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STUDENT REPORT

THE QUEST FOR A HELICOPTER SUITABLE FOR
COMBAT RESCUE, 1967-1983

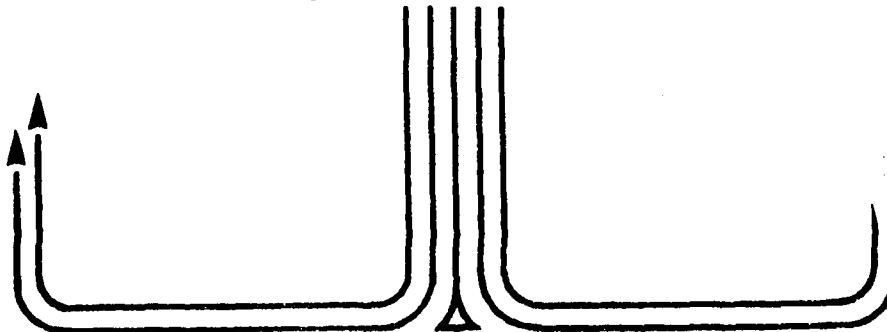
MAJOR THOMAS O. JAHNKE

85-1330

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REPORT NUMBER 85-1330

TITLE THE QUEST FOR A HELICOPTER SUITABLE FOR COMBAT RESCUE,
1967-1983

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Submitted to the faculty in partial fulfillment of
requirements for graduation.

AIR COMMAND AND STAFF COLLEGE
AIR UNIVERSITY
MAXWELL AFB, AL 36112

REPORT DOCUMENTATION PAGE				
1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED		1b. RESTRICTIVE MARKINGS		
2a. SECURITY CLASSIFICATION AUTHORITY		3. DISTRIBUTION/AVAILABILITY OF REPORT		
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE				
4. PERFORMING ORGANIZATION REPORT NUMBER(S) 85-1338		5. MONITORING ORGANIZATION REPORT NUMBER(S)		
6a. NAME OF PERFORMING ORGANIZATION ACSC/EDCC		6b. OFFICE SYMBOL <i>(If applicable)</i>	7a. NAME OF MONITORING ORGANIZATION	
6c. ADDRESS (City, State and ZIP Code) Maxwell AFB AL 36112		7b. ADDRESS (City, State and ZIP Code)		
8a. NAME OF FUNDING/SPONSORING ORGANIZATION		8b. OFFICE SYMBOL <i>(If applicable)</i>	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	
8c. ADDRESS (City, State and ZIP Code)		10. SOURCE OF FUNDING NOS		
		PROGRAM ELEMENT NO	PROJECT NO	TASK NO
				WORK UNIT NO
11. TITLE (Include Security Classification) THE QUEST FOR A HELICOPTER SUITABLE				
12. PERSONAL AUTHOR(S) Jahnke, Thomas O., Major, USAF				
13a. TYPE OF REPORT		13b. TIME COVERED FROM _____ TO _____	14. DATE OF REPORT (Yr., Mo., Day) 1985 Apr 1	15. PAGE COUNT 21
16. SUPPLEMENTARY NOTATION ITEM 11: FOR COMBAT RESCUE, 1967-1983				
17. COSATI CODES		18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB GR		
19. ABSTRACT (Continue on reverse if necessary and identify by block number) This paper provides a concise, historical perspective of the quest for a helicopter suitable for combat rescue. Concentrating on the period 1967-1983, this report looks at the historical development, roles and missions, and analyzes the selection process of four different combat rescue helicopters. The study concludes that the unique mission requirements of combat rescue require aircraft designed from the ground up as "pure" rescue helicopters.				
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT <input checked="" type="checkbox"/> DTIC USERS <input checked="" type="checkbox"/>		21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED		
22a. NAME OF RESPONSIBLE INDIVIDUAL ACSC/EDCC Maxwell AFB AL 36112		22b. TELEPHONE NUMBER <i>(Include Area Code)</i> (205) 293-2483	22c. OFFICE SYMBOL	

PREFACE

Air rescue became a vital part of American airpower in World War II. Since 1946, the Aerospace Rescue and Recovery Service (ARRS) has been the chief Air Force advocate for enhanced fixed and rotary-wing aircraft to perform this mission. From the primitive Sikorsky H-5 helicopter used in Korea to the sophisticated, 21st century, HH-60 "Nighthawk," capable of night, adverse weather search and recovery, ARRS has been on the cutting edge of advanced helicopter technology. The command's ultimate goal being the acquisition of a superior helicopter capable of performing a worldwide combat rescue mission.

This paper, the quest for a helicopter suitable for combat rescue, 1967-1983, tells part of this story. Chapter one provides a brief historical overview of combat rescue and makes the point that combat rescue, a relatively new phenomenon, grew out of the Luftwaffe's combat experience in World War II. Next, chapter two describes the roles and missions of Air Force combat rescue helicopters in Korea and Vietnam. In both wars, the helicopter proved a superior rescue vehicle. Chapter three provides an analysis of the selection process of four different helicopters and discusses the modifications required to make them viable, all-purpose combat rescue helicopters. Finally, in chapter four, the selection process is summarized and draws the conclusion that wartime search and rescue requires a unique aircraft designed from the ground up as a "pure" rescue helicopter.

