



# Unmanned Vehicles for U.S. Naval Forces: Background and Issues for Congress

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## **Summary**

Unmanned vehicles (UVs) are viewed as a key element of the effort to transform U.S. military forces. The Department of the Navy may eventually acquire every major kind of UV. Navy and Marine Corps UV programs raise several potential issues for Congress. This report will be updated as events warrant.

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## Introduction

Unmanned vehicles (UVs) are viewed as a key component of U.S. defense transformation.<sup>1</sup> Perhaps uniquely among the military departments, the Department of the Navy (DON), which includes the Navy and Marine Corps, may eventually acquire every major kind of UV, including unmanned air systems (UASs)—which include unmanned aerial vehicles (UAVs) and armed UAVs known as unmanned combat air vehicles, or UCAVs—unmanned surface vehicles (USVs), unmanned underwater vehicles (UUVs) and autonomous underwater vehicles (AUVs), and unmanned ground vehicles (UGVs).

Section 220 of the FY2001 defense authorization act (H.R. 4205/P.L. 106-398 of October 30, 2000) states, “It shall be a goal of the Armed Forces to achieve the fielding of unmanned, remotely controlled technology such that—(1) by 2010, one-third of the aircraft in the operational deep strike force aircraft fleet are unmanned; and (2) by 2015, one-third of the operational ground combat vehicles are unmanned.” A 2005 report by the Naval Studies Board (NSB) recommended that the Navy and Marine Corps should accelerate the introduction of UAVs, and UUVs, UGVs; the report made several additional recommendations concerning DON UV efforts.<sup>2</sup>

## Background: Key Navy And Marine Corps UV Programs<sup>3</sup>

### Navy UAVs and UCAVs<sup>4</sup>

The **Navy Unmanned Combat Air System (N-UCAS)** is the Navy’s program for acquiring a UAS that can operate from aircraft carriers and penetrate enemy defenses to conduct surveillance and reconnaissance operations or suppress enemy air defenses (SEAD). The Navy plans to demonstrate the aircraft’s suitability for carrier-based operations in 2013, and have it enter service in 2021 as a penetrating surveillance and reconnaissance system. The N-UCAS program was initiated as the UCAV-N program in conjunction with the Defense Advanced Research Projects Agency (DARPA). In December 2002, the Department of Defense (DOD) decided to merge the Air Force and Navy UCAV programs into a Joint Unmanned Combat Air System (J-UCAS) program. In October 2005, management of J-UCAS was transferred from DARPA, which had managed it since October 2003, to a joint Air Force-Navy office led by the Air Force. In February 2006, DOD announced that it was restructuring the J-UCAS program into a Navy-oriented UCAV

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<sup>1</sup> For more on defense transformation and naval transformation, see CRS Report RL32238, *Defense Transformation: Background and Oversight Issues for Congress*, by Ronald O’Rourke, and CRS Report RS20851, *Naval Transformation: Background and Issues for Congress*, by Ronald O’Rourke.

<sup>2</sup> National Research Council, Naval Studies Board, *Autonomous Vehicles In Support Of Naval Operations*. Washington, The National Academies Press, 2005. 256 pp.

<sup>3</sup> Unless otherwise stated, information in this section is taken from Navy and marine Corps point papers provided to CRS between October and December 2006.

<sup>4</sup> For more on UAVs, see CRS Report RL31872, *Unmanned Aerial Vehicles: Background and Issues for Congress*, by (name redacted) and (name redacted) .

program. The effort became a Navy program once again at the start of FY2007. Details about the J-UCAS program are being defined.<sup>5</sup>

The **Broad Area Maritime Surveillance UAS (BAMS UAS)** is the Navy's program for acquiring an unmanned, persistent, multi-sensor (radar, electro-optical/infrared, and electronic support measures) maritime ISR system that can cover any part of the world. BAMS UAS is to work with the Navy's planned P-8 Multi-Mission Aircraft (or MMA—the Navy's planned successor to the P-3 Orion maritime patrol aircraft). Competitors for BAMS UAS include variants of the existing Global Hawk and Predator UAVs, and possibly an unmanned version of the Gulfstream 550. The Navy's FY2008-FY2013 aircraft procurement plan calls for procuring the first four BAMS UASs in FY2011, and four more each in FY2012 and FY2013. The first BAMSs are expected to enter service in 2013.<sup>6</sup> In support of the BAMS UAS program, the Navy, under the **Global Hawk Maritime Demonstration (GHMD)** program, has procured two Global Hawks under an Air Force production contract for use as test and demonstration assets in developing a concept of operations and tactics, training, and procedures for persistent ISR.

