Order Code RL32447

Military Helicopter Modernization: Background and Issues for Congress

June 24, 2004

name redacted
Research Associate
Foreign Affairs, Defense and Trade Division

name redacted
Specialist in National Defense
Foreign Affairs, Defense and Trade Division

Military Helicopter Modernization: Background and Issues for Congress

Summary

Recent military operations, particularly those in Afghanistan and Iraq, have brought to the fore a number of outstanding questions concerning helicopters in the U.S. armed forces, including deployability, safety, survivability, affordability, and operational effectiveness. These concerns are especially relevant, and made more complicated, in an age of "military transformation," the "global war on terrorism," and increasing pressure to rein in funding for the military, all of which provide contradictory pressures with regard to DOD's large, and often complicated, military helicopter modernization efforts. Despite these questions, the military use of helicopters is likely to hold even, if not grow. This report includes a discussion of the evolving role of helicopters in military transformation.

The Department of Defense (DOD) fields 10 different types of helicopters, which are largely of 1960s and 1970s design. This inventory numbers approximately 5,500 rotary-wing aircraft, not including an additional 144 belonging to the Coast Guard, and ranges from simple "utility" platforms such as the ubiquitous UH-1 "Huey" to highly-advanced, "multi-mission" platforms such as the Air Force's MH-53J "Pave Low" special operations helicopter and the still-developmental MV-22B "Osprey" tilt-rotor aircraft.

Three general approaches can be taken to modernize DOD's helicopter forces: upgrading current platforms, rebuilding current helicopter models (often called recapitalization), or procuring new models. These approaches can be pursued alone, or concurrently, and the attractiveness or feasibility of any approach or combination of approaches depends largely on budgetary constraints and operational needs. In some cases, observers argue that upgrades to helicopter sub-systems, especially radar, communications, and targeting systems, are the most cost effective way to satisfy current helicopter requirements. Others argue that while upgrades are cost effective in some cases, today's helicopters are sufficiently aged to require re-building, a more involved modernization approach.

The modernization programs outlined in this paper suggest a number of issues that may compete for congressional attention. These issues include 1) budgetary concerns (Helicopter modernization plans and programs described in this paper would account for approximately $34.6 billion in spending between FY2005 and FY2009), 2) impact on overall force structure, 3) whether there is adequate coordination among the Services, 4) how modernization may effect the helicopter industrial base, and 5) a number of operational considerations such as whether the envisioned programs will adequately improve operational shortcomings identified in recent conflicts such as deployability, reliability, and survivability.

This report will be updated as events warrant.

Contents

Military Helicopter Modernization: Background and Issues for Congress[1]

Introduction

Recent military operations, particularly those in Afghanistan and Iraq, have brought to the fore a number of outstanding questions concerning helicopters in the U.S. armed forces, including deployability, safety, survivability, affordability, and operational effectiveness. These concerns are especially relevant — and made more complicated — in an age of "military transformation," the "global war on terrorism," and increasing pressure to rein in funding for the military, all of which provide contradictory pressures with regard to DOD's large, and often complicated military helicopter modernization efforts. In addition, military helicopters' operational roles and missions may also be challenged by the emergence of a number of significant factors, including the increased use and capabilities of unmanned platforms,[2] the perception of increased vulnerability in combat situations, and the increased effectiveness of fixed-wing aircraft equipped with precision munitions in the close air support (CAS) role.[3] Yet, emerging demands of homeland defense and stability operations may increase helicopter applications.

The Department of Defense (DOD) fields 10 different types of helicopters, which are largely of 1960s and 1970s design. This inventory numbers approximately 5,500 rotary-wing aircraft — not including an additional 144 belonging to the Coast

---

[1] For the purposes of this report, the term "helicopter" will be used interchangeably with "rotary-wing aircraft" as well as "rotorcraft" so that the V-22 Osprey — technically a member of the latter categories of aircraft — may be included.

[2] Various acronyms exist to describe these platforms: Unmanned Aerial Vehicles (UAVs), Unmanned Combat Aerial Vehicles (UCAVs), Unmanned Aerial Rotorcraft (UARs), and Unmanned Combat Aerial Rotorcraft (UCARs).

[3] "Close Air Support" is defined as 'Air action by fixed- and rotary-wing aircraft against hostile targets that are in close proximity to friendly forces and that require detailed integration of each air mission with the fire and movement of those forces. See *JP 1-02, Dictionary of Military and Associated Terms*, Apr. 12, 2001 (as amended through Mar. 23, 2004), p. 90, online at [http://www.dtic.mil/doctrine/jel/new_pubs/jp1_02.pdf]. It is interesting to note that the General Accounting Office, in a March 2003 report, included only one helicopter platform as performing CAS in the U.S. armed forces, while including such fixed-wing aircraft as the A-10, F-16, F-15E , B-52, AC-130, AV-8B, F/A-18, and the F-14. See U.S. General Accounting Office, *Military Readiness: Lingering Training and Equipment Issues Hamper Air Support of Ground Forces* (Washington: GAO, 2003), specifically Appendix II, "Examples of DOD Aircraft That Perform Close Air Support," pp. 32-33.

Guard [4] — and ranges from simple "utility" platforms such as the ubiquitous UH-1 "Huey" to highly-advanced, "multi-mission" platforms such as the Air Force's MH-53J "Pave Low" special operations helicopter and the still-developmental MV-22B "Osprey" tilt-rotor aircraft. Also, there are a large and potentially confusing number of types and variants of the same basic helicopter platform. For example, DOD has so far acquired seven different types of the H-60 "Black Hawk" design: the CH-60, EH-60, HH-60, MH-60, SH-60, UH-60, and the VH-60. These design types have, in turn, multiple variants.[5]

Helicopter Classifications

Rotary-wing aircraft are described and classified in a number of different ways. The most general method is according to gross weight although it should be noted that there has yet to be universal agreement with regard to the specific thresholds. Nevertheless, for the purpose of this report, "light" will generally refer to those rotary-wing aircraft weighing less than 12,000 lbs.; "medium" (or "medium-lift") are those weighing between 12,000 and 45,000 lbs.; and "heavy" (or "heavy-lift") are those which weigh more.[6]

---

[4] The U.S. Coast Guard operates approximately 144 helicopters. This figure fluctuates operationally due to maintenance schedules. Major missions performed by these aircraft include Search/Rescue, Law Enforcement, Environmental Response, Ice Operations, and Air Interdiction. The majority of the Coast Guard's helicopters (94 total inventory) are HH-65 Dolphin short range recovery aircraft. The HH-65 is built by the French company Aerospatiale, and are based at Coast Guard Air Stations in Michigan, Hawaii, Puerto Rico, New Jersey, Texas, California, Florida, Alabama, Louisiana, Oregon, Washington, and Georgia. The Coast Guard also operates 42 HH-60 Jayhawk medium range recovery helicopters. The Jayhawk is built by Sikorsky, and based in Alabama, Alaska, California, Florida, Massachusetts, North Carolina, and Oregon. The MH-68A Stingray is the Coast Guard's short range armed interdiction helicopter. Built by the Italian company Augusta, the Coast Guard's eight Stingray helicopters are based in Jacksonville, Florida. For more information on the Coast Guard, its missions, and its fixed and rotary wing aircraft, see [http://www.uscg.mil/USCG.shtm]. The Coast Guard is planning to modernize 207 of its aircraft, including its helicopter fleet, through its "Deepwater" program. For more information about the Deepwater program and the specific mix of manned and unmanned air vehicles to be procured, see CRS Report RS21019 *Coast Guard Deepwater Program: Background and Issues for Congress*. Additionally, a number of agencies involved in homeland security and border security (such as Immigration and Customs Enforcement, and Customs and Border Protection) operate older military utility and observation helicopters (e.g. OH-6A, UH-1H, HH-60J) or civilian helicopters (e.g. Eurocopter AS-350B1, Hughes 500, Bell JetRanger, MD-500E, and MD-600N). Some of these helicopters are armed, and most are equipped with forward-looking infrared sensors and search lights. See David Hughes, "Homefront Security," *Aviation Week & Space Technology,* Mar. 15, 2004, for more information.

[5] See [http://globalsecurity.org/military/systems/aircraft/h-60-var.htm]. Many of these types and variants have already been retired from the fleet or are in the process of being either renamed or replaced to reflect new mission functions and/or capabilities.

[6] Note that "light," "medium" and "heavy" rotorcraft will often overlap with regard to maximum gross weights as some variants of the same type may cross into another weight range.

A more specific method of classification involves the specific lettering used to identify different types of helicopters which are based on that platform's primary mission capability.[7] Central to this classification system is the letter "H" (for "helicopter") which is immediately followed by a number indicating a specific design (e.g., H-1, H-60, etc.). (The one significant exception is the tilt-rotor V-22 Osprey which can be more accurately described as a hybrid aircraft, such as the AV-8 Harrier "jump jet," with a Vertical Take-Off and Landing — VTOL — capability.) Next in importance is a single-letter prefix which indicates a particular mission capability or mission-set for that helicopter design. These prefixes (and their meaning) have included the following: "A" (Attack), "C" (Cargo), "E" (Electronic), "H" (Hospital/Med-evac/Search and Rescue), "M" (Multi-Purpose), "O" (Observation), "R" (Reconnaissance), "S" (Anti-Surface/Anti-Submarine), "U" (Utility), and "V" (VIP/Staff). Single-letter suffixes are then added after the design numbers to differentiate between variants, often indicating improved standards and/or configurations of equipment (and/or armaments).

Helicopters in the U.S. Armed Forces

The Army has six different types of helicopters in service. Its central platform is the medium-lift H-60 Black Hawk which serves primarily as a troop utility transport in the air assault role. Complementing it are the slightly smaller H-1 Huey and the much larger, heavy-lift CH-47 Chinooks. The active Army has two attack-type helicopters, the first being the lighter reconnaissance/attack OH-58 Kiowa, and the second being the AH-64 Apache attack platform. The Army Reserves and National Guard fly the AH-1S attack helicopter. Improved capability variants of the Black Hawk and the Chinook are operated by the Army's Special Operations Aviation Regiment (SOAR), under Special Operations Command (SOCOM), along with a different, light, multi-purpose/attack helicopter, the H-6 Little Bird.

The Navy and Marine Corps operate a total of five different types of rotary-wing aircraft. The latter service fields the only true attack helicopter between the two in the AH-1 Cobra. Troop transport and vertical replenishment missions are fulfilled by a number of aircraft, including the medium-lift H-46 Sea Knight and H-60 Sea Hawk, as well as the heavy-lift H-53 Sea Stallion (which is also used by the Navy in a mine countermeasures role). New multi-purpose Sea Hawk variants are being introduced to the fleet as is the V-22 Osprey tilt-rotor aircraft, and are scheduled to replace all of the older model helicopters performing standard transport and assault and roles, respectively.

The Air Force fields three different types of helicopters. Its H-1 Huey performs various utility missions while its H-60 variants are especially configured for Combat Search and Rescue (CSAR) missions. The specially-equipped H-53 Pave Low is used as a CSAR helicopter by the Air Force and for extraction operations by SOCOM.

---

[7] These capabilities — and therefore classifications — will frequently overlap as certain missions, such as troop transport, cargo transport, and medical-evacuation (or "med-evac") do not necessarily require special modifications be made.

DOD Helicopter Modernization Plans and Programs

Three general approaches can be taken to modernize DOD's helicopter forces: upgrading current platforms, rebuilding current helicopter models (often called recapitalization), or procuring new models. These approaches can be pursued alone, or concurrently, and the attractiveness or feasibility of any approach or combination of approaches depends largely on budgetary constraints and operational needs. In some cases, observers argue that upgrades to helicopter sub-systems, especially radar, communications, and targeting systems, is the most cost effective way to satisfy current helicopter requirements.

Others argue that while upgrades are cost effective in some cases, today's helicopters are sufficiently aged to require re-building, a more involved modernization approach. Upgrades often do not address reliability and readiness challenges that can plague aging helicopters. Stripping and re-building the airframe while adding new engines, transmissions and rotor assemblies is more cost effective in the long run in many instances. In other cases, the need to replace legacy helicopters with new models justifies the time and expense of research and development and procurement programs. (However, as in the case of the recent Comanche cancellation, new procurement programs can sometimes become too expensive for the benefits offered.)

This section describes ongoing Service plans to modernize specific aircraft. The following text focuses on the key issues for each modernization program. Those readers seeking detailed budget information may refer to the footnotes. Those readers seeking more background information can find a brief description of each aircraft type in Appendix I. The current inventory of all aircraft models is found in Appendix II.

SOCOM. The Special Operations Command (SOCOM) has its own budget allocation for its relatively small, modern fleet of approximately 200 aircraft. Many SOCOM modifications fall under a generic Rotary Wing Upgrades and Sustainment program which provides for ongoing survivability, reliability, maintainability, and operational upgrades as well as sustainment costs for fielded rotary wing aircraft and subsystems. Modifications involve avionics and navigation systems, sensor systems, active and passive survivability systems for all or most Army Special Operations Aircraft (ARSOA) as well as specific alterations to MH-60, MH-47, A/MH-6, and MH-53 platforms; modifications to the Air Force's CV-22 Osprey variant is funded separately (see Air Force sub-section below).[8]

---

[8] Budget breakdown: FY2005: $447.3M; FY2006: $225.5M; FY2007: $274.4M; FY2008: $339.7M; and FY2009: $329.4M; Total After FY2004: $1,616.3M. See U.S. SOCOM, "Rotary Wing Upgrades and Sustainment," *Procurement, Defense-Wide, Fiscal Year (FY) 2005 Budget Estimates*, Feb. 2004, Item No. 37. For all H-6 "Little Birds," H-47 "Chinooks," and H-60 "Black Hawks," modifications include the replacement of Mission Processors, Multifunction Displays, and Modular Avionics, as well as the procurement of a "next generation" FLIR system, a Low Probability of Intercept (LPI)/Low Probability of Detection (LPD) radar altimeter, and color weather mode capability in Multi-Mode Radar. For the MH-47 and MH-60 aircraft only, procurement includes (new) Obstacle Avoidance

(continued...)

Army. On February 23, 2004, the Pentagon, with backing from the White House, announced the cancellation of the Army's $39 billion RAH-66 "Comanche" armed reconnaissance helicopter procurement program, mainly for cost reasons.[9] As this move "frees up" approximately $14.6 billion that had been allocated in future spending, the Army has proposed a number of changes to its planned and ongoing modernization programs, assuming the money from the Comanche program remains within the purview of Army aviation. Estimated costs for terminating the contract range from $450 million to $2.7 billion.[10] It is generally expected that Congress will approve the Comanche's cancellation, which has already cost taxpayers nearly $7 billion over more than 20 years, with only two prototypes to show for the effort. This report has therefore included the Army's new Army Aviation Modernization Plan, which plans for the Comanche cancellation and the subsequent use of Comanche funds.[11]

The Army also has a number of ongoing modernization programs which apply to almost every platform in the aviation fleet, although funding estimates are calculated according to number of sub-systems procured rather than numbers of platforms upgraded. They are grouped together under "Ground Support Avionics" and "Other Support" sub-headings. The former consists of Aircraft Survivability Equipment (ASE) and ASE Infrared Countermeasures while the latter includes Airborne Command and Control, Avionics Support Equipment, Common Ground Equipment, Aircrew Integrated Systems, Air Traffic Control, Industrial Facilities, 2.75 Rocket Launcher, and Airborne Communications.[12]

---

[8] (...continued)
(OA)/Cable Warning (CW) systems and the Suite of Infrared Countermeasures (SIRCM). More aircraft-specific modernizations (and their costs) are detailed below. (All of these latter costs are included in the above total budget figures.)

[9] 'The central issue to this difficult decision was that Comanche program growth accounted for 40% of the current aviation budget and up to 47% in the Extended Planning Period (EPP).' See *Statement by LTG Richard A. Cody, Deputy Chief of Staff, G-3, United States Army, Before the Tactical Airland Subcommittee, Armed Services Committee, United States Senate on United States Army Aviation, Second Session, 108th Congress,* Mar. 30, 2004.

[10] Anne Plummer, "Boeing Says Negotiations To End Comanche Deals Will Take Time," *Inside the Army*, May 3, 2004.

[11] For a detailed outline of the Army's new plans for its aviation forces, see DOD Briefing, "Briefing on the Restructure and Revitalization of Army Aviation," Feb. 23, 2004, at [http://www.defenselink.mil/news/Feb2004/g040223-D-6570C.html]. Please note that very little was outlined with regard to any new plans concerning Army special operations aviation programs.

[12] Department of the Army, *Procurement Programs, Committee Staff Procurement Backup Book, FY 2005 Budget Request: Aircraft Procurement, Army*, Feb. 2004, pp. 115-166 (Item Nos. 23-32). Budget breakdown ('Ground Support Avionics': Item Nos. 23 and 24): FY2005: $86.5M; FY2006: $111.1M; FY2007: $137.1M; FY2008: $194.0M; FY2009: $171.3M; To Complete: $3,158.8M; Total Program: $3,519.4M; Total Remaining After FY2004: $3,858.8M. Budget breakdown ('Other Support': Item Nos. 25-32): FY2005: $155.0M; FY2006: $152.5M; FY2007: $155.1M; FY2008: $173.3M; FY2009: $157.0M; Total Program: $3,076.1M; Total Remaining After FY2004: $792.9M.

Light Helicopters

UH-1 Divestiture/Light Utility Helicopter (LUH) Procurement — Before the cancellation of the Comanche, the Army had planned to retire all of its remaining Hueys by 2004 as part of an overall effort to switch 'to an all Black Hawk fleet,'[13] although an option to retain approximately 70 aircraft 'at least through FY2008 for designated support tasks' was still being considered to allow enough time to phase in a possible replacement.[14] Indeed, with the cancellation of the Comanche in February 2004, the Army has resurrected its inactive *Light Utility Helicopter (LUH)* program as a possible replacement for the UH-1. The LUH would 'provide utility missions in other than wartime settings and free up for more critical operations the Black Hawks currently being used.'[15] The Army plans to purchase a total of 303 Commercial-Off-the-Shelf (COTS) LUHs by 2020,[16] possibilities for which include upgraded Bell Hueys, Bell OH-58D Kiowas, and even Sikorsky UH-60s.[17] While the latter two competitors represent new-build platforms, Bell is planning to offer its "new" 210 model helicopter conversion which would actually involve the rebuild/remanufacture of UH-1H airframes, at $3 million apiece, with 'a new tailboom, overhauled engine, dual hydraulics and a zero-timed airframe[18] which is hoped to be more reliable and more powerful, while costing about 40 percent less to operate.[19] While the contractor for the LUH is expected to be announced in 2005,[20] DOD has yet to provide any *specific* cost estimates for this acquisition program.[21]

---

[13] Richard Aboulafia, "Bell UH-1/212/412 Huey," *World Military & Civil Aircraft Briefing* (Fairfax, VA: Teal Group Corporation, June 2003) p. 7.

[14] Harold Kennedy, "Army's Old Huey Choppers Getting a New Lease on Life," *National Defense Magazine*, Mar. 2004, at [http://www.nationaldefensemagazine.org/article.cfm?Id=1362].

[15] Robert Wall, "Appetite for Aviation: U.S. Army Juggles Operational Demands With Desire to Overhaul, Buy New Aircraft," *Aviation Week & Space Technology*, Apr. 5, 2004, pp. 35-36.

[16] DOD Briefing Slides, "Briefing on the Restructure and Revitalization of Army Aviation," Feb. 23, 2004, at [http://www.defenselink.mil/news/Feb2004/g040223-D-6570C.html].

