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RUNNING ON EMPTY: THE DEVELOPMENT OF HELICOPTER AERIAL REFUELING AND IMPLICATIONS FOR FUTURE USAF COMBAT RESCUE CAPABILITIES

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by

Maj Tracy W. Colburn

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The views expressed in this academic research paper are those of the author and do not reflect the official policy or position of the US government or the Department of Defense.

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Preface

En route to a rendezvous with an HC-130P tanker one dark night off the coast of Iceland I first came to appreciate how much we combat search and rescue (CSAR) helicopter crews depend upon these aging tankers to “pass the gas” and get us home. Sure enough, the tanker canceled due to yet another maintenance problem. Fortunately we were on a routine training mission and our fuel status was not critical. Had we been 400 miles out to sea on a life-or-death rescue mission, we would have been in for an icy swim in the North Atlantic. There and then I decided to find out more about the partnership between rescue helicopter and aerial tanker. If my crew and I were going to risk our lives to help others, I wanted to become better informed about the Air Force CSAR mission, the aircraft we use, and the future of both. Perhaps then I could educate others as well. Therein lie the origins of this paper.

Abstract

By 1999 the total active United States Air Force fighter wing equivalents will have shrunk from 24 to 13 in only ten years.[1] The declining defense budget means painful force structure decisions lie ahead. Even as funds are drying up, the armed forces are being called upon to execute contingencies in places such as Haiti, Somalia, Liberia, and Bosnia. The future appears very busy for Air Force rescue units as well. According to "Strategic Assessment 1996—Instruments of U.S. Power" by the National Defense University and the Institute for National Strategic Studies, ". . . U.S. armed forces will most likely be called upon to engage in numerous evacuation and rescue missions for Westerners over the next quarter of a century."[2] It goes on to predict, "The rescue of U.S. military personnel under combat conditions, particularly downed flight crews, will also continue to be carried out on a fairly frequent basis."[3] Ultimately it concludes, "The practice by certain societies of abusing U.S. military prisoners to put psychological pressure on the U.S. government and public will only make such rescue operations more imperative."[4]

To accomplish these long-range operations USAF rescue helicopters rely greatly on aerial refueling from HC-130 tanker aircraft. Unfortunately, the current fleet of HC-130s has many deficiencies that degrade mission performance. Worse yet, based upon current operations tempo these tankers will begin to lose airworthiness in 2005.[5]

Despite the budget crunch the time has come to modernize the HC-130 fleet. By tracing helicopter aerial refueling from its inception during the Vietnam War to the

present, this paper will demonstrate the need to purchase new HC-130J aircraft. This should occur even if it means delaying other programs or further cutting active duty personnel. The alternative is to abandon the long-range combat rescue mission, leaving aviators shot down over hostile territory to fend for themselves.

Notes

[1] Joint Chiefs of Staff, *National Military Strategy of the United States of America*. (Washington, D.C.: Government Printing Office, 1995), 17.

[2] National Defense University and the Institute for National Strategic Studies, *Strategic Assessment 1996, Instruments of U.S. Power* (Washington, D.C.: National Defense University Press, 1996), 161.

[3] Ibid., 162.

[4] Ibid.

[5] Air Combat Command, *Air Force Modernization Planning, Combat Rescue Mission Area Plan, FY 1996*, 15 November 1995, 17.

Chapter 1

Introduction

The reductions of recent years have exhausted all the easy options and, properly done, the QDR will present difficult choices.

—William Cohen
Secretary of Defense

At the Crossroads

The Cold War is over and the United States won. The problem is, what do the American armed forces do now? One thing appears certain—the nation is unwilling to dedicate the previous level of resources to its defense establishment. Defense spending as a percentage of gross domestic product (GDP) is currently at its lowest level since the post-World War II demobilization.[1] For at least the foreseeable future military planners and decision-makers must learn to live with intense Congressional pressure to do more with less, and do so in a very uncertain, dangerous world. Under such constraints it may not be possible for the Air Force to maintain both readiness and an ambitious modernization program. Officials have difficult choices to make. Will readiness continue to dominate, or will the focus shift to modernization? Which modernization programs will proceed and which will wither on the vine? On what criteria should these decisions be based? If resources are critically scarce, what if any funds should be expended on seemingly minor mission areas such as combat search and rescue (CSAR)? This paper will

show that rather than be starved, the Air Force CSAR capability should be enhanced via modernization of its fleet of HC-130 tankers, even at the expense of readiness or other weapon system procurement programs.

In his paper entitled, *Ready for What and Modernized Against Whom? A Strategic Perspective on Readiness and Modernization*, nationally recognized policy analyst Jeffrey Record discussed the need for selective modernization. He wrote:

> In terms of training, sustainability, and weaponry, it is always better to be ready and modern than unready and obsolete. What Congress does not look at, because it is constitutionally incapable of doing so in a coherent fashion, is the broader and far more critical question: Ready for what? What exactly should we expect our military to do? Against whom do we modernize? Have we correctly identified future threats to our national security and the proper forces for dealing with those threats?[2]

Fortunately, these threats and their impact on Air Force roles, missions and force structure are being studied.

The National Defense University and the Institute for National Strategic Studies recently accomplished one such assessment. Their "Strategic Assessment 1996—Instruments of U.S. Power" presents a detailed analysis of the emerging challenges the US must meet. Among other things, this analysis predicts an important role for CSAR forces. The report states, "Since the United States remains committed to various surveillance, exclusion, humanitarian, peacekeeping, and covert operations involving manned aircraft and special-operations units, the rescue of their personnel will almost certainly be required from time to time."[3] What is at stake here is more than the lives of captured military personnel. The analysts conclude, "The practice by certain societies of abusing U.S. military prisoners to put psychological pressure on the U.S. government and public will only make such rescue operations more imperative."[4] Today the United States

Air Force includes squadrons dedicated to executing these long-range CSAR operations. However, unless immediate steps are taken, the Air Force's capability to conduct this important mission will soon begin to erode.

