

December 1998

# UNMANNED AERIAL VEHICLES

## Progress Toward Meeting High Altitude Endurance Aircraft Price Goals



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**National Security and  
International Affairs Division**

B-280126

December 15, 1998

Congressional Committees

Section 216 of the National Defense Authorization Act for Fiscal Year 1998 directed us to review the Department of Defense's (DOD) High Altitude Endurance (HAE) Unmanned Aerial Vehicle (UAV) program to determine whether the average flyaway cost for the Global Hawk and DarkStar HAE air vehicles will be within DOD's cost goal of \$10 million.<sup>1</sup> As agreed with your office, this report addresses the status of DOD's progress toward meeting its goal as the HAE program proceeds through its ongoing demonstration phase.

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**Results in Brief**

DOD does not expect to be able to produce DarkStar or Global Hawk HAE vehicles within its goal of \$10 million per unit in fiscal year 1994 dollars. DOD's price projections, which updated the original estimates of \$10 million, are currently \$13.7 million for DarkStar and \$14.8 million for Global Hawk. In addition, these projections may understate the actual amount by which the UAV's unit price will exceed \$10 million because in their agreements with the HAE contractors, program officials used a definition of unit flyaway price that excludes several cost categories that are traditionally included in determining unit flyaway cost. Including these costs will increase the average unit price of each air vehicle.

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**Background**

DOD's HAE program, originally managed by the Defense Advanced Research Projects Agency (DARPA), is currently managed by the Air Force.<sup>2</sup> Two types of HAE vehicles are being developed, Global Hawk and DarkStar, as advanced concept technology demonstration projects rather than as a traditional defense acquisition program.<sup>3</sup> Global Hawk is a conventional

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<sup>1</sup>As provided for in the legislation, the term "flyaway cost" refers to a firm unit cost. Though not defined in the legislation, the standard definition of unit flyaway cost used by DOD is found in the DOD Financial Management Regulations. However, for purposes of this program, DOD has established what it calls a unit flyaway *price*, which is defined in its agreements with the Global Hawk and DarkStar HAE contractors. As provided in those agreements, flyaway *price* includes some, but not all, of the cost categories included in the standard definition of unit flyaway cost, plus the contractor's fee. DOD's goal is stated as a \$10 million average unit flyaway *price* in fiscal year 1994 dollars for (1) DarkStar vehicles numbered 11 through 20 and (2) the first production lot of 10 Global Hawk air vehicles. Thus, for purposes of our reporting, we have used DOD's stated goal as criteria.

<sup>2</sup>The Air Force assumed program management responsibility from DARPA on October 1, 1998.

<sup>3</sup>An advanced concept technology demonstration program does not follow DOD's formal approval process for its acquisition programs. It is designed to enhance the military's capability by successfully demonstrating mature and cost-effective technologies to the user before a formal decision to acquire them is made.

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aircraft design and DarkStar is a “stealth,” or low observable, design. Both are projected to augment DOD’s current high altitude manned reconnaissance aircraft, the U-2.

DOD is currently building nine prototype HAE aircraft, five Global Hawks and four DarkStars, for use in an HAE military utility assessment scheduled to begin in April 1999.<sup>4</sup> In March 2000, military users are scheduled to complete their assessment report of the prototype aircraft. At that time, the Air Combat Command, the operating command, expects to have its HAE operational requirements document approved. With the performance data available, DOD will then determine if these vehicles satisfy the user’s requirements and decide whether it should acquire production versions of one or both aircraft. In a preliminary assessment made in October 1996, the Command concluded that it would require 20 Global Hawks and 7 DarkStar vehicles, plus an undetermined number for backup and attrition.

Global Hawk is being designed by Teledyne Ryan Aeronautical to fly 3,000 nautical miles, conduct reconnaissance for 24 hours, and return to base. Because of its conventional design (i.e., large radar cross-section), Global Hawk will operate in areas where the enemy threat is considered low to medium. DarkStar, with its stealth design (i.e., small radar cross-section), will operate in high-threat areas. It is being designed by Lockheed Martin to fly over 500 nautical miles, conduct reconnaissance during an 8-hour period, and return to base.