[17] "AUSA: Army Faces Aviation Bills," *Jane's Defence Weekly*, Jan. 14 , 2004. See Richard L. Aboulafia, "Bell 406/OH-58D," *World Military & Civil Aircraft Briefing* (Fairfax, VA: Teal Group Corporation, Dec. 2003), p. 4, for the 'UH-1 Replacement Proposal' involving the OH-58D.

[18] Wall, "Appetite for Aviation," This article also mentioned that Sikorsky was considering offering its S-76 model.

[19] Bob Cox, "Bell Touts Plan to Retrofit Hueys," *Fort Worth Star-Telegram*, Mar. 16, 2004.

[20] Wall, "Appetite for Aviation," p. 36.

[21] See Letter to the Speaker of the House of Representatives from the White House, Mar. 5, 2004, which submits a number of FY2005 budget amendments, including one (FY2005 Budget Appendix, p. 276-277) that would 'increase the [pending request for Aircraft Procurement, Army] by $840 million to support the acquisition of high-priority aircraft survivability equipment, purchase of additional CH-47, UH-60, and TH-67 aircraft, and the start of a Light Utility Helicopter program. Funding also would allow the Army to transfer

(continued...)

A/MH-6 Mission Enhanced Little Bird (MELB) — This ongoing program aims to complete the upgrade of approximately 50 A/MH-6J Little Bird variants to the -6M configuration. Changes include a more powerful engine, a six-bladed main rotor, a four-blade tail rotor, a crashworthy fuel system and larger cargo door; a new cockpit display with two large-format, full-color screens; Hellfire missiles and the GeCAL 50 three-barrel 12.7mm Gatling gun.[22] Additional improvements, which are part of the SOCOM "Rotary Wing Upgrades and Sustainment" program, include Avionics and Navigation Modifications, Sensor Modifications (including new FLIR targeting system), Active Survivability System Modifications (including SIRFC and SIRCM), and Passive Survivability System Modifications (including crew protection from chemical and biological weapons). More specific A/MH-6 Modifications include the same mission processors, multifunction displays, and software as the MH-47 and MH-60 fleet of aircraft, additional external fuel tanks, and funding for component miniaturization and spares.[23] The Army also plans to buy 25 new Little Birds between 2010 and 2015, although no cost estimates have been released.[24]

OH-58D Kiowa Warrior — At the time of the Comanche cancellation, the Kiowa Warrior fleet was continuing two modernization programs. One is the Safety Enhancement Program (SEP) which 'incorporates upgraded engines and engine barrier filters, crashworthy crew seats, cockpit airbags, enhanced digitization capabilities, and improved weapons interface' which are aimed at 'enhancing crew survivability' and improving 'system reliability and maintainability.'[25] The new aircraft, sometimes referred to as the OH-58DR, would permit direct communications with digitally-equipped ground vehicles.[26] The other program is the SEP Weight Reduction initiative which will improve operational and auto rotational characteristics as well as increase system reliability and lower support costs by reducing operational gross weight by 300-400 pounds.[27] While these modifications

---

[21] (...continued)
Comanche-developed radar technology to APACHE Block III.'

[22] Bill Sweetman, "High Dependency for Special Ops," *Jane's International Defense Review,* Aug. 2003, p. 69. 'The A/MH-6M is fully qualified for maritime operations.'

[23] See U.S. SOCOM, "Rotary Wing Upgrades and Sustainment," *Procurement, Defense-Wide, Fiscal Year (FY) 2005 Budget Estimates,* Feb. 2004, Item No. 37. Costs specifically attributable to A/MH-6 Little Bird modernization are difficult to estimate due to costs being calculated according to numbers of 'kits' purchased/installed rather than number of platforms modified.

[24] Richard Aboulafia, "MD Helicopters MD 500/600N," *World Military & Civil Aircraft Briefing* (Fairfax, VA: Teal Group Corporation, July 2003), p. 3.

[25] Department of the Army, "Kiowa Warrior," *Procurement Programs, Committee Staff Procurement Backup Book FY 2005 Budget Request, Aircraft Procurement, Army,* pp. 89-93 (Item No. 18).

[26] Robert Wall, "Combat-Ready: Distributed Helo Ops May Yield Enhanced Combat Effectiveness," *Aviation Week & Space Technology,* April 12, 2004, pp. 68-69. One further modification includes the replacement of the 7.62mm three-barreled mini-gun with the .50 caliber machine gun which is more reliable and has a greater rate of fire.

[27] Department of the Army, "Kiowa Warrior," *Procurement Programs, Committee Staff* (continued...)

are set to continue past FY2009, the Army, as part of its efforts to reallocate money from the Comanche cancellation, is planning to procure a total of 368 armed reconnaissance helicopters as replacements for the entire OH-58 fleet of approximately 800 aircraft within the 2020 timeframe. These new aircraft are to be commercial off-the-shelf (COTS) purchases.[28] (See below for the *Light Armed Reconnaissance Helicopter — LARH*.)

Light Armed Reconnaissance Helicopter (LARH) — This new program was born from the Comanche cancellation. It aims to replace the aging OH-58 Kiowa Warrior fleet, beginning in 2007. Reports indicate that the Army 'will want an aircraft that has a high degree of survivability, transportability and connectivity with other forces...[as well as] a small logistics tail.'[29] It appears that the sole front-runner is the MH-6 Little Bird (see above) but other contenders include the Agusta A-129 and possibly rebuilt Kiowas.[30] Although the latter option has been dismissed by a few Army officials, the Kiowas' performance in Iraq, where they logged more hours per aircraft than any other helicopter and maintained monthly readiness rates of around 85 percent, suggests that the rebuild option may yet be considered.[31]

RAH-66 Comanche — As mentioned above, the Pentagon announced on February 23, 2004, that it was cancelling this 20-year old, $39 billion project which has resulted in only two flying prototypes (and six currently on the assembly lines). The Army has planned for and requested that future funds for the Comanche, amounting to approximately $14.6 billion, be reallocated to a number of ongoing modernization programs and a few new ones as detailed throughout this report.[32]

Medium Helicopters

UH-60 Black Hawk (MYP) [Multi-Year Procurement] and UH-60M Recap/Upgrade — While the former program primarily involves funding a total of

---

[27] (...continued)
Procurement Backup Book FY 2005 Budget Request, Aircraft Procurement, Army, pp. 89-93 (Item No. 18). Budget breakdown: FY2005: $33.8M; FY2006: $22.4M; FY2007: $42.1M; FY2008: $20.7M; FY2009: $15.3M; To Complete: $24.9M; Total Program: $3,488.0M; Total Remaining After FY2004: $159.2M.

[28] DOD Briefing Slides, "Briefing on the Restructure and Revitalization of Army Aviation," Feb. 23,2004, at [http://www.defenselink.mil/news/Feb2004/g040223-D-6570C.html] See also Letter to the Speaker of the House of Representatives, Mar. 5, 2004, p. 3.

[29] Marc Selinger, "Army Wants New Helicopter To Be Survivable, Transportable," *Aerospace Daily*, Mar. 30, 2004.

[30] Robert Wall, "Appetite for Aviation: U.S. Army Juggles Operational Demands with Desire to Overhaul, Buy New Aircraft," *Aviation Week & Space Technology*, Apr. 5, 2004, p. 35.

[31] Megan Scully, "Reliable Kiowas Face Retirement," *DefenseNews*, Apr. 5, 2004, p. 38.

[32] "Briefing on the Restructure and Revitalization of Army Aviation," *op. cit*. For details concerning the funding reallocation as requested by the White House on behalf of the Office of Management and Budget, see Letter to the Speaker of the House of Representatives, Mar. 5, 2004, with attached FY2005 budget amendments.

91 new-build UH-60L aircraft from FY2005 onwards,[33] the latter effort consists of a number of recapitalizations/upgrades involving 906 UH-60A and 331 UH-60L aircraft to convert them to UH-60M standards (formerly UH-60L+).[34] Modifications involve some or all of the following: strengthened fuselages, new propulsion systems, new rotors, advanced digitized avionics and navigation systems, new Crashworthy External Fuel Systems (CEFS), Ballistic Protection Systems (BPS), and the purchase of new Medical Equipment Package (MEP) kits (to upgrade some new UH-60L models to the HH-60M configuration),[35] which include improved Forward Looking Infrared (FLIR), High Performance (Rescue) Hoist (HPH), Personnel Locator System (PLS), Environmental Control System (ECS), and improved avionics and medical equipment. In addition, the upgrades are hoped to meet lift, range, survivability, and interoperability requirements while addressing all top ten operations and support (O&S) cost drivers and extending the useful life of these aircraft another 20 years.[36] Due to the Comanche cancellation, the Army is planning to purchase 101 additional new-build UH-60L and 80 additional (new-build) UH-60M aircraft. Ten of the latter will receive the Army's A2C2S command and control packages.[37]

In addition to the modifications made to all ARSOA aircraft (including all of its H-60s — see above), SOCOM, which operates both MH-60K and MH-60L variants, initiated a service life extension program (SLEP) in FY2004. This program will convert the whole fleet of Black Hawks into a common MH-60M configuration.

---

[33] Budget breakdown: FY2005: 8 aircraft for $124.5M; FY2006: 28 aircraft for $301.9M; FY2007: 24 aircraft for $392.0M; FY2008: 10 aircraft for $202.1M; FY2009: 7 aircraft for $164.7M; To Complete: 14 aircraft for $336.6M; Total Program: 1,688 aircraft for $11,380.2M; Total Remaining After FY2004: 91 aircraft for $1,521.8M. See Department of the Army, "UH-60 Blackhawk," *Procurement Programs, Committee Staff Procurement Backup Book, FY 2005 Budget Request: Aircraft Procurement, Army*, Feb. 2004, pp. 4-14 (Item Nos. 3 and 4). These figures include 'production incorporation of the modifications being developed in the UH-60 BLACK HAWK upgrade program (UH-60M) following completion of the FY2002-06 airframe multiyear contract.'

[34] Budget breakdown: FY2005: 5 aircraft for $137.8M; FY2006: 5 aircraft for $138.2M; FY2007: 14 aircraft for $299.3M; FY2008: 58 aircraft for $677.1M; FY2009: 61 aircraft for $693.1M; Total to Complete: 1,070 aircraft for $12,645.9M; Total Program: 1,213 aircraft for $15,271.2M; Total Remaining After FY2004: 1,213 aircraft for $14,591.4M. See Department of the Army, "UH-60 Mods," *Procurement Programs, Committee Staff Procurement Backup Book, FY 2005 Budget Request: Aircraft Procurement, Army*, Feb. 2004, pp. 75-88 (Item Nos. 16 and 17).

[35] 'One of the four UH-60M prototypes now in process will be completed in an HH-60M Dust Off configuration [formerly UH-60Q variant]....[T]he UH-60M gives the Army a higher-performance utility helicopter with a common integrated cockpit....The Dust Off/CSAR avionics suite in the HH-60M supplements the digital cockpit of the UH-60M with FLIR, Personnel Locator System and Tactical Air Navigation.' Frank Colucci, "Joint Mission, Different Strategies: Service Plan Upgrades for Life-Saving Helicopters," *Armed Forces Journal*, May 2003, p. 48.

[36] Department of the Army, "UH-60M/HH-60M Recap/Upgrade," *Procurement Programs, Committee Staff Procurement Backup Book, FY 2005 Budget Request: Aircraft Procurement, Army*, Feb. 2004, p. 82.

[37] "Briefing on the Restructure and Revitalization of Army Aviation," *op.cit*.

Modifications include fly-by-wire flight controls, new engines, engine filters, improved fuel management system, new rotor blades, and O&S cost saving modifications.[38] As part of the Integrated Defensive Armed Penetrators (IDAP) program, SOCOM is budgeting a total of $53.4 million over four years for a weapons system lifecycle upgrade for 10 existing Armed MH-60L helicopters and 10 new IDAP kits.[39]

AH-64D Longbow Apache — The program to upgrade a total of 501 Apaches to the AH-64D Longbow-radar-capable aircraft is continuing through its final stages, mainly through TADS/PNVS Upgrades, and Airframe Modifications. Funds will also be spent to develop, test, integrate, and produce a Second Generation FLIR for the entire fleet of AH-64A and AH-64D aircraft.[40]

Due to the Comanche cancellation, the Army is planning to upgrade *all* 501 AH-64D Longbow (radar-capable) Apaches to a Block III configuration which the Army claims "offers all the capabilities that would have been provided by the...Comanche Block Is, with the exception of low observability."[41] In addition to improvements to rotor blades and powerplants, the Block III modifications include UAV connectivity and Future Combat Systems compatibility.[42] In addition, the Army plans to rebuild the AH-64As operated by the National Guard[43] which would bring to fruition a

---

[38] See U.S. SOCOM, "Rotary Wing Upgrades and Sustainment," *Procurement, Defense-Wide, Fiscal Year (FY) 2005 Budget Estimates*, Feb. 2004, Item No. 37 (Exhibit P-3A, Individual Modification, "MH-60 Service Life Extension Program (SLEP)"). Cost breakdown: FY2004: $52.4M; FY2005: $94.4M; FY2006: $24.4M; FY2007: $94.3M; FY2008: $160.5M; FY2009: $135.7M; To Complete: $470.1M; Total Program: $1,031.9M; Total Remaining After FY2004: $979.4M. Note that these costs have already been included as part of the gross total figures outlined above in the SOCOM summary.

[39] U.S. SOCOM, "Rotary Wing Upgrades and Sustainment," *Procurement, Defense-Wide, Fiscal Year (FY) 2005 Budget Estimates*, Feb. 2004, Item No. 37 (Exhibit P-3A, Individual Modification, "Defensive Armed Penetrator (MH-60 Helicopter)"). Budget breakdown: FY2005: $14.9M; FY2006: $10.5M; Total Program: $53.5M; Total Remaining After FY2004: $25.4M. Note that these costs have already been included as part of the gross total figures outlined above in the SOCOM summary.

[40] Department of the Army, "AH-64 Mods," *Procurement Programs, Committee Staff Procurement Backup Book, FY 2005 Budget Request: Aircraft Procurement, Army*, Feb. 2004, pp. 28-35 (Item No. 8). Budget breakdown: FY2005: $37.2M; FY2006: $152.6M; FY2007: $133.6M; FY2008: $84.3M; FY2009: $19.4M; Total Program: $1,327.2M; Total Remaining After FY2004: $427.1M.

[41] "Comanche Cancellation Frees Up Billions in U.S. Army Funding for Other Programs," *Jane's International Defense Review*, April 2004, p. 10.

[42] Richard Aboulafia, "Boeing AH-64 Apache," *World Military & Civil Aircraft Briefing*, December 2003, p. 10. 'There could also be a Block IV mod, possibly with an external refueling boom.'

[43] "Comanche Cancellation Free Up Billions ..." *op.cit*. "Briefing on the Restructure and Revitalization of Army Aviation," *op.cit*. for a total of 213 AH-64As to remain after FY2020.

previously proposed Service Life Extension Program (SLEP) for 218 AH-64As in the Army Reserve and Army National Guard.[44]

Heavy Helicopters

CH-47 Cargo Helicopter Modifications — This ongoing program centers around the re-manufacture of the CH-47D fleet to the latest configuration through safety and operational modifications. While improving overall capability, maintainability, reliability, and crew/aircraft safety, the program also aims to reduce O&M costs and extend operational life through 2033 (when the Chinook is scheduled to be replaced by a new, yet-to-be-determined heavy-lift cargo helicopter).[45] Major modifications include engine and auxiliary power unit upgrades, an extended range fuel system, an engine filtration system, a low maintenance rotor head, Ballistic Protection Systems, and blade-folding kits (for maritime operations capabilities). In addition, this program funds the conversion of 287 CH-47Ds to the CH-47F Improved Cargo Helicopter (ICH) variant which includes the recapitalization of the power train and the following systems: auxiliary, electrical/electronic, hydraulic, pneumatic, structural, and power plant. The modernization program also includes the conversion of 50 Chinook SOA (i.e. MH-47D and MH-47E) to the MH-47G variant.[46]

The Army has proposed scaling back the total number of CH-47F variants to be procured over the long term to 169 while retaining 259 CH-47D variants. The Army also plans to buy 26 new Chinooks, 24 of which are to be transferred to SOCOM.[47] However, a later report indicated a number of changes in the Army's plans regarding the Chinook. First, negotiations were underway with Boeing to produce basically all-new CH-47F Chinooks, rather than having to settle for refurbishment of much of the aircraft. Second, the Army is buying seven new Chinooks in the near term, with an expected total buy of 56 platforms. (These include both CH-47Fs and MH-47Gs.) Lastly, the Army has decided to convert all of its CH-47Ds to the CH-47F configuration, not just 300, which included the accelerated recapitalization of 19 platforms over the next five years.[48]

---

[44] See Paul Jackson (ed.), *Jane's All the World's Aircraft, 2003-2004* (Alexandria, VA: Jane's Information Group, 2003), p. 559.

[45] *Ibid*. p. 556.

[46] See Department of the Army, "CH-47 Cargo Helicopter Mods," *Procurement Programs, Committee Staff Procurement Backup Book, FY 2005 Budget Request: Aircraft Procurement, Army*, Feb. 2004, pp. 36-53 (Item No. 9). Budget breakdown: FY2005: $542.7M; FY2006: $605.5M; FY2007: $521.0M; FY2008: $538.5M; FY2009: $842.0M; To Complete: $5,227.3M; Total Program: $13,858.8M; Total Remaining After FY2004: $8,227.0M.

[47] DOD Briefing Slides, "Briefing on the Restructure and Revitalization of Army Aviation," Feb. 23, 2004, at [http://www.defenselink.mil/news/Feb2004/g040223-D-6570C.html].

[48] Robert Wall, "Almost New: Army Poised to Begin Operational Testing of Enhanced CH-47F Chinook," *Aviation Week & Space Technology*, Apr. 5, 2004, p. 43.

MH-47G Special Operations Aircraft (SOA) — Led by SOCOM, this is an ongoing SLEP which supplements the above-referenced CH-47 Modification program. It involves a number of additional modifications to MH-47G aircraft including long range fuel tanks, multimode radar, an IFR boom, special operation unique communications/navigation systems, survivability equipment, and improved weapons systems.[49]

Navy and Marine Corps. Similar to the Army, the Navy also has a few "common" modernization programs which are applicable to almost every aviation platform in the fleet, including some fixed-wing aircraft. They are divided into three sub-headings, including Common Electronic Countermeasure (ECM) Equipment, Common Avionics Changes, and ID Systems.[50]

Light Helicopters

H-1 Upgrade — This multi-phased program was initiated in the early 1990s after the proposed Integrated Weapon System (IWS) was cancelled.[51] Within the 2004-2014 timeframe, 100 UH-1N Hueys and 180 AH-1W Super Cobras are to be re-manufactured into the UH-1Y and AH-1Z models, respectively,[52] which will effectively be "new" aircraft — scheduled to last 'beyond 2020' — as each model is to receive a U.S. government approved 10,000 hour life-span.[53] Major modifications include a new 4-bladed rotor system with semiautomatic blade fold of the new composite rotor blades, new performance matched transmissions, a new 4-bladed tail rotor and drive system, upgraded landing gear, and pylon structural modifications. Both aircraft will also incorporate common, modernized and fully integrated cockpits/avionics that will reduce operator work load and improve situational

---

[49] U.S. SOCOM, "Rotary Wing Upgrades and Sustainment," *Procurement, Defense-Wide, Fiscal Year (FY) 2005 Budget Estimates*, Feb. 2004, Item No. 37 (Exhibit P-3a, Individual Modification, "MH-47 Service Life Extension Program (SLEP)"). Budget breakdown: FY2005: $152.8M; FY2006: $31.2M; FY2007: $31.2M; FY2008: $31.5M; FY2009: $25.7M; To Complete: $189.1M; Total Program: $945.7M; Total After FY2004: $461.5M. Note that these costs have already been included as part of the gross total figures outlined above in the SOCOM summary.