CSAR, HC-130s and the US Air Force

Like it or not, CSAR is an important force enhancement area for which the Air Force must plan, equip and train. Joint Publication 3-50.2, *Doctrine for Joint Combat Search and Rescue*, begins by stating, "Each Service and USSOCOM is responsible for performing combat search and rescue (CSAR) in support of their own operations, consistent with their assigned functions."[5] This joint doctrine is authoritative—the Air Force has no choice but to comply. Moreover, in 1996 Secretary of Defense William Perry designated the Air Force as the Pentagon's executive agent for CSAR.[6] This action was logical since the USAF maintains a fleet of helicopters and tankers specifically for long-range CSAR, and possesses a wealth of rescue experience gained in Korea, Vietnam, and more recent operations. Finally, a responsive, long-range CSAR capability greatly benefits the Air Force as well as the joint community. The latest draft of Joint Publication 3-50.21, *Joint Tactics, Techniques, and Procedures for Combat Search and Rescue*, explains that, "Successful CSAR operations enhance a joint force commander's (JFC's) capabilities by returning valuable resources to friendly control, by denying adversaries opportunities to exploit the intelligence and propaganda value of captured personnel, and by maintaining force morale."[7] It is estimated that 71 percent of such CSAR operations require aerial refueling to be successful.[8] Unfortunately, the current fleet of Air Force HC-130 tankers has many deficiencies that degrade mission performance. Worse yet,

based upon current operations tempo these tankers will begin to lose airworthiness in 2005.[9] By tracing helicopter aerial refueling from its development during the Vietnam War through today, this paper will demonstrate the necessity of modernizing the HC-130 fleet to maintain this valuable CSAR capability within the United States Air Force.

Notes

[1] Dennis S. Ippolito, *Federal Budget Policy and Defense Strategy* (Carlisle Barracks, PA: Strategic Studies Institute, US Army War College, 1996) 3.

[2] Jeffrey Record, *Ready for What and Modernized Against Whom? A Strategic Perspective on Readiness and Modernization* (Carlisle Barracks, PA: Strategic Studies Institute, US Army War College, 1995) 2.

[3] National Defense University and the Institute for National Strategic Studies, *Strategic Assessment 1996, Instruments of U.S. Power* (Washington, D.C.: National Defense University Press, 1996), 162.

[4] Ibid.

[5] *Joint Publication 3-50.2, Doctrine for Joint Combat Search and Rescue*. 26 January 1996. Joint Electronic Library. CD-ROM. September 1996.

[6] Stacey Evers, "USAF to put muscle into combat search & rescue," *Jane's Defence Weekly*, 29 May 1996, 6.

[7] Joint Publication 3-50.21 (draft), *Joint Tactics, Techniques and Procedures for Combat Search and Rescue*, I-2.

[8] Air Combat Command, *Air Force Modernization Planning, Combat Rescue Mission Area Plan, FY 1996*, 15 November 1995, 19.

[9] Ibid, 17.

Chapter 2

CSAR Before Helicopter Air Refueling

To me 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.

—Brigadier General Thomas J. Dubose
ARS Commander, 1952–1959

Lack of Long-Range CSAR

When the United States entered the Vietnam War it was unprepared to conduct CSAR, or Combat Aircrew Recovery (ACR) as it was called at the time. In 1964 the Air Force tasked the Air Rescue Service (ARS) to provide ACR in Southeast Asia. The first ARS rescue helicopters reached Vietnam in March of that year.[1] The task was daunting. The ARS' area of responsibility covered 1.1 million square miles, including all of South Vietnam, North Vietnam, Cambodia, Laos, Thailand and the Gulf of Siam. The US Navy assumed responsibility for rescue coverage in the Gulf of Tonkin and that portion of North Vietnam up to five miles inland from shore.[2] The ARS responded as best it could, sending the only helicopters available, Kaman HH-43 "Huskies" or "Pedros". The HH-43 was simply not up to the challenges of ACR in Southeast Asia. Huskies were Local Base Rescue (LBR) assets, designed to augment base fire and crash rescue forces. They possessed no armor or weaponry. Top speed of the ungainly HH-43 was only 90 knots,

its radius of action a mere 75 miles.[3] In one incident a downed F-105 pilot rescued under intense enemy fire by an HH-43 was asked when during the episode was he most frightened. He replied, "When that damned helicopter had to land to refuel!"[4]

In the Valley of the Jolly Green Giants

New Sikorsky helicopters partially overcame the range limitations of the HH-43s. In July 1965 ARS borrowed CH-3C cargo helicopters from Tactical Air Command (TAC), quickly repainted them in a green camouflage scheme, and dubbed them "Jolly Green Giants".[5] The CH-3Cs' greater speed and size improved the ACR response, but their 250 NM combat radius proved critical when crews needed to circumnavigate heavy flak areas. This meant the CH-3C, like the HH-43 before it, still had to operate from risky forward operating locations in Laos called "Lima Sites".[6] In November 1965 ARS units began to receive the new HH-3C/E. This version could carry 30 percent more fuel than the CH-3C. Nevertheless, the newer "Jollys" still were limited. The problem was not their fuel capacity per se. Rather, due to their low power they were often unable to hover out of ground effect at high-density altitudes and high gross weights. In other words, for rescues in hot, mountainous areas H-3s could not carry full fuel loads or risk being too heavy to hover and pick up the survivor.[7] Had air refueling been possible, HH-3C/E crews could have dumped fuel if necessary to hoist a survivor to safety, then refueled from a tanker en route to base. Unfortunately this capability did not yet exist.

An Urgent Plea for Help

The limitations of CSAR in Southeast Asia frustrated senior Air Force leaders. Air Force studies concluded an airman's chances of being rescued were very good if recovery

forces could reach him within 15 minutes, but the probability of recovery decreased significantly if the ACR force took longer than 30 minutes to reach the area.[8] To accomplish this feat rescue helicopters on strip alert would have to be extraordinarily fast, or already airborne, orbiting along routes where strike aircraft were ingressing to, or egressing from, their targets. To maintain these orbits in-flight refueling would be required. Thus, in August 1964 the Air Rescue Service forwarded a requirement for helicopter aerial refueling.

Over a year later ARS squadrons still had no helicopters capable of air refueling, nor any tankers to supply the fuel. On 28 October 1965 Military Air Transport Service (MATS) commander General Howell M. Estes, Jr. briefed General John P. McConnell, Air Force Chief of Staff, on the urgent requirements of the ARS in Southeast Asia. "While it is realized that there are established channels for requesting improved and additional equipment," General Estes' briefing notes read, "Our inability to meet combat recovery requirements in SE Asia *demands that extraordinary measures* be taken to correct deficiencies in recovery aircraft and associated equipment."[9] High among General Estes' recommendations was that, "The Systems Command be directed to rephase and expedite the development of air-to-air refueling for the HC-130 and HH-3. . . ."[10]

Notes

[1] Earl H. Tilford, Jr., *Search and Rescue in Southeast Asia, 1961-1975* (Washington, D.C.: Office of Air Force History, 1980) 59.

[2] Edgar Ulsamer, "Air Rescue in Southeast Asia—Right from Hanoi's Own Backyard," *AIR FORCE Magazine*, October 1972, 30.