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## HAE Aircraft as Currently Designed Will Exceed Price Goal

DOD estimates indicate that, as currently designed and configured, production versions of its DarkStar and Global Hawk prototype aircraft will exceed DOD’s \$10 million unit flyaway price goal. Furthermore, DOD’s price estimates do not include estimates of system modification costs to the aircraft that are typically included in traditional acquisition programs.

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## DOD-Developed Price Projections for HAE Vehicles Exceed \$10 Million Unit Flyaway Price Goal

DOD has not yet requested authority to build HAE production vehicles. The decision to begin production will be based on the results of the ongoing HAE demonstration effort that will be reported in March 2000. For planning purposes, though, DARPA HAE program officials developed price projections using current vehicle designs and configurations to update the original program estimates. Based on these price projections, DOD does not expect to be able to produce DarkStar or Global Hawk HAE vehicles within the

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<sup>4</sup>Public Law 103-160, section 845, provides DOD with the authority to enter into transactions, other than procurement contracts, to acquire prototypes without requiring compliance with all elements of federal acquisition regulations. Both the Global Hawk and DarkStar efforts are using this authority.

\$10 million goal (fiscal year 1994 dollars). These updated estimates indicate that the first 10 production Global Hawk vehicles and DarkStar unmanned aerial vehicles 11 through 20, as currently designed and configured, will be priced at \$14.8 million and \$13.7 million, respectively.

The original and updated estimates (as of July 1998) for the average unit flyaway prices for the first 10 Global Hawk production vehicles and vehicles 11 through 20 for DarkStar are shown in tables 1 and 2. The single largest increase for Global Hawk, \$3.5 million per unit, is in the aircraft structure, with \$1.9 million of that due to modifying the wings to provide the lift needed to meet range and endurance goals. The largest increases for DarkStar are in the areas of avionics - \$1.3 million, and payloads - \$1.2 million.

**Table 1: Original and Updated Estimates for Average Unit Flyaway Price for Global Hawk Production Vehicles Numbered 1 to 10 (FY 94 Millions of Dollars)**

Category	Original estimate	Updated estimate	Difference
Structure	\$2.6	\$ 6.1	\$3.5
Avionics	0.4	0.5	0.1
Payloads	4.1	5.2	1.1
Propulsion	1.6	1.6	0.0
Fee	1.3	1.4	0.1
<b>Total</b>	<b>\$10.0</b>	<b>\$14.8</b>	<b>\$4.8</b>

Source: DARPA HAE Program Office.

**Table 2: Original and Updated Estimates for Average Unit Flyaway Price for Darkstar Vehicles Numbered 11 to 20 (FY 94 Millions of Dollars)**

Category	Original estimate	Updated estimate	Difference
Structure	\$ 4.8	\$ 5.5	\$ 0.7
Avionics	2.8	4.1	1.3
Payloads	1.2	2.4	1.2
Propulsion	0.5	0.6	0.1
Fee	0.8	1.1	0.3
<b>Total</b>	<b>\$10.1</b>	<b>\$13.7</b>	<b>\$ 3.6</b>

Source: DARPA HAE Program Office.

DOD and the HAE contractors are continuing to try to identify ways to reduce the costs of producing HAE vehicles in the event they are eventually authorized to build them. According to HAE program officials, however, DOD will not consider failure to meet the \$10 million unit flyaway price goal an automatic failure of its HAE efforts. As of November 1998, two Global

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Hawks and two DarkStars had been completed. One DarkStar was destroyed in a crash during its second flight.

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## Definition of Unit Flyaway Cost Used by DOD

The standard definition of aircraft unit flyaway cost is found in the DOD Financial Management Regulations.<sup>5</sup> Standard unit flyaway cost elements include the costs of procuring airframes; engines; avionics; armaments; engineering change orders; nonrecurring costs including production tooling, software, and other costs (if funded from aircraft procurement appropriations); divided by the procurement quantity. Flyaway cost does not include research and development, support equipment, training equipment, technical data, or spares.

