DSIAC TECHNICAL INQUIRY (TI) RESPONSE REPORT

Commercial or Government Off-the-Shelf (COTS/GOTS) Light Helicopters

Report Number:
DSIAC-2019-1007
Completed October 2018

DSIAC is a Department of Defense Information Analysis Center

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DSIAC is sponsored by the Defense Technical Information Center, with policy oversight provided by the Office of the Under Secretary of Defense for Research and Engineering. DSIAC is operated by the SURVICE Engineering Company.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	**2. REPORT TYPE**	**3. DATES COVERED** *(From - To)*
26-10-2018	Technical Research Report	

4. TITLE AND SUBTITLE

Commercial or Government Off-the-Shelf (COTS/GOTS) Light Helicopters

5a. CONTRACT NUMBER
FA8075-14-D-0001

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Travis Kneen

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Defense Systems Information Analysis Center (DSIAC)
SURVICE Engineering Company
4695 Millennium Drive
Belcamp, MD 21017-1505

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Defense Technical Information Center (DTIC)
8725 John J. Kingman Rd.
Ft. Belvoir, VA 22060-6218

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release: distribution unlimited.

13. SUPPLEMENTARY NOTES

Technical Areas: aircraft platforms: rotary wing vehicles/future vertical lift; military sensing, survivability and vulnerability

14. ABSTRACT

The Defense Systems Information Analysis Center (DSIAC) received a technical inquiry requesting information on light helicopters that are transportable on a Boeing C-17III Globemaster aircraft and that can be equipped for a variety of desired operations. The desired qualities included the ability to fit a fleet of four or more of the helicopters in the C-17III; that the helicopters be either commercial or government off-the-shelf; and equipped with a simple but proven intelligence, surveillance, and reconnaissance package. DSIAC compiled information on nine helicopter manufacturers and 12 models with the dimensions of the helicopters that met the inquirer's requirements, as well as one prototype model.

15. SUBJECT TERMS

helicopter, vertical lift helicopter, light helicopter

16. SECURITY CLASSIFICATION OF: U			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
					Ted Welsh, DSIAC Director
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**	UU	15	**19b. TELEPHONE NUMBER** *(include area code)*
U	U	U			443-360-4600

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

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A chief service of the DoD IACs is free technical inquiry (TI) research, limited to 4 research hours per inquiry. This TI response report summarizes the research findings of one such inquiry jointly conducted by DSIAC.

ABSTRACT

The Defense Systems Information Analysis Center (DSIAC) received a technical inquiry requesting information on light helicopters that are transportable on a Boeing C-17III Globemaster aircraft and that can be equipped for a variety of desired operations. The desired qualities included the ability to fit a fleet of four or more of the helicopters in the C-17III; that the helicopters be either commercial or government off-the-shelf; and equipped with a simple but proven intelligence, surveillance, and reconnaissance package. DSIAC compiled information on nine helicopter manufacturers and 12 models with the dimensions of the helicopters that met the inquirer's requirements, as well as one prototype model.

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1.0 TI Request

1.1 INQUIRY

What commercial or government off-the-shelf (COTS/GOTS) “light helicopters” are C-17III transportable and can be equipped for special operations forces operations?

1.2 DESCRIPTION

The inquirer requested information on COTS/GOTS light helicopters that could be used for rapid forward deployment. The inquirer noted that the helicopter design should include a simple but proven intelligence, surveillance, and reconnaissance (ISR) equipment package.

2.0 TI Response

In 2018, 16 special operations support helicopters were requested, and a fleet of four of these helicopters would have to be transportable by a Boeing C-17III Globemaster aircraft. They would also need to be able to provide air assault capability by small teams of special forces, have ISR with electro-optical (EO) sensors, and be rapidly reconfigurable between roles. The need was a focus of the 2018 Land Forces Exhibition, and corporations expected to compete for the bid included Bell, Boeing, Airbus Group, Leonardo, McDonnell Douglas (MD), and NorthStar Aviation (NSA) [1]. The Defense Systems Information Analysis Center (DSIAC) examined these COTS/GOTS helicopter manufacturers and models, as well as several others.

