COMBAT RESCUE OPERATIONAL REVIEW

A Summary of Combat Rescue Operations from Vietnam to Kosovo

March 2001

Prepared for:
HQ ACC/DRMR
Langley AFB, VA

In Support of:
Combat Rescue Future
Recovery Vehicle
Analysis of Alternatives

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ACKNOWLEDGMENTS

An effort as lengthy and detailed as the Combat Rescue Operational Review (CROR) cannot be completed without the input and assistance of many people. First and foremost, the entire Future Combat Rescue Vehicle Analysis of Alternatives (AoA) team must be acknowledged. Although the AoA was truly a team effort, the input and expertise of the following people was particularly helpful to the completion of the CROR:

Lt Col Travis Chevallier, Air Combat Command
Major Alvin Drew, Air Combat Command
Major Dave Fulk, PhD, Air Combat Command
Major Dave Morgan, Air Combat Command
Mr. Mike Agin, Pioneer Technologies Corporation
Mr. Steve Alston, Pioneer Technologies Corporation
Mr. Charles Cunningham, Pioneer Technologies Corporation
Mr. Jeff Eggers, Pioneer Technologies Corporation
Mr. Steve Lupenski, Pioneer Technologies Corporation
Mr. Bob Mohan, Pioneer Technologies Corporation
Lt Col (ret.) AI Wood, Pioneer Technologies Corporation

The time and thoughtful review of the Combat Rescue Operational Review by Combat Rescue operators must also be acknowledged. Their first-hand accounts of operations and frank feedback improved the quality of the CROR immeasurably. Although there were too many to list individually, participation of the following individuals was particularly helpful:

Lt Col Joe Callahan, Air Combat Command
Lt Col Tom Trask, Air Force Special Operations Command
Major John Cherry, Air Combat Command
Major John McGonagill, Air Combat Command
Major Mike Trumpfheller, Air Combat Command

The CROR relied heavily on the voluminous work done by others over the decades since the war in Southeast Asia. That fine work, by analysts, operators, and researchers both known and unknown, is acknowledged here. It is hoped that the CROR can match their standard of quality and may be viewed as a helpful addition to existing papers. Access to much of that information was possible only with the expert assistance of archivists at the Joint Personnel Recovery library in Ft. Belvoir, Virginia and with the generous assistance of Mr. Steven Maxner of the Vietnam Center at Texas Tech University in Lubbock, Texas. Lastly, the significant assistance of Ms. Donna Egner of the Survivability/Vulnerability Information Analysis Center at Wright-Patterson AFB, Ohio must be acknowledged. Her generous, timely, and expert support went well beyond expectations, and benefited the CROR in a way that is beyond measure.
"Combat Search and Rescue (CSAR) is an integral part of US combat operations and must be considered across the range of military operations. CSAR consists of those air operations conducted to recover distressed personnel during wartime or Military Operations Other Than War...Although all US Air Force weapon systems have the inherent capability to support CSAR operations, certain forces are specifically dedicated for search, rescue, and recovery operations.” (AF Doctrine Document 1, Sep 97)

Per tasking to the Combat Rescue Analysis of Alternatives (CR AoA) by the Undersecretary of Defense for Acquisition and Technology Milestone 0 Decision, a historical data analysis relating to operational factors for CSAR missions was conducted. Comprehensive reviews of Combat Rescue missions from Southeast Asia, Operations Desert Storm, Operation Deny Flight, Operation Allied Force, Cold War losses provide the basis of research data for the study.

The scope of this study focused on scenarios of downed aircrews in combat, excluding missions such as conventional troop support, medical evacuation, and non-combatant evacuation operations. The objectives of the study were:

- Describe historic Combat Rescue operations
- Identify trends pertaining to factors associated with combat aircraft losses
- Identify Combat Rescue capabilities and the threat facing recovery forces
- Identify factors that will affect recovery operations in future scenarios (2010-2030)
- Enhance the fidelity and accuracy of Combat Rescue modeling and simulation by providing a single historical data source

Although force composition, duration of the conflict, topography and climatologic factors, Information Technology advances and enhancements, and Combat Rescue tactics, techniques, and procedures varied from conflict to conflict, a remarkable analogy of lessons learned and factors affecting successful recovery operations can be postulated. Foremost, direct correlation exists between exposure times in the target/terminal area of operations and mission success rates. Data analysis validates “slow moving” Combat Rescue assets and “fast moving” fighter aircraft experience higher loss rates in the target/terminal area, while ingress and egress loss rates were relatively low. Additional factors affecting successful Combat Rescue operations include (but are not limited to) aircraft distance traveled from initial battle damage to aircrew ejection, specific aircrew ejection parameters, command and control relationships, available Combat Rescue assets (dedicated versus non-dedicated Combat Rescue elements), and threat environment to both the Survivor/Evader and recovery forces. The probability of rescuing downed Survivors/Evaders (S/E) is a function of accurate S/E location identification and time available to rescue forces. From Desert Storm to current contingency operations, this study reinforces the need for improved S/E communication capabilities, to include passage of geo-location information, secure communications, and increased transmission range of S/E communications equipment. Lessons learned also show consistent ability of the enemy to
“spoof” and jam S/E communications, complicating rescue efforts and increasing risk to the rescuers.

