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Rotocraft for War - Part 2

Helicopters in America's post-9/11 wars

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New missions, old dilemma

Recent military experience in Afghanistan and Iraq has prompted a significant change in American ideas about the combat use of helicopters, implying a greater emphasis in the future on small-unit combat support roles. These have significantly supplanted ideas of deep attack and large-scale helicopter assaults. These changes have not really surmounted the dilemmas associated with rotary-wing aircraft, however. Indeed, recent experience starkly illustrates these dilemmas. And nothing is more telling than the high attrition rate for helicopters in operations Enduring Freedom and Iraqi Freedom.

Since 2001, the US military has kept an average of approximately 550 helicopters of all types in the "Central Command" area, which encompasses both the Afghanistan and Iraq wars. (As of August 2008, there are more than 600 involved in these conflicts.) All told, in seven years, the United States has lost about 25 percent of the average number of deployed helicopters, that is: 136 helicopters lost – at least one-third of these to enemy action.[1] Moreover, the Army estimates that 3 percent of its entire fleet of 3,150 helicopters will be "washed out" due to recent military operations and require replacement. This, despite spending an average of $500 million per year to "reset" those craft returning from service in Afghanistan and Iraq.

To restate the dilemma that frames our analysis:

> Helicopters are prized for their unique combination of mobility, flexibility, and agility as well as their putative capacity to work closely with ground forces and provide them with persisting support. But these promises and capabilities are offset by issues of cost and vulnerability.
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> Once deployed, helicopters prove acutely sensitive to environmental conditions, are relatively fragile, and can be engaged throughout their performance envelope by

multiple, relatively-inexpensive weapon systems. These vulnerabilities can be mitigated, partially – but only in ways that substantially increase costs while narrowing the scope of the crafts' usability.

More than ever before, fielding military helicopters is a high-cost proposition. In 2008, the value of an Apache AH-64D ranged between $34 million and $48 million, depending on the level of upgrades. To keep them flying requires a complement of 30 support personnel each. And, due to maintenance scheduling, it takes a fleet of 30 Apaches to keep eight available in the field.

Any nation hoping to frequently deploy and use combat helicopters in operationally significant numbers must have very deep pockets and a certain insensitivity to cost and cost-effectiveness – as though it has money to burn. Even then, higher command and political authorities may, at the last moment, prove unwilling to risk these costly assets in the types of missions for which they were supposedly procured. Thus, the crash of two US Army helicopters at the outset of the 1999 Kosova war contributed to keeping Apaches out of that conflict entirely (although 24 had deployed to fight).

Nations with fewer helicopters to spare than does the United States will be even more cautious about putting them in harm's way. Thus, peace operations in Chad and Darfur have had a difficult time attracting sufficient numbers of even transport types. The problem is not that the world has too few military helicopters on hand, however. All told, UN operations employ about 150 helicopters worldwide – out of total member military holdings that exceed 12,000.

Pivotal experiences in the Afghanistan and Iraq wars

The most important factor influencing post-9/11 US helicopter operations was the general shift in US security concerns from conventional warfare to counter-insurgency efforts. Counter-insurgency scenarios typically involve too few forces attempting to secure too much space. In this context, helicopters promise a capacity to rapidly concentrate troops and firepower across large expanses of territory despite poor ground transportation nets. This is something of a return to origins for military helicopters, calling to mind their early use in the Vietnam and Algerian conflicts.

Also important in shaping recent US practice were a host of negative experiences in Somalia, Afghanistan, and Iraq. The net result of these has been to undermine command enthusiasm for large-scale "deep operations" by armed helicopters and to raise a caution flag on "air assault" operations as well. (The latter involve using helicopters to insert infantry units deep in enemy territory with attack helicopters providing support).

Operation Anaconda and the challenge of air assault

Depositing lightly armed troops deep in enemy territory is a high risk gambit. Success depends on luck, good intelligence, and close coordination among different arms. The vulnerability of the

troops leaves little room for mishaps, while the vulnerability of the helicopters and their sensitivity to environmental conditions raises the likelihood that mishaps will occur. Operating in mountains or other challenging environments adds to the risks and uncertainties. Operation Anaconda illustrates how easily things can come apart.