In preparing this paper, the author wishes to thank Donald D. Little, 23rd Air Force historian. His expert assistance and thorough knowledge of ARRS history was most helpful. Finally, the author wishes to dedicate this short history to retired Col Warren R. Lilly, USAF. He went to Vietnam and returned seven years later.

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ABOUT THE AUTHOR

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Major Jahnke has written several articles for the Aerospace Rescue and Recovery Service. His latest, "MAC's Newest--The 23rd Air Force," was published in the Fall 1984 issue of *Airlift: The Journal of the Airlift Operations School*.

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REPORT NUMBER 85-1330

AUTHOR(S) MAJOR THOMAS O. JAHNKE, USAF

TITLE THE QUEST FOR A HELICOPTER SUITABLE FOR COMBAT RESCUE, 1967-1983

I. **Purpose:** Can an examination of the quest for a helicopter suitable for combat rescue, 1967-1983, help define future acquisition requirements such as the HH-60?

II. **Statement of Problem:** Although the United States Air Force (USAF) used helicopters for combat rescue since World War II, each helicopter has been an existing helicopter, purchased "off-the-shelf," then modified at great expense to accomplish the combat rescue mission. As a result, the Aerospace Rescue and Recovery Service (ARRS), as the USAF's single manager of helicopters, has never had a helicopter designed from the ground up specifically for combat rescue. Can a concise history of combat rescue helicopters help define requirements for future rescue helicopters?

III. **Objective:** This report provides a concise, historical perspective of the Air Force selection process for combat rescue helicopters. This perspective considers the development of combat rescue forces, tactics, and doctrine; looks at the rolls and missions of combat rescue helicopters in two wars; then analyzes the selection process using four helicopters. Finally, this report identifies factors that may preclude the development of follow-on combat rescue helicopters and sheds new light on analyzing future combat rescue helicopter requirements.

IV. **Conclusion:** In peacetime, given the fiscal constraints imposed on defense spending, as well as the relatively low priority of combat rescue,

CONTINUED

ARRS bought existing helicopters, designed for other missions, and modified them for combat rescue. This process, while expensive, made aircraft immediately available for wartime and saved the research and development costs associated with new aircraft designs. However, in wartime, the design deficiencies inherent in these aircraft caused ARRS to search for other, more capable helicopters. Given these spending constraints, the question arises, can the Air Force afford new aircraft designed from the ground up as "pure" rescue helicopters? In the event of war, can we not afford a viable rescue helicopter? Additionally, based on the current enemy threat, can we afford to develop even more sophisticated aircraft such as the joint vertical lift experimental aircraft, when less expensive, already available helicopters, can perform this same mission?

Chapter One

A BRIEF HISTORY OF COMBAT RESCUE

Brigadier General Thomas J. Dubose, Commander, Air Rescue Service from 1952 to 1959, once said ". . . it has always been a source of wonder and pride that the most potent and destructive military force ever known should create a special service dedicated to saving life. Its concept is typically American We hold human lives to be the most precious commodity on earth" (2:2). The value of combat rescue forces is well known. When combat crews are assured of a reasonable chance of being rescued, their effectiveness as a combat force is enhanced. The idea of developing a specialized force to rescue downed aircrew members encompasses these three ideals:

First, the traditional belief in the sanctity of human life. Because of this dedication to the preservation of life, the American military made extensive efforts to protect the lives of fighting men throughout World War II, the Korean War, and the struggle in Vietnam. Secondly, the expense of training a pilot for the United States Air Force surpassed the quarter-million dollar mark long before the war in Vietnam. As a pilot gains experience and his value to the Air Force increases, so logically everything possible should be done to protect the Air Force's investment. Finally, from the early days of aerial combat the men who fly and fight performed their duties more efficiently knowing that every effort would be made to rescue them if they were shot down. As a result of these attitudes, rescue evolved into the proud heritage of the Aerospace Rescue and Recovery Service (ARRS) and of the men who labor that others may live. (2:2-3).

The rescue mission, defined in Air Force Regulation (AFR) 23-19, is to "provide a world-wide [sic] capability to search for, locate, and recover personnel . . ." (4:1) in distress on land or at sea. The primary missions which fall under this broad spectrum include, but are not limited to the following: providing combat forces to rescue United States Air Force (USAF) personnel from hostile areas and providing forces for taking part in special operations.

Although ARRS is charged with the responsibility of rescuing downed USAF aircrews in hostile environments, air rescue in United States military doctrine is a relatively new phenomenon, having evolved from the German Luftwaffe experience in World War II. "The Germans had a small rescue

service integral to the Luftwaffe in 1939, but it was not until the invasion of Norway and major bombardment of England that the need was fully recognized" (7:unnumbered). The German contribution to air rescue, with its emphasis on doctrine, tactics, and specialized equipment, proved that air rescue was a viable addition to any nation's war fighting capability and an indispensable element of national power.

Like the Germans, the British and Americans quickly established air rescue forces in 1940 and 1942 respectively. "Although rescue from the water dominated search and rescue activities in World War II, rescue from land areas received increasing attention as the war dragged on" (2:7). From this need came the development of the helicopter as a rescue vehicle, a development that came late in World War II.

