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STAFF STUDY

CH-53E HELICOPTER

DEPARTMENT OF THE NAVY

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Contents

ABBREVIATIONS

BIS	Board of Inspection and Survey
DCP	Development Concept Paper
DSARC	Defense System Acquisition Review Council
HLH	Heavy Lift Helicopter
IOC	Initial Operational Capability
NAVAIR	Naval Air Systems Command
NPE	Navy Preliminary Evaluation
SAR	Selected Acquisition Report
SHP	Shaft Horsepower
IOT&E	Initial Operational Test and Evaluation

CH-53E HELICOPTER

SYSTEM DESCRIPTION AND STATUS

The CH-53E helicopter is being developed to give the Navy and Marine Corps the capability to carry heavier payloads. It is a growth version of the CH-53D which can lift twice the payload while using only 1.1 times the hangar or deck space. (CH-53E is required to carry 16 tons while the CH-53D carries about 7 tons)

The development of the CH-53E was undertaken after the Deputy Secretary of Defense determined that, of the candidates for a joint Army-Navy Heavy Lift Helicopter, none of the designs submitted were fully acceptable for routine shipboard basing on ships of primary interest to the Navy. For this reason, a program was authorized to develop a smaller ship-based helicopter that would result from up-grading of an existing Marine Corps inventory aircraft.

The CH-53E helicopter will be used to (1) carry cargo, troops and passengers internally, (2) carry heavy, bulky equipment and supplies externally, and (3) tow craft, vehicles and mine countermeasure devices.

The CH-53E incorporates in its design several major changes from the CH-53D which enables it to carry the heavier payloads. These are:

CH-53E	CH-53D	Purpose of Change
3 T-64-GE-415 Engines	2 T-64-GE-413 Engines	Provide increased performance
79 foot main rotor diameter with seven main rotor blades	72 foot main rotor diameter with six main rotor blades	Provide increased lift

(cont.)

CH-53E	CH-53D	Purpose of Change
Canted tail with 20 foot tail rotor diameter	Conventional tail with 16 foot tail rotor diameter	Provide lift in tail section to compensate for an undesirable aft center of gravity
Main gear box: 11,570 SHP	Main gear box: 7,560 SHP	Provide increased performance

In conjunction with the above changes, common parts which have been affected by fundamental differences in aircraft characteristics (size, weight, power, etc.), have been modified to meet CH-53E characteristics.

Concept formulation, preliminary design efforts, and selected component hardware testing have been completed. The system is currently in Phase I of a two phase development program. The purpose of Phase I is to validate the concept formulation approach by fabricating and demonstrating two prototypes.

COMING EVENTS

The first flight of the two development prototypes is scheduled for March 1974. Navy preliminary evaluation I (NPE-I) testing is scheduled for September 1974. The Navy will seek approval for full-scale development following DSARC II which is scheduled for October 1974.

CONTRACT DATA

The Naval Air Systems Command (NAVAIR) has awarded four contracts totaling $39.3 million to Sikorsky Aircraft Division for development of the CH-53E helicopter as follows:

Contract No.	Type	Description	Target Cost	Target Fee	Target Price
			(in millions)		
N00019-71-C 0306	CPFF	Propulsion System Test Bed Testing	$ 1.8	$ .1	$ 1.9
N00019-71-C 0368	CPFF	CH-53E-Design Effort	2.5	.1	2.6
N00019-72-C 0483	CPFF	CH-53E Design Effort	1.7	.2	1.9
N00019-73-C 0228	CPIF	Two CH-53E Prototype Helicopters (Phase I)	30.0	2.9	32.9[1/]
	Totals		$36.0	$3.3	$39.3

[1/] Contract had not been completely funded as of September 30, 1973.

Contracts 0306, 0368 and 0483 have been substantially completed and contract 0228 is still in process.

COST

The following table compares the Navy's planning estimates for the CH-53E with the estimate current as of September 30, 1973:

	Planning Estimate 6/30/72	Current Estimate 9/30/73	Change 72-73
Quantities			
Development	4	4	0
Procurement	70	70	0
Total	74	74	0
Cost (in millions)			
Development	$100.3	$100.3	$ 0
Procurement	552.1	470.2	(81.9)
Total Program	$652.4	$570.5*	$(81.9)

*As reported in the 31 December 1973 Selected Acquisition Report (SAR, the current estimate of the total program cost has been further reduced to $553.9 million. The $16.6 million reduction since the 30 Sept. 1973 SAR is attributatble to a DOD directed migration of investment spares ($16.5M) to replenishment spares and a $0.1 million reduction in Navy Test and Evaluation costs due to a change in the overhead funding policy at Naval Air Test Center, Patuxent River.

Navy project personnel informed us that the $652.4 million cost estimate of June 30, 1972, was based on historical data acquired from the CH-53D. As more became known about CH-53E requirements, they revised the estimate to $578.4 million, representing a $74.0 million decrease. The September 30, 1973, estimate includes a decrease of $7.9 million for estimating changes from the revised planning estimate. Logistic Support/Additional Procurement costs, are undefined at this time.

Economic escalation

The Navy is using an escalation factor of 5 percent for this program. This is a composite percentage derived from Navy estimates that material prices have increased about 4 percent per year for the past 5 years and the latest Presidential guidelines which call for a limit of about 6 2/10 percent increase in labor costs. A Navy official stated that the September 30, 1973, estimate ($570.5 million) included about $100 million attributable to escalation.

Funding

As of September 30, 1973, $43.17 million had been appropriated for the CH-53E development program, of which $38.7 million had been obligated and $11.2 million expended. No funds had been appropriated for procurement. The fiscal year 1975 RDT&E budget request for the CH-53E was $46.7 million.