Growing political and military trends will have a dramatic effect on future Combat Rescue operations. Perhaps the most significant factor will be the level of commitment to maintaining a trained Combat Rescue force organized under an Air Component Commander. Although current USAF and Joint doctrine defining tactics, techniques, and procedures for Combat Rescue exists, specific command and control relationships continue to affect the safe and expeditious tasking and execution of Combat Rescue missions. Joint Pub 3-50.2, Doctrine for Joint Combat Search and Rescue, specifically makes each service responsible for providing forces capable of performing Combat Rescue in support of its own operations, consistent with its assigned functions. Each service then organizes, trains, and equips its own Combat Rescue forces based on inherent missions. An area of emphasis requiring attention is the use of another Component’s forces to support an Air Component Commander’s Combat Rescue requirements. While other Component assets continue to be a valuable resource in Combat Rescue operations, loss of Unity of Command has been observed as a significant problem. There also exist doctrine, tactics, and training gaps that affect the planning and coordination of effective recovery operations. Differences between Services or Component communications equipment as well as Standard Operating Procedures for sister-service units can, and has, led to significant mission delays. In some cases, the breakdown of communications due to command relationships greatly impacted on timely execution of rescue operations. Technological advances and system enhancements are expected to reduce problems in the dissemination of data information between Combat Rescue assets supporting forces, and Command and Control nodes, but specific command and control relationships must be stated and adhered to by all players. The introduction of a Time-Critical Targeting model to Combat Rescue operations significantly benefits recovery operations. With improved Command and Control concepts (including full integration of Combat Rescue functions into the Air Operations Center, mission risk will be reduced and Combat Rescue success rates should increase.
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1. Study Objectives and Overview

In May 1999, the Combat Rescue Analysis of Alternatives (AoA) Study Team was directed by the Undersecretary of Defense for Acquisition and Technology (USD[A&T]) to conduct a study of historical data relating to operational aspects of the Combat Search and Rescue (CSAR) mission. Emphasis was to be placed on an evaluation of the factors found to be most important to the success or failure of actual CSAR missions.

The scope of the study is generally limited to scenarios in which aircrew were downed in combat. Missions such as conventional troop transport, medical evacuation (MEDEVAC), and non-combatant evacuation operations (NEO) were excluded. This report further restricts itself to assessment of operational factors, while questions of accounting for aircrew declared Missing in Action (MIA) and assessment of the financial and opportunity costs of performing the Combat Rescue mission will be addressed by the Defense Prisoner of War (POW)/MIA Office. Within those constraints, the objectives of this study were:

- Describe historic Combat Rescue operations in their contemporary context.
- Identify important trends in the evolution of combat aircraft losses, Combat Rescue capabilities, and the threat facing recovery forces.
- Attempt to identify those factors that will be most important in the 2010-2030 time frame.
- Provide a convenient data source for developers of Combat Rescue models so that their fidelity and accuracy may be enhanced.

To meet those objectives, the Research Team performed a comprehensive review of Combat Rescue research to date, interviewed actual participants in Combat Rescue operations from Vietnam to Kosovo, reviewed operational test data, and hosted round-table discussions to provide context and perspective for the research findings.

A note on data—despite the voluminous reporting on the air wars covered in this report, there are many gaps and conflicting information. The numerous reporting systems underwent many revisions, and non-standard terminology created problems in analyzing/verifying data from different sources. When data sources conflicted, the authors either cited both sources or, using their judgment, used the data they perceived was most accurate.

Section 2 of the report, Operational Summaries, contains the bulk of the research findings, and is organized by the conflicts that were studied. The purpose of each summary is to lay out the facts at face value, using a common outline to provide an evidentiary point of departure for the analysis in Section 3 as well as future studies of the Combat Rescue operations. Some analysis and inferences are made in Section 2, however, and readers should consider the totality of the report when drawing their own conclusions.

Section 3, Assessment of Empirical Combat Rescue Operations, contains the bulk of the report's analysis. The primary objective of this section is to put the findings of the discrete operational summaries into historic context for comparison, and to identify trends that may help Combat Rescue planners prepare for some future conflict. Equally important is the identification of factors that are not trends—operational "dead-ends," that (in context of our total Combat Rescue experience) are probably not significant factors for future operations. Some of this report's most remarkable conclusions fall into this category.
2. Operational Summaries

Southeast Asia (1961-1975)

Operation Desert Storm (Iraq 1991)

Operation Deny Flight (Bosnia 1993-1995)

Operation Allied Force (Kosovo 1999)

Cold War (1946-1992)
2.1 Southeast Asia (1961-1975)

2.1.1 General Description of the Operational Environment

The United States military buildup in Southeast Asia (SEA) began in earnest in 1962, and by 1965 a significant force had begun air operations in that Theater. The tempo of the war increased and decreased until it peaked in response to the North Vietnamese 1972 Spring Offensive and during Linebacker II in December of that year. US involvement in SEA began to wind down during that period, leading to eventual "Vietnamization" of the conflict, and total withdrawal of US forces by early 1973. Although commonly called the Vietnam War, the fighting in Southeast Asia actually involved several wars of varying degrees of intensity. In Laos, there was a three-way civil war between rightists, Neutralists, and the Pathet Lao. There was an insurgency in South Vietnam (SVN) guided and eventually dominated by North Vietnam (NVN). The United States conducted an air war against NVN, another against the infiltration system along the Ho Chi Minh Trail, provided air support to the forces in SVN, and after 1970 carried out an air war against the Khmer Rouge in Cambodia.\(^1\) Accordingly, the environment faced by rescue forces in the region varied significantly in terms of its physical characteristics and the political and operational factors that shaped their missions.

2.1.1.1 The Physical Environment

Indochina presents a remarkable diversity in topography, climate, and flora and fauna. The area could present a survivor with environments ranging from dense tropical jungle where a survivor might take 30 minutes to travel 10 feet; to rice paddy areas where he could be seen from a mile away; to mountainous karst regions with cold, wet nights; to mangrove swamps; to desert-like stretches of sandy beach; to (best of all in terms of rescue success) open sea. Adding to that description, the character of the environment changed twice a year depending upon the monsoon and the overabundance (or lack) of rain. A survivor landing in a rice paddy at one time of year

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\(^1\) Tilford, p. 31.
"might sink in mud above his knees. He might land in the same paddy 6 months later and break an ankle on the parched earth."²

VIETNAM

Vietnam is located in the extreme southeastern part of the Indochinese peninsula and occupies about 128,000 square miles (slightly larger than the state of California), and has a long, narrow geography that made egress to the sea a matter of minutes if a damaged aircraft could hold together that long. Before the communist takeover of SVN, a demilitarized zone divided the country at approximately 17 degrees north latitude.