**Fire Scout**—a small, unmanned helicopter—is the Navy's program for acquiring a Vertical Takeoff and Landing UAV (VTUAV) for use aboard Littoral Combat Ships (LCSs)<sup>7</sup> as an ISR and communications-relay platform. Five Fire Scouts were procured in FY2006 and four were procured in FY2007. The Navy's FY2008-FY2013 aircraft procurement plan calls for procuring three in FY2008, five in FY2009, six each in FY2010 and FY2011, nine in FY2012, and 10 in FY2013. A planned improvement for Fire Scout is the **Coastal Battlefield Reconnaissance and Analysis (COBRA)** mine countermeasures payload. The **Tactical Control System (TCS)**, a part of the Fire Scout system, is being evaluated by the Navy as a possible control system for BAMS UAS (see above) and STUAS (see below).

The **Small Tactical UAS (STUAS)** is a Navy-Marine Corps program (with additional Air Force and Special Operations Command [USSOCOM] participation in developing program requirements) initiated in FY2008 to develop a small UAV for persistent ISR operations. For the Navy, STUAS is to support ship and small-unit commanders involved in the Navy's participation in what the Administration refers to as the global war on terrorism (GWOT).<sup>8</sup> The Navy and Marine Corps want to have STUAS enter service in FY2010.

## Marine Corps UAVs and UCAVs

The Marine Corps organizes its UAS acquisition efforts into three tiers based on the level of the Marine Corps commander supported. **Tier I UASs** support small-unit (platoon and company)

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<sup>5</sup> Jefferson Morris, "Northrop Grumman Expecting UCAS-N Downselect in May/June '07," *Aerospace Daily & Defense Report*, Oct. 19, 2006: 1-2; John M. Doyle, "NAVAIR UAV Chief Say New Strategy Needed For Joint Development," *Aerospace Daily & Defense Report*, Apr. 19, 2006; David A. Fulghum and Amy Butler, "Supposedly Dead J-UCAS Spawns New Designs," *Aerospace Daily & Defense Report*, Mar. 23, 2006; John M. Doyle, "If Navy Successful, AF Could Revisit J-UCAS Program," *Aerospace Daily & Defense Report*, Mar. 16, 2006.

<sup>6</sup> See also Jefferson Morris, "Navy Warns Industry BAMS Must Stay On Cost, Schedule," *Aerospace Daily & Defense Report*, May 18, 2006; "Navy Details Huge Unmanned Aerial Vehicle Program," *Congress Daily*, May 18, 2006; Jason Ma, "Navy Expects BAMS UAV Solicitation In FY-07, Contract Late In FY-07," *Inside the Navy*, Feb. 6, 2006.

<sup>7</sup> For more on the LCS program, see CRS Report RL33741, *Navy Littoral Combat Ship (LCS) Program: Background, Oversight Issues, and Options for Congress*, by Ronald O'Rourke.

<sup>8</sup> For more on the Navy's role in the GWOT, see CRS Report RS22373, *Navy Role in Irregular Warfare and Counterterrorism: Background and Issues for Congress*, by Ronald O'Rourke.

commanders. The current Tier I UAS is the **Dragon Eye**. In September 2006, the Marine Corps selected the **Raven B**—a UAS also operated by the Army and the USSOCOM—as the Marine Corps’ follow-on Tier I UAS. The Marine Corps as of November 2006 operated more than 100 Tier I systems.

**Tier II UASs** support battalion, Marine Expeditionary Unit (MEU), regimental, and division commanders. The Marine Corps wants the **STUAS** (see discussion above) to be its new Tier II system. Between now and STUAS’ planned entry into service in FY2010, the Marine Corps is filling its need for Tier II UASs in Iraq through ISR service contracts. Boeing/Insitu is the current contractor; future contracts will be competed.

**Tier III UASs** support Marine Expeditionary Force (MEF) and Joint Task Force (JTF) commanders. The current Tier III UAS is the **Pioneer**, which entered service with the Navy and Marine Corps in 1986 and is now in sustainment status. The Marine Corps is changing the Pioneers’ ground control system (GCS) to a Replacement GCS based on the Army’s “One System” GCS, providing a common GCS capability with the Army. The Marine Corps plans to ultimately use the **One System GCS** across all three UAS tiers. The **Vertical UAS (VUAS)** is the Marine Corps’ planned follow-on Tier III UAS. The Marine Corps is currently developing requirements documentation and conducting an analysis of alternatives (AOA) for the program, and is evaluating options for sustaining its current Tier III capability until VUAS is fielded.

