CH–46 could perform almost all of the missions required. In the Vertol study "The CH–53 and CH–46 were considered as equally suitable aircraft for retrieval, Air Search and Rescue, helicopter control, and a pathfinder transport on a 1 for 1 basis." [45] Such an assumption, it was later pointed out, "overlooks the payload and speed advantage of the CH–53, which might enable it to perform these missions with a smaller force than the CH–46." The conflicting analyses prompted further investigations. In September 1966, MCOAG released a new report which traced the development of the mix and summarized the progress and problems in resolving the question.

In first establishing a helicopter force which could conduct the required initial assault, the Marine Corps had determined that 360 CH–46s and 72 CH–53s would be needed in the operating forces. Subsequent to this decision, the cost of the CH–46 had risen considerably. The increase in price upset the "cost/effectiveness" calculations and "was cause for a reevaluation of the helicopter program mix." [46] It was this study which had resulted in the recommendation to buy only CH–53s. "Because a force with more CH–53s and fewer CH–46s would have a smaller total number of helicopters, there was some concern about flexibility to perform follow-on missions," MCOAG stated. Therefore:

> . . . the War Games Division of the Marine Corps Landing Force Development Center [at Quantico] was asked to examine the overall helicopter mission, assault and follow-on, to determine whether mixes capable of transporting assault elements were also capable of supporting subsequent operations.

There was one major difficulty with a study of this type. As MCOAG had to admit, "First of all, there is no established doctrine to be satisfied in providing helicopter support of post-assault operations." Up until the war in Vietnam, the Marine Corps had concentrated the development of its doctrine, tactics, equipment, and even organization almost exclusively on the initial vertical amphibious landings. Little attention was given to any operations after the beachhead had been secured. At first glance, this appears to be an oversight. It was not.

In 1973, Major General Henry R. Paige recalled the events 20 years earlier that led up to the neglect of a post-assault doctrine. General Paige had served as the first president of the Tactics and Techniques Board at the Marine Corps Development Center from September 1950 until July 1953. He was also the officer who had made such a strong case for enlisted Marines as helicopter pilots. He wrote:

> To understand this, you must go back to the 1945–1950 era when the Marine Corps was literally fighting for its life. The roles and missions of the various services were finally spelled out and the Marine Corps ended up with a task of "Developing Tactics, Techniques and Equipment for *Landing Force* Operations."
>
> This led to the organization of the Marine Corps *Landing Force* Development Center in the fall of 1950. The Navy was assigned "Amphibious Operations" so you can see the Marine Corps was limited to only the *Landing Force* phase. The Army had the responsibility for land operations, and we were guided by their manuals.
>
> So to avoid conflict, we devoted our efforts principally on how to get Marines and equipment and supplies ashore. The roles and missions were put to a test in Korea. You may recall that the Army controlled land operations, and the Air Force air operations, while the Navy looked after the sea (and amphibious operations in conjunction with the Marine Corps). That, in essence, is why . . . we did not pursue postlanding operations at that time.[47]

It was difficult to determine the proper mix of transport helicopters for a type of war for which there was no Marine doctrine. By the summer of 1966 it was becoming increasingly apparent that the majority of the Marine combat operations which had been ordered in Vietnam would not require amphibious landings, but would be post-assault warfare.

The Marine Corps intensified its efforts to develop an appropriate doctrine. In the meantime, MCOAG could conclude only that "requirements for helicopter lift in post-assault operations may well be a function of the tactical situation, the terrain, and the number of helicopters available." [48] Thus, "rather than a requirement for a minimum number of helicopters, whatever helicopters are available might be used. Their effectiveness may not be determined easily." As this study was being written, the shortage of helicopter pilots was beginning to be felt acutely and the crews in Vietnam were on duty up to 15 hours a day for months on end. There was no question in their minds that "whatever helicopters were available" were being used.

The attempt to establish a proper mix, not only for the amphibious landings but in post-assault combat, continued. The war game analysis conducted by MCLFDC at Quantico in 1966, "originally used a 5:1 (CH–46:CH–53) helicopter mix." MCOAG pointed out that "to use the follow-on missions generated in this case as a basis for comparing various mixes assumes that these are the only such missions which could be performed, and which are of any value." The fact was that, "other mixes might perform other kinds of missions, with more or less tactical value." Not only that, it was pointed out: "The use of Vietnam experience, based on UH–34 operations, can also bias the results. The UH–34 missions were naturally geared to the payload, speed, and number of these helicopters available. To assume that the same kind of missions

may be performed if other helicopters are available," could make a small helicopter more efficient and effective than it, in fact, was, the report concluded. The only recommendation MCOAG could give was:

> The implications of the assumptions made in the Vertol and MCLFDC studies clearly point out the need for a much broader study of Marine Corps missions and transportation. An analysis of the trade offs between forms of transportation, surface, and air, in support of overall tactical and strategic goals, is necessary before any long-run program decisions can be made.[49]

The Marine Corps was not the only one wrestling with the problem. OSD was also taking a hard look at the cost/effectiveness of the transport helicopter mix. In July 1968, General McCutcheon reported that OSD "proposed that the mix of medium to heavy helicopter squadrons in our wings be changed from 5:1 to 4:2 and that the number of helicopters in each medium squadron be reduced from 24 to 21." Reluctantly, the Marine Corps had to accept the decision. At the same time SecDef "indicates his belief that we do not need the number of medium and heavy helos in each wing that we requested and which he had previously authorized. It is now proposed," General McCutcheon continued, "that ¼ of the currently authorized total active helo assets be placed" in the reserve squadrons. If such a plan was forced on the Marine Corps, it "would end up with two 18-plane heavy and three 21-plane medium squadrons in each of the four wings." The Marine Corps was "fighting this plan, of course, but it is too early to know how successful we are going to be."

The new 2:1 mix was agreed to by the Marine Corps "on the condition that our light helicopter structure would be increased," for, he said, "Vietnam has proven that we do not have enough small helicopters for all the tasks that Marine ingenuity can devise." [50]

During the next year, the switch to the new mix got underway. There were to be 12 squadrons equipped with 252 CH–46s and six with 144 CH–53s. It was not the only change in the organization of helicopters taking place. As planning started for the FY 68 program, "the Marine Corps stated a requirement for armed and light helicopters in the base line [permanent peacetime] force." [51] The need for these squadrons had been amply demonstrated in Vietnam. "This requirement was recognized by OSD, but only if the Marine Corps would identify an equal cost force trade." It was the same old problem: any increase in the number of helicopter units had to be compensated by a reduction in fixed-wing aircraft. By October 1970 the Marine Corps was ready to recommend where the cuts would be made. One F–4 Phantom jet fighter/attack squadron was to be deactivated. In addition, one fixed-wing group headquarters with all the associated elements was to be abolished. Since the flow of students from the training command was beginning to taper off, the need for postgraduate flight training would be reduced in the future and additional deactivations were planned.

Marine Helicopters around the World

The first Marines began their withdrawal from South Vietnam in August 1969. In the next year and a half, one by one, the helicopter squadrons departed and were reassigned to other bases. On 26 May 1971, the last unit, HML–167, ceased combat operations and redeployed to New River where it was to receive the new twin-engined UH–1N. Two UH–1Es remained behind "for last minute administrative support." [52] Three weeks later, on 15 June, the two aircraft flew on board ship for transfer to Okinawa. They were the last Marine helicopters stationed in Vietnam. It seemed that the Marine commitment was over. It was not.

With the Americans gone, the North Vietnamese sensed that, finally, they had an opportunity to conquer the south. On 30 March 1972 they launched a massive invasion. The northern areas were quickly overrun. The two special landing forces sailed back to Vietnam and arrived off the coast the first week of April. On board the USS *Tripoli* (LPH 10) was Lieutenant Colonel Paul L. Moreau's HMM–165 and on board the USS *Okinawa* was HMM–164 under the command of Lieutenant Colonel Edward C. Hertberg. In addition to their normal complement of CH–46s, the squadrons were reinforced with detachments of CH–53s, UH–1Es, and Cobras. Meanwhile, Marine fixed-wing units returned to combat. Eventually the aircraft were stationed at Nam Phong in Thailand. A detachment of CH–46s from H&MS–36 under the leadership of Major John G. McCabe supported the jet operations. The squdarons were not withdrawn until 21 September when they returned to their home bases.

Off the coast of Vietnam the two SLFs assisted in recapturing the territory conquered by the enemy. U.S. ground forces were not used, but the helicopters made repeated assaults with the Vietnamese Marine Corps. It was some of the most bitter fighting of the war. By the end of the year, the invasion had been repulsed. Though the Marine helicopters would continue to patrol in the area—and later were used to clear mines from the waters of North Vietnam—they were not actively engaged in combat.

December 1972 found Marine helicopters, once again, around the world. Many of the places were

USMC Photo A422853

These Marine CH–46s of HMM–161, partially dismantled and rigged for shipment, have been loaded onto an amphibious ship at Da Nang for redeployment out of Vietnam in August 1970.

familiar, Futema, Kaneohe, Santa Ana, Camp Pendleton, Quantico, New River, and the LPHs in the Caribbean, Mediterranean, and Pacific. It seemed just like 1962. But there was a difference. All aircraft now had turbine engines, and it would not be long until all had two engines. The observation squadrons, while still a part of the helicopter groups, had no helicopters assigned. All aircraft were the fixed-wing OV–10s. There were now light HML squadrons, in addition to the HMMs and HMHs. There were attack helicopter units equipped with Cobras. There were other changes. The much sought for postgraduate training groups had been reduced to a single composite squadron on each coast offering instruction in the CH–46 and CH–53. The biggest difference, however, was in the pilots and crews. Many of those from 1962 were gone. Some permanently. For those who remained, there was no question of them being second-class citizens. The events of the decade had proved beyond any doubt that they were among the finest in all of the Marine Corps.

The "Father of Helicopters" Leaves the Ranks

Missing from the ranks of Marine aviators in December 1972 was the man who had contributed as much as any other individual to the development of helicopters in the Marine Corps—General McCutcheon. On 5 February 1970, McCutcheon's nomination for promotion to lieutenant general had been approved by President Nixon. The Senate confirmed it less than three weeks later, and soon after General McCutcheon left the post of DCS (Air) for a new assignment.

USMC Photo A422870

CH—53Ds of HMM–463 make their last flight over Marble Mountain Air Facility before redeployment on 18 May 1971. With its wooden huts and protective arches for aircraft, Marble Mountain in 1971 contrasts sharply with the improvised facility established almost six years before.

USMC Photo A800677

Marine helicopters return to war. Aircraft of HMM–164 land near Hue to embark South Vietnamese Marines for a counterattack against invading North Vietnamese forces in June 1972.

He returned to Vietnam as Commanding General, III Marine Amphibious Force (III MAF). In this post he helped to direct the redeployment of III MAF from Vietnam. Eight months after going to Vietnam, he was selected for promotion to the rank of full general and in January 1971 returned to Washington and an assignment as the Assistant Commandant of the Marine Corps. This time, however, he could not keep to the dictum he had laid down for himself 34 years before, that "anything I have been made responsible for, or anything I have undertaken, I have always endeavored to complete." [53]

McCutcheon was seriously ill and was not responding to medical treatments. Sadly he had to notify the Commandant that he would be unable to assume his new position for reasons of ill health. His failing strength forced him prematurely into retirement, but in recognition of his 34 years of distinguished service, Congress passed special legislation placing McCutcheon on the retired list in the grade of general effective 1 July 1971.[54] Just 13 days later, the general died of cancer at the National Naval Medical Center, Bethesda, Maryland. He was only 55.

A year later at a dual ceremony, the airfield at New River was named in honor of him, and the chapel renamed "Memorial Chapel" for all those who had served with the Marine Corps' first active duty four-star aviator. [55] *

At the dedication, the Assistant Commandant, an aviator, General Earl E. Anderson reflected:

> He was one of the finest and most distinguished Marine Officers [whose career] reads like a history of Marine aviation. He was a pioneer whose great determination, aggressive, innovative spirit produced so many long lasting programs.[56]

General Anderson went on to add: "All the Marine Corps shares with great pride in this recognition of the unparalleled accomplishments," of General McCutcheon. Undersecretary of the Navy Frank P. Sanders said:

MCAS(H) New River Photo 0978 5 72

Mrs. McCutcheon attends the ceremony at New River naming airfield in honor of the late General McCutcheon in 1972. Pointing out the ceremony site to Mrs. McCutcheon is General Earl E. Anderson, Assistant Commandant of the Marine Corps.

> America was built on the lives of those who have gone before. Faith, in God, in country, in desire has made this great country what it is today. General McCutcheon, throughout his career and his long illness, displayed this faith. He was a great Marine, a great American.[57]

General McCutcheon is often best remembered in connection with Marine Corps helicopters. But he had an equally significant impact on close air support command and control techniques, guided missile weapons systems, combat air operations doctrine, and the introduction of the true VTOL attack aircraft—the AV–8 "Harrier."

McCutcheon has been called "The Father of Helicopters," a title which ignores both his other aviation achievements and the contributions of many other Marines to helicopter development. If Marine Corps helicopters had a father, however, it undoubtedly would have been General Keith Barr McCutcheon.

* The first to be promoted while on active duty, though he was placed on the retired list the same day.

CHAPTER FOURTEEN

LOOKING TO THE FUTURE

The LHA

As 1972 came to a close, there were two major developments under way. Neither one would be completed until some years later. One was at Pascagoula, Mississippi, where a new type of ship was taking form.[1] Termed a Landing Helicopter Assault ship (LHA), it bore little resemblance to the original LPH, the "Teddybear," USS *Thetis Bay*.

At the time the true LPHs of the *Iwo Jima* class were being designed, the Marine Corps still had hopes of being able to conduct an "all helicopter" amphibious assault. Helicopter manufacturers continued to be optimistic that they could design and build a helicopter which could lift all the equipment needed for the attack. If this were to be the case, there would be no need for conventional landing craft and amphibious vehicles. Helicopters would carry everything. Thus the LPHs were designed with no provision for any landing boats, and the Landing Ship Dock (LSD), Landing Platform Dock (LPD), and Landing Ship Tank (LST) were built for surface attack.

The LSD and LPD were constructed with a "well deck." This ingenious arrangement allowed the ships to carry smaller landing craft inside them. When such a vessel reached its objective area, a large gate at its stern would be opened and, by taking on ballast, the ship would partially submerge, allowing the well deck to flood . The landing craft then could swim out and conduct the assault. On their return they could reenter the ship, the gate would be closed, ballast pumped out, and the well deck would once again be dry. It was an excellent system for surface assaults.

In the mid and late 1950s, the concept of an all-helicopter landing began to be questioned. The difficulties in producing the "Deuce" were a clear indication of the problems which would be encountered in any large helicopter. Attempts to reduce the weight of combat equipment to fit current aircraft were not all successful. There just seemed to be no lightweight substitute for some items, particularly tanks and heavy artillery. Thus the "all-helicopter" amphibious assault was set aside in favor of a balanced air and surface landing, which if not ideal, was obtainable. By now, the LPHs had been built and the lack of any facilities for landing craft was a matter of serious concern. In large-scale attacks, assault Marines often had to be transferred from the LPHs to the LSDs and LPDs to board landing craft. This posed constant problems for commanders and reduced the inherent flexibility of a balanced amphibious attack.

These problems and the testing of solutions to them pointed to a need for a ship which had facilities for both helicopters and landing craft. The answer was the LHA.

On 28 May 1968, the Secretary of Defense announced the award of a contract to build the new ships to the Ingalls Shipbuilding Division of Litton Industries. They would combine a helicopter flight deck and hangar space with a well deck for landing craft. They were to be very different from the first conversion into an LPH. Where the "Teddybear" at a full load displaced 10,000 tons, the new models are four times as large, displacing 39,000 tons. The LHAs are larger even than the *Boxer*-class conversions. The flight decks are 820 feet long. Their beam of only 106 feet permits passage through the Panama Canal with a scant three feet to spare. Their tallest masts reach 221 feet above the keel, and are designed to fold so that the ships can pass under the Brooklyn Bridge, if it ever were necessary to do so.

If the "keel-up" LPHs were three ships stacked on top of each other, the LHA is at least five different ones. Large holds are included to handle essential cargo. There are living facilities for a total of 262 officers and 2,542 enlisted personnel, including 1,672 combat marines. The well deck can accommodate an assortment of landing craft and amphibian tractors. And, of course, there are spaces for the helicopters and the necessary spare parts and machinery.

Originally, the Marine Corps requested nine of these ships. Tentative approval had been given, but on 20 January 1971 the number was reduced to five. It was a blow to the Marine Corps, but at least produc-

USMC Photo A702362

General Robert E. Cushman, Jr., 25th Commandant of the Marine Corps, presided over the christening of the Navy's first LHA, USS Tarawa, *in December 1973.*

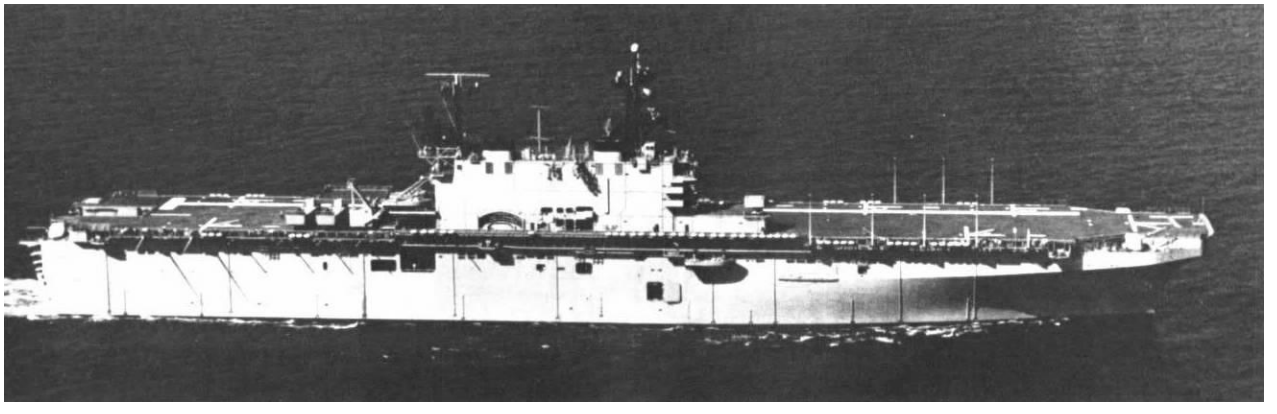
tion began on the ones approved. Litton Industries had long been a manufacturer of aerospace equipment and had only recently entered the field of shipbuilding. It had constructed a new shipyard at Pascagoula and attempted to apply the techniques of the aerospace business to the new venture. There were, understandably, problems. By the end of 1971, most had been corrected and the first LHA was back almost on schedule.

The date of 1 December 1973 was to be an important one for the Marine Corps. On that day, the Commandant, General Robert E. Cushman, Jr., arrived in Pascagoula. He had succeeded General Chapman as CMC on 1 January 1972. General Cushman, winner of the Navy Cross for heroism in the recapture of Guam in 1944, had come to Mississippi to attend the launching of the first LHA. It was to be named the USS *Tarawa* (LHA 1).

In his speech at the launching he said he felt a sense of exhilaration "at the impending arrival of a versatile amphibious assault ship designed from the keel up with the requirements of its landing forces in mind. In the current vernacular, this one really 'gets it all together.'" [2] He went on to predict that "The LHA will be the backbone of our amphibious forces for the rest of this century." At the conclusion of the speech he turned and said: "It is with great personal pride that I present to you the sponsor of *Tarawa* . . . my own personal wife." [3] A few minutes later she broke the traditional bottle of champagne on the bow of the *Tarawa*—a major development had arrived.

The CH-53E

On the opposite end of the nation from Pascagoula, in Stratford, Connecticut, the other major development at the end of 1972 was underway. Sikorsky was building a true "flying crane" for the Marine Corps. The idea that a helicopter could have a lift capability greater than its own weight always had been tantalizing, but the design and construction of such a machine



USN Photo 1166266

The USS Tarawa (LHA 1) here steaming in the Gulf of Mexico during her sea trials in 1976, is the first of a new class of amphibious assault ships which can accommodate both helicopters and landing craft.

had eluded all manufacturers. In spite of the tremendously impressive record of the CH–53 "Superbirds" as retrievers in Vietnam, if one of them was forced to land in enemy territory, the aircraft still had to be dismantled partially before another CH–53 could pick up the various components and take them back to the home airfield. In addition, there remained items of equipment which the assault Marines needed in any amphibious landing which still were beyond the lift capability of the CH–53D. The idea of attaching several helicopters to a single piece of equipment no longer was seriously considered. What was needed was a helicopter which, in an emergency, could lift another one just like it, as well as the heavy equipment of an amphibious landing.

On 24 October 1967, a specific operational requirement (SOR–14–20) was approved by the CNO. It called for a helicopter with an 18-ton lift capability to be used by both the Navy and the Marine Corps.[4] The document specified that the new helicopter had to be able to be operated, not only from the LHA, but also from the older *Iwo Jima* class LPHs. As this proposal was being studied, the Army, recognizing a similar need, requested a much larger and more powerful helicopter for its shore-based operations. OSD directed that the three services continue to study the problem to see if a single model could not be acceptable. What followed was, by now, a familiar story.

Even though the last of the CH–53Ds would not be delivered to the Marine Corps until January 1972, Sikorsky had begun efforts to improve the lift capability of the CH–53 much earlier. By 1968 it had determined that it was feasible to install a third engine in the aircraft. Such a development promised a significant increase in power with relatively little increase in the empty weight of the helicopter. Even more attractive, it would not require extensive redesign of the aircraft with usual delays and expenses.

On 8 November 1968, General McCutcheon met with representatives from the Navy "to determine the direction the Navy should take in satisfying the well recognized heavy lift helo requirement." [5] At stake was the necessary funds for Sikorsky to build a test bed to evaluate the idea. This test bed would consist of nothing but the propulsion train, and could be used to confirm the engineering and design of the third engine installation. At the meeting it was concluded that the three-engined CH–53 "was an acceptable method to satisfy the Crane heavy lift requirement for the Navy and Marine Corps." [6] Approval was recommended, and limited funding approved.

OSD, believing that the requirements of the Army and the Marine Corps were similar, directed that both proposals be reviewed. Early in 1970 it became apparent that the needs were different and two aircraft should be developed. Secretary of Defense Melvin R. Laird disagreed. On 21 September he announced that he favored the Army version and designated it to pro-

Photo courtesy of Sikorsky Aircraft Division, United Aircraft Corporation

Two CH–53Es, one with Navy and the other with Marine markings, fly in formation. The three-engine CH–53E can lift its own weight.

ceed with the development of a single heavy-lift helicopter for all services. The Navy and the Marine Corps protested vigorously. OSD partially relented and decided that, though the Army would continue the joint development, the Navy could support the Sikorsky testbed program—if it could find the money from funds already budgeted for other items. In December, the Navy had scraped up $1.97 million, and OSD approved the continuing effort.[7]

Meanwhile, the Army went ahead and asked manufacturers to submit their proposals. They were received on 11 February 1971, and turned over to a Source Selection Advisory Council for evaluation. This council was made up of senior officers from the Army, Navy and Marine Corps. Five companies submitted proposed designs: Sikorsky, Boeing/Vertol, Hughes, Gyrodyne, and Kamman. After studying the designs, the members of the council unanimously agreed on 2 April 1971 that all the proposals "leave no doubt that" any aircraft meeting the Army's requirements "will be minimally suitable for LHA use, and not suitable at all for" the *Iwo Jima* class LPHs.

There were two problems. First, the Army wanted an aircraft which could lift 22.5 tons, while the Marine Corps would now be satisfied with 16. This meant that if the Army type was adopted, it would be an aircraft which empty would probably weigh as much as 60,000 pounds, and fully loaded "in excess of 108,000 pounds." [8] The elevators and flight decks of the *Iwo Jima* class LPHs simply could not handle aircraft of that weight, and if they were ever to be used on such ships, major—and very expensive—modifications would have to be made. The second problem revolved around the blade fold capability. The Army did not need it; the Marine Corps had to have it. Just as in the conversion of the YH–1C into the CH–46, the addition of blade folding calls for major changes in the entire aircraft and greatly complicates the design and production. Finally, though not a factor in the council's decision, the Navy and Marine Corps were wary of a brand-new design which called for a helicopter so much larger than those flying. The memory of the "Deuce" lingered on. Also, the Army had just recovered from the cancellation of its AH–56A "Cheyenne" super-sophisticated attack helicopter, and the Marine Corps was anxious to avoid being tied to any program that could end the same way.

This time OSD agreed that no one aircraft could meet both sets of requirements. In May, it authorized the Army to continue to work on its helicopter, and the Navy to proceed with the development of a three-engined CH–53. On 1 November, OSD approved the program and a month later Congress gave its blessing. Only two aircraft were to be built until the design was proven acceptable and reliable. Then additional production could be begun. The aircraft would be the CH–53E, "Super Stallion."

The third engine was mounted to the rear and slightly above the one on the left side of the aircraft. To accept the power developed by these three General Electric T–64–415 engines, a new transmission, capable of accepting up to 11,340 horsepower, was installed. Likewise, the main lifting rotor was enlarged to 79 feet in diameter and to seven blades. The tail rotor was also

USMC Photo A355822

An AH–1G Cobra of HMA–169 sits on the pad at an auxiliary Marine landing field near Camp Pendleton in January 1972. Attack squadrons (HMAs) equipped with Cobras now were part of the permanent Marine helicopter force.

Photo courtesy of LtCol William R. Fails, USMC (Ret.)

On board the USS Iwo Jima *(LPH 2), the helicopters currently in the Marine inventory are ready for an amphibious assault. CH–46Ds are spotted along the starboard side, CH–53Ds at bow and stern, AH–1Js near the elevators, and UH–1Ns beside the island.*

made larger, and in an unusual design, canted to the left. In this position, in addition to providing antitorque control, the rotor produced some lift and allowed greater flexibility in loading cargo near the center of gravity of the aircraft. Earlier, specialized versions of the CH–53 had provisions for inflight refueling and for carrying additional fuel on the outside of the aircraft. These were adapted to the "Super Stallion."

Like all the CH–53 series, the new one could trace its ancestry directly to the "Deuce." When the first CH–53E made its maiden flight on 1 March 1974, it proved that it was a worthy descendant of the helicopter which had taken the first step toward fulfilling the dreams of the early Marine Corps planners of developing the capability for true vertical amphibious assaults.

The First Concert

New Year's Day 1973 dawned cloudy in Washington, D.C., with a light drizzle falling. Shortly after daybreak, the sky cleared and the temperature would soar to 63 degrees. As most of the residents of the Nation's Capital slept away the revelry of the night before, in the same full block of staid but substantial brick buildings located in the southeast section of the city, there was a flurry of activity.

Drum Major Dennis Carroll and Master Gunnery Sergeant Charles P. Erwin were readying the United States Marine Band for yet another New Year's Day concert. All were in position in front of the Commandant's house at 1020. Lieutenant Colonel Dale L. Harpham, director of the band, who had been a Marine since July 1935, took his post. As the band began to play for the well-rehearsed "impromptu" concert, General Robert E. Cushman, Jr., Commandant of the Marine Corps, appeared at the door of his house "looking suitably surprised."

The contrast between spring-like weather and bitterly cold snow-laden skies was not the only difference between the New Year's Day concert of 1973 and the one 11 years before. Great changes had occurred throughout the Marine Corps between the two holidays, and nowhere had the changes been greater than in Marine helicopters. In 1962, as General Shoup had listened to the band, Marine helicopters consisted of a few rapidly aging "Deuces"—the remnant of the original dream of massive vertical amphibious assaults—the ubiquitous but interim UH–34s, and a collection of the unusual OH–43s with their excellent visibility but notorious low speed. Helicopter carriers, then, were all makeshift conversions including the tiny *Thetis Bay*. The entire concept of a helicopter-supported air/ground team remained untested except in small-scale maneuvers and exercises. Combat experience in helicopters was confined to a handful of Korean War veterans. Helicopter pilots and crews were firmly entrenched at the bottom of the heirarchy of aviation prestige, regarded as second-class citizens by their high-flying fixed-wing brethren.

As General Cushman listened to the concert, he knew that all Marine helicopters were jet powered and shortly would be joined by the 16-ton lift capability of the CH–53E. Helicopter carriers were all keel-up LPHs, and the vastly improved LHA soon would be in service. Amphibious vertical assault doctrine and tactics had been tested and proven repeatedly in full-scale maneuvers, international crises, and shooting war. The Marine Corps had a wealth of pilots and crews hardened by combat experience in Vietnam, where the "second-class syndrome" had been exploded once and for all.

For all Marines, and indeed for all Americans, there was a final and even more important difference between the two days: This was the first New Year's Day Concert since 1962 when Marines, including helicopters and their crews, were not actively fighting a war. For Marines and their helicopters, it had been a long 11 years.

NOTES

Note: Unless otherwise indicated, all material is located in the Support Branch, History and Museums Division, Headquarters, USMC, Washington, D.C.

CHAPTER I

The Last Concert

New Year's Day 1962

1. USMC Band Log, dtd 1Jan62 (HistFile, USMC Band. Washington, D. C.).
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Marine Helicopters around the World

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4. *Naval Aviation News*, Aug65, p. 7.
5. LtCol Eugene W. Rawlins, *Marines and Helicopters, 1946–1962* (Washington: History and Museums Division, Headquarters, U.S. Marine Corps, 1977), hereafter cited as Rawlins, *Marines and Helicopters.*
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Helicopters are Different

7. Transcript provided and permission to reprint granted by "ABC Evening News with Howard K. Smith and Harry Reasoner."
8. LtCol Alvah J. Kettering, Intvw by HistBr, HQMC, dtd 12Dec74 (Oral Hist Coll, Hist&MusDiv, HQMC).
9. BGen Jay W. Hubbard, ltr to HistBr, HQMC, dtd 16Jan73.
10. LtCol David A. Spurlock, Intvw by HistBr, HQMC, dtd 24Jan64 (Oral HistColl, Hist&MusDiv, HQMC).
11. MajGen Marion E. Carl, Intvw by HistBr, HQMC, dtd 1May73, (Oral HistColl, Hist&MusDiv, HQMC).
12. Chronological List of Qualified Helicopter Pilots, p. 1.
13. BuAir memo to CNO, dtd 3Sep52, Subj: Model HRS–1 Helicopter JATO Installation, Investigation of; Recommendations Concerning. (Ser 016983).
14. Subject accident report at Naval Safety Center, Norfolk, Va.
15. Chief, BuAir ltr to CNO, dtd 26Aug52, Subj: Model HRS–1 Helicopter, JATP installation, Investigation of; Recommendations Concerning, 1st Endor. (No serial).
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CHAPTER 10

Medium Transport Crisis

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37. Symposium Book, 1968 General Officers' Symposium, Tab II–E, p. 1.
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CHAPTER 11

A General and His Pilots

Conscience and Will Power

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"There Is No Shortage"

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5. Symposium Book, 1966 General Officers' Symposium, Tab 1–B, p. 3.
6. DC/S (Air) memo, dtd 31Mar66.
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22 C/S memo to SecNav, dtd 29Mar67, Subj: Key Issues Relative to Marine Corps Pilot Requirements and Inventory (Ser. 008A8867)
23. *Ibid.*, p. 3.
24. DC/S (Air) memo for the record, dtd 31Mar67, Subj: Marine Corps Pilot Requirements.
25. *Ibid.*, p. 2.
26. DC/S (Air) memo for the record, dtd 31Mar67, Subj: Review of USMC Pilot Requirements.
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28. DC/S (Air) memo for the record, dtd 3Apr67, Subj: Review of USMC Pilot Requirements.
29. *Ibid.*, p. 2
30. Gen Wallace M. Greene, Transcript of Telecon with Dr Alain Enthoven, dtd 3Apr67 (Wallace M. Greene Papers, Collections Section, Hist&MusDiv, HQMC).
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More Pilots for the War

Busy Helicopter Crews

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31. *Ibid.*, Encl. 2.
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Army Helicopter Training

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CHAPTER 13

Twins and Mixes

Continue the March

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22. *Marine Corps Gazette*, Vol. 55, No. 10 (Oct71), p. 27.
23. CG 1st MAW msg to CMC, dtd 11Jul69.
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The "Sea Cobra"

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26. Point Paper, dtd 2Aug69, Subj: Status of Navy/Marine FY–70 UH–1N Procurement (DC/S [Air] Code AAW files, HQMC, Wash., D.C.).
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The Twin "Huey"

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Change in the Mix

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Marine Helicopters around the World

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The "Father of Helicopters" Leaves the Ranks

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55. JPAO, MCAS New River, Release No. 06–028–72, dtd 8Jun72.
56. *Ibid.*
57. *Ibid.*, p. 2.