Even though the United States Army Air Forces (later USAF) did an outstanding job rescuing downed aircrew members in World War II, saving nearly 5,000, the question of future conflicts and the coming jet age forced policy makers to consider the reorganization and expansion of a rescue force capable of meeting the global responsibilities of United States airpower. All too often, as our World War II experience showed, rescue forces were too few in number, acting too independent of each other, and lacking standardized equipment, tactics, and doctrine.

To remedy this situation, Lieutenant General Hoyt S. Vandenberg, Assistant Chief of the Air Staff for Operations, proposed consolidating all air rescue forces under the Air Rescue Service (ARS) of the Air Transport Command. As an integral part of the United States Army Air Forces, ARS was established on 13 March 1946. Conceived during a period of rapid postwar demobilization, ARS consisted of ". . . a headquarters, two squadrons, 10 detachments, and . . . 1135 personnel" (7:unnumbered). The total ARS inventory consisted of a mix of 116 fixed and rotary wing-aircraft.

Even though postwar budget cutbacks limited air rescue force growth, it centralized rescue resources under one command. Thus, a small and highly mobile rescue force was immediately available for war or contingency. Shortly after, on 25 June 1950, elements of the North Korean Army crossed into South Korea. Five weeks later, ARS aircrews entered the battle. Commenting on the role of the helicopter in Korea, one author writes:

Helicopter use for search and rescue [SAR] in a combat situation came into its own during the Korean War when more than 20,000 personnel were rescued or evacuated. Air Rescue Service was officially credited with 9,688 saves, nearly 1,000 of them from behind enemy lines. These figures are most impressive when we realize two facts: (1) these were human lives saved from almost certain death or capture and (2) these saves were made with antiquated, underpowered helicopters possessing limited hover capability and maximum airspeeds of less than 80 knots. By the end of the Korean war, the concept of helicopter search and rescue was firmly established in the Air Force. (13:1).

The ARS, bloodied in combat, emerged at the end of the Korean War a

highly trained and professional force. However, "because an air rescue force does not have a potential for military deterrence, its manpower and equipment levels rise only with the onset of war and fall quickly in times of peace" (17:1). Thus, by 1958, ARS combat rescue forces were reduced and the aircrew recovery mission was all but eliminated. With the exception of one group of specially modified C-47 aircraft for use in the Strategic Air Command's long-range SAR role in the Soviet Union, the Air Force no longer had a force trained and equipped for SAR in hostile environments. Consequently, with the dispersal of the remaining rescue helicopters to other commands throughout the world, ARS no longer developed tactics or procured new equipment to keep pace with the USAF tactical force modernization. In 1961, equipped with only 58 fixed-wing aircraft, "rescue efforts were limited to peacetime tasks under the concept that war contingency requirements should be accomplished as an extension of peacetime capability using the same resources" (7:unnumbered).

With the escalation of hostilities in Southeast Asia, the Air Force was once again called on to provide combat rescue expertise. However, by August 1964, all combat rescue aircraft in the inventory were outdated, and tactics and doctrine were inadequate to meet the North Vietnamese threat or the needs of USAF tactical forces employed in the theater of operations.

"Soon after the Gulf of Tonkin incident, four ARS provisional detachments were organized in Southeast Asia. This was the beginning of a buildup that continued until 1972, then gradually diminished through 1975" (3:6). The initial ARS force structure in Vietnam consisted of seven obsolete and vulnerable aircraft stationed in Thailand and South Vietnam. As the war intensified, ARS, later redesignated Aerospace Rescue and Recovery Service, rapidly expanded to include 18 helicopter detachments of 28 HH-43B helicopters. Later, this force was increased to include the CH-3C and CH-53A helicopters. These two aircraft, modified to a rescue configuration, were superior helicopters and admirably performed the combat rescue mission in Southeast Asia.

Equipped with the most modern aircraft in the world, ARRS aircrews were justifiably proud of their wartime accomplishments. During this conflict, ARRS personnel saved the lives of 4,128 personnel, of which 2,788 were combat saves. In addition, ". . . the gallantry of rescue personnel in Southeast Asia was highlighted by more than 33,000 individual decorations, including one Medal of Honor, 37 Air Force Crosses, and over 600 Silver Stars. Rescue units also earned 86 campaign streamers, 128 [sic] decorations, including 23 Presidential Unit Citations, and 106 Outstanding Unit Awards" (3:6).

In 1975, as hostilities ended in Southeast Asia, rescue forces redeployed to the United States. As a result of this conflict, Air Force planners now recognized the need for a readily available, modern, mobile, and highly trained combat rescue force. With the exception of subsequent personnel drawdowns and training accidents, the ARRS force structure remained constant until the addition of 11 UH-60A helicopters in 1982-1983. Two of these aircraft, the first new Air Force helicopters in 20 years, are now undergoing prototype development at Edwards Air Force Base, California. Designated the

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"rubber on the ramp," but at the expense of modern rescue forces of adequate design and number. The source selection process for the HH-60A helicopter provides one more example of the problems the USAF faced in aircraft acquisition.