## Navy USVs

The Navy reportedly was to complete a new USV master plan by the end of 2006.<sup>9</sup> The **Remote Minehunting System (RMS)** is a high-endurance, semi-submersible vehicle that tows a submerged mine-detection and -classification sensor suite. The Navy originally envisioned procuring at least 12 systems for use on at least 12 DDG-51-class Aegis destroyers, but in FY2003 reduced the program to 6 systems for 6 DDG-51s. Additional RMSs are now to be deployed from LCSs. The Office of Naval Research (ONR) reportedly is developing two USV prototypes as future options for a common USV or family of USVs.<sup>10</sup> The Navy’s **Spartan Scout** USV program uses an unmanned 7-meter (23-foot) or 11-meter (36-foot) boat capable of semi-autonomous operations that can be launched from surface ship or shore. The craft can be equipped with modular payload packages for missions such as mine warfare and antisubmarine warfare (ASW). The Navy accelerated deployment of Spartan; the first system was deployed in October 2003.<sup>11</sup>

## Navy UUVs And AUVs

The Navy’s 2005 UUV master plan sets forth nine high-priority missions for Navy UUVs: (1) ISR, (2) mine countermeasures (MCM), (3) anti-submarine warfare (ASW), (4) inspection/identification, (5) oceanography, (6) communication/ navigation network nodes (CN3), (7) payload delivery, (8) information operations, and (9) time-critical strike operations. The plan

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<sup>9</sup> Michael Bruno, “Unmanned Surface Vehicle Master Plan Due This Year,” *Aerospace Daily & Defense Report*, Aug. 28, 2006: 2.

<sup>10</sup> Jason Ma, “ONR Developing Two ‘Unmanned Sea Surface Vehicle’ Prototypes,” *Inside the Navy*, July 26, 2004.

<sup>11</sup> For more on Spartan and other USVs, see Richard R. Burgess, “A New Generation,” *Seapower*, July 2006: 26-29.

stresses the need for commonality, modularity, and open-architecture designs for Navy UUVs, organizes Navy UUVs into four broad categories:

- **Man-portable UUVs** with diameters of 3 to 9 inches and weights of 25 to 100 pounds, for use in special-purpose ISR, expendable CN3, very-shallow-water MCM, and explosive ordnance disposal (EOD);
- **Lightweight vehicles** with 12.75-inch diameters and weights of up to 500 pounds (the same as lightweight Navy torpedoes), for use in harbor ISR, special oceanography, mobile CN3, network attack, and MCM area reconnaissance;
- **Heavyweight vehicles** with 21-inch diameters and weights up to 3,000 pounds (the same as heavyweight Navy torpedoes), for use in tactical ISR, oceanography, MCM, clandestine reconnaissance, and decoys; and
- **Large vehicles** with diameters of 36 to 72 inches and weights of up to 20,000 pounds, for use in persistent ISR, ASW, long-range oceanography, mine warfare, special operations, EOD, and time-critical strike operations.<sup>12</sup>

The Navy is using its single **Long-term Mine Reconnaissance System (LMRS)** (which includes two UUVs) and its single **Advanced Development UUV** (which includes 1 vehicle) to support the development of the **Mission-Reconfigurable UUV System (MRUUVS)**. The MRUUVS is a 21-inch-diameter, submarine-launched and -recovered UUV being developed for conducting mine countermeasures and ISR missions in areas denied to inaccessible to other Navy systems. The Navy wants the MRUUVS program to start in FY2009, and the first MRUUVS to enter service in 2016. The **Large-Displacement, Mission-Reconfigurable UUV System (LD-MRUUVS)** is a large, clandestine UUV for launching from submarines, LCSs, and amphibious ships that is to be used for conducting multiple missions, including mine countermeasures (including neutralization), delivery of payloads for special operations forces, persistent ISR, and limited ASW in areas denied or inaccessible to other Navy systems. The Navy is currently developing requirements for the system, and the development effort will leverage technology developed for the 21-inch MRUUVS.

The **Surface Mine Countermeasure (SMCM) UUV System** for use on older Avenger (MCM-1) class mine countermeasures ships and LCSs. The Navy plans to develop and field a few Increment 1 and Increment 2 versions of the SMCM UUV as user operational evaluation systems (UEOS), and then produce an Increment 3 version as a heavyweight-class UUV for use aboard LCSs, with the system entering service in FY2011. The **Battlespace Preparation Autonomous Undersea Vehicle (BPAUV)** is a 21-inch-diameter AUV with a side-looking sonar for mine detection for use aboard LCSs as a complement to other LCS mine countermeasures systems. The first BPAUV is to be delivered in December 2006 for integration into the first LCS.

