MILE STONES

Technological impact on Close Air Support

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Close Air Support (CAS or CAIRS), where aircraft engage hostile ground forces in close contact with friendly ground forces, remains a vital role for combat aircraft. Much has changed since the first use of aircraft during the Great War, to the extent that the use of armed aircraft has turned the tide of many land force engagements. In the digital age, precision munitions and digital technology have transformed how this role is performed, reducing risks to aircraft and friendly troops.

For decades, CAS involved fighter or attack pilots flying at very low altitudes, to visually acquire and deliver dumb weapons, while doing their best to evade hostile ground fire. While the results were often spectacular, the losses in aircraft were often high, and the risks to friendly troops were enormous, with high potential for 'blue-on-blue' losses.

Precision munitions have without doubt been the principal enabler for more accurate and lethal CAS operations, and important reductions in both losses of aircraft and collateral damage on friendly ground forces. More recently, the advent of digital datalinks, networks, and mapping systems has improved accuracy and reduced opportunities for the mistaken delivery of weapons against 'friendlies'.

CAS operations arise in a number of 'classic scenarios', each of which share some commonalities but also differ in key respects.

In manoeuvre warfare scenarios, a manoeuvre force element advances deep into contested or hostile territory to cut supply lines and 'encapsulate' pockets of hostile resistance. This is the classic Blitzkrieg model articulated by Guderian and Tukhachevskii during the 1930s, and refined by Simpkin during the 1980s. As well planned as the manoeuvre force advance might be, movements by opposing forces and fixed defences in geographical bottlenecks will inevitably force engagements to arise – and even in the ideal scenario a manoeuvre force must at some point reduce the isolated enemy units it has bypassed. These scenarios more than often see dismounted motorised troops and armour confronting dug-in infantry and armour, as the defending opponent attempts to hold ground.

CAS has been an integral part of such manoeuvre operations since the early 1940s, with this model continuing to be used, most recently during the 2003 invasion of Saddam's Iraq. CAS in COunter INsurgency (COIN) operations follows a similar pattern, but usually involving lightly armed insurgents and in recent times, human shielding by exploiting civilian presence especially in urban areas.

GBU-54 Laser JDAM trial drop at USNWC.

While dumb bombs and unguided Folding Fin Aerial Rockets (FFAR) continue to be used, many traditional weapons like napalm tanks have been effectively displaced by smart munitions.

The weapon of choice in Western forces is currently the GBU-31/32/35/38 Joint Direct Attack Munition (JDAM), an inertially-guided satellite navigation aided bomb kit attached to a 2,000 lb, 1,000 lb or 500 lb bomb. Frequently used are legacy GBU-10 2,000 lb and especially GBU-12 500 lb Laser Guided Bombs (LGB), supplemented by newer GPS/inertial aided LGBs such as the Paveway IV series. More recently, the GBU-54 Laser JDAM has been introduced, which adds a semi-active laser homing seeker to a JDAM kit.

In the East, Russia's KTRV manufactures and exports a range of analogous weapons for CAS operations. The legacy KAB-500L 1,000 lb class and KAB-1500L 3,000 lb class LGBs are direct analogues to the US Paveway II/III LGB series, recently supplemented by the new 500 lb class KAB-250L. A recent addition to this family of weapons is the 1,000 lb class KAB-500S-E, often dubbed the JDAM-ski. A 500 lb class KAB-250S-E has been reported but is yet to be seen publicly. China has deployed the LT-2 1,000 lb class LGB, modelled on the KAB-500L and Paveway II, and displayed a derivative with a more accurate proportional navigation seeker modelled on the GBU-24 Paveway III. A Chinese analogue to the LJDAM, the Luoyang LT-3, has also been marketed, this weapon combining a "Paveway III-like" nose section with a "JDAM-like" GPS/inertial tailkit.