[3] Earl H. Tilford, Jr., "Search and Rescue in Southeast Asia, 1961-1975," *Air University Review*, Jan-Feb 1980, 62.

[4] "A New Platform for the Hoist," *AIR FORCE Magazine*, November 1968, 95.

[5] Frank Colucci, "Big Charlies, Jolly Greens and Pave Pigs," *Air International*, December 1996, 372.

Notes

[6] HQ Aerospace Rescue & Recovery Service, *Analysis of SEA Combat ACR for Validation/Revision of RAD 7-39-(1) dated 31 January 1967*, 19 February 1970, III-2.

[7] Colonel Jon E. Hannan, "Aerial Refueling—An Army Requirement for the AH-64 Apache?" *U.S. Army Aviation Digest*, March/April 1993, 33.

[8] *Analysis of SEA Combat ACR for Validation/Revision of RAD 7-39-(1) dated 31 January 1967*, II-5.

[9] General Howell M. Estes, Jr., Commander of Military Air Transport Service (MATS), briefing to General McConnell, subject: Combat aircrew recovery in Southeast Asia, 28 October 1965.

[10] Ibid.

Chapter 3

Helicopter Air Refueling At Last

So, rather than stand by and wait for a call, we want to be as close as possible to the strike area, loitering on the periphery of the action and then going right in when a man needs us. We want to pick him up in seconds, not in minutes or hours. Air refueling will give us a much greater capability to make this possible.

—Col. Bestow R. Rudolph
ARS DCS for Plans, 1966

Rotary Wing "Right Stuff"

Air Force flight test engineers with Aeronautical Systems Division (ASD) at Wright-Patterson AFB hypothesized that helicopters could actually ride on top of the wingtip vortices trailing behind a C-130 Hercules transport. They believed the helicopter would be able to reduce power and extend its range by "drafting" behind the Hercules. A feasibility test at Wright-Patterson in 1965 demonstrated good compatibility between a CH-3 and C-130. Follow-up trials at the Air Force Flight Test Center at Eglin AFB, FL quantified the CH-3 power reduction to be 28 percent, resulting in a 25 percent increase in range.[1]

Buoyed by these results, a small group of Air Force and civilian engineers in the H-3 System Program Office at Wright-Patterson set out to take the tests one step further in response to the ARS operational requirement for helicopter air refueling capability. Mr.

James Eastman, Mr. Richard Wright and Major Harry Dunn (an experienced helicopter pilot) hoped to demonstrate the feasibility of helicopters refueling in-flight from behind a C-130. In December 1965 Dunn configured an Air Force CH-3 with a mock air refueling probe on its nose. After coordination with Marine Corps officials at Cherry Point, NC, Dunn flew the CH-3 there. On 17 December 1965, Dunn and Wright rendezvoused with a Marine Corps KC-130 tanker over the Atlantic Ocean. Dunn eased the fake probe into the drogue basket attached to a hose trailing from the KC-130's wing. Thus, he single-handedly launched perhaps the most important innovation in helicopter operations since Igor Sikorsky first took to the skies decades earlier.[2]

The Tankers Arrive

During the next year of tests, the Air Force ordered Lockheed Corporation to convert 11 HC-130H rescue command and control aircraft to tankers, to be redesignated HC-130Ps. Each was modified with drogues, pumps and fuel tanks capable of carrying 48,500 pounds of fuel. The 48th Aerospace Rescue & Recovery Squadron at Eglin AFB took delivery of the first HC-130P on 18 November 1966. Less than a month later one of these HC-130Ps and an HH-3E helicopter accomplished the first actual in-flight transfer of fuel.[3]

Notes

[1] Colonel Jon E. Hannan, "Aerial Refueling, An Army Requirement for the AH-64 Apache," *U.S. Army Aviation Digest*, March/April 1993, 33.

[2] Earl H. Tilford, Jr., *Search and Rescue in Southeast Asia, 1961-1975* (Washington, D.C.: Office of Air Force History, 1980) 83-84.

[3] Tilford, 84.

Chapter 4

Helicopter Air Refueling in Southeast Asia

> *When the history of the war in Vietnam is finally written, the story of Air Rescue may well become one of the most outstanding human dramas in the entire history of the Air Force.*
>
> —Harold Brown, former Secretary of the Air Force

Air Force crews conducted the first combat air refueling of helicopters in June 1967 using HC-130P and HH-3E aircraft in Southeast Asia. To reduce response time following a shoot-down, the Aerospace Rescue & Recovery Service designated four helicopter refueling orbits. Two were over the Laotian-North Vietnamese border, one was located over central Laos, and the fourth was east, over the Gulf of Tonkin.[1] HC-130P crews established holding patterns prior to US airstrikes to immediately support CSAR helicopters.

Besides serving as helicopter refuelers, these HC-130Ps (callsign "Crown" and later "King") carried mission coordinators whose job it was to assemble and manage the Search and Rescue Task Force (SARTF) of helicopters, escort fighters, and tankers. "Crown" directed the Jollys to the downed flyer, as well as to their refueling rendezvous points. They also acted as a communication link between rescue forces and higher echelons.[2] Many missions required lengthy helicopter holding times adjacent to a survivor's location while escorting A-1 "Sandy" and jet aircraft bombed and strafed enemy positions to

"sanitize" the area for pickup. It was not unusual for Jollys to hold as long as five hours.[3] These marathon rescue missions would have been impossible were it not for the new air refueling capability.

"Super" Jolly Green Giants

As good as the HH-3E Jolly Green Giants were, even with air refueling they were limited. Fortunately, their "big brothers" were on the way to carry the burden. On 15 September 1967 the first Sikorsky HH-53B "Super Jolly Green Giant" arrived in Southeast Asia. The venerable HH-3Es began to be phased out, and all were removed from the Vietnam theater by December 1970.[4] Like its predecessor, a key feature of the HH-53B was its ability to refuel in-flight from HC-130Ps. Yet, it was clearly superior to the HH-3E in many ways. To begin with, as its nickname implied, the HH-53B was larger, and more heavily armed and armored than the H-3. With air refueling it could easily fly up to 18 hours at 140 knots, and had a dash speed of nearly 200 knots.[5] Despite criticism that it was too large and still too slow, the HH-53 proved to be a superior long-range rescue helicopter. The HC-130/HH-53 team played a crucial role in Southeast Asia right until the bitter end. HC-130s refueled HH-53s participating in the November 1970 Son Tay POW rescue attempt.[6] Finally, in April of 1975 HC-130s enabled HH-53s to evacuate Phnom Penh (Operation Eagle Pull), and assist the final withdrawal from Saigon (Operation Frequent Wind).[7]

"That Others May Live"

Thanks in no small part to the development of helicopter air refueling, the ARS (redesignated Aerospace Rescue & Recovery Service, or ARRS, in 1966) ultimately

rescued 3,883 people in Southeast Asia. The 3d Aerospace & Recovery Group became the most highly decorated unit in U.S. Air Force history.[8] Nevertheless, one wonders how many American flyers captured or killed on the ground could have been rescued had CSAR forces not been so badly neglected in the decade leading up to the Vietnam War.