Vietnam is a country of tropical lowlands, hills and densely forested highlands, with level land covering no more than 15-20 percent of the area.³ The country is divided into the highlands and Red River Delta in the north; and the Central Mountains (sometimes called the Annamite Mountains), the coastal lowlands, and the Mekong River Delta in the south.

The Red River Delta consists of a flat triangular region of 1,800 square miles, but is smaller and more intensely developed than the Mekong River Delta. The Red River Delta is a highly populated region, accounting for almost 70 percent of the agriculture and 80 percent of the industry of NVN before 1975.⁴ The entire Delta region is no more than 3 meters above sea level (much of it is 1 meter or less) and the area is subject to frequent flooding. The Cau Mau Peninsula consists of thick jungles and mangrove swamps, which covers the southernmost tip.

The highlands and mountain plateaus in the north and northwest form Vietnam’s border with Laos and Cambodia, which terminates in the Mekong River Delta north of Ho Chi Minh City (formerly Saigon). In stark opposition to the flat Delta region, these jungled, irregularly formed mountains and limestone karst outcroppings, sometimes rising to 8,500 feet, presented a hazardous obstacle to low flying aircraft and a technical challenge to rescue crews. Following bailout, some pilots were killed when they landed on the jagged karst and others suffered broken bones as they came down through the branches of the multilayered jungle canopy.

Vietnam’s climate was as debilitating as its geography was rugged and hostile. The temperature rarely dipped below 80°F.

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² Porter, p. 9.
³ Smith, p. 12.
⁴ Cima, p. 85.
while the humidity was always high (averaging 84 percent throughout the year). Annual rainfall is substantial in all regions and torrential in some, ranging from 50 to 120 inches. Nearly 90 percent of the precipitation occurs during the summer. During this period, most of SVN experiences heavy precipitation, low cloud ceilings, chronic fog, and poor visibility. When the rains came, equipment often became inoperable, roads impassible, and flying nearly impossible.

NVN experienced the same uneven distribution of population that was typical of Indochina, which averaged 288 persons per square mile overall (see Figure 2-1: Population Density in NVN). The extremes were greater in NVN, however, with very sparse population of the inhospitable uplands, and with densities in the Red River Delta being described as "among the highest in the world." As the war progressed, populations migrated from urban to rural areas in response to US bombing and encouragement of the North Vietnamese government.

Considering its size, SVN as a whole was not densely populated. Although the average density was about 243 persons per square mile, the distribution was uneven, ranging from more than 750-2,000 per square mile in the Mekong Delta to only 13 per square mile on some of the plateaus of the Central Highlands. Contrary to what was observed in the North, the population migrated towards urban areas as the war progressed.

LAOS

Laos, a landlocked nation covering 91,400 square miles (approximately the size of Great Britain), is surrounded by Burma, Cambodia, China, Thailand, and Vietnam in the center of the Southeast Asian peninsula. Sixty percent of Laos, particularly the north, is covered with dense tropical rain forest and humped-back mountains with elevations above 1,500 feet characterized by steep terrain that has been described as "torturous." Laos has a tropical monsoon climate, with a pronounced rainy season from May to October (as much as 145 inches of rain in some areas). The cool dry season begins in November and continues through January. March begins the warmer humid weather, while the temperature reaches a high of 95°F in April and is the hottest month of the year. Dust and haze dominate the dry season, when the Lao farmers practice their slash and burn agriculture.

Although not a physical characteristic per se, the famed Ho Chi Minh Trail deserves specific mention here based on its operational significance during the war. The trail (actually a series of footpaths) ran north-to-south along the Annamite Mountains and fanned out into the jungles of SVN. This terrain favored unconventional warfare, allowing guerrillas to hide in the monsoon forest and jungle that covered 60 percent of the nation. The forest canopy rose as high as 200-250 feet above the jungle floor—a factor that complicated the efforts of rescue forces whenever an aircraft was shot down in tree-covered areas of Vietnam or Laos.

The average density of the population was under 40 persons per square mile in 1959 and was very unevenly distributed. The population density was greatest in the Mekong lowlands along the Thailand border where it averaged 180 persons per square mile. Next highest was the

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7 ??Cite "Laos: A Country Study."
Ventiane plain which, excluding the city of Ventiane itself, was estimated at 77 persons per square mile. Density was lowest in the far northwest, at less than 7 per square mile.\(^8\)

### 2.1.1.2 The Operational Environment

Many factors shaped US rescue operations in SEA. One important factor was the politically sensitive nature of any military operations in the area (particularly in Laos). Often, military necessity could not prevail against the political sensitivities present at the time. Detailed analysis of how international (and domestic) politics may have interfered with the effectiveness of Combat Rescue forces is well beyond the scope of this report, although it is reasonable to believe that our ability to recover Survivors/Evaders (S/E) in that Theater surely suffered as a result. Just how many airmen were lost that could otherwise have been recovered will never be known.