CHAPTER 14

Looking to the Future

The LHA

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3. *Ibid.*

The CH-53E

4. Much of the information, unless otherwise noted, on the CH–53E program is from: Colonel Frederick M. Kleppsattel, "CH–53E Super Stallion," *Marine Corps Gazette*, Vol. 56, No. 5, (May72), p. 43.
5. NavAirSysCom memo, dtd 13Nov68, Subj: Heavy Lift Helicopter.
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7. DC/S (Air) C/S Conference Item, dtd 18Dec70, Sub: Status of Funding for Sikorsky. Propulsion System Test Program.
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CHRONOLOGY

1962

17 Jan — CG FMFPac, LtGen Alan Shapley, recommended to CMC that, instead of sending Marine pilots to augment Army helicopter squadrons in Vietnam, as suggested by the U.S. Military Assistance Advisory Group, Vietnam, an entire Marine Corps helicopter squadron be sent to the area.

5 Feb — Capt L. Kenneth Keck, USMC, set a new world's speed record for helicopters of 210.6 mph while flying a HSS-2.

1 Mar — The Secretary of the Navy approved adoption of the Bell Helicopter Company's UH-1B (Marine designation UH-1E) as the new Marine light reconnaissance and utility helicopter.

19 Mar — The Joint Chiefs of Staff approved dispatch of a Marine Corps helicopter squadron to Vietnam in place of an additional Army helicopter company, to be in position in Vietnam on or about 15 April 1962.

22 Mar — 1st Marine Aircraft Wing was ordered to prepare to deploy a squadron to Vietnam. Planning began for what would become Operation SHUFLY.

15 Apr — The first SHUFLY helicopter squadron, HMM-362, under LtCol Archie J. Clapp, began operations from Soc Trang airfield, Republic of Vietnam.

23 Apr — The first SHUFLY helicopter received combat damage in Vietnam but was able to land safely.

30 Apr — The first Boeing/Vertol CH-46 was accepted by the Navy for testing.

25 Jul — Gen David M. Shoup, CMC, asked the Chief of Naval Operations to furnish the Marine Corps six T-28 aircraft for use in target-marking, escort and protection of helicopters, and limited close air support in lightly defended areas.

26 Jul — The Navy Bureau of Weapons (BuWeps) announced its selection of the Sikorsky S-64 (CH-53) as the new heavy helicopter for the Marine Corps.

30 Aug — CNO, at recommendation of HQMC, issued order that about 500 Marine fixed-wing aviators were to be transferred into helicopters in order to relieve a severe helicopter pilot shortage in the Marine Corps.

16 Sep — The SHUFLY squadron began movement from Soc Trang in the Mekong Delta to Da Nang.

18 Sep — The Navy revised its directive establishing pilot criteria so that single-engine helicopters could be flown under certain conditions by only one pilot instead of the previously required two.

24 Sep — The Department of Defense announced that Sikorsky, with its S-64, had won the competition to design the HHX, the new heavy Marine Corps helicopter transport, which now would be known as the CH-53A.

Oct-Nov — HMMs-261, -263, -264, and -361 participated in operations in the Caribbean during the Cuban Missile Crisis and quarantine.

1963

16 Feb — The Joint Chiefs of Staff temporarily permitted helicopter crews in Vietnam to "engage clearly defined VC elements considered to be a threat to the safety of the helicopters and their passengers" without waiting for the VC to shoot first.

23 Feb — The Joint Chiefs of Staff again restricted helicopter crews in Vietnam to returning enemy fire "for defensive purposes only."

13 Mar — The SHUFLY squadron announced that three armed UH-34s for the first time had provided close air support from helicopters.

29 Mar — Gen Shoup, CMC, proposed that armed T-28s be sent to Vietnam to provide escort for the SHUFLY squadron.

13 Apr — Six Army UH-1B gunships from the Utility Tactical Company based at Da Nang began escorting the Marine UH-34s of the SHUFLY squadron on all troop-carrying missions and missions into Viet Cong-infested areas.

1964

1 Jan — Gen Wallace M. Greene, Jr. became 23d Commandant of the Marine Corps.

15 Jan — The last Marine crew members, "Soldier-Mechanics of the Sea," were removed from the U.S.S. *Boxer* (LPH-4).

22 Jan — The Joint Chiefs of Staff approved extension of the SHUFLY operation in Vietnam until 30 June 1964.

31 Jan — The last Marine crew members, "Soldier-Mechanics of the Sea," were removed from the U.S.S. *Princeton* (LPH-5).

21 Feb — At Fort Worth, Texas, Bell Helicopter Company delivered the first UH-1E to a Marine tactical squadron, VMO-1.

17 Mar — CNO published Specific Operational Requirements No. W-14-09 for an all-weather navigation system for helicopters called the integrated helicopter avionics system (IHAS).

20 May — The Joint Chiefs of Staff announced that helicopters were to use their on-board weapons only for protection of the aircraft passengers and that armed helicopters were not to be used as "substitutes for Close Air Support."

28 May — The first CH–53A to roll off the production line was accepted by the Sikorsky Flight Test Division.

10 Jun — The Joint Chiefs of Staff ordered that Operation SHUFLY continue indefinitely.

30 Jun — The first three CH–46As were delivered to LtCol Eldon C. Stanton's HMM–265 at New River, the first squadron to receive the turbine-powered medium helicopter.

1 Jul — The second CH–46 squadron in the Marine Corps, HMM–164 under LtCol Herbert J. Blaha, was commissioned at MCAS Santa Ana but did not receive its aircraft until 21 Dec 64.

4 Aug — North Vietnamese patrol boats attacked two U.S. destroyers on patrol in the Gulf of Tonkin, and the U.S. launched retaliatory air strikes at targets in North Vietnam.

17 Aug — Gen Greene, CMC, directed MCLFDC and HMX–1 to begin work on an armament kit for the UH–34.

13 Oct — CMC directed HMX–1 at Quantico to begin a high-priority project to "develop, evaluate, and service test a readily installable weapons kit for the UH–1E helicopter to provide armed helicopter support for transport helicopters."

14 Oct — The first test flight of a CH–53A was made by the Sikorsky Aircraft Company.

26–31 Oct — Marine Aircraft Group 26, under Col Stanley V. Titterud, with six helicopter squadrons and 105 aircraft, participated in Operation STEEL PIKE I, on the Mediterranean coast of Spain, the largest amphibious assault ever made using helicopters.

16–23 Nov — HMM–162 joined the SHUFLY squadron, HMM–365, in rescuing thousands of Vietnamese in the Da Nang area who were endangered by floods caused by Typhoon Kate.

mid-December — TK–1 machine gun and rocket pod kits were installed on UH–34s of HMM–365, the SHUFLY squadron.

1965

15 Jan — The first TK–2 armament kits were shipped to Camp Pendleton for installation in UH–1Es of VMO–6.

6–7 Mar — The Joint Chiefs of Staff ordered the landing of the 9th MEB at Da Nang.

8 Mar — The headquarters of MAG–16 moved from Futema to Da Nang, and Col John H. King, Jr., commander of SHUFLY at the time, assumed command of the helicopter group.

9 Mar — HMMs –365 and –162 switched equipment and aircraft at Da Nang, HMM–365 delivering its aircraft to Da Nang, where officers and men from HMM–162 flew from Futema to take them over. The personnel from HMM–365 then embarked on the U.S.S. *Princeton* and sailed to Futema to take over the helicopters of HMM–162.

25 Apr — In response to reports of rioting and an attempted coup in the Dominican Republic, U.S. naval forces, including the U.S.S. *Boxer* (LPH–4) with HMM–264 embarked, were ordered into Dominican waters.

27 Apr — HMM–264, under Lt Col Frederick M. Kleppsattel, evacuated 558 civilians from the civil war-torn Dominican Republic.

27 Apr–31 May — HMMs–263 and –264 and elements of VMO–1 and HMH–461 participated in Marine peacekeeping operations in the Dominican Republic, lifting troops, evacuees, and supplies, and performing reconnaissance missions.

3 May — Six armed UH–1Es of LtCol George Bauman's VMO–2 arrived at Da Nang, the Marines' first gunship helicopter escorts in Vietnam.

6 May — Capt Thomas P. McBrien, flying a UH–1E attached to HMM–263 over Santo Domingo City during peacekeeping operations there, was wounded by ground fire but safely landed his aircraft, becoming one of the few Marine aviators to become a combat casualty in the Western Hemisphere.

8 Jun — HMM–361 arrived at Futema from Santa Ana, under LtCol Lloyd F. Childers, bringing to five the number of Marine transport helicopter squadrons in the western Pacific.

12 Jun — HMM–161 (LtCol Gene W. Morrison) arrived at Phu Bai, South Vietnam, from Kaneohe.

21 Jun — HMM–261, under LtCol Mervin B. Porter, arrived at Da Nang from New River as part of the Marine helicopter buildup in Vietnam.

1Jul — Aircraft, Fleet Marine Force, Pacific (AirFMFPac) was consolidated into Fleet Marine Force, Pacific (FMFPac), under LtGen Victor H. Krulak, with aviation MGen Avery R. Kier becoming Deputy Commander, FMFPac.

28 Jul — President Lyndon B. Johnson announced that U.S. forces in Vietnam would be increased to 125,000 men and that additional reinforcements would be sent if required.

11–30 Aug — MAG–36 under Col William G. Johnson deployed from Santa Ana to Vietnam with three UH–34 squadrons, one squadron of UH–1Es, and a detachment of six HR2Ss.

26 Aug — MAG–16 moved from Da Nang Airbase to Marble Mountain Air Facility.

2 Sep — MAG–36 began construction of a helicopter facility on the Ky Ha Peninsula near Chu Lai.

12 Sep — A HR2S of MAG–16 performed what was called "the first helo lift of a downed aircraft under tactical considerations" by retrieving a downed helicopter in Vietnam about 15 miles from Chu Lai and carrying it externally back to the airfield.

15 Sep — HMH–461 (Maj Richard L. Hawley) deployed as the aviation component of the Caribbean Ready Force with 12 HR2Ss, the only squadron-size force of these helicopters ever operationally deployed.

22 Sep — The Department of Defense notified Vertol to accelerate production of the CH–46 by 100 percent over the previously planned production rate, to meet the need for more helicopters in Vietnam.

27 Oct — Viet Cong sappers attacked Marble Mountain Air Facility, destroying 19 helicopters of MAG–16 and heavily damaging 11 more.

1966

20 Jan Marine Helicopter Training Group (MHTG) 30 was commissioned at Santa Ana. This was the first of two temporary helicopter post-graduate flight training groups authorized by Secretary of Defense McNamara to meet Vietnam war pilot requirements.

8 Mar The first CH–46 squadron to enter the Vietnam war, HMM–164 under LtCol Warren C. Watson, arrived at Marble Mountain with 27 of the new jet-powered medium transports.

15 Jun MGen Keith B. McCutcheon, long associated with aviation and helicopter development, became Deputy Chief of Staff (Air) at HQMC.

9 Sep MGen Keith B. McCutcheon, DC/S (Air), accepted delivery of the first operational CH–53A for the Marine Corps.

20 Sep The first CH–53A was delivered to an operational Marine squadron, HMH–463 at Santa Ana.

19 Dec HMM–161 received the first "D" model CH–46s at New River MCAS.

1967

8 Jan The first four CH–53As of HMH–463 arrived at Marble Mountain Air Facility, where a detachment of the squadron was waiting to put them into operation as helicopter retrievers.

25 Jan A CH–53A from LtCol William R. Beeler's HMH–463 performed the first helicopter retrieval accomplished in Vietnam by this aircraft, lifting a disabled UH–34 off the landing platform of a Navy hospital ship.

14 May A HR2S made the last operational flight of a HR2S in Vietnam, carrying 20 troops and 3,000 pounds of cargo.

22 May The main body of HMH–463, with 22 CH–53s, arrived at Marble Mountain, completing the deployment of the new heavy helicopters to Vietnam.

Jul The Secretary of the Navy approved funding and production of the Bell AH–1G Huey Cobra gunship for the Marine Corps.

30 Jul Naval Air Systems Command directed that all stored HR2Ss be stricken from the records and disposed of at the least expense to the government. This action marked the end of the association of this first true heavy-lift helicopter with the Marine Corps.

31 Aug MGen Norman J. Anderson, CG, 1st MAW, ordered all CH–46s grounded, except for missions to meet "emergency combat requirements which could not be met by other aircraft," after a series of fatal crashes caused by disintegration of the CH–46s' tail pylons.

24 Oct The Chief of Naval Operations approved Operational Requirement SOR–14–20, which called for a helicopter with an 18-ton lift capability, to be used by both the Navy and Marine Corps, operable from both *Iwo Jima* class LPHs and the new LHAs.

9 Nov Secretary of Defense Robert S. McNamara directed the U.S. Army to prepare plans for training helicopter pilots for the Marine Corps at Army facilities. This measure was intended to help remedy the Marines' wartime shortage of helicopter pilots.

29 Nov The first 32 "D" model CH–46s arrived at Phu Bai, to equip LtCol Louis A. Gulling's HMM–364. Personnel of the squadron had deployed to Vietnam earlier and had flown UH–34s to help relieve the lift shortage caused by the grounding of the CH–46.

20 Dec The CH–46 structural modification program at Futema, Okinawa, instituted to correct the problems which had caused the crashes and grounding of the CH–46 during the summer, was officially completed. During it, 80 CH–46s had been completed and returned to operation in Vietnam.

1968

1 Jan Gen Leonard F. Chapman, Jr., became the 24th Commandant of the Marine Corps.

22 Mar 2d Lt Larry D. Mullins was commissioned on this date and was the last Marine aviator to be commissioned from the MarCad program, which now came to an end.

28 May The Secretary of Defense announced the award of a contract to build a new type of amphibious assault ship for the Navy. This was the LHA (Landing Helicopter Assault Ship).

24 Jul The first CH–46F was accepted by the Marine Corps at the Vertol Plant in Morton, Pennsylvania. This model was designed to carry the long-awaited integrated helicopter avionics system (IHAS), which, however, quickly proved a failure in tests and was never installed.

8 Nov MGen McCutcheon, DC/S (Air), and Navy representatives recommended funding of tests of Sikorsky's proposed three-engine CH–53E as a heavy lift helicopter for the Navy and Marines.

1969

18 Apr The first Marine AH–1G Huey Cobra gunship flew its first operational mission in Vietnam, assigned to VMO–2.

30 Jun Marine Helicopter Training Group (MHTG)–40 was commissioned at New River, with the mission of providing post-graduate helicopter flight training to Marine pilots.

2 Jul The 500th CH–46 was delivered to the Marine Corps in a ceremony at the Vertol factory at Morton, Pennsylvania. Accepting the aircraft for the Marine Corps was BGen Homer S. "Dan" Hill, General McCutcheon's assistant and eventual successor as DC/S (Air).

18 Aug Ceremonies were held by HMM–362 at Phu Bai to mark the end of combat operations in Vietnam for the UH–34. The last six of these aircraft were flown to Da Nang for shipment to the U.S. two days later.

14 Oct — The first Bell AH–1J twin-engine Sea Cobra was unveiled at the Bell factory before a board of Marine officers headed by BGen Victor A. Armstrong.

27 Oct — The last Marine squadron equipped with UH–34s, HMM–561 at Santa Ana, a temporary wartime augmentation squadron, was decommissioned.

16 Dec — All AH–1G Cobra gunships in Vietnam were transferred to HML–367, under LtCol Warren G. Cretney.

1970

29 Jan — HMHT–401, the heavy helicopter training squadron of MHTG–40 at New River, accepted its first CH–53.

9 Mar — Lieutenant General McCutcheon, who had just left the post of DC/S (Air), took command of the III Marine Amphibious Force in Vietnam.

July — The first four AH–1J Sea Cobra gunships were delivered to the Naval Air Test Center at Patuxent River for Board of Inspection and Survey trials.

1971

20 Jan — The number of LHAs to be built was reduced from nine to five.

2 Feb — BGen Homer S. "Dan" Hill, DC/S(Air), accepted the final production model of the CH–46F for the Marine Corps at the Vertol plant in Morton, Pennsylvania. This was the last of 624 A, D, and F models of the CH–46 to be delivered to the Marine Corps.

18 Feb — Four AH–1J Sea Cobras arrived in Vietnam for combat evaluation and were assigned to HML–367.

7 Apr — The first Bell UH–1N twin-engine Huey was delivered to HMA–269 at New River MCAS.

28 Apr — Combat evaluation of the AH–1J in Vietnam was completed, with the twin-engine gunship having proved its ability to deliver "significantly greater effectiveness in firepower" than the AH–1G.

26 May — The last Marine helicopter unit in Vietnam to cease combat operations, HML–167, stood down for redeployment to New River, leaving two UH–1Es behind for last-minute administrative support of the 3d Marine Amphibious Brigade.

15 June — The last two UH–1Es of HML–167 flew on board ship for transfer to Okinawa. These were the only Marine helicopters then remaining in Vietnam.

21–28 Jun — HML–167, just returned from Vietnam, was re-equipped at New River with the twin-engine Bell UH–1N Huey, becoming the first Marine light helicopter squadron to be so equipped.

1 Jul — HMA–269, the first of three helicopter attack squadrons in the active Marine forces, was formally commissioned at New River MCAS.

1 Nov — OSD approved continued development by the Navy of a three-engine CH–53 and separate development by the Army of a flying crane helicopter.

1972

1 Jan — Gen Robert E. Cushman, Jr., became 25th Commandant of the Marine Corps.

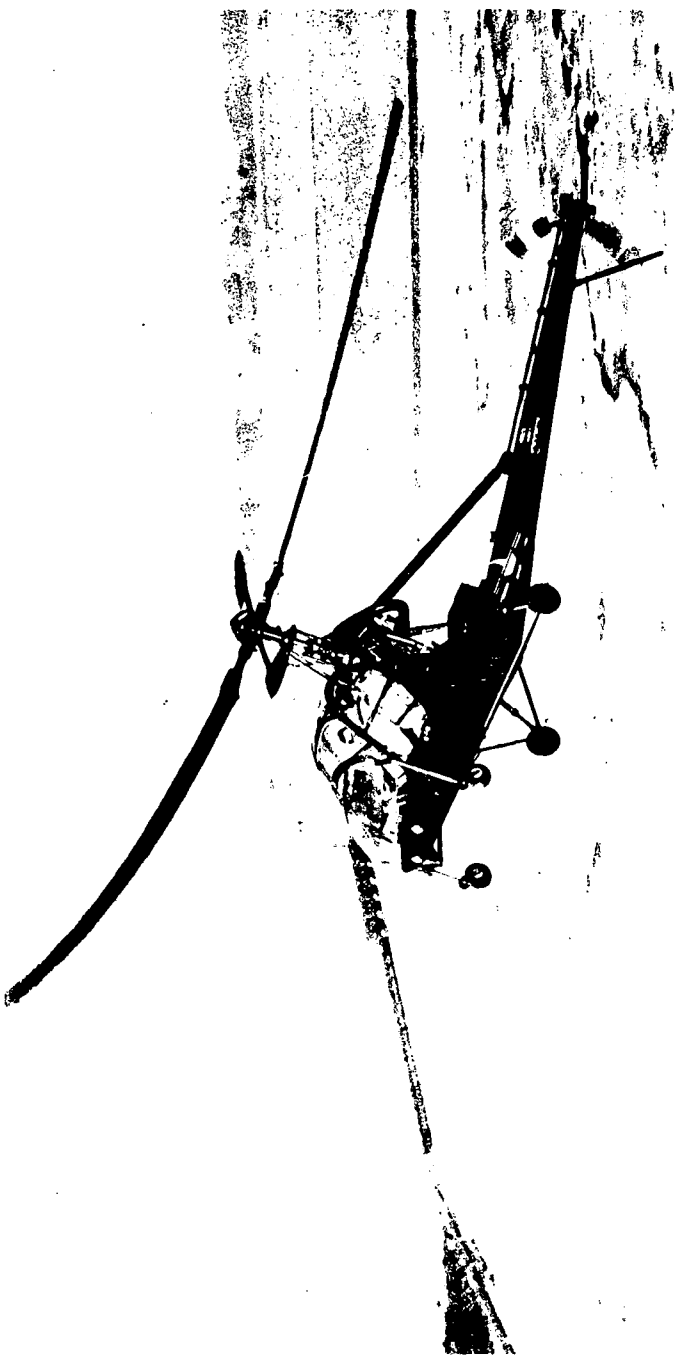
Apr — The two special landing forces of the Seventh Fleet returned to the coast of South Vietnam to support Allied forces against the 30 March North Vietnamese invasion. The SLFs included HMM–164 and HMM–165.

1973

1 Dec — Gen Cushman, CMC, attended the launching of the U.S.S. *Tarawa* (LHA–1) at Pascagoula, Mississippi.

1974

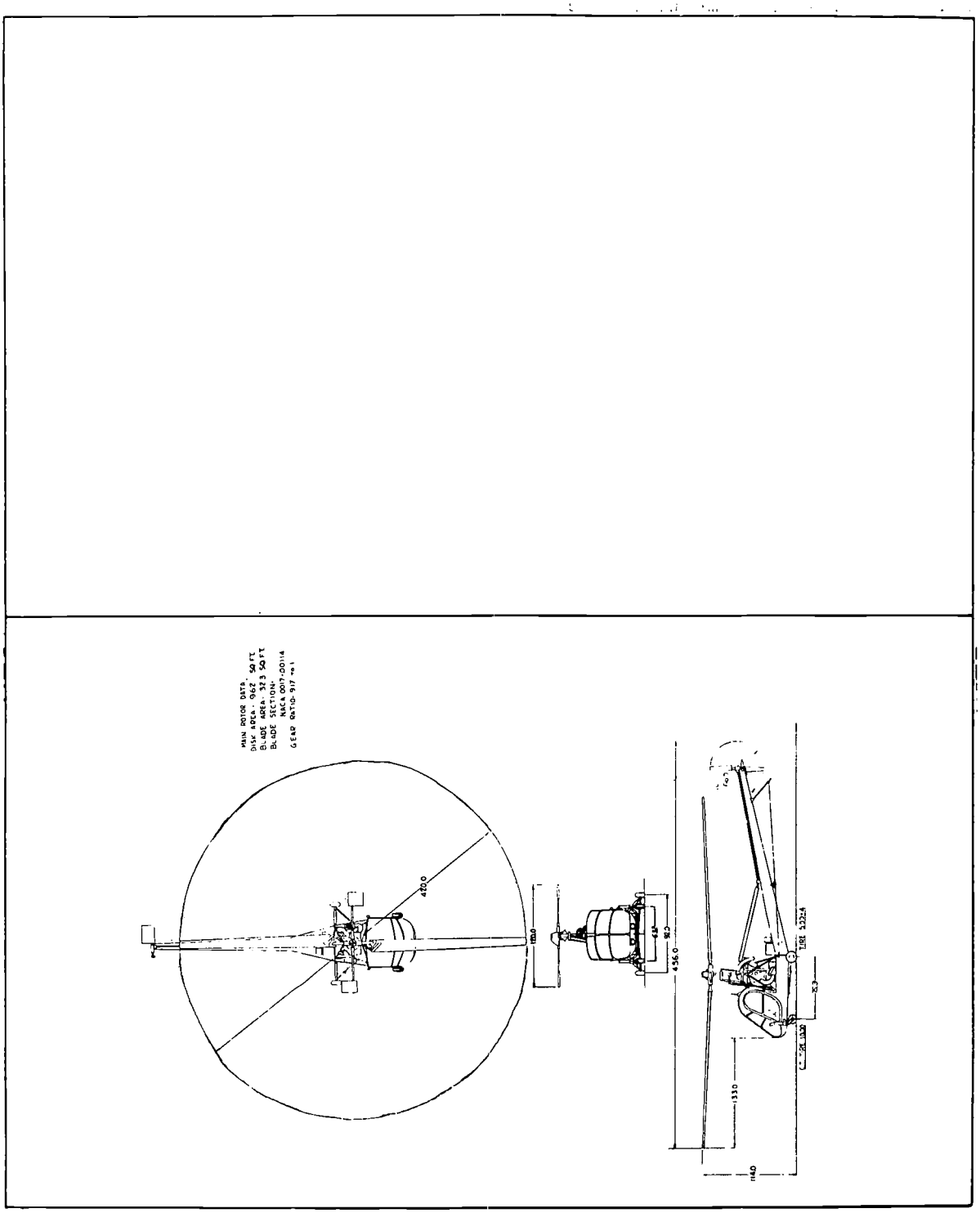
1 Mar — The first three-engine CH–53E made its initial flight.



STANDARD AIRCRAFT CHARACTERISTICS

HTE-2

HILLER


MAIN ROTOR DATA
DISC AREA- 5281 SQ FT.
BLADE AREA- 323 SQ FT
BLADE SECTION-
NACA 0017-0014
GEAR RATIO- 917 to 1
400.0
120.0
436.0
1330
1140
5.3

POWER PLANT

NO. & MODEL.....(1) O-335-6
MFR.....Franklin
ROTOR GEAR RATIO.....0.109
TAIL ROTOR RATIO.....0.629

RATINGS

	Bhp. @	Rpm @	Alt.
T.O.	200	3100	S.L.
NORMAL	200	3100	S.L.

SPEC. NO. 19261A

ACCOMMODATIONS

CREW.....2
PASSENGER.....1
LITTERS.....2

MISSION AND DESCRIPTION

The HTE-2 helicopter is procured primarily for use as a trainer. It is similar in general configuration and rotor dimensions to the HTE-1 helicopter but has a 200 HP engine in place of the 178 HP engine and quadricycle instead of tricycle landing gear. These changes result in an increase in gross weight.

The model HTE-2 helicopter is a three-place (side-by-side) aircraft equipped with dual controls operated from the left and center seat positions. The aircraft has a two-bladed, teetering main rotor, a two-bladed, anti-torque tail rotor, and is equipped with an aerodynamic servo control rotor, whereby cyclic control is obtained through the aerodynamic action of two small airfoils mounted to the rotor hub at right angles to the main rotor blades.

DEVELOPMENT

Service use.....January 1951

DIMENSIONS

DISC AREA.....962.0 sq.ft.
BLADE AREA.....32.3
BLADE DIA.....35'
SPAN *.....10'
LENGTH.....40' -5"
HEIGHT.....9' - 6"
TREAD.....7' -8"
CONTROL ROTOR
BLADE AREA....3.55 sq.ft.
STABILIZER AREA..2.49 sq.ft.

*Rotor stationed fore and aft.