Notes

[1] Frank Colucci, "Big Charlies, Jolly Greens and Pave Pigs," *Air International*, December 1996, 374.

[2] Edgar Ulsamer, "Air Rescue in Southeast Asia: Right From Hanoi's Own Backyard," *AIR FORCE MAGAZINE*, October 1972, 31.

[3] HQ Aerospace Rescue & Recovery Service, *Analysis of SEA Combat ACR for Validation/Revision of RAD 7-39-(1) dated 31 January 1967*, 19 February 1970, III-3.

[4] Colucci, 374.

[5] Earl H. Tilford, Jr., *Search and Rescue in Southeast Asia, 1961-1975* (Washington, D.C.: Office of Air Force History, 1980), 93.

[6] Robert K. Ruhl, "Raid at Son Tay," *Airman*, August 1975, 28.

[7] Tilford, 135-145.

[8] Tilford, 155.

Chapter 5

Contemporary Role of Air Refueling in US Air Force Search & Rescue

> *I must tell you first of all that you did not save only my life. You also saved my wife, Larisa, and my daughters, Lena and Ludmilla. Without your courage, they would be alone, a widow and two orphans.*
>
> —Ukrainian Aleksander Taranov, in note to ANG rescuers

Today the HH-3Es are retired from service and the HH-53s serve as special operations aircraft with the U.S. Special Operations Command. The primary USAF combat search and rescue helicopter now is the sophisticated, air refuelable Sikorsky HH-60G "Pavehawk". The HC-130Ps continue to serve with distinction.[1]

Current Air Refueling Procedures

Surprisingly, the procedures developed for air refueling of CSAR helicopters during the Vietnam War remain much the same today. There have, however, been some notable advances. As the need for around-the-clock rescue operations grew, night-vision technology finally reached the point where it was practical and affordable. In 1985 Air Force Captains Mike Damron and James "Pappy" Walters of the 20th Special Operations Squadron flew the first approved night vision goggle (NVG) air refueling using an HH-53H helicopter. Air Force Special Operations Forces (AFSOF) began to regularly air refuel using NVGs in 1987, and USAF rescue aircrews quickly followed suit. During

1987 AFSOF also proved the safety and effectiveness of simultaneously refueling two helicopters, one on each side of the HC-130. Immediately AFSOF and rescue units adopted this procedure as the standard for multi-ship air refueling, day or night.[2]

CSAR in Desert Storm

Iraqi forces downed thirty-eight Coalition aircraft during DESERT STORM. Several downed crewmembers ejected deep inside Iraq, over heavily fortified Iraqi positions, making recovery impossible. However, three American fliers were rescued in separate operations. One downed Kuwaiti pilot was also recovered by Kuwaiti partisans. Interestingly enough, Air Force CSAR units did not deploy for Desert Storm; special operations forces were assigned to provide CSAR support as a collateral mission.[3] The DOD final report to Congress, *Conduct of the Persian Gulf War*, explains that, "SOF aircraft were preferred because of their radar evasion, communications and weapons system countermeasures capabilities that were considered important for aircraft survivability."[4]

It is arguable that had properly equipped USAF CSAR squadrons been deployed for Desert Storm, more downed Coalition crewmen might have been recovered. Yet, while Air Force CSAR forces are dependent on the service to fund modifications and modernization, the US Special Operations Command has the unique charter to procure its own aircraft and equipment without service approval. The apparent lack of adequate aircraft and equipment within Air Force CSAR squadrons at the outset of the Gulf War leads one to question whether Air Force leaders are serious about maintaining a viable CSAR force.

Two examples of more recent rescue missions performed by HH-60G and HC-130P crews are illustrative of the criticality of helicopter air refueling to Air Force long-range rescue operations. The first is a narrative of the longest over-water rescue by helicopters in history. It is followed by a description of another open-ocean rescue attempt by the very same squadron, this time with tragic results due to the inability to air refuel.

Sinking of the *Salvador Allende*

At 9:30 P.M. on 9 December 1994 the *Salvador Allende*, a Ukrainian cargo ship with 31 crewmen aboard, issued a radio distress call in stormy seas 780 miles off the coast of Nova Scotia, Canada. A Canadian C-130 responded, arriving on scene at 3:00 A.M. the following morning. The Hercules crew confirmed the ship was listing severely and appeared to be sinking. They reported a number of survivors were in the water while others were in life rafts. The Canadian C-130 dropped survival kits to the beleaguered sailors, including food, water, pumps, survival suits and radios. Meanwhile, two HH-60G Pavehawk CSAR helicopters from the 102d Rescue Squadron, New York Air National Guard (ANG), deployed from their base on Long Island to Nova Scotia. They were accompanied by an ANG HC-130P from Long Island, another from Patrick AFB, FL that happened to be in the area, and a Marine Corps KC-130.[5]

Using NVGs the helicopter crews launched from Nova Scotia at 5:30 A.M. on 10 December for the long over-water flight to the last known position of the *Salvador Allende*. En route weather was horrific. Often there was no visual contact between the pair of helicopters. The crews frequently relied on their weather radars to avoid colliding with one another. Upon arriving on scene the Pavehawks found a line of floating debris

stretching one-half mile wide and 20 miles long. The ship was gone and there were no survivors in sight. The weather remained stormy—cloud ceilings were low, winds were gusting to 50 knots, and waves were 30 feet high. After nearly four hours of systematic searching, the helicopter crews had found only seven bodies and two empty life rafts. They prepared to depart the search area to refuel again with the Hercules tankers.[6]

Suddenly, an aircraft scanner spotted someone among the debris. The trail helicopter deployed a pararescueman (PJ), and then hoisted both the PJ and 36-year old Aleksander Taranov. Taranov had been in the water nearly two days wearing only a nylon jumpsuit, two woolen sweaters and an orange life jacket. Safely on board the helicopter, Taranov was treated and flown to a hospital in Nova Scotia. HH-60G crews found no one else alive; the only other survivor was recovered by a passing ship.