[50] See DON, "Common ECM Equipment," "Common Avionics Changes," and "ID Systems," *Department of the Navy Fiscal Year (FY) 2005 Budget Estimates, Justification of Estimates, Aircraft Procurement, Navy, Volume II: Budget Activity*, Feb. 5, 2004, Item Nos. 49-51. Budget breakdown (all three inclusive): FY2005: $212.3M; FY2006: $290.6M; FY2007: $253.5M; FY2008: $234.9M; FY2009: $227.2M; To Complete: $2,018.9M; Total Programs: $4,689.2M; Total Remaining After FY2004: $3237.4M.

[51] See Paul Jackson (ed.), *Jane's All the World's Aircraft 2003-2004* (Alexandria, VA: Jane's Information Group, 2003), p. 540.

[52] Jason Sherman, "U.S. Marine Corps Will Expedite Utility Helo Buy," *DefenseNews*, June 16, 2003, p. 34.

[53] MJG, "H-1 Upgrades for U.S. Marines Enters LRIP," *Jane's International Defense Review*, Jan. 2004, p. 29.

awareness and safety.[54] While reducing safety deficiencies and improving operational capabilities, this commonality of systems — estimated at 84% — also aims to reduce life-cycle costs as well as logistical footprints, and increase overall maintainability and deployability.[55] Estimated costs per rebuilt platform (both AH-1 and UH-1) amount to approximately $20.15 million, up from $16.5 million.[56]

With these upgrades, the overall capabilities of the AH-1Z and the UH-1Y over the AH-1W and UH-1N, respectively, were estimated to improve as follows: maximum gross weight increases of 25% and 76%; internal fuel capacity increases of 32% and 90%; useful load increases up to 39% and 68%; and a 152% increase in mission radius for the AH-1Z.[57] The new AH-1Z will also have an expanded weapons suite with twice the number of anti-armor missiles and an additional pair of Stinger air-to-air missiles.[58] Low-rate initial production (LRIP) batch of six UH-1Ys and three AH-1Zs began in FY2004.[59] Future funding requirements for total numbers of H-1 rebuilds are as follows: 9 in FY2005; 12 in FY2006; 19 in FY2007; 21 in FY2008; 21 in FY2009; and 189 to completion.[60] In addition, the Navy has an

---

[54] DON, "UH-1Y/AH-1Z," *Department of the Navy Fiscal Year (FY) 2005 Budget Estimates, Justification of Estimates, Aircraft Procurement, Navy, Volume I: Budget Activities 1-4*, Item No. 7. 'Additionally, the AH-1Z will upgrade the current Night Targeting FLIR system to a 3rd generation, staring, focal plane array FLIR that will significantly extend autonomous weapons engagement ranges.' These aircraft do not have radars installed but the 'possibility exists that Longbow radar will eventually be fitted as a so-called Cobra Radar System.' See Paul Jackson (ed.), *Jane's All the World's Aircraft, 2003-2004* (Alexandria, VA: Jane's Information Group, 2003), p. 541.

[55] [USMC], *Concepts and Issues* (Washington, DC: HQ USMC, [Jan/Feb] 2004), p. 174. See also Deputy Commandant for Aviation, Department of Aviation, HQMC, *Aviation Implementation Plan* (Washington, DC: HQ, USMC, n.d.), pp. B-7/8.

[56] See DON, "UH-1Y/AH-1Z," *Department of the Navy Fiscal Year (FY) 2005 Budget Estimates, Justification of Estimates, Aircraft Procurement, Navy, Volume I: Budget Activities 1-4*, Item No. 7, for $20.15 million figure (average over life of program) and Katie Fairbank, "Bell Helicopter to Expand in Amarillo," *The Dallas Morning News*, Dec. 9, 2003, for $16.5 million figure.

[57] Mark Hewish, "Hueys Transformed for the 21st Century," *International Defense Review*, 18 January 2002. The UH-1Y will also be special operations capable. See Christian Lowe, "Upgraded Huey Approved for Special Ops," *DefenseNews*, Dec. 8, 2003, p. 34, and [Unattributed], "Upgraded Marine Corps Huey Finishes Special Warfare Testing," *Aerospace Daily*, Nov. 25, 2003.

[58] Paul Jackson (ed.), *Jane's All the World's Aircraft, 2003-2004*, (Alexandria, VA: Jane's Information Group, 2003), p. 540. Upgraded ASE includes 'AN/ALQ-144(V) IR countermeasures set'; 'AN/ALE-39 chaff system'; and a 'AN/APR-39A(XE2) radar warning receiver and...AN/AVR-2 laser warner and AN/AAR-47 plume detecting set.' (see p. 541)

[59] Christopher J. Castelli, "DOD Approves First Lot of Low-Rate Production for H-1 Upgrades," *Inside the Navy*, Oct. 27, 2003; Jefferson Morris, "DAB Approves H-1 Upgrade for Low-Rate Initial Production," *Aerospace Daily*, Oct. 27, 2003. See Jason Sherman, "U.S. Marine Corps Will Expedite Utility Helo Buy," *DefenseNews*, June 16, 2003, p. 34, for the original procurement schedule through 2014.

[60] See DON, "UH-1Y/AH-1Z," *Department of the Navy Fiscal Year (FY) 2005 Budget* (continued...)

ongoing upgrade program ("H-1 Series Modifications") which includes the installation of a Navigational Thermal Imaging System (NTIS) as well as a number of Safety Upgrades, although most of the latter are in the last stages.[61]

Medium Helicopter

Executive Helicopter Modifications — This program aims to modernize 11 VH-3D and eight VH-60N Executive Helicopters primarily through a communications system upgrade to provide communications commonality between Executive Helicopters, Air Force One, and N-Cap, Traffic Collision Avoidance System (TCAS), VH-60 Maintenance Trainer, TACAN Upgrade, GPS Upgrade; and a tailored electronic warfare (EW) suite. In addition, the VH-60 variants' cockpits will be altered to all-glass instrumentation while a further communications upgrade to all aircraft will include satellite, FM, and high-frequency radio replacements as well as new data-transfer capability.[62]

VXX (Executive Helicopter Replacement) — As mentioned previously, the 13 VH-3A/D and eight VH-60N executive transports — operated by the Marines and the Navy — are scheduled to be replaced by one platform (dubbed the VXX) beginning in 2008. Two competitors have submitted entries: Sikorsky, with its twin-engine S-92 (VH-92) "Superhawk" design and a consortium of Lockheed Martin Corp., Agusta-Westland (UK-Italy), and Bell Helicopter, with their three-engine US-101. Approximately $1.6 billion has been estimated to purchase a total of 23 aircraft, the first of which is expected to be operating in 2008.[63] The Navy plans to buy five VXX helicopters in FY-05, three in FY-07 and four in FY-08 after a funding transfer

---

[60] (...continued)
Estimates, Justification of Estimates, Aircraft Procurement, Navy, Volume I: Budget Activities 1-4, Feb. 2004, Item No. 7. Budget breakdown: FY2005: 9 aircraft for $250.9M; FY2006: 12 aircraft for $367.1M; FY2007: 19 aircraft for $480.3M; FY2008: 21 aircraft for $551.7M; FY2009: 21 aircraft for $454.6M; To Complete: 189 aircraft for $3,206.8M; Total Program: 280 aircraft for $5,642.0M; Total After FY2004: $5,311.4M.

[61] See DON, "H-1 Series Modifications," *Department of the Navy Fiscal Year (FY) 2005 Budget Estimates, Justification of Estimates, Aircraft Procurement, Navy, Volume II: Budget Activity 5*, Feb. 2004, Item No. 32. Budget breakdown: FY2005: $3.5M; FY2006: $7.4M; FY2007: $7.4M; FY2008: $6.0M; FY2009: $7.6M; To Complete: $27.5M; Total After FY2004: $55.9M; Total Program: $179.3M. While indicating that there was also an "AH-1 Series" modification program under Item No. 29, the data displayed was, in fact, an exact copy of the "H-1 Series" information summarized above, so these figures are incomplete.

[62] See DON, "Executive Helicopter Modifications," *Department of the Navy Fiscal Year (FY) 2005 Budget Estimates, Justification of Estimates, Aircraft Procurement, Navy, Volume II: Budget Activity 5*, Feb. 2004, Item No. 43. Budget breakdown: FY2005: $21.8M; FY2006: $17.4M; FY2007: $15.8M; FY2008: $16.2M; FY2009: $16.5M; To Complete: $23.8M; Total Program: $280.4M; Total Remaining After FY2004: $111.5M.

[63] Ron Laurenzo, "Lockheed Martin: U.S. Firms Would Keep US101 Data," *Defense Week Daily Update*, Feb. 5, 2004.

request was made by DOD to accelerate the VXX buy.[64] However, this aggressive plan has been delayed until the end of 2004 because the two competing proposals are less technically mature than the companies advertised and the Navy expected.[65]

H/MV-22 Osprey — The V-22 entered Low-Rate Initial Production (LRIP) in May 1997 which has increased the total number produced to 48. Four have crashed, however, resulting in 30 fatalities, which has brought the whole program under repeated scrutiny and continued threats of cancellation. Still, funding to maintain an absolute minimum production rate (11 or 12 aircraft per annum) has been forthcoming with 11 aircraft each in FY2003 and FY2004 already appropriated. (Of the 11 latter aircraft, two were slated for the Air Force for special operations missions.) Numbers of aircraft still to be funded are estimated as follows: 11 (8 USMC and 3 USAF) in FY2005; 17 (15 and 2) in FY2006; 31 (29 and 2) in FY2007; 35 (30 and 5) in FY2008; and 39 (33 and 6) in FY2009; with 253 (225 and 28) remaining through completion.[66] These numbers assume that the full-rate production decision — already delayed more than five years — will be approved in November of 2005. However, doubts have already arisen due to problems discovered in March 2004 which threaten to delay the critical operational evaluation testing scheduled for April 2005.[67] The Navy has also budgeted some limited monies for an MV-22 Modification program (for Block A through C) which procures retrofit kits necessary to correct discrepancies identified during initial flight testing as well as those resulting from any redesign efforts.[68]

---

[64] Jason Ma and Malina Brown, "Zakheim Requests Transfer of Money From MH-60R to VXX Helicopter," *Inside the Navy*, Mar. 8, 2004.

[65] Christopher J. Castelli, "Young: Lack of Maturity in Proposals Drove White House Helo Delay: Navy Seeks to Avoid Messy Protest," *Inside the Navy*, Mar. 29, 2004. See also Robert Wall, "Applying Brakes: Navy Wants More Time, Data, Before Choosing Presidential Helo," *Aviation Week & Space Technology*, Mar. 29, 2004, p. 30.

[66] See DON, *Department of the Navy Fiscal Year (FY) 2005 Budget Estimates, Justification of Estimates, Aircraft Procurement, Navy, Volume I: Budget Activities 1-4*, Feb. 2004, Item Nos. 5 & 6. Budget breakdown: FY2005: 8 aircraft for $1,036.7M; FY2006:15 aircraft for $1,593.7M; FY2007: 29 aircraft for $2,286.9M; FY2008: 30 aircraft for $2,334.3M; FY2009: 33 aircraft for $2,381.1M; To Complete: 225 aircraft for $15,353.3M; Total Program: 408 aircraft for $32,234.9M; Total After FY2004: 340 aircraft for $26,414.196M. See below for additional funding estimates required for the Air Force and SOCOM procurement of the CV-22 special operations variant (with modifications). The Navy would not begin procuring the V-22 until 'around 2009, but that has remained questionable because it was always outside the scope of the Navy's long term budget.' See Christoper J. Castelli, "Asked About Navy Missions for V-22, Senior Official Hedges," *Inside the Navy*, May 3, 2004.

[67] Christopher J. Castelli, "V-22 Osprey Forced to Land in Georgia, Further Delayed by 'Problem'," *Inside the Navy*, Mar. 15, 2004, p. 1. See also Christian Lowe, "Osprey Passes Test in Flight Deck Wind," *DefenseNews*, Dec. 8, 2003, p. 34, and Marc Selinger, "V-22 Osprey Drawing More Interest From Foreign Militaries, Reps Say," *Aerospace Daily*, Dec. 2003.

[68] See DON, *Department of the Navy Fiscal Year (FY) 2005 Budget Estimates, Justification of Estimates, Aircraft Procurement, Navy, Volume II: Budget Activity 5*, Feb. 2004, Item No.

(continued...)

H-46 Series Helicopter — This program involves keeping the H-46 Sea Knight operating until fully replaced by the H-60R. Modifications include upgrading critical dynamic components, the engine control system, the electrical system, and the engine; installing on-board vibration monitoring equipment; and replacing the existing steel plate armor with lighter weight armor.[69]

Helicopter Master Plan (H-60) — This plan aims to phase out seven aging helicopter models by 2015: the warship-based SH-60B, the Carrier-based SH-60F and HH-60H, and amphibious ship-based CH-46D, and the shore-based UH-3H and HH-1N Huey. Marine Corps officials are deciding whether to replace MH-53E helicopters.[70] The two helicopters slated to replace the aforementioned types are the MH-60R and the MH-60S. Twelve of the former and eight of the latter will be attached to a carrier wing, with the R-models operating off of carriers and surface combatants and the S-models working from carriers and either oilers or other combat logistics force ships. These aircraft will assume anti-surface warfare, combat search-and-rescue, special warfare and organic airborne mine countermeasures missions.[71]

MH-60R procurement initially began as a program to re-manufacture between 189 and 289 of the Navy's SH-60Bs, SH-60Fs, and HH-60Hs into a new, more capable and more common variant with the introduction of a next-generation Airborne Low Frequency Sonar (ALFS) system as well as the integration of previously-planned "Block II" improvements, including an improved Electronic Surveillance Measures (ESM) system and a new inverse synthetic aperture radar (ISAR).[72] In June 2001 the Navy reversed course and made the R-model a new-build program. The stated reason was cost-effectiveness — rebuilt R-model airframes would cost $17 million, while new aircraft would cost $21 million. Production will shift to all-new airframes after the first batch of five rebuilds. Initial Operational Capability (IOC) is scheduled for 2005, with first carrier deployments in 2007.

---

[68] (...continued)
52. Budget breakdown: FY2005: $3.4M; FY2006: $19.1M; FY2007: $23.9M; FY2008: $24.4M; FY2009: $24.9M; To Complete: $378.8M; Total After FY2004: $474.5M; Total Program: $535.4M.

[69] DON, "H-46 Series Helicopter," *Department of the Navy Fiscal Year (FY) 2005 Budget Estimates, Justification of Estimates, Aircraft Procurement, Navy, Volume II: Budget Activity 5*, Feb. 2004, Item No. 28. Budget breakdown: FY2005: $71.2M; FY2006: $52.0M; FY2007: $47.2M; FY2008: $5.5M; To Complete: $14.8M; Total Program: $822.2M; Total Remaining After FY2004: $190.7M.

[70] Jason Sherman, "U.S. Navy to Increase Helicopter Buys," *DefenseNews*, June 9, 2003, p. 52.

[71] David Brown, "Dual-Threat Duo," *Navy Times*, June 9, 2003, p. 22. The MH-60R could also be stationed on the future Littoral Combat Ship (LCS) due to its primary ASW [and ASuW] capabilities.

[72] Richard L. Aboulafia, "Sikorsky SH-60/MH-60 Seahawk," *World Military & Civil Aircraft Briefing* (Fairfax, VA: Teal Group Corporation, May 2003), pp. 7-8.

Current plans call for 243 rebuilds.[73] In 2003, however, the program encountered software problems serious enough to abort operational testing.[74]

The MH-60S (formerly CH-60S) is being procured for fleet combat support, vertical replenishment and SAR roles. Its mission could be expanded through airborne mine counter-measure (AMCM)[75] and combat search and rescue (CSAR) add-on kits.[76] This aircraft was undergoing an operational assessment — begun in June of 2003 and scheduled to continue through October 2005 — when it experienced problems with software integration which not only caused the assessment to be delayed until at least February of 2005 but also forced the Pentagon Comptroller to deny a Navy proposal to accelerate the acquisition of MH-60R variants. While disappointing, this incident apparently does not affect the Navy's desire to replace the Navy's fleets of CH-46D Sea Knights, HH-60H Sea Hawks and H-3 Sea Kings.[77] In fact, it was reported that the 50th MH-60S helicopter was delivered to the Navy in June of 2003 and that this variant is flying in five Navy squadrons based in Guam, San Diego and Norfolk.[78] Like the newer MH-60R, however, this aircraft also seemed to have experienced difficulties during testing in

---

[73] Richard L. Aboulafia, "Sikorsky SH-60/MH-60 Seahawk," *World Military & Civil Aircraft Briefing* (Fairfax, VA: Teal Group Corporation, May 2003), p. 8. See DON, "MH-60R," *Department of the Navy Fiscal Year (FY) 2005 Budget Estimates, Justification of Estimates, Aircraft Procurement, Navy, Volume I: Budget Activities 1-4*, Feb. 2004, Item No. 10, for a total of 252 platforms to be procured. Budget breakdown: FY2005: 8 aircraft for $454.348M; FY2006: 15 aircraft for $688.299M; FY2007: 21 aircraft for $817.301M; FY2008: 31 aircraft for $1,141.460M; FY2009: 31 aircraft for $1,168.135M; To Complete: 135 aircraft for $4,066.131M; Total Program: $9,191.991M; Total After FY2004: $8,335.674M.

[74] Robert Wall, "Report Card: Helicopter Vulnerability to Air Defenses Is Drawing The Interest of the Pentagon's Test Community," *Aviation Week and Space Technology*, Feb. 2, 2004, p. 55.

[75] The first flight of the AMCM variant of the MH-60S occurred in late summer of 2003. See Greg Couteau and Michele Savage, "New Helicopter Will Hunt Mines," *DefenseNews*, Aug. 4, 2003, p. 26.

[76] 'The Navy plans to buy 52 armed helicopter/CSAR mission kits for delivery between 2003 and 2009. Plans call for 110 of the 237 MH-60S helicopters to be compatible with the kits. The new CSAR-capable helicopters should replace all HH-60Hs in active-duty squadrons by fiscal 2012.' Frank Colucci, "Joint Mission, Different Strategies: Services Plan Upgrades for Life-Saving Helicopters," *Armed Forces Journal*, May 2003, pp. 47-48.

[77] Amy Butler, "MH-60R Hits Snags in Operational Assessment, Acceleration Off the Table," *Defense Daily* [online], Jan. 15, 2004. While this article had a total number of 254 platforms to be procured, official documents budget for only 237 aircraft. See DON, "MH-60S Vertical Replenishment (MYP)," *Department of the Navy Fiscal Year (FY) 2005 Budget Estimates, Justification of Estimates, Aircraft Procurement, Navy, Volume I: Budget Activities 1-4*, Feb. 2004, Item No. 8. Budget breakdown: FY2005: 15 aircraft for $419.392M; FY2006: 26 aircraft for $627.129M; FY2007: 30 aircraft for $690.496M; FY2008: 30 aircraft for $661.289M; FY2009: 40 aircraft for $888.990M; To Complete: 18 aircraft for $357.010M; Total Program: $5,557.498M; Total Remaining After FY2004: $3,644.306M.