A second significant factor that helped shape the operational environment in SEA is the level to which American Combat Rescue capability had been allowed to decay after World War II and Korea. Not just a by-product of poor planning, the lack of a wartime Combat Rescue capability was the centerpiece of the plan itself. In 1958, HQ USAF withdrew its wartime mission clause from the National Search and Rescue Plan by declaring:

"[The Air Rescue Service] will be organized, manned, equipped, trained, and deployed to support peacetime air operations. No special units or specially designed aircraft will be provided for the sole purpose of wartime search and rescue. Wartime rescue operations will be dictated by the capabilities of equipment used for peacetime SAR..."\(^9\)

As a consequence, the first few years of rescue operations in SEA were made up of a hodgepodge of assets and informal agreements between services, government agencies, and politicians. Once American involvement shifted from limited and clandestine operations to a more conventional air war, the build-up of a rescue capability was rapid. By 1966, forces were finally in place, the concept of a Search and Rescue Task Force (SARTF) was well developed, and Combat Rescue operations had become a key component of the air campaign in SEA.

Sentiment of the local population in the vicinity of a shootdown was another important variable in the operational environment. Over the course of the conflict, approximately 20 percent of the population in SVN was characterized as being under control of the Viet Cong, 25 percent was characterized as "contested," and the remainder (about 55 percent of the SVN countryside) was described as "relatively secure."\(^11\) In such an environment, 17.4 percent of Americans lost that were neither rescued nor killed in action (KIA) in SVN became POW, and the remainder (82.6 percent) were categorized as missing in action.

### Table 2-1: Fate of Aircrew That Were Not Rescued\(^10\)

<table>
<thead>
<tr>
<th></th>
<th>MIA</th>
<th>POW</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>NVN</td>
<td>51.5%</td>
<td>48.5%</td>
<td>800</td>
</tr>
<tr>
<td></td>
<td>(412)</td>
<td>(388)</td>
<td></td>
</tr>
<tr>
<td>SVN</td>
<td>82.6%</td>
<td>17.4%</td>
<td>552</td>
</tr>
<tr>
<td></td>
<td>(456)</td>
<td>(96)</td>
<td></td>
</tr>
<tr>
<td>Laos</td>
<td>98.2%</td>
<td>1.8%</td>
<td>283</td>
</tr>
<tr>
<td></td>
<td>(278)</td>
<td>(5)</td>
<td></td>
</tr>
</tbody>
</table>

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\(^8\) Roberts, p. 40.

\(^9\) HQ USAF letter to MATS, Sep 26, 1958, in Tilford, p. 16.

\(^10\) Commanders Digest, p. 6.

\(^11\) Westmoreland, p. 199.
As dismal as that statistic is, it is markedly better than the situation in Laos where less than 2 percent of personnel that were not recovered became POWs. The remainder, slightly more than 98 percent, were declared MIA, prompting reasonable suspicion about the treatment of those men while in the hands of the local population. In NVN, where one could assume the population was most hostile towards downed Americans, about 48.5 percent of aircrew that were not rescued were categorized as POWs and 51.5 percent were declared MIA. Those numbers seem to contradict the trend noted in SVN and Laos, suggesting that, in addition to the degree to which the population was "contested," the local government's ability to control the behavior of the population is a key variable in the survival of downed airmen. Such a measurement of the "sympathies" of the local population may be useful when assessing the likelihood of evasion success in other areas of the world where similar assessments can be made.

RESCUE FORCE ASSETS AND DEPLOYMENT

Rescue force strength generally paralleled the pace of USAF fixed-wing activity in SEA (see Figure 2-10). The responsibility for providing assets to rescue personnel around SEA operating bases and in hostile territory was delegated to the 3rd Aerospace Rescue and Recovery Group (3d ARRG) by the Commander, Seventh Air Force. The Navy Control Center subordinate to this group was responsible for sea/littoral rescues, and was located in the Gulf of Tonkin. Although the number and basing locations varied over the course of the war, as of 1969 more than 15 rescue units contributed to that mission from operating locations across SEA (see Figure 2-2). These widespread units, located in two nations, were responsible for search and rescue activities in an area covering more than 1.1 million square miles. The 3d ARRG was also responsible for operating a Joint Search and Rescue Center (then called a JSARC) at Tan Son Nhut Air Base and several subordinate Rescue Coordination Centers (RCC) assigned by region. A detailed description of the aircraft used for rescue is in Section 2.1.6.2.

Figure 2-2: 3rd ARRG Units in SEA
(Source: Overton, Figure 2)
When rescue assets and infrastructure were finally in place, employment followed a Concept of Operations that had developed over time in that Theater. Any individual having knowledge of an emergency could initiate a rescue mission by notifying the JSARC, an RCC, or some other agency. At that point, the Mission Commander (typically aboard an HC-130) would determine the composition of the SARTF to include task primary and secondary forces, if required. It was even possible to receive support from civilian agencies such as Air America and Continental Air Services. For missions entering NVN, Rescue Coordinators had the added requirement of obtaining "border clearance" from the 7AF Commander.

**Prepositioning:** To reduce the time and distance for potential missions, rescue helicopters were put at forward operating locations (FOL) in SVN and northern Laos. The aircraft would arrive at the FOL at first light, staging two HH-53s (once they had arrived in theater) for northern missions in NVN and HH-3s for missions in SVN and north of the demilitarized zone.

**Orbit Concept:** Another tool for decreasing response time was the "orbit concept." It was conceived in March 1969 when the arrival of four additional HH-53s provided a sufficient number of airframes to support such a plan. Execution of the orbit concept put rescue aircraft (both helicopters and rescue escort [RESCORT]) in the air during periods of heavy air activity over NVN in anticipation of a shootdown. Called “airborne alert” in today’s terminology, the airborne forces augmented the rescue forces on ground alert (see Figure 2-3).

**CSARTF:** When a rescue mission began, it tended to take priority over other ongoing missions, and aircraft were often diverted from their assigned targets to support the recovery effort. Although much of the fighter-bomber support marshaled was generic, some roles were highly specialized. In particular, On-Scene Commander (OSC) and RESCORT tasks were unique to rescue missions, and are described in Section 2.1.6.3.