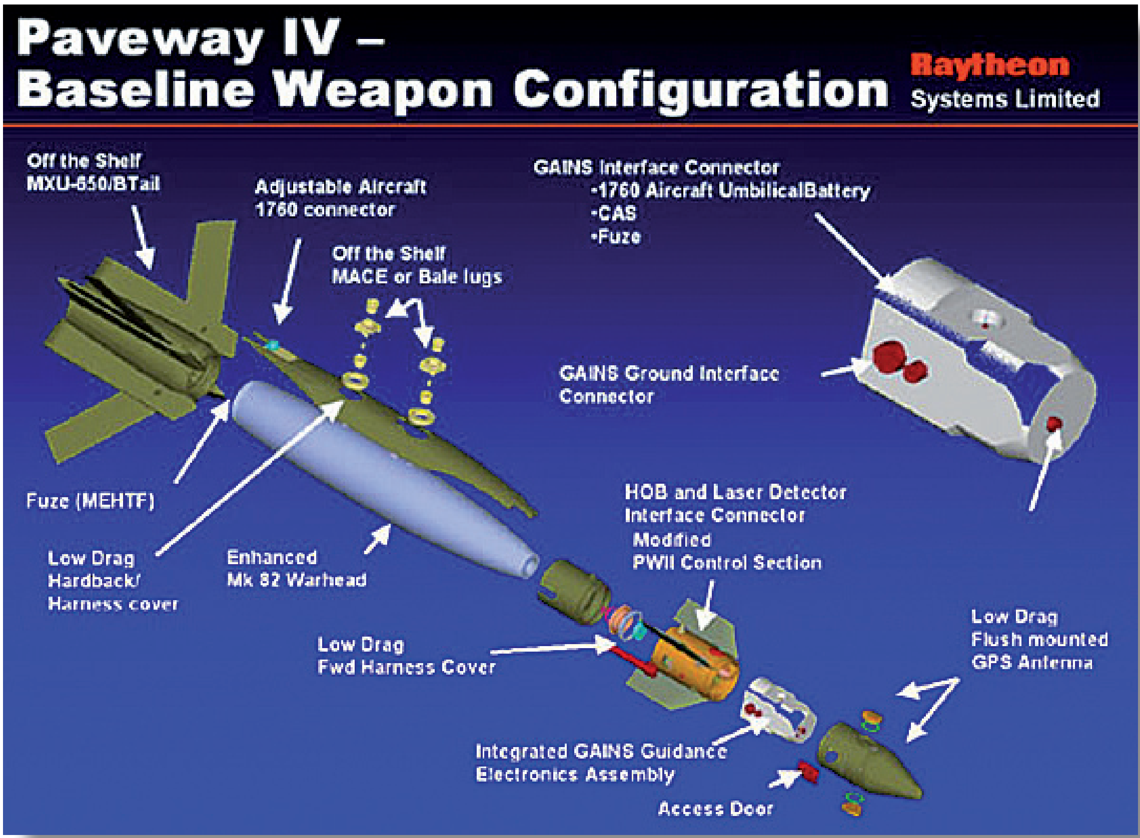
Laser-guided weapons dominated early use of guided bombs for CAS as they were cheap, simple, usually reliable, and could be used against moving targets, a capability only introduced into much later satellite/inertial weapons. The emergence of dual mode seeker equipped weapons like the LJDAM, Paveway IV and LT-3 reflects the attraction of laser guidance, but adding the reliability of a satellite/inertial guidance system, especially where laser lock might by compromised by inclement weather or obscurants like battlefield smoke.

While 'smart' weapons have improved lethality and accuracy, and permit attacks from altitudes outside the reach of man portable weapons, they cannot overcome the more fundamental problems encountered in synchronising and coordinating ground forces and air power.

CAS operations have always been challenging in the need to coordinate aircraft and ground forces, and countless instances of breakdowns in communications with lethal consequences exist, dating back to the 1940s. Whether the aricraft is dive-bombing with napalm or dumb bombs, or pickling off a smart bomb from 15,000 ft AGL, hitting the wrong aimpoint is a recipe for disaster given the lethality of these weapons.

The traditional approach to this problem assigns a Ground Forward Air Controller (GFAC) to a ground unit. The GFAC may be a specially trained ground force soldier, or an assigned air force NCO or officer. The role of the FAC is to assess the situation, and communicate with aircraft overhead, assigning targets and assessing effect. Covertly inserted GFACs played a pivotal role in the 2001 rout of Taliban and Al Qaeda land armies in Afghanistan.

Airborne FACs seated in observation aircraft, light attack aircraft, modified trainers or fighters have been used extensively since the 1940s. The advantage of an airborne FAC versus a GFAC



EGBU-16 Paveway IV.

GBU-54/B laser JDAM.

GBU-32 JDAM exploding on impact at USNWC.

is that he has a better 'bird's eye' view of the engagement, but often airborne FACs suffer heavy combat losses, as flying low and slow to 'eyeball' the engagement results in exposure to small arms, machine guns, automatic cannon fire, and since the late 1960s, MANPADS fire.

Key technological advances have appeared over the last decade, providing deconfliction and accurate transmission of target aimpoints in CAS operations. These have in many respects been a reaction to numerous friendly fire incidents post-2001.

The traditional method of communication between ground forces and overhead aircraft was wireless voice radio introduced during the 1940s. This technique remains in use but presents the ever-present risk of miscommunication, regardless of the weapon used. For instance, a number of JDAM drops in CAS operations went wrong when numerical coordinates of the intended aimpoint were either miscommunicated or incorrectly entered on a cockpit keypad – the JDAM then flew a perfectly correct trajectory hitting the wrong target. In one reported incident, a GFAC transmitted his own coordinates, having misread the display on his GPS receiver, upon which the B-52 overhead proceeded to pickle a 2,000 lb JDAM on top of the GFAC's location.