A previous commander of the Air Rescue Service, Brigadier General Thomas J. Dubose, once said it was a source of wonder and pride that the United States, the most powerful nation on earth, could create a special service dedicated to the preservation of human life. Undoubtedly, this nation still believes in this ideal, but at what cost? Can we as a nation afford modern, highly sophisticated, multiple mission helicopters? Can a battlefield commander, engaging Warsaw Pact forces, afford the luxury of using \$10 million helicopters to recover downed aircrew members when a 25-year old UH-1 "Huey" helicopter would suffice? Even if he is recovered, will the fighter pilot have another F-15 waiting for him on the flight line? Finally, given the quantity and quality of the Soviet threat, can we afford to develop ever more sophisticated hybrid aircraft such as the joint vertical lift experimental aircraft? Programmed for the early-1990s, will this aircraft be able to penetrate and counter existing enemy air and ground defenses? With a projected price tag of over \$25 million each, is the cost worth it?

History clearly shows, given the constraint imposed on peacetime defense spending, that existing helicopters, designed for peacetime missions, can perform the combat rescue mission. To do this mission, however, requires extensive and costly changes which, in some cases, exceed the cost of the basic airframe. If the USAF has learned any lesson from this experience it is this: wartime SAR requires unique aircraft designed from the ground up to perform the combat rescue mission. The question remains: can we afford the costs associated with this need?

Chapter Four

SUMMARY

The objective of combat rescue since World War II has been the successful recovery of American forces from hostile environments. To perform this mission requires modern and capable aircraft specifically designed for the combat rescue mission. History has shown, however, that neither the USAF nor ARRS was equipped with a rescue helicopter designed especially for combat rescue. Instead, ARRS took already available aircraft then modified them for combat. From the H-5 to the HH-53 helicopter, this process was costly, both in terms of modification costs and in degraded performance. Even with the Army's UH-60A, designed to succeed the HH-3, ARRS will have to add more powerful engines, a strengthened gearbox, external fuel tanks, an air-refueling probe, a rescue hoist, titanium armor plate, and advanced avionics.

In today's combat environment, particularly in a worst case European scenario, USAF tactical aircraft attrition rates will be high. In addition, enemy targets will be highly defended by state-of-the-art ground and air defenses. Moreover, the battlefield will be swept by electronic counter-measures of all types further complicating the USAF's tasks of air superiority and battlefield interdiction. Despite these problems, ARRS is charged with the responsibility of penetrating the FEBA under the cover of darkness, in adverse weather, and recovering downed aircrew members.

In the post-Vietnam era, ARRS once again found itself ill-prepared to perform the combat rescue mission. Aircrews trained using antiquated Vietnam-era tactics and procedures, using worn out and outmoded helicopters. Helicopters designed for 4,000 flight hours now approached 6,500 flying hours. Tactics designed for an era when the USAF held air supremacy were being used to penetrate the latest Warsaw Pact air and ground defenses. New combat rescue helicopter proposals were being offered based on mid 1970's technology. While the Air Force learned many lessons from the Vietnam War, it did not apply some of those lessons, especially in the selection of new combat rescue helicopters.

Beginning in 1964 with the HH-43B, ARRS took existing helicopters from the USAF inventory and extensively modified them for worldwide combat rescue. For each helicopter, design deficiencies and/or lack of some aircraft capability led to another "more capable" helicopter. Even with an extensively modified vehicle such as the HH-53H, ARRS and the USAF never had a "pure" rescue helicopter designed from the ground up to perform a worldwide combat SAR mission. The demands of the combat situation, as well as a shortfall in aircraft, required readily available aircraft instead of long-term research and development of new rescue designs. Ultimately, this put

to HH-60A configuration.

By 1983, the USAF, based on APPS planning studies, had programmed a total of 243 HH-60 helicopters. Subsequent analysis, plus a highly unfavorable Government Accounting Office report, questioned this number and forced the USAF to reevaluate the program. Congressional concern over the aircraft's high cost (almost \$19.5 million), plus the consolidation of TAC's special operation (SO) mission under MAC, also led to a redefinition of the combat rescue helicopter mission. Now ARRS helicopters would perform both the combat SAR and SO missions with the ultimate objective being the consolidation of both missions under one squadron. As a result, Congress forced the Air Staff to cut the procurement schedule from 243 aircraft to 155 aircraft, 89 of which would be "Pave Low" modified, and the remaining capable of night precision navigation without an adverse weather capability. Able to perform both the combat rescue and SO missions, these aircraft would provide theater commanders an enhanced combat capability throughout the conflict spectrum.

Congressional discontent with the high cost of the program surfaced again in mid-1984, further reducing this number to 90 aircraft. Now designated the HH-60A, this third derivative of the basic UH-60A is much less capable than the "Pave Low" modified HH-60D. With a flyaway cost of about \$10 million, the HH-60A will still provide the combat rescue force with a modern, state-of-the-art helicopter. Flown by the most highly trained crews in the world, the HH-60A promises to become a superior combat rescue helicopter.

the mission of the H-X as ". . . combat aircrew recovery in hostile territory in daylight or darkness, and under instrument meteorological conditions" (10:2). To justify the H-X, the USAF argued ". . . the H-3 would be 20 years old in 1983, the H-3 was subject to considerable limitations in speed, gross weight, hover capabilities; and it was not cost effective to add ECM [electronic countermeasure], IRCM [infrared countermeasure], navigation, armor, and other equipment to existing aging H-3s" (6:92).