2.1 THE BOEING C-17III

The Boeing C-17 Globemaster III, shown in Figure 1, is a flexible cargo aircraft capable of rapid strategic delivery of troops and all types of cargo to main operating bases or directly to forward bases in the deployment area. The C-17 is 174 ft (53 m) long and has a wingspan of 169 ft, 10 in. (51.75 m). Cargo is loaded into a C-17 through a large aft ramp and door system that accommodate air-transportable equipment with floors that can either be flat or have roller conveyers for palletized cargo. The C-17 is also designed to airdrop 102 paratroopers along with the accompanying equipment. The maximum payload is 170,900 lb (77,519 kg), and the cargo compartment dimensions are 88 ft (26.82 m) long, 18 ft (5.48 m) wide, and 12 ft 4 in. (3.76 m) high. There are currently 157 C-17 Globemaster III aircraft in active duty for the U.S. Air Force; 47 in the Air National Guard; and 18 in the Air Force Reserve [2].

They have been used for support during deployments and as an integral part of disaster relief and humanitarian missions. The aircraft can house up to three Black Hawk helicopters or a single CH-47F Chinook helicopter [3].

Figure 1: The Boeing C-17 Globemaster III is a Flexible Cargo Aircraft that the Military Uses to Transport Troops and Gear, as Well as Perform Airlift or Airdrop Missions
(Source: Photo by U.S. Air Force Tech. Sgt. Shane A. Cuomo [2]).

2.2 HELICOPTER MANUFACTURERS AND MODELS

2.2.1 Airbus Group H145M and H135M

The Airbus Group's H145M is a multirole, battlefield-support helicopter that can carry up to two crew members and up to 10 troops. It can be deployed in transportation, special operations, intelligence, surveillance, target acquisition, reconnaissance, search-and-rescue, fire support, and medical evacuation missions [4]. The H145M can be reconfigured in minutes using a wide range of available mission equipment packages, including the HForce weapon system [5]. It can be fitted with an incremental modular weapon system to engage conventional and asymmetric threats and is also compatible with seven-tube and 12-tube rocket launchers, a 20-mm cannon pod, a 12.7-mm machine gun pod, and air-to-surface missiles. It can also be configured to carry laser-guided rockets [4].

The H145M is equipped with a mission computer, an infrared (IR)/TV EO system, an emergency locator transmitter, and a laser rangefinder (LRF). Its survivability technology includes self-sealing fuel tanks, ballistic protection, IR suppressors, and crashworthy seats [4]. Its maiden flight occurred in November 2014, and it received its European Aviation Safety Agency certification in May 2015. Four Airbus H145M helicopters should be able to fit within a C-17 as required; the dimensions of the H145M are shown later in Table 1 [6]. Organizations that employ the Airbus H145M helicopter include the German Armed Forces (15), the Royal Thai Navy (5), Serbian Air Force and Police (9), Hungarian Ministry of Defence (20), the Luxembourg Defence (2) [4], and the U.S. Army as the UH-72A Lakota (400+) [5].

The Airbus Group's H135M helicopter is extremely versatile due to a diverse selection of optional equipment that allows it to act as an armed scout, light utility, or command and control workhorse. It can be equipped with a weapon system that incorporates a multipurpose mission computer, an EO system with IR/TV cameras, a ballistic targeting system, and two multipurpose weapon pylons that allow for symmetric or asymmetric armament configurations (i.e., twin air-to-ground Ingwe missile launchers; 12-tube and 7-tube 70mm unguided rocket launchers; a 20mm cannon pod and 12.7mm machine gun pod; and the potential for laser-guided rockets). Additionally, two door-mounted 7.62mm machine guns installed in the cabin provide protection during escort and extraction/insertion of troops in permissive environments. The H135M can accommodate up to six passengers and two pilots or multiple medical stretchers [7].

As the H135M is smaller than the H145M, four H135Ms would fit in the cargo bay of a C-17III; see Table 1 for the specifications of the H135M. The H135M has been ordered and used for utility and training missions by Switzerland (20) and the Royal Jordanian Air Force (9) [8].