[78] Couteau and Savage, *op.cit*. p. 26.

late 2003 when testers determined that the MH-60S was not operationally suitable. But the failing grade was linked less to the aircraft than to supply problems. The helicopter itself was characterized as operationally effective and survivable.[79]

Heavy Helicopters

H-53 Modifications — While most of the individual programs in this upgrade effort were last funded in FY2004, there are still three programs ongoing. These include a new radio system to improve inter-communications with other services (for all three types of H-53), engine housing improvements to reduce maintenance (for the CH-53E and MH-53E variants), and the Helicopter Night Vision System for all-weather capability (for the CH-53E variant).[80]

CH-53(X) Super Stallion Remanufacture — Although the Marine Corps had been considering a major upgrade for the CH-53E fleet,[81] it was reported in March 2004 that the Marine Corps was instead launching a program to replace its heavy-lift helicopter fleet with a substantially redesigned version of the CH-53 Super Stallion. The Marine Corps plans to buy 154 new CH-53s.The new CH-53(X)will look like the current E variant but otherwise will be a new aircraft. This plan rescinds the previous plan for a SLEP that would have kept the original airframes and replaced the engines, rotor blades and cockpit, at approximately $43 million per aircraft, or $6.6 billion for a 154-helicopter order. The decision to build new aircraft may be based more on the existing aircraft's reliability challenges, and the resulting maintenance burden, than a need for a more capable aircraft. The new helicopter is hoped to be twice as reliable and have a 10 percent smaller logistics footprint than today's CH-53E.[82]

Air Force. The Air Force operates DOD's smallest helicopter fleet.

Light Helicopters

UH-1N Huey — This program, which centers on tail boom replacements for all 62 helicopters, also includes night vision instrumentation and other low cost modifications. These alterations, plus others being completed in FY2004, are hoped

---

[79] Robert Wall, "Report Card: Helicopter Vulnerability to Air Defenses Is Drawing The Interest of the Pentagon's Test Community," *Aviation Week and Space Technology*, Feb. 2, 2004, p. 55.

[80] DON, "H-53 Modifications," *Department of the Navy Fiscal Year (FY) 2005 Budget Estimates, Justification of Estimates, Aircraft Procurement, Navy, Volume II: Budget Activity 5*, Feb. 2004, Item No. 30. Budget breakdown: FY2005: $9.8M; FY2006: $9.0M; FY2007: $7.7M; FY2008: $15.9M; FY2009: $16.2M; To Complete: $61.9M; Total Program: $505.0M; Total After FY2004: $120.5M. There is also a FY2005 funding request for $2.5M for the installation of two Joint Chemical Agent Detector (JCAD) kits on the CH-53 variant. See Item 48, p. 4.

[81] Frank Colucci, "Joint Mission, Different Strategies: Services Plan Upgrades for Life-Saving Helicopters," *Armed Forces Journal*, May 2003, p. 48.

[82] Christian Lowe, "U.S. Marines to Buy Redesigned CH-53," *DefenseNews*, Mar. 1, 2004, p. 34.

to enhance operational capability while improving flight safety, reliability, and maintainability.[83] According to an official source, the fleet of 62 aircraft is to be sustained until a new Common Vertical Lift Support Platform (CVLSP), is funded and fielded.[84] One report, however, indicated that the Air Force was also considering leasing helicopters to replace its Hueys.[85]

Medium Helicopters

CV-22 Osprey — Funding for the first two Air Force CV-22s was appropriated in FY2004. Plans for future production of the Air Force's CV-22 variant include funding for three aircraft in FY2005, two in FY2006, two in FY2007, five in FY2008, six in FY2009 and another 28 in the out years to complete the planned procurement of 48.[86] In addition to procurement, the Air Force has a modification program in place which consists of a few low cost modifications (and reprogrammings) which were begun in FY2004 and a future upgrade, scheduled to begin in FY2007.[87] SOCOM also has a number of modifications planned for the CV-22 variants once they are procured. These SOF- unique systems include such items as 'terrain following radar [and] electronic and infrared warfare suites as well as additional support and training equipment.[88]

HH-60G Modifications — This program funds a number of ongoing modifications — most of which are nearing completion — while initiating two new ones. Included in the former are new FLIR systems for 48 aircraft, SLEPs for 10-12 aircraft, new Lightweight Airborne Recovery Systems for 11 aircraft, improved communications and navigation systems and integrated electronic warfare systems

---

[83] See USAF, "H-1," *Committee Staff Procurement Backup Book, FY 2005 Budget Estimates, Aircraft Procurement, Air Force, Volume II*, Feb. 2004, pp. 541-549 (Item No. 55). Budget breakdown: FY2005: $6.575M; FY2006: $8.668M; FY2007: $14.955M; FY2008: $11.385M; FY2009: $11.371M; Total After FY2004: $52.954M. The alterations being completed in FY2004 included reprogrammings and seat replacement.

[84] Email, dated Dec. 19, 2003, sent to CRS by Lt. Col. Daniel K. Elwell, SAF/LLW, USAF.

[85] Gail Kaufman, "U.S. May Seek Lease to Replace Hueys," *DefenseNews*, Jan. 27, 2004, p. 9.

[86] See USAF, "CV-22 (Osprey)," *Committee Staff Procurement Backup Book, FY 2005 Budget Estimates, Aircraft Procurement, Air Force, Volume I*, Feb. 2004, Item Nos. 10 and 11. Budget breakdown: FY2005: 3 aircraft for $360.0M; FY2006: 2 aircraft for $253.9M; FY2007: 2 aircraft for $286.4M; FY2008: 5 aircraft for $517.0M; FY2009: 6 aircraft for $523.8M; To Complete: 28 aircraft for $2,362.7M; Total Program: 48 aircraft for $4,755.7M; Total Remaining After FY2004: 46 aircraft for $4,303.7M.

[87] No details on these modifications were provided. See USAF, "CV-22," *Committee Staff Procurement Backup Book, FY 2005 Budget Estimates, Aircraft Procurement, Air Force, Volume II*, Feb. 2004, p. 597 (Item No. 59). Budget breakdown: FY2005: $0.3M; FY2006: $1.9M; FY2007: $4.3M; FY2008: $4.6M; FY2009: $4.8M; Total to Completion: $16.2; Total Program: 16.2M; Total Remaining After FY2004: $15.8M.

[88] U.S. SOCOM, *Procurement, Defense-Wide, Fiscal Year (FY) 2005 Budget Estimates*, Feb. 2004, Item No. 40. Budget breakdown: FY2005: $126.083M; FY2006: $122.299M; FY2007: $162.419M; FY2008: $200.094M; FY2009: $160.503M; Total For FY2005-FY2009 Period: $771.398M.

for all 105 aircraft, and new ASE for 82 aircraft. The latter include a new Dual Engine Control Unit (to maximize power during emergency/constrained situations) for 104 aircraft and gearbox, rotor-brake and [new] engines for 41 aircraft.[89]

Personnel Recovery Vehicle (PRV) — This program aims to procure up to 194 long-range helicopters to replace the Air Force's 104 aging HH-60G Pave Hawks and 62 UH-1N aircraft for CSAR and security/VIP personnel transport missions, respectively.[90] Program documents have indicated that this aircraft is to have a minimum combat radius of 325 nautical miles (~397 miles), a self-deployment capability of 4,000 nautical miles (~4,603 miles), a 24-hour mission-readiness capability, a high degree of information exchange interoperability, and significant restrictions on the aircraft's downwash so as to minimize interference with rescue hoist operations while hovering.[91] The program is expected to cost $6 billion, one of the largest helicopter contracts in recent years.[92] The Air Force expects to set up a system program office, possibly as early as the end of FY2004, receive initial R&D funding in FY2005, receive first production deliveries in FY2012, and attain initial operating capability in 2014.[93]

Heavy Helicopters

MH-53Modifications — The Air Force completed funding for the replacement of obsolete IFF systems for 36 aircraft in FY2004.[94] SOCOM also completed funding for conversion of the fleet from the -J to -M variant in FY2004 while planning to complete funding of the Directed Infrared Countermeasure (DIRCM) system procurement and installation in FY2005 for all aircraft.[95] An official source indicated

---

[89] See USAF, *Committee Staff Procurement Backup Book, FY 2005 Budget Estimates, Aircraft Procurement, Air Force, Volume II*, Feb. 2004, pp. 551-567. Budget breakdown: FY2005: $95.1M; FY2006: $40.8M; FY2007: $10.5; FY2008: $8.4M; FY2009: $4.0M; Total After FY2004: $158.8M; Total Program: $647.6M. These figures also include 'Low Cost Modifications' which could consist of 'gun mount and ammunition handling system[s] (for .50 caliber and 7.62mm weapons); and interior and exterior lighting for use with NVS.' See Gail Kaufman, "USAF Speeds Up Rescue Helicopter Contest," *DefenseNews*, Mar. 22, 2004, p. 20.

[90] Megan Scully and Gail Kaufman, "Battle Fatigue: U.S. Fleet to Get $1.4B Overhaul," *DefenseNews*, Mar. 22, 2004, p. 38. See email, dated Dec. 19, 2003, from Lt. Col. Daniel K. Elwell, USAF, Secretary of the Air Force/Legislative Liaison, Weapons, to CRS.

[91] Hampton Stevens, "Air Force Fleshes Out Personnel Recovery Vehicle Requirements: Range, Deployability are Key," *Inside the Air Force*, Apr. 26, 2004.

[92] See Stevens, "Air Force...", and Scully and Kaufman, "Battle Fatigue," p. 38.

[93] Staff Sgt. Melanie Streeter, USAF, "Replacements Sought for Aging Helicopters," *Air Force Print News*, Dec. 17, 2003. This program may actually become part of a future "common helicopter" concept.

[94] See USAF, *Committee Staff Procurement Backup Book, FY 2005 Budget Estimates, Aircraft Procurement, Air Force, Volume II*, Feb. 2004, pp. 569 and 575.

[95] See U.S. SOCOM, "Rotary Wing Upgrades and Sustainment," *Procurement, Defense-Wide, Fiscal Year (FY) 2005 Budget Estimates*, Feb. 2004, Item No. 37. Budget breakdown:

(continued...)

that numbers of MH-53s would be reduced to 33 in FY2009, 26 in FY2010, 20 in FY2011, 12 in FY2012, and 7 in FY2013 as the CV-22 comes online.[96]

Conceptual Programs. The programs described earlier in the modernization section of this paper have been represented in past and current budget request submissions. The following programs have not been included in procurement budget requests, but may gain traction in what appears to be a turbulent helicopter modernization environment.

Future Utility Rotorcraft (FUR) — This program was formerly known as the UH-60X which was designated as the possible follow-on to the UH-60M variant. A total of 256 were originally required but the program was unfunded and projected by some to be unlikely to enter inventory until 2025.[97] Due to the February 2004 cancellation of the RAH-66 Comanche program, there was mention of a Joint Multirole Helicopter program to begin around 2020 but the purpose of this helicopter program and its relationship with current aircraft is unclear.[98]

Common Vertical Lift Aircraft (CVLA)/Joint Replacement Aircraft (JRA) [USN/USMC] — The Navy's Common Vertical Lift Aircraft [CVLA] may replace the UH-1N and A[H]-1W. It may support the helicopter air-to-air and air-to-ground mission, troop transport, and search and rescue function. It may also be a candidate to incorporate tilt-rotor technology developed under the V-22 program, and production start is projected for about the 2015 time frame.[99]

CH-47X Program — This is a proposed follow-on program to CH-47F in response to diversion of funds from Future Transport Rotorcraft (FTR) [see below]. Maximum take off weight would be near 31 tons (68,000 lb), which would require a new engine, as well as new components, such as a four-blade rotor system.[100] In comparison, the largest Chinook so far envisaged would only be able to transport 13.5 tons approximately 500 kms, although it could be fielded as early as 2015 at an estimated cost of $55 million a piece.[101] This would fall far short of the desired capabilities for the Future Transport Rotorcraft (FTR) it was intended to replace.

---

[95] (...continued)
FY2004: $77.797M; FY2005: $0.599M; Total After FY2003: $78.396M.

[96] See email, dated Dec.19, 2003, from Lt. Col. Daniel K. Elwell, USAF, Secretary of the Air Force/Legislative Liaison, Weapons, to CRS.

[97] Paul Jackson (ed.), *Jane's All the World's Aircraft, 2003-2004* (Alexandria, VA: Jane's Information Group, 2003), p. 720.

[98] See DOD briefing transcript, "Briefing on the Restructuring and Revitalization of Army Aviation," Feb. 23, 2004, at [http://www.DOD.mil/transcripts/2004/tr20040223-0484.html]

[99] John Pike, "Joint Replacement Aircraft [JRA] Common Vertical Lift Aircraft [CVLA]," [http://www.globalsecurity.org/military/systems/aircraft/jra.htm], Oct. 21, 2002.

[100] Paul Jackson (ed.), *Jane's All the World Aircraft, 2003-2004* (Alexandria, VA: Jane's Information Group, 2003), p. 556.

[101] Andrew Koch and Jashua Kucera, "Pentagon Explores Joint Heavylift Aircraft Options," *Jane's Defence Weekly*, Jan. 14, 2004.

Joint Transport Rotorcraft (JTR)/Future Transport Rotorcraft (FTR)/Air Maneuver Transport (AMT) — Originally called the Joint Transport Rotorcraft (JTR), the Future Transport Rotorcraft (FTR) was intended to replace the CH-47 Chinook as a centerpiece heavy-lift helicopter for transporting the Army's 20-ton Future Combat System (FCS) series of armored fighting vehicles. Deliveries are supposed to begin by 2020 as the SLEPs for the CH-47s and CH-53Es are due to end in the 2020-2025 time frame. Although it could have a strategic deployment capability up to 2,100 nautical miles, it is likely to be primarily a tactical helicopter with a combat radius of 500-1,000 kilometers. The FTR will be designed to carry a 10 to 20 ton internal combat payload or outsized external loads over its combat radius in challenging conditions. It will carry loads up to the size of fully loaded 22.4 ton containers over shorter distances, for logistics distribution and re-supply, recovery, and logistics-over-the-shore operations.[102] In January 2004, it was reported that the DOD, through its Joint Vertical Airlift Task Force, was considering a number of options for a heavy-lift FTR which included (a) a larger Chinook that could carry only 13.5 tons (see above); (b) a new Air Maneuver Transport (AMT) rotorcraft that could carry 20 tons, had a range of 500 km., and cost an estimated $91 million per copy (although it was too slow to keep up with the U.S. Marine Corps' V-22 Osprey); (c) a tilt-rotor version of the AMT — sometimes referred to as the Advanced Theater Transport (ATT), built by Boeing — which would meet all requirements at an estimated cost of $101 million per aircraft but not be ready for fielding until 2025; and (d) a Quad Tilt-Rotor (QTR) aircraft — built by Boeing as a larger version of its V-22 (and sometimes referred to as a V-44) — which would also meet all requirements and cost an estimated $100-110 million per aircraft.[103]

Another concept involves the Sikorsky Super Heavy Lift Crane helicopter, which is designed to carry as much as a 20 ton combat platform externally. The Super Heavy Lift Crane could be mated with a high speed sealift ship to provide expeditionary capabilities for the Army. This paper design resembles the Sikorsky CH-54A Skycrane, but features a coaxial rotor system and small fuselage.With the capacity to lift a 20 ton payload — the weight of an army Future Combat Systems platform — as far as 500 nm, it would exceed the 15 ton capacity and 110 nm range of the U.S. Marine Corps' CH-53X upgrade.[104] Another concept uses Reverse Velocity Rotor (RVR) technology which allows helicopters to travel much faster than conventionally possible, by using a hybrid eight-blade RVR helicopter with fixed wings and two fuselage-mounted turboprop engines. The resulting aircraft would

---

[102] Aviation Applied Technology Directorate [U.S. Army], "Future Transport Rotorcraft,"at [http://www.aatd.eustis.army.mil/Business/FactSheets/FTR/FTR.asp].

[103] Andrew Koch and Jashua Kucera, "Pentagon Explores Joint Heavylift Aircraft Options," *Jane's Defence Weekly*, Jan. 14, 2004. See also Mike Hirschberg, "From the Past to the Future of Heavy Lift, Part Three: Heavy Lift Helicopters," *Vertiflite*, Spring 2002, at [http://www.vtol.org/vertiflite/]; and Scott R. Gourley, "V-44," *Popular Mechanics*, no date, at [http://www.popularmechanics.com]. Provisional specifications for the V-44 include a cargo capacity of 40,000 lbs. (i.e. one AH-64, AH-1, RAH-66, UH-1Y, or UH-60 helicopter; or 90 troops; or three HMMWVs). See Paul Jackson (ed.), *Jane's All the World's Aircraft, 2003-2004* (Alexandria, VA: Jane's Information Group, 2003), pp. 541-2.

[104] Kim Burger, "Unveiled: Helicopter, Sealift Combination for the Future," *Jane's Navy International*, Sept. 1, 2003.

have cargo-carrying capacity equivalent to a C-130J transport aircraft.[105] The course for this platform is still undecided, although the latest performance goals seem to revolve around a 20-24 ton carrying capacity, a 2,100 nautical mile range (~2,416 miles) with 20 minutes of hovering time, and a cruising speed of 170 knots (~195 mph).[106]

Heavy Lift Replacement (HLR) [USMC] — As discussed above, the Army is examining a heavy-lift helicopter replacement/procurement program which aims to satisfy weight and range requirements in transporting the FCS (20 tons apiece) into battle. While the Marines may have similar weight and range requirements, they must also require a minimum speed in order to keep up with the MV-22B Osprey. As such, of the aforementioned concepts for heavy-lift, VTOL-capable aircraft, only the QTR seems to satisfy the speed requirement.

CH-53X Super Stallion Remanufacture — Over the next few years, the CH-53D/E will undergo a Service Life Assessment Program (SLAP) which will most likely result in a Service Life Extension Program (SLEP). This is necessary to maintain a heavy-lift capability past the time that the current Super Stallion fleet begins to retire (i.e. FY2011-2012 and at least until the Heavy Lift Replacement (HLR) has been developed. During this interim period, the MV-22B is scheduled to replace the remaining CH-53Ds, thereby completely taking over the medium-lift (troop) transport mission from the CH-53Es which have been operating in the multi-mission role.[107]

Issues for Congress

The modernization programs outlined above suggest a number of issues that may compete for congressional attention. These issues include budgetary concerns, whether there is adequate coordination among the Services, how modernization may effect the helicopter industrial base, and a number of operational considerations such as whether the envisioned programs will adequately improve operational shortcomings identified in recent conflicts.

Budgetary Issues

The helicopter modernization plans and programs described in this paper account for approximately $34.6 billion in spending between FY2005 and FY2009.

---

[105] Andrew Koch, "Ship-to-Objective Lift Still A Key Issue, Says U.S. Study," *Jane's Defence Weekly*, Aug. 27, 2003, pp. 28-29.

[106] Robert Wall, "Appetite for Aviation: U.S. Army Juggles Operational Demands With Desire to Overhaul, Buy New Aircraft," *Aviation Week & Space Technology*, Apr. 5, 2004, pp. 35-36. For more information about the FTR and related concepts see Jon Grossman et al., *Vertical Envelopment and the Future Transport Rotorcraft: Operational Considerations for the Objective Force* (Santa Monica, CA: Arroyo Center, RAND, 2003).

[107] Deputy Commandant for Aviation, USMC, *Aviation Implementation Plan* (Washington, DC: HQMC, USMC, [2000]), pp. B-5/6.