The inadequacies of the USAF's combat rescue helicopter force, both in terms of mission capabilities and number of aircraft required to perform the worldwide combat rescue mission, clearly demonstrated the need for the H-X helicopter. In addition, to regain a viable rescue capability in the near term, plus the relatively small number of total airframes required, meant the selection of an existing helicopter design. The urgency of the need, particularly as a result of our failure to rescue the Iranian hostages, did not allow ARRS the luxury to develop a new aircraft from the ground up or continue modifying existing aircraft such as the HH-53 and HH-3. The new helicopter had to be readily available and capable of sustained combat operations with the following capabilities: be reliable and easily maintained; be combat and crash survivable; be impervious to 7.62 mm small arms and light antiaircraft weapons; possess a rescue hoist; be able to self-deploy or be easily transported by MAC strategic airlift; be able to match the cruise performance of ARRS HH-3 and HH-53 helicopters; and promote commonality of design with existing Department of Defense resources (11:5).

In February 1981, HQ MAC/XPGA in conjunction with ARRS/DOR, published MAC Statement of Need (SON) 82-81. The SON reiterated the current ARRS shortfall in combat rescue helicopters and stated it could best be corrected by the acquisition of the UH-60A "Blackhawk." Already in production since 1976, the UH-60A grew out of the United States Army's airmobile helicopter experience in the Vietnam War. The aircraft possessed the ". . . performance, reliability, maintainability and survivability characteristics required of a combat rescue helicopter" (11:5). With an unrefueled range of 127 nautical miles and dash speed of 160 knots, the UH-60 can withstand a 2,500 feet per minute rate of descent ground impact. Designed to be invulnerable to small arms fire, safety of flight items can survive a 23 mm high explosive shell without catastrophic failure. Furthermore, based on an Office of Secretary of Defense and Undersecretary of Defense for Research and Engineering assessment of a new helicopter, ". . . an existing airframe such as the UH-60 . . . appear[s] as the best alternative to fill the need" (15:44).

To justify the need for a new combat rescue helicopter, USAF, in mid-1979, issued a Mission Element Needs Statement (MENS) for the acquisition of the H-X. Signed on 22 November 1980 by the Secretary of the Air Force Hans Mark, the MENS provided for the mission validation and sole source acquisition of a modified UH-60A with competition for avionics and systems integration. The decision to procure the UH-60 came after the Congressional debate over additions to the Fiscal Years 1981 and 1982 budgets. A total of 11 helicopters were approved with the first nine going to the 55th Aerospace Rescue and Recovery Squadron, located at Elgin Air Force Base, Florida, and the remaining two delivered to the Air Force Systems Command for modification

make a night approach into a hover and affect a recovery. First delivered to a combat rescue unit in Thailand in late-1971, the NRS helicopter was

equipped with a movable low light level TV (LLLTV) camera, a TV screen, an automatic deceleration and descent system, an IR (infrared) illuminator, an automatic hover coupler, and a hover trim control stick. With the NRS equipment, the HH-53 could make an automated programmed approach and descend to a hover over a survivor. (17:11).

During the early 1970s, Air Force planners, based on an analysis of the changing Soviet defensive and offensive threat, identified the need for additional modifications to the HH-53C. As a result, the Aeronautical Systems Division of the Air Force Systems Command, in conjunction with ARRS and the Military Airlift Command (MAC), developed a successor to ARRS NRS equipped helicopters. Called the HH-53H "Pave Low III," it combined an existing high-tech terrain following/terrain avoidance radar with the combat proven HH-53 airframe. Based on the concept of night, adverse weather, low-level flight, the "Pave Low III" satisfied the objective of MAC's Requirement of Capability 19-70 for a night, adverse weather aircraft able to fly over any terrain at low altitude. Initiated in 1973 with a program for modifying only nine airframes, the HH-53H represented the cutting edge of advanced helicopter technology.

THE HH-60A

Even though the HH-53H represented the state-of-the-art technology, the limited number of airframes, coupled with airframe age and high cost of aircraft modification, forced ARRS to search for yet another helicopter able to do the combat rescue mission in a high threat environment against high-tech enemy defenses. After the abortive Iranian hostage rescue attempt in April 1980, and the resultant transfer of the HH-53Hs to the 1st Special Operations Wing of TAC, the ARRS need was immediate and required an existing and readily available helicopter.

The USAF combat rescue helicopter mission statement has always been unconstrained, incorporating both combat and noncombat environments at all levels of conflict. "One of the key reasons for not being able to acquire combat rescue systems has been the lack of a definitive combat rescue mission statement in Air Force doctrine" (?:unnumbered). This lack of definition meant a mission, conducted without limits throughout the conflict spectrum, with little or no support requirements. Consequently, ARRS planners developed numerous mission statements without regard to fiscal or technological reality.

To correct this problem, MAC and ARRS planners, for the first time, defined the combat rescue mission in MAC General Operation Requirement (GOR) 4-77, dated 2 December 1977. Titled "H-3 Rescue Replacement Helicopter," or H-X, this document stated that the only helicopter able to meet the performance requirements identified in the GOR was the HH-60A "Blackhawk," currently being manufactured by the Sikorsky Division of United Technologies. The GOR defined

Electric T64-GE-1A (later -3) engines, the "BUFF" could cruise comfortably at 140 knots true airspeed, and if necessary, dash at 195 knots. Titanium armor plate protected the aircrew and vital engine and system components making it invulnerable to small arms fire. Equipped with three General Electric 7.62 millimeter (mm) miniguns, the HH-53 provided the rescue task force commander greater firepower and survivability in combat.