The entire mission lasted nearly 15 hours. HC-130P and KC-130 tankers refueled the HH-60Gs 10 times, eight of which were under critical circumstances. This mission set the world record for the longest over-water helicopter rescue. The Pavehawks from Long Island are the only air refuelable helicopters in the northeastern United States and Canada.[7] Without this capability and the ever-present C-130 tankers, Taranov would have surely perished like his shipmates.

Pavehawk Ditches at Sea

Not every rescue mission ends so well. Three years earlier a crew from the same squadron, including one of the pilots who later flew on the *Salvador Allende* mission, discovered firsthand what can happen when air refueling is not possible. On 30 October 1991 a Pavehawk and HC-130P took off from Westhampton, NY destined for a sailboat

reportedly foundering in heavy seas 200 miles south of Long Island. The HC-130P refueled the helicopter twice en route to the sailboat. Arriving at dusk, the Pavehawk crew determined the sailboat was not actually in danger of sinking. Rough 30-40 foot seas prevented either the deployment of a PJ or the recovery of the boat's skipper, so the helicopter departed for home, refueling a third time from the HC-130P.

The weather deteriorated quickly. The Pavehawk flew on through driving rain, 50-knot wind and severe turbulence. The crew attempted a fourth air refueling but failed due to heavy turbulence and equipment malfunction. At 9:20 P.M. with fuel starvation imminent and no where to land, the crew elected to ditch before the engines flamed out. Three crewmembers bailed out in a hover, then the pilot and flight engineer ditched the HH-60G nearby in 40-60 foot seas.

Winds gusting up to 80 miles per hour swept their life rafts away. Wind whipped one raft tied to a crewman so hard, it broke his arm, forcing him to cut the cord. The Coast Guard cutter Tamaroa began recovering the hypothermic crewmembers at 2:00 A.M. Although four Pavehawk crewmen were rescued, TSgt Rick Smith was never found and was presumed drowned.[8] Admittedly, operational and environmental factors were critical elements of this tragedy. Despite that, this incident further illustrates the important contribution aerial refueling makes to successful long-range rescue operations.

Notes

[1] HQ ACC/DRS, *Air Force Modernization Planning: Combat Rescue Mission Area Plan FY 1996*, 15 November 1995, 4.

[2] Captains Jay Strack and Joe Becker, "Helicopter and C-130 Air Refueling Techniques," *Flying Safety Magazine*, March 1994, 16.

[3] Joint Publication 3-50.21 (draft), *Joint Tactics, Techniques and Procedures for Combat Search and Rescue*, I-3.

[4] Quoted in Joint Publication 3-50.21 (draft), I-3.

Notes

[5] Air Force Office of Public Affairs-Eastern Region, news release, 14 Dec 1994, 1-3.

[6] TSgt John A. Krulder, Jr., 102d Rescue Squadron, e-mail interview with author, 7 January 1997.

[7] Air Force Office of Public Affairs-Eastern Region,1-3.

[8] Kaminski, Tom. "ANG's Oldest Unit.", 1 January 1997, On-line. Internet, 2 February 1997. Available from http://infoshop.com/106rescue/html/history1.html.

Chapter 6

Current Status of Air Force HC-130 Fleet

Personnel deployment tempos are up fourfold in as many years. Average annual deployment rates for special mission and support aircraft are particularly high—HC-130 (194 days). . . .

—Secretary of the Air Force Sheila E. Widnall
SECAF's 1995 Report

Current Inventory

The Air Force presently has 30 HC-130N/Ps designated for rescue operations. The HC-130Ps were once HC-130Hs. Of the 43 HC-130Hs delivered to the Air Force, 21 were modified as helicopter air refuelers beginning in 1966. The HC-130Hs were originally configured for the mid-air recovery of film, data packets, and other items from space during the Mercury, Gemini and Apollo projects. Each HC-130P still sports a large "blister" on the top front of the fuselage that once housed a re-entry tracking system. The Aerospace Rescue and Recovery Service (ARRS) also acquired 15 HC-130Ns. The HC-130N, while similar to the HC-130H, does not have the distinctive Fulton forks on its nose, nor the internal fuel tank capacity. In the current aerial tanker role there is little difference functionally between the HC-130N and HC-130P, so they will be considered the same model for purposes of this paper.[1]

Only nine of the HC-130N/Ps are actually in the active Air Force inventory. Built in 1964-1965, these are some of the oldest USAF aircraft flying today. All nine belong to Air Combat Command (ACC) and are assigned to the 71st Rescue Squadron (RQS) at Patrick AFB, FL. The Air National Guard (ANG) operates twelve more. Five of these belong to the 102d RQS at Gabreski International Airport, NY. Three were built in 1964-1965, while the other two were constructed in 1988. Four more HC-130s are flown by the 129th RQS at Moffett Field, CA. Lockheed assembled these aircraft in 1964-1965. The three newest HC-130N/Ps, built in 1994, are based at Kulis, AK with the 201st RQS. Air Force Reserve (AFRES) squadrons operate the final nine aircraft. Five are stationed at Patrick AFB, FL with the 301st RQS, while four are located at Portland International Airport, OR with the 304th RQS. Each AFRES squadron has a mixture of tankers built in 1964, 1965 and 1968.[2]

Until very recently the 304th RQS at Portland also flew a fifth HC-130N/P. Tragically, on 22 November 1996 this aircraft crashed into the Pacific Ocean 60 miles west of Eureka, CA during a training flight. Prior to the mishap the 11-man crew reported one of their four engines had quit, and were experiencing difficulty with another. Shortly thereafter they suffered complete electrical failure. Only one crew member survived and the aircraft was a complete loss. Cause of the mishap has yet to be determined.[3]

HC-130N/P Capabilities

Although the technology in the HC-130N/P is not cutting-edge, the aircraft is nonetheless a capable rescue asset. The standard HC-130 crew complement consists of a pilot, copilot, navigator, flight engineer, radio operator, loadmaster, and three PJs. The

crew and aircraft self-deploy for all operations. HC-130s still perform the airborne mission commander (AMC) role in no-to-low threat environments. With a top speed of 290 knots at high altitude and low-altitude cruise speed of 210-250 knots, the Hercules can also airdrop PJs with survival equipment to treat and stabilize survivors until the slower HH-60Gs arrive. In fact, using Computed Air Release Point procedures an HC-130 can deploy personnel and/or equipment on a single pass. It has the capability to simultaneously refuel two helicopters, one on each outboard hose and drogue, and specially trained HC-130 crews provide NVG low-altitude air refueling. While ingressing to and egressing from air refueling areas, HC-130s avoid threats by using tactical, low-level flight profiles. Additionally, in a permissive environment HC-130s can perform extended aerial searches. Finally, it has a no-wind range of 3,000 to 4,500 NM depending on internal fuel tank configuration.[4]

