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CONCEPTUAL CONFIGURATION EVALUATION STUDY FOR SINK RATE DELAY/I--ETC(U)
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- System Function
- Engineering Manhour Estimate
- System Activating Alternatives
- Material Requirements
- Cost Data

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This conceptual configuration evaluation study for the sink rate delay/improved in-water stability system for helicopters includes typical developmental component prices, physical characteristics of the system, system function, and system activating alternatives.

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FORM 46282 (3/67)

ABSTRACT

This Conceptual Configuration Evaluation Study for the Sink Rate Delay/Improved In-Water Stability System for Helicopters includes typical developmental component prices, physical characteristics of the system, system function, and system activating alternatives.

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1.0 PURPOSE

1.1 The purpose of this document is to evaluate the conceptual configuration of the "Sink Rate Delay/Improved In-Water Stability System for Helicopters.

2.0 SCOPE

2.1 The scope of this evaluation study will include component rice information, physical characteristics of the system, system function, and system activating alternatives.

3.0 BACKGROUND

3.1 Since the beginning of rotary-wing flight, concern has existed about the survivability, after ditching, of crew members and passengers in helicopters which operate mainly over water. The Navy has a special concern about its crew members since many fly day and night missions over water; carry passengers shore-to-ship, ship-to-ship, ship-to-shore; and fly vertical replenishment missions "round the clock".

3.2 During the Vietnam conflict, unique combat units such as the Special Landing Forces came into being. This unit was an air-ground mix of Naval and Marine personnel in readiness off the coast of South Vietnam for immediate helicopter launch into hot spots. Operational concepts such as this created a special concern as to the ability of helicopter crews and passengers to survive a ditching at sea.

3.3 These combat troops were heavily armed; loaded with ammunition, armor protection, canteens, helmets, etc./ and were usually dispatched for immediate combat deployment. When they went into combat they had no time for lengthy survival briefings, life raft inflation checkouts, donning mae-wests, etc., during their brief overwater flights. Nor is it likely they will have time for these activities in future similar situations.

3.4 An explanation is in order as to what takes place in an overwater flight in the event of a crucial emergency when helicopter's rotors are still turning. The helicopter's only method of survival is its limited capability of autorotation. Briefly this is a no-power maneuver in which the upward flow of air through the rotor system causes the blades to rotate as the helicopter descends. Just prior to touchdown, the accumulated energy within the spinning rotor system is converted into lift by increasing the rotor blade angle of attack and by flaring the helicopter. The resulting increased lift slows the rate of descent and cushions the aircraft's landing. For the autorotation to be successful, the pilot must have control of the aircraft, and the aircraft must have sufficient altitude and airspeed to be able to enter autorotation prior to water impact. To be completely successful, there must be favorable atmospheric conditions of wind and density altitude, a reasonable sea state, and adequate visibility.

3.5 An analysis was conducted of more than 200 Navy/Marine helicopter water mishaps. Significant lessons derived from the analysis are summarized below:

3.5.1 Seven different types of helicopters reacted similarly in water mishaps.

3.5.2 More than 50% sank in less than one minute.

3.5.3 All non-amphibious helicopters capsized before or during submergence.

3.5.4 Almost all sank nose first.

3.5.5 The longer the helicopter floated, the better the survival potential for crew and passengers.

3.6 From survivor statements, observer recollections, accident investigation reports, and reviews of available motion pictures of helicopter ditchings, the following events appeared to be consistent in their occurrence.

3.6.1 Helicopters react violently as the turning rotor blades hit the water during or following the ditching. The fuselage often rocks from side to side and the fuselage may turn around its vertical axis like an unwinding gyro. As rotor RPM decays and aircraft control is lost, the helicopter typically rolls inverted, left or right; rotor blades break or bend; and the helicopter fills with water, usually from the nose to the tail. The nose windows, not stressed for severe water impact, frequently implode inward, permitting rapid water entry. The helicopter sinks inverted, nose low.

3.7 The objective of the basic feasibility study was to determine the best methods of providing additional airframe buoyancy and stability to a helicopter. A delay in sinking rate and improved stability would provide adequate time for occupants of a ditched helicopter to successfully egress, if necessary. The helicopter would not sink so rapidly that occupants would be trapped inside by inrushing water, nor should the helicopter capsize, creating disorientation, confusion and panic, once it had been ditched.

4.0 PHYSICAL CHARACTERISTICS OF SELECTED SYSTEM

4.1 The conceptual design configuration of the Helicopter Flotation System consists of four externally encapsulated spherical flotation bags. These flotation bags are contained in two nose blisters and in two stub wing pods. These bags are capable of being inflated automatically or at the pilot's option. Inflation time is approximately 10 seconds. The flotation system is capable of automatic deployment in the event the helicopter is inadvertently flown into the water.