Although introduced into combat on 15 September 1967, within a year performance problems surfaced which severely restricted the ability of the HH-53B to accomplish the high altitude SAR mission. Unable to hover out of ground effect at altitudes above 4,000 feet density altitude at temperatures above 80 degrees Fahrenheit without dumping fuel, the engine's power limitations placed the aircraft dangerously close to main rotor blade stall. Moreover, high terrain, weather avoidance, and operational requirements often dictated air-refueling with the HC-130 at altitudes above 10,000 feet mean sea level. Flight operations at that altitude placed the HH-53 at maximum power with no reserve. The "B" model's operational limitations are explained by Lt Col Charles R. Campbell, Commander, 40 Aerospace Rescue and Recovery Squadron (ARRS). He writes:

In the northern SAR area of responsibility for the 40th [ARRS] the average mission altitude is 4600 feet density altitude. Also, several missions in the eastern and southern SAR areas have been at or above this same altitude. For a "B" model to make a pick up under these conditions, the auxiliary fuel tanks must be jettisoned and internal fuel dumped down to between 2500-3000 pounds, allowing approximately 1700 pounds of fuel for ingress, hover and egress. This leaves only 30 minutes of fuel remaining-if all goes well on the [mission]. This condition also requires hovering with only a two percent power reserve . . . which is a situation where everything must be perfect for a successful mission. Also, from the center of our northern area of responsibility there are no safe recovery bases within 30 minutes flying time. Consequently, an immediate aerial refueling would have to be [made] . . . (9:1).

By 1968, the USAF began to deliver a new version of the HH-53B to ARRS combat units in Vietnam. Called the HH-53C, this aircraft had the T64-GE-7 engine which gave rescue crews a greatly improved combat SAR capability. Besides more powerful engines, the "C" model was also equipped with two 450 gallon jettisonable fuel tanks, upgraded avionics, and a 20,000 pound rated external cargo hook.

The HH-53C was the last combat rescue helicopter introduced in Vietnam. As the air war intensified and the North Vietnamese ground threat became more deadly, ARRS began to consider additional modifications to the "C" model. While the HH-53C helicopter represented the best in the rescue inventory, it still lacked sufficient night and adverse weather capability, an advantage necessary when operating in highly defended areas. One modification which would enable the helicopter aircrew to operate in an adverse weather, night environment, became known as the Limited Night Recovery System (LNRS). Later called the Night Recovery System (NRS), it permitted the helicopter pilot to

formidable rescue helicopter complete with armor plating, enhanced navigation and communication radios, a 240 foot rescue hoist, an air-refueling probe, auxiliary fuel tip tanks, and suppressive armament. With the exception of upgraded engines, the HH-3E corrected many of the problems identified in the earlier CH-3. However, with no increase in power, the additional weight of the added rescue equipment only aggravated an already serious lack of engine performance. The solution to this problem was the installation of new, more powerful engines.

In April 1968, the Air Force Flight Test Center completed flight testing of the HH-3E for the installation of an upgraded engine, the T58-GE-5. This engine increased power by 200 shaft horsepower. Moreover, the increase in power led to a greater combat capability with little or no degradation in transmission life, drive train, or tail rotor effectiveness. Even though the "-5" engine produced greater power throughout the entire flight envelope, it still could not overcome the additional weight caused by the rescue modifications. In essence, the HH-3E's operational capability, while much improved over the HH-43B/F, was still marginal, especially in a hot, high altitude situation. Consequently, the HH-3 remained only marginally capable of performing the rescue mission.

THE HH-53B/C

Although the HH-3E represented "off-the-shelf" technology, it greatly enhanced the combat rescue force capability available to theater tactical commanders. However, like the HH-43 "Pedro" before it, the HH-3's performance limitations necessitated the acquisition of a newer, more capable helicopter, the CH-53A.

Originally designed for the United States Marine Corps in 1962, the CH-53A ". . . had the necessary power, speed, range, and physical size to meet the needs of rescue units in Southeast Asia" (2:98). Capable of greater speed, increased hover performance in the hot, high altitude environment of Southeast Asia, a modified CH-53 could meet the near term requirements of the Department of Defense's Project PROVOST (Priority Research and Development Objective for Vietnam Operation Support) program. Titled "High Performance Search and Rescue Aircraft," the objective of this program was to develop and procure a new search and rescue aircraft capable ". . . of surviving in the hostile environment of AA [antiaircraft weapons] . . . and small arms. This can only be realized through the development of a more responsive SAR aircraft capable of high performance and self-protection" (14:2). While the CH-53 represented a great leap in technology over the older HH-3E, the CH-53 had to be quickly modified to a combat rescue configuration. Designated the HH-53B, it soon evolved into a superior rescue helicopter.