2.2.2 Bell 407GT and OH-58 Kiowa Warrior

Bell intended to bid the 407GT, which is an armed version of the 407GX civil helicopter, as it was COTS and already deployed in the Middle East [1]. The light attack helicopter can be reconfigured to suit troop transport, medical evacuation, search and rescue, or command and control missions. Avionics included are the Wescam MX-15DI and Forward-Looking Infrared (FLIR) Systems 230-H, with a separate suite for aircraft survivability equipment. The 407GT features a configurable weapons system for tactical operations and a universal weapons pylon that can be configured or removed quickly, depending on the mission. The 407GT has been fitted with the BAE Systems Advanced Precision Kill Weapon System (APKWS) and has fired 70mm APKWS rockets. It can also be equipped with a variety of optional armament kits, including the semi-active, laser-guided, 2.75-in. version of the existing Hydra 70 unguided rocket system with a range of more than 5,000 m; AGM-114 Hellfire; General Dynamics GAU-19/B .50-caliber machine gun; mid-body guidance unit (WGU-59/B); and the LifePort armor protection system. The 407GT can also fit up to six passengers and one crew member [9].

The Bell OH-58 Kiowa Warrior is a scout attack helicopter that can be optionally equipped to carry out transport and utility roles using equipment kits installed externally on existing hard points [10]. The OH-58F is an upgrade to the OH-58D, with an advanced, nose-mounted sensor and cockpit via the Cockpit and Sensor Upgrade Program. The upgraded sensor is a Raytheon AN/AAS-53 Common Sensor Payload that includes an advanced IR camera, a color EO camera, and an image intensifier [11]. The Kiowa Warrior is equipped with two universal, quick-change weapons pylons that can be armed with two Hellfire missiles, seven Hydra 70 rockets, two air-to-air Stinger missiles, or one .50-caliber fixed forward machine gun. For air transportation, the vertical tail fin pivots, the main rotor blades, and horizontal stabilizer are folded, and external pieces are removed. The dimensions of the OH-58 Kiowa Warrior can be found in Table 1 [12].

Each Kiowa Warrior can house up to two crew members and six passengers. Various models of the Bell OH-58 are in service worldwide [10].

2.2.3 Boeing AH-6 Little Bird

Boeing classifies its AH-6 Little Bird as a highly capable light-attack/armed-reconnaissance helicopter that is specifically designed with superior performance characteristics and flexible, easily configurable mission equipment ideal for light attack, precision attack, anti-armor, close combat attacks, reconnaissance, security and escort, troop insertion/extraction, and combat search and rescue [13]. Boeing views its AH-6i Little Bird as a candidate [1]. The AH-6i is a variant of the AH-6M (used by U.S. Special Forces) for export markets. The AH-6i can mount a variety of lightweight weapons such as the M-134D 7.62mm mini-gun, the GAU-19 12.7mm mini-gun, the M260 seven-shot rocket pod, the laser-guided 70mm Folding-Fin Aerial Rocket, and Hellfire semi-active laser missiles (a laser-guided, air-to-surface missile with multimission, multitarget, precision-strike capabilities). The AH-6i is equipped with an L-3 Wescam MX-15Di EO/IR targeting sensor system that can be integrated with up to six high-performance sensors, including a laser designator with an LRF, a laser illuminator, and an eye-safe LRF, a color daylight camera with zoom lens, a mono daylight camera with a spotter lens, and IR with high-magnification, four-step zoom. The Saudi Arabian government ordered 36 AH-6i helicopters, and South American countries including Chile, Brazil, Colombia, and Argentina were also interested in the AH-6i [14]. The Jordanian government also was interested in procuring 18−24 of the Little Birds [15]. In 2010 Boeing and MD Helicopters signed a Memorandum of Agreement to jointly produce and market the AH-6i [14].