Handheld or tripod-mounted laser designators remain a valuable tool for GFACs. Such devices were originally built to provide rangefinding to intended ground targets, and coded laser illumination for attacking aircraft. A coded laser spot on the target prevents any ambiguity in terms of where the weapon is intended to hit, unlike voice communication which may be misinterpreted or jammed by a smarter opponent.

Digital equipment that has appeared in operations, or marketed for such, includes handheld computer pads with integrated digital datalinks or interfaces to combat radios with digital datalinks. Some laser rangefinder/designator products have also been enhanced with GPS receivers, or further enhanced with digital datalinks.

A man-portable computer with a digital map system, when integrated with a digital datalink, allows the GFAC to enter specific text instructions for the weapon delivery, along with exact coordinates, which are then transmitted over a digital datalink directly to the mission computers of the aircraft overhead. This minimises the number of opportunities for targeting errors to be introduced between the GFAC's choice of aimpoint and actual weapon release. Once the aircraft has the coordinates, they can be used to directly program a satellite/inertial weapon, or to cue the aircraft's targeting pod for target visual acquisition, identification and then attack.

A handheld or tripod mounted laser designator, with integrated GPS receiver and datalink, provides a similar capability but permits the GFAC to directly 'paint' the target for a laser guided weapon.

Other technologies have emerged, especially for deconfliction. These include X-band radar transponders for ground forces, intended to display their locations for aircrew performing CAS. What is often overlooked in the popular debate on CAS is that choice of direction for a bomb drop can be critical, even with smart bombs, as many guidance system failures see the weapons revert to a 'dumb' ballistic trajectory. If the bomb falls short or far, and the friendlies are along that trajectory, they become potential collateral damage. This discipline was drummed into trainee CAS pilots during the era of dumb weapons, since aiming errors were so common, but had to be retaught in the era of smart weapons.

The declining cost and increasing performance of handheld computer hardware and satellite navigation equipment is likely to see increasing use of digital technologies by GFACs, and less

B-52H “Buff” armed with JDAM.

A-10A “Warthog”.

specialised ground force elements who may need to call for CAS support.

Other technologies have emerged. One is the integration of a digital radio downlink in thermal imaging and/or television targeting pods, the intent being to transmit the image seen by a pilot in a CAS tasked aircraft to the GFAC. This is not a new idea, and was first trialled by the RAAF using a modified AVQ-26 Pave Tack pod on an F-111 during the early 1980s, using an analogue video downlink. Contemporary technology uses digital downlinks and uplinks, and far higher resolution thermal imaging and TV cameras. Systems of this ilk permit the GFAC to gain a better situational picture, especially if the opponent is retreating, or receiving reinforcements.

The advent of Remotely Piloted Vehicles (RPV/UAV) has been of great importance in providing persistent situational awareness for ground forces engaged in COIN operations. This is arguably as much an evolutionary as a revolutionary development, as the ability to position a robotic camera above the battlespace extends the ground force commander’s visual horizon to the coverage limits of the RPV rather than the visual line of sight which is constrained by local terrain.

Curiously, media and popular culture views of RPVs are firmly focused on the weapons payload, which remains by manned aircraft standards grossly uncompetitive. The important gains in persistent capability to surveil and target remain largely ignored.

Persistence is a subject that receives far too little attention in the public discussion of CAS operations, which seems to be more generally dominated by discussion of equipment and weapons, rather than technique.

The development of smart munitions was a key enabler for persistent CAS using manned aircraft, as these could orbit at altitudes where fuel burn was reasonable and achieve equal or better accuracy to dumb bomb equipped aircraft, which would have to loiter at low altitudes incurring high fuel burns at the expense of on station endurance. Another factor limiting time on station is that tactical aircraft have limited weapon payloads and must return for a reload once these are expended.

As smart bombs migrated from tactical fighters to heavy bombers, the persistence equation changed fundamentally. The Americans have made good use of their legacy B-52H and B-1B fleets armed with the JDAM, to provide highly persistent CAS capability since 2001. The size of these aircraft and their prodigious fuel capacity allows them to orbit for hours with a large payload of weapons – a task otherwise requiring multiple tactical aircraft and supporting tankers.

Contemporary CAS operations have benefited enormously from the mass production of modern smart weapons. Also, the proliferation of digital datalinks and networks have contributed to making modern CAS operations more accurate, more lethal, less prone to human error, and available 24 hours a day in all weather conditions.