In addition to correcting the performance limitations of the earlier HH-3, the HH-53 significantly upgraded ARPS capability to recover United States military personnel under combat conditions. Known as the "Super Jolly Green Giant" and "BUFF" (Big Ugly Flying Fellow), the HH-53's flight time with air-refueling was limited only by aircrew stamina. Powered by two General

modified the "B" model to the "F" model standard with a more powerful engine, self-sealing fuel tanks, upgraded transmission, bullet resistant glass, and aircrew and aircraft component armor. The "F" model, while an improved and more capable helicopter, was still only marginally capable of performing the combat rescue mission in the hot, high altitude environment of Southeast Asia. Even with an increase in range to 260 nautical miles, the lack of increased speed, and the vulnerability to enemy weapons, dictated the need for an enhanced combat rescue helicopter. The ARRS now looked to the Tactical Air Command (TAC) for a helicopter able to perform the SAR mission.

THE HH-3C/E

This aircraft, the venerable CH-3C, was originally designed for the logistical airlift of both personnel and cargo. With greater size, speed, and range than the HH-43, the CH-3 represented a quantum leap in helicopter technology. Introduced in Vietnam in mid-1965, and later modified to a combat rescue configuration, the HH-3C "Jolly Green Giant" provided increased aircrew protection, suppressive armament, and increased range and speed.

While a suitable aircraft for logistical support, it lacked the necessary performance and defensive countermeasures necessary to survive in highly defended areas. At best, the CH-3 could perform the combat rescue mission, but only in a low to medium threat environment. Unfortunately, the nature of international crises require rescue forces that can be quickly deployed and employed against the enemy. On the battlefield, modern rescue forces must be able to penetrate the forward edge of the battle area (FEBA) to recover downed aircrew members. The rescue crew must also operate in an environment in which it would be exposed to such sophisticated enemy weapons as armed fighter or helicopter aircraft, radar, optical, and infrared guided missiles, and guns. The USAF's combat experience proved the CH-3C could not operate in this environment.

Powered by two General Electric T58-GE-1 engines that each develop 1,300 shaft horsepower, "the ability of the . . . [CH-3] . . . to operate in a heavy gross weight condition in other than a low altitude environment was extremely marginal" (16:5). Flight test data published by the Air Force Flight Test Center, Edwards Air Force Base, California, substantiated this fact and test results clearly showed a decrease in available engine power as altitude and temperature increased. This degradation in performance was crucial to USAF operations in Southeast Asia and effectively prevented the successful recovery of downed aircrew members at higher elevations. In addition, the CH-3's relatively slow cruise speed of 90 knots greatly increased the exposure time to hostile gunfire while adding to the flight time required to reach the recovery area. Since speed was essential to a successful aircrew recovery, the time required to reach the SAR area often meant the difference between capture or freedom.

With the further modification of the combat configured HH-3C, now designated the HH-3E in November 1965, ARRS was much better equipped to provide long-range SAR in Southeast Asia. Without a doubt, the HH-3E was a

Chapter Three

AN ANALYSIS OF COMBAT RESCUE HELICOPTERS

The primary mission of ARRS is combat rescue and the primary objective of any SAR mission is the successful recovery of the survivor in good condition. In a peacetime environment, the recovery of a downed aircrew member is relatively easy since rescue crews must only contend with bad weather, unfavorable terrain, and the survivor's location. In wartime, these factors are present but they are made much more difficult by enemy actions or threats. Thus, by definition, a rescue vehicle designed for a wartime mission is a much more capable aircraft than one designed for peacetime. And conversely, an aircraft designed for peacetime is not always able to perform a combat mission without major modification.

"Historically, ARRS has adapted existing helicopters, designed for other missions, to the combat rescue role" (16:1). In the short-term, this saved the research and development costs associated with a new helicopter. Ultimately, this put "rubber on the ramp," but at the expense of a true rescue vehicle able to perform a worldwide combat rescue mission. In combat, when using existing aircraft, initial mission success can be quite high, but as the enemy's capability grows, the threat intensifies, and tactics become known, the overall mission success rate quickly falls.

THE HH-43B/E

"During periods of armed conflict . . . [when] . . . the need for a strong and viable rescue force is evident . . . vast amounts of resources and efforts are expended to modify existing aircraft to meet the current needs for a rescue vehicle" (16:1). However, because rescue equipment designed for peacetime does not always suffice in wartime, ARRS ". . . was not prepared to effectively accomplish the combat rescue mission [in Vietnam]" (8:2). In June 1964, when the USAF introduced rescue forces into Vietnam, the HH-43B was the only rescue helicopter available. Originally designed for the local base rescue mission, it lacked range, speed, power, and suppressive armament. Even with the addition of externally carried 55-gallon fuel drums for increased range, the "B" model was wholly inadequate for SAR operations deep inside North Vietnam.

Besides the limitation on range, the "B" model was restricted to day visual flight operations, with a top speed of only 100 knots indicated airspeed, a forward landing location was critical to insure the success of any long-range SAR operation. Recognizing these deficiencies, ARRS in 1965,

border, rescue aircraft were located strategically close to high strike targets in North Vietnam.

With the introduction of combat rescue helicopters in Korea and Vietnam, the combat SAR and medical evacuation missions became an integral part of American tactical airpower. As a specific mission of the USAF, combat rescue required an adequate force structure, equipped and trained to accomplish a dangerous mission. In the Vietnam War, as the enemy air-to-air and ground-to-air threat became more intense, the need for more capable helicopters, as well as improved combat tactics became apparent. Despite the high priority placed on rescuing downed American airmen, ARRS aircrews still had to fly "off-the-shelf" helicopters, specially modified for the combat rescue mission. In the short run, this requirement made aircraft quickly available, but at the expense of a long-term research and development effort to design a true rescue helicopter.

recovery of over 8,890 personnel, including almost 1,000 combat saves.