Generally at issue is whether these planned expenditures are appropriate and acceptable in light of current and projected federal and DOD budget constraints. Second, DOD is facing what many both in DOD and in Congress have called a budgetary "train wreck," caused by too many programs vying for already scarce funds.[108] A review of DOD's most recent estimates indicates that current aviation acquisition programs total $563 billion in past, current, and anticipated costs.[109] Additional budgetary complications competing in general with helicopter modernization, are the mounting costs of the conflicts in Afghanistan and Iraq, which the administration estimates will require at least another $25 billion in supplemental costs.[110]

The anticipated cost of helicopter modernization, especially in light of the budget pressures described above, generate a number of questions that may arise in the course of congressional oversight. For example, can and should the current plans be modified to reduce costs? Are there cases where helicopter modernization can be postponed? The Services, and their proponents are likely to argue that modernization can't be postponed. They would likely note that military helicopter deliveries were cut almost in half during the 1990s,[111] and that many 1970s era helicopters face block obsolescence without modernization.

Can modernization methods that incur more costs in the near term, such as the design and manufacture of new helicopters, be replaced by modernization approaches that incur lower near term costs? Upgrades and Service Life Extension Programs (SLEPs) are two potential examples. Can the services more aggressively pursue technologies, such as unmanned aerial vehicles (UAVs) that may (and some argue may not) be cheaper than manned helicopter? For example, some questions could be raised about the cost effectiveness of the proposed Armed Reconnaissance Helicopter program. Some could contend that the Army already has existing platforms or programs which, when augmented by technologies from the cancelled Comanche program, would probably permit them to satisfy the armed reconnaissance helicopter's missions. Three examples include the Block III AH-64 Apache, the additional reconnaissance capabilities in the Fire Scout unmanned aerial rotorcraft, and the Extended-Range Multi-Purpose UAVs, although the latter itself might face

---

[108] See, for example: John W. Douglass, "The Reports Of Our Demise Have Been..."*Aviation Week & Space Technology*, Apr. 26, 2004. Rep. Curt Weldon, quoted in Lorenzo Cortes, "GAO Official Says Adding Ground Attack To F/A-22 Costs $8 Billion," *Defense Daily*, Mar. 26, 2004. Interview with Gen. (Ret.) Russell Dougherty, Aerospace America, Oct. 2003, p. 14.

[109] Selected Acquisition Report (SAR) Summary Tables, Department of Defense OUSD (AT&L) as of Sept. 30, 2003. pp.3-4.

[110] For more information, see CRS Report RL32090, *FY2004 Supplemental Appropriations for Iraq, Afghanistan, and the Global War on Terrorism: Military Operations & Reconstruction Assistance*.

[111] "World Rotorcraft Overview," *World Military and Civil Aircraft Briefing*, Teal Group Inc., July 2003, p.8.

scrutiny as a new UAV program among the many that have been facing pressure to consolidate.[112]

Another question is how much more reduction in force structure, or consolidation in terms of the number of different aircraft types can be pursued as a cost saving measure. Through consolidating its helicopter fleet from seven to only two types of helicopters, the Navy hopes to realize operations and maintenance savings estimated at $18 to $20 billion over a twenty year period.[113] If inventory numbers fall as part of this consolidation, however, does spending on readiness have to increase to maintain the same capability? If so, how much would that defray O&M savings? Could the Army field an "all Black Hawk force?" If so, what would be the savings over a heterogeneous force?

Another issue is how the approximately $14.6 billion in procurement funds resulting from the Comanche cancellation should be invested. The Army has produced a plan for spending that $14.6 billion on modernizing most of the other helicopters in its fleet and initiating new helicopter programs such as the LUH and the armed reconnaissance helicopter. Yet, some question whether the funds made available from the Comanche cancellation are sufficient to adequately subsidize the Army's stated aviation ambitions.[114] The Office of Management and Budget requested a reallocation of the $1.2 billion in requested Comanche FY2005 R&D spending. These funds would be reallocated to purchase helicopter aircraft survivability equipment, and additional helicopters, and to upgrade and accelerate helicopter recapitalization.[115] Yet, the Army would require additional funding reallocation to fund other aviation objectives, such as accelerating tactical UAV programs.

Some may find, however, that more urgent problems, either within Army (e.g. funding the Future Combat System) or outside the Army (e.g. general war costs) offer more compelling demands for these funds. It is currently not clear whether Congress will reallocate some portion, or even all, of the funds made available by the Comanche cancellation to programs outside of Army aviation.

A final question pertains to funding mechanisms. Might the budgetary tensions presented above generate increased pressure for legislators to adopt new, or previously controversial funding approaches to satisfy DOD's helicopter modernization plans? For example, leasing, rather than procuring military helicopters may become more attractive to some legislators because a lease typically requires less money "up front" than does a procurement contract. It may be, for example, that the

---

[112] Emily Hsu, "FCS to Retain Initial Comanche Capabilities," *Inside the Army* [online], Mar. 29, 2004.

[113] Email communication from Navy Office of Legislative Affairs (LA 558) Naval Aviation Programs to CRS, May 6, 2004.

[114] One immediate problem is that terminating the Comanche program will incur cancellation fees which could reduce the amount of anticipated savings.

[115] Letter from Joshua B. Bolten, Director, Office of Management and Budget to Honorable J. Dennis Hastert, Speaker of the House of Representatives, Mar. 5, 2004.

lack of near-term budget in the Air Force procurement account was one factor that stimulated policy makers to pursue the controversial lease of 100 Boeing KC-767 aerial refueling aircraft, instead of the more traditional procurement. Congress has also traditionally demanded that DOD pursue a full funding principle in its procurement programs, so not to "tie the hands" of future congresses. Yet, exceptions to full funding, called incremental funding have been allowed in some circumstances, such as the eventual KC-767 "20/80 compromise." Incremental funding profiles typically allow a more even authorization of funds over time than full funding profiles, which can be advantageous in budget constrained environments.[116] Critics, however, note that this approach limits future flexibility and may foreclose future options.

Force Structure

DOD's current helicopter modernization plans may raise questions on future force structure. The rationale behind the planned numbers for some future helicopter inventories is unclear and may be subject to examination. For example, the current aviation modernization plan indicates that the Army will procure approximately 456 fewer attack/reconnaissance helicopters than it currently fields. This is almost a 35% decrease in the current force structure. It is likely that this smaller inventory is anticipated to be as effective as the larger force due to helicopter improvements and through the effective exploitation of UAVs. But, is this the case? Is this smaller force enough to maintain or improve combat capabilities? Can the Army accurately predict and quantifiably demonstrate that this smaller force is as or more lethal than the larger force? If not, does the Army have a hedging strategy? If desired improvements in future helicopter programs do not come to fruition, or if UAVs become more difficult to exploit, or are not as effective as hoped, will the Army procure more attack/reconnaissance helicopters?

Recent press reports describe some Army techniques for increasing the effectiveness of smaller helicopter forces. These techniques include improvements to radar, infrared sensors, and communications. Changes to doctrine and concepts of operation may also be utilized. Training and experimentation with tactics and doctrine has been conducted for the Korean peninsula, as one example, and these lessons learned may be applicable elsewhere.

> Operating in smaller formations would reduce the exposure of helicopters to air defenses and allow the Army to overwhelm North Korean forces by attacking from multiple directions....The goal would be to mass fires, not mass formations....The concept of smaller formations is critical in Korea and other mountainous environments [e.g. Afghanistan] where there is a limited number of valleys helicopters can fly through to reach a target, making them more vulnerable to air-defense traps. Because an adversary could probably not cover

[116] See CRS Report RL31404, on the full funding principle, and CRS Report RL32056 on the KC-767 lease.

> every possible approach, splitting the force should allow at least some to engage the enemy unimpeded.[117]

Conversely, the Navy appears to be adding, rather than reducing helicopter force structure. The Navy currently plans to replace 386 legacy aircraft with 497 MH-60R/S helicopters. What is the Navy's justification for purchasing 111 more multipurpose helicopters than are required today? Typically, more effective aircraft are purchased in smaller quantities than the legacy aircraft they replace. Does the Navy foresee the requirement for this kind of capability increasing?

The Army's aviation modernization plan does not indicate how many Joint Vertical Airlift Task Forces (JVATF) it will equip. The Army does indicate that 303 LUH platforms will be procured, but this is just one of several helicopters that will populate the JVTAF. The apportionment of the various utility helicopters among the JFATF's is not currently clear. Congress may opt to inquire into this issue to determine the depth and maturity of Army plans.

Finally, a question remains about force structure coordination. The Services are making plans that may significantly alter the size of their individual helicopter inventories over the coming decades. Are these plans, and their potential force structure implications, being adequately coordinated and considered by the Joint Staff or Office of the Secretary of Defense to ensure maximum operational, economic, and industrial benefit?

Coordination of Modernization Efforts

Diversity and competition among the armed services can often be positive. Diversity can complicate our adversary's planning, and the creative friction from competition can lead to new and improved warfighting approaches. In weapons acquisition and modernization, however, the savings and efficiencies derived by coordination and jointness often are more beneficial than the fruits of diversity and competition.

All the services are pursuing or have initiated helicopter modernzation programs. Some of these plans are broad in scope and effect helicopter programs for decades. At issue is whether there is sufficient coordination among these programs to realize maximum benefit. Do opportunities exist for closer coordination? If so, would this coordination save money or result in increased "jointness"?

As described in the previous section of this report, the services already fly many of the same helicopters, and plans to consolidate the number of types of helicopters will perpetuate this state of affairs. There appear to be, however, several opportunities for increased consolidation that may be explored.

One possible approach to increased consolidation reflects the fact that all helicopters in the Immigration and Customs Enforcement (formerly INS and

---

[117] Robert Wall, "Combat-Ready: Distributed Helo Ops May Yield Enhanced Combat Effectiveness," *Aviation Week & Space Technology*, Apr. 12, 2004, pp. 68-69.

Customs), Border Patrol, and the Coast Guard are now managed by the Bureau of Customs and Border Protection (CBP) within the Department of Homeland Security (DHS). All told, the CBP fields at least six different types of helicopters, including eight MH-68A Sting Rays (Agusta A-109E), a number of HH-60J Jayhawks, a number of Coast Guard cutter-fielded HH-65A Dolphins, 26 Eurocopter AS-350B1s (with four new AS-350B2s being purchased), some legacy OH-6As, one Bell UH-1H Huey, and some legacy OH-6As as well as their modernized sister-ships, the MD-500Es and MD-600Ns (with NOTAR systems).[118] Would it be plausible and cost effective to integrate helicopter purchases with another service or services in order to consolidate the number of platforms being operated both on land and at sea?

H-1 Helicopters. As described in the background section, the Army and Navy plan to divest themselves of their aging UH-1 fleets.[119] The Army will either replace UH-1 with a UH-60 variant or the LUH, and USN will replace its UH-1s with the MH-60. The Marine Corps plans to upgrade its H-1 helicopters to last beyond 2020 and the Air Force will sustain its H-1 fleet until planned replacement in 2014 by a version of the PRV.

These plans may prompt the following questions. First, why are the Army and the Air Force pursuing two new and separate UH-1 replacement programs? Have the services explored the efficacy of cancelling either the LUH or the Common Vertical Lift Support Platform (CVLSP) and making the survivor a joint program? Along the same line of inquiry, Congress may probe why the Army developing the LUH. Prior to the announcement of the intended Comanche cancellation, the Army planned on replacing the UH-1 with a UH-60 variant and creating an "all Blackhawk" fleet. A homogenous fleet based on a proven platform — one that is flown by the Navy and Air Force — appears to offer the potential for O&M savings.

Similarly, the Marine Corps could consider replacing its H-1 helicopters with the MH-60S, as the Navy is doing, and achieve increased commonality with its sister service. Alternatively, the Marine Corps could participate in the Army's LUH, the Air Force's Common Vertical Lift Support Platform program, or preferably, a joint program derived from either the Army or Air Force program.

There are a number of options that some observers maintain the Marines could consider to replace the AH-1 Cobras sooner rather than later, and facilitate the expedited retirement of H-1 airframes from DOD's inventory. For example, the Marine Corps could consider the AH-60 "Battlehawk," developed by Sikorsky for the Australian Army. If Congress decides to block the Comanche retirement and the Army continues operating the OH-58D, the Marine Corps could consider that aircraft as an alternative to the AH-1. Finally, the Marine Corps could consider replacing the Super Cobra with the AH-64. The Apache's mission has already been expanded to include maritime missions. Apaches in South Korea are prepared to defeat North

---

[118] David Hughes, "New Umbrella For a Variety of Enforcement Agencies Highlights Helo Use in All Cases," *Aviation Week & Space Technology*, Mar. 15, 2004, pp. 48-51.

[119] While Army plans indicate that UH-1s will be retired, it has also been reported that the Bell 210 helicopter, essentially an overhauled UH-1, may be a contender for the LUH program.

Korean special operations boats.[120] The Marines and Army operate the same main battle tanks, might there be both economic and operational opportunities inherent in operating the same "main battle helicopters?"

H-6 Helicopters. The Army operates the only H-6 helicopters in DOD's inventory. While this small fleet (approximately 40 aircraft) is being upgraded, no mention of it has been made as part of the Army's new aviation modernization plan. Are specialized observation/light attack helicopters still required in an era of increased use of UAVs for this mission? If so, could the H-6's be retired and replaced by a variant of the Army's LUH? Or, preferably, could the H-6's be replaced by a variant of a joint Army, and Air Force program? Conversely, some argue that the H-6 is an attractive candidate to replace OH-58s through the Army's Light Armed Reconnaissance Helicopter (LARH) program, which is expected to be fielded in 2007 with a total of 368 units procured.

Army and Air Force H-60 Helicopters. Another coordination issue concerns the Air Force's planned acquisition of up to 194 new aircraft, primarily to replace its 101 aging HH-60G Pave Hawk CSAR helicopters (but also to replace its 62 UH-1N Hueys). Eighty seven percent of the HH-60G's components are identical to the Army's primary troop/utility transport, the UH-60.[121] Air Force long-range planners claim that 'it would be more cost-effective to buy the new aircraft than to fly the HH-60G Pave Hawk, today's CSAR aircraft, beyond 2011 or 2012.'[122] However, the potential savings from continuing to operate the same aircraft across services may outweigh the savings for one service in acquiring a new helicopter.

Heavy Lift Helicopters. Although it is a joint effort, the V-22 Osprey program does not include all of DOD's users of heavy lift helicopters. The Army is noticeably absent from this program. The Army is planning to build a future heavy-lift helicopter to carry its Future Combat System (FCS). The Army has used a number of names to describe this future heavy lifter, including the Joint Transport Rotorcraft (JTR)/Future Transport Rotorcraft (FTR)/Air Maneuver Transport (AMT). Might the V-22, if it successfully enters production, adequately fulfill the Army's future heavy lift requirements? Procuring a V-22 variant would amortize the sunk R&D costs over a larger production run and reduce the per-unit cost. Additionally, operating the same heavy-lift helicopter in three services could result in O&M savings rather than operating heterogeneous heavy lift fleets.

The Navy and Marine Corps may be pursuing different solutions to its aging H-53 fleets. The Navy is currently considering replacing its H-53 with the MH-60R/S. The Marine Corps is considering a service life extension program for its H-53s, a more comprehensive retrofit, and new production of the same design. Can a combination of MH-60s and V-22's satisfy the Marine Corps' needs? Alternatively,

---

[120] Robert Wall. "Better Defense, Better Offense," *Aviation Week & Space Technology*, Apr. 12, 2004, pp. 64-66.

[121] Gail Kaufman, "USAF Speeds Up Rescue Helicopter Contest," *DefenseNews*, Mar. 22, 2004, p. 20.

[122] *Ibid*.

might the Navy cooperate with the Marine Corps in building a larger number of new H-53s, and thus reduce per unit costs? What synergy might be derived from participating in a new Army heavy lift program, as mentioned above?

Industrial Base Issues

The helicopter modernization programs outlined in this paper raise several questions that pertain to the U.S. industrial base. What impact, if any, will planned helicopter modernization have on jobs, growth, and competition? Conversely, how much of a consideration should industrial base factors be in determining modernization strategies?

Some industry observers predict "respectable growth" in military helicopter production from 2003 to 2012 compared to the 1993-2002 period.[123] Up to 8,700 helicopters worth $78 billion are projected to be built world wide. Would the cancellation of the Comanche have a negative or positive impact on this projection? Would it cut jobs or actually create jobs? Many observers assert that, if the Comanche is cancelled, it will have negative near-term effects in terms of job loss.[124] Sikorsky officials hope that modernization activity that will be pursued in lieu of the Comanche will make up for most of these lost jobs. However, it does not appear that the Army's current plans to purchase an additional 80 UH-60s will offset the value of the Comanches cancelled. This suggests that winning new contracts may be important for this company to sustain its position in the helicopter industry. Other large companies, such as Lockheed Martin, will continue to work on other projects, such as Apache components and upgrades.

The cancellation of the Comanche could retard Sikorsky's entry into the attack helicopter market. How will this effect Sikorsky's longer-term diversification and competitiveness? Will this result in less competition for Boeing and Bell in terms of producing attack helicopters and, in turn, reduce dynamism and creativity in attack helicopter design?

Will helicopter modernization plans facilitate or retard the ability of U.S. companies to compete with European helicopter manufacturers? Do upgrading helicopters and performing SLEPs provide defense companies with the type of work that challenges engineers and designers to develop new skills and to push the state of their art? If not, do upgrades and SLEPs at least maintain the requisite skills required to build new helicopters in the future? If not, might the increase in upgrades and SLEPs also have a negative effect on the dynamism and creativity of the defense helicopter industrial base?

What impact might current helicopter modernization plans have on industry consolidation? Many argue that there is currently an overcapacity in the military helicopter market: too many companies are chasing too little business. Some estimate

---

[123] "World Rotorcraft Overview," *World Military & Civil Aircraft Briefing,* Teal Group, Inc. Fairfax, VA, July 2003.

[124] Greg Schneider, "Comanche's Cancellation Brings Layoffs," *Washington Post*, Mar. 26, 2004.

that most helicopter contractors are only operating at 50 percent capacity.[125] While much of the defense aviation industrial base has consolidated over the past 15 years (e.g., only Boeing and Lockheed Martin today manufacture new fighter aircraft), the helicopter industrial base has not followed suit. There are currently five large global helicopter firms. These companies include Bell Helicopter, Boeing, and Sikorsky in the United States, and Eurocopter and Augusta-Westland, in Europe.[126]

Some say that the planned cancellation of the Comanche program is likely to hasten helicopter industry consolidation. It was difficult to purchase or sell companies involved in the Comanche program, these observers argue, because company valuation was too tenuous. Now that the Comanche appears likely to be cancelled, Boeing may be more likely, and more able, to sell its military helicopter business. United Technologies, the parent company of Sikorsky helicopters is one potential buyer.[127]

Domestic helicopter manufacturers today appear to face increasing competition from Eurocopter and Augusta-Westland. The European companies are spending increasing amounts of money on R&D, and have increased their market share of sales over the past 10 years.[128] The European domestic market for military helicopters is much smaller than that in the United States and many observe that the Europeans are poised to increase their attempts to penetrate the U.S. defense market. The competition for the U.S. presidential helicopter contract is one example. Some say that expertise in domestic and military tilt-rotor technology is one advantage that U.S. companies have over European companies. If true, to what degree should supporting U.S. competitiveness be a factor in making decisions on the V-22 program?[129]

Noting the desire of European companies to more effectively penetrate the U.S. defense market, some argue that a Bell Helicopter merger with Augusta-Westland is another possibility. Current political tensions between the United States and many European countries, however, as well as trade and competitiveness concerns may make such an international merger more difficult than a national one. Also, the potential vulnerability of the V-22 program could make mergers for both Bell and Boeing difficult, for the same reason the Comanche program's clouded future made mergers difficult.