In March 2002, three months after the fall of the Taliban regime, US forces led an effort to kill or capture Taliban and Al Qaeda fighters still holed up in the Shahi-Kot Valley. The plan was to have pro-government militia (stiffened by US air power and special operations units) engage the anti-government forces, while other US forces stemmed their retreat – a hammer and anvil operation. Helicopters were to deliver US troops – the "anvil" -- into blocking or observation positions and provide them with fire support. However, upon being inserted, the first wave of about 200 US personnel unexpectedly found their landing areas to be swarming with Taliban fighters. Due to environmental conditions, difficult terrain, and the density of enemy fire, Apache gunships were unable to provide sufficient fire support.

All of the seven Apaches involved sustained significant damage – and five were compelled to return to base (although three of these returned to the fight within 24 hours). Deployment of a second wave of US "anvil" troops was postponed and half of the first wave was evacuated that night. Given heavy support by fixed-wing aircraft, deployment re-commenced the next day. Under a revised plan, fixed-wing bombardment continued for nearly a week before US and pro-government forces secured the valley. Central Command claimed that between 500 and 770 anti-government forces had been killed, although only dozens of bodies were found.

In a related incident, an attempt to land a US SEAL reconnaissance team near a peak (Takur Ghar) overlooking the Shahi-Kot valley also ran into unexpected heavy fire. One of the two Chinook transport helicopters carrying the team was hit by an RPG and both were forced to fly off – but not before a team member fell out and into the hands of the Taliban. The damaged Chinook made a controlled crash-landing seven kilometers away and its crew was rescued. A subsequent attempt to land a rescue team for the SEAL who had fallen from the chopper near Takur Ghar also came under heavy fire, but successfully inserted the team before flying off, damaged. Finally, an effort to reinforce this team similarly met heavy fire. Another Chinook was hit by an RPG and crashed, killing four on board.

The challenge of helicopter operations under fire in difficult mountain terrain was illustrated again more than three years later (28 June 2005) when a MH-47 Chinook sent to rescue another trapped SEAL team was hit by an RPG. Badly damaged, it was nonetheless able to land on a high ledge. Unfortunately, the ledge gave way and the helicopter toppled down the mountainside. All 16 service people on board were killed. Due to high altitudes, the Apaches that had been escorting the Chinook could not keep pace, so it had to fly into the hot zone without fire support. (Russian heliborne troops faced a similar tragedy in Chechnya on 27 April 2007 when the rotor of their Mi-8 helicopter struck a mountain side while trying to land special operations troops. It tilted over, slid down the mountain side, and burst into flames, killing all 20 on board.)

The troubles encountered in Operation Anaconda also call to mind the October 1993 "Black Hawk Down" incident in Mogadishu, Somalia. There, an air assault raid into a militia-controlled area of the city was stalled when RPGs brought down two MH-60 Black Hawk helicopters. A blizzard of small-arms fire and RPGs held support helicopters and relief convoys at bay for 14 hours. Nineteen Americans were killed and 73 wounded.

Karbala, Iraq – deep attack undone

On 23 March 2003, three days after the onset of the Iraq war, 31 Apache helicopters of the 11th Attack Helicopter Regiment (some organic, some attached) set out to deplete the armor and air defenses of the Iraqi Medina Division near Karbala. As was doctrine, they flew low in packs toward their objective. However, en route they became ensnared in "flak traps" – storms of small arms fire, rocket-propelled grenades, and man-portable missiles, originating from roof tops. This ad hoc air defense effort, which was reminiscent of Somali tactics ten years earlier, had probably been triggered by Iraqi pickets equipped with either cell phones or low-power radios. The fire brought down one of the Apaches and damaged all the others sufficiently to compel their return to base. The experience dampened command interest in attempting helicopter deep attack thereafter.

Following the Karbala incident, attack aviation focused mostly on reconnaissance efforts, flank security operations, and the provision of fire support (Close Combat Attacks or CCAs) for advancing ground units – especially in built-up areas. According to one observer, this "signaled the rebirth of aviation in a close fires role and represented a paradigm shift from a decade-long infatuation with deep attacks."[2]

One partial exception – a denouement, actually – was a 28 March helicopter attack on the 14th Mechanized Brigade of the Medina Division conducted by the aviation units of the 101st Airborne. This was a more deliberate effort than the 23 March attack by the 11th AHR, with the units carefully reconnoitering and clearing zones as they proceeded, and pulling back when they faced heavy ground fire (so that artillery and fixed-wing aircraft might suppress it). As a result, no helicopters were lost to enemy action (although two succumbed to accidents). On the downside, the attack claimed only a handful of Iraqi armored vehicles, artillery, and air defense systems. Caution has its price as well as its benefit.

Recent counter-insurgency operations – a helicopter renaissance?