4.2 The flotation bags are made of protective-coated nylon construction with dual compartments in each sphere for minimum weight and stowage size. Each deflated bag is approximately 1.5 cubic feet in volume. The bags provide exceptional strength, as well as resistance to flame, fuel, fungus, salt spray and environmental extremes.

4.3 The total weight of the system is approximately 220 pounds. A weight summary is contained in the feasibility study D210-11003-1.

4.4 Pickup of established hard points at the base of the nose landing gear and on each stub wing as flotation bag anchor points provide ideal float location for stability and buoyancy.

4.5 An electrical firing circuit enables the pilot to deploy the flotation bags or they can be deployed automatically.

5.0 SYSTEM ACTIVATION AND OPERATION

5.1 PILOT-CONTROLLED OPERATION

5.1.1 The Flotation Arming handle located near the engine fire control panel on the instrument panel is pulled and rotated 90 degrees either way. This closes two contacts. The flotation Arming handle light comes on indicating "BAGS ARMED". The helicopter enters the water with power, and stabilizes with rotors turning. The aircraft is under pilot control.

5.1.2 The flotation toggle switch is put to the 'ON' position activating the inflation sequence for all 4 bags.

5.1.3 The encapsulation doors come off as the bags inflate out of their containers.

5.1.4 Engine condition levers are retarded; rotor brake arming lever is armed; rotor brake is applied. Aircraft is secured.

5.1.5 Aircraft floats upright.

5.2 AUTOMATIC OPERATION

5.2.1 Rotor brake arming handle contacts are closed if rotor brake is not armed (Note: Rotor brake can't be armed if throttles are in "FLY" position.).

5.2.2 Main landing gear also is fully extended. Micro switch closed (In flight the landing gear is always extended).

5.2.3 Both generators drop off the line as Rotor RPM is lost. (closes two contacts).

5.2.4 Zero speed sensor contacts close when rotor speed is less than 1 RPM.

5.2.5 When contacts are all closed, squibs fire, bags inflate out of containers, popping doors off, bags inflate into position.

5.2.6 Helicopter floats upright.

6.0 SERVICES AND MATERIAL NECESSARY TO DEVELOP THE HELICOPTER FLOTATION SYSTEM

6.1 The Engineering Manhour Estimate, Material Requirement and Cost Data is contained in Appendix A.

6.2 Estimated Travel Requirements are contained in Appendix B.

6.3 The Preliminary Program Schedule reflects accomplishment of the proposed program through demonstration and delivery of the prototype helicopter flotation system within eight months after receipt of authorization to proceed.

7.0 HELICOPTER FLOTATION SYSTEM ACTIVATING ALTERNATIVES

7.1 The inflating gases to inflate the flotation bags may be provided by alternate means. One method to be demonstrated will utilize CO_2 in conjunction with air aspirators. An alternate method to be demonstrated, consistent with component cost, utilizes gases derived from solid propellent cool gas generators. This method also utilizes air aspirators to supplement the inflating gases.