Once the CSARTF was assembled, the helicopters were escorted to the terminal area (usually by A-1E or A-7 "Sandy" aircraft) where one helicopter

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12 Overton, p. 12.
13 Information suggesting that rescue missions received priority over other missions is anecdotal. Research has not uncovered official policy that subordinated offensive air operations to Combat Rescue missions, and it is unlikely that such a policy existed. Regardless, it is an often-mentioned observation (as in Overton, p. 96 and among aircrew assigned to SEA).
was assigned as the "low bird." When the "low bird" aircraft commander had determined the survivor's location and his best course of action, he would start the approach to the area, jettisoning external fuel tanks if necessary. "Normally, the best approach was a high-speed descending pass over the survivor's position, and then a tear-drop turn to arrive back at the survivor's position headed into the wind." The second helicopter was assigned as the "high bird," and would typically orbit over the pickup area at 5,000-6,000 feet, generally safe from the threat of small arms. If weather or hostile activity prevented orbiting directly over the area he would orbit at a position from which the recovery could be observed. The "high bird" would advise the SARTF of enemy activity and could act as a forward air controller, if required. If the low helicopter were disabled, the high helicopter would attempt the recovery unless denied by enemy activity.

Major Gerald A. Jones flew a typical recovery from an orbit position in November 1968. The mission is best described in his own words:

"We were orbiting near Lima Site 36 [an FOL in northern Laos] when the mission broke. The pilot was down in a relatively open area with much enemy gunfire from surrounding hills. The [on-scene commander] mentioned that it was an extremely hot area so I was required to hold out for one and one-half hours during which time extensive sanitization was carried out by fast-movers. Finally I was brought in through intermittent cloud coverage. I couldn't spot the survivor at all and was taken back out as we began receiving ground fire. The survivor also came on the air and told us to leave the area. I then tried to come in from the west real low with the sun behind me. The Sandys had laid down a smoke screen for me, and flew 'daisy chains' over the area while continually firing. I still couldn't see him, but bored on in anyway. All of my guns were firing at this time. The survivor came on the air saying, 'I can see you.' We looked everywhere but couldn't see him. We were taking fire and I told the Sandys, but failed to give them exact positions. As I was casting about, the survivor came on again, 'You're right over me.' I did a quick 180 [degree turn] and there he was! The hoist operator sent down the penetrator while the rest of the crew fired from the other guns. In about 30 seconds we had him aboard and we egressed climbing and turning all the way...One of the problems in a high threat area such as this was that when the hoist was in operation, we lost the service of the #2 mini-gun."

The CHECO report from which that account was taken describes the terminal area operation in greater detail as follows:

"The description of the rescue by Major Jones...did not detail the intense hostile fire during ingress, egress and throughout the area. Six flights of fast-movers were put on numerous hostile gun positions in the area for suppression. Additionally, there were many troops within 200 yards of the survivor. As a matter of fact, the pickup was made on the last possible attempt. The survivor was in the open, being fired on from surrounding gun positions, and being

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14 Overton, p. 25.
Mission Closure/Suspension/Withdrawal: If operations were unsuccessful, and when it appeared that all reasonable action had been taken, the JSARC would recommend to the 7AF Commander that the mission be suspended. The Airborne Mission Commander (AMC, usually the HC-130 Crown aircraft) or the On-Scene Commander could also direct the temporary withdrawal of rescue forces in the situation dictated. The JSARC could close the mission completely when:

- The recovery was completed
- The location of the survivor was positively identified but there could be no further value in the continued use of the SARTF
- There was no indication of need for Search and Rescue effort
- Recovery was extremely doubtful due to hostile activity, probable capture, or time lapse
- The mission proved to be false

2.1.2 Characteristics of Isolating Incidents

2.1.2.1 Causes of Isolating Incidents

The type and severity of the threat faced by American and allied flyers in SEA varied significantly by the location of the operation and the timeline of the conflict. In the end, however, ground fire caused about 83 percent of total combat losses between 1962 and 1972. During that same period, surface-to-air missiles (SAMs) accounted for 6.3 percent of combat losses, and base attack and Migs accounted for 5.5 percent and 3.8 percent respectively.\(^{17}\)

Although enemy weapons typically used for air defense (SAMs, anti-aircraft artillery [AAA], Mig fighters) caused most combat losses, it is noteworthy that (as of 1971) at least 80 fixed-wing USAF aircraft had been lost in SEA due to small arms fire. The actual total for small arms may be much larger due to many kills attributed to "unknown ground fire."\(^{18}\) Also noteworthy is the introduction of man-portable air defense systems (MANPADS) late in the conflict. In 1972, as US involvement waned, SA-7 MANPADS were introduced in SEA, killing 20 aircraft and damaging six more.\(^{19}\) Had the war continued, MANPADS would have played a very significant role in the air war over North and South Vietnam.

Figures 2-4 and 2-5 illustrate the proportions of aircraft losses that are attributable to each threat category for operations in all of SEA. Of great significance is that simple, widely proliferated weapons (AAA, large caliber automatic weapons, and small arms) account for more than 80 percent of SEA losses.

---

\(^{16}\) Overton, p. 27.
\(^{17}\) Granville, p. 24. Although not exactly identical, that general distribution of causes matches that described by Hewett.
\(^{18}\) Hewett, p. 5.
\(^{19}\) Crosthwaite, p. 12.
Figure 2-4: Causes of Fixed-Wing Combat Losses in SEA by Type of Weapon
(Source: Hewett, Tables IV, V, and VI)

Figure 2-5: Fixed-Wing Combat Losses in SEA by Country
(Source: Hewett, Tables IV, V, and VI)
NORTH VIETNAM

On the eve of the Gulf of Tonkin incidents in 1964, air defenses in NVN were of low effectiveness. There were no fielded missile defenses and conventional anti-aircraft weapons used for air defense had very limited radar tracking capability.\(^\text{20}\) By June of 1968, Russia had equipped NVN with about 35 SAM battalions and had supplied a sophisticated communications and radar network, numerous aircraft (including the Mig-15, Mig-17, and Mig-21), and large quantities of anti-aircraft weapons. All of those weapons contributed to establishing "the most sophisticated air defense system ever faced by any force in combat."\(^\text{21}\) In NVN, AAA accounts for nearly half of all losses, and nearly all aircraft lost to SAMs were in NVN.