Despite the experience of Operation Anaconda and the failed Karbala mission, helicopters have come to play a central role in recent counter-insurgency efforts. Today, they are key providers of transport, with armed types acting as escorts. Gunships also serve to provide security to ground convoys. And they serve in reconnaissance, surveillance, and "close combat attack" roles, providing ground units with "over the shoulder" firepower. Sometimes they act independently in smaller-scale "counter-insurgent strike" efforts. In urban cordon and search operations, they have acted to block and interdict insurgents attempting escape. During the

2008 operations in Sadr City, at least a half-dozen Apaches were kept in the air at all times, employing hundreds of Hellfire missiles over a few weeks.

The fact that helicopters are serving broadly does not mean they are the optimal choice for all the tasks they have been assigned, however. They are an asset that America held in abundance before the onset of the current wars. Despite America's unique investment in them, they have not escaped the dilemma associated with their vulnerability. This can be appreciated by analyzing the types of threats they have faced in recent wars and the ways these threats have been managed.

Environmental challenges and maintenance overload

As noted earlier, helicopters seem to offer a ready-made solution to the force-to-space problems that often plague counter-insurgency efforts. It is just as important to note, however, that insurgencies are most likely to flourish in physical environments that helicopters will find challenging.

As we have seen above, jagged terrain and cityscapes make landings difficult and they offer insurgents occluded firing positions. Telephone and electrical wires in and around cities have claimed at least four helicopters. Thin, cold mountain air saps lift and power, degrading performance and shortening helicopter "on station" time. High ambient temperatures also stresses engines and limits lift. Snow storms in Afghanistan, sandstorms in Iraq, and wind and rain storms in both limit visibility and make controlled maneuver difficult.

Environmental conditions too frequently require that helicopter use be curtailed, which can disrupt joint operations. Such problems effected the conduct of Operation Anaconda, delayed planned helicopter attacks at the start of Iraqi Freedom, and limited helicopter use to daylight hours for 10 crucial days during the first phase of the war.

Sand and dust pose persistent problems. Most of the helicopter accidents in Iraq and Afghanistan are due to "brownout conditions" in which the downwash of rotors kicks up an envelope of blinding dust. To compensate, pilots execute "no hover" landings, touching down while their aircraft are still moving forward – a practice that stresses the rotor gears and airframe. Sand and dust continuously coat, clog, and erode mechanical and electronic gear (notably including infrared missile warning systems). Despite regular maintenance in the field, one helicopter was found to harbor 230 pounds of sand when it rotated home, according to the commander of the Army Aviation Center.[3]

Helicopters fly between 30- and 50-hours per month, on average, in Afghanistan and Iraq, which is considered a high operational tempo. The Army has been able to sustain a 77 percent readiness rate for its deployed helicopters by substantially boosting its field maintenance efforts, routinely rotating helicopters into and out of the theater – only 17 percent of the total inventory is deployed at any one time -- and mounting an ambitious $4 billion helicopter "reset"

program at home. Today, maintenance crews make up 85 percent of the Army aviation force. By contrast, British forces, unable to match American resources, have seen their helicopter readiness levels in theater drop to 50 percent.

The insurgent threat

Modern attack helicopters and the doctrine for their use developed with reference to Soviet armored forces in Europe. There, the expected main threat to helicopters was radar guided missile and anti-aircraft cannon (notably the ZSU-23-4, an armored self-propelled system with four 23-mm guns). Helicopter attack scenarios envisaged fixed-wing aircraft neutralizing these weapons. Helicopters were supposed to approach their objective flying nap-of-the-earth (to lessen their exposure) and then pop-up on arrival to deliver anti-tank missiles at standoff ranges. Presumably, most of their flying would occur over threatened, but not enemy-controlled territory. Clearly, such scenarios have little relevance to America's post-9/11 wars.

The insurgent threat to helicopters in Iraq and Afghanistan includes small arms fire, anti-aircraft machine guns (notably the 12.7 mm DshK), rocket-propelled grenades (notably the RPG-7), and portable surface-to-air missiles (principally the SA-7, but also the SA-14 and SA-16). While small-arms fire is often spontaneous, the use of RPGs, portable missiles, and heavy machine guns is not. Insurgents often fight in "air defense" teams that combine weapons, spotters, and communications personnel. Favored sites in Iraq are roof tops, court-yards, alleys, and groves. Small open-bed trucks carrying weapons covered with a tarp offer a means to rapidly concentrate weapons – especially heavy machine guns – and then disperse. Favored targets include helicopters flying predictable transit routes or conducting routine reconnaissance. Any coalition effort that concentrates helicopters over a period of days, or any area that regularly attracts helicopter surveillance, also offer insurgents an opportunity to concentrate their air defense efforts.