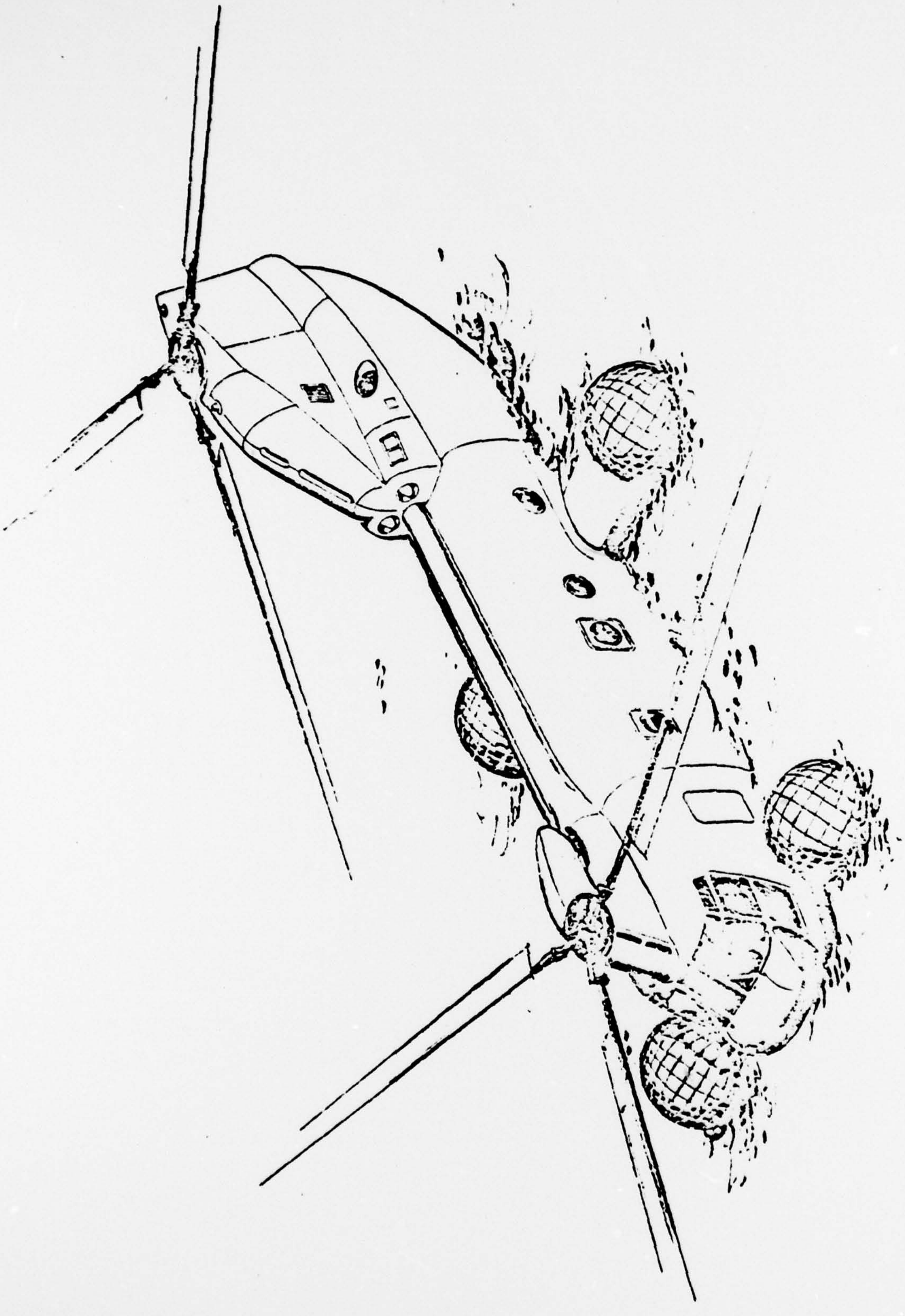

Figure 1. H-46 Helicopter Flotation-Stability System

APPENDIX A

APPENDIX A

HELICOPTER FLOTATION SYSTEM

ENGINEERING MANHOUR ESTIMATE, MATERIAL REQUIREMENTS, AND COST DATA

ENGINEERING MANHOUR ESTIMATES

		Hours
Task I	Study and Design Management	84
Task II	Fabricate and Assemble Prototype	600
Task III	Prototype Test Program	580
Task IV	Prototype Demonstration	160
Task V	Documentation	200
		1,824 M/H
		$63,185

MATERIAL REQUIREMENTS

Flotation Bag Encapsulation Pods Nuts, Bolts, Fittings, Bracketry, Fuselage Reinforcements, Fasteners, etc.	$20,000
Electrical Circuitry Test Circuit Squibs Switches Arming Lights, Wiring, Connectors, etc.	$ 500
Contingencies	$ 1,315

COST DATA

NOTE: The costs of the above program calculated using representative cost data (generated using industry rate averages) would be approximately $85,000

APPENDIX B

FLOTATION

TRAVEL

BOEING VERTOL COMPANY

TASK	NUMBER OF MEN	YEAR	NUMBER OF TRIPS	DURATION DAYS	DURATION NIGHTS	DESTINATION	PURPOSE OR JUSTIFICATION
II	1	1977	Five (5)	5	1	NADC, Warminister, Pennsylvania	System Coordination
II	1	1977	Three (3)	1	0	Trenton, N.J. (POV)	Inspect Material before shipment to Navy
III	1	1977	One (1)	One (1) Week		NADC, Warminister, Pennsylvania	Technical Consultation
IV	2	1977	One (1)	Two (2) Weeks		NADC, Warminister, Pennsylvania	Prototype Demonstration

APPENDIX C

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PRELIMINARY PROGRAM SCHEDULE

SCHEDULING DATA SHEET

PROGRAM Helicopter Flotation System

CONTRACT

AUTHORIZATION

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DATE ISSUED	
DATE REVISED	
PREPARED BY	
APPROVED	
APPROVED	

ACTIVITY / MONTHS	1	2	3	4	5	6	7	8
GO-AHEAD								
TASK I - STUDY AND DESIGN								
TASK II - FABRICATION & ASSEMBLY								
TASK III - PROTOTYPE TEST PROGRAM								
TASK IV - PROTOTYPE DEMONSTRATION								
TASK V - DOCUMENTATION								
1 PERIODIC REPORTS								
2 ENGR'G. DRAWINGS								
3 FINAL REPORT								