HC-130N/P Deficiencies

Having identified the many capabilities of the "King" aircraft, one would be remiss not to also address its shortcomings. The HC-130N/P is a Vietnam-era aircraft lacking modern communication equipment. For instance, although the PRC-112 is now the standard survival radio issued to combat aircrews, one may be surprised to learn the HC-130 does not have search radios compatible with the PRC-112. Furthermore, while its CSAR partner—the HH-60G helicopter—has secure VHF-FM radios, the HC-130 does not. This mode can not, therefore, be used to pass sensitive or classified information between the aircraft. Likewise, the tanker's navigation system is lacking. Again unlike the HH-60G, the HC-130 does not have an advanced, integrated navigation suite. This

could result in gaps in search coverage, delays in air refueling, or inaccurate PJ parachute drops. Additionally, the HC-130's APX-65 Transponder Interrogator is so antiquated, the last 28 APX-65s in the entire USAF inventory are aboard HC-130s. As far as combat survivability is concerned, HC-130s have no threat Radio Frequency (RF) warning or RF countermeasures, and 11 of the 30 HC-130s have no Infrared Countermeasures (IRCM). Physical limitations hinder the HC-130 as well. Visual scanners have a restricted field of vision through its windows. HC-130N/Ps also can not simultaneously deploy PJs and their Rigging Alternate Method-Zodiac (RAMZ) boat. Multiple passes to drop both increase the risk of separating the PJ team from their boat, and unnecessarily exposes the aircraft to threat systems. Last, but not least, the tanker's hydraulic-powered refueling pods are unreliable.[5]

The HC-130's refueling pods deserve further mention. Today's rescue tankers still have the system installed decades ago by the Sargent-Fletcher Company of California, using aircraft hydraulics to run hose reels and boost pumps on both sides of the HC-130. It taps into two-inch fuel lines running along the leading edge of C-130 wings, and draws fuel from two removable 1,800 gallon tanks in the cabin.[6] Unfortunately, this system is difficult to maintain in working order. Mean Time Between Failure (MBTF) is only 49 hours, resulting in a mission capable rate of only 75 percent.[7] This can lead to aborting missions due to lack of fuel for CSAR helicopters.

Planned Modifications: Good News & Bad News

The good news is there are modifications planned to correct many of these deficiencies. Two fully funded improvements in the works include the installation of

Global Positioning System (GPS) receivers compatible with the Self Contained Navigation System (SCNS), as well as new ARC-222 SINCGARS radios. Another modification is partially funded—installation of Airlift Defensive System (ADS) in ANG HC-130s. This includes AN/ALE-47 chaff/flare dispensers and AAR-47 missile warning systems.[8]

Sadly, many important HC-130 modifications and upgrades remain totally unfunded. One of these is the Lightweight Airborne Recovery System (LARS)—an AN/APR-6 radio used by search aircraft to precisely locate a downed flyer with a PRC-112 survival radio. Another badly needed but overlooked modification is the Night Vision Imaging System (NVIS). This entails installing NVG-compatible cockpit and exterior lighting on the HC-130 to facilitate night-time helicopter air refueling. As mentioned earlier, the HC-130's APX-65 transponder is so old, it's insupportable. Yet, funding has not been allocated for its replacement. Nor has money been found to install parasitic armor around crew positions to protect against up to 7.62mm rounds. The plan to install static line retriever (SLR) cables and winches to permit simultaneous deployment of PJs and their RAMZ kit languishes for lack of funding as well.[9] Finally, the entire Air Force fleet of rescue HC-130s could receive new, reliable, electric-powered air refueling pods for roughly $22 million.[10] Unfortunately these programs never seem to make the cut when the Air Force submits its Program Objective Memorandum (POM) for inclusion into the President's budget.

End of Service-Life Approaching

The service-life of the HC-130N/P is largely limited by its center wing box. The more the aircraft are flown, and the more extreme the maneuvers they must perform, the earlier

they will reach the end of their service-life. As recently as 1995, HC-130s deployed on contingencies an average of 194 days per year—more than any other aircraft in the Air Force inventory.[11] Assuming the current operations tempo remains constant, the HC-130 fleet will begin to lose airworthiness in 2005.[12]

Notes

[1] Paul Jackson, editor-in-chief, *Jane's All The World's Aircraft, 1996-1997* (London: Butler and Tanner Limited, 1996), 632-633.

[2] Major David Blackburn, HQ ACC/DRHR, e-mail interview with author, 18 November 1996.

[3] Associated Press, "Survivors Sought In Crash of Rescue Plane," *Sunday Montgomery Advertiser*, 24 November 1996, 5A.

[4] HQ ACC/DRS, *Air Force Modernization Planning: Combat Rescue Mission Area Plan FY 1996*, 15 November 1995, 7.

[5] HQ ACC/DRS, 17-20.

[6] Frank Colucci, "Must Plug," *Defence Helicopter*, December 1991-February 1992, 12.

[7] HQ ACC/DRS, 19.

[8] Ibid., 43-44.

[9] Ibid.

[10] Major David Blackburn.

[11] Department of Defense, *Annual Report of the Secretary of Defense and the Annual Reports of the Secretary of the Army, Secretary of the Navy, and the Secretary of the Air Force* (Washington, D.C.: Government Printing Office, 1995).

[12] HQ ACC/DRS, 17.

Chapter 7

The Future of the HC-130 Fleet

I worry that the department has maintained force structure and readiness but has deferred modernization to near the breaking point.

—Secretary of Defense William Cohen

As stated earlier current joint doctrine for combat search and rescue makes each service (and the US Special Operations Command) responsible for performing combat search and rescue for its own forces.[1] Yet, if the Air Force is to maintain this capability past the year 2005, decisions must be made now to determine the structure of its future CSAR force. One important question to answer is whether HC-130s will even be needed in this future force.

The V-22 Tiltrotor

The future of USAF combat search and rescue, and the HC-130 in particular, can not be thoroughly discussed without considering the role of the V-22 Osprey, more commonly known as the "tiltrotor". The tiltrotor seems to hold great promise—finally an aircraft that can take off and land like a helicopter, yet fly long distances at speeds comparable to turboprop aircraft. Perhaps once the V-22 enters service it will replace both CSAR helicopters and the HC-130 tankers! Closer examination reveals that is not likely.