The contest between insurgent tactics and helicopter counter-moves is evident in the 20 January 2007 downing of a UH-60 Black Hawk helicopter in which 12 died. In this case, the second helicopter in a team of two took fire, tried to land, and was hit again by an RPG round. The lead aircraft immediately returned fire and then landed in an effort to assist the downed crew. Soon, another set of Black Hawks joined the fray as did two attack helicopters. These destroyed a truck mounting a heavy machine gun as well as three houses near some trees where a second anti-aircraft gun was hidden. Shortly afterward, a rapid reaction team of seven armored jeeps (HMMWVs or "Humvees") arrived. One was hit by an improvised explosive device, however, which killed another soldier. After securing the area, they additionally found missile launchers and a mortar tube.

There are technological counter-measures available that are usually effective for dealing with those anti-aircraft missiles currently in insurgent hands -- as long as helicopters fly high enough to allow for reaction time (minimally, above 2,000 meters). However, as noted below, the best

counter-measure systems have not always been installed – nor will be. And there are no counter-measures yet available for the small arms, machine gun, and RPG threats.

RPGs are very effective up to 200 meters, but also have scored hits as far out as 700. Small arms are out-ranged beginning at 1000 meters. Heavy machine guns in skilled hands can be quite effective up to 1,500 meters. So, taken together, these weapons can make flying below 2,000 meters quite perilous. Unfortunately, given the nature of these conflicts, there are no or few truly secure zones.

In providing fire support or striking insurgent targets, pilots would prefer to engage from standoff ranges – at least three kilometers using missiles. Cannons require closer shots, however: 1,500 meters or less. Indeed, in order to distinguish individual combatants, helicopters often must fly closer. And, of course, insurgents will choose to engage at close ranges. Thus, most engagements occur at distances of less than 1,000 meters, which puts helicopters within range of an array of weapons.

Technological Countermeasures

Ideally, helicopters in harms way – which includes all types in Iraq and Afghanistan – would have infrared heat suppressors as well as rugged, advanced missile warning systems, flare dispensers, and active jammers. At the start of the Iraq war, however, only special operations types met this standard. Most conventional scout and attack helicopters had older warning and jamming systems and no flare dispensers. Some lacked infrared suppressors. Transport types were worse off. As the war progressed (and helicopters fell from the sky), warning and jamming systems received upgrades, and these began to spread from attack models to transport types. Yet, as of August 2008, coverage was still not complete. And existing upgrade programs have not kept pace with the threat. Losses to enemy fire in Iraq during 2006 and 2007 – before many Sunni and Shia militia stood down – were greater than those during the preceding two-year period.

Losses not withstanding, there is no likelihood that even the attack helicopter fleet will be upgraded to the standard of special operations craft. Upgrades to the latter cost about $19 million per airframe in 2004, while upgrades to conventional helicopters were in the range of $3 million each. Cancellation of the Comanche program has made possible a more thorough upgrade program for the conventional fleet. But the savings cannot close the gap because they are also supposed to help the Army generally modernize its helicopter fleet.

Equipping the Apache AH-64D with "best protection" would probably drive the per unit to cost into the $45 million to $55 million range. The RAH-66 Comanche faced cancellation in 2004 when its unit cost rose to nearly $59 million. Helping to motivate that decision was the realization that, despite the Comanche's many advanced features and high cost, it was not well protected against the insurgent threat. Additional upgrades would have had to be made.

Tactical countermeasures

No foreseeable technology will cure the vulnerability of these fragile machines as they operate over and within complex terrain, ridden with adversaries. Indeed, the principal means of alleviating helicopter attrition in Iraq and Afghanistan have been tactical and operational, not technological. But these have imposed their own limits and costs.

Helicopters have taken to flying in small teams – usually two -- rather then alone or in large groups. Team members keep 500 meters between them, so that one might cover the other and both might divide the labor of identifying and engaging targets. More generally, the importance of working together with other arms has been emphasized. Thus, for instance, fixed-wing aircraft might escort helicopters in especially dangerous areas.

Crashes are most common at night, but day time is when insurgents have their greatest success in downing helicopters. Night-time dangers can be mitigated by flying above terrain obstacles and landing only on landing strips in secure bases, however. Unlike early in the war, by 2007 plenty of these bases existed. So night flying increased. Still, most close combat support operations require daytime flight. And reconnaissance and transport tasks cannot be restricted to night.