WEIGHTS

Loadings	Lbs.	L.F.
EMPTY	1,762	
BASIC	1,769	
DESIGN	2,500	2.84
MAX.T.O	2,400 *	
MAX.LAND	2,400	

* Limited by performance

All weights are actual

FUEL AND OIL

Gals.	No. Tanks	Location
28	1	Fuselage

FUEL GRADE.....91/96
FUEL SPEC.....MIL-F-5572

OIL

CAPACITY (Gals.).....2.5
GRADE.....1100
SPEC.....MIL-O-6082

ELECTRONICS

Receiver.....R-19
Transmitter.....T-11A
Transmitter.....T-13
Receiver.....R-11A

PERFORMANCE SUMMARY

TAKE-OFF LOADING CONDITION		(1) TRAINER 1 Pilot 1 Student	(2) UTILITY 1 Pilot 1 Passenger			
TAKE-OFF WEIGHT	lb.	2,338	2,400			
Fuel	lb.	168	168			
Payload	lb.	190	252			
Disc loading	lb./sq.ft.	2.4	2.5			
Vertical rate of climb at S.L. (A/B)	fpm.	0	- -			
Absolute hovering ceiling (A/B)	ft.	0	- -			
Max. rate of climb at S.L. (A)	fpm.	780	740			
Service ceiling (100 fpm) (A)	ft.	7,400	7,000			
Speed at S.L. (A)	kn.	73	72			
Max. speed/altitude (A)	kn./ft.	73/S.L.	72/S.L.			
Combat range	n.mi.	110	105			
Average cruising speed	kn.	67	67			
Cruising altitude	ft.	1,500	1,500			
Max. Endurance	hrs.	2.0	2.0			
Average cruising speed	kn.	40	41			
Cruising altitude	ft.	1,500	1,500			

NOTES

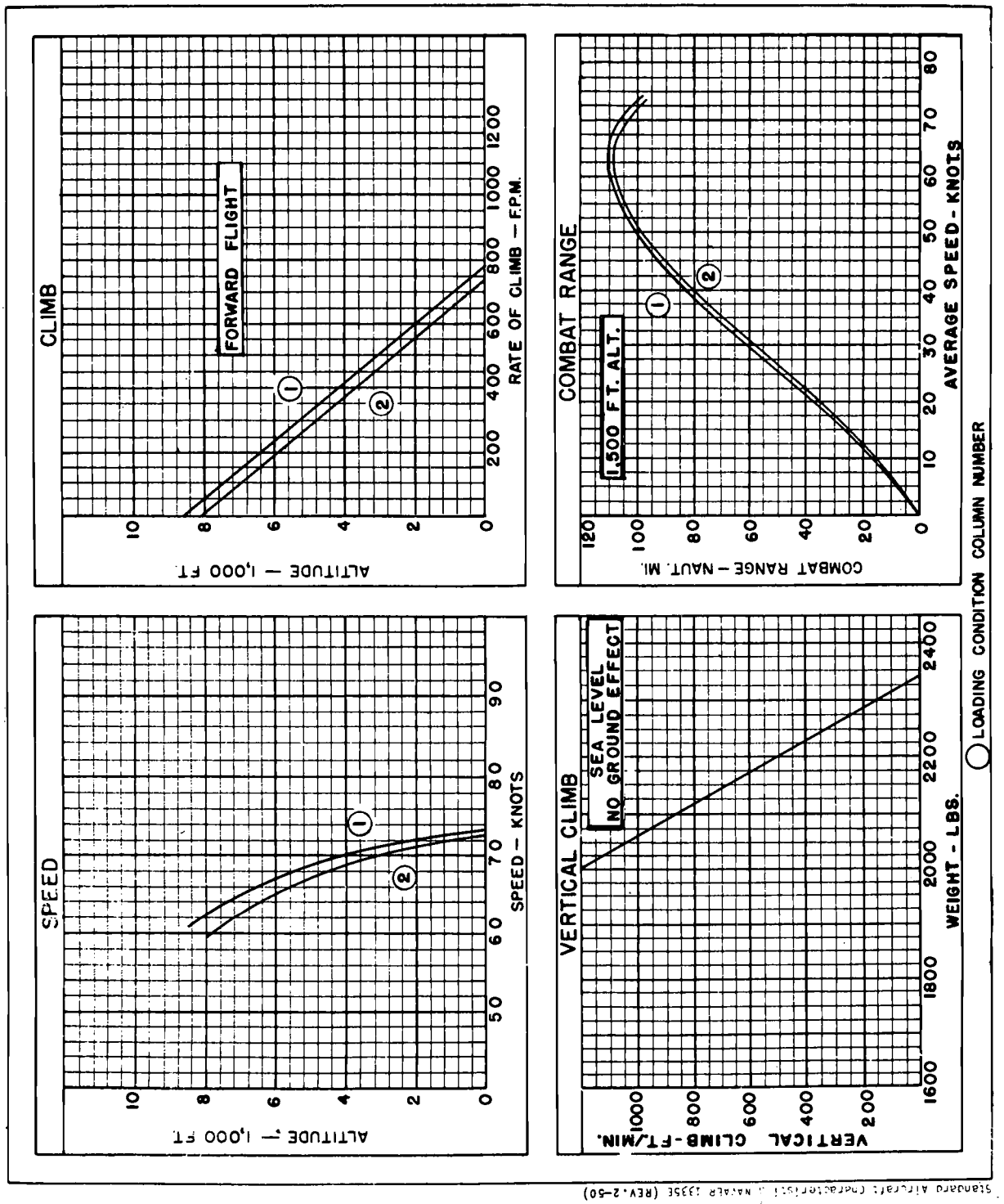
(A) Normal power
(B) Take-off power

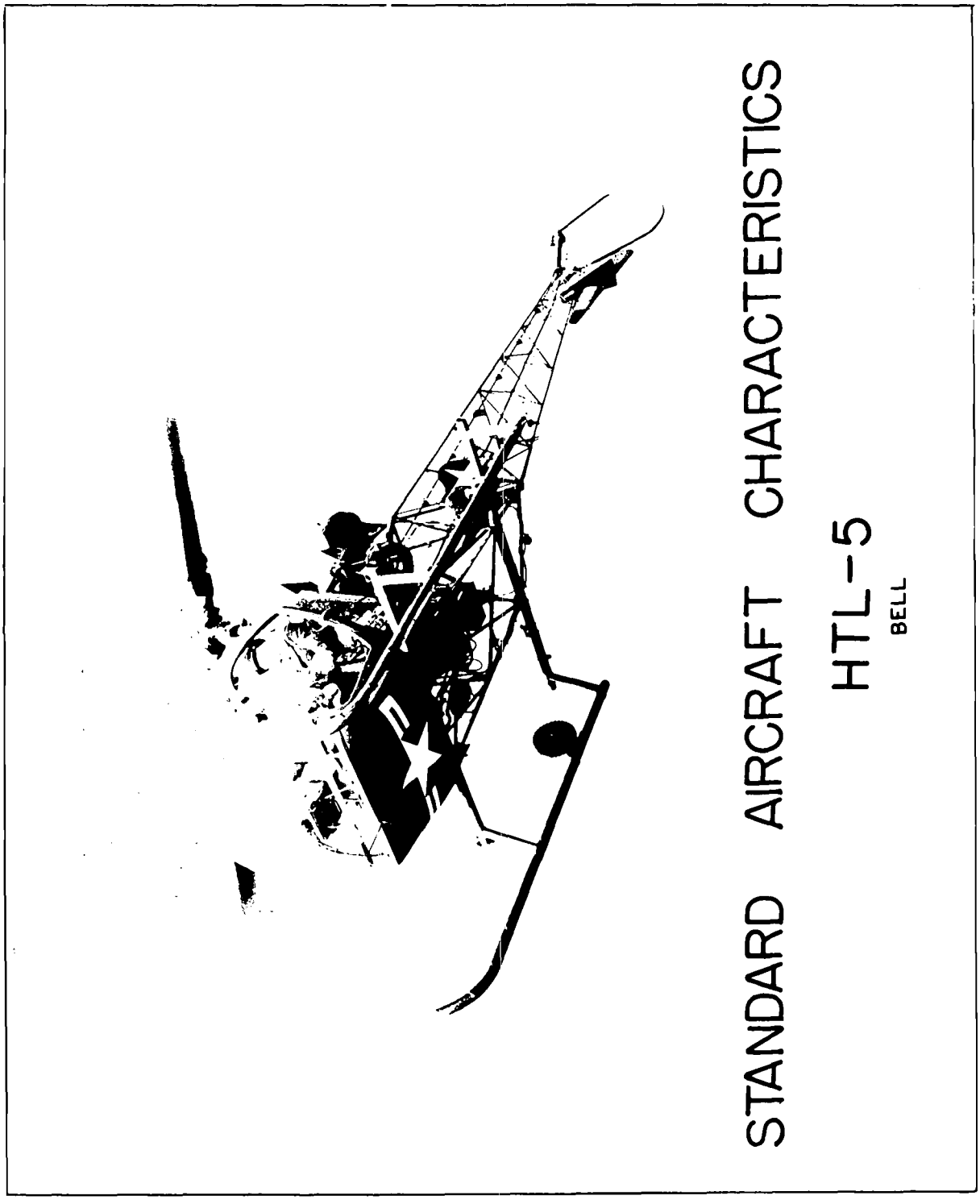
Performance is based on NATESTCEN flight test of the HTE-2

Combat range and maximum endurance are based on engine specification fuel consumption data increased by 5% and allowing fuel for warm-up and take-off (5 minutes at NRP) and a 10% fuel reserve. 3100 RPM is used at all speeds.

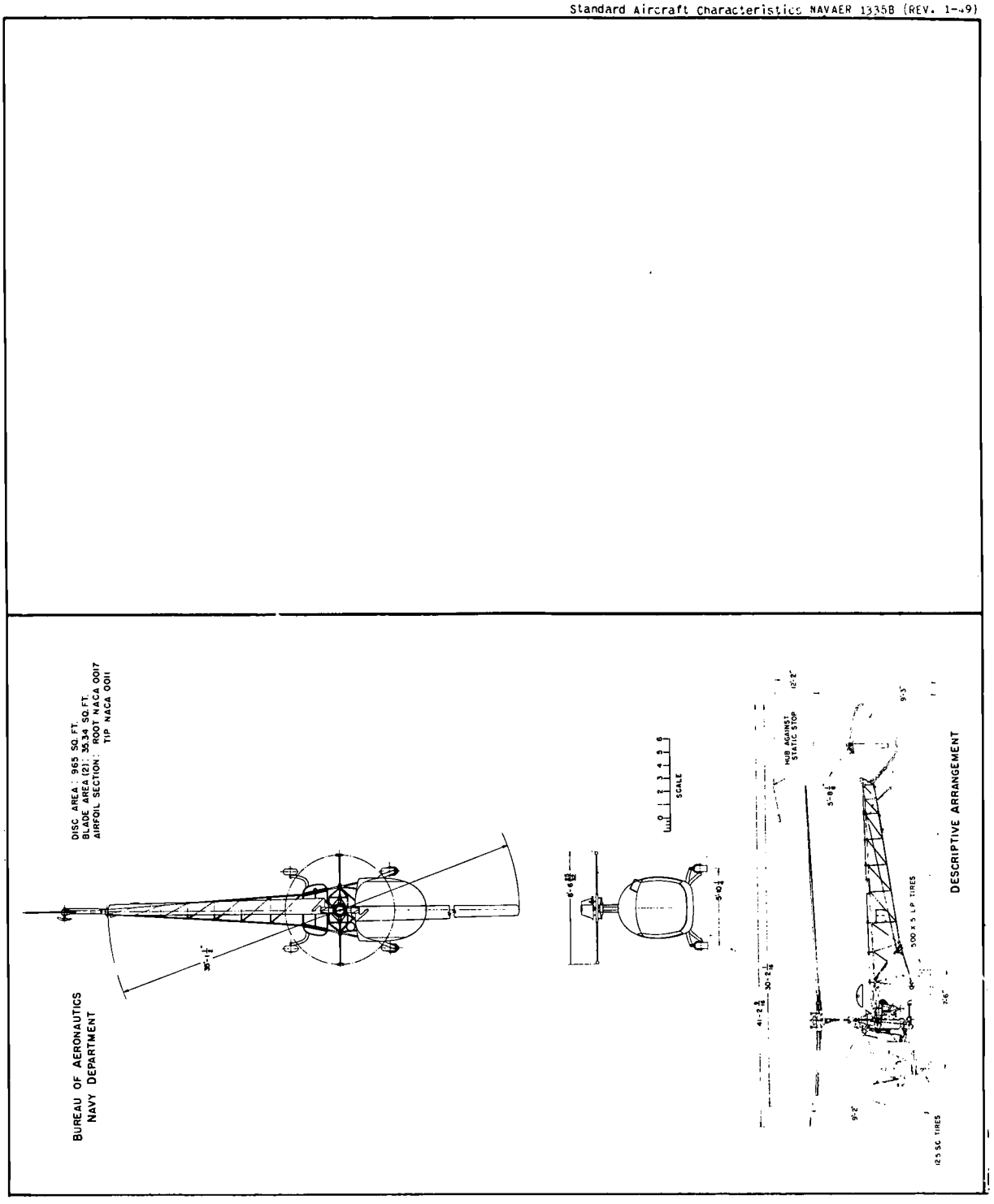
All performance is out of ground effect.

NAVAER-1335G (Rev. 10-51)


CLIMB
FORWARD FLIGHT
ALTITUDE — 1,000 FT.
RATE OF CLIMB — F.P.M.
COMBAT RANGE
1,500 FT. ALT.
COMBAT RANGE — NAUT. MI.
AVERAGE SPEED - KNOTS
SPEED
ALTITUDE — 1,000 FT.
SPEED — KNOTS
VERTICAL CLIMB
SEA LEVEL
NO GROUND EFFECT
VERTICAL CLIMB - FT./MIN.
WEIGHT - LBS.
LOADING CONDITION COLUMN NUMBER


STANDARD AIRCRAFT CHARACTERISTICS
HTL-5
BELL

Standard Aircraft Characteristics NAVAER 1335B (REV. 1-49)



POWER PLANT

NO. & MODEL.....(1) O-335-5
MFR.....Aircooled Motors
ROTOR GEAR RATIO.....0.111
TAIL ROTOR RATIO.....0.60

RATINGS

	Bhp @	Rpm @	Alt.
NORMAL	200	3,100	S. L.

SPEC. NO. 19178

ACCOMMODATIONS

CREW AND PASSENGERS ON SEAT.....3
EXTERNAL LITTERS.....2

MISSION AND DESCRIPTION

The primary mission of the HTL-5 is training. It will also be used in combat areas for the evacuation of wounded, mine spotting, liaison, carrying limited amounts of critical supplies, and general utility.

It is similar in general configuration and rotor dimensions to the HTL-4, but an improved transmission and a rotor brake have been installed with a 15 pound increase in empty weight.

Some of these helicopters are being delivered with skid type gear and some with wheel type gear. Kits containing the other type of gear are being supplied with each helicopter.

The HTL-5 is a three-place, single engine helicopter equipped with a two-bladed main rotor with a gyroscopic action stabilizer bar. The main rotor is of the see-saw type, the blade being rigidly interconnected by means of the hub except that each blade is separately journaled to the hub for pitch change.

In service use -- November 1951

DIMENSIONS

DISC AREA.....969 sq. ft.
BLADE DIA.....35' - 2"
LENGTH.....41' - 5"
HEIGHT*.....11' - 3"
TREAD.....5' - 11"
BLADE AREA.....35 sq. ft.

* Blades in stowed position.

WEIGHTS

Loadings	Lbs.	L.F.
EMPTY	1,561	
BASIC	1,570	
DESIGN	2,350	2.5
MAX.T.O.	2,350	2.5
MAX.LAND	2,350*	

All weights are calculated.

* Limited by performance

FUEL AND OIL

Gals.	No. Tanks	Location
29	1	Fuselage

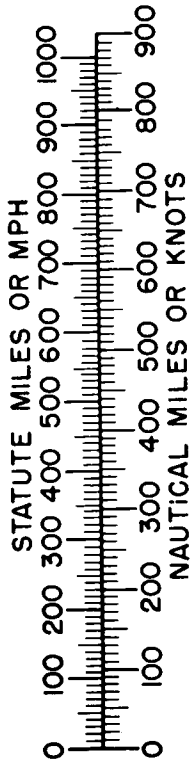
FUEL GRADE....91/98
FUEL SPEC...AN-F-48

OIL

CAPACITY (Gals.).....2
GRADE.....1100
SPEC.....AN-O-8

ELECTRONICS

VHF TRANSMITTER.....T-11A
VHF TRANSMITTER.....T-13
VHF REC.(118-148 mcs)....R-19
RANGE REC.(190-550 kcs).R-11A



PERFORMANCE SUMMARY

LOADING CONDITION		(1) TRAINER 1 Pilot 1 Student	(2) TRAINER 1 Pilot Cargo/Passen.		
TAKE-OFF WEIGHT	lbs.	2,141	2,350		
Fuel	lbs.	174	174		
Pay Load	lbs.	190	400		
Engine Power	bhp/rpm.	200/3,100	200/3,100		
Disc Loading	lbs./sq.ft.	2.2	2.4		
Power Loading (A)	lbs./bhp.	10.7	11.7		
Maximum Speed-S.L. (B)	kn.	80	80		
Maximum Speed/Alt. (B)	kn./ft.	82/1,900	80/S.L.		
Rate of Climb--S.L. (B)	ft./min.	985	850		
Speed for Rate of Climb--S.L. (B)	kn.	45	45		
Time-to-Climb 5,000 ft. (B)	min.	6.3	7.6		
Time-to-Climb 10,000 ft. (B)	min.	18.0	25.0		
Service Ceiling (B)	ft.	12,500	10,600		
Vertical Rate of Climb--S.L. (B/C)	ft./min.	300	--		
Abs. Hover Ceil. No Grd. Effect (B/C)	ft.	1,400	--		
Abs. Hover Ceil. In Grd. Effect (B/C)	ft.	--	--		
Combat Range/Vav 1,500 ft.	n.mi./kn.	105/65	95/65		
Max. Endur./Vav 1,500 ft.	hr./kn.	1.9/45	1.7/45		

NOTES

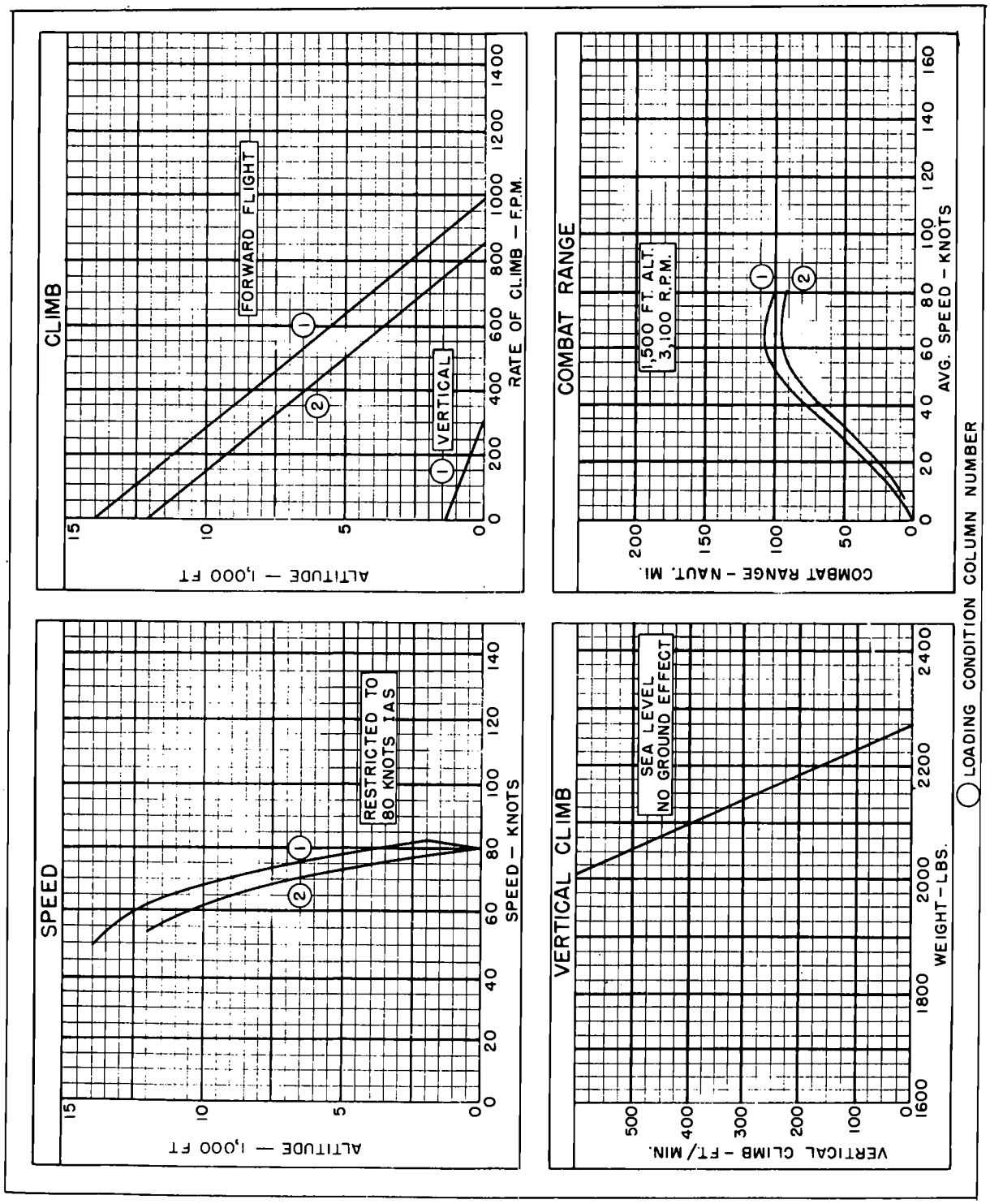
(A) BHP at Maximum Critical Altitude
(B) Normal BHP
(C) Take-Off Power

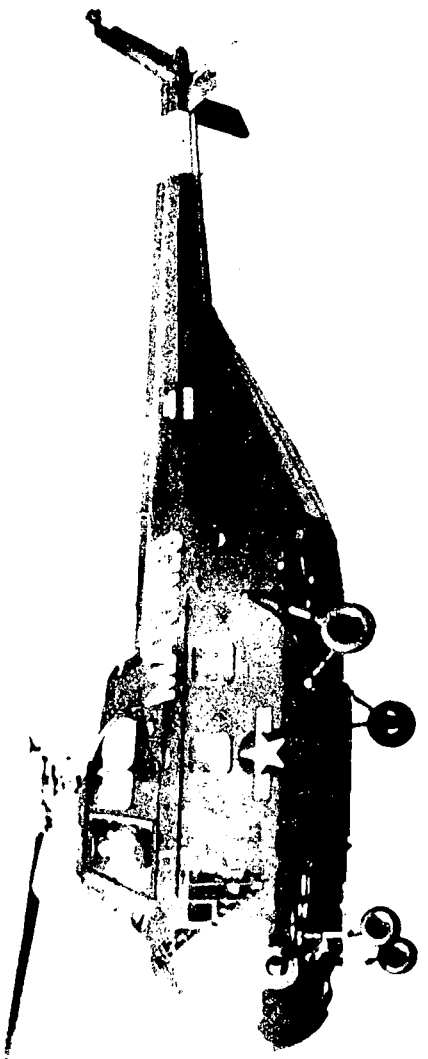
Performance is based on NATC flight test of the HTL-3 helicopter.

Combat range and maximum endurance are based on flight test fuel consumption data increased by 5% and allowing fuel for warm-up and take-off (5 minutes at NHP) and a 10% fuel reserve.

All performance is based on 3,100 RPM and is out of ground effect.

Maximum speed is restricted to 80 knots IAS by BUAER Technical Order No. 40-51 of 1 June 1951.

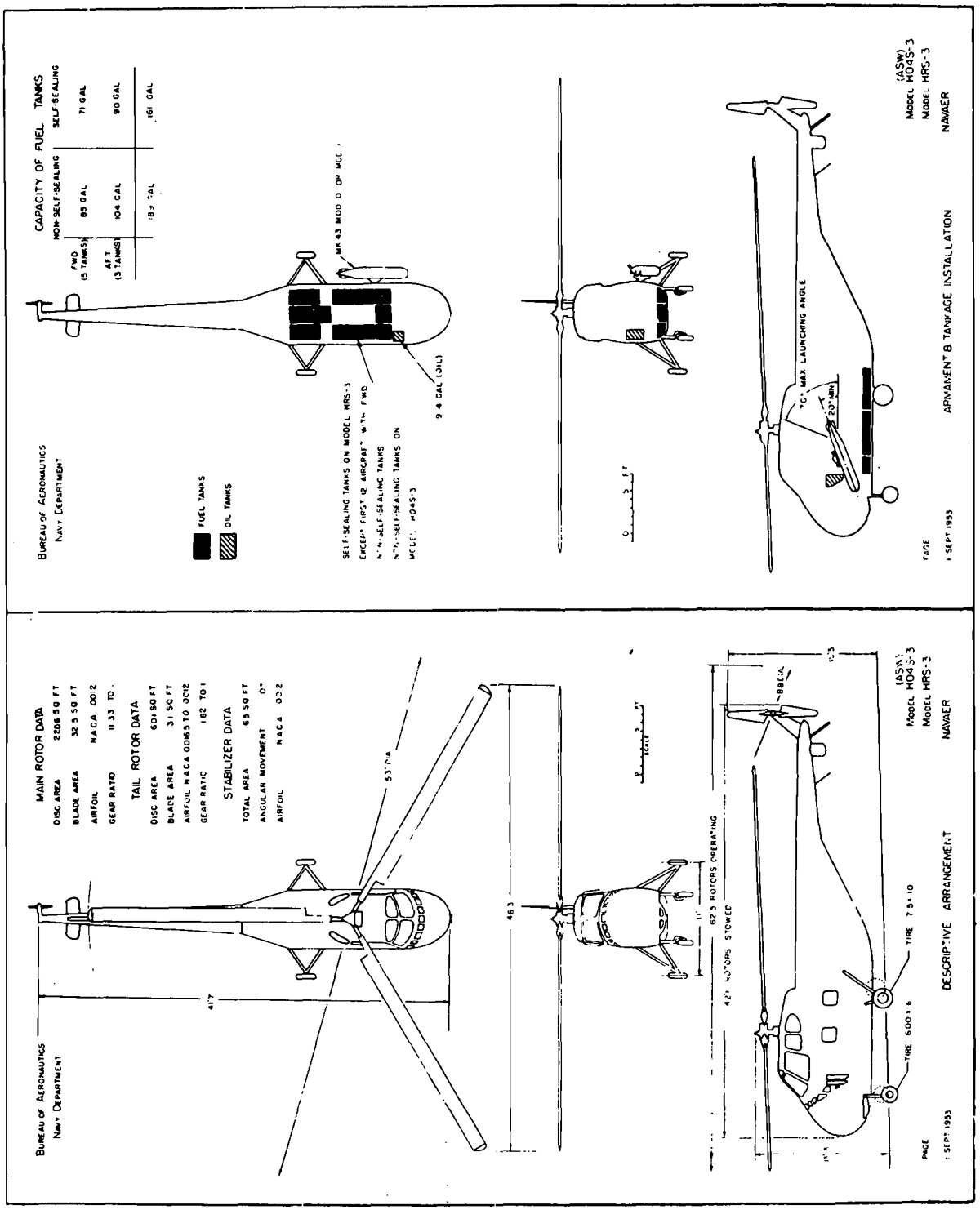

CLIMB
FORWARD FLIGHT
VERTICAL
RATE OF CLIMB – F.P.M.
ALTITUDE – 1,000 FT
COMBAT RANGE
1,500 FT. ALT.
3,100 R.P.M.
AVG. SPEED – KNOTS
COMBAT RANGE – NAUT. MI.
SPEED
RESTRICTED TO 80 KNOTS IAS
SPEED – KNOTS
ALTITUDE – 1,000 FT
VERTICAL CLIMB
SEA LEVEL
NO GROUND EFFECT
WEIGHT – LBS.
VERTICAL CLIMB – FT/MIN.
LOADING CONDITION COLUMN NUMBER



STANDARD AIRCRAFT CHARACTERISTICS

HRS-3

SIKORSKY


BUREAU OF AERONAUTICS
NAVY DEPARTMENT
CAPACITY OF FUEL TANKS
NON-SELF-SEALING
SELF-SEALING
FWD (3 TANKS) 85 GAL 71 GAL
AFT (3 TANKS) 104 GAL 90 GAL
189 GAL 161 GAL
FUEL TANKS
OIL TANKS
MK 43 MOD 0 OR MOD 1
9.4 GAL (OIL)
SELF-SEALING TANKS ON MODEL HRS-3
EXCEPT FIRST 12 AIRCRAFT WITH FWD
NON-SELF-SEALING TANKS
WITH SELF-SEALING TANKS ON
MODEL HO4S-3
0 1 2 3 FT
70° MAX LAUNCHING ANGLE
20° MIN
PAGE
1 SEPT 1953
ARMAMENT & TANKAGE INSTALLATION
NAVAER
(ASW)
MODEL HO4S-3
MODEL HRS-3
MAIN ROTOR DATA
DISC AREA 2206 SQ FT
BLADE AREA 32.5 SQ FT
AIRFOIL NACA 0012
GEAR RATIO 11.33 TO 1
TAIL ROTOR DATA
DISC AREA 601 SQ FT
BLADE AREA 31 SQ FT
AIRFOIL NACA 0065 TO 0012
GEAR RATIO 1.62 TO 1
STABILIZER DATA
TOTAL AREA 65 SQ FT
ANGULAR MOVEMENT 0°
AIRFOIL NACA 0012
53' DIA
41'7
46'3
62'3 ROTORS OPERATING
42'1 ROTORS STOWED
11'
88 DIA
TIRE 600 x 6
TIRE 7.5 x 10
PAGE
1 SEPT 1953
DESCRIPTIVE ARRANGEMENT
NAVAER
(ASW)
MODEL HO4S-3
MODEL HRS-3

POWER PLANT

NO. & MODEL.....(1)R-1300-3
MFR.....Wright
SUPERCH.....1 Speed
ROTOR GEAR RATIO.....0.0882
TAIL ROTOR RATIO.....0.617

RATINGS

	BHP @	RPM @	ALT
T.O.	800	2600	S.L.
NORMAL	700	2400	5,700

See not on performance summary page

SPEC. NO. W.A.D. AN-9500

ACCOMMODATIONS

Pilot.....1
Dual-Pilot.....1
Combat Troops.....10
Litters.....3
Door size.....48" X 48"

MISSION AND DESCRIPTION

The HRS-3 is a transport helicopter. The primary mission of this helicopter is to transport assault troops and equipment from ships or land bases to the objective area and the evacuation of wounded. It may also be used for ship-to-ship liaison and general utility.

The most significant change incorporated in this model was the installation of a more powerful engine. The engine is mounted facing rearward in the nose of the aircraft with the shaft inclined 35° from the horizontal. Access is provided through clam-shell type nose doors and through a removable panel in the firewall.

Design features include an external cargo sling, provisions for a hydraulic hoist for airborne loading or rescue, equipment for night contact flying, hydraulically operated servo controls, a hydraulic clutch to accelerate the transmission to engine speed, and cockpit and cabin ventilation.

Accommodations for ten passengers are provided in the cabin of the HRS-3. Alternate arrangements for three litters and an attendant can be carried.

DEVELOPMENT

Development of the HRS-2
Service Use.....February 1953

DIMENSIONS

DISC AREA .....2206 sq.ft.
BLADE AREA.....97.5 sq.ft.
STABILIZER AREA....6.5 sq.ft.
BLADE DIA.....53' -0"
LENGTH.*.....42' -1"
OVERALL LENGTH**.....62' -6"
HEIGHT.....13' -4"
TREAD.....11' -0"

* Blades Folded
** Rotors operating

WEIGHTS

LOADINGS	LBS	L.F.
EMPTY	5,193	
BASIC	5,261	
DESIGN	7,100	2.67
MAX.T.O.*	7,761	2.44
MAX.LAND*	7,761	2.44

* Maximum anticipated loading

FUEL AND OIL

NO.TANKS	TOT.GALS	LOCATION
2	161	Fuselage

FUEL GRADE.....91/96
FUEL SPEC.....MIL-F-5572

OIL

CAPACITY(Gals).....9.4
GRADE.....1100
SPEC.....MIL-O-6082

ELECTRONICS

R-19 A.R.C. Type Receiver
R-26/ARC-5 MHF Receiver
T-19/ARC-5 MHF Transmitter
T-23/ARC-5 VHF Transmitter
R-11A A.R.C. Type Receiver

PERFORMANCE SUMMARY

TAKE-OFF LOADING CONDITION		(1) Troop Transp. Crew (1) Passengers (8)	(2) Rescue Crew (1) Litter Patients (3)	(3) Cargo Transp. Crew (1)		
TAKE-OFF WEIGHT	lb.	7,761	7,065	7,725		
Fuel	lb.	456	966	210		
Payload	lb.	1,800	510	2,000		
Disc loading	lb./sq.ft.	3.5	3.2	3.5		
Vertical rate of climb at S.L. (A/B)	fpm.	145/ -	745/ -	180/ -		
Absolute hovering ceiling (A/B)	ft.	2,000/ -	7,100/ -	2,550/ -		
Max. rate of climb at S.L. (A)	fpm.	1,095	1,345	1,110		
Service ceiling (100 fpm) (A)	ft.	12,800	14,700	12,900		
Speed at S.L. (A)	kn.	103	105	103		
Max. speed/altitude (A)	kn./ft.	105/5,000	108/5,700	105/5,000		
Combat range	n.mi.	110	280	40		
Average cruising speed	kn.	77	79	76		
Cruising altitude	ft.	1,500	1,500	1,500		
Combat radius	n.mi.	45	108	10		
Average cruising speed	kn.	77	78	77		
Cruising altitude		1,500	1,500	1,500		
Max. endurance		1.7	4.4	0.6		
Average speed		54	49	54		
Altitude		1,500	1,500	1,500		
%NRP req'd to hover at S.L., no wind.		97	86	96		

NOTES

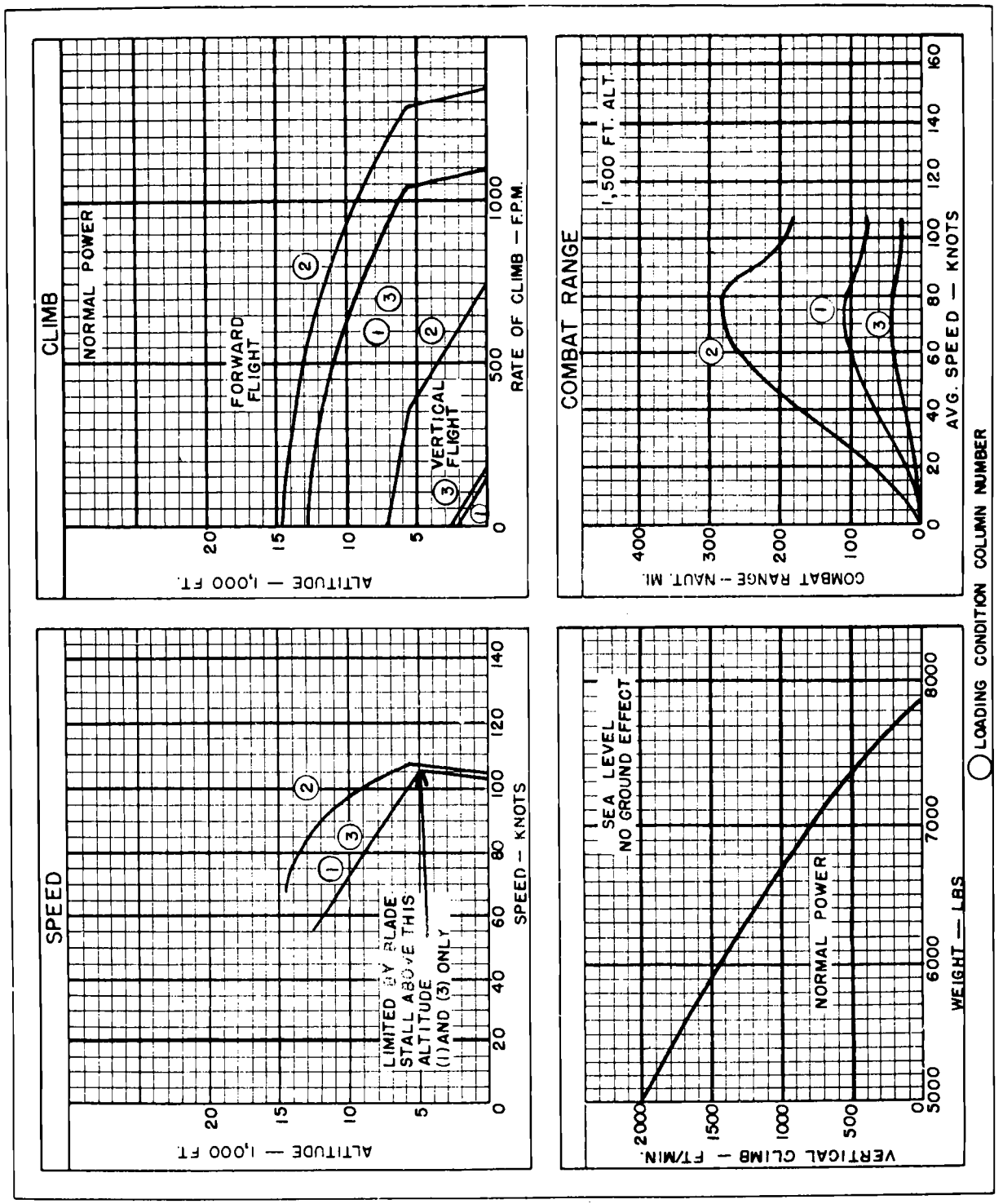
(A) Normal power
(B) Take-off power

Performance basis: NATESTCEN flight test of the HRS-3 helicopter and Air Force flight test of the H-19B helicopter.