The Osprey truly is a technological marvel. At sea level it can take off vertically, transition to forward flight, and comfortably reach 275 knots.[2] That may not seem particularly impressive until one considers the cruise speed of the Air Force's primary vertical-lift rescue platform, the HH-60G Pavehawk, is only 120-140 knots.[3] Likewise, the Osprey has a substantially greater load capacity. Its maximum vertical takeoff weight of 47,500 pounds is over twice that of the cramped HH-60G. Many other V-22 capabilities are similarly far ahead of present-day helicopters. It can hover out-of-ground-effect at 14,200 feet. Its service ceiling is 26,000 feet, and even with one engine inoperative it can maintain 11,300 feet. When loaded for amphibious assault the V-22's range is 515 NM.[4] Designers also boast it can self-deploy up to 2,500 NM with one air refueling. The manufacturing team of Bell-Boeing also claims the V-22 is 75 percent quieter than helicopters, and 14-21 times less vulnerable to small arms fire. It even provides nuclear, biological, and chemical protection for crew and passengers, a glaring deficiency of modern military helicopters.[5] Can there be any doubt the V-22 Osprey will replace both the HH-60G and HC-130? Actually, there is.

Of the 523 V-22s scheduled for production over the next 25 years, none are destined for Air Force CSAR units. The US Marine Corps will receive the bulk of the Ospreys—425 in all—for combat assault and assault support missions. Deliveries to the Marines should begin in 1999. The Air Force Special Operations Command (AFSOC) will receive 50 airframes for long-range special operations missions, and the US Navy will use the remaining 48 V-22s for CSAR, Special Warfare, and fleet logistics support.[6]

Although Air Force Special Operations Forces (AFSOF) are sometimes tasked to perform CSAR, it is not their primary mission. According to Air Force Doctrine

Document 35, *Special Operations*, "AFSOF are not organized, trained, or equipped to conduct search and rescue or combat search and rescue. There may be situations, however, when the capabilities of AFSOF are required to recover isolated personnel whose recovery may be beyond capabilities of other theater combat rescue forces."[7] The experience of ARRS during the Vietnam War clearly demonstrated the value of dedicated CSAR resources positioned to immediately respond to the shoot-down of strike aircraft. AFSOC V-22s will likely be committed to inserting, extracting, or otherwise supporting Special Forces teams. It is hard to foresee such valuable special operations assets ($29.4 million flyaway cost) set aside exclusively for CSAR alert.[8]

Even if the allocation is somehow changed to divert Ospreys to Air Force CSAR squadrons, the HC-130s will still be needed. One may have noticed earlier the V-22's self-deployment capability *depended on air refueling*. Indeed, the V-22 will be equipped with a refueling probe like current CSAR helicopters. Test flights have already been completed using the Osprey's instrumentation probe to simulate air refueling from a C-130 tanker.[9] The V-22 may someday replace rescue helicopters, but it will still require air refueling for some of its missions. With apologies to Mark Twain, it appears reports of the HC-130's demise have been greatly exaggerated.

The HC-130J

The FY 1996 Combat Rescue Mission Area Plan calls for gradual replacement of HC-130N/P tanker aircraft with a variation of the new C-130J beginning in 2005.[10] Purchasing these HC-130J aircraft is a logical step. New HC-130Js will have an estimated 35-year service-life. Even if the service-life of existing HC-130s can be extended

somewhat, the need will soon arise to find more capable aircraft. The C-130J offers 35 percent greater range, 42 percent higher cruising ceiling, 59 percent decrease in time-to-climb, 21 percent increase in maximum speed, and 41 percent decrease in takeoff run. Furthermore, defensive systems, instrumentation, communications, and navigation equipment would all be state-of-the-art. In fact, a navigator is not even necessary on the "J-model", a substantial manpower savings.[11] Since the Air Force has now embarked on a program to replace its tactical airlifters with C-130Js, choosing the HC-130J would maximize fleet commonality, thereby reducing logistic and training requirements. Already the Air Force purchased two test-bed C-130Js, and requested funding for another in 1997. The Pentagon also approved spending ANG and AFRES funds for an additional two C-130Js.[12] Aviation industry analysts flatly state, "The C-130J will be very successful."[13] Likewise, the HC-130J makes good sense, functionally and fiscally.

Notes

[1] *Joint Publication 3-50.2, Doctrine for Joint Combat Search and Rescue*. 26 January 1996. Joint Electronic Library. CD-ROM. September 1996.

[2] "V-22 Key Characteristics," September 1995, n.p.; on-line Internet, 15 January 1997, available from http://www.boeing.com/V22/1687-B10B.html.

[3] HQ ACC/DRS, *Air Force Modernization Planning: Combat Rescue Mission Area Plan FY 1996*, 15 November 1995, 7.

[4] "V-22 Key Characteristics".

[5] "Bell Boeing V-22 Osprey.", n.p.; on-line Internet, 20 December 1996, available from http://www.bellhelicopter.com/lowrez/pd/tr/v22.html.

[6] Ibid.

[7] Air Force Doctrine Document 35, *Special Operations*. 16 January 1995. Joint Electronic Library. CD-ROM. September 1996, 10.

[8] "First V-22 Wing/Nacelle Mate Takes Place," December 1995, n.p.: on-line, Internet, 11 February 1997, available from http://www.boeing.com/v22/trt/W1827-01.html#mating.

[9] "Bell Boeing V-22 Osprey".

[10] HQ ACC/DRS, 30.

[11] William Dane and Raymond Jaworski, "Lockheed Martin C-130 Hercules," *Military Aircraft Forecast*, July 1996, 11.

Notes

[12] Ibid., 5.
[13] Ibid., 11.

Chapter 8

Recommendations and Conclusion

We intend to remain the best-equipped force in the world. Modernization programs preserve the essential combat edge that US forces now possess.

—General John M. Shalikashvili
Chairman of the Joint Chiefs of Staff

Recommending the Air Force purchase HC-130J combat support aircraft in times of diminishing military budgets is not going to win many friends in the Pentagon. Nevertheless, it is the right thing to do to preserve a viable long-range combat search and rescue capability in the Air Force. The benefits extend beyond the monetary expense of replacing downed fliers. Pilots entering aerial combat are more likely to do so with vigor and perseverance if they believe their government is willing and able to rescue them quickly should their aircraft become disabled. Few will be motivated to fight and possibly die for a government that considers them expendable. Increasingly the "CNN factor" also means America's adversaries stand to gain much by parading humbled, captured US fliers before the world media. Worse yet, who can forget the reaction of American audiences to images of jubilant Somali crowds dragging murdered American servicemen through the streets of Mogadishu? Unfortunately, American foreign policy can be held hostage right along with American fliers. HC-130J tankers will help maintain the credible long-range CSAR capability that preserves US freedom of action.