![Figure 2-6: Losses by Threat System in North Vietnam](Source: Hewett, Table IV)

---

\(^{20}\) Sharp, p. 13.

\(^{21}\) Sharp, p. 4.
LAOS

In Laos, automatic weapons and AAA were predominant. Pathet Lao air defenses were less sophisticated than were found in NVN but Laotian experience indicates that the threat was nearly as lethal. Along the Ho Chi Minh Trail and in Viet Cong controlled areas of SVN, the enemy's principle antiaircraft weapons were the 12.7 mm Soviet or Chinese built heavy machine gun and small arms.

Figure 2-7: Losses by Threat System in Laos
(Source: Hewett, Table VI)
SOUTH VIETNAM

In SVN, air defenses were similar to those found in Laos where small arms and automatic weapons account for the majority of losses. South Vietnam differs from Laos in that, as the war progressed, the North Vietnam regular army occupied more and more territory in SVN, bringing with them a more conventional and more lethal air defense capability.

![Figure 2-8: Losses by Threat System in SVN](Source: Hewett, Table V)

CAMBODIA

In Cambodia, the communist Khmer Rouge remained a force without sophisticated weapons up to the day they took power in April 1975. Throughout the war, they rarely, if ever, employed the larger caliber anti-aircraft guns used by the North Vietnamese and, to a lesser extent, by the enemy forces in SVN. As of 1971, only five aircraft were officially reported as lost over Cambodia. Consequently, rescue activity there never assumed the scope that it did elsewhere in SEA.  

---

22 Hewett, p. 8.
2.1.2.2   Type of Asset Lost

Table 2-3 summarizes USAF in-flight combat losses between 1962 and 1973, and suggests that the average number of aircrew available for rescue per loss incident is 0.93. That number includes only those aircrew known to be available for rescue (i.e., rescued or captured). The figure was calculated by: (Rescued + POW)/Aircraft Lost.

US Navy (USN) combat loss experience is similar to that of the USAF. The average number of aircrew available for rescue per loss incident is 1.0 (Table 2-2, based on data from Office of Naval Aviation History and aircrew status distributions described in Every [21, pp. 27-30). The Navy results closely resemble the USAF average of 0.93 per loss incident.

Table 2-2: Summary of USN Losses in SEA

<table>
<thead>
<tr>
<th>Aircraft Type</th>
<th>Typical Crew Size</th>
<th>Distribution of USN Losses by Aircraft Type</th>
<th>Personnel Losses per 100 Aircraft Losses</th>
<th>Available for Rescue per 100 Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-4</td>
<td>1</td>
<td>37%</td>
<td>37</td>
<td>26.3</td>
</tr>
<tr>
<td>R/F-4</td>
<td>2</td>
<td>21%</td>
<td>42</td>
<td>29.8</td>
</tr>
<tr>
<td>R/F-8</td>
<td>1</td>
<td>13%</td>
<td>13</td>
<td>9.2</td>
</tr>
<tr>
<td>E/A-6</td>
<td>2</td>
<td>10%</td>
<td>20</td>
<td>14.2</td>
</tr>
<tr>
<td>A-7</td>
<td>1</td>
<td>8%</td>
<td>8</td>
<td>5.7</td>
</tr>
<tr>
<td>E/A-1</td>
<td>1</td>
<td>7%</td>
<td>7</td>
<td>5.0</td>
</tr>
<tr>
<td>RA-5</td>
<td>2</td>
<td>3%</td>
<td>6</td>
<td>4.3</td>
</tr>
<tr>
<td>OV-10</td>
<td>2</td>
<td>2%</td>
<td>4</td>
<td>5.6</td>
</tr>
<tr>
<td>K/EA-3</td>
<td>9</td>
<td>1%</td>
<td>9</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Average USN Crew Size per Aircraft Lost: 1.46
Available for Rescue per Loss (Rescued + POW): 1.0