All performance is out of ground effect and in standard atmosphere (59°F).

Range, radius, and endurance are based on NATESTCEN fuel consumption test data increased by 5% and allowing fuel for warm-up and take-off (5 minutes at NRP) and a 10% fuel reserve. 2,400 rpm is used at all speeds.

Power is limited to a maximum value of 700 BHP by helicopter transmission capacity. Engine is limited to 2400 rpm.


CLIMB
NORMAL POWER
FORWARD FLIGHT
VERTICAL FLIGHT
ALTITUDE — 1,000 FT.
RATE OF CLIMB — F.P.M.
COMBAT RANGE
1,500 FT. ALT.
COMBAT RANGE — NAUT. MI.
AVG. SPEED — KNOTS
SPEED
LIMITED BY BLADE STALL ABOVE THIS ALTITUDE (1) AND (3) ONLY
SPEED — KNOTS
SEA LEVEL
NO GROUND EFFECT
NORMAL POWER
VERTICAL CLIMB — FT/MIN.
WEIGHT — LBS
LOADING CONDITION COLUMN NUMBER

NOTES

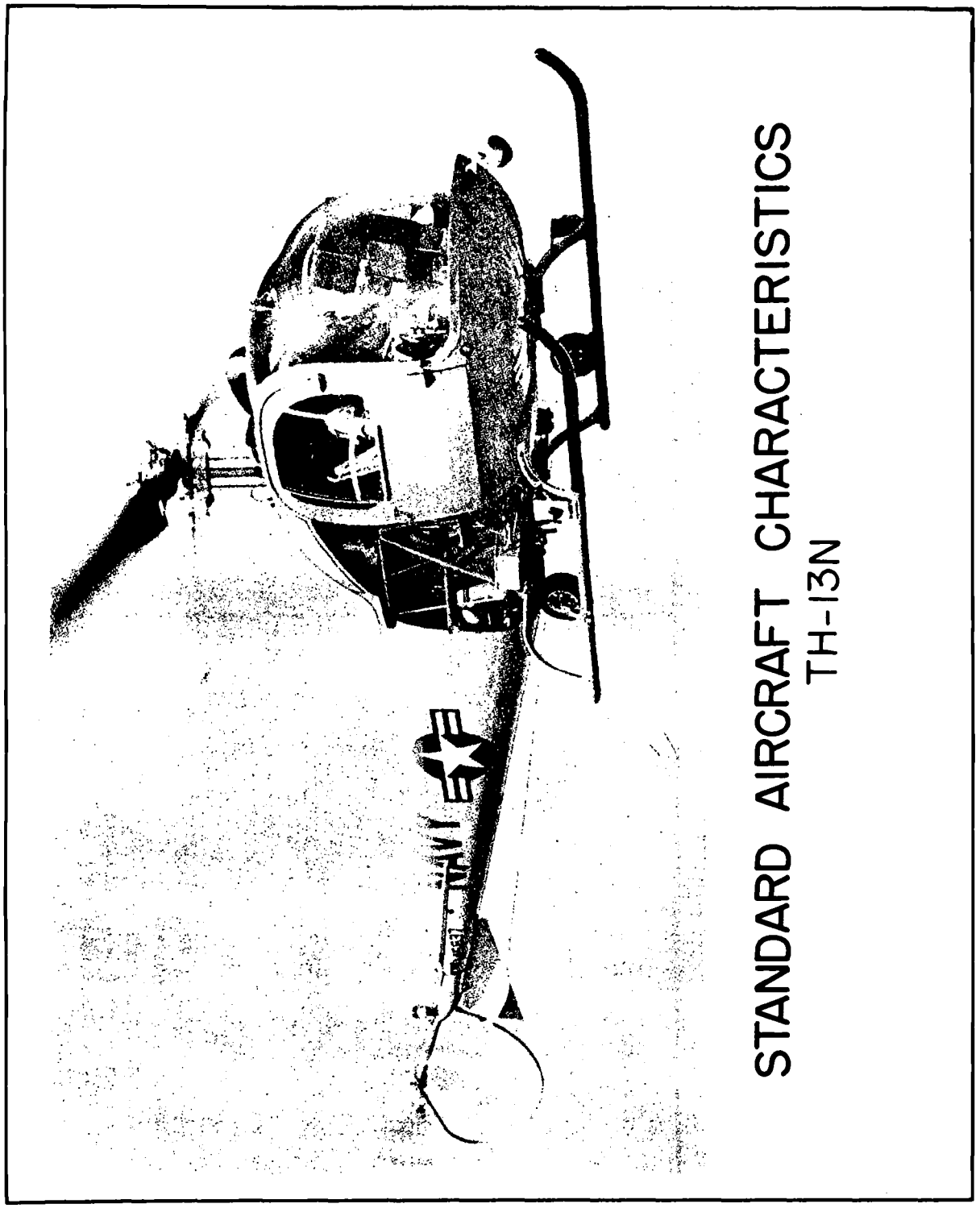
ENDURANCE PROBLEM

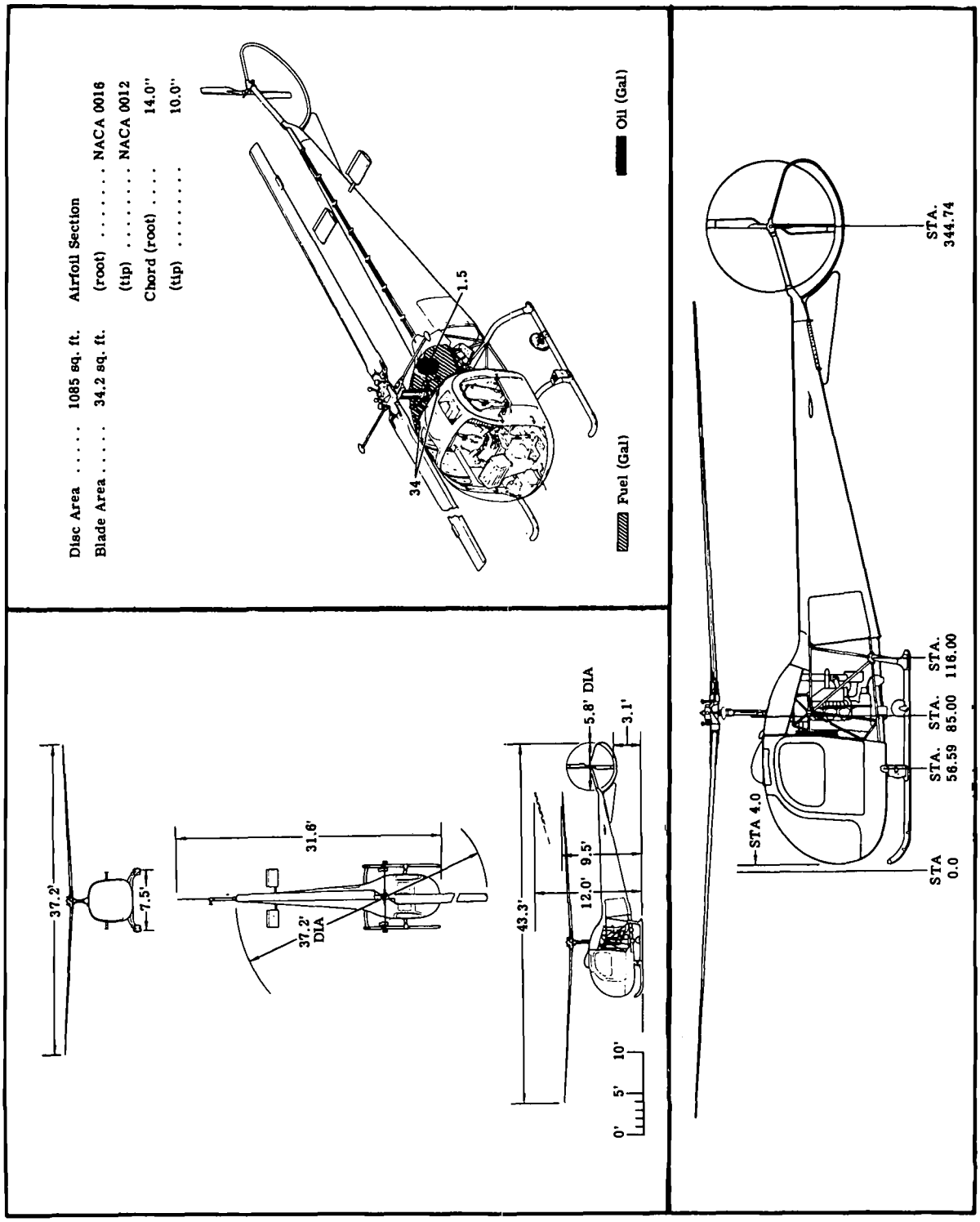
WARM-UP AND TAKE-OFF: 5 minutes at normal rated power
CLIMB: To 1500 ft. altitude
CRUISE: At speed for minimum fuel flow
RESERVE: 10% of initial fuel load

COMBAT RADIUS PROBLEM

WARM-UP AND TAKE-OFF: 5 minutes at normal rated power
CLIMB: To 1500 ft. altitude
CRUISE: At speed for maximum range
LAND AT REMOTE SEA LEVEL BASE
RESTART, WARM-UP AND TAKE-OFF: 5 minutes at normal rated power
CLIMB: To 1500 ft. altitude
CRUISE-BACK: At speed for maximum range
RESERVE: 10% of initial fuel load

NOTE: Weight of cargo carried both ways.


STANDARD AIRCRAFT CHARACTERISTICS
TH-13N


Disc Area ..... 1085 sq. ft.
Blade Area ..... 34.2 sq. ft.
Airfoil Section
(root) ..... NACA 0016
(tip) ..... NACA 0012
Chord (root) ..... 14.0"
(tip) ..... 10.0"
Oil (Gal)
Fuel (Gal)
1.5
34
37.2'
7.5'
31.6'
37.2' DIA
43.3'
5.8' DIA
3.1'
12.0'
9.5'
0' 5' 10'
STA 4.0
STA 0.0
STA. 56.59
STA. 85.00
STA. 116.00
STA. 344.74

POWER PLANT

No. and Model.....(1) VO-435-6
Manufacturer.....Lycoming
Main Rotor Gear Ratio.....0.111
Tail Rotor Gear Ratio.....0.600

RATINGS

	BHP @	RPM @	ALT
Take-off (5 Min)	240	3200	1300
Normal	220	3200	3800

Spec. No. 2207-B

ACCOMMODATIONS

Pilot.....1
Passenger.....1

or

Instructor.....1
Student.....1

MISSION AND DESCRIPTION

The basic mission of the HTL-7 is to train pilots for both primary and instrument flight.

The HTL-7 has a two-blade semi-rigid rotor with a stabilizer bar, and a two-blade semi-rigid tail rotor mounted on a delta hinge. The rotor, transmission and engine are suspended as a unit on rubber mounts in the fuselage. Mechanically the HTL-7 is nearly identical to the HUL-1. The fuselage is semi-monocoque except for the engine compartment, or center frame, which is of steel tube construction.

The control system has conventional dual controls, with full hydraulic motivation on the cyclic stick, and direct mechanical linkage to the rotor. The cabin has a military standard arrangement in all respects with side by side seating. Blind flying is possible using the A.C. powered gyro horizon and gyro stabilized compass. The stand-by blind flying instruments include a D.C. turn and slip indicator, a barometric rate of climb indicator, and a magnetic compass. A radio system is provided to permit communication and radio navigation. The landing gear is of the skid type with small handling wheels.

DEVELOPMENT

First Flight.....December 1957
Service Use.....February 1958

DIMENSIONS

Disc Area.....1085 sq. ft.
Rotor Dia.....37'.2 sq. ft.
Blade Area.....34'.2 sq. ft.
Length (Fuselage).....31'.6 sq. ft.
Height.....9' 6"
Tread.....7' 6"

WEIGHTS

Loading	Weight
Empty	1892
Basic	1916
Design	2565
Maximum T.O.	2565

All weights are actual

FUEL AND OIL

No. of Tanks	Gals.	Location
2	35	Fuselage

Grade 91/96
Specification MIL-F-5572

OIL

Capacity (Gals).....3
Grade 1065/1100
Specification.....MIL-L-6082

ELECTRONICS

UHF.....ARC-TYPE 12
UHF RECEIVER.....R-19
UHF TRANSVERTER.....TV-10
UHF RELAY OSCILLATOR UNIT.....K-13
ADF RADIO.....AN/ARN-41A

PERFORMANCE SUMMARY

TAKE-OFF LOADING CONDITION			(1) TRAINER 1 pilot 1 student	(2) TRAINER 1 pilot 1 passenger+cargo			
TAKE-OFF WEIGHT		lb.	2450	2565			
Fuel		lb.	210	210			
Payload		lb.	170	285			
Disc loading		lb./sq.ft.	2.26	2.36			
Vertical rate of climb at S.L.	(A) /(B)	fpm.	700/220	525/25			
Absolute hovering ceiling	(B)	ft.	C) 4400/7725(C)	C) 200/6400 (D)			
Max. rate of climb at S.L.	(B)	fpm.	835	680			
Service ceiling (100 fpm)	(B)	ft.	15,750	13,800			
Speed at S.L.	(B)	kn.	82	81			
Max. speed/altitude	(B)	kn./ft.	83/3500	82/3500			
Max. range	(B)	n.mi.	130	125			
Average cruising speed		kn.	72	72			
Cruising altitude		ft.	S.L.	S.L.			
Max. endurance		hrs.	2.2				
Average cruising speed		kn.	40				
Cruising altitude			S.L.				

NOTES

(A) MILITARY POWER (5 min. limit)
(B) NORMAL POWER
(C) IN GROUND EFFECT
(D) OUT OF GROUND EFFECT

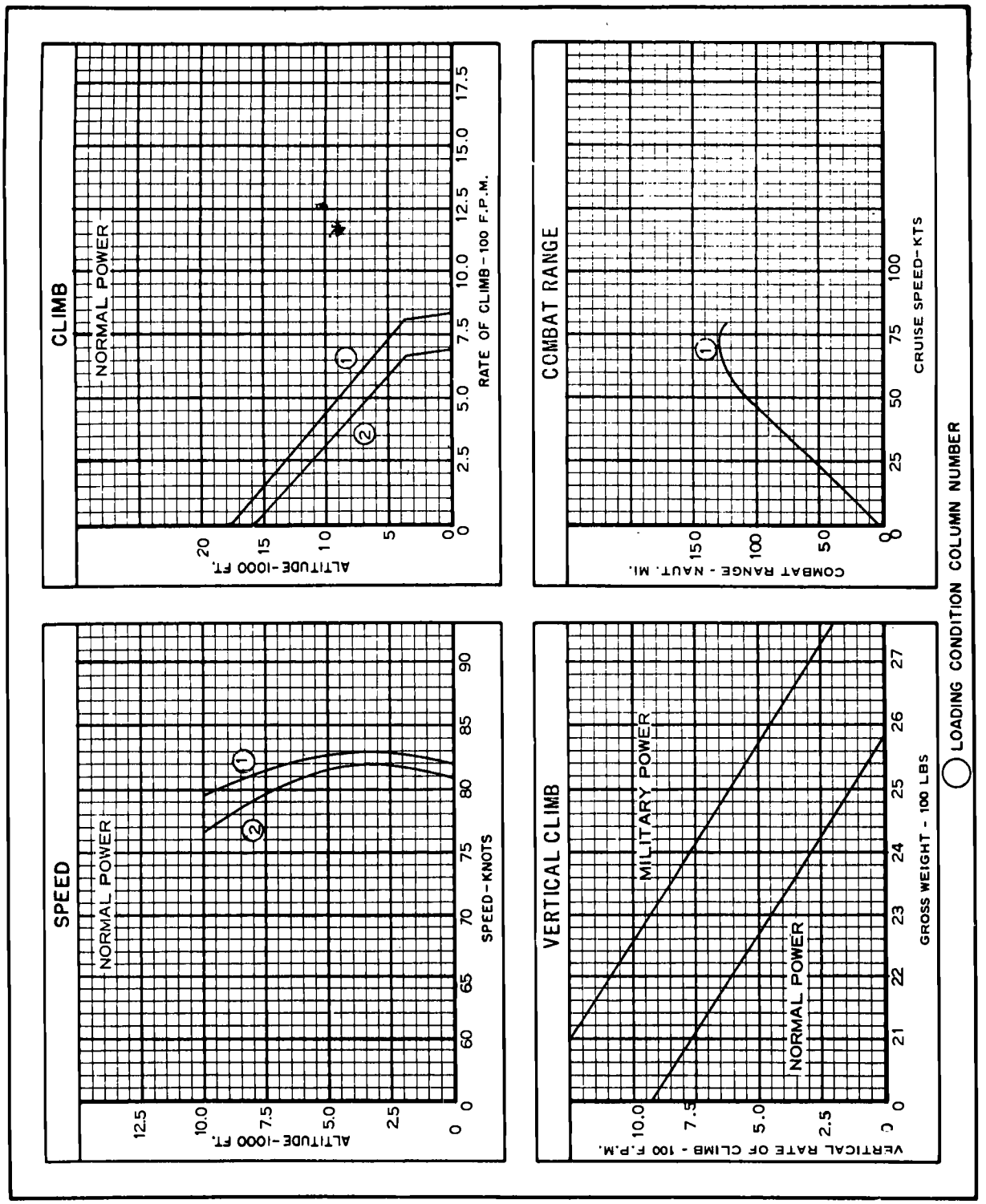
Peformance is based on NATESTCEN evaluation of the Model HTL-7 Helicopter
Range and Endurance are based on NATESTCEN fuel consumption test of the Model HTL-7 Helicopter
All performance data presented is for the skid gear configuration

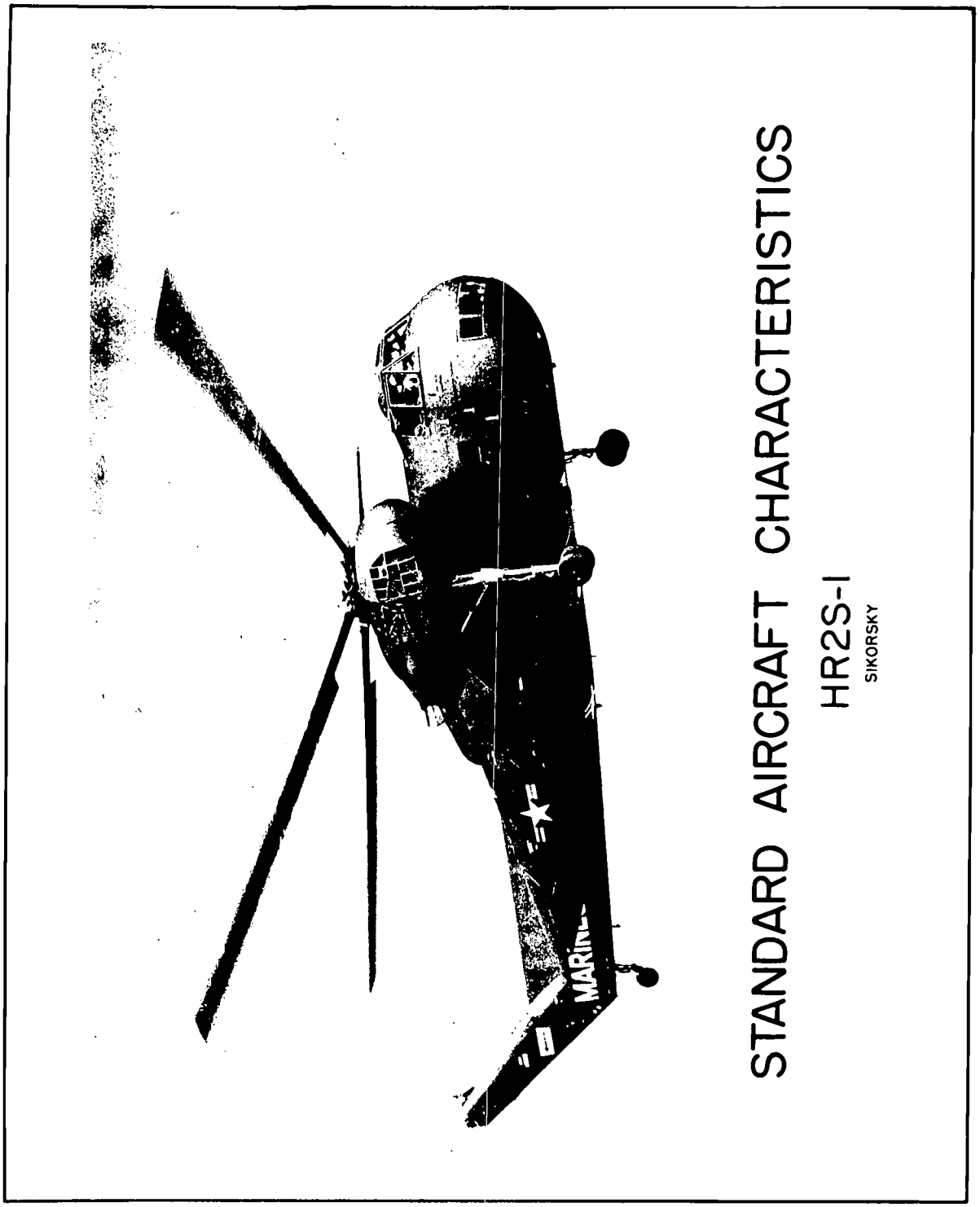
Maximum Range Mission

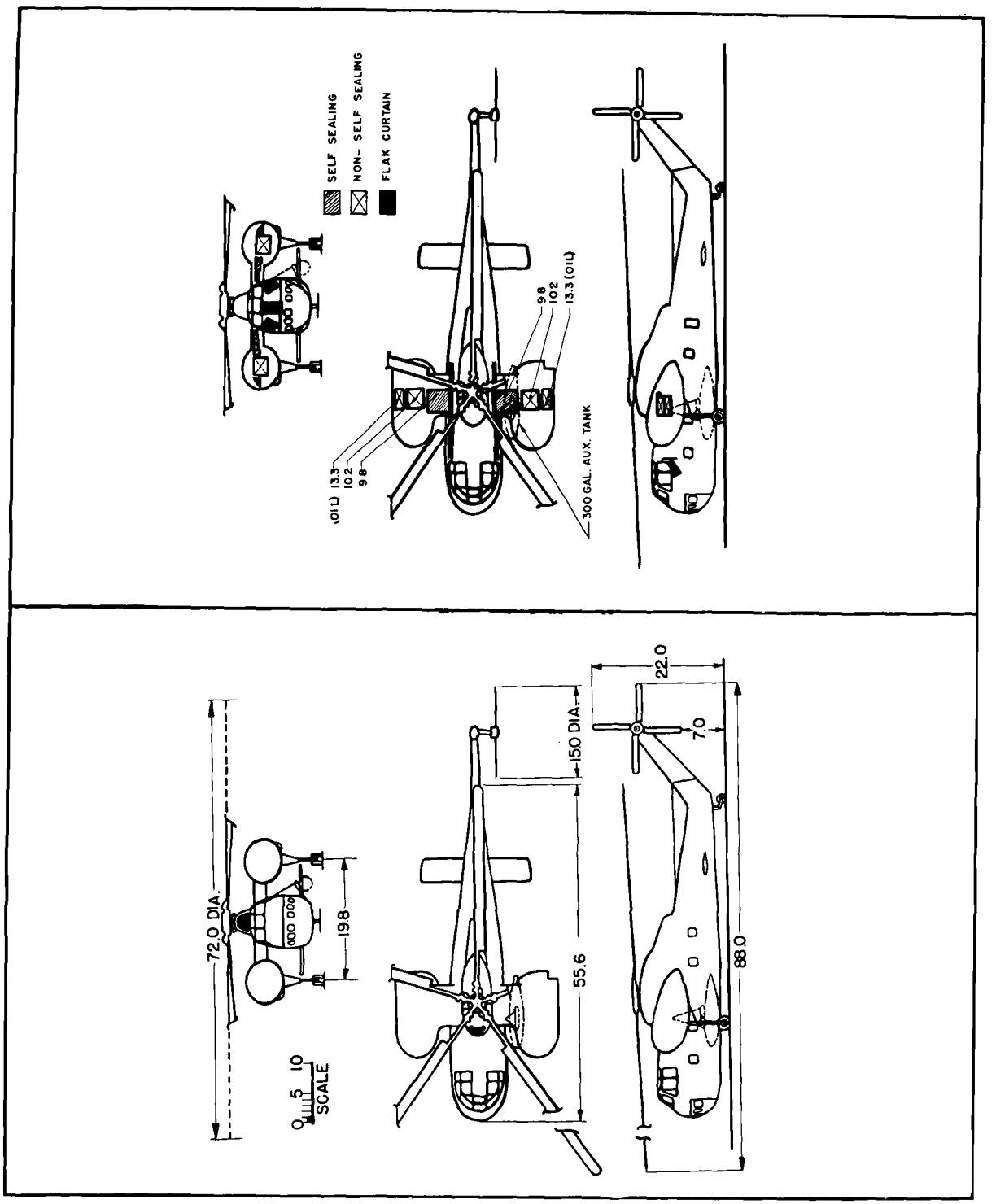
Warm-up and take-off: 5 minutes at Normal Rated Power
Cruise out: At speed for maximum range at sea level
Reserve: 10% of initial fuel load

Maximum Endurance Mission

Warm-up and Take-off: 5 minutes at Normal Rated Power
Cruise out: At speed for maximum endurance at sea level
Reserve: 10% of initial fuel load


CLIMB
NORMAL POWER
ALTITUDE-1000 FT.
RATE OF CLIMB-100 F.P.M.
COMBAT RANGE
COMBAT RANGE - NAUT. MI.
CRUISE SPEED-KTS
SPEED
NORMAL POWER
ALTITUDE-1000 FT.
SPEED-KNOTS
VERTICAL CLIMB
MILITARY POWER
NORMAL POWER
VERTICAL RATE OF CLIMB - 100 F.P.M.
GROSS WEIGHT - 100 LBS
LOADING CONDITION COLUMN NUMBER


STANDARD AIRCRAFT CHARACTERISTICS
HR2S-1
SIKORSKY


SELF SEALING
NON- SELF SEALING
FLAK CURTAIN
(OIL) 13.3
10.2
9.8
300 GAL. AUX. TANK
72.0 DIA.
19.8
0 5 10
SCALE
55.6
15.0 DIA.
22.0
7.0
88.0

POWER PLANT

NO. & MODEL ..... (2) R-2800-54
MFR ..... Pratt & Whitney
SUPERCHARGER ..... 1 Stage, 1 Speed
ROTOR GEAR RATIO ..... 14.01 to 1
TAIL ROTOR RATIO ..... 2.9 to 1

RATINGS

	BHP	@ RPM	@ ALT
T.O.	2100	2700	5000
NORM.	1900	2600	7000

Spec. No. N-8143B

ACCOMMODATIONS

PILOT 1
CO-PILOT 1

COMBAT TROOPS 20
or
LITTERS 16

MAXIMUM CARGO CAPACITY ... 10,000 lbs.

MISSION AND DESCRIPTION

The primary mission of the model HR2S-1 helicopter is to transport assault troops and equipment from ships or land bases to a target and return. It is suitable for operation from aircraft carriers (except for CVE and CVL class) and from land bases.

The HR2S-1 has a twin engine, single main rotor with an automatic torque compensation tail rotor and a controlled stabilizer. It incorporates a dual control system. The mechanical flight controls are augmented by a primary and secondary servo system with an automatic stabilization device.

A blade flapping restrainer and a rotor brake are provided for starting and stopping the rotor in winds up to 60 knots.

There are provisions for an auxiliary fuel system to allow installation of two-300 gallon external tanks or two-150 gallon tanks.

DEVELOPMENT

First Flight ..... December 1953
Service Use ..... June 1956

DIMENSIONS

DISC AREA ..... 4017.5 sq. ft.
BLADE AREA ..... 261.5 sq. ft.
NO. OF BLADES(MAIN)..... 5
ROTOR DIA. ..... 72' - 0"
LENGTH ..... 58' - 5"
HEIGHT ..... 16' - 8"
(tail rotor folded and tail rotor positioned)
TREAD ..... 19' - 9"
STABILIZER AREA ..... 111.7 sq. ft.

WEIGHTS

LOADING	LBS	L.F.
EMPTY	21,502	
BASIC	21,502	
DESIGN	31,000	2.5
COMBAT (Basic)	28,706	2.7
T.O. (Normal)	31,000	2.5
T.O. (Overload)	31,000	2.5
MAX. LANDING	31,000	

All weights are actual

FUEL AND OIL

GALS.	NO. TANKS	LOCATION
196	2	Nacelles
204	2	Wing *
600	2	Fuse. Sides (ext.)