DARPA, in its HAE agreements, incorporated a definition of unit flyaway price that included some, but not all, of the standard elements described above plus the contractors' fees. (See tables 1 and 2.) DARPA officials did so because they assumed the future production units would be identical to the prototype units being built in the demonstration phase. The cost categories they did not include are associated with system modifications, which they reasoned would not be incurred if the vehicles were the same. Cost categories not included in the HAE agreements that are otherwise typically included are costs such as engineering change orders, software changes, system test, and nonrecurring costs, including tooling costs.

Because projections of what these other costs might be were not calculated by DARPA when it developed the original estimates for average unit flyaway price, the updated estimates shown in tables 1 and 2 also do not include these other cost categories. The Air Force program office, in order to have a realistic assessment of this newly transitioned program, is developing total program production cost estimates that include these costs. The addition of these cost categories will increase the unit flyaway price for the Global Hawk and Dark Star above the DARPA updated estimates of \$14.8 million and \$13.7 million, respectively.

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## Agency Comments

In commenting on a draft of this report, DOD concurred with our findings. Technical comments have been incorporated as appropriate. DOD's comments are reprinted in appendix I.

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<sup>5</sup>Volume 2B, Chapter 4 - Procurement Appropriations, Exhibit P-5 - Cost Analysis.

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## Scope and Methodology

To determine DOD's progress toward its price goal, we met with DOD, DARPA and contractor officials, and analyzed HAE program and cost data. To determine whether DOD used a standard definition for unit flyaway cost, we compared cost categories included in DARPA's analysis for its HAE vehicles to those included in DOD's Financial Management Regulations and weapon system management regulations. We conducted our work at the Defense Airborne Reconnaissance Office (now the Division of Intelligence, Surveillance, and Reconnaissance Systems), Office of the Secretary of Defense, Washington, D.C.; the Defense Advanced Research Projects Agency, Arlington, Virginia; and the Air Force Reconnaissance Mission Area Group, Wright-Patterson Air Force Base, Ohio.

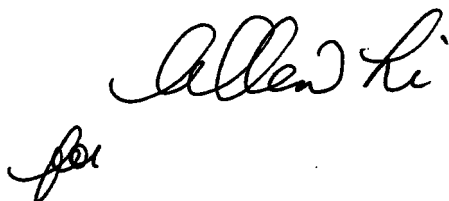
We conducted our work from May 1998 through November 1998 in accordance with generally accepted government auditing standards.

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We are sending copies of this report to the Secretaries of Defense and the Air Force, and the Director of the Office of Management and Budget. We will also provide copies to others upon request.

If you or your staff have any questions, please contact me at (202) 512-4841. Principal contributors to this report were Stephanie May, Richard Strittmatter, and Charles Ward.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Louis J. Rodrigues". The signature is written in a cursive style and is positioned above a small, stylized mark that looks like a lowercase "r" or "l".

Louis J. Rodrigues  
Director, Defense Acquisitions Issues

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List of Congressional Committees

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Permanent Select Committee on Intelligence  
House of Representatives





# Comments From the Department of Defense



OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE  
6000 DEFENSE PENTAGON  
WASHINGTON, DC 20301-6000

December 8, 1998

Mr. Louis J. Rodrigues  
Director, Defense Acquisitions Issues  
National Security and International  
Affairs Division  
U.S. General Accounting Office  
Washington, D.C. 20548


Dear Mr. Rodrigues:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "UNMANNED AERIAL VEHICLES: High Altitude Endurance Aircraft Unlikely to Meet Price Goals," dated November 16, 1998 (GAO Code 707340), OSD Case 1714.

The DoD has reviewed the draft report and concurs without further comment. Suggested technical changes for clarification and accuracy have been provided separately.

The Department appreciates the opportunity to comment on the draft report. For further questions concerning this report, please contact Col. Chuck Wilson, ISR Systems, 607-0410.

Sincerely,

  
Robert M. Nutwell, RADM, USN  
Deputy Assistant Secretary of Defense  
(C3ISR and Space Systems)



See comment 1.

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**Appendix I**  
**Comments From the Department of Defense**

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The following is GAO's comment on the Department of Defense's letter dated December 8, 1998.

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**GAO Comment**

To more clearly reflect the objective of our work, we have modified the report title.

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