23 Office of Naval Aviation History (no page number).
Table 2-3: Summary of USAF Combat Losses in SEA (1962-1972) 24

<table>
<thead>
<tr>
<th>Aircraft</th>
<th>Aircraft Lost</th>
<th>Total Crew Members</th>
<th>Fate of Aircrew</th>
<th>Typical Crew Size</th>
<th>Available for Rescue per Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>147</td>
<td>158</td>
<td>Rescued 81</td>
<td>MIA 21</td>
<td>KIA 54</td>
</tr>
<tr>
<td>A-7</td>
<td>2</td>
<td>2</td>
<td>Rescued 2</td>
<td>MIA 2</td>
<td>KIA 0</td>
</tr>
<tr>
<td>A-26</td>
<td>10</td>
<td>21</td>
<td>Rescued 3</td>
<td>MIA 9</td>
<td>KIA 9</td>
</tr>
<tr>
<td>A-37</td>
<td>14</td>
<td>14</td>
<td>Rescued 3</td>
<td>MIA 2</td>
<td>KIA 9</td>
</tr>
<tr>
<td>AC-47</td>
<td>15</td>
<td>109</td>
<td>Rescued 24</td>
<td>MIA 28</td>
<td>KIA 57</td>
</tr>
<tr>
<td>A-119</td>
<td>2</td>
<td>10</td>
<td>Rescued 7</td>
<td>MIA 0</td>
<td>KIA 3</td>
</tr>
<tr>
<td>AC-130</td>
<td>6</td>
<td>82</td>
<td>Rescued 30</td>
<td>MIA 50</td>
<td>KIA 2</td>
</tr>
<tr>
<td>B/RB-26</td>
<td>9</td>
<td>21</td>
<td>Rescued 1</td>
<td>MIA 0</td>
<td>KIA 20</td>
</tr>
<tr>
<td>B-52</td>
<td>16</td>
<td>98</td>
<td>Rescued 32</td>
<td>MIA 44</td>
<td>KIA 18</td>
</tr>
<tr>
<td>B-57</td>
<td>32</td>
<td>65</td>
<td>Rescued 26</td>
<td>MIA 16</td>
<td>KIA 21</td>
</tr>
<tr>
<td>C-7</td>
<td>7</td>
<td>22</td>
<td>Rescued 4</td>
<td>MIA 0</td>
<td>KIA 18</td>
</tr>
<tr>
<td>C-47</td>
<td>6</td>
<td>47</td>
<td>Rescued 11</td>
<td>MIA 8</td>
<td>KIA 28</td>
</tr>
<tr>
<td>C-123</td>
<td>17</td>
<td>77</td>
<td>Rescued 15</td>
<td>MIA 16</td>
<td>KIA 46</td>
</tr>
<tr>
<td>C-130</td>
<td>22</td>
<td>134</td>
<td>Rescued 35</td>
<td>MIA 34</td>
<td>KIA 65</td>
</tr>
<tr>
<td>CH-3</td>
<td>13</td>
<td>55</td>
<td>Rescued 40</td>
<td>MIA 3</td>
<td>KIA 9</td>
</tr>
<tr>
<td>CH-53</td>
<td>2</td>
<td>8</td>
<td>Rescued 6</td>
<td>MIA 0</td>
<td>KIA 2</td>
</tr>
<tr>
<td>EB-66</td>
<td>4</td>
<td>25</td>
<td>Rescued 3</td>
<td>MIA 9</td>
<td>KIA 1</td>
</tr>
<tr>
<td>F-4</td>
<td>369</td>
<td>734</td>
<td>Rescued 322</td>
<td>MIA 222</td>
<td>KIA 70</td>
</tr>
<tr>
<td>F-5</td>
<td>7</td>
<td>8</td>
<td>Rescued 2</td>
<td>MIA 0</td>
<td>KIA 6</td>
</tr>
<tr>
<td>F-100</td>
<td>193</td>
<td>218</td>
<td>Rescued 141</td>
<td>MIA 55</td>
<td>KIA 5</td>
</tr>
<tr>
<td>F/TF-102</td>
<td>3</td>
<td>3</td>
<td>Rescued 2</td>
<td>MIA 1</td>
<td>KIA 0</td>
</tr>
<tr>
<td>F-104</td>
<td>8</td>
<td>8</td>
<td>Rescued 2</td>
<td>MIA 3</td>
<td>KIA 2</td>
</tr>
<tr>
<td>F-105</td>
<td>334</td>
<td>353</td>
<td>Rescued 127</td>
<td>MIA 105</td>
<td>KIA 25</td>
</tr>
<tr>
<td>F-111</td>
<td>8</td>
<td>15</td>
<td>Rescued 0</td>
<td>MIA 15</td>
<td>KIA 0</td>
</tr>
<tr>
<td>HH-3</td>
<td>10</td>
<td>40</td>
<td>Rescued 26</td>
<td>MIA 3</td>
<td>KIA 11</td>
</tr>
<tr>
<td>H-43</td>
<td>8</td>
<td>31</td>
<td>Rescued 24</td>
<td>MIA 0</td>
<td>KIA 4</td>
</tr>
<tr>
<td>HH-53</td>
<td>8</td>
<td>44</td>
<td>Rescued 18</td>
<td>MIA 1</td>
<td>KIA 25</td>
</tr>
<tr>
<td>HU-16</td>
<td>2</td>
<td>13</td>
<td>Rescued 4</td>
<td>MIA 7</td>
<td>KIA 2</td>
</tr>
<tr>
<td>O-1</td>
<td>94</td>
<td>110</td>
<td>Rescued 51</td>
<td>MIA 15</td>
<td>KIA 44</td>
</tr>
<tr>
<td>O-2</td>
<td>72</td>
<td>59</td>
<td>Rescued 25</td>
<td>MIA 15</td>
<td>KIA 23</td>
</tr>
<tr>
<td>OV-10</td>
<td>44</td>
<td>59</td>
<td>Rescued 25</td>
<td>MIA 10</td>
<td>KIA 23</td>
</tr>
<tr>
<td>RB-57</td>
<td>2</td>
<td>4</td>
<td>Rescued 4</td>
<td>MIA 0</td>
<td>KIA 0</td>
</tr>
<tr>
<td>RB-66</td>
<td>2</td>
<td>9</td>
<td>Rescued 5</td>
<td>MIA 0</td>
<td>KIA 4</td>
</tr>
<tr>
<td>RF-4</td>
<td>72</td>
<td>144</td>
<td>Rescued 58</td>
<td>MIA 51</td>
<td>KIA 14</td>
</tr>
<tr>
<td>RF-101</td>
<td>32</td>
<td>31</td>
<td>Rescued 9</td>
<td>MIA 1</td>
<td>KIA 11</td>
</tr>
<tr>
<td>T-28</td>
<td>17</td>
<td>20</td>
<td>Rescued 6</td>
<td>MIA 5</td>
<td>KIA 9</td>
</tr>
<tr>
<td>UH-1</td>
<td>13</td>
<td>51</td>
<td>Rescued 40</td>
<td>MIA 11</td>
<td>KIA 0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1622</td>
<td>2902</td>
<td>1212</td>
<td>717</td>
<td>677</td>
</tr>
</tbody>
</table>

24 Granville, Table 15. Data from Table 15 was adjusted, based on data in Table 6 of the same document, to remove numbers of aircraft lost on the ground due to enemy attacks on airfields.