* Self Sealing

FUEL GRADE 115/145
FUEL SPEC (applicable) MIL-F-5572

OIL

CAPACITY (Gals.) 26.6
GRADE 1100
SPEC (applicable) MIL-O-6082

ELECTRONICS

CODER GROUP AN/APA-89
UHF TRANS/RECOR ..... AN/ARC-27A or AN/ARC-55
MHF TRANS/RECOR AN/ARC-2A
ICS AN/AIC-4A
DIR. FINDER GROUP AN/ARA-25
RADAR ALTIMETER AN/APN-22
TRANS/RECOR AN/APX-6B
RADIO SET (TACAN) AN/ARN-21
RADIO RECEIVER AN/ARN-41A
FM COMMUNICATIONS SET AN/ARC-44

PERFORMANCE SUMMARY

TAKE-OFF LOADING CONDITION			(1) ASSAULT TRANSPORT (Normal) 1 Ext. Fuel Tank	(2) CARGO (Overload)	(3) FERRY Maximum Fuel 2 Ext. Fuel Tanks		
TAKE-OFF WEIGHT		lb.	31,000	31,000	28,533		
Fuel internal/external		lb.	2400/1527	2400/0	2400/3600		
Payload		lb.	4500	6673	0		
Disc loading		lb./sq.ft.	7.61	7.61	7.00		
Vertical rate of climb at S.L.	(A)	fpm.	0	0	950		
Absolute hovering ceiling	(A)	ft.	0	0	5400		
Max. rate of climb at S.L.	(B)	fpm.	1280	1280	1580		
Service ceiling (100 fpm)	(B)	ft.	11,500	11,500	13,800		
Speed at S.L.	(B)	kn.	115	119	121		
Max. speed/altitude	(B)	kn./ft.	115/S.L.	119/S.L.	121/S.L.		
Combat range		n.mi.	- -	- -	335		
Average cruising speed		kn.	- -	- -	100		
Cruising altitude		ft.	- -	- -	0		
Combat radius		n.mi.	100	71	- -		
Average cruising speed		kn.	100	100	- -		

NOTES

(A) TAKE-OFF RATED POWER

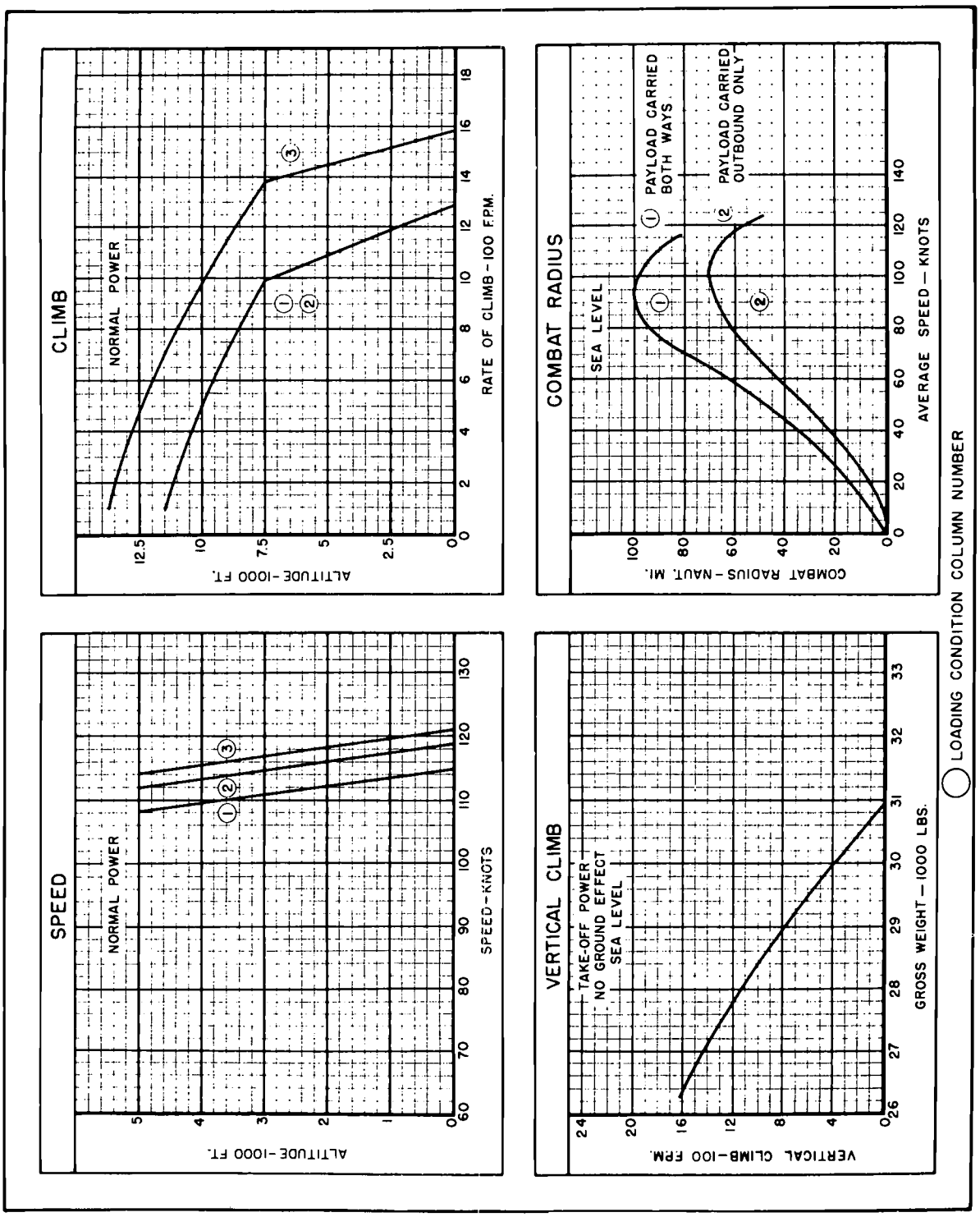
(B) NORMAL RATED POWER

PERFORMANCE BASIS: NATESTCEN flight test data.

COMBAT RANGE and RADIUS are based on NATESTCEN fuel consumption data.

All performance is out of ground effect.

Maximum airspeed limited by blade tip stall and Mach Number effects on rotor blades.


CLIMB
NORMAL POWER
ALTITUDE-1000 FT.
RATE OF CLIMB-100 F.P.M.
COMBAT RADIUS
SEA LEVEL
① PAYLOAD CARRIED BOTH WAYS
② PAYLOAD CARRIED OUTBOUND ONLY
COMBAT RADIUS-NAUT. MI.
AVERAGE SPEED-KNOTS
SPEED
NORMAL POWER
ALTITUDE-1000 FT.
SPEED-KNOTS
VERTICAL CLIMB
TAKE-OFF POWER
NO GROUND EFFECT
SEA LEVEL
VERTICAL CLIMB-100 F.P.M.
GROSS WEIGHT-1000 LBS.
LOADING CONDITION COLUMN NUMBER

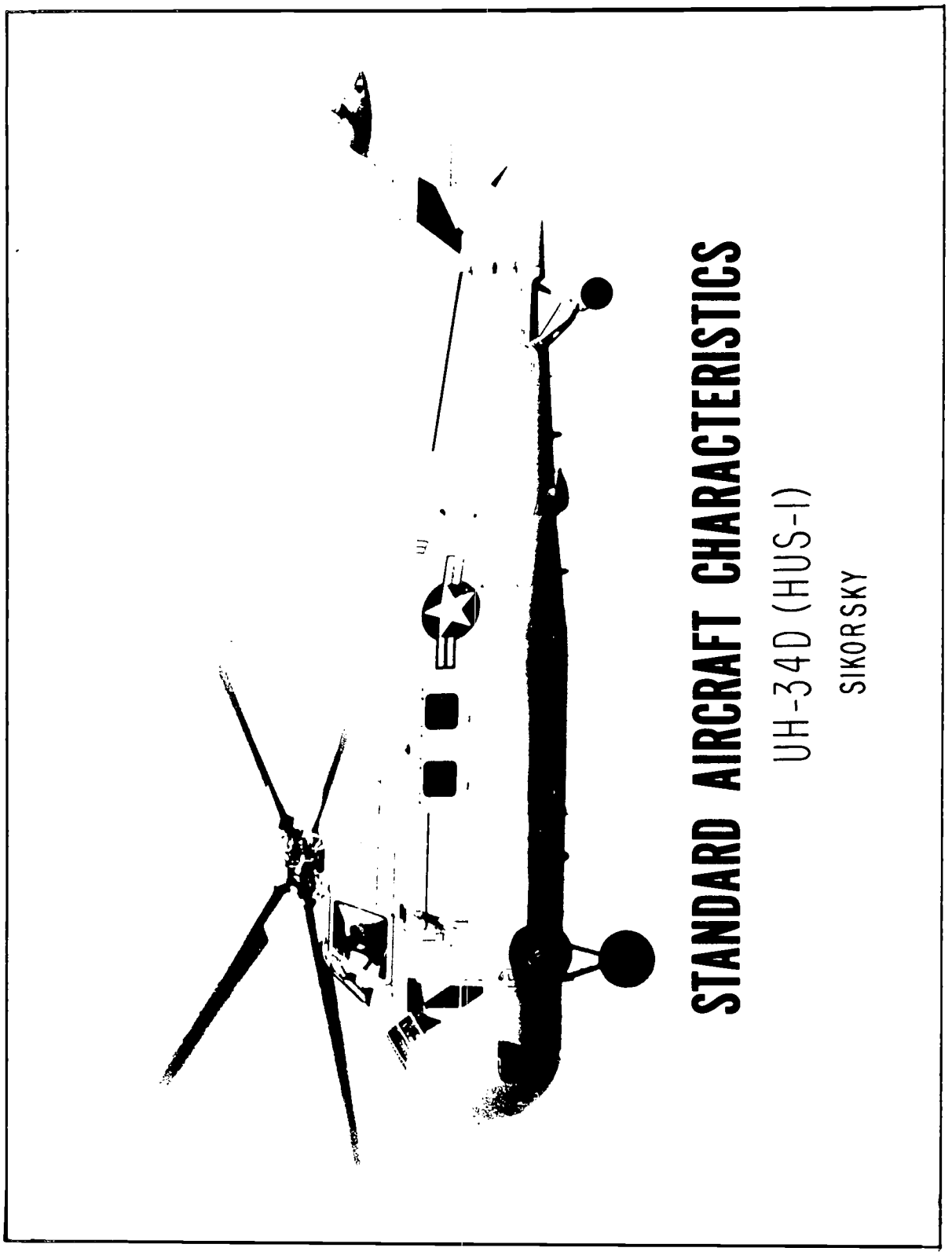
NOTES

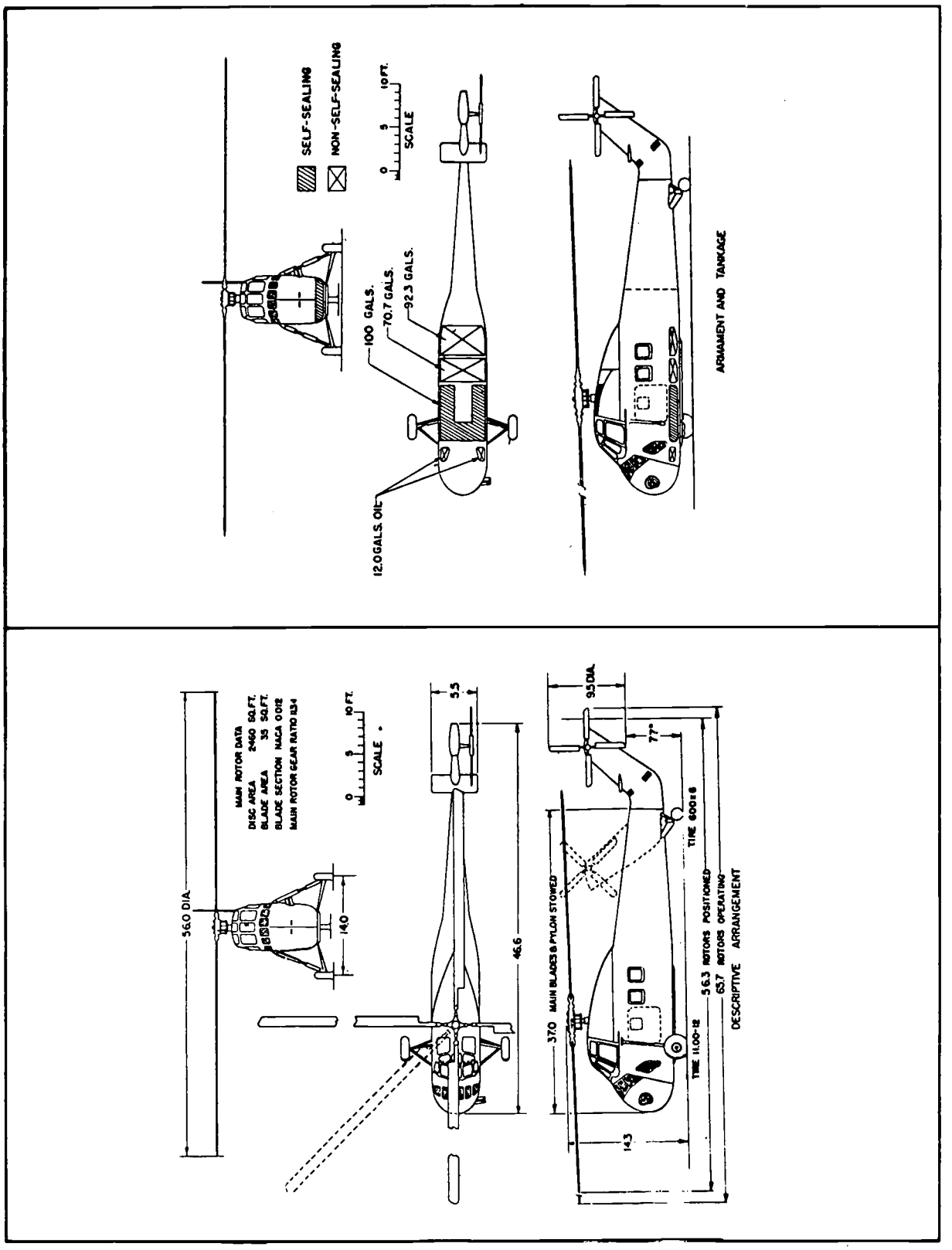
ASSAULT COMBAT RADIUS MISSION

WARM-UP, TAKE-OFF, RENDEZVOUS: 10 minutes fuel allowance at normal rated power.
CRUISE-OUT: At sea level at 80% normal rated power.
LAND AT TARGET AND TAKE-OFF: No change in payload; fuel allowance of 5 minutes at normal rated power.
CRUISE-BACK: At sea level at 80% normal rated power.
RESERVE: 10% of initial fuel load.

CARGO MISSION

Same as Assault Combat Radius Mission except in lieu of 20 assault troops, 6673 lbs. of cargo is carried out and unloaded at target.


STANDARD AIRCRAFT CHARACTERISTICS
UH-34D (HUS-1)
SIKORSKY


SELF-SEALING
NON-SELF-SEALING
0 5 10 FT.
SCALE
100 GALS.
70.7 GALS.
92.3 GALS.
12.0 GALS. OIL
ARMAMENT AND TANKAGE
MAIN ROTOR DATA
DISC AREA 2460 SQ.FT.
BLADE AREA 35 SQ.FT.
BLADE SECTION NACA 0012
MAIN ROTOR GEAR RATIO 13.4
56.0 DIA
14.0
46.6
5.5
9.5 DIA.
7.7"
37.0 MAIN BLADES & PYLON STOWED
14.3
TIRE 6.00-6
TIRE 11.00-12
56.3 ROTORS POSITIONED
63.7 ROTORS OPERATING
DESCRIPTIVE ARRANGEMENT

POWER PLANT

NO.& MODEL ..... (1)R-1820-84
MFR ..... WRIGHT
SUPERCH ..... 1 STAGE, 1 SPEED
ROTOR GEAR RATIO ..... 11.3 to 1
TAIL ROTOR RATIO ..... 1.9 to 1

RATINGS

	BHP	RPM	ALT	TIME
T. O.	1525	2800	700'	5 Min.
MIL.	1425	2700	2400'	30 Min.
NORM.	1275	2500	3500'	Cont.

ENGINE SPEC. N-895
of 26 Nov 1952

ACCOMMODATIONS

Crew (Pilot & Co-Pilot) 2
Troops 12
or
Litters 8

CARGO

Internal/Capacity.....4000 lbs.
External Capacity .....5000 lbs. (on sling)
Cargo Compartment:
Length.....13' 7"
Width .....4' 11"
Height ..... 6' 0"

MISSION AND DESCRIPTION

The principal mission of this helicopter is to transport general cargo and large aircraft maintenance spare components.

The HUS-1 is a four bladed all metal main rotor type helicopter with a four bladed all metal automatic torque compensating tail rotor. The engine is mounted in the nose facing rearward inclined 35° from the horizontal. This helicopter incorporates a dual control system of the conventional stick and rudder pedal type, supplemented by a collective pitch control lever synchronized with the throttle to provide constant rotor speed. Automatic stabilization equipment is provided capable of maneuvering and maintaining heading, altitude, and attitude established by the pilot under stick and pedal free conditions. The tail pylon and main rotor blades flod without disconnecting transmission or controls, thus permitting stowage on the smallest carrier or cruiser deck elevator. The fixed type landing gear consists of a main two wheel alighting gear and a tail wheel.

Hoist Capacity 400#

DEVELOPMENT

First Flight.....January 1957
Service Use .....January 1957

DIMENSIONS

ROTOR DIA ..... 56' 0"
DISC AREA ..... 2460 sq. ft.
*LENGTH ..... 37' 0"
HEIGHT (MAX) ..... 15' 8"
TREAD ..... 12' 0"
STABILIZER AREA..... 12.4 sq. ft.

*ROTOR AND TAIL PYLON FOLDED.

WEIGHTS

LOADING	LBS	L.F.
EMPTY	8090	
BASIC.....	8598	
DESIGN	11305	.....2.68
MAX T.O.	13300	.....2.29
MAX LANDING.....	13300	.....2.29

All weights are actual

FUEL AND OIL

NO. Tanks	Gals.	Location
3	263	Fuselage

FUEL GRADE.....115/145
FUEL SPEC F-5572-1

OIL

Capacity (Gals).....12.4
Grade 1065/1100
Spec. MIL-L-6082A

ELECTRONICS

UHF RADIO SET AN/ARC-55
MHF..... AN/ARC-39
ICS AN/AIC-4A
RADAR ALTIMETER AN/APN-117
FINDER GROUP AN/ARA-25
RADAR ID SET AN/APX-6
CODER GROUP.....AN/APA-89
ADF AN/ARN-59
TACAN AN/ARN-21
FM RADIO SET AN/ARC-44
COURSE INDICATOR ... ID-250/ARN
VIDEO CODER KY-81/APA-89

PERFORMANCE SUMMARY

TAKE-OFF LOADING CONDITION		(1) Cargo Transport	(2) Troop Transport	(3) Combat Evacuation	(4) Cargo Transport (Overload)	(5) Ferry Range
TAKE-OFF WEIGHT	LB.	11297	12936	11837	13300	10284
FUEL	LB.	1240	1446	1562	504	1562
PAYLOAD	LB.	1335	2700	1520	4110.9	--
DISC LOADING	LB./SQ.FT.	4.59	5.26	4.82	5.41	4.18
VERTICAL RATE OF CLIMB AT S.L. (B)	FPM.	1350	500	1060	320	1910
ABSOLUTE HOVERING CEILING (B)	FT.	7900	3875	6480	3000	10700
MAX. RATE OF CLIMB AT S.L. (B)	FPM.	2020	1570	1860	1475	2350
SERVICE CEILING (100 FPM.) (A)	FT.	14300	10800	13100	10000	16550
SPEED AT S.L. (A)	KN.	132	123	129	121	135
MAX. SPEED/ALTITUDE (A)	KN./FT.	132/S.L.	123/S.L.	139/S.L.	121/S.L.	135/S.L.
COMBAT RANGE (A)	N.MI.	210	218	263	58	298
AVERAGE CRUISING SPEED	KN.	94	98	94	99	93
CRUISING ALTITUDE	FT.	1500	1500	1500	1500	1500
COMBAT RADIUS (A)	N.MI.	100	110	128	24	--
AVERAGE CRUISING SPEED (C)(D)	KN.	94/93	98/93	94/93	99/93	--
Cruising Altitude	ft.	1500	1500	1500	1500	--

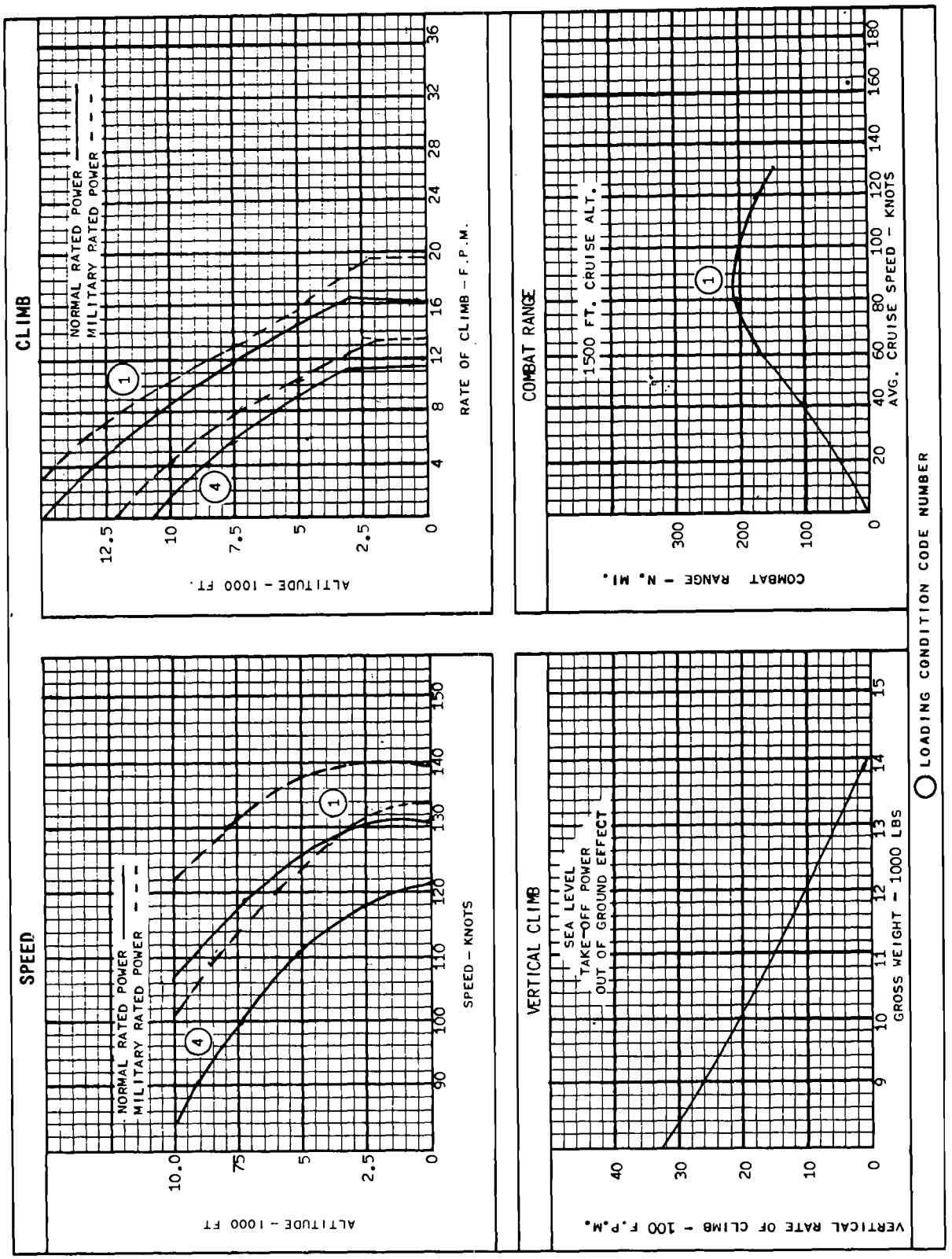
NOTES:

(A) NORMAL RATED POWER
(B) TAKE-OFF POWER
(C) AVERAGE CRUISE SPEED OUTGOING
(D) AVERAGE CRUISE SPEED RETURNING

PERFORMANCE BASIS: NATESTCEN Evaluation of HSS-1 and HUS-1 helicopters.

RANGE AND RADIUS Are based upon NATESTCEN fuel consumption data.

All performance is out of ground effect and for standard atmospheric conditions.


CLIMB
NORMAL RATED POWER
MILITARY RATED POWER
RATE OF CLIMB – F.P.M.
ALTITUDE – 1000 FT.
COMBAT RANGE
1500 FT. CRUISE ALT.
AVG. CRUISE SPEED – KNOTS
COMBAT RANGE – N. MI.
SPEED
SPEED – KNOTS
ALTITUDE – 1000 FT
VERTICAL CLIMB
SEA LEVEL
TAKE-OFF POWER
OUT OF GROUND EFFECT
GROSS WEIGHT – 1000 LBS
VERTICAL RATE OF CLIMB – 100 F.P.M.
LOADING CONDITION CODE NUMBER

NOTES

COMBAT RADIUS MISSION:

Warm-up and Take-off: 10 Minutes at Normal Rated Power
Climb: To 1500 feet at Normal Rated Power
Cruise: At long range speed to advanced area
Land: Deposit Cargo or Discharge Troops
Climb: To 1500 feet at Normal Rated Power
Cruise: Back to base at speed for best range
Reserve: 10% of initial fuel load

EVACUATION MISSION:

Warm-up and Take-off: 10 Minutes at Normal Rated Power
Climb: To 1500 feet at Normal Rated Power
Cruise: At long range speed to advanced area
Land: Pick up evacuees (8)
Climb: To 1500 feet at Normal Rated Power
Cruise: Back to base at speed for best range
Reserve: 10% of initial fuel load

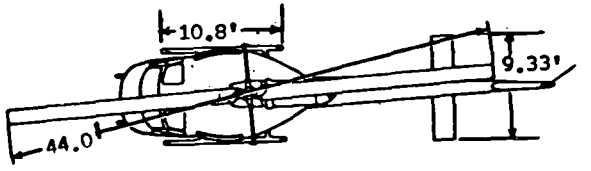
COMBAT RANGE MISSION:

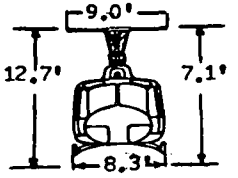
Warm-up and Take-off: 5 minute at Normal Rated Power
Climb: To 1500 feet at Normal Rated Power
Cruise: At speed for best range
Reserve: 10% of initial fuel load

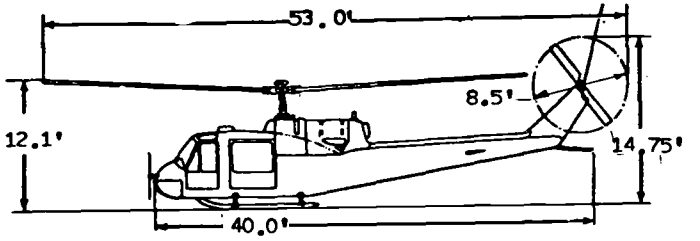
○ LOADING CONDITION COLUMN NUMBER


MARINES
03606
STANDARD AIRCRAFT CHARACTERISTICS
UH-1E

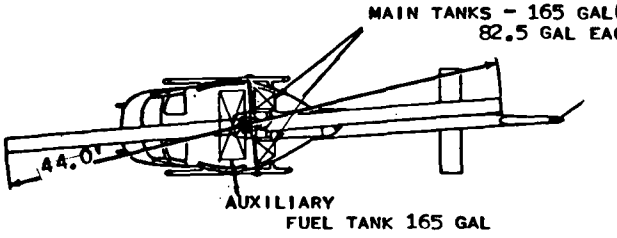
PROJECTED DISC AREA	1520 SQ. FT.
BLADE AREA (TOTAL)	77 SQ. FT.
BLADE DIAMETER	44 FT.

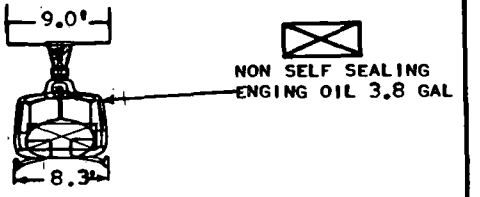


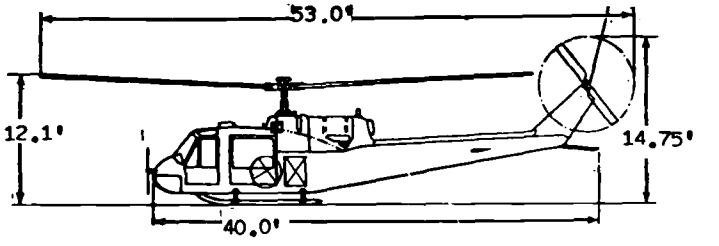




DESCRIPTIVE ARRANGEMENT







TANKAGE INSTALLATION

POWER PLANT

No. and Model ..... (1)T53-L-9
Mfg. ..... Lycoming
Engine Spec. No..... 104.22-B
Type ..... Free Power Turbine
Red. Gear Ratio 0.3119
Tail Pipe ..... Fixed Area
Augmentation ..... None

RATINGS

	Sea Level Std.	ESHP	SHP	Net Jet Thrust (lb)	RPM	MIN
T.O.		1150	1100	124	6610	5
MIL.		1046	1000	115	6610	30
Nor.		943	900	107	6610	Cont.

ACCOMMODATIONS

Basic Mission
Crew 1
Observer 1
Transport (Personnel) Mission
Normal
Crew 1
Passengers 4
Alternate
Crew 1
Passengers 7
Litter Evacuation
Crew (Pilot & Medical Attend.).... 2
Litters 3
Ferry Mission
Crew (Pilot) 1

Hoist Capacity ..... 600 lb.

MISSION AND DESCRIPTION

The basic missions of the UH-1E are visual observation and target acquisition, reconnaissance and command control. The UH-1E is capable of flight from established airfields, carriers of the LPH and CVS class, advanced bases, areas or ships with individual landing platforms or limited landing facilities, and from unprepared fields. It may be handled on carrier elevators without any folding of components.

In addition, the UH-1E may be used for medical evacuation, to transport personnel, special teams or crews, equipment and supplies. These missions may be performed under instrument operations including light icing and day or night flight. By the attachment of appropriate weapons it is possible to deliver point target and area fire.

The gas turbine powered UH-1E is of compact design having a low silhouette. The two-bladed main and tail rotors are of all metal construction. The fuselage is of semi-monocoque construction.

The cabin has large sliding doors allowing straight-through loading. Litters may be loaded from either side or from both sides simultaneously. The cargo floor is knee high for easy loading. The copilot's controls are easily removed; thus providing accomodations for a passenger in the copilot seat or when the copilot seat is removed, an additional 8.75 square feet of cargo area for a total of 47.2 square feet.

