



This sequence from an arena test of the BROACH warhead for the JSOW clearly reveals the penetrating plasma jet created by the precursor shaped charge

# Broaching a hard target

GRAHAM WARWICK/WASHINGTON DC

**A**HOLE BLASTED through 3.7m-thick reinforced concrete is testament to the capabilities of the UK's BROACH multi-warhead system. It is midway through US testing and the evaluation appears to be going well, but the ultimate challenge still lies ahead: can Team BROACH penetrate the US procurement system and get its warhead into at least one candidate missile?

The hole in the concrete resulted from the first dynamic sled test of the BROACH warhead for Boeing's AGM-86C conventional air-launched cruise missile (CALCM). It was caused by the BROACH's initial, or precursor, shaped charge. If the secondary, or follow-through, penetrator which then passed through the hole had been packed with explosive rather than instrumentation, the test would have demonstrated the warhead's ability to destroy hard and buried targets (see diagram).

As it was, according to the US Air Force, the test verified the ability of a 400kg warhead to defeat reinforced structures. Team BROACH says that the concrete target was 20% thicker than anything previously defeated by a 450kg-class penetrator warhead and that performance was similar to that of the 1,800kg GBU-28

## Can the UK breach the Pentagon's procurement walls?

kinetic-energy penetrator bomb used during Operation Desert Storm in 1991.

At stake is a contract to provide warheads to give the CALCM, carried by USAF Boeing B-52s, the ability to destroy buried or reinforced targets. Boeing is evaluating the BROACH against Lockheed Martin's kinetic-energy Advanced Unitary Penetrator (AUP). A decision is expected early next year.

The BROACH is being evaluated under the US Department of Defense's Foreign Comparative Test (FCT) programme. The CALCM FCT is one of two involving the UK-developed multi-warhead system. The other, just completed, involved a BROACH warhead for the Raytheon AGM-154 Joint Stand-Off Weapon (JSOW). In the latter case, the BROACH is in competition with kinetic-energy penetrators developed by Matra BAe Dynamics and Rafael, as well as a version of Lockheed Martin's AUP.

The BROACH was conceived originally to meet the UK Royal Air Force's conventionally

armed stand-off missile requirement. It is the warhead in the winning Storm Shadow missile now under development by Matra BAe Dynamics. Whereas conventional penetrators rely on kinetic energy to drive through the layers of soil and concrete that may protect a target, the BROACH takes a different approach.

The precursor shaped charge creates a plasma jet that blasts through the soil and concrete, creating a hole that allows the follow-through warhead to penetrate more deeply into the target before exploding. The BROACH is the product of a team comprising warhead maker British Aerospace Royal Ordnance, fuze developer Thomson-Thorn Missile Electronics and the Defence Evaluation and Research Agency.

The JSOW FCT was intended to determine the BROACH's ability to meet the US Navy's requirement for a unitary-warhead version of the glide bomb. The evaluation involved two sled tests in 1996, which Team BROACH says demonstrated the warhead's capability against the hardest targets on the JSOW's hit list. Two "arena" tests demonstrated the BROACH's reversionary blast/fragmentation mode, for use against non-hardened targets. Six further tests of just the warhead and fuze showed that the BROACH complies with the Navy's "insensitive munitions" requirements, the team says.

Raytheon is under contract to select one of the competing penetrators for the JSOW, but the US Navy has cut out-year funding for the unitary-warhead version and its future is now in doubt. The JSOW is a joint programme, and any cut in Navy procurement will increase the cost of the US Air Force's variant, so Team BROACH expects the Pentagon to have the ultimate say on the weapon's future.

The CALCM programme looks more secure because there is funding in the Air Force budget for a penetrator version. An outcome in favour of the BROACH is not certain, however. Team BROACH describes it as a "dissimilar competition - the AUP does not have the same performance and can penetrate only half the thickness that BROACH can." The UK multi-warhead system is more expensive, but its developers say that fewer BROACH-armed missiles will be needed to destroy the required targets. □

### BROACH's effect against hardened aircraft shelters