25 Although the summaries of aircrew status (rescued, MIA, KIA, POW) in Table 2-3 are useful for estimating rescue demand for each aircraft type, the totals in this table appear to understate the POW and MIA totals when compared with other accounts.
2.1.2.3 **Type of Mission Being Conducted When Asset Was Lost**

Figure 2-9 shows the distribution of S/Es in SEA by mission type, as well as the distribution of S/Es that were captured and became POWs. It shows that two missions, “Strike” and Reconnaissance (“Recce”), combine as the sources for more than half of all S/Es in SEA. A look at the distribution of captured aircrew, also in Figure 2-9, paints a slightly different picture. It shows that losses during strike missions resulted in aircrew capture at about twice the rate of S/E production. Recce losses produced POWs in approximate proportion to the S/Es from that mission, while losses during combat air patrol, while producing only 2.5 percent of total USAF S/Es in SEA, produced 14.1 percent of the total POW population.26

2.1.2.4 **Phase of Mission Being Conducted When Asset Was Lost**

Operations in the target area were, by far, the most lethal mission phase for combat aircrew anywhere in SEA. For fixed-wing aircraft, the target area’s combination of threat exposure and predictable aircraft flight profile account for 83 percent of all combat damage incidents leading to aircraft loss.27 The remainder (17 percent) received combat damage and were lost during ingress, egress, or during crash landing.

---

26 Granville, Table 14.
27 Hewett, 1971, p. xii.
2.1.2.5 **Frequency of Isolating Incidents**

**NUMBERS OF SURVIVORS/EVADERS**

Although references to numbers of rescues attempted in SEA abound, it is difficult to assess which are most accurate. Some reports are very detailed but cover only portions of the conflict’s duration. Other reports contain summary information, but the figures vary widely and are difficult to assess since various methods are used to categorize the losses. In his now classic book, Earl Tilford credits the Air Rescue and Recovery Service forces with saving 3,883 lives in SEA.\(^{28}\) That number includes not only the combat rescues of aircrew that are the centerpiece of this report, but also rescues resulting from non-combat losses of aircraft, evacuation of conventional US Army (USA) troops, and mass evacuations of civilians from one area to another. Table 2-4 lists the number and status of aircrew lost to combat action and their yearly distribution, using the best data available. It conflicts with tallies of POW and MIA aircrew in Tables 2-3 and 2-5 which are assessed as being more accurate.

**Table 2-4: Number and Status of Airmen Surviving Shootdown in SEA 1964-1972\(^{29}\)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Combat ACR</td>
<td>26 (est)</td>
<td>122 (est)</td>
<td>179</td>
<td>192</td>
<td>263</td>
<td>214</td>
<td>132</td>
<td>122 (est)</td>
<td>75 (est)</td>
<td>1325</td>
</tr>
<tr>
<td>POW</td>
<td>3</td>
<td>74</td>
<td>97</td>
<td>179</td>
<td>95</td>
<td>13</td>
<td>12</td>
<td>11</td>
<td>5</td>
<td>489(^{30})</td>
</tr>
<tr>
<td>MIA</td>
<td>4</td>
<td>54</td>
<td>204</td>
<td>226</td>
<td>294</td>
<td>176</td>
<td>85</td>
<td>79</td>
<td>23</td>
<td>1145</td>
</tr>
<tr>
<td>Rec Rate</td>
<td>89.7%</td>
<td>62.2%</td>
<td>64.9%</td>
<td>51.8%</td>
<td>73.5%</td>
<td>94.3%</td>
<td>91.7%</td>
<td>91.7%</td>
<td>93.8%</td>
<td>73.0%</td>
</tr>
<tr>
<td>Rec Rate</td>
<td>78.8%</td>
<td>48.8%</td>
<td>37.3%</td>
<td>32.2%</td>
<td>40.3%</td>
<td>53.1%</td>
<td>57.6%</td>
<td>57.5%</td>
<td>72.8%</td>
<td>44.8%</td>
</tr>
</tbody>
</table>

**Table 2-5: Summary of Airmen Downed in SEA (including KIA)**

<table>
<thead>
<tr>
<th></th>
<th>Rescued</th>
<th>POW</th>
<th>MIA/KIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>USAF Only (Granville)(^{32})</td>
<td>41.8%</td>
<td>10.2%</td>
<td>48.0% (24.7%/23.3%)</td>
</tr>
<tr>
<td>USAF Only (Hewett)(^{33})</td>
<td>44.3%</td>
<td>14.8%</td>
<td>40.9% (19.9%/21.0%)</td>
</tr>
<tr>
<td>USN Only (primarily NVN losses)(^{34})</td>
<td>39.1%</td>
<td>32%</td>
<td>28.9%</td>
</tr>
</tbody>
</table>

\(^{28}\) Tilford, p. 155.


\(^{30}\) In 1973, 587 American POWs were released from Vietnam. The figures in the table are dated 1973 (prior to release of POWs) and may have categorized as MIA some personnel that were POW. In any case, figures of the type shown in the table vary based on the source and the MIA total is apparently not limited to downed aircrew.

\(^{31}\) "Available" refers to those S/E available for rescue (i.e. excludes KIA and MIA).

\(^{32}\) Granville, p. 57.

\(^{33}\) Hewett, pp. 43-44.

\(^{34}\) Every (2), pp. 27 and 30.
Figure 2-10: Fixed-Wing Aircraft Losses and Rescue Inventory (1965-1972)