DEVELOPMENT

Three (3) production articles being procured for the Department of the Navy.
First Flight (Est)..... Feburary 1963
First Deliver (Est) ..... March 1963

DIMENSIONS

Rotor Diameter ..... 44.0'
Disc Area ..... 1520.0 - Blade Area..77.0'
Length - Rotors Operation ..... 53.0'
Fuselage ..... 39.5'
Span (Max. Lateral)..... 9.3'
Height ..... 14.7'
Tread ..... 8.4'
Rotor Ground Glearance..... 7.4'
(Static, Against Stops)

WEIGHTS

LOADING	LB.	L.F.
Empty	4734(A)	
Basic	5145	
Design	6600	3.0
Combat	6171	3.0
Max T.O.	8500	2.3
Max Land	8500	

(A)Actual

FUEL AND OIL

LOCATION	No. TANKS	GALS
Fuselage	2	165.0
Fuselage, Ferry	1	165.0
External, Ferry	2	200.0
	Total	530.0

Grade JP-4
Specification MIL-J-5624D

OIL

Fuselage 3.8
Specification MIL-L-7808D

ELECTRONICS

UHF Transceiver AN/ARC-52
LF Automatic Direction Finder.....AN/ARN-59
HF-AM/SSB Transceiver..AN/ARC-94
Intercom System.....AN/AIC-14
UHF-DF Homing Group ..AN/ARA-25A
Gyro Compass System MA-1
IFF Radar Identification Set.....AN/APX-6B
Coder Group.....AN/APA-89
Radar Altimeter AN/APN-141
FM Radio Set AN-ARC-44
TACAN Radio Set.....AN/ARN-52(V)

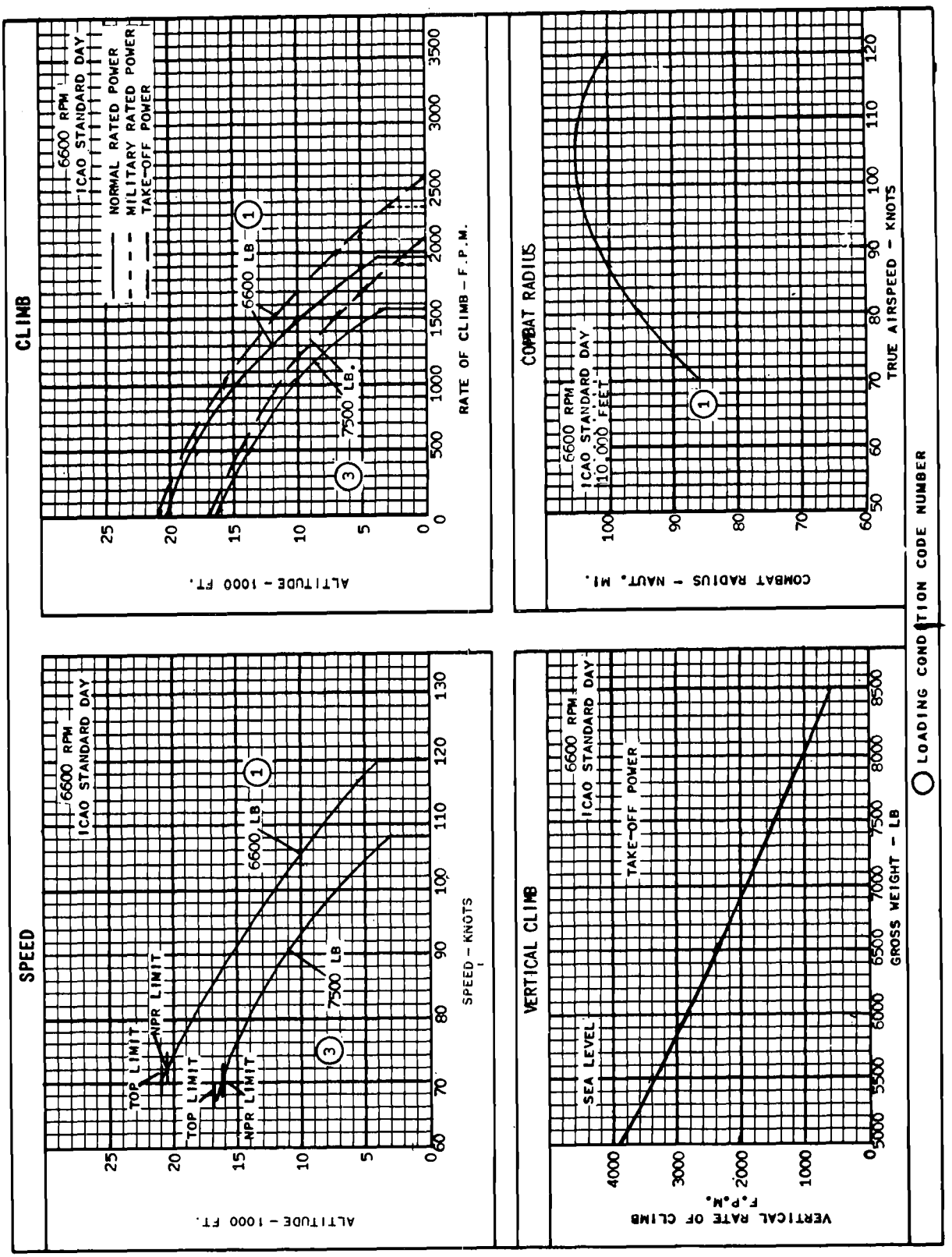
PERFORMANCE SUMMARY

TAKE-OFF LOADING CONDITION		(1) PRIMARY OBSERVATION	(2) TRANSPORT	(3) OVERLOAD TRANSPORT	(4) LITTER EVACUATION	(5) FERRY
TAKE-OFF WEIGHT	LB.	6600	6868	7500	6701	8500
FUEL INTERNAL/EXTERNAL	LB.	1072/-	1072/-	1072/-	1072/-	1072/2056 (4)
PAYLOAD	LB.	332	800	1432	400 (5)	0
DISC LOADING	LB./SQ.FT.	4.34	4.52	4.93	4.15	5.59
VERTICAL RATE OF CLIMB AT S.L. (1)	FPM.	2300	2050	1470	2210	560
ABSOLUTE HOVERING CEILING (1)	FT.	11900	10500	6800	11300	1700
MAX. RATE OF CLIMB AT S.L. (2)	FPM.	1985	1840	1565	1932	1200
SERVICE CEILING (100 FPM.) (2)	FT.	19700	18450	15700	19200	11600
SPEED AT S.L. (3)	KN.	120	116	108	120	95
MAX. SPEED/ALTITUDE (3)	KN./FT.	120/S.L.	116/S.L.	108/S.L.	120/S.L.	95/S.L.
COMBAT RANGE	N.MI.	243	230	214	214	548
AVERAGE CRUISING SPEED	KN.	98	104	100	107	90
CRUISING ALTITUDE	FT.	10000	10000	10000	10000/50000	10000
COMBAT RADIUS /MISSION TIME	N.MI.	105/2.27	112/2.21	109/2.24	104.9/2.12	219/-
AVERAGE CRUISING SPEED	KN.	107	105	102	106	90
MAXIMUM ENDURANCE @ S.L.	HRS.	2.40	2.30	2.25	2.37	5.20
MISSION TIME - FERRY RANGE	N.MI.					6.11

NOTES:

(1) Take-Off Power
(2) Normal Rated Power
(3) V_{ne} Limit
(4) Additional fuel in two 100-gallon external tanks (External Tank System under Development By Navy - Not Presently Available) and one 165-gallon Internal Tank

PERFORMANCE BASIS: YHU-1B Category II (Air Force) Flight Test
Range and Radius are based on engine specification fuel consumption increased by 5%


CLIMB
6600 RPM
ICAO STANDARD DAY
NORMAL RATED POWER
MILITARY RATED POWER
TAKE-OFF POWER
6600 LB
7500 LB.
RATE OF CLIMB – F.P.M.
ALTITUDE – 1000 FT.
COMBAT RADIUS
6600 RPM
ICAO STANDARD DAY
10,000 FEET
TRUE AIRSPEED – KNOTS
COMBAT RADIUS – NAUT. MI.
SPEED
6600 RPM
ICAO STANDARD DAY
TOP LIMIT
NPR LIMIT
6600 LB
7500 LB
SPEED – KNOTS
ALTITUDE – 1000 FT.
VERTICAL CLIMB
6600 RPM
ICAO STANDARD DAY
TAKE-OFF POWER
SEA LEVEL
GROSS WEIGHT – LB
VERTICAL RATE OF CLIMB F.P.M.
LOADING CONDITION CODE NUMBER

NOTES

Observation and Reconnaisance (1)

1. Warm-Up and Take-Off: 2 minutes at Normal Rated Power at Sea Level
2. Climb: On course to 10,000 feet
3. Cruise Out: At speeds for best range at 10,000 feet
4. Descent: To sea level loiter for 10 minutes at speeds for maximum endurance
5. Climb: On course to 10,000 feet
6. Cruise Back: At speeds for best range at 10,000 feet
7. Reserve: 10% of initial fuel load

Transport (2), (3), (5)

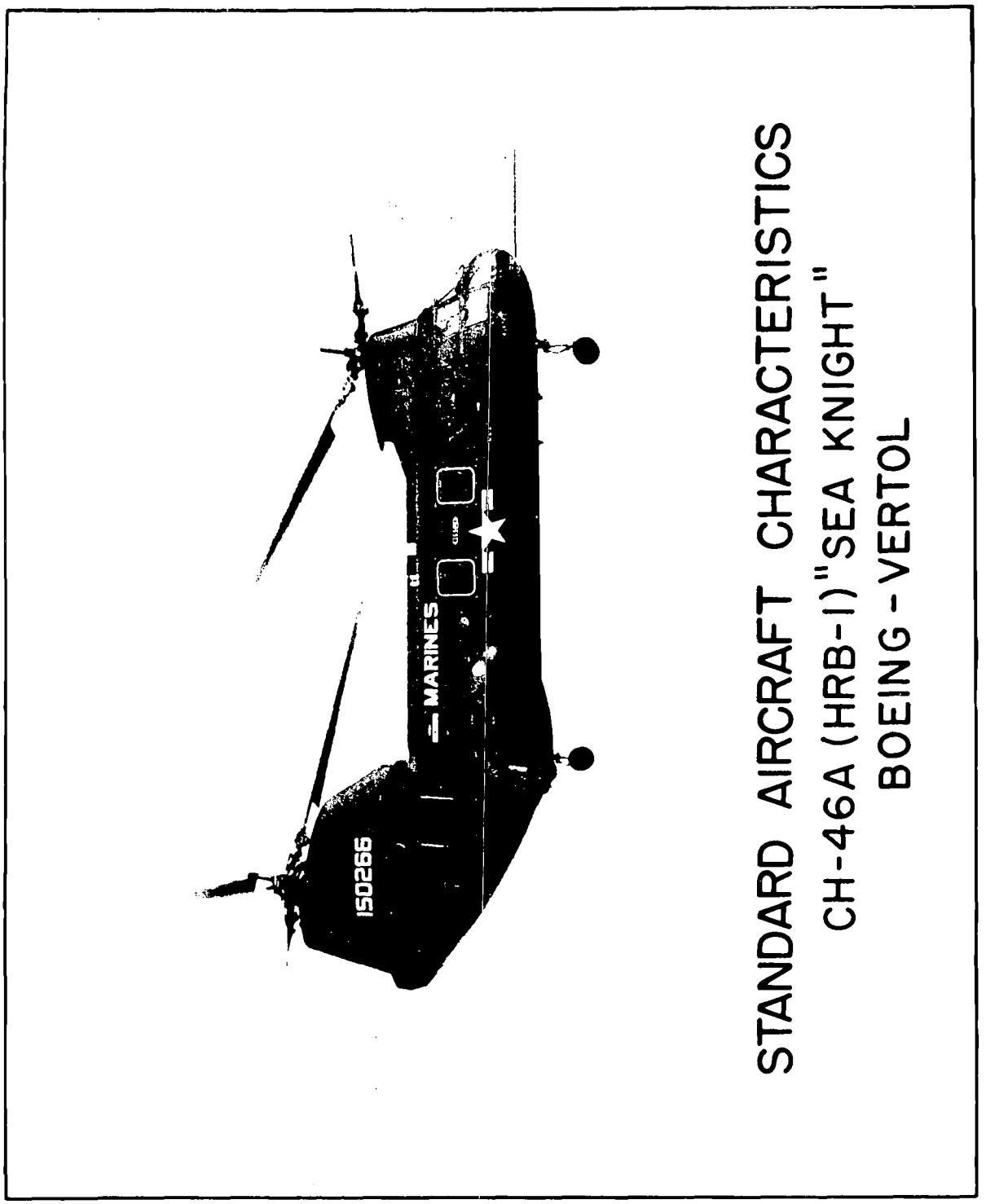
1. Warm-Up and Take-Off: 2 minutes at Normal Rated Power at Sea Level
2. Climb: On course to 10,000 feet
3. Cruise: At speeds for best range at 10,000 feet
4. Reserve: 10% of initial fuel

Litter Evacuation (4)

1. Warm-Up and Take-Off: 2 minutes at Normal Rated Power at Sea Level
2. Climb: On course to 10,000 feet
3. Cruise out at speeds for best range at 10,000 feet
4. Land: At remote base and discharge 2 passengers, pick up two litter patients
5. Warm-up and Take-off: 2 minutes at normal rated power at sea level
6. Climb: On course to 5000 feet
7. Cruise Back: At speeds for best range at 5000 feet
8. Reserve: 10% of initial fuel load

Mission Time: Excludes Warm-Up, Take-Off and Reserve Loiter Time
Cycle Time: Excludes Warm-Up and Take-Off Time

○ LOADING CONDITION COLUMN NUMBER


STANDARD AIRCRAFT CHARACTERISTICS
CH-46A (HRB-1) "SEA KNIGHT"
BOEING - VERTOL
MARINES
150266

Disc Area (projected)	sq ft	Engine/Rotor Gear Ratio	73.772:1
Blade Area (each)	37.50 sq ft	Airfoil Section	NASA 0012 (Mod)
Blade Area (total)	225 sq ft	Blade Chord	18 inches

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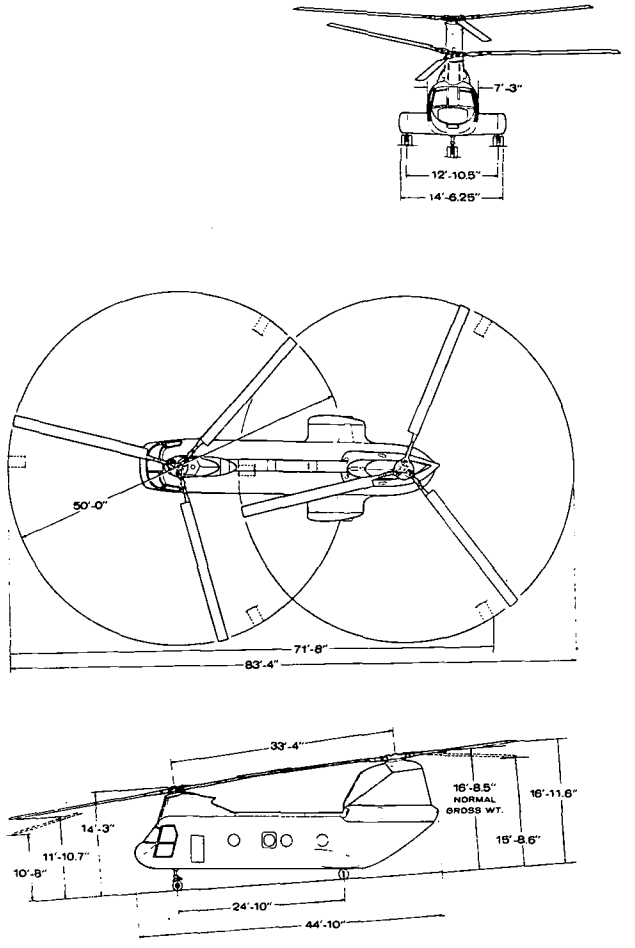
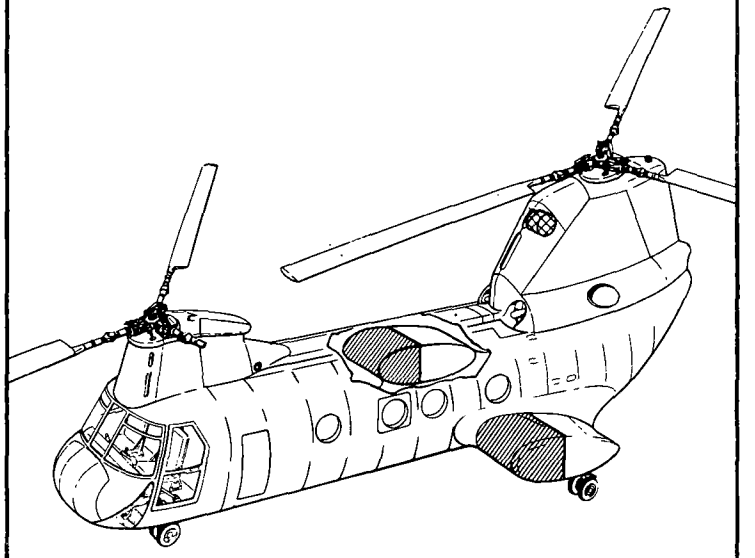


DESCRIPTIVE ARRANGEMENT



TANKAGE INSTALLATION

FUEL [redacted] OIL

POWER PLANT

No. & Model (2)T58-GE-8B
Manufacturer General Electric Co.
Rotor Gear Ratio 73.772:1

RATINGS

	SHP/RPM/ALT
Military	1250/19500/SSL
Normal	1050/19500/SSL

Engine Spec. No. E-1025B
15 Sept. 1961

CARGO

Cargo Compartment 1023 cu ft
(including Ramp Area)
Dimensions 6' x 6' x 24' 2"
External Cargo Hook Capacity
10,000 lbs
Floor Area 180 sq ft
(incl. Ramp)
Floor Limit Loads
Roller Beams for 3000 lb
Pallet 40" x 48"
Wheel Tread 1000 lb Dead Weight
Wheel Load @33 psi Tire Pressure
Remaining Floor Area 300 lb/sq ft

ACCOMMODATIONS

Crew	3
Troops (Combat Equipped)	17
or	
Litters	15
Attendants	2

MISSION AND DESCRIPTION

The primary mission of this aircraft is to rapidly disperse combat troops, support equipment and supplies from amphibious assault landing ships and established airfields to advanced bases in undeveloped areas with limited maintainance and logistic support under all-weather conditions, day or night.

The Sea Knight is a twin turbine, tandem-rotor helicopter with an all-metal fuselage of semi-monocoque stressed skin construction. The engines drive two three-bladed fully articulated partially overlapping rotors, which are synchronized by positive gearing and an interconnecting drive shaft. The all-metal steel-spar rotor blades are interchangeable and have provisions for electrically heated deicing boots. Automatic blade folding within 60 seconds under 45/knot wind conditions is another feature included in the rotor system design.

By sealing the fuselage during assembly, inherent flotation capability is achieved in the normal configuration for emergency water landings and take-offs. A rear loading ramp provides access to the unobstructed payload space for rapid straight-in loading and unloading of personnel, supplies, equipment and vehicles. The ramp is capable of being operated both on the ground and in flight.

For instrument flight capabilities, a dual Stability Augmentation System (SAS) is included as standard equipment. It is a normal and integral part of the control system, and provides positive dynamic stability about the yaw, pitch, and roll axes throughout the entire speed range from hover to maximum forward speed.

DEVELOPMENT

FIRST FLIGHT	Aug. 1962
SERVICE USE	Sept. 1963

DIMENSIONS

Disc Area: 3495 sq ft (projected)
No. of Blades: 6 (2 rotors)
Total Blade Area: 225 sq ft
Rotor Diameter: 50 ft
Length (Blades Folded) 44' 10"
" (" Turning) 83' 4"
Height (Blades Folded) 16' 8.5"
" (" Turning) 16' 11.6"
Width (Blades Folded) 14' 11.6"

WEIGHTS

	Lbs.	L.F.
Empty:	11,708	
Basic:	11,729	
Design:	18,700	2.67
Max. T.O.:	21,400	2.3
Max. Landing:	21,400	2.3

Weights are 39% actual, 3% estimated, and 58% calculated

FUEL AND OIL

Tanks	Gals	Location
2	190	Left and Right Stub Wings

Fuel Grade JP-4
Fuel Spec Mil-F-5624C

OIL

Capacity (Gals)
Engine 4.2
Transmission 14.4
Oil Grade 1065
Oil Spec Mil-L-7808C

ELECTRONICS

Radio Set (UHF)	AN/ARC-52
Radar Ident. Set	AN/APX-6B
ICS	AN/AIC-14
ADF	AN/ARN-59
TACAN	AN/ARN-52
Radio Finder Group	AN/ ARN-25A
Radar Altimeter	AN/APN-117
Coder	AN/APA-89
FM Liaison	AN/ARC-44
Compass	MA-1

CONFIDENTIAL

PERFORMANCE SUMMARY

TAKEOFF LOADING CONDITION		(1) ASSAULT TRANSPORT	(2) CARGO	(3) CARGO OVERLOAD	(4) FERRY	
TAKEOFF WEIGHT	lb.	18708	18708	21400	21400	
Fuel	lb.	2387	2364	2470	8609	
Payload	lb.	4000	4023	6611	0	
Disc Loading	lb./sq.ft.	4.77	4.77	5.45	5.45	
Vertical rate of climb at S L (A)	fpm.	1290	1290	220	220	
Absolute hovering ceiling (A)	ft.	7300	7300	2050	2050	
Max. rate of climb at S.L. (B)	fpm.	1540	1540	1060	1060	
Service ceiling (100 fpm) (B)	ft.	12800	12800	8300	8300	
Speed at S.L. (B)	kn.	131	131	124	124	
Max. speed/altitude (A)	kn./ft.	139/SL	139/SL	134/SL	134/SL	
Range	n.mi.	211	209	204	843	
Average cruising speed	kn.	120	120	119	116	
Cruising altitude	ft.	SL	SL	SL	5000	
Radius	n.mi.	100	100	98	---	
Average cruising speed	kn.	130	130	127(C)	---	
Cruising altitude		SL	SL	SL	---	

NOTES

(A) MILITARY POWER.

(B) NORMAL RATED POWER.

(C) CRUISE AT NORMAL RATED POWER.

ALL PERFORMANCE IS OUT OF GROUND EFFECT.

PERFORMANCE BASIS: CALCULATED DATA BASED ON CONTRACTOR'S FLIGHT TESTS OF BOEING-VERTOL 107-II HELICOPTER.

RANGE AND RADIUS ARE BASED ON ENGINE SPECIFIC FUEL CONSUMPTION INCREASED 5% PER MIL-C-5011A.

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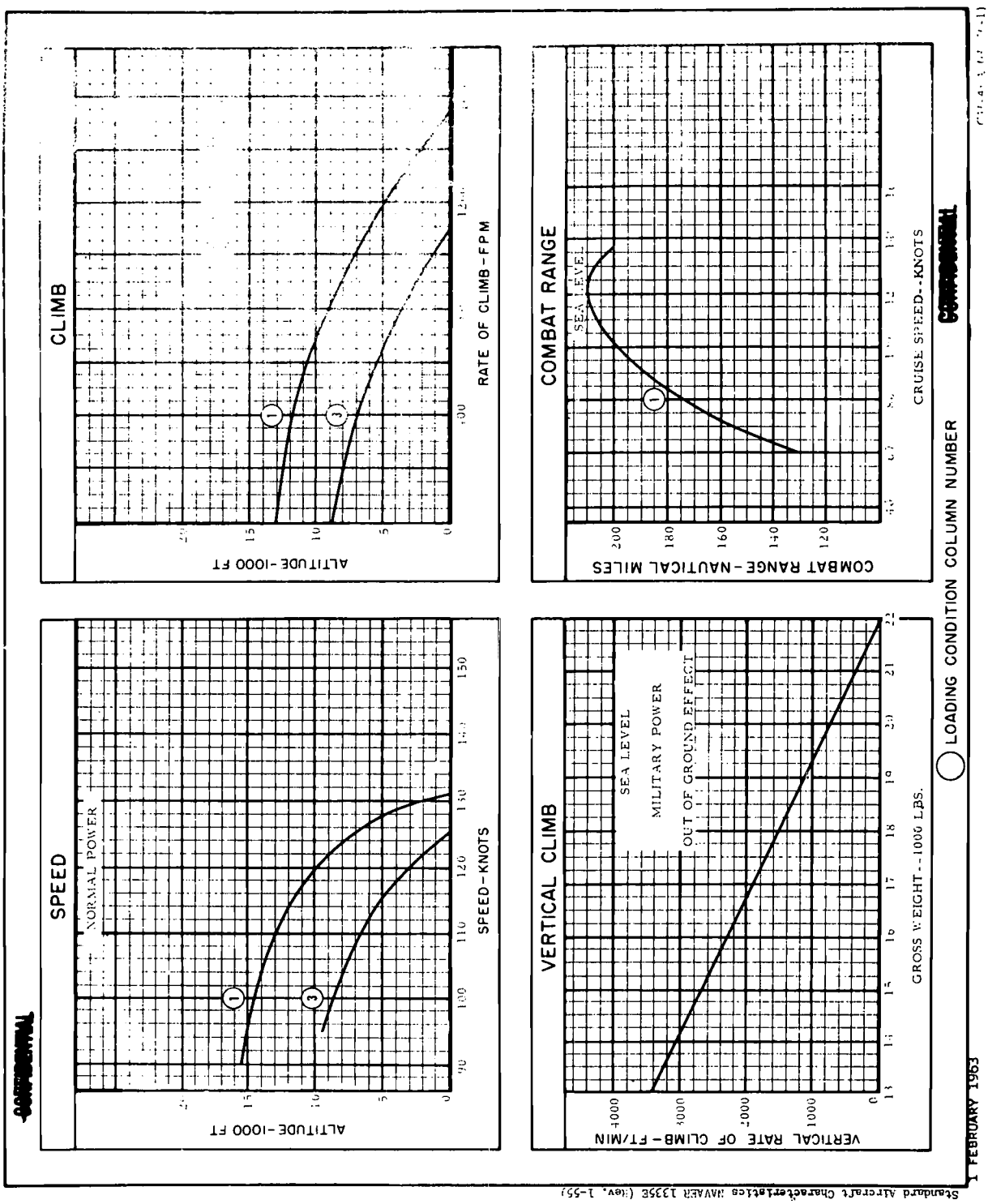

CLIMB
ALTITUDE-1000 FT
RATE OF CLIMB-FPM
COMBAT RANGE
SEA LEVEL
COMBAT RANGE-NAUTICAL MILES
CRUISE SPEED--KNOTS
SPEED
NORMAL POWER
ALTITUDE-1000 FT
SPEED-KNOTS
VERTICAL CLIMB
SEA LEVEL
MILITARY POWER
OUT OF GROUND EFFECT
VERTICAL RATE OF CLIMB-FT/MIN
GROSS WEIGHT--1000 LBS.
LOADING CONDITION COLUMN NUMBER
1 FEBRUARY 1963
Standard Aircraft Characteristics NAVAER 1335E (Rev. 1-55)

NOTES

COMBAT RANGE MISSION:

W.U. and T.O.: 2 min. at Normal Power
CRUISE: at speed for best range at sea level
RESERVE: 10% of initial fuel load

RADIUS MISSION (ASSAULT TRANSPORT):

W.U. and T.O.: 7 min. at Normal Power
(includes allowance for warm-up and take-off at remote base)
CRUISE OUT: at 130 knots at sea level
LAND: at remote base and unload troops
CRUISE BACK: at 130 knots at sea level
RESERVE: 10% of initial fuel load

MISSION TIME: INCLUDES ALL ITEMS OF THE MISSION EXCEPT TIME AND FUEL FOR WARMUP, TAKE-OFF AND RESERVE.

CYCLE TIME; INCLUDES ALL ITEMS OF THE MISSION EXCEPT TIME AND FUEL TO WARM-UP AND TAKE-OFF

FERRY RANGE MISSION:

W.U. and T.O.: 2 min. at Normal Power
CLIMB: on course to 5000 ft.
CRUISE: at speed for best range at 5000 ft.
DESCEND: to sea level (no fuel consumed, no distance gained)
RESERVE: 10% of initial fuel load

RADIUS MISSION (CARGO):

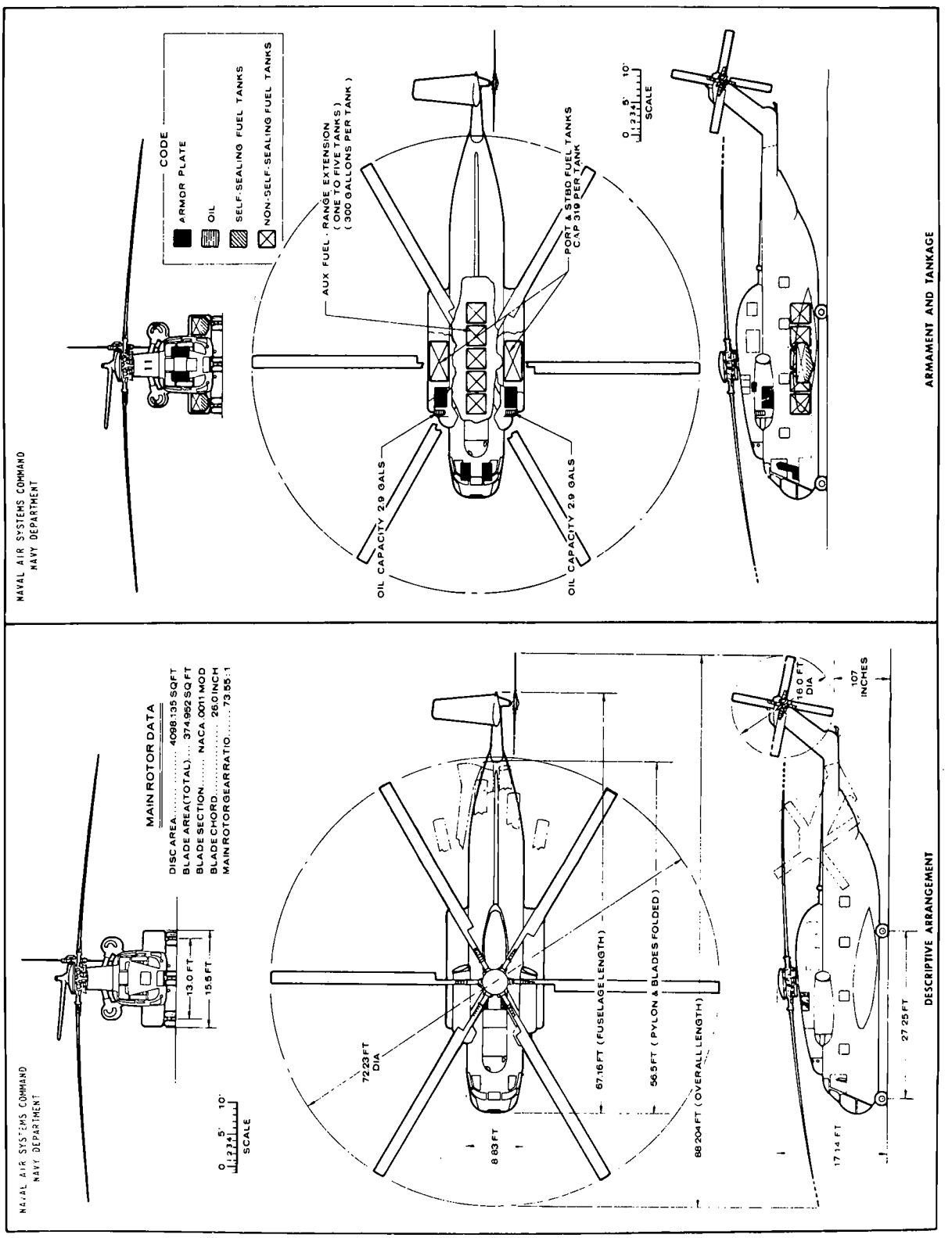
W.U. and T.O.: 2 min. at Normal Power
CRUISE OUT: at 130 knots at sea level
LAND: at remote base, do not unload cargo
W.U. and T.O.: 2 min. at Normal Power
CRUISE BACK: at 130 knots at sea level
RESERVE: 10% of initial fuel load

◯ LOADING CONDITION COLUMN NUMBER

STANDARD AIRCRAFT CHARACTERISTICS

CH-53D

SIKORSKY


NAVAL AIR SYSTEMS COMMAND
NAVY DEPARTMENT
CODE
ARMOR PLATE
OIL
SELF-SEALING FUEL TANKS
NON-SELF-SEALING FUEL TANKS
AUX FUEL - RANGE EXTENSION
(ONE TO FIVE TANKS)
(300 GALLONS PER TANK)
PORT & STBD FUEL TANKS
CAP 318 PER TANK
OIL CAPACITY 2.9 GALS
OIL CAPACITY 2.9 GALS
0 1 2 3 4 5' 10'
SCALE
ARMAMENT AND TANKAGE
NAVAL AIR SYSTEMS COMMAND
NAVY DEPARTMENT
MAIN ROTOR DATA
DISC AREA..... 4098.135 SQ FT
BLADE AREA (TOTAL).... 374.952 SQ FT
BLADE SECTION..... NACA 0011 MOD
BLADE CHORD..... 26.0 INCH
MAIN ROTOR GEAR RATIO..... 73.55:1
13.0 FT
15.5 FT
0 1 2 3 4 5' 10'
SCALE
72.23 FT DIA
8.83 FT
67.16 FT (FUSELAGE LENGTH)
56.5 FT (PYLON & BLADES FOLDED)
88.204 FT (OVERALL LENGTH)
16.0 FT DIA
107 INCHES
17.14 FT
27.25 FT
DESCRIPTIVE ARRANGEMENT

POWER PLANT

No. and Model: (2)T64-GE-413
Manufacturer: General Electric
Engine Spec. No.: E1159(19 March 1969)
Type: Axial
Length: 78.8 inches
Diameter: 23.8 inches
Gear Ratio (Eng/Rotor) 73.55 to 1

RATINGS

S. L. STATIC	SHP	RPM	MIN.
Max.	*3925	13600	10
Military	3695	13600	30
Normal	3230	13600	Cont.

* See Note Performance Summary page for transmission ratings.