SCHEDULE

The key schedule milestones remaining to be accomplished for the CH-53E as of September 30, 1973, are:

Schedule Milestone	Planning Estimate 6/30/72	Current Estimate 9/30/73
1. First Prototype Flight	Mar. 74	Mar. 74
2. NPE-I Complete	Not Shown	Sep. 74
3. DSARC II	Not Shown	Oct. 74
4. NPE II Complete	Feb. 75	Jan. 75
5. IOT&E Complete	Not Shown	Feb. 76
6. BIS Initial Report	Feb. 76	Mar. 76
7. DSARC III	Not Shown	Mar. 76
8. Initial Operational Capability (IOC) of Production Aircraft	Not shown	Jul. 77

The only reported change to the CH-53E program milestones at 9/30/73 was a 1 month advance in NPE II tests.

PERFORMANCE

The goals stated in the approved May 14, 1973, DCP for weight, payload, and range have not changed. At September 30, 1973, these were:

Characteristic	Internal Load	External Load
Hover gross weight (lbs.)	56,300	69,750
Weight empty (lbs.)	31,915	31,915
Payload (lbs.)	17,900	32,200
Range radius (nautical miles)	100	50

MANAGEMENT REPORTING SYSTEM

Sikorsky has instituted its Sikorsky Program Operation Tracking System (SPOTS) in complaince with DODI 7000.2 in reporting to Navy. This system has been validated by a Government tri-service evaluation team.

SELECTED ACQUISITION REPORT (SAR)

The Navy prepared the first CH-53E helicopter SAR as of June 30, 1973. We reviewed the June 30, 1973, and September 30, 1973, SARs and noted several discrepancies:

1. Difference in SAR and DCP speed requirements

The approved DCP requires that the CH-53E attain a cruise speed of:

1. 100 kts[1/] with external payload
2. 150 kts with internal payload
3. 170 kts with 1/2 internal payload

The SAR states that the CH-53E maxium level flight speed at sea level is:

1. 100 kts with external payload
2. 170 kts with internal payload

It does not seem to us that cruise speed and maximum level flight speed are synonymous. It would seem that cruise speed would be something less than maximum speed.

It also appears that the second SAR requirement has erroneously combined the second and third requirement of the DCP. We were informed by the Navy that the December 31, 1973, SAR has been expanded to include additional data elements like cruise speed with an internal load.

[1/] kts = nautical miles per hour.

2. DCP payload thresholds not contained in the SAR

The DCP identifies three thresholds concerning payloads:

1. Transporting a payload equal to or greater than 16 tons over a 50-mile radius at sea level, at 90 degrees F. (fahrenheit).

2. Transporting a payload equal to or greater than 8 tons (target 9 tons) over a 100-mile radius at 3,000 feet above sea level, at 91.5 degrees F.

3. Transporting a three ton payload (target four tons) 1,000 miles (Vertical on Board Delivery Mission - VOD).

The SAR does not contain number 2 above. Instead, it cites transporting a payload of about 9 tons internal or 15 tons external 100 miles at sea level at 90 degrees F. At the conclusion of our review we were informed by the Navy that the December 31, 1973, SAR would be changed to include the DCP internal cargo/range threshold.

3. Contractor costs not properly reported

The contractor cost section of the September 30, 1973, SAR shown $30.8 million for Initial Contract Price and Price at Completion. The $30.8 million are funds obligated by the Navy to the Sikorsky contract (N00019-73-C-0228).

The SAR instructions state that the Initial Contract Price should be the initial contract (target) price stipulated in the contract. The amount reported should therefore have been $32.94 million (see page 3).

The Current Contract Price should be changed to show the current contract target and ceiling adjusted for any definitized changes and estimates for any authorized but undefinitized changes. At September 30, 1973, there had been no contract changes, so the target amount shown should have been

the contract target of $32.94 million. Although there is no ceiling price stipulated in the contract, there is a cost threshold imposed by the Secretary of Defense of $44.37 million through Phase I. This amount includes Sikorsky contracts and costs for other non-Sikorsky items, such as government furnished equipment and effort.

The Price at Completion should have reflected the Government and contractor's current estimates to complete the contract.

The Navy informed us that the December 31, 1973, SAR had been changed to reflect the correct information.

RELATIONSHIP TO OTHER SYSTEMS

The CH-53E is being designed to be fully operable and maintainable on board Landing Platform Helicopter (LPH) and Landing Helicopter Assault (LHA) class ships and operable on board other prime amphibious and non-aviation Navy ships.

STATUS OF TESTING

The development of the CH-53E is being accomplished by prototyping. The contractor is required to develop and demonstrate two improved lift prototype aircraft that meet the heavy lift mission requirements of the Navy and Marine Corps (Phase I) before the Navy is allowed to continue with full scale development (Phase II). During full scale development the Navy must satisfactorily complete Initial Operational Test and Evaluation (IOT&E) before the Defense System Acquisition Review Council (DSARC) meets to consider the production decision (Phase III).

In our opinion testing has been adequate through the initial stages of development. Risk areas identified in the Development Concept Paper have been evaluated, hardware has been built and tested and problems which have arisen have either been solved by redesign and check out or redesign with check out scheduled for the Phase I prototype effort.

The next major testing effort is scheduled for September 1974 and will be conducted by the Navy with the prototype aircraft.

The Development Plan, coupled with the constraints set forth by the Secretary of Defense, represents an orderly, logical method for acquisition. The constraints provide assurance to the Government that it will not be irrevocably committed to the system. There is no pressure to move from one stage to the next because there can be no funds committed or contract entered into until the system has satisfactorily completed the requirements of the existing phase.

AGENCY COMMENTS

A draft of this study was reviewed by DOD officials associated with the management of this program and their comments are incorporated as appropriate. As far as we know there are no residual differences in fact.