The **Semi-Autonomous Hydrographic Reconnaissance Vehicle (SAHRV)**, sponsored by USSOCOM, is a small, man-portable vehicle to be used by Navy Special Warfare (NSW) forces (i.e., Navy SEALs) for hydrographic reconnaissance and mapping operations in very shallow waters. The Navy states that SAHRV “has completed all phases of the acquisition cycle to the

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<sup>12</sup> Christopher P. Cavas, “U.S. Navy Refines UUV Roles, Missions,” *Defense News*, Jan. 31, 2005, p. 14; Aarti Shah, “Updated UUV Master Plan Categorizes Vehicles Into Four Groups,” Jan. 31, 2005; Aarti Shah, “Navy Updates UUV Master Plan To Focus On Four Key Categories,” *Inside the Navy*, Oct. 18, 2004; Keith Jacobs, “U.S. Navy Master Plan For UUV Development,” *Naval Forces*, No. 3, 2005: 96, 98-102.

point of fielding and sustaining 17 operational units. As such, the SAHRV has achieved Full Operational Capability (FOC) defined by USSOCOM and continues to fulfill a critical requirements capability of NSW forces in the War on Terror.” The Navy plans to improve the system’s capabilities over time.<sup>13</sup>

## Marine Corps UGVs

The **Armored Breaching Vehicle (ABV)**, currently undergoing developmental testing and field user test and evaluation, is an unmanned, tracked combat engineer vehicle for breaching minefields and complex obstacles. The Army is considering purchasing some for its own use in Iraq. The **Gladiator** is a wheeled, tele-operated, semi-autonomous UGV for armed reconnaissance and breaching operations. It can be equipped with machine guns, the Shoulder-Launched Multipurpose Assault Weapon (SMAW), an obscuration smoke system, and a system for breaching anti-personnel systems. The Marine Corps states that Gladiator “was recently removed from System Design and Development (SDD) but development of the revised system continues, test and contingency assets are being designed and built at Carnegie Mellon University (CMU). The Gladiator Baseline 0 Contingency project design and build [effort] is progressing, [and] delivery of the first system is scheduled for 3<sup>rd</sup> qtr FY07 with developmental testing to commence in 4<sup>th</sup> Qtr FY07. “

The **MarcBot IV** is a small, tele-operated UGV for reconnaissance and surveillance, particularly in investigating improvised explosive devices (IEDs). More than 500 have been fielded for Marine Corps and Army use. An improved design (MarcBot V) is being developed. The **Talon** is a small (two-man-portable), commercial-off-the-shelf (COTS), tele-operated UGV used by explosive ordnance disposal (EOD) personnel. Numerous systems have been fielded for Marine Corps and Army use, and use of additional payloads (Such as metal detectors, explosive detectors, infrared devices, radars, and weapons) is being explored. The **FIDO-PackBot** is a UGV equipped with an explosive vapor detector for detecting vehicle-and personnel-borne IEDs at checkpoints and major points of entry. A large number of units are planned for Marine Corps and Army use., with the first entering service in early FY2007.

## Issues for Congress

Potential issues for Congress regarding naval UVs include the following: What implications might UVs have for required numbers and characteristics of naval ships and manned aircraft, and naval concepts of operations? Since the current Navy UCAV and Gladiator UGV programs will likely fall far short of meeting the goals established by Section 220 of P.L. 106-398, should the these programs be accelerated so as to come closer to meeting the goals, or should the goals in Section 220 be amended? How will the restructuring of the J-UCAS program into the Navy-oriented UCAV program affect the Navy UCAV effort? Are the Marine Corps’ UAV and UGV programs adequately coordinated with those of the Army? Is the Marine Corps’ plan for using upgraded Pioneers as an interim tactical UAV the best approach?

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<sup>13</sup> For additional discussion of UUV programs, see Richard Scott, “In Harm’s Way,” *Jane’s Defence Weekly*, June 21, 2006: 22-24, 26-27; Glenn W. Goodman, “Breakthrough,” *Seapower*, May 2006: 14-16; and Massimo Annati, “UUVs and AUVs Come of Age,” *Military Technology*, No. 6, 2005: 72, 74-76, 78-80.



## **Legislative Activity in 2007**

The Department of the Navy's proposed FY2008 budget, with funding for various Navy and Marine Corps UV programs, was submitted to Congress in February 2007.

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