2.2.4 Leonardo AW109 Trekker

The AW109 Trekker requires less than 30 min of preparation to embark on the C-17 [16], and four of the helicopters could fit within the cargo bay; see Table 1 for AW109 Trekker specifications. It can fit one or two pilots along with six or seven passengers, or it can hold one stretcher with three to four medical attendants or two stretchers with two attendants. It is equipped with search and rescue (SAR) mission technology such as multiband radios, EO/IR sensors and FLIR cameras, searchlight, rescue hoist, and a cargo hook. In addition, the AW109 Trekker can be easily configured for a variety of missions, including emergency medical services, SAR, law enforcement, utility, surveillance, transport, and government duties. There have been orders for over 60 AW109 Trekkers placed worldwide [17]. A new Leonardo AW109 Trekker is priced at $4.2M [18].

2.2.5 MD 530G and 540F

The width of the MD 530G, including the weapons pods [19], could prevent it from meeting the need to transport four helicopters in a C-17III aircraft. The MD 530G is a light scout helicopter that is designed for easy supportability and low-cost operation [20]. The 530G was derived

from the civilian-based MD 530F airframe and is equipped with a variety of weapons, including Raytheon's 70mm TALON laser-guided rocket; a Heavy Machine Gun Pod (HMP-400) developed by FN Herstal; a Rocket Machine Gun Pod; Dillon Aero's 7.62mm M134D-H (hybrid) Gatling gun; and an Arnold Defense M260 seven-shot rocket pod. The MD 530G is also equipped with the L-3 Wescam MX-10 and MX-10D EO/IR tactical surveillance systems in a single line-replaceable unit configuration. The payload incorporates multiple IR imagining sensors, precision optics, a laser designator, and an advanced communications suite. Since the MD 530G was first unveiled in February 2014, there have been orders for six helicopters each to the Malaysia's Ministry of Defense, the Lebanese Armed Forces, and the Lebanese Air Force (provided by the United States) [21].

An upgrade to the 530G is the 540F, which is equipped with an L-3 Wescam MX-10 EO/FLIR chin turret, and has several armament options, including the 7.62mm six-barrel mini-gun, 70mm Hydra rockets, the 50-caliber three-barrel machine gun, laser-guided rockets, and Hellfire II missiles. It is compact and can quickly change special features. MD 500 aircraft are currently operated by the Chilean Army, Mexican Air Force, Jordan Special Operations, Japanese Self Defense Forces, Kenyan Army, Republic of Korea Army, Philippine Air Force, and U.S. Army [22].

2.2.6 NSA 407MRH

The NSA 407MRH Lightning is a light, multirole helicopter developed by the United Arab Emirates (UAE) aviation solutions provider. It is based on the Bell 407GX civilian helicopter. The MRH edition is intended for missions including light attack, close-air support, ISR, airborne ISR, utility, cargo, and passenger transport. This variant has an advanced, lightweight weapons integration platform that enables the mounting of a variety of weapons on removable weapon stores. These weapons include AGM 114 Hellfire air-to-surface missiles, the M134 7.62mm mini-gun, the GAU-19 .50-caliber machine gun, and Hydra 70 rockets, which are carried in a seven-shot rocket pod. The 407MRH has a FLIR Star SAFIRE 260-HLD EO/IR gyrostabilized sensor that provides high-resolution imagery, target tracking, and identification during the day and night. The unit cost of the NSA 407MRH Lightning is estimated to be $9M. The UAE Armed Forces ordered 30 of these retrofitted 407MRH helicopters in 2016 [23].

2.2.7 Iran Aircraft Manufacturing Company (HESA) Shahed 285/AH-85

The HESA Shahed 285/AH-85 is a light helicopter developed from the American Bell 206 Ranger series. There is a variety of armament options that range from land-based light and heavy reconnaissance models to a ship-borne armed reconnaissance/attack model. Weapons included are the 7.62mm machine gun, 2.75-in. seven-shot rocket pods, antitank guided missiles, and antiship missiles. It is manufactured and operated by Iran [24].