When conducting operations, nap-of-the-earth flying is no longer attempted. Shooting "on the run" or while diving has largely replaced stationary fire techniques or "hovering fires" (except sometimes at night). This, of course, complicates the task of acquiring and accurately engaging targets.

Helicopters have also taken to flying faster and higher when transiting "hot spots". Predictable transit corridors – such as those that might follow surface lines of communication – are avoided. And numerous "no fly zones" have been designated. Complementing these are shifting "danger zones" over which pilots must exercise greater caution.

Seeking alternatives

The measures outlined above probably have helped prevent a debilitating rise in the numbers of helicopters claimed by insurgent action. But they succeed by narrowing the utility of helicopters – that is, by revoking the promise of a "go anywhere, do anything" flying machine. (Similarly, the wider adoption of advanced countermeasures systems help drive the cost of helicopters toward prohibitive heights).

These factors, and the inherent vulnerability of helicopters, make a search for alternatives worthwhile. One approach is to avoid using helicopters for tasks that other arms -- artillery or fixed-wing aircraft, for instance – might accomplish just as well and more safely (as the US Marine Corps' Cobra Survivability Plan concluded early in the war).[4] In many situations, the armed reconnaissance role is better fulfilled by more heavily armored ground forces, with helicopters relegated to standoff surveillance and fire support. Unmanned Aerial Vehicles

(UAVs) might substitute for helicopters in performing many surveillance and reconnaissance tasks, and they increasing are. Especially in cities and other complex environments, UAVs are substituting for scout helicopters (such as the OH-58 Kiowa Warrior).

A tilt-rotor alternative to helicopters?

One alternative not worthy of consideration is increased reliance on tilt-rotor aircraft, such as the US Marine Corps MV-22 Osprey. The Osprey's one sure advantage is its capacity to fly 40% to 60% percent faster than helicopters when it operates in "airplane" mode. Thus, it is presumed less vulnerable when in flight. But its cost – $75 million per unit (2009) – is much higher and its transport efficiency is much less than that of comparable helicopters. Helicopters equal in power and empty weight to the V-22 can carry much more payload to any distance. The CH-53E Super Stallion, for instance, costs approximately $40 million, but it can carry twice as much payload to 400 nautical miles. And the difference between helicopters and tilt rotors in terms of transport efficiency increases with altitude, which is relevant to operations in mountainous terrain.

The MV-22 figures centrally in the Marine Corps' plans for "rapid maneuver from the sea," thus they are loathe to surrender it. Actually, comparable helicopters could do the job faster whenever several round trips are required. This is due to their "transport efficiency" advantage. But the MV-22 speed advantage holds true if only one or two waves are planned. What happens on arrival is another matter, however.

In "hover mode," the MV-22 is considerably less stable than helicopters and must descend slowly and carefully, which increases its exposure precisely when insurgents might be closest. Maneuverability in hover mode also is compromised. These limits reflect efforts to address persistent aerodynamic problems ("vortex ring state"), which also make the craft likely to kick-up especially disruptive dust clouds when landing.

In 2007-2008, 12 MV-22s deployed to Iraq, but these were not used in high-threat missions or areas. During 2,500 sorties, pilots reported being fired on twice. Given substantial manufacturer support, the Osprey's in Iraq where able to achieve a 68 percent average readiness rating – which is still below that achieved by older helicopters in theater. The aircraft also has faced persistent engine problems. These compelled at least one emergency landing in Iraq, while a series of engine fires have plagued the craft back home. (All told, 30 personnel have been killed in crashes during Osprey test flights between 1991 and 2000.)

Despite its troubles, the Osprey has gained popularity as a VIP taxi in Iraq – a favorite of top brass and visiting dignitaries and celebrities. Notably, on 22 July 2008, a flight of four transported Pres. Barack Obama from Al-Anbar province to an airport in Jordan. Without question, images of the four odd-looking craft landing together were impressive. But even as showman, the Osprey is unlikely to supplant the helicopter – at least not until some footage of it deftly maneuvering in battle supplants the ubiquitous videos of its spectacular test crashes.

Notes

1. "General says US Army has lost 130 helicopters in Iraq and Afghanistan," *International Herald Tribune* (*Associated Press*), 23 Mar 2007.
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3. P. Hess, "Army Needs $1.2b for Chopper Replacement," *UPI,* 2 Jan 2006.
4. R. Wall and D. A. Fulghum, "Coming Under Fire," *Aviation Week,* 12 May 2003.

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