In their primary role of combat rescue, the aging and vulnerable Sikorsky H-5 and H-19 helicopters performed admirably. Operating in conjunction with fixed-wing aircraft such as the L-5 light liaison aircraft, the helicopter was ideally suited to operate in steep mountainous terrain, deep defiles, and over water-filled rice patties. Moreover, in concert with its primary mission of combat rescue, ARS helicopters could perform a secondary mission of medical evacuation. Describing one of these missions, the ARRS historian writes: "In two days, H-5s and crews from Detachment 1, 3d AR [Air Rescue] Squadron, evacuated 52 critically wounded American soldiers completely surrounded by the enemy in Chipyong-Ni, 20 miles east of Seoul, Korea" (1:6). The helicopter's speed, versatility, and mission flexibility coupled with the SA-16's (Albatross) ability to make water recoveries undoubtedly lowered combat mortality rates, thus reducing the overall American casualty figure.

As the air war penetrated deeper into North Korea, ARS was forced to deploy both men and equipment to forward operating bases to affect recovery of downed aircrew members behind enemy lines. This tactic was highly successful and many combat recoveries were made, including the rescue of Captain Joseph C. McConnell, Jr., leading ace of the Korean War. The ARRS historian describes the rescue: "After shooting down an eighth Mig in Korea, Capt Joseph McConnell felt his F-86 shudder and slow. After radioing for help, he ejected over the Yellow Sea. Within a few minutes, he was rescued by an H-19 from the 3d Air Rescue Squadron" (1:10).

Just as the helicopter dominated rescue in Korea, so did it dominate rescue in Vietnam. As in Korea, ARS was ill-prepared to perform the combat rescue mission. With noncombat equipped aircraft such as the HH-43B, ARS was forced to seek newer and more versatile helicopters to counter the increasingly sophisticated enemy ground and air threat. Unlike Korea, however, where fixed-wing aircraft such as the SA-16 performed water surface recoveries, HU-16s and aging HC-54s (later replaced by HC-130s) provided rescue orbits in the Gulf of Tonkin and along the Thailand-Vietnam border. These aircraft acted as on-the-scene commanders able to command and control large-scale SAR operations. From their orbit positions, HC-130 rescue aircraft commanders could launch helicopters off ground alert for either medical evacuation or SAR.

The combat rescue AOR in Southeast Asia encompassed over 1,000,000 square miles of which 700,000 square miles was impenetrable jungle. While extremely hostile to the survival of downed American aircrews, mission success depended on the time required to search for, locate, and pick up a survivor. After one hour "we consistently lose the race with the enemy in his unrelenting effort to capture a downed American airman . . . the chances of a successful recovery diminish rapidly from 15 minutes to an hour" (12:5).

Beginning in 1967, in an effort to cut down the rescue time between bailout and recovery, ARRS refined the orbit concept of operations to include air-refuelable HH-3 and HH-53 helicopters and HC-130 tanker aircraft. Operating over the Gulf of Tonkin and two locations on the Laos-North Vietnam

Chapter Two

THE RULES AND MISSIONS OF COMBAT RESCUE HELICOPTERS IN KOREA AND VIETNAM

The objective of USAF combat rescue is to recover friendly personnel from hostile environments. To accomplish this objective, combat rescue aircrews require specialized equipment and procedures that meet the operational requirements of the contingency area. Unfortunately, as our combat experience in Korea and Vietnam makes clear, the Air Force was ill-equipped to meet the enemy and perform the mission.

Air Force Regulation 23-19, *Organization Mission-Field, ARRS*, describes the USAF combat rescue mission. Although rewritten over the years, this regulation clearly defines ARRS roles and mission. As this document points out, combat rescue

. . . saves resources, increases the survivability of fighting forces, and promotes aircrew confidence and morale. The nature of current and future weapons systems, as well as the operational environments to which they are committed, create a continuing and expanding need for a capability to search for, locate, and recover personnel anywhere in the world. (5:1).

To function in a combat environment requires highly trained, specially equipped, and combat ready forces that can be rapidly mobilized and quickly deployed on a worldwide basis. Combat rescue forces must also provide a command and control function consisting of specially trained personnel that augment the tactical air commander. Commonly found in a Rescue Coordination Center located in a Tactical Air Control Center, these personnel provide the expertise necessary to coordinate a successful aircrew recovery. As an adjunct to this mission, selected senior rescue personnel serve as liaison officers or combat rescue air commanders on the joint or combined staff level.

Unlike our GAF experience in World War II, combat rescue aircrews in Korea relied heavily on the helicopter. It became apparent, with the start of the Korean War on 25 June 1950, that airpower would play a crucial role with combat rescue helicopters providing a humanitarian service to United Nations' forces.

In the Korean area of responsibility (AOR), the ". . . 2d and 3d Air Rescue Squadrons were responsible for rescue in the Far East Air Forces" (2:9). Utilizing a mix of both fixed and rotary-wing aircraft, these units, plus the 4th Air Rescue Squadron, were responsible for the successful

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