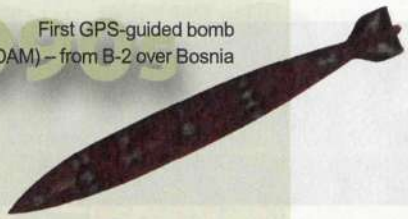
1976 First Tomahawk cruise missile air launch

1981 Airborne Laser Laboratory shoots down aerial target

1985 Anti-satellite missile fired from F-15 destroys satellite

1989 Northrop B-2 flies – first stealth bomber

1999 First GPS-guided bomb use (JDAM) – from B-2 over Bosnia



2000 Tactical High-Energy Laser shoots down Katyusha rocket

2002 GPS-guided weapons destroy mobile targets in network-centric warfare tests.

but cost remains the obstacle.

Instead, the US military is pursuing development of a new family of bombs that will extend the capability of GPS-guided munitions. The Small Diameter Bomb (SDB) will be a 115kg (250lb) weapon, half the size of the smallest bomb in NATO-wide use today, but with the destructive capability of a 900kg penetrating bomb. The SDB's small size will allow aircraft to carry more munitions and engage more targets – from eight on a Lockheed Martin/Boeing F/A-22 to around 200 on a Northrop Grumman B-2 – while reducing collateral damage. Two versions are planned: one with GPS/INS guidance for use against fixed targets; and a second with a terminal seeker with automatic target recognition for use against mobile targets. A pop-up wing kit is planned to extend the weapon's range and later versions may have the capability to loiter and autonomously seek out targets.

The current focus of GPS-guided weapon advanced development is on engaging mobile targets. This is part of a wider thrust towards networked targeting technology, enabling forces to attack fixed or moving targets at short notice, at any time, in any weather. The ability to hit a target on the move with a seekerless JDAM has been demonstrated under the US Defense Advanced Research Projects Agency's advanced moving surface target engagement (AMSTE) programme.

The key to networked targeting is to be able to locate and track targets and provide timely and accurate location information first to the launch aircraft then to the weapon in flight. In the AMSTE demonstration, data from multiple ground moving-target indication (GMTI) radars was combined to provide precision targeting. GMTI radars – on airborne ground-surveillance aircraft, unmanned air vehicles and, eventually, even satellites – provide all-weather capability. Combining data from two or more geo-registered radars – called multilateration – allows moving targets to be tracked with fire-control precision.

In the AMSTE demonstration, target updates were datalinked to the launch aircraft, then to the weapon after it was released. The goal was to achieve an accuracy of better than 10m. In tests, the JDAM has scored direct hits on moving trucks. AMSTE prime contractor Northrop Grumman is now proposing producing kits for JDAM – and the Raytheon Joint Stand-Off Weapon, a seekerless glide bomb – for under $12,000, depending on the datalink.

Critical datalink

The choice of datalink is critical to the success of networked targeting technology. A standard datalink, such as the widely used Link 16, is preferred, but may be too bulky and expensive for a weapon like JDAM. A cheaper, more compact UHF datalink would be better, but would incur the cost of retrofitting the GMTI radar platforms. Introducing another unique datalink to the lexicon of tactical communications would also complicate coalition operations.

The Link 16 digital datalink has been around for decades, but is only now entering widespread use. Developed by the USA as the Joint Tactical Information Distribution System, it has been adopted as the NATO-standard Multifunction Information Distribution System and is emerging as one of the key enablers of network-centric warfare.

Unlike earlier systems, which are point-to-point, Link 16 is a multiple-access, jam-resistant digital datalink. There is no controlling node to the network. Each participant is assigned a time slot in which to transmit data. All participants receive all the data, then select from it the information they need. One or more members of the net can act as relays, extending its reach beyond line of sight and to other, similar networks.

The early Link 16 terminals were heavy and bulky and were used only on high-value platforms such as airborne early-warning aircraft, air-defence command centres and ships. The more recent development of low-volume terminals has extended the tactical datalink's use to air-defence and strike fighters. Now tankers and transports are being equipped so that they can act as communications relays and extend the reach of the network.

Conceived in the mid-1970s, Link 16 has a relatively narrow bandwidth by today's commercial communications standards, but designers are finding ways to exploit the datalink to provide an internet-like capability to exchange information – whether it is sending target images direct to a fighter cockpit or mission instructions to an unmanned air vehicle.

The commercial computing industry has adopted on network standards that may not be the best technology can produce, but are the most widely accepted. The technology exists to produce a much better tactical datalink, but is in the military's interest to encourage Link 16's adoption as an alliance standard for network-centric warfare. As long as standards exist, coalition operations will be possible. ■

JDAM has turned the ageing Boeing B-52 into a powerful precision-strike platform

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