---

[125] Renae Merle, "Comanche Cancellation May Reshape Industry," *Washington Post,* Feb. 25, 2004.

[126] Several other companies in the United States, Russia, China and elsewhere also produce, or are capable of producing military helicopters, but are not in the same class, in terms of size and scope, as the five mentioned here.

[127] Telephone conversations between Morgan Stanley aerospace industry analysts and CRS.

[128] Richard Aboulafia, "World Rotorcraft Overview," *World Military & Civil Aircraft Briefing* (Fairfax, VA: Teal Group Corporation, June 2003).

[129] See CRS Report RL31384 on the V-22 program for more details.

Operational Issues

The final objective of DOD's helicopter modernization efforts is to make tomorrow's military helicopters effective enough to meet combatant commanders' needs and to achieve defense strategy goals. Do DOD's modernization efforts put today's helicopter programs on a path to meet tomorrow's challenges? Based on experience with helicopters in a number of recent conflicts, it appears that improvements in deployability, reliability, survivability, and safety might prove particularly valuable.

Deployability. Before helicopters can contribute to the fight, they must get to the fight. Unlike long-range aircraft, or even theater-range aircraft, helicopters' range is too short to allow them to self deploy across oceans. While this problem is largely solved for Navy and Marine Corps helicopters by being based on aircraft carriers or amphibious assault ships, Air Force and Army helicopters typically are transported by air or sea to the theater of conflict.

An Army helicopter task force ("Task Force Hawk") participating in the 1999 conflict in Serbia (Operation Allied Force) heightened awareness of the difficulties sometimes associated with deploying helicopter forces to and around a theater of conflict.[130] In Kosovo, the Army was criticized for not being able to quickly deploy and use Task Force Hawk, a group of 24 AH-64 Apache attack helicopters accompanied by mechanized ground units. Critics emphasized that the task force had grown into a 5,000-soldier force that required 500 C-17 sorties to deploy.

While many of the specific organizational and planning problems of Task Force Hawk appear to have been addressed,[131] deploying to subsequent operations in Afghanistan and Iraq have heightened concerns about potential airlift shortfalls. It may be that fighting a global war on terrorism could place even greater demand on improved helicopter deployability. Do today's helicopter modernization programs do enough to improve deployability? Folding rotor-blades are one innovation that can make it easier to fit helicopters into airlift aircraft. Are other techniques being pursued? Increasing helicopter range can increase the number of installations at which helicopters can be based and still reach the fight. Increasing helicopter effectiveness through improving capabilities or by integrating the aircraft with UAVs can lead to a reduction in force structure and organization, which in turn can improve deployability. Changes in helicopter organization can help address deployability. How much experimentation are the Services pursuing toward improved helicopter deployability, and are such experiments adequately resourced?

Reliability and Maintainability. Past problems with helicopter reliability and maintainability have been reported. In 2001, for instance, the GAO found critical shortages among 90 pieces of equipment for high-maintenance attack and transport

---

[130] See "Kosovo/Operation Allied Force After Action Report," Jan. 31, 2000, Report to Congress, U.S. Department of Defense, pp. 42-43, 46, 59, 75-76.

[131] U. S. General Accounting Office, "Kosovo Air Operations: Army Resolving Lessons Learned Regarding the Apache Helicopter, " GAO-01-401, Mar. 2001.

helicopters.[132] The high operations tempo of the ongoing conflicts in Afghanistan and Iraq and a global war on terrorism may exacerbate maintenance challenges. The Army's deputy chief of staff for aviation. Lt.Gen. Richard Cody, commented on how Army aviation is "stretched thin," and that it would have to find "innovative ways" to address readiness and maintenance challenges.[133]

Has the Army (and other Services) budgeted enough in terms of spare parts and diagnostic equipment to address the high wear and tear caused by the combination of high operations tempo and harsh environments? Some argue that current helicopters suffer from maintainability and reliability problems in part because they were not originally designed to operate in the harsh environments of Iraq and Afghanistan.[134] If true, will modernization be enough to improve maintainability and reliability of legacy helicopters, or would new-build programs make more sense from a reliability standpoint?

Do opportunities exist to more widely implement programs like the Marine Corps Mod programs, which will result in more than 80% commonality among major parts, equipment, and systems? Similarly, can procurement of multi-mission kits, as part of modernization programs, be implemented to ease maintenance challenges?

The Army Aviation Modernization Plan appears to emphasize more upgrades to Army helicopters than was planned prior to the Comanche cancellation. The Army has over 500 helicopters deployed to Iraq and Afghanistan alone. How will the Army meet its operational and readiness challenges if it loses more and more aircraft to upgrades and maintenance? Some Army leaders have expressed concerns, but have not yet described a mitigation plan.[135]

Survivability. Recent conflicts have raised questions about how survivable military helicopters are under a variety of conditions. Between October 2001 and March 2004, the Army alone lost 44 helicopters (an additional 23 are pending repair analysis) in hostile and non-hostile incidents and a total of 38 soldiers have died.[136]

While flying low to the ground can help helicopters avoid detection, it also puts them within reach of a wide variety of enemy surface-based weapons. Many of these weapons, such as small arms and rocket-propelled grenades, are not affected by aircraft electronic and infrared countermeasures. Also, flying low to the ground can

---

[132] Bernard Adelsberger, "Spare-Parts Shortages Threaten U.S. Readiness," *DefenseNews*, July 21, 2003, p. 50.

[133] Marc Selinger, "Army Aviation Needs 'Innovative Ways" to Sustain Force, Official Says," *Aerospace Daily*, Mar. 26, 2004.

[134] Megan Scully, "Desert Dust, Scattered Enemy Formation Altered Apache Mission," *Inside the Army*, May 19, 2003.

[135] Robert Wall, "Appetite for Aviation," *op. cit.*

[136] Statement of LTG Richard A. Cody (Dep. Chief of Staff, G-3, USA), in U.S. Congress, Senate Armed Services Committee, Tactical Airland Subcommittee, *United States Army Aviation*, 108th Cong., 2nd sess., Mar. 30, 2004.

exacerbate the threat of environmental dangers such as power lines, fog and dust. Some report that the biggest threat to special operations helicopters in Afghanistan was the environment. Iraq presented a different set of environmental risks, including towers and high-power wires, that were not found in Afghanistan.[137]

In Operation Allied Force, once Task Force Hawk was deployed to Albania, it was not employed, primarily because commanders were concerned about survivability. The Task Force also lost two aircraft during training missions. In Afghanistan, a flight of eight A-model Apaches all took heavy small-arms fire during Operation Anaconda in the Shah-i-Kot Valley in March 2002. Two were heavily damaged by rocket propelled grenade hits to the tail and nose sections.

In the Iraq war, it was reported that helicopters encountered problems with survivability. An attack on a Republican Guard division by 34 AH-64 helicopters from the Army's 11th Attack Helicopter Regiment has been described as a near disaster. Every helicopter was hit by ground fire, one helicopter was lost, and 27 of the 33 that returned to base were too damaged to fly again without repair.[138] Some observers suggest that, reminiscent of problems with Army helicopter operations in Kosovo and Afghanistan, an Army failure to coordinate the Apache attack with supporting Air Force and Navy aircraft operations may have played a significant role in the poor outcome of this attack.[139] By using different tactics and by more closely integrating their efforts with fixed-wing attack aircraft and Army artillery, AH-64s from the 101st Air Assault Division conducted a raid on the city of Karbala four days later with much less damage.[140] Helicopter supporters argue that this shows that helicopter survivability is adequate.

One traditional role for Army attack helicopters is conducting close air support (i.e., attacking enemy forces that are directly in contact with, or near contact with, friendly forces). Early in the Iraq war, attack helicopter pilots complained that they were being sidelined — that U.S. war planners were relying more on fixed-wing aircraft (many armed with precision-guided weapons) than on helicopters for performing close air support missions.[141] This perceived preference for fixed-wing aircraft, if accurate, may have been due in part to concerns regarding helicopter survivability following results of the attack by the 11th Attack Helicopter Regiment.

---

[137] Robert Wall, "Growing Pains: Finding Qualified Pilots for the Army's New Helo Operation Is Just One of the Potential Roadblocks," *Aviation Week & Space Technology*, Apr. 5, 2004, p. 38.

[138] Rowan Scarborough, "Apache Operation a Lesson In Defeat," *Washington Times*, Apr. 22, 2003, p.1. Eric Rosenberg, "Karbala Retreat Raises Questions About Choppers," *San Antonio Express-News*, Mar. 23, 2004.

[139] *Ibid.*

[140] Rick Atkinson, "A Flotilla of Army Helicopters Joint Attack on Karbala," *Washington Post*, Mar. 29, 2003, p. 23. See also Neil Baumgardner, "Apache Longbow Battalion Destroyed Two Republican Guard Battalions During OIF," *Defense Daily*, May 12, 2003. p. 4.

[141] Thomas Frank, "Back-Seat Role for Apaches," *Long Island Newsday*, Apr. 15, 2003.

Army aviation leaders say that improving aircraft survivability is a high priority[142], but what is the best way to improve helicopter survivability? It does not appear that Aircraft Survivability Equipment (ASE) was a high priority for helicopter modernization in the 1990s; in 2000 and 2001, a lack of funds further delayed improvements to platforms.[143] Senior Army aviation officials have called the state of aircraft defenses a "travesty," and promised to expedite the fielding of ASE.[144] Do current plans support this goal? How long will it take to implement on such a large helicopter force? It has been reported that one currently fielded helicopter self defense system, the AN/ALQ-144 countermeasures system, "routinely breaks down in the desert and requires extensive maintenance."[145]

Is fielding ASE the only, or the best, way to improve survivability? How much effort is being spent on reducing helicopter's infrared signature? Measures such as suppressing the engine's exhaust may prove more beneficial than, or as beneficial as, fielding countermeasures. Also, as mentioned, electronic and infrared countermeasures have no effect on small arms fire and rocket propelled grenades.

Much of helicopter survivability challenges may be caused by the challenging operational environments recently encountered, such as deserts, mountains, or urban topography. Reports indicate that the Army is pursuing a strategy to combat both the technological and tactical/doctrinal deficiencies that have adversely affected manned helicopters in Afghanistan and Iraq. Led by the Applied Aviation Technology Directorate (AATD), the Army just finished revising a number of 'smaller-scale road maps' in its major technology areas, including engines, airframes, rotor blades, and maintenance systems. Part of this strategy will include the AATD returning its efforts to manned platforms. In the past few years the Army has focused on unmanned technologies, which were hoped to dominate aviation in the future. Specific efforts include developing erosion protection and anti-icing, new field repair capabilities for rotor blades, new air vehicle design that can self-detect damage, a self-healing flight control system, and a GPS navigation system to help reduce accidents while flying in brownout conditions.[146] How efficacious are these survivability enhancements, and how much weight should be placed on them vis-a-vis ASE?

How much effort are the services placing on improving helicopter concepts of operations (CONOPs) to increase survivability in urban operations? The Army is changing its flight school curriculum to reflect the unique desert and urban conditions

---

[142] Joshua Kucera, "Aircraft Survivability is Top U.S. Army Priority," *Jane's Defense Weekly*, Mar. 31, 2004.

[143] Sandra Erwin, "Army Rushes to Deploy Defensive Gear on Aircraft," *National Defense*, Mar. 2004.

[144] Nathan Hodge, "Army Aircraft Defenses a 'Travesty,'Top Aviator Says," *Defense Week*, Jan. 12, 2004.

[145] Hearst Newspapers, "Helicopter Defense System Suffers Woes in Iraq," *Baltimore Sun*, Jan. 18, 2004.

[146] Emily Hsu, "Army Forging Strategic S&T Plan to Mend Aviation Deficiencies: S&T Focus to Shift to Manned Aircraft," *Inside the Army* [online], Apr. 19, 2004.

found in Afghanistan and Iraq. Previous training efforts had focused on the European battlefield and technological superiority. The new conditions, however, have forced changes in tactics, techniques and procedures (TTPs), for example, with regard to 'evasive maneuver tactics' and 'running and dive fire tactics' which take into account hot weather and high altitude factors.[147] Are efforts like these adequately resourced?

Some suggest that helicopters would be more survivable during operations if they were better integrated into the joint air tasking order (ATO) and supported more closely by fixed-wing aircraft operations. Are the services taking steps to address this shortcoming? How much will the incorporation of UAVs into helicopter operations improve survivability?

[147] Emily Hsu, "Army Adjusts Aviation Training Methods Based on Iraq, Afghanistan: Responding to a Changed Environment...," *Inside the Army* [online], Apr. 5, 2004.

Appendix I: Current Rotary-Wing Aircraft Platforms

This section provides a basic description of the helicopters discussed in this report. To improve readability, the most technical information is found in footnotes.

H-1 "Iroquois" (**"Huey"** and **"Cobra"**).[148] The UH-1 "Iroquois" (or "Huey," after its original designation HU-1) first flew in 1958 as the first gasoline turbine-engine helicopter in the U.S. Army.[149] Originally designed as an 'aerial ambulance,' this single-engine helicopter evolved into a number of different types, including troop and cargo transport, armed support, search and rescue, training, and psychological warfare.[150] More than 14,000 Hueys have been produced, both in the U.S. and abroad.[151]

As of February 2004, there were four variants of the UH-1 in the U.S. inventory. The Army fields approximately 421 UH-1H/V models.[152] These are single-engine machines that can operate at night and in partially adverse weather conditions. They serve primarily as utility/troop and medical-evacuation ("med-evac") transports, respectively, and can be equipped with minimal Aircraft Survivability Equipment (ASE), mainly for infrared (IR) suppression.[153] The Navy, Marine Corps, and Air Force field a number of twin-engine HH-1N and UH-1N variants with the former two services using 27 HH-1Ns primarily for search and rescue operations, and the latter two services employing 90 and 62 UH-1Ns, respectively, for various support missions.[154] The UH-1N is larger, heavier, and slower than the UH-1H but has a

---

[148] UH-1 manufacturers: *Airframe* — Bell Helicopter Textron, Inc. (Ft. Worth, TX); *Engines* — Pratt & Whitney (Quebec, Canada). AH-1 manufacturers: *Airframe* — Bell Helicopter Textron, Inc. (Ft. Worth, TX); *Engines* — General Electric Aircraft Engines (HQ — Lynn, MA).

[149] Richard Aboulafia, "Bell UH-1/212/412 Huey," *World Military & Civil Aircraft Briefing* (Fairfax, VA: Teal Group Corporation, June 2003), p. 4. Its prototype, the XH-40, first flew on Oct. 22, 1956. See Robert F. Dorr, "Flight Revolution: Helicopters Altered History of Aviation," *DefenseNews*, July 14, 2003, p. 35.

[150] The UH-1 had at least 10 variants (A, B, C, D, E, F, L, M, and P); the HH-1 had two (H and K); and the TH-1 had one (L). See [http://globalsecurity.org/military/systems/aircraft/uh-1-history.htm] (modified on Mar. 17, 2002).

[151] Aboulafia, "Bell UH-1/212/412 Huey," p. 1.

[152] Phone interview with spokesman from Army Aviation & Missile Command (AMCOM) on Mar. 15, 2004.

[153] Maximum capacities for each are 13 troops and 6 litters (with one attendant), respectively, for the UH-1H and UH-1V. ASE includes 'low-reflecting' paint, 'upturned insulated exhaust duct assembl[ies],' an 'oil cooler exhaust shield,' and 'engine side shields.' See [http://globalsecurity.org/military/systems/aircraft/uh-1h-ase.htm] (modified on Mar. 17, 2002). At one point, the HH-1H was said to be equipped with a M134 7.62mm mini-gun.

[154] See "USN Total Active Inventory (TAI)" and "USMC Total Active Inventory (TAI)" spreadsheets sent via email, Apr. 12, 2004, to CRS by PAO, HQ USMC; and email, "Air Force Helicopters," Dec. 19, 2003, sent to CRS by Lt. Col. Daniel K. Elwell, USAF. The (continued...)

longer range, is capable of instrument and night flying, and has a significantly higher service ceiling.[155] Although the N-variant can be armed with various combinations of machine/mini-guns and rocket pods, it continues to be used primarily in a support role, whether for offensive, defensive/security or medical missions.

The AH-1 (Huey) "Cobra" attack helicopter evolved in the mid-1960s as a result of the early Huey "gun-ship" variants (i.e. UH-1B/C) not being fast enough to provide adequate combat support to UH-1 transports in Vietnam. Essentially, the UH-1's powerplant was transferred into a tandem-seat, 38-inch-wide airframe (the UH-1's airframe was 100 inches wide) which effectively doubled the new aircraft's speed while providing more capacity for various armaments. Weapons centered around rockets on stub-wings and a chain-gun mounted in a swivelling nose-turret. The Army's main variant, the AH-1G, proved effective in Vietnam — 1,078 were purchased — and the Marine Corps soon developed its own twin-engine variant, the AH-1J "Sea Cobra," which saw extensive service during Vietnam and afterwards.[156]

Although the Army recently retired its AH-1s,[157] the Marine Corps maintains an inventory of 181 AH-1W "Super Cobras."[158] Not only is this variant night and marginal weather capable, it is also one of the few western helicopters with proven air-to-air and anti-radar missile capabilities. Its weapons configuration can include the M197 three-barrel 20mm nose-turret gun (750 rounds) as well as various weapons systems located under the stub-wings: two Sidewinder or Sidearm air-to-air missiles, up to four 2.75-inch rocket launcher pods (each with 7 or 19 tubes); two CBU-55B fuel-air explosive weapons; two M118 grenade dispensers; two mini-gun pods; or up to eight Hellfire and/or TOW missiles. ASE includes a radar signal

---

[154] (...continued)
Air Force uses its UH-1N helicopters to transport security and surveillance personnel around ballistic missile sites and also to evacuate VIP personnel from the Washington, DC, area in cases of national emergency. See Megan Scully and Gail Kaufman, "Battle Fatigue: U.S. Fleet to Get $1.4B Overhaul," *DefenseNews*, Mar. 22, 2004, p. 38.

[155] Specifications for UH-1H and UH-1N: length (fuselage): 44'+/57'+; height: 13+'/14'+; weight (max): 9,500/11,200 lbs; cargo (max): 4,410/5,651 lbs; speed (max): 130/126 mph; service ceiling: 12,700/17,400 ft; range: 273/357 miles. The maximum capacities for troops and litters/attendants for both models are 11-13 and 7, respectively. See [http://globalsecurity.org/military/systems/aircraft/uh-1n.htm].

[156] Richard Aboulafia, "Bell AH-1 Cobra," *World Military & Civil Aircraft Briefing* (Fairfax, VA: Teal Group Corporation, Sept. 2003), p. 5. The AH-1 first flew in September 1965. The AH-1G was followed by Q, R, S, P, E, and F variants while the AH-1J was followed by a T variant. See [http://globalsecurity.org/military/systems/aircraft/ah-1j.htm].

[157] A total of 357 AH-1 Cobras were retired from the Army National Guard in FY2000. [Chief, National Guard Bureau], "Report on Impact of Army Aviation Modernization Plan on the Army National Guard," *NGB Report (#107-772)*, Jan. 21, 2003, p. 12.