ELECTRONICS

AN/ARC-51A Radio Set (UHF)
AN/ARN-52 Tacan Navigation Set
AN/APX-64 IFF Transponder Set
AN/ARC-94 Radio Set
AN/ARN-59 ADF
AN/ARC-54 or 131 Radio Set (VHF)
AN/AIC-14 Interphone System
AN/APN-154 Radar Beacon Set
AN/APN-171 Radar Altimeter
ID-351 or 387/ARN Course Indicator
ID-663A/U or B/U or C/U Bearing Distance Heading Indicator

MISSION AND DESCRIPTION

Primarily designed as an assault transport, the helicopter is employed in the movement of cargo and equipment and in the transportation of troops. When appropriately equipped, it may be used in the recovery of downed aircraft and personnel, performing mine countermeasure missions, and towing of vehicles and ships.

The twin turbine engine helicopter uses a single main rotor and a single anti-torque tail rotor. The blades are all metal construction. Main rotor blades are equipped with Sikorsky BIM® to eliminate mandatory blade retirement. Conventional helicopter controls are provided for both pilot and copilot. The mechanical controls are augmented by two parallel and independent hydraulic servo systems. An automatic flight control system (AFCS) is also provided. Landing gear is retractable. Main rotor blades and tail pylon fold for stowage aboard an aircraft carrier. To facilitate cargo loading, the aircraft is equipped with a hydraulically operated rear ramp, two cargo winches, roller conveyors, and tie-down facilities.

DEVELOPMENT

First Flight: ---------- 27 January 1969
First Service Use: ---------- 7 March 1969
Production Status: ---------- In Production

DIMENSIONS

Main Rotor Dia.----------72'-2.8"
Length (blades & pylon folded)---------- --56'-6"
Height (blades & pylon folded)----------17'-1.7"
No. of Blades, main---------- 6
Blade Area (each)----------62.5 sq. ft.
Disc Area----------4098.1 sq. ft.
Main Wheel Tread----------13'-0"
Max. Width (Main Blades and Pylon Folded)------15'-6"

WEIGHTS

LOADING	POUNDS	L.F.
Empty (A)	23628	
Basic	23634	
Design	33500	3.0
**Design Alternate	42000	2.39
*Combat	34958	
*Take-off	36693	

(A) Actual
* For Basic Mission
** ECP 6144 Part II

FUEL AND OIL

LOCATION	NO. TANKS	GAL.
L. Sponson*	1	319
R. Sponson*	1	319
Cabin**	5	1500
	TOTAL	2138

Grade ---------- JP-4, JP-5
Specification----------MIL-J-5624D
*Bottom third self-sealing
**Aux. tanks for range extension

OIL

Nacelles ---------- 2 (tot. 5.8)
Specification----------MIL-L-23699

ACCOMMODATIONS

Crew (Normal) 3
Cargo (basic mission)---------- 8000 lb.
or
Cargo (overload mission) ---------- 12742 lb.
or
Troops---------- 38
or
Litters---------- 24

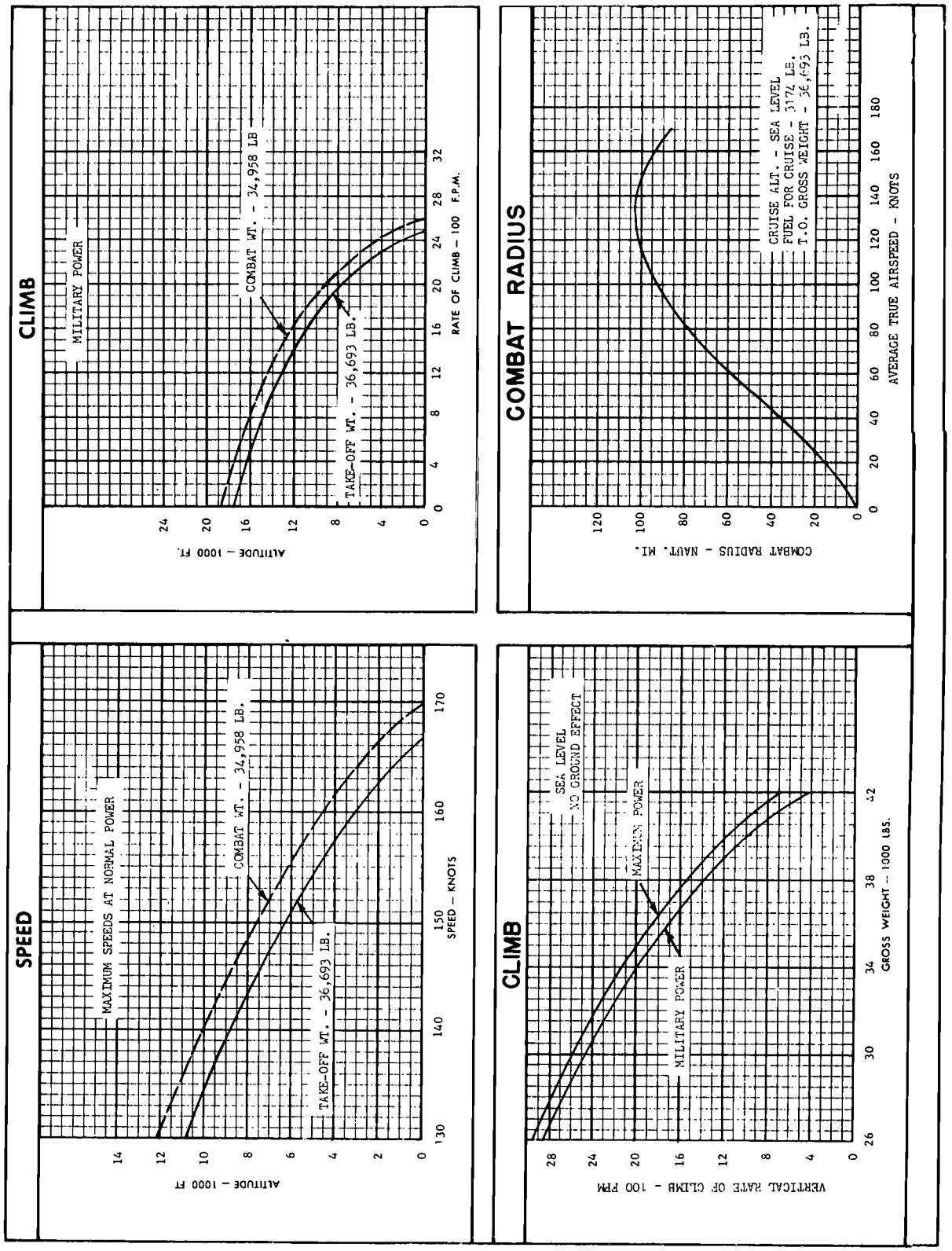
Cabin Size Clearance:
Length ---------- 30'-0"
Height ---------- 6'-6"
Width ---------- 7'-6"

PERFORMANCE SUMMARY

TAKE-OFF LOADING CONDITION		BASIC ASSAULT MISSION I	OVERLOAD ASSAULT MISSION II	COMBAT RANGE MISSION III	FERRY RANGE MISSION IV	RETRIEVAL (TROPICAL DAY)* MISSION V
TAKE-OFF WEIGHT	LB.	36693	41435	36693	41513	28693
FUEL	LB.	4338	4338	4338	14538	4338
PAYLOAD	LB.	8000/4000	12742/4000	8000/0	0/0	0/9289**
DISC LOADING	LB./SQ.FT.	8.95	10.11	8.95	10.23	7.00
VERTICAL RATE OF CLIMB AT S.L. (B/C)	FPM.	1590/1740	580/840	1590/1740	560/820	2110/2325
ABSOLUTE HOVERING CEILING (B/C)	FT.	6250/7200	1700/2900	6250/7200	1650/2850	7900/8900
MAX. RATE OF CLIMB AT S.L. (A/B)	FPM.	2180/2460	1845/2160	2180/2460	1855/2150	2320/2710
SERVICE CEILING (100 FPM.) (A)	FT.	16750	13350	16750	13300	17500
SPEED AT S.L. (A)	KN.	166	158	166	157	172
MAX. SPEED/ALTITUDE (A)	KN./FT.	166/S.L.	158/S.L.	166/S.L.	127/8000	169/3000
COMBAT RANGE	N.MI.	---	---	228	886	---
AVERAGE CRUISING SPEED	KN.	---	---	140	135	---
CRUISING ALTITUDE	FT.	---	---	0	8000	---
COMBAT RADIUS	N.MI.	100	95	---	---	106
AVERAGE CRUISING SPEED	KN.	150	150	---	---	138
Cruising altitude	FT.	0	0	---	---	3000
Total-mission time	HRS.	1.48	1.40	1.63	6.62	1.55

NOTES: (A) Normal power
(B) Military power
(C) Maximum power
* Tropical Day: 91.5°F. at 3000 ft. cruise altitude.
** Inbound payload is carried externally (Δf = 35 sq. ft.)

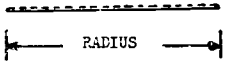
Performance Basis:
(1) ICAO Standard conditions (except Mission V), no wind, no ground effect.
(2) Calculated data based on Navy flight tests on CH-53A helicopter.
(3) Range and radius based on General Electric specification fuel consumption data using fuel grade JP-5.
(4) Fuel consumption data are increased 5% above engine specification values.
(5) Transmission ratings are 7560 HP dual engine and 3780 HP single engine operation.
(6) Aircraft red line airspeed is 170 knots IAS.
(7) Weight data based on "Actual Weight and Balance Report", SER-65575 dated 10 March 1970.
(8) Performance reference: Sikorsky Report, SER-65583, "Substantiating Data for Standard Aircraft Characteristics and Performance Charts for CH-53D Helicopter."


CLIMB
MILITARY POWER
COMBAT WT. - 34,958 LB
TAKE-OFF WT. - 36,693 LB.
ALTITUDE – 1000 FT.
RATE OF CLIMB – 100 F.P.M.
COMBAT RADIUS
CRUISE ALT. - SEA LEVEL
FUEL FOR CRUISE - 3174 LB.
T.O. GROSS WEIGHT - 36,693 LB.
COMBAT RADIUS - NAUT. MI.
AVERAGE TRUE AIRSPEED - KNOTS
SPEED
MAXIMUM SPEEDS AT NORMAL POWER
COMBAT WT. - 34,958 LB.
TAKE-OFF WT. - 36,693 LB.
ALTITUDE – 1000 FT
SPEED – KNOTS
CLIMB
SEA LEVEL
NO GROUND EFFECT
MAXIMUM POWER
MILITARY POWER
VERTICAL RATE OF CLIMB - 100 FPM
GROSS WEIGHT – 1000 LBS.

NOTES

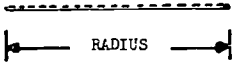
BASIC ASSAULT

Warm-Up & Take-Off: 2 min. at S.L., NRP
Cruise Out: At 150 kts. airspeed at S.L. to remote base
Hover Over Remote Base: At S.L. out of ground effect, for 10 min.
Land At Remote Base: Discharge 8000 lbs. and accept 4000 lbs. for return
Warm-Up & Take-Off: 2 min. at S.L., NRP
Cruise Back: At 150 kts. airspeed at S.L.
Reserve: 10% of initial fuel load



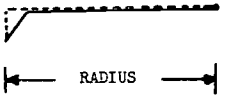
OVERLOAD ASSAULT

Warm-Up & Take-Off: 2 min. at S.L., NRP
Cruise Out: At 150 kts. airspeed at S.L. to remote base
Hover Over Remote Base: At S.L. out of ground effect for 10 min.
Land At Remote Base: Discharge 12,742 lbs. and accept 4000 lbs. for return
Warm-Up & Take-Off: 2 min. at S.L., NRP
Cruise Back: At 150 kts. airspeed at S.L.
Reserve: 10% of initial fuel load



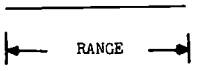
DUD RETRIEVAL (TROPICAL DAY)

Warm-Up & Take-Off: 5 min. at S.L., 90°F, NRP
Climb: On course to 3000 ft. 91.5°F with Mil power
Cruise Out: At best range speeds to remote base
Hover Over Base: Out of ground effect, at 3000 ft., 91.5°F for 10 min. Pick up external maximum payload (O.G.E. hover, $\Delta f = 35\ ft^2$)
Cruise Back: At best range speeds 3000 ft., 91.5°F
Descend: To S.L. (no fuel used, no distance gained)
Reserve: 10% of initial fuel load



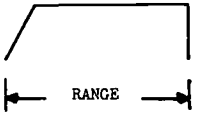
COMBAT RANGE

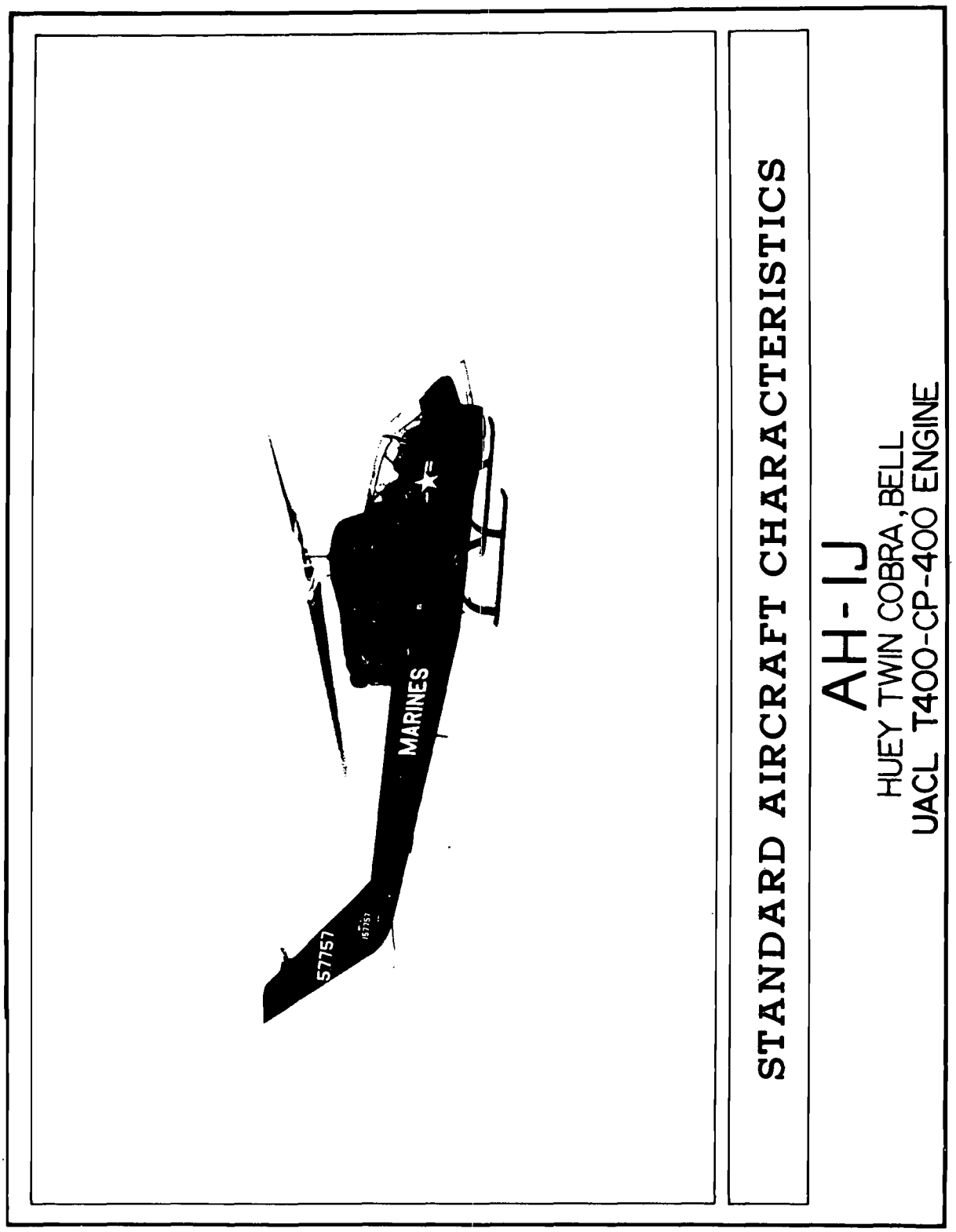
Warm-Up & Take-Off: 5 min. at S.L., NRP
Cruise Out: At S.L. at best range speeds until reserve fuel remains
Reserve: 10% of initial fuel load

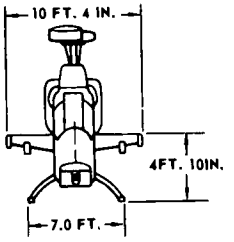


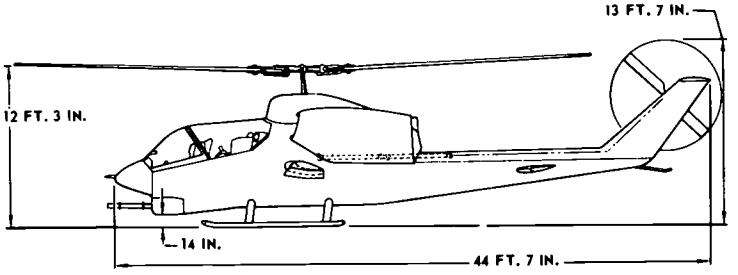
FERRY RANGE

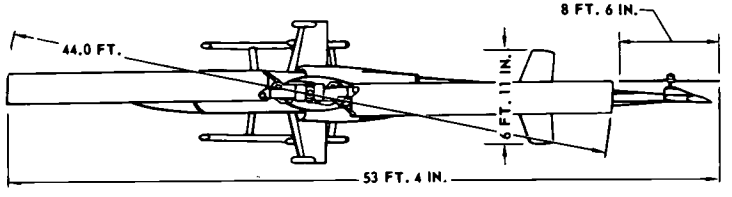
Warm-Up & Take-Off: 5 min. at S.L., NRP
Climb: On course to 8000 ft. with Mil power
Cruise Out: At best range speeds until reserve fuel remains
Descend: To S.L. (no fuel used, no distance gained)
Reserve: 10% of initial fuel load




STANDARD AIRCRAFT CHARACTERISTICS
AH-1J
HUEY TWIN COBRA, BELL
UACL T400-CP-400 ENGINE
MARINES
157757

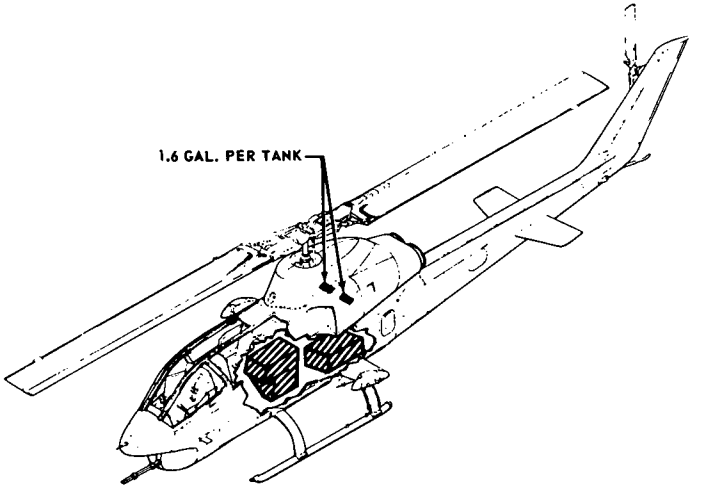




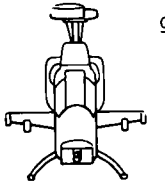


DESCRIPTIVE ARRANGEMENT

Disc Area	1520.0 Sq. Ft.	Airfoil Section Designation	9.33% Sym
Blade Area	99.0 Sq. Ft.	and Thickness	Section Special
Engine/Rotor Gear Ratio	20.4:1	Chord (Root to Tip)	27.0 In.



▨ FUEL (GAL) ■ OIL (GAL)



CONFIGURATION	ARMAMENT
CLEAN:	20MM NOSE TURRET WITH CLEAN WING
BASIC:	20MM NOSE TURRET TWO UNFAIRED LAU 68 ROCKET PODS OUTBOARD
MEDIUM:	20MM NOSE TURRET TWO UNFAIRED LAU 68 ROCKET PODS OUTBOARD TWO SUU-11A MINIGUN PODS INBOARD
HEAVY:	20MM NOSE TURRET TWO UNFAIRED LAU-61A ROCKET PODS OUTBOARD TWO UNFAIRED LAU-61A ROCKET PODS INBOARD

ARMAMENT AND TANKAGE

POWER PLANT

No. & Model .....(1) T400-CP-400
Manufacturer.....United Aircraft of Canada (Pratt and Whitney)
Engine Spec. No.....7120
Type.....Twin Section Free Power Turbine with Reduction Gearbox
Gear Reduction Ratios
Main Rotor.....20.383:1
Tail Rotor.....3.974:1

RATINGS

	SHP	RPM	ALT
Intermediate	1800*	6600	SL
Maximum Continuous	1530**	6600	SL
Single Power Section			
Intermediate	900	6600	SL
Maximum Continuous	765	6600	SL

Transmission Limits
*1290 SHP
**1134 SHP

ELECTRONICS

UHF Command Set.....AN/ARC-51AX
FM Tactical Set.....AN/ARC-131
Intercom.....AN/AIC-18
TACAN Nav Sys.....AN/ARN-52(V)
UHF Direction Finder.....AN/ARA-50
Gyrosyn Compass.....AN/ASN-75
Direction Finder Set.....AN/ARN-83
Radar Altimeter.....AN/APN-171(V)
IFF Transponder Set.....AN/APX-72
Radar Beacon.....AN/APN-154(V)
Two Juliet 28 Controls.....C-8057
Two Mounts.....Barry Controls 21078-1

PROVISIONS FOR

Two Voice Security Units.....Juliet 28
Transponder Test Set.....TS-1843( )/APX
Mounting.....MT-3513/APX
Computer, MK XII.....KIT-1A/TSEC
Mounting.....MT-( )/U

MISSION AND DESCRIPTION

The primary mission of this aircraft is that of an armed tactical helicopter capable of delivering weapons fire, low-altitude high-speed flight, search and target acquisition, reconnaissance by fire, multiple weapons fire support, and troop helicopter support. The aircraft is capable of performing this mission from prepared or unprepared areas and operation from ships at sea.

The gas turbine powered Huey Twin Cobra is of compact design, featuring tandem seating to give both pilot and gunner nearly unlimited visibility. Both crew stations have flight control and fire control systems permitting flexibility in division of functions under all normal and emergency situations.

The twin engine installation improves both hot day and altitude performance and enhances overall reliability. A mission designed fuselage coupled with 540 "door hinge" rotor system gives a low vibration level plus increased maneuverability and speed. Four wing stores stations and integral chin turret provide a high degree of armament versatility with the capability of quickly changing a wide combination of weapons to match the desired mission. Many UH-1 parts which have been combat proven assure reliability and maintainability.

DEVELOPMENT

Contract Placement	May 29, 1965
First Flight AH-1J	November 1969
BIS	November 1970
First Delivery	January 1971
Final Delivery	In Production

DIMENSIONS

Rotor diameter.....44.0 ft
Length
  Rotors operating.....53.3 ft
  Rotors static.....53.3 ft
  Fuselage.....44.6 ft
Span (max lateral).....10.3 ft
Height.....13.6 ft
Tread..... 7.0 ft
Rotor ground clearance
  (static against stops)..... 7.9 ft

WEIGHTS

Loading	Lb	LF
Empty	6503	
Basic	6702	
Design	6600	3.5
Combat		
Clean	8202	2.8
Basic	9272	2.5
Medium	9534	2.4
Heavy	9821	2.4
Maximum Takeoff	10000	2.3
Maximum Landing	10000	

FUEL AND OIL

FUEL

Location	No. Tanks	Gals.
Fuselage	2	270
Grade		JP-4 JP-5
Specification		MIL-J-5624

OIL

Engine	2	3.2
Specification		MIL-L-7808

ORDNANCE

20MM CHIN TURRET
WING STORES PYLONS (FOUR)

Any combination of the following
(1) LAU-68 rocket launcher (or equivalent)
(2) LAU-61A rocket launcher (or equivalent)
Outboard wing station only:
(3) Smoke grenade dispenser
Inboard wing station only:
(4) SUU-11A minigun pod
Maximum ammunition capacity for the 20 mm chin turret is 750 rounds.

ACCOMMODATIONS

Basic, Medium, or Heavy combat
  Pilot.....1
  Gunner.....1
Clean Mission
  Pilot.....1
  Copilot.....1

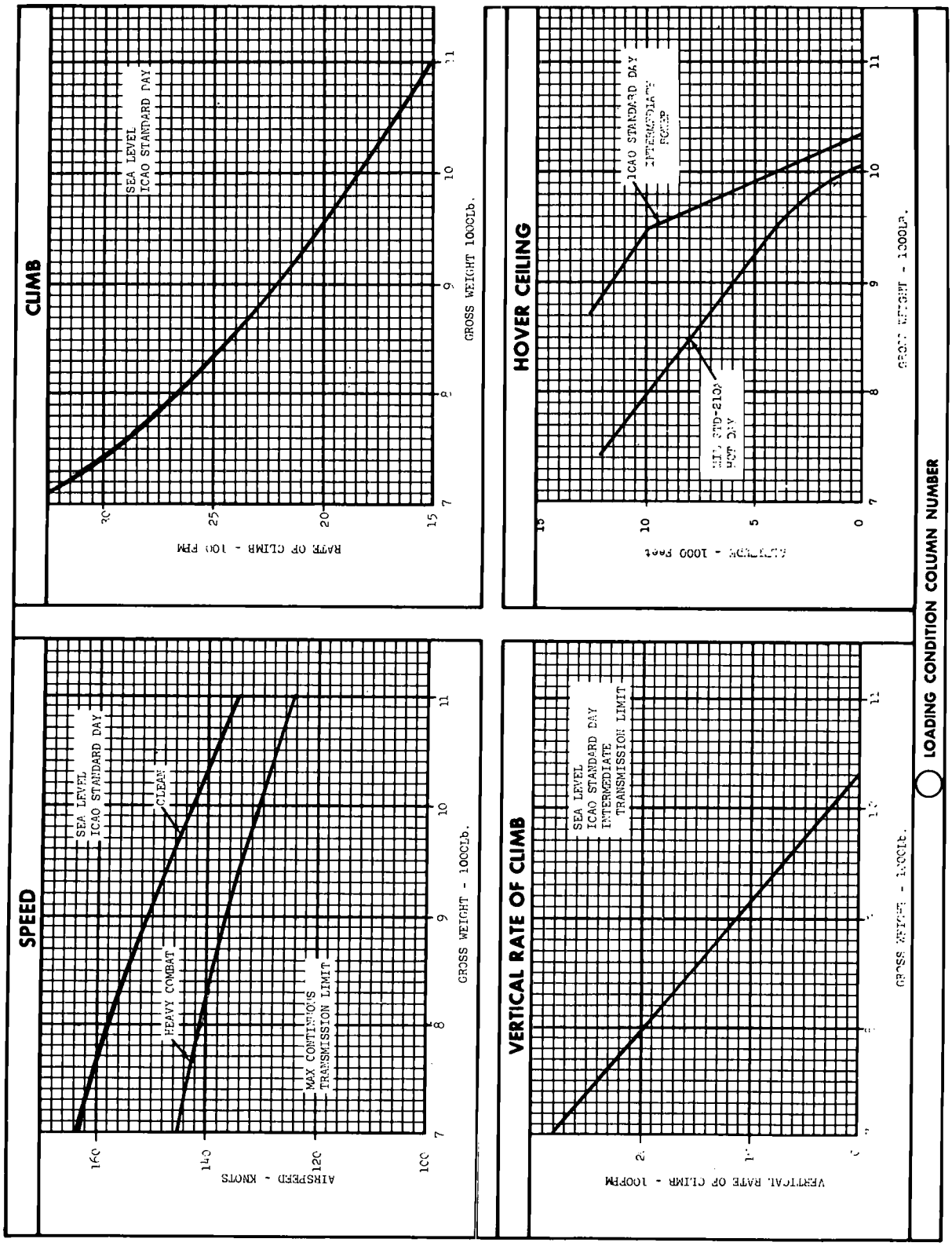
PERFORMANCE SUMMARY

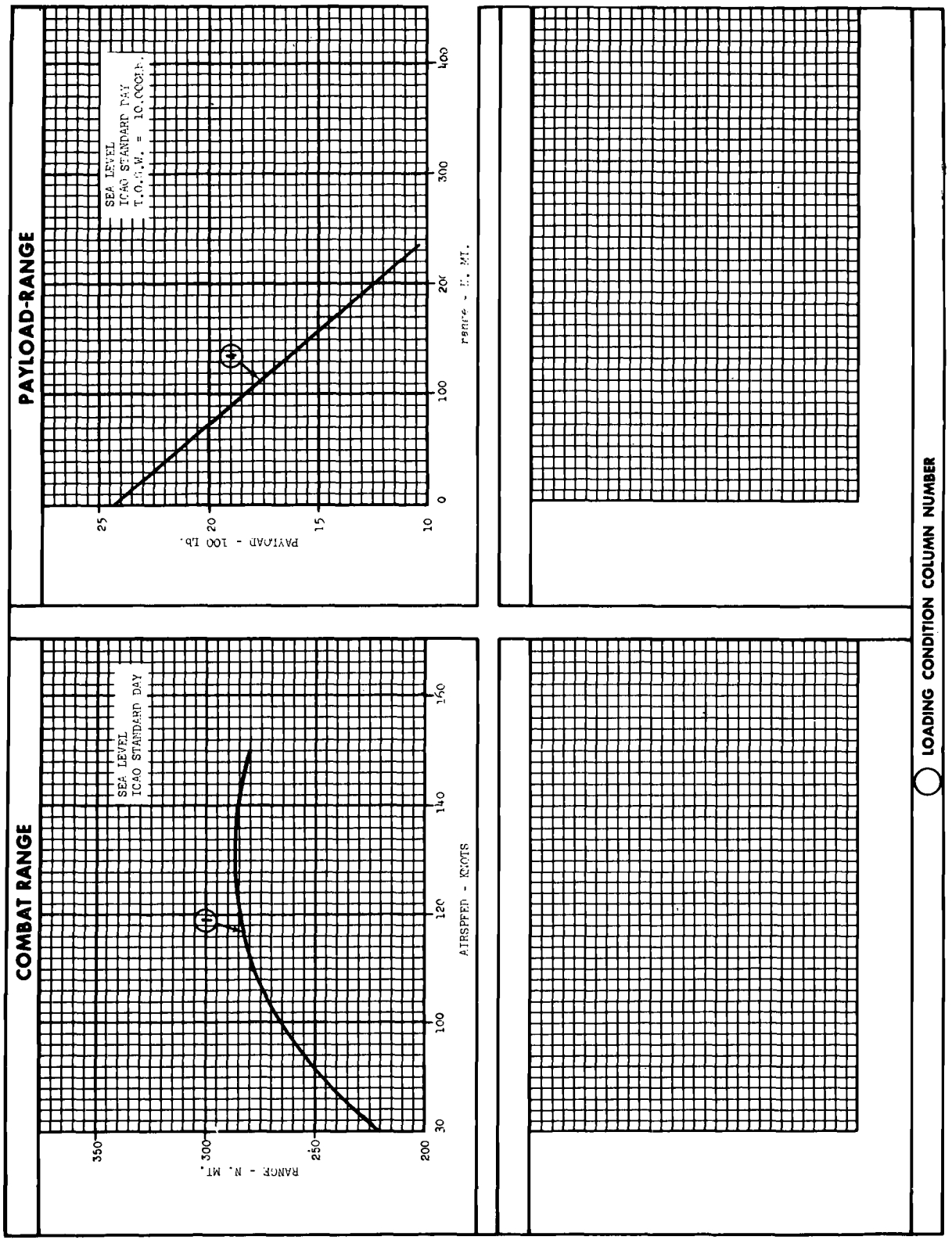
TAKE-OFF LOADING CONDITION		① CLEAN	② BASIC COMBAT	③ MEDIUM COMBAT	④ HEAVY COMBAT		
TAKE-OFF WEIGHT	lb.	8976	10000	10000	10000		
Fuel internal (JP-5)	lb.	1836	1819	1164	446		
Payload (A)	lb.	0	1041	1696	2414		
Disc loading	lb./sq.ft.	5.90	6.58	6.58	6.58		
Vertical rate of climb at S.L. (B)	fpm.	1160	285	285	285		
Absolute Hover Ceiling	ft.	10,000 (D)	4200	4200	4200		
Max. rate of climb at S.L. (B)	fpm.	2230	1820	1814	1776		
Service Ceiling	ft.	10000 (D)	10000 (D)	10000 (D)	10000 (D)		
Speed at S.L. (C)	kn.	151	141	139	131		
Max. speed/altitude (C)	kn./ft.	153/3000	142/2000	140/2000	133/2000		
O.E.I. Service ceiling	ft.	10000 (D)	10000 (D)	10000 (D)	10000 (D)		
Min. Speed (O.E.I.)	kn.	30	35	35	35		
Max. Speed (O.E.I.)	kn.	128	116	115	108		
Combat radius	n.mi.	-	134	72	7		
Mission time (E)	hrs.	-	1.87	1.08	.10		
Average cruising speed	kn.	-	150	142	132		
Cruising altitude	ft.	-	SL	SL	SL		
Range	n.mi.	288	257	134	2		
Average cruising speed	kn.	134	132	131	120		
Cruising altitude	ft.	SL	SL	SL	SL		
Max. endurance	hrs.	2.8	2.55	1.32	.02		
Endurance speed	kn.	71	71	70	69		
Endurance altitude	ft.	SL	SL	SL	SL		

NOTES

(A) Includes Ammo
(B) Take-off Transmission rating of 1290 HP
(C) Maximum Continuous Transmission rating of 1134 HP
(D) Limited by oxygen requirement
(E) Mission Time - Time in air (excludes time before start of enroute climb and reserve, unless otherwise specified and noted.)

