber (see figure 2). ISIS will continue seeking imagery of the Parchin site from later in the year 2000.

An important question is which experiments were allegedly done in the chamber that are related to the development of nuclear weapons? In the November 2011 IAEA safeguards report on Iran, the IAEA described evidence that Iran used the test chamber to conduct high explosive tests in the early 2000s, possibly related to nuclear weapons development. A senior U.S. official told CNN, "We know explosive compression was done at this chamber". As the IAEA notes, using a chamber would aid in preventing the dispersal of detectable material used in testing. As far as can be determined, neither the IAEA nor the U.S. government is alleging that such experiments happened after 2004**.**

Although the IAEA possesses evidence that indicates that the chamber was used for conducting hydrodynamic experiments, these experiments are not the same as a full-scale cold test. Such tests are usually done in an open air environment or a much larger chamber and would involve more explosives than this chamber could contain. Such a test may include testing a pulsed neutron initiator at the center of a full assembly.

The IAEA has asked Iran to visit this building to verify the chamber's existence and evaluate whether high explosive tests were conducted that are relevant to developing nuclear weapons. Iran has so far rebuffed the IAEA's requests. Although Iran in theory has said it would allow the visits, it has insisted on conditions that are unacceptable to the IAEA.

[1] In 2004, ISIS acquired commercial satellite imagery of Parchin from multiple dates, including one from May 25, 2000. The cropped image that ISIS acquired from this date, however, did not include the portion of the Parchin site containing this high explosive chamber. The original image collection on May 25, 2000 likely included this portion of the Parchin site. The entire May 25, 2000 image is not currently in the commercial archives available to the public but ISIS is seeking this imagery.

Testing Initiation of a Shock Generator System

Background on Small Warhead Development

The IAEA obtained from member states details of the design, development, and possible testing of what is called in IAEA information the R265 shock generator system, which is a round multipoint initiation system that would fit inside the payload chamber of the Shahab 3 missile tri-conic nose cone. In the November 2011 safeguards report, the IAEA noted that the explosive chamber at Parchin would be suitable for carrying out a test of the initiation components of the R265 system. This system is described in an earlier ISIS report and summarized here.

According to the information given to the IAEA by a member state, the R265 system involves a hemispherical aluminum shell with an inside radius of 265 mm and wall thickness of 10 mm thick. Outer channels are cut into the outer surface of the shell, each channel one by one millimeter, and contain explosive material. Each channel terminates in a cylindrical hole, 5 mm in diameter, that is drilled though the shell and contains an explosive pellet.[2] The geometrical pattern formed by channels and holes is arranged in quadrants on the outer hemispheric surface which allows a single central point of initiation and the simultaneous detonation of explosives in all the holes on the hemisphere. This in turn allows the simultaneous initiation of all the high explosives under the shell by one exploding bridgewire (EBW). If properly prepared, the R265 constitutes the outer part of an explosively driven implosion system for a nuclear device. The outer radius of the R265 system is 275 millimeters, or a diameter of 550 millimeters, less than the estimated diameter of about 600 millimeters available inside the payload chamber of a Shahab 3 (or the Sejjil-2 missile).

The IAEA assessed that this information suggests Iran developed an effective high explosive implosion system which can fit within the payload container of the reentry vehicle of the Shahab 3. However, IAEA officials also assessed that this system was not finished when the program abruptly halted in 2003.

Testing of Initiation System of R265

According to information provided to the IAEA, and reported earlier by ISIS, the testing of the R265 system involved evaluating the uniformity of the time of arrival of the detonation front, which is measured at the inner surface of 50 kilograms of composition B hemispherical explosive charge located inside the aluminum hemisphere. Hundreds of fiber optic cables are placed in another thin hemispherical shell placed in proximity of the inner surface of the high explosive. The other end of the fiber cables go to a fixture for a rotating mirror that is part of a high speed streak camera.

With the firing of a EBW detonator of the hemispherical shock generator, the complex explosive distribution system initiates the high explosive charge. The detonation front travels through the composition B explosives and on exiting produces light, which is captured on film in the streak camera via the fiber optics cables, allowing a determination of smoothness of the converging shockwave and the symmetry of a imploding shell of uranium.

The IAEA obtained information from a member state that one experiment of such a system was conducted in 2003. The IAEA says that this chamber would have been suitable for carrying out this experiment.

Ascertaining the Symmetry of an Imploding Shell of Uranium?

Another possible purpose of this explosive test chamber could have been to ascertain the symmetry of an imploding hemispherical shell of uranium metal in a scaled down experiment. However, the test may have

[2] PETN-based explosives.

required more powerful explosives than Composition B, such as 75/25 Cyclotol, to achieve the necessary shell speeds. Based on the constraints of this chamber and using a more powerful high explosive, the shell could be approximately 9 centimeters thick while still containing about 50 kilograms of high explosives.

A streak camera and fiber optic cables could be used to track the motion of the metal shell. This type of implosion configuration would cause a massive high speed jet of metal followed by a large “self forging fragment” that would have to be stopped by a concrete wall. This fragment would be expected to penetrate deeply into the wall. If the IAEA were able to examine the chamber, it may be able to determine if such a test took place.

Why Visit the Chamber?

An experiment of the initiation of the R265 system described above would contain less than 70 kilograms of high explosives and would have been possible to conduct in the chamber at Parchin. Likewise, a scaled down test to ascertain the symmetry of an imploding shell of uranium could have been done in this chamber. The explosive compression experiments mentioned by a U.S. official to CNN above may be related to these types of test or may involve a different one. In all the cases discussed here, Iran’s goal of using this chamber would likely have been to hide its activities from overhead observation.

Iran has already agreed in principle to another IAEA visit to the Parchin site. Because a visit could help establish more transparency over Iran’s alleged nuclear weaponization activities, the public and governments should support such a visit.

Figure 1. March 14, 2000 GeoEye satellite image showing the foundation where Iran would place a high explosive test chamber later in the year 2000.

Figure 2. August 13, 2004 commercial satellite image which shows the building containing a high explosive test chamber.