[158] See "USMC Total Active Inventory (TAI)" spreadsheet sent via email, dated 12 April 2004, to CRS by PAO, HQ USMC. Number is as of Dec. 31, 2003.

detection system, radar warning receiver (RWR), an IR countermeasures set, and dual chaff dispensers (one over each stub wing).[159]

H-3 "Sea King". Sikorsky's S-61[160] helicopter, which was designated the H-3A in 1962, has achieved two helicopter "firsts": first to have an automatic blade-fold system (for storage below deck on aircraft carriers) and first to fly faster than 200mph (in 1962). This twin-engine, amphibious-capable aircraft[161] (with a five-bladed main and tail rotor) first flew in March of 1959 and evolved into three main variants: the SH-3D/H for anti-submarine warfare, the UH-3H for shore and ship-board utility operations, and the VH-3A/D for executive/VIP passenger transport (i.e. "Marine One").

H-6 "Little Bird". The original Hughes OH-6A[162] "Cayuse" entered service in 1965 as a result of the Army's need for an agile, light observation helicopter (LOH) in Vietnam which could be used for escort, attack, and med-evac duties. The "teardrop"-shaped aircraft had a single-turbine engine and a seating capacity for six passengers. Possible armament included a 7.62mm six-barrel mini-gun, a grenade launcher, and an M60 machine gun mounted in either side doorway.[163] A total of 1,438 OH-6s were produced.[164]

The OH-6 has evolved into two "Little Bird" variants — the AH-6 (light attack) version and the MH-6 (light multi-role/transport) — which are flown exclusively by the Army's 160th Special Operations Aviation Regiment (SOAR).[165] Both of these versions are adverse weather and night-flight capable with common avionics and multirole capability, and a folding tail boom for easy air transport. A laser marker (targeting) and FLIR are optional as are 29 or 62.5 gallon cabin fuel tanks. Armed variants can carry a 7.62mm mini-gun, 70mm Hydra rocket pods, .50 caliber machine

---

[159] Paul Jackson (ed.), *Jane's All the World's Aircraft 2003-2004* (Alexandria, VA: Jane's Information Group, 2003), p. 541. Specifications for the AH-1W Super Cobra are as follows: weight (empty/max.): 10,920/14,750 lbs.; speed (cruising/max.): 173/175 mph; range: 322 miles; service ceiling: 14,000+ ft.

[160] *Airframe*: Sikorsky (Stratford, CT); *Engines*: General Electric (HQ — Cincinnati, OH).

[161] A boat-shaped hull, and pontoons allow the H-3 to land on water if necessary.

[162] Manufacturers: *Airframe* — Boeing MD Helicopters — formerly McDonnell Douglass (Meza, AZ); *Engines* — Allison/Rolls Royce (Indianapolis, IN).

[163] See [http://globalsecurity.org/military/systems/aircraft/oh-6.htm] .

[164] Richard Aboulafia, "MD Helicopters MD 500/600N," *World Military & Civil Aircraft Briefing* (Fairfax, VA: Teal Group Corporation, July 2003), p. 3.

[165] The AH-6 has had four variants (C, F, G, and J) and the MH-6 has had five (B, C, E, H, and J). (A few of the J variants were equipped with No Tail Rotor (NOTAR) systems but this practice was halted in 1995.) There was also an EH-6 type which had two variants (B and E) but they were converted to AH-6 and MH-6 types. See Paul Jackson (ed.), *Jane's All the World's Aircraft, 1998-1999* (Alexandria, VA: Jane's Information Group, 1998), p. 584. As of February 2004, there were a total of 37A/MH-6s, see the former figure and United States Special Operations Command, *Fiscal Year (FY) 2005 Budget Estimates, Procurement, Defense-Wide*, Feb. 2004, Item No. 37, Exhibit 3a, p. 1, for the latter figure.

gun pods and possibly Hellfire, TOW, and Stinger missiles.[166] The unarmed MH-6 provides transport for up to six combatants on external platforms located on either side of the aircraft (plus up to two more internally) and can be fitted with a fast-rope system, caving ladders, stabilizing rigs, or a winch. Passive defensive mechanisms for these variants can include radar warning receivers and chaff and flare systems.[167]

V-22 "Osprey".[168] The Bell/Boeing V-22[169] Osprey — a hybrid aircraft which takes-off and lands vertically but can fly horizontally like a normal turbo-prop airplane[170] — evolved from the Joint Service Advanced Vertical Lift Aircraft (JVX) program.[171] Originally led by the Army, which had a requirement for 231 UV-22 types, the program was transferred to Navy leadership in 1983 with DOD projecting a total procurement of six prototypes and 657 production aircraft in 1989 (552 MV-22s for the Marine Corps, 55 CV-22s for the Air Force (to be used by Special Operations Command), and 50 HV-22s for the Navy). These projections would decrease twice, first to 523 production aircraft in 1994 (425 MV-22s, 50 CV-22s, and 48 HV-22s) and then to 458 production aircraft in 1997 (360 MV-22s, 50 CV-22s, and 48 HV-22s) where they remain.[172] A total of 49 had been built as of January 2004; four have crashed (one in 1991, one in 1992, and two in 2000) with 30 fatalities.[173]

---

[166] See Paul Jackson (ed.), *Jane's All the World's Aircraft, 1998-1999* (Alexandria, VA: Jane's Information Group, 1998), p. 584, and Richard Aboulafia, "MD Helicopters MD 500/600N," *World Military & Civil Aircraft Briefing* (Fairfax, VA: Teal Group Corporation, July 2003), p. 2. Specifications for the A/MH-6 are as follows: length (fuselage): ~24/25 ft; width (fuselage): ~6'4"; weight (empty/max): 1,871/3,550 lbs; speed (max cruising): 139 mph; service ceiling: 15,210/16,000 ft; range: 202/233 miles. See also [http://globalsecurity.org/military/systems/aircraft/oh-6.htm].

[167] Paul Jackson (ed.), *Ibid.*.

[168] For more details see CRS Report RL31384, *V-22 Osprey Tilt-Rotor Aircraft*, by Chrispher Bolkcom.

[169] Manufacturers: *Airframe* — Bell Helicopter Textron (Ft. Worth, TX) and Boeing Helicopters (Philadelphia, PA; Amarillo, TX); *Engines* — Allison/Rolls Royce (Indianapolis, IN).

[170] The aircraft consists of a short airplane fuselage with a high-mounted fixed wing. It is powered by two, triple-rotor engines that are housed in forward-tilting/rotating nacelles located on the end of each wing. Although the aircraft takes-off (and lands) vertically with the engines in an upright position, it flies like a turbo-prop airplane by gradually tilting its engines forward 90 degrees from the hover position, until enough forward speed is attained to permit the fixed wings to provide lift and the engines to provide forward propulsion.

[171] The prototype of the V-22 is the Bell XV-15 — an approximate half-size version of the Osprey — which first flew in 1977 and is now on display at the Smithsonian Museum at Dulles Airport. Its predecessor was the Bell XV-3 which was developed in the 'early 1960s.' See Richard Aboulafia, "Bell/Boeing V-22 Osprey," *World Military & Civil Aircraft Briefing* (Fairfax, VA: Teal Group Corporation, Apr. 2004), p. 7.

[172] Bolkcom, op. cit., pp. 2-3.

[173] [Bloomberg News], "Military Knows Why Osprey Crashed," *Wichita Eagle*, Jan. 2004.

The Marine Corps' MV-22V "baseline" variant is to replace aging medium-lift CH-46 transports and heavy-lift CH-53 cargo/transports in their expeditionary (amphibious) assault/vertical envelopment role. In this role, the rotorcraft is designed to transport either 24 troops, 10,000 lbs of cargo internally, or 15,000 lbs. of cargo externally, for distances nearing 600 miles, at 250 mph speeds, and at altitudes of up to 26,000 ft.[174] The Air Force/SOCOM variant, the CV-22B, is to be modified with additional internal fuel capacity, a retractable In-Flight Refueling (IFR) probe, extra ASE (e.g. SIRFC), improved navigation avionics, and probably a nose-mounted mini-gun turret, for long-range special operations missions and possibly for CSAR purposes (to replace the Air Force's MH-53J/M Pave Low and HH-60G variants, respectively).[175] The Navy variant, the HV-22B, is to be used primarily for CSAR, special warfare, and fleet logistics.[176] ASE for each variant will include a missile warning system, a radar warning system, a laser warning system, and a countermeasures dispenser system (CMDS).[177]

---

[174] Paul Jackson (ed.), *Jane's All the World's Aircraft, 2003-2004* (Alexandria, VA: Jane's Information Group, 2003), p. 545. Specifications: wing span (incl. nacelles): ~51'; length (fuselage): 57' 4"; weight (empty/max): 33,140/52,870 lbs; speed (helicopter cruising/max): 115/316 mph; range (amphibious assault): 592 miles; service ceiling: 26,000 ft. See (name redacted), "V-22 Osprey Tilt-Rotor Aircraft," *CRS Report for Congress RL31384*, p. CRS-3, for recent flight test accomplishments including, but not limited to, the following: 'Achieved speeds of 342 knots (402 mph); altitude of 25,000 ft; gross weight of 60,500 lbs, and a G maneuver load factor of +3.9 at 260 knots. External loads of 10,000 lbs have been carried at 230 knots.'

[175] Paul Jackson (ed.), *op. cit.*, pp. 543-545. The CV-22B comes standard with a retractable In-Flight Refueling (IFR) probe while the MV-22B has an optional IFR kit. Both variants will also have a rescue hoist and rope ladder system for insertion/extraction operations. While both the CV-22B and the MV-22B may mount a nose-turreted machine/mini-gun for self-defense, the Navy is also planning to purchase a rear-mounted .50 caliber FN Herstal machine gun system: 'Unlike previous plans to mount a three-barreled .50-caliber turreted machine gun under the front of each Osprey, the interim gun under consideration would go in the rear, near the ramp that opens to let troops enter and exit. But that requirement remains unfunded and years away from realization....'See Christopher J. Castelli, "Navy to Buy 24 Defensive Weapon Systems for Helicopters, Ospreys," *Inside the Navy*, Jan. 5, 2004.

[176] Paul Jackson (ed.), *op. cit.*, p. 543. Aside from the original Army variant under consideration (UV-22), there were two other possible variants of the Osprey that were considered. The first was the naval SV-22A variant which would have performed ASW missions equipped with sonobuoys and torpedoes as well as anti-shipping and self-defense missiles. See Richard Aboulafia, "Bell/Boeing V-22 Osprey," *World Military & Civil Aircraft Briefing*, Apr. 2004, p. 3. The second was the VV-22 Executive Transport variant for which a feasibility study was produced by Bell/Boeing. See [http://globalsecurity .org/military/systems/aircraft/v-22-history.htm].

[177] The CV-22B variant will actually receive a SIRFC system which includes a RWR, and ESM radar location and jammers system, and an additional CMDS. See Paul Jackson (ed.), *Jane's All the World's Aircraft, 2003-2004* (Alexandria, VA: Jane's Information Group, 2003) p. 545.

H-46 "Sea Knight". The twin-turbine, tandem rotor (three blades each), Boeing Vertol **CH-46**[178] Sea Knight evolved from an Army demand in the mid-1950s for a medium-lift, troop/cargo transport helicopter. Vertol — formerly Piasecki — produced two prototypes (YHC-1A and YHC-1B) in 1958 with the former (lighter) model evolving into the CH-46A in the early 1960s due to demands from the Marine Corps for a medium-lift troop/cargo assault helicopter.[179] Specific design characteristics — which were revolutionary for that time period — included an emergency amphibious landing capability, powered blade folding (for shipboard storage), a rear loading ramp which could remain open in flight, and a 10,000 lb. external cargo capability. Entering service in November of 1964, the aircraft was adopted by the Marine Corps as an (amphibious) assault troop transport and by the Navy as a vertical replenishment helicopter (UH-46). A total of 524 Sea Knights were produced by February of 1971.[180]

The Marine Corps fielded 226 CH-46Es as of 31 December 2003 for troop and supply transport (max capacity is 24 troops or 15 litters with two attendants) plus six HH-46D versions, primarily for search and rescue operations. The Marine Corps' CH-46E fleet average age is over 33 years.[181] The Navy, as of the same date, had three CH-46Ds, 18 HH-46Ds; and one UH-46D, down from nine, 24, and one, respectively, in May 2003.[182] Current armament includes up to three M60 machine guns mounted at the side doors and rear ramp.[183]

H-47 "Chinook". The **CH-47**[184] Chinook resulted from the Army's demand for a larger and heavier version of (Boeing) Vertol's YHC-1A (CH-46) medium-lift prototype to complement the UH-1 "Huey" in the assault and resupply role. While similar to the CH-46 in overall design (i.e. tandem, counter-rotational rotor system) and armament, the CH-47 was nearly five feet longer, had its two engines mounted externally on the rear sail/pylon and had a four-point landing gear configuration (as opposed to the CH-46's triangular three-point system) fixed to a widened lower fuselage section which provided an expanded carrying capacity of 33 troops (or 24

---

[178] Manufacturers: *Airframe* — Boeing Helicopters (Philadelphia, PA); *Engines*: General Electric (Lynn, MA).

[179] The YCH-1B was to evolve into the Army's CH-47A Chinook — see below.

[180] See [http://globalsecurity.org./military/systems/aircraft/ch-46.htm].

[181] U.S. General Accounting Office, *Military Readiness: DOD Needs a Clear and Defined Process for Setting Aircraft Availability Goals in the New Security Environment,* GAO-03-300, Apr. 2003, p. 38.

[182] See "USMC Total Active Inventory (TAI)" and "USN Total Active Inventory (TAI)" spreadsheets sent via email, dated 12 April 2004, to CRS by PAO, HQ USMC. Old numbers are from USN Office of Legislative Affairs, May 19, 2003.

[183] Other specifications are as follows: length (fuselage): 45'7.5"; width (fuselage): 14'9"; weight (max): 24,300 lbs.; speed: ~167 mph; range (assault): ~152 miles; service ceiling: 10,000+ ft. See [http://globalsecurity.org/military/systems/aircraft/ch-46-specs.htm].

[184] Manufacturers: *Airframe* — Boeing Helicopters (Philadelphia, PA); *Engines* — Honeywell (Phoenix, AZ).

litters plus two attendants).[185] In 1976, the Chinook's first modernization program was initiated which ultimately resulted in the re-manufacture of 472 A, B, and C models to an improved CH-47D variant with more than double the cargo carrying capability of the original CH-46A. There were 424 of this model in the Army inventory as of February 2003.[186]

The Army also operates 11 MH-47Ds and 23 MH-47Es,[187] both of which are multi-purpose Special Operations Aircraft (SOA) used by the Army's 160th Special Operations Aviation Regiment. While design specifications are almost identical to those of the most modern CH-47D, particular characteristics of the -47D include IFR probes, thermal imagers, (all)-weather radar, improved communications and two pintel-mounted 7.62mm six-barrel mini-guns located in side portals/doors. The -47E has, in addition to upgraded propulsion systems, new integrated avionics, jamming-resistant radios, GPS receiver, chin-turret FLIR targeting system, troop seating for up to 44 soldiers, a rescue hoist, and air-to-ground ranging and ground-mapping radar. Increased fuel capacity expands the aircraft's operating radius to 581 miles in almost any conditions and the aircraft is protected by laser, radar, and missile warning systems, a pulse jammer, and chaff/flare dispensers.[188]

H-53 "Sea/Super Stallion". Sikorsky's **CH-53A**[189] Sea Stallion originated from a 1962 order from the Marine Corps for a heavy-lift helicopter able to perform ship-to-shore deliveries of equipment, supplies, and personnel as well as recover downed aircraft. It had two turbine engines, a six-bladed main rotor (with an automatic blade-folding system for shipboard storage), a four-bladed tail rotor, and a rear cargo ramp. Capable of carrying up to seven tons externally, 38 combat-ready troops, or up to 24 litters internally, the aircraft was also capable of all-weather and day/night flight as well as emergency water landings.[190] The CH-53A prototype first flew in October of 1964 and was first delivered to the Marine Corps in 1966 with an improved variant, the CH-53D, beginning service in March of 1969. Additional variants included the RH-53D for minesweeping, the HH-53B/C "Super Jolly" transport, and the HH-53H Pave Low III search and rescue aircraft which was flown by the Air Force.[191]

---

[185] See [http://globalsecurity.org./military/systems/aircraft/h-47.htm].

[186] Telephone interview with spokesperson from Army AMCOM on Mar. 15, 2004.

[187] Two MH-47Es have been lost in operations relating to GWOT, one during Operation ANACONDA in Afghanistan and another in the Philippines.

[188] Specifications for the MH-47E: weight (empty/max): 26,918/54,000 lbs; speed (max cruising): 161 mph; radius (combat insertion): 581 miles; service ceiling: 10,150 ft. See Paul Jackson (ed.), *Jane's All the World's Aircraft, 2003-2004* (Alexandria, VA: Jane's Information Group, 2003), p. 558. Apparently, provisions have been made for the MH-47E to carry Stinger AAMs.

[189] Manufacturers: *Airframe* — Sikorsky Aircraft (Stratford, CT); *Engines* — General Electric (Lynn, MA).

[190] See [http://globalsecurity.org./military/systems/aircraft/h-53.htm].

[191] Richard Aboulafia, "Sikorsky H-53 Super Stallion," *World Military & Civil Aircraft Briefing* (Fairfax, VA: Teal Group Corporation, May 2003), p. 5.

A six-foot longer, three-engine version (with a seven-bladed main rotor), the CH-53E "Super Stallion," first flew in March 1974 and was delivered to the Marine Corps beginning in June 1981. Other significant changes include improved avionics, transmissions, retrofitted FLIR and GPS receiver, and structural modifications such as retractable triangular landing gear, a hydraulically-folding tail pylon, and a retractable IFR probe. The aircraft is night and adverse weather conditions flight capable and also has provisions for 1,300 gallons of extra fuel to be carried in tanks attached to side sponsons. A mine-countermeasure variant, the MH-53E Sea Dragon, is also in service with the Navy. Using a 'minefield, navigation and automatic flight control system' the aircraft is primarily equipped to tow sonar as well as 'a hydrofoil sledge carrying mechanical, acoustic and magnetic sensors.' It can also carry 1,000 gallons of extra fuel in enlarged side sponsons as well as an additional 2,100 gallons of extra fuel internally. One final variant, used by the Air Force, is the MH-53J Pave Low III which is converted from twin-engine HH-53B, HH-53C and CH-53C models with improved avionics and more powerful engines as well as new weapons (three 7.62mm or .50 caliber machine guns).[192] As of December 2003, there were 40 CH-53Ds and 147 CH-53Es in the Marine Corps' inventory, one CH-53E and 37 MH-53Es in the Navy's inventory, and 35 MH-53J/Ms in the Air Force's inventory.[193] The Marine Corps' CH-53Ds average 32 years and the CH-53Es average 14 years in age.[194]

H-58 "Kiowa". The **OH-58A/C**[195] Kiowa originated as a single turbine-engine, light observation helicopter (with single, twin-bladed main and tail rotors) which was chosen in 1968 as part of the Light Observation Helicopter (LOH) program.[196] It served primarily as an observation and armed scout helicopter in Vietnam — first in 1969 — although it also flew as a troop transport (four passengers with one pilot), a med-evac platform (with four litters), and a (light-)lift platform. Basic armaments included the Stinger AAM, a 40mm grenade launcher, and a 7.62mm mini-gun. A

---

[192] Specifications for both the CH-53E and MH-53E (unless indicated otherwise): length (fuselage): 73'4"; width (fuselage): 8'10"; weight, empty (CH-53E/MH-53E): 33,228/36,336; weight, max (internal/external loads): 69,750/73,500 lbs; speed (cruising/max): 173/196 mph; service ceiling: 18,500 ft; range: n/a. See Paul Jackson (ed.), *Jane's All the World's Aircraft, 2001-2002* (Alexandria, VA: Jane's Information Group, 2001), pp. 760-761, and Richard Aboulafia, "Sikorsky CH-53 Super Stallion," *World Military & Civil Aircraft Briefing* (Fairfax, VA: Teal Group Corporation, May 2003), pp. 1-7.