2.2.8 Changhe Aircraft Industry Corporation (CAIC) Z-11WB

The Chinese-designed CAIC Z-11WB is a reconnaissance and light-attack derivative of the Z-11 light utility helicopter. The Z-11WB can perform ground attack, battlefield surveillance, counterterrorism, and network-centric and aerial warfare missions. It accommodates a single pilot and three passengers. The Z-11WB includes an integrated, nose-mounted EO pod and can carry a variety of weapons/pods. It can mount an automatic grenade launcher or 7.62mm CS/LM12, six-barreled mini-gun and includes two pylons to carry missiles and bombs [25].

2.2.9 Harbin Aircraft Industry Group Z-9W

The Harbin Z-9W is an attack variant of the Z-9 utility helicopter produced by the Harbin Aircraft Industry Group, which is a license-built version of the Eurocopter AS365 Dauphin. The Z-9W has weapon pylons on either side that can carry up to eight HJ-8 wire-guided antitank missiles, and it can be armed with two 23mm cannons/12.7mm machine guns/57mm rocket launchers, or four TY-90 air-to-air missiles. The Z-9W is equipped with an optical sight installed on the roof of the cockpit to search and aim targets, though the Z-9WA can be fitted with a nose-mounted EO turret developed by Luoyang Electro-Optics Technology Development Centre. The Z-9W's integration of FLIR and a low-light TV system allows for operations to be undertaken day or night and in all weather conditions. This helicopter, like the Airbus H145M, is potentially too long to fit four of the aircraft within a C-17III [26].

2.3 PROTOTYPE HELICOPTERS

2.3.1 Sikorsky S-97 Raider

The Sikorsky S-97 Raider vertical lift aircraft is a next-generation, light tactical prototype helicopter based on X2 Technology that can carry six troops. It is being keyed to exceed the requirements of the U.S. Army's Future Attack Reconnaissance Aircraft. Weapons included are Hellfire missiles, 2.75-in. rockets, a .50-caliber gun, and a 7.62mm gun [27]. The helicopter can be armed with external weapons and will be equipped with a variety of sensors to support reconnaissance and light attack missions [28]. Lockheed Martin claims an ability to transport four S-97 RAIDERs via C-17 loadout, even with a width larger than the other models [27].

2.4 SPECIFICATIONS OF CANDIDATE HELICOPTERS

The specifications of candidate helicopters by manufacturer and model are documented in Table 1. Note that there may be other light helicopters that could meet the inquirer's requirements, and that some of the models mentioned could fall short of fulfilling all the desired attributes.

Table 1: Specifications of Candidate Helicopters by Manufacturer and Model

Manufacturer	Model	Length (m)	Height (m)	Width (m)	Max Weight (t)
Airbus Group	H145M/EC 645 T2 [6]	13.64	3.46	2.4	3.7
	H135M/EC 635 [8]	10.2	3.51	2.65	2.8
Bell	407 GT [9]	12.7	3.56	-*	2.7
	OH-58 Kiowa Warrior [12]	10.48	3.93	-	2.5
Boeing	AH-6i Little Bird [14/15]	7.5/9.8	1.6/2.5	3.3	1.7
	S-97 RAIDER [27]	10.97	1.98	4.88	5
Leonardo	AW 109 Trekker [16]	12.96	3.53	-	3.35
MD	MD 530G [19]	7.76	2.88	3.0	1.7
	MD 540F [22]	7.77 9.78 (w/ rotor)	2.5	1.97	1.8
NSA	407MRH Lightning [23]	10.17	2.68	1.5	2.7
HESA	Shahed 285/AH-85 [24]	12.94	3.42	-	1.5
Changhe	Z-11WB [25]	13	3.14	1.8	2.2
Harbin	Z-9W/WA [26]	13.7	3.9	-	4.1

* Dashes indicate no data available.

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BIOGRAPHY

Travis Kneen is a research analyst at DSIAC. Prior to joining DSIAC, he was an intern at America Makes. His graduate research focused on the mechanical properties of additively manufactured stainless steel 316L. Mr. Kneen holds a B.S. in physics and astronomy and a B.A. in history from the University of Rochester and an M.S. in mechanical engineering from Youngstown State University.