Performance Basis:
(1) All performance at Standerd day conditions.
(2) Aerodynamic flight test data.
(3) Engine specification fuel consumption increased 5%
(4) 20 MM nose turret on all configurations.


CLIMB
SEA LEVEL
ICAO STANDARD DAY
RATE OF CLIMB - 100 FPM
GROSS WEIGHT 1000LB.
HOVER CEILING
ICAO STANDARD DAY
GROSS WEIGHT - 1000LB.
SPEED
SEA LEVEL
ICAO STANDARD DAY
CLEAN
HEAVY COMBAT
MAX CONTINUOUS
TRANSMISSION LIMIT
AIRSPEED - KNOTS
GROSS WEIGHT - 1000LB.
VERTICAL RATE OF CLIMB
SEA LEVEL
ICAO STANDARD DAY
INTERMEDIATE
TRANSMISSION LIMIT
VERTICAL RATE OF CLIMB - 100FPM
LOADING CONDITION COLUMN NUMBER

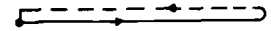

PAYLOAD-RANGE
SEA LEVEL
ICAO STANDARD DAY
PAYLOAD - 100 LB.
RANGE - N. MI.
COMBAT RANGE
SEA LEVEL
ICAO STANDARD DAY
RANGE - N. MI.
AIRSPEED - KNOTS
LOADING CONDITION COLUMN NUMBER

NOTES

RANGE MISSION

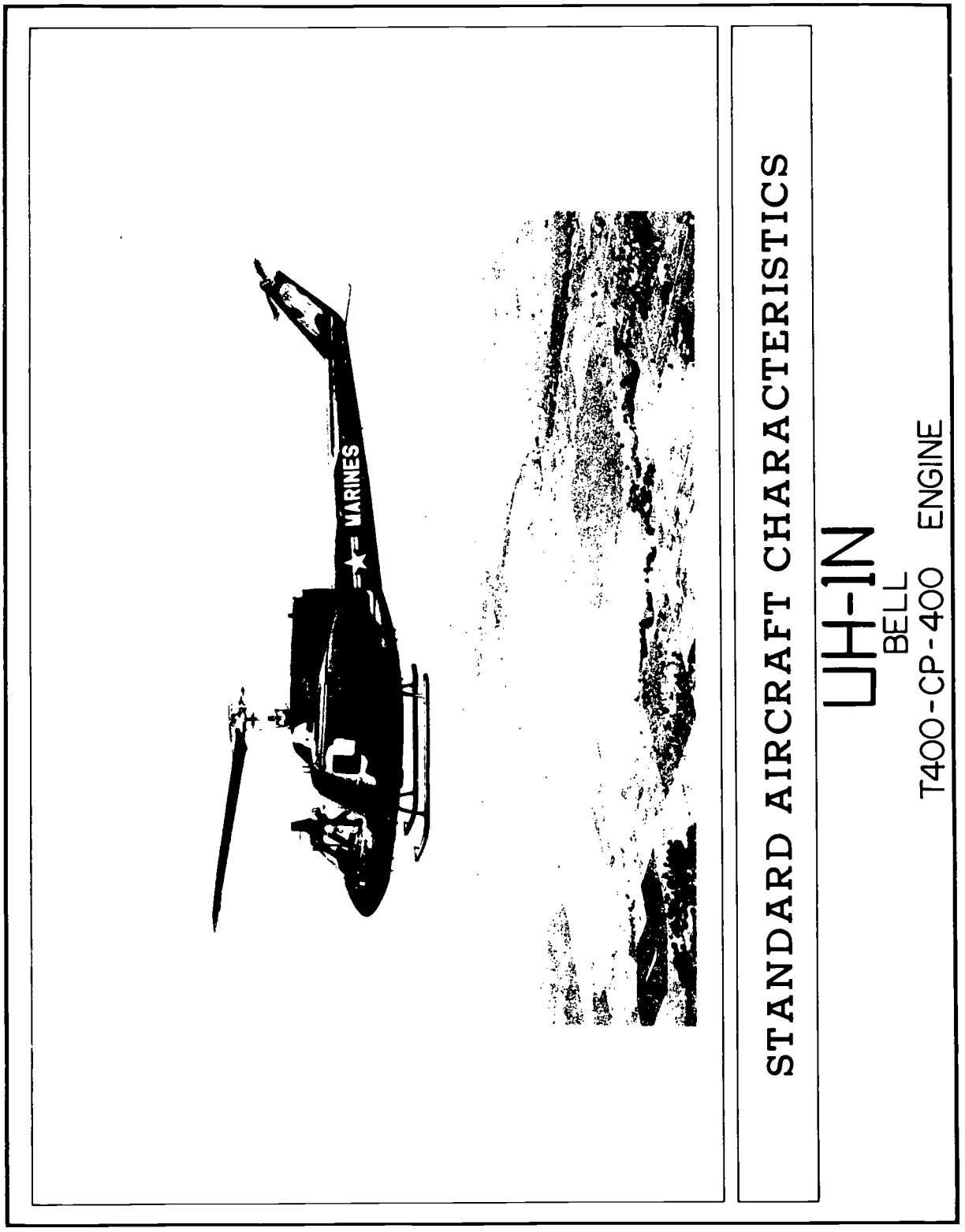
1. Warm-up and take-off: Fuel allowance of 5 minutes at maximum continuous power at sea level.
2. Cruise out: To remote base at speed for maximum range at sea level.
3. Landing reserve: Fuel for 30 minutes at speed for maximum range at sea level.

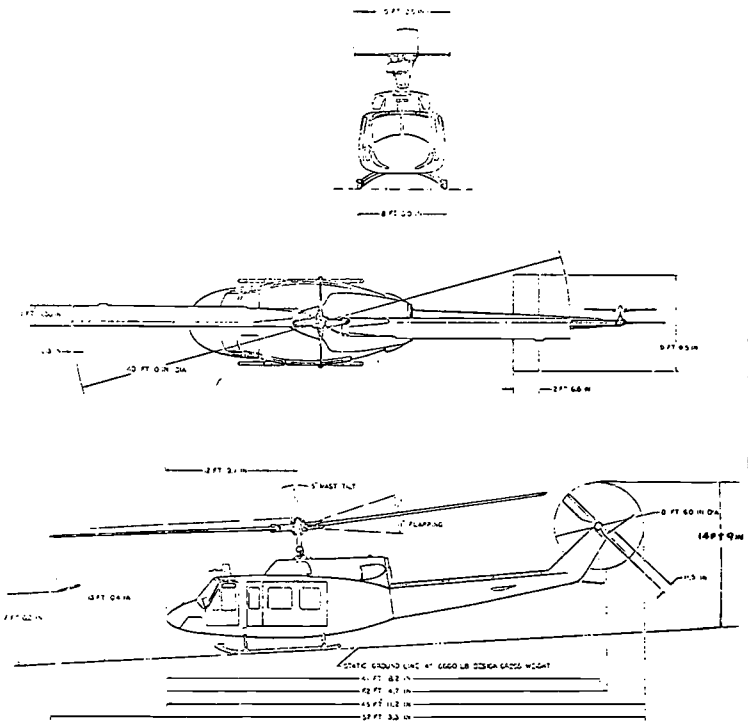
ATTACK MISSION



1. Warm-up and take-off: Fuel allowance of 5 minutes at maximum continuous power at sea level.
2. Dash out: To target at maximum continuous power at sea level.
3. Combat: 5 minutes at intermediate power at sea level at Vmax.
4. Expended all ordnance.
5. Dash back: To home base at maximum continuous power at sea level.
6. Landing reserve: Fuel for 20 minutes at speed for maximum range at sea level.

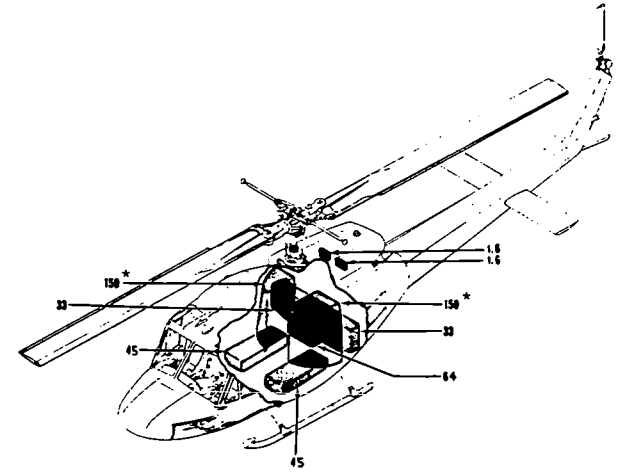
◯ LOADING CONDITION COLUMN NUMBER


MARINES
STANDARD AIRCRAFT CHARACTERISTICS
UH-1N
BELL
T400-CP-400 ENGINE



DESCRIPTIVE ARRANGEMENT

Disc Area	1809.0 sq ft	Airfoil Section (Root to 80%)
Blade Area	93.5 sq ft	10.8% thick (80% to Tip) Tapers
Engine/Rotor Gear Ratio	20.38:1	to 5.4% thick at tip. modified
		droop snoot.
		Chord (Root to Tip)= 23 3/8 in



FUEL (GAL) *Auxiliary fuel tanks OIL (GAL)

ARMAMENT AND TANKAGE

POWER PLANT

No. & Model.....(1) T400-CP-400
Manufacturer.....United Aircraft of Canada (Pratt and Whitney)
Engine Spec. No.....712 C
Type.....Twin Section Free Power Turbine with Reduction Gearbox
Gear Reduction Ratios
Main Rotor.....20.383:1
Tail Rotor.....3.974:1

RATINGS

	SHP	RPM	ALT
Intermediate	1800*	6600	SL
Maximum Continuous	1530**	6600	SL
Single Power Section			
Intermediate	900	6600	SL
Maximum Continuous	765	6600	SL

Transmission Limits
*1290 SHP
**1134 SHP

ELECTRONICS

VHF-FM Radio Set	AN/ARC-114
Altimeter Encoder	AAU-21/A
UHF-AM Radio Set	AN/ARC-116
Communication Sys	C-6533/ARC
Gyromag Compass Set	AN/ASN-43( )
UHF Dir Find Sys	AN/ARA-50
TACAN Navigation Set	AN/ARN-105
Transponder Set	AN/APX-72
HF Radio Set	AN/ARC-102
Auto Direc Finder	AN/ARN-89
Radar Altimeter	AN/APN-171(V)
Transponder Test Set	TS-1843A/APX

PROVISIONS FOR

Loudspeaker System Kit	
Commun Security Set	TSEC/KY-28
VHF-AM Radio Set	AN/ARC-115
Mark XII Computer	KIT-1A/TSEC

MISSION AND DESCRIPTION

The basic missions of the UH-1N are visual observation and target acquisition, reconnaisance and command control. The UH-1N is capable of flight from established airfields, carriers of the LPH and CVS class, advanced bases, areas or ships with individual landing platforms or limited landing facilities, and from unprepared fields. It may be handled on carrier elevators without any folding of components.

In addition, the UH-1N may be used for medical evacuation, to transport personnel, special teams or crews, equipment and supplies. These missions may be performed under instrument operations including light icing and day or night flight.

The twin power section installation improves both hot day and altitude performance.

The semi-monocoque fuselage is of all metal construction as are the tail rotor blades and the two main rotor blades. The large sliding door along each side allows rapid entry and exit and simplified straight-through loading from either side or both sides simultaneously. The knee-high cargo floor also contributes to loading ease.

DEVELOPMENT

Contract Placement	September 1969
First Flight (Comm. 212)	April 1969
(USAF UH-1N)	March 1970
(USN UH-1N)	January 1971
First Delivery	March 1971
Final Delivery	In Production

DIMENSIONS

Rotor Diameter	48.0'
Length	
Rotors Operating	57.3'
Rotors Static	57.3'
Fuselage	42.4'
Span (Max Lateral)	3.2'
Height	14.9'
Tread	8.5'
Ground Clearance (Static, Against Stops)	7.0'

WEIGHTS

Loading	Weight	L.F.
*Empty	6032	
Basic	6277	
Operating	7101	
Design	6600	3.0
Combat	7968	2.5
Overload	10,500	1.9
Maximum Takeoff	10,500	1.9
Maximum Landing	10,500	1.9

*UH-1N (Navy) is 91 lbs. Heavier

FUEL AND OIL

FUEL

Gal.	No. of Tanks	Locations
220.0*	5	Fuselage
300.0	2	Fuselage

Fuel Grade.....JP-4/JP-5
Fuel Spec.....MIL-J-5624
* Estimated with Foam.

OIL

Engine (Gal.).....3.2
Spec.....MIL-L-7808

ORDNANCE

ACCOMMODATIONS

Crew (Observation).....4
Cabin Size Clearance:
Length (Overall) 7.8'
Width (Maximum) 7.7'
Height (Maximum) 4.1'
Usable Volume
Cargo Area 220 Cu-ft
Copilot Area 20 Cu-ft
Provision for Troop Seats.....8
Provision for Litters.....6
Cargo Hook Capacity.....5,000lb.
Limit Floor Loading.....100lb/sq.ft. at L.F. 3.5

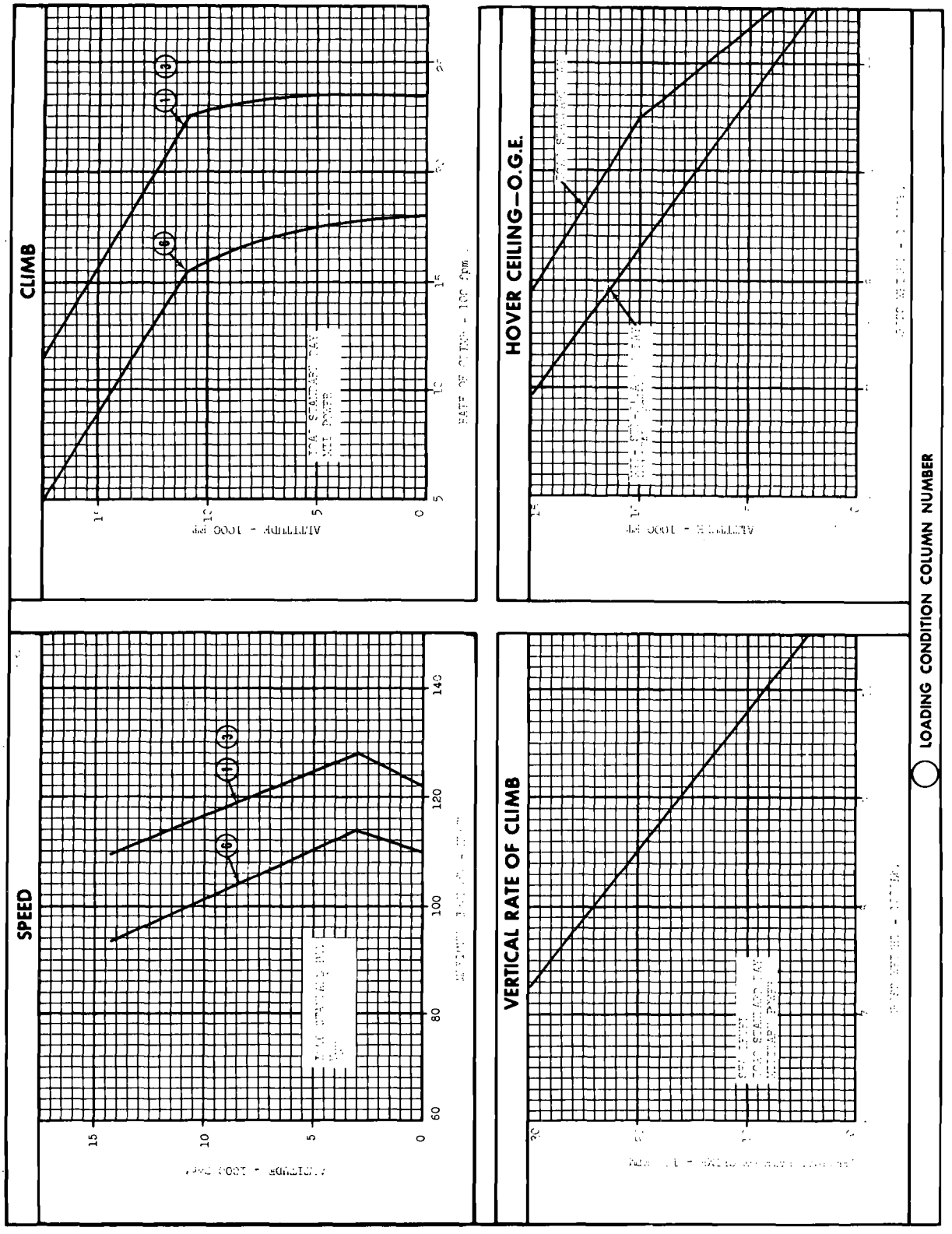
PERFORMANCE SUMMARY

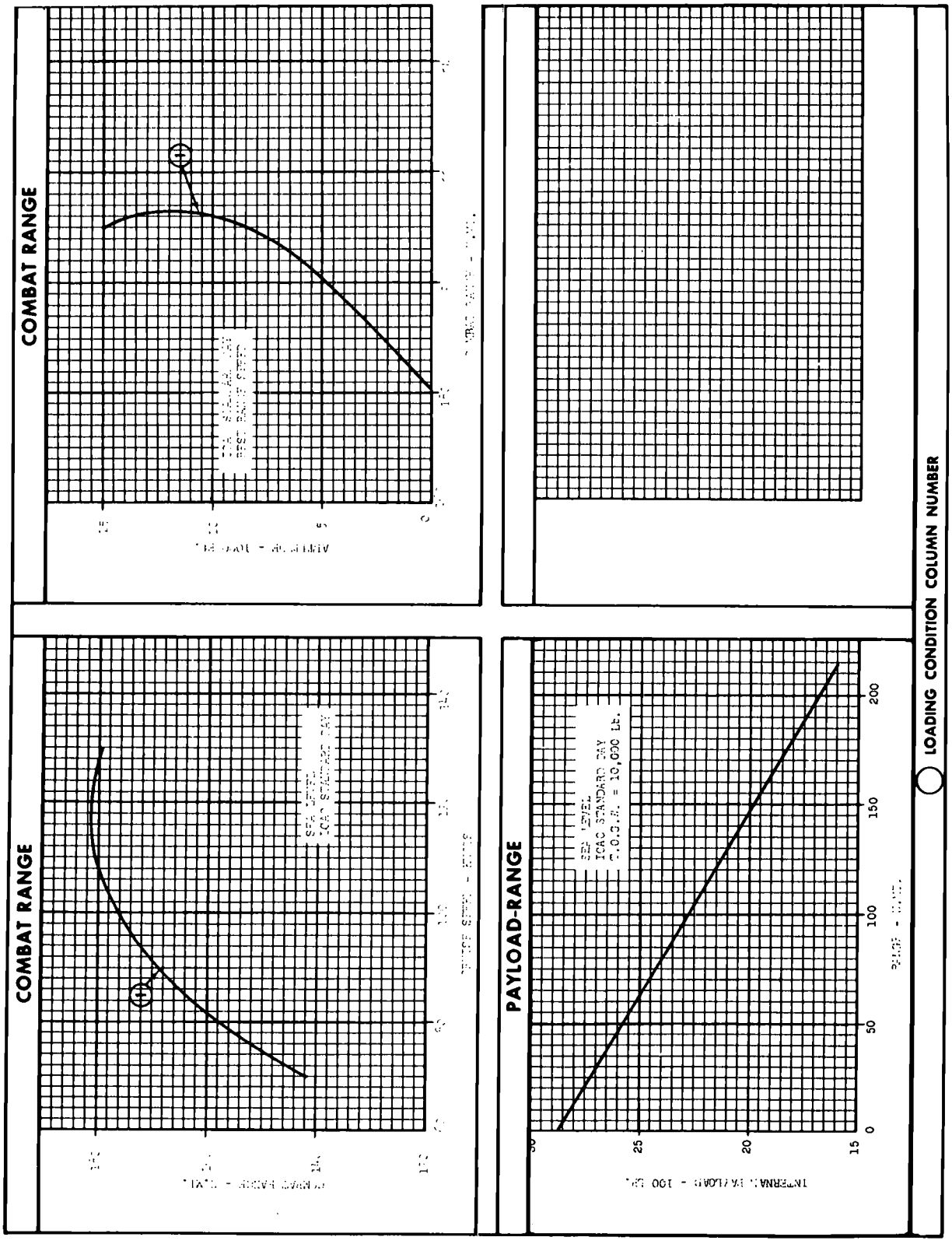
TAKE-OFF LOADING CONDITION	① OBSERVATION	② RESCUE	③ MEDICAL EVACUATION	④ TROOP TRANSPORT	⑤ EXTERNAL TRANSPORT	⑥ FERRY
TAKE-OFF WEIGHT lb.	8546	8704	8586	9946	10,500	10,000
Fuel internal/external (JP-5) lb./lb.	1445/0	1445/0	1445/0	1445/0	799/0	3186/0
Payload Outbound/Inbound lb/ lb.	0/0	200/0	0/ 1200	1800/0	3000/0	0/0
Disc loading lb./sq.ft.	4.72	4.81	4.74	5.50	5.80	5.52
Vertical rate of climb at S.L. (A) fpm.	2010	1880	1970	900	460	880
Absolute hovering ceiling (OGE) ft.	13,000 (B)	12,500 (B)	12900 (B)	7800 (A)	4000 (A)	7400 (A)
Max. rate of climb at S.L. (A) fpm.	2310	2260	2300	1830	1660	1810
Service ceiling (C) ft.	21,600	21100	21400	17800	16500	17700
Speed at S.L. (D) kn.	122	120	121	111	110	110
Max. speed/altitude (D) kn./ft.	128/3000	126/3000	127/3000	115/3000	115/3000	115/3000
O.E.I. Service ceiling (B) ft.	14450	14000	14400	10600	9100	10400
Min. speed (O.E.I.) kn.	11	15	11	29	34	30
Max. Speed (O.E.I.) kn.	120	119	120	111 (D)	110 (D)	110 (D)
Combat radius n.mi.	96	87	105	97	31	----
Mission time (E) hrs.	1.58	1.68	1.77	1.59	.69	----
Average cruising speed kn.	128	125	122	122	105	----
Cruising altitude ft.	SL	SL	5000	SL	SL	----
Range n.mi.	181	--	--	--	46	565
Average cruising speed kn.	128	--	--	--	80	117
Cruising altitude ft.	SL	--	--	--	SL	8000
Maximum endurance hrs.	2.02	--	--	--	--	----
Endurance speed kn.	67	--	--	--	--	----
Endurance altitude ft.	SL	--	--	--	--	----

NOTES

(A) Take-off Transmission Rating of 1290 HP
(B) Military Rated Power
(C) Maximum Continuous Power
(D) Vne
(E) Mission Time - Time in air (excludes time before start of enroute climb and reserve, unless otherwise specified and noted).

Performance Basis:
(1) All performance at standard day conditions.
(2) Aerodynamic flight test data.
(3) Engine specification fuel consumption increased 5%

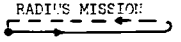

CLIMB
HOVER CEILING—O.G.E.
SPEED
VERTICAL RATE OF CLIMB
LOADING CONDITION COLUMN NUMBER


COMBAT RANGE
COMBAT RANGE
PAYLOAD-RANGE
SEA LEVEL
ICAO STANDARD DAY
G.O.S.H. = 10,000 LB.
0
50
100
150
200
15
20
25
LOADING CONDITION COLUMN NUMBER

NOTES

(1) OBSERVATION

RADIUS MISSION



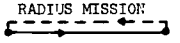
1. Warm-up and take-off: Fuel allowance of 5 minutes at maximum continuous power at sea level.
2. Cruise out: At speed for best range at sea level.
3. Hover: 5 minutes out of ground effect at mid-mission.
4. Cruise back: To home base at speed for best range at sea level.
5. Landing Reserve: Fuel for 20 minutes at speed for maximum range at speed at sea level.

RANGE MISSION

1. Warm-up and take-off: Fuel allowance of 5 minutes at maximum continuous power at sea level.
2. Cruise out: To remote base speed for maximum range at sea level.
3. Landing Reserve: Fuel for 30 minutes at speed for maximum range at sea level.

(2) RESCUE

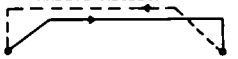
RADIUS MISSION



1. Warm-up and take-off: Fuel allowance of 5 minutes at maximum continuous power at sea level.
2. Dash out: To target at maximum cruise speed for maximum continuous power at sea level.
3. Search: Over target at speed for best endurance for 15 minutes at sea level.
4. Pick up survivor: Hover out of ground effect 2 minutes at sea level.
5. Cruise back: To base at speed for maximum range at sea level.
6. Landing reserve: Fuel for 20 minutes at speed for maximum range at sea level.

(3) MEDICAL EVACUATION

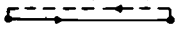
RADIUS MISSION



1. Warm-up and take-off: Fuel allowance 5 minutes at maximum continuous power.
2. Climb out: On course at speed for best climb at intermediate power to 5000 feet.
3. Cruise out: To remote base at 5000 feet at maximum continous power.
4. Descend to sea level: No fuel used, no distance gained.
5. Land pick up six (6) litter patients: Mid-point fuel allowance of 2 minutes at maximum continuous power at sea level.
6. Climb back: On course at best climb speed at maximum continuous power to 5000 feet.
7. Cruise back: To home base at 5000 feet at maximum continuous power.
8. Descend to sea level: No fuel used, no distance gained.
9. Landing reserve: Fuel for 20 minutes at speed for maximum range at sea level.

(4) TROOP TRANSPORT

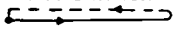
RADIUS MISSION



1. Warm-up and take-off: Fuel allowance of 5 minutes at maximum continuous power at sea level.
2. Cruise out: To remote base at maximum continuous power at sea level.
3. Land and unload troops: Mid-point fuel allowance of 2 minutes at maximum continuous power at sea level.
4. Cruise back: To home base at maximum continuous power at sea level
5. Landing reserve: Fuel for 20 minutes at speed for maximum range at sea level.

(5) EXTERNAL TRANSPORT

RADIUS MISSION



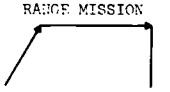
1. Warm-up and take-off: Fuel allowance of 5 minutes at maximum continuous power at sea level.
2. Cruise out: To remote base with payload at 80 knots at sea level.
3. Hover: 5 minutes out of ground effect at sea level with payload.
4. Release payload
5. Cruise back: To home base without payload at speed for best range at sea level.
6. Landing Reserve: Fuel for 20 minutes at speed for maximum range at sea level.

RANGE MISSION

1. Warm-up and take-off: Fuel allowance of 5 minutes at maximum continuous power at sea level.
2. Cruise out: To remote base with payload at 80 knots at sea level.
3. Landing Reserve: Fuel for 30 minutes at speed for maximum range at sea level.

(6) FERRY

RANGE MISSION



1. Warm-up and take-off: Fuel allowance of 5 minutes at maximum continuous power at sea level.
2. Climb out: On course at best climb speed at intermediate power to optimum cruise altitude not to exceed 10,000 feet (unless limited by cruise ceiling).
3. Cruise out: To remote base at speed for maximum range at optimum cruise altitude not to exceed 10,000 feet (unless limited by cruise ceiling).
4. Descend to sea level: No fuel used, no distance gained.
5. Landing reserve: Fuel for 30 minutes at speed for maximum range at sea level.

◯ LOADING CONDITION COLUMN NUMBER

INDEX

☆ U.S. GOVERNMENT PRINTING OFFICE: 1979 O—245–335

The device reproduced on the back cover is the oldest military insignia in continuous use in the United States. It first appeared, as shown here, on Marine Corps buttons adopted in 1804. With the stars changed to five points, this device has continued on Marine Corps buttons to the present day.