[193] See "USMC Total Active Inventory (TAI)" and "USN Total Active Inventory (TAI)" spreadsheets sent via email, Apr. 12, 2004, to CRS by PAO, HQ USMC; and email, dated Dec. 19, 2003, from Lt. Col. Daniel K. Elwell, USAF, Secretary of the Air Force/Legislative Liaison, Weapons, to CRS.

[194] U.S. General Accounting Office, *Military Readiness: DOD Needs a Clear and Defined Process for Setting Aircraft Availability Goals in the New Security Environment*, GAO-03-300, Apr. 2003. p. 38

[195] Manufacturers: *Airframe* — Bell Helicopter Textron (Ft. Worth, TX); *Engines* — Allison/Rolls Royce (Indianapolis, IN).

[196] See U.S. Army TACOM-RI's "U.S. Army Helicopter Info" website at [http://tri.army.mil/LC/CS/csa/aahist2.htm] for a brief summary of this program (1960-1968).

total of 458 A/C variants were still operating in the Army inventory as of 15 March 2004.[197]

In 1981, the Army initiated the Advanced Helicopter Improvement Program (AHIP) which converted 411 OH-58A/C variants into OH-58Ds through the installation of a high-tech 'Mast-Mounted Sight (MMS), [an] improved engine and drive system, and new avionics and survivability equipment.'[198] A new (rebuild) program was also initiated in FY1992 which included outfitting a total of 188 Kiowas (technically OH-58D(I)s) with Stinger AAMs, Hellfire AGMs, 7-tube rocket pods and a .50 caliber machine gun, among additional engine, transmission, electronic and aircraft survivability upgrades.[199] One final reconfiguration effort which provided for all Kiowa Warriors to have a Multipurpose Light Helicopter (MPLH) capability involved the installation of quick-folding rotor-blades to allow transport aboard C-130 cargo aircraft, a 2,000 lb cargo hook for underslung cargos, and side-mounted fittings to enable the carriage of either six troops or two stretchers.[200] As of 15 March 2004, there were 365 Kiowa Warriors in the Army inventory.[201]

H-60 "Black Hawk/Sea Hawk". Sikorsky's S-70A design (Army UH-60A "Black Hawk") and S-70B design (Navy SH-60B "Sea Hawk" — see below) evolved from the Utility Tactical Transport Aircraft System (UTTAS) of 1972-1978 which aimed to develop a replacement for the UH-1 Huey as a troop transport, a command and control platform, and a medical evacuation aircraft. A twin-engine turbine aircraft (with a four-bladed main and tail rotor) which first flew in 1974, the Black Hawk was designed to carry three crew members and eleven combat-ready soldiers, 8,000 lbs. of cargo (underslung), or four medical litters in air assault and combat support roles. A total of 1,049 were produced, including 66 EH-60A "Quick Fix" electronic warfare versions, before the production line was changed in 1989 to the UH-60L which incorporated a number of basic upgrades, resulting in improved overall performance and survivability.[202] One such upgrade was the External Stores Support System (ESSS), a fixed provision attached to the airframe plus removable

---

[197] Telephone interview with spokesperson from Army AMCOM on Mar. 15, 2004.

[198] Richard L. Aboulafia, *op. cit.*

[199] Paul Jackson (ed.), *Jane's All the World's Aircraft 2001-2002* (Alexandria, VA: Jane's Information Group, 2001), p. 569. The latter ASE upgrades include radar warning receivers, an IR jammer, and a laser detection system.

[200] Richard L. Aboulafia, "Bell 406/OH-58D," *World Military & Civil Aircraft Briefing* (Fairfax, VA: Teal Group Corporation, Dec. 2003), p. 4.

[201] Telephone interview with spokesperson from Army AMCOM on Mar. 15, 2004.

[202] Specifications for UH-60A and UH-60L variants are as follows: length: ~ 50'; width: 7'9"; mission take-off weight: 16,994/17,432 lbs.; max underslung cargo: 8,000/9,000 lbs.; max cruising speed: 160/183 mph; service ceiling: 18,700/19,150 ft.; range: 368/262 miles. Electronic ASE on baseline models included RWR, IR CM, and chaff/flare dispensers. Other variants also have one or more of the following: missile warning system, radio frequency jammer, laser detector, and ATIRCM. See Paul Jackson (ed.), *Jane's All the World's Aircraft 2003-2004* (Alexandria, VA: Jane's Information Group, 2003), pp. 717-722.

pylons, which was retrofitted on at least 554 UH-60As and fitted on all UH-60Ls.[203] This allowed these platforms (and their special variants) to carry up to 5,000 lbs on each side of the aircraft, either in the form of extra fuel tanks (2 x 230 gallon externally, plus 2 x 450 gallons internally) or armament packages. The latter included up to 16 Hellfire anti-tank missiles (plus another 16 internally), aimable machine/chain-gun or M56 mine dispensing pods, Stinger AAMs, ECM packs, rockets or motorcycles. Pintel mounts on both cabin side-doors could also accommodate .50 caliber machine guns or 7.62mm six-barrel mini-guns.[204]

There were 899 UH-60A and 567 UH-60L models in the Army inventory as of mid-March 2004.[205] The Army's 160th Special Operations Aviation Regiment (SOAR) fields approximately 23 MH-60K and 37 MH-60L multi-purpose, shipboard-capable variants — upgrades of UH-60As and -60Ls — which have been specifically configured with upgraded engines and transmissions, in-flight refueling probes, integrated avionics systems, terrain-following, ground-mapping and air-to-ground ranging radar, external hoists, folding tailplanes, additional ASE, and a maximum allowance for fuel and weapons systems.[206] The Marines operate eight VH-60Ns (formerly VH-60As) as executive transports, and the Air Force operates 101 HH-60G "Pave Hawk" variants.[207] The latter are UH-60As which have been upgraded with newer engines and transmissions, advanced avionics and navigation systems as well as additional fuel (and in-flight refueling) capacities.

The Navy developed Sikorsky's S-70B design into the SH-60B Sea Hawk, which first flew in 1979, as part of its Light Airborne Multi-Purpose System (LAMPS) program. It and its follower, the SH-60F, were almost identical to the Black Hawk but were specifically outfitted to perform ASW and SAR. Equipment includes integrated folding rotor blades and tail pylon, ASW mission avionics, dipping sonar, automatic flight control system, internal/external fuel system, and extra weapon station for three Mk 50 homing torpedoes, with further provision for

---

[203] Richard L. Aboulafia, "Sikorsky UH-60 Black Hawk," *World Military & Civil Aircraft Briefing* (Fairfax, VA: Teal Group Corporation, May 2003), p. 7.

[204] See Paul Jackson (ed.), *Jane's All the World's Aircraft 2003-2004* (Alexandria, VA: Jane's Information Group), pp. 717-722.

[205] Telephone interview with spokesperson from Army AMCOM, Mar. 15, 2004.

[206] See Paul Jackson (ed.), *Jane's All the World's Aircraft 2003-2004* (Alexandria, VA: Jane's Information Group, 2003), pp. 717-722. An improved version of the MH-60L is sometimes referred to as the A/MH-60L "Direct Action Penetrator" (DAP) which is additionally equipped with FLIR as well as various armaments, including multiple chain guns, a 40mm grenade launcher or trainable 7.62mm Gatling guns. The Army has also fielded a command and control Black Hawk which first evolved from a modified UH-60A (the UH-60A(C)) and was then referred to as the UH-60C. As of mid-March 2004, there were four EUH-60 A2C2S (Army Airborne Command and Control System) aircraft in the Army inventory. Phone interview with spokesman from Army Aviation & Missile Command (AMCOM) on 15 March 2004. See also the U.S. Army's Aviation Applied Technology Directorate webpage, "Army Airborne Command and Control System (A2C2S)" at [http://www.aatd.eustis.army.mil/Business/FactSheets/A2C2S/A2C2S.asp].

[207] Email, Dec. 19, 2003, from Lt. Col. Daniel K. Elwell, USAF, Secretary of the Air Force/Legislative Liaison, Weapons, to CRS.

surface search radar, FLIR, NVS, passive ECM, ASM missile capability, chaff/sonobuoy dispenser, and GPS. Two additional variants of the SH-60F were produced, the HH-60H for the Navy and the HH-60J (Jayhawk) for the Coast Guard. While the former had additional ASE as well as Hellfire ASMs, Penguin Mk 2 Mod 7 anti-shipping missiles, rockets, and forward-firing machine gun capabilities installed, the latter was primarily equipped with additional external fuel tanks, a rescue hoist, an external cargo hook, and expanded navigation and communications systems for long-range SAR missions.[208] As of the end of 2003, the Navy had 149 SH-60B and 73 SH-60F helicopters plus 39 HH-60H aircraft.[209] The Coast Guard had 47 HH-60J helicopters in its inventory as of 9 March 2004.[210]

AH-64 "Apache". The **AH-64**[211] Apache is a tandem-seat, twin-engine (with single, four-bladed main- and tail-rotors), attack helicopter that originated in the mid-1970s from a competition between the Bell (model 409) YAH-63 and the Hughes (model 77) YAH-64 prototypes as part of the Advanced Attack Helicopter (AAH) program (1970-1981).[212] The AH-64A, of which 827 were ultimately delivered to the U.S. Army, was designed as an adverse-weather, nighttime-capable, anti-armor platform that is armored and damage resistant to small arms fire up to 23mm rounds. A Target and Designation System/Pilot's Night Vision Sensor (TADS/PNVS) — consisting 'of a TV, Forward Looking Infrared (FLIR), Direct View Optics, Laser Designator/Rangefinder and Spot Tracker'[213] — is housed in a nose turret and provides targeting for a standard armament complement of up to 16 Hellfire laser-guided missiles or 76 2.75" FFARs located under two stub-wings as well as a single 30mm automatic cannon (with up to 1,200 rounds) located on a swivel-mount beneath the cockpit. The Apache is air-transportable, with two platforms fitting in a C-141, three in a C-17, and six in a C-5.[214]

Earlier plans to upgrade the AH-64A into B and C variants were overtaken by the AH-64D "Longbow" Apache upgrade program which was approved in 1990. This

---

[208] See Paul Jackson (ed.), *Jane's All the World's Aircraft 2003-2004* (Alexandria, VA: Jane's Information Group, 2003), pp. 722-725.

[209] See "USN Total Active Inventory (TAI)" spreadsheet sent via email, Apr. 12, 2004, to CRS by PAO, HQ USMC.

[210] See U.S. Coast Guard webpage data sheet, updated on Mar. 9, 2004, for latter figures at [http://www.uscg.mil/datasheet/hh-60.htm].

[211] Manufacturers: *Airframe* — Boeing/McDonnell Douglas Helicopter Systems (Mesa, AZ); *Engines* — GE Aircraft Engines (Lynn, MA).

[212] Prior to this, the Advanced Aerial Fire Support System (AAFSS) program (1964-1971) had produced the AH-56A "Cheyenne" attack helicopter prototype which was cancelled in August of 1972 due to the Cheyenne being too large and having an overly-complicated fire control and navigation system. See U.S. Army TACOM — RI, Aircraft Armament and Small Arms Commodity Business Unit webpage, "Historic U.S. Army Helicopters — Modern Era Helicopters," at [http://tri.army.mil/LC/CS/csa/aahist3.htm].

[213] Department of the Army, *Committee Staff Procurement Backup Book, FY 2005 Budget Request: Aircraft Procurement, Army*, Feb. 2004, p. 28.

[214] Paul Jackson (ed.), *Jane's All the World's Aircraft, 2003-2004* (Alexandria, VA: Jane's Information Group, Inc., 2003), pp. 558-561.

program centered around a number of AH-64 platform modifications — including electric/electronic improvements, enhanced fire control computers and avionics, an advanced cockpit configuration, and RF-seeking Hellfire missiles — which were all geared to supporting the "Longbow" Airborne Adverse Weather Weapons System (AAWWS). The latter system consists of a mast-mounted, millimeter-wave fire control radar (FCR) dome which provides each Longbow-radar-equipped AH-64D with multiple target tracking (up to 256 targets through almost any weather and sight-obscured condition) and true "fire-and-forget" capabilities, not only for Longbow-equipped Apaches but also for all AH-64Ds equipped with the RF-seeking Hellfire missiles. Down from the initial plan for 748 AH-64D Apaches, a total of 501 were contracted for Longbow-capability upgrades through FY2005, but with only 227 AH-64Ds having the actual Longbow radar (dome) and associated upgraded propulsion system. Standard ASE for all Apaches included a passive RWR, laser warning receiver, IR and radar jammers, and chaff dispensers.[215]

RAH-66 "Comanche".[216] The **RAH-66**[217] On 23 February 2004, the Pentagon announced the cancellation of the Army's $39 billion RAH-66 "Comanche" armed reconnaissance helicopter procurement program, mainly for cost reasons. Two RAH-66 prototypes had been delivered.

Comanche was a tandem-seat, twin-engine, armed reconnaissance helicopter (with single, five-bladed main rotor and enclosed tail rotor) that evolved from the Light Helicopter Experimental (LHX) program (1983-1991)[218] which was subsequently changed to the Light Helicopter (LH) program. Originally planned to produce 5,000 LHX variants to replace the Army's fleet of AH-1s, OH-58s, and OH-6s, this total procurement figure, as of the sixth program restructuring undertaken in October of 2002, was again reduced to 650 aircraft. Armaments were to include a 20mm, triple-barrel chain gun mounted under the nose (with 500 rounds) and four Hellfire and two Stinger missiles in a retractable weapons bay. By attaching stub-wings, additional Hellfires, Stingers, TOWs, 2.75" Hydra rockets or fuel tanks could be carried. (Maximum loads for Hellfire and Stingers were 14 and 28, respectively.)[219]

---

[215] Specifications (AH-64D): weight (empty/max): 11,387/21,000 lbs; speed (max cruising): 182 mph; service ceiling: 21,000 ft; range (max): 300 miles. See Paul Jackson (ed.), *Jane's All the World's Aircraft, 2003-2004* (Alexandria, VA: Jane's Information Group, Inc., 2003), pp. 558-561; and Richard Aboulafia, "Boeing AH-64 Apache," *World Military & Civil Aircraft Briefing* (Fairfax, VA: Teal Group Corporation, Dec. 2003), pp. 7-10.

[216] For more details see CRS Report RS20522, *Army Aviation: The RAH-66 Comanche Issue*, (name redacted).

[217] Manufacturers: *Airframe* — Boeing Helicopters (Philadelphia, PA) and Sikorsky Aircraft (Stratford, CT); *Engines* — LHTEC [Light Helicopter Turbine Engine Company — a joint effort by Allison/Rolls Royce (Indianapolis, IN) and Honeywell Aerospace/Garrett (Phoenix, AZ)].

[218] See [http://tri.army.mil/LC/CS/csa/aahist3.htm] and Paul Jackson (ed.), *Jane's All the World's Aircraft, 2003-2004* (Alexandria, VA: Jane's Information Group, 2003), p. 583.

[219] Additional specifications include the following: length (fuselage): 43'4"; width: 6'8"; (continued...)

Appendix 2: Estimated Helicopter Inventories

ARMY[220]

- **H-1**
  — UH-1H/N: 421
  — AH-1S: 370 (Reserves and Guard)

- **H-6**
  — AH-6J: 10
  — AH-6M: 12
  — MH-6C: 8
  — MH-6J: 14
  — MH-6M: 23

- **H-47**
  — CH-47D: 424
  — MH-47D: 11
  — MH-47E: 23

- **H-58**
  — OH-58A/C: 458
  — OH-58D: 365

- **H-60**
  — EH-60: 66
  — EUH-60L: 4
  — HH-60L: 9
  — MH-60K: 23
  — MH-60L: 37
  — UH-60A: 899
  — UH-60L: 567
  — UH-60M: 4
  — UH-60Q: 4

- **H-64**
  — AH-64A: 381
  — AH-64D: 340

---

[219] (...continued)
weight (primary mission): ~13,000 lbs.; cruising/max speeds: up to 201/184; range: 173 miles; service ceiling: n/a.

[220] Figures received via phone call with spokesperson at Army AMCOM on Mar. 15, 2004, except where noted otherwise. Some discrepancy exists with regard to the total numbers of MH-6s, MH-47s, and MH-60s which are listed, respectively, as follows: 45, 61, 61. See U.S. SOCOM, *Fiscal Year (FY) 2005 Budget Estimates, Procurement, Defense-Wide*, Feb. 2004, Item No. 37, Exhibit P-3a, p. 1.

- **H-66**
  — RAH-66: 2 (demonstration)

NAVY

- **H-1**
  — AH-1W: 3
  — HH-1N: 19[221]

- **H-3**
  — UH-3H: 44
  — VH-3A: 2

- **H-46**
  — CH-46D: 9
  — HH-46D: 24
  — UH-46D: 7

- **H-53**[222]
  — CH-53D: 40 (USN/USMC)
  — CH-53E: 151 (USN/USMC)
  — MH-53E: 38 (USN/USMC)

- **H-60**[223]
  — HH-60H: 44
  — MH-60R: 2
  — MH-60S: 43
  — SH-60B: 160
  — SH-60F: 74

---

[221] *Dept. of the Navy Fiscal Year (FY) 2004 Budget Estimates, Justification of Estimates, Aircraft Procurement, Navy, Volume I: Budget Activities 1-4*, Feb. 2004, Item No. 29, p. 1.

[222] *Dept. of the Navy Fiscal Year (FY) 2005 Budget Estimates, Justification of Estimates, Aircraft Procurement, Navy, Volume II: Budget Activity 5*, Feb. 2004, Item No. 30, p. 1, although figures differ somewhat in subsequent pages (i.e. p. 2 had 44 MH-53Es — 32 active, 12 reserve; p. 4 had 47 CH-53Ds and 158 MH-53Es; and p. 11 had 170 CH-53Es — 166 aircraft and 4 trainers).

[223] *Ibid.* This page also had 'retrofit plan [for] 74 MH-60S and 36 MH-60R.'

MARINE CORPS

- **H-1**
  — AH-1W: 181
  — HH-1N: 9[224]
  — UH-1N: 89[225]

- **H-3**
  — VH-3D: 11[226]

- **H-46**
  — CH-46E: 226
  — HH-46D: 7

- **H-53**
  — CH-53D: 40
  — CH-53E: 149

- **H-60**
  — VH-60N: 8[227]

AIR FORCE[228]

- **H-1**
  — UH-1N: 62

- **H-53**
  — MH-53J/M: 35

- **H-60**
  — HH-60G: 101

---

[224] DON, *Dept. of the Navy Fiscal Year (FY) 2004 Budget Estimates, Justification of Estimates, Aircraft Procurement, Navy, Volume I: Budget Activities 1-4*, Feb. 2004, Item No. 29, p. 1.

[225] *Ibid*. Further identified as 68 active; 20 reserve; 1 test.

[226] DON, *Dept. of the Navy Fiscal Year (FY) 2005 Budget Estimates, Justification of Estimates, Aircraft Procurement, Navy, Volume II: Budget Activity 5*, Feb. 2004, Item No. 43, p. 1.

[227] *Ibid.*

[228] Numbers for all USAF aircraft compiled from email received from Lt. Col. Daniel K. Elwell, USAF, "Air Force Helicopters," Dec. 19, 2003.