While the fiscal 1996 Combat Rescue Mission Area Plan proposes 35 HC-130J aircraft be purchased, its analysis was based on the need to simultaneously fight two Major Regional Conflicts (MRCs). The comprehensive Quadrennial Defense Review (QDR) currently underway may well modify this basic assumption. It would therefore be a mistake to recommend procurement of a set number of HC-130J aircraft at this time. In spite of this, the Air Force should procure and field some HC-130Js by 2005.

It is probable the QDR will confirm the need to modernize current aircraft inventories to maximize flexibility in an uncertain and very dangerous world. Furthermore, the QDR will certainly recognize the trend toward military operations other than war (MOOTW). Cold War systems are too costly and not designed to fight the battles America is most likely to face in the future. Add to this the closure of numerous overseas military installations, and one can see the logic in spending scarce funds on long-range CSAR aircraft. If "global attack" makes sense, then so too does global CSAR to support the attackers.

It is unrealistic to expect additional money will be added to the Air Force budget to pay for any HC-130J aircraft. Secretary of Defense Cohen admitted recently, "In my own judgment, it is likely that unless we have some sort of a major conflict, we won't see anything in the way of dramatic improvements as far as budget escalation in Washington. We're likely to operate at current levels plus inflation."[1] In fact, the Air Force may already be overextended. An analysis by the Center for Strategic and Budgetary Assessments, a Washington, D.C. based research group, finds that, "Over the long term, the cost of the Air Force's current modernization and force-structure plans is likely to exceed available funding levels by some $18 billion to $24 billion a year."[2] Air Force

leaders and Department of Defense officials are simply going to have to make some difficult choices—between competing weapon systems, and perhaps even between modernization and readiness. As Secretary of Defense Cohen recently observed, "Either the department has to achieve more significant savings in areas such as infrastructure, privatization and the acquisition process or revisit the basic issue of preserving force structure at the expense of modernization."[3]

The time for action is fast approaching. The results of the QDR will be released this May. Based on the QDR's findings service officials must decide where to make cuts and where to shift funds to organize, train and equip the Air Force of tomorrow. There is no time to waste if such revised priorities are to be included in the next Program Objective Memorandum (POM).

While not as glamorous or high profile as the F-22, the Joint Strike Fighter, or the C-17, the HC-130J is also not as expensive. Cost of the basic C-130J will be approximately $44 million, while the tanker version should be slightly higher.[4] By comparison, Lockheed Martin recently estimated each of the controversial F-22s will cost $71 million, while Congressional staffers put the F-22 per unit cost at $100 million.[5] The proven HC-130 seems a bargain compared with the exorbitant F-22 many analysts feel is not even needed. This paper does not argue the F-22 should be canceled in lieu of the HC-130J. Rather, it is held up as an example of a good place for service officials to begin looking for funds to pay for a much smaller HC-130J program.

It will take more than demonstrated cost-benefit analysis to make the HC-130J a reality. Air Force leaders must look beyond their blinders and recognize and support the valid requirement for intrinsic, long-range CSAR. This will be a painful admission. Pet

projects will undoubtedly be affected. Yet, if the Air Force is unwilling or unable to maintain a viable CSAR capability within its conventional forces, two possible scenarios arise. First, the Department of Defense may grant USSOCOM exclusive control over this mission area, along with the funding to perform it. Although CSAR is not USSOCOM's main focus, the lack of USAF CSAR participation in Desert Storm established the precedent for such an initiative. Second, CSAR responsibility might remain with the service, but its rescue force would atrophy, becoming impotent to execute its combat mission. Such a force would be reminiscent of the Air Rescue Service at the beginning of the Vietnam War. Either way, the Air Force would lose the power to rescue its own pilots from hostile territory. Infusing affordable new technology today into Air Force CSAR will help prevent such an outcome.

Purchasing the HC-130J is therefore the right thing to do, and now is the right time to do it. Otherwise, twenty years from now images of haggard, humiliated American military fliers may again appear before the public—courtesy of CNN and some third-world despot with a grudge against the United States. Today's decision-makers would then have no one to blame but themselves.

Notes

[1] SSgt Cheryl L. Tower, "Secretary of Defense cites priorities during first base visit," 28 February 1997. *Air Force News Online.* On-line. Internet, 1 March 1997. Available from http://www.af.mil/news/Feb1997/n19970228_970238.html.

[2] Steven Watkins, "Costly Purchases Planned, But Air Force Leaders Face a Budget Crisis," 6 January 1997. *Air Force Times Online*. On-line. AOL, 28 January 1997.

[3] Rick Maze, "Cohen Outlines Priorities For New Job as Defense Secretary," 3 February 1997. *Air Force Times Online.* On-line. AOL, 28 January 1997.

[4] William Dane and Raymond Jaworski, "Lockheed Martin C-130 Hercules," *Military Aircraft Forecast*, July 1996, 1.

[5] T. C. Skanchy, "The F-22 is Too Costly: Scrub It," 3 February 1997. *Air Force Times Online*. On-line. AOL, 12 February 1997.

Glossary

ACC	Air Combat Command
ACR	Combat Aircrew Recovery
ADS	Airlift Defensive Systems
AFB	Air Force Base
AFRES	Air Force Reserve
AFSOC	Air Force Special Operations Command
AFSOF	Air Force Special Operations Forces
AMC	Airborne Mission Commander
ANG	Air National Guard
ARS	Air Rescue Service
ARRS	Aerospace Rescue and Recovery Service
ASD	Aeronautical Systems Division
CNN	Cable News Network
CSAR	Combat Search And Rescue
DCS	Deputy Chief of Staff
DOD	Department of Defense
GDP	Gross Domestic Product
IRCM	Infrared Counter Measures
JFC	Joint Force Commander
LARS	Lightweight Airborne Recovery System
LBR	Local Base Rescue
MATS	Military Air Transport Service
MTBF	Mean Time Between Failure
MRC	Major Regional Conflict
MOOTW	Military Operations Other Than War
NM	Nautical Miles
NVG	Night Vision Goggles
NVIS	Night Vision Imaging System

PJ	Pararescueman
POM	Program Objective Memorandum
POW	Prisoner Of War
QDR	Quadrennial Defense Review
RAMZ	Rigging, Alternate Method-Zodiac
RQS	Rescue Squadron
SAR	Search And Rescue
SARTF	Search And Rescue Task Force
SCNS	Self Contained Navigation System
SECAF	Secretary of the Air Force
SLR	Static Line Receiver
SOF	Special Operations Forces
TAC	Tactical Air Command
US	United States
USAF	United States Air Force
USSOCOM	United States Special Operations Command
VHF-FM	Very High Frequency-Frequency Modulation

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