"Marine GCI": Past, Present And Future
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OUTLINE

Thesis statement: This paper will trace the historical development of the equipment and mission of the Marine Air Control Squadron (MACS), commonly known among United States Fighter and Interceptor aircrews as simply "Marine GCI".

I. The Humble Beginning
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      1. Organization and Equipment
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EXECUTIVE SUMMARY

TITLE: "MARINE GCI": PAST, PRESENT AND FUTURE

I. Purpose: To trace the historical development of the equipment and mission of the Marine Air Control Squadron (MACS), commonly known among United States Fighter and Interceptor aircrews as simply "Marine GCI".

II. Problem: Despite the importance placed on the air war in the modern era, few people realize that the key ingredients in air warfare, and air defense in general, are radar detection and fighter control.

III. Data: Today's Marine Air Control Squadron can trace its roots back to the Air Warning Squadrons of World War II. First formed in 1943, these squadrons were created to fill a critical need for early-warning and intercept direction for both day and night fighters. In the 40 years since, the MACS has undergone major evolutionary, and in some cases revolutionary, changes in mission and equipment. It now employs sophisticated radars and a major computer-based digital data exchange capability with both U.S. and Allied nations. MACS squadrons have participated in every major conflict which has involved the United States. The MACS will continue to evolve to meet the ever-changing threat, and to be able to respond quickly and appropriately.

IV. Conclusion: The Marine Air Control Squadron continues to make a vital contribution to the successful accomplishment of the mission of Marine aviation.

V. Recommendation: That when discussing Marine aviation, care be taken to further emphasize the role of the Marine Air Control Squadron in the prosecution of the air war.

"MARINE GCI": PAST, PRESENT AND FUTURE

Great men of all time are remembered in rhyme;
Brave men, stand immortal in stone.
We never forget the valiant who met
Danger's challenge and faced it, alone.
The pilots who soar with thundering roar
Are saluted in musical lines.
But there's one motley crew, a forgotten few,
On whom glory's light seldom shines.
They spend their long nights in figuring drifts,
Settings and headings and mach.
They wait for their bird to give them the word,
And pray that he doesn't break lock.
Their problems magnetic often give them a headache,
They slowly go blind watching squawks.
Their nightmarish sleeps run in twelve-second sweeps,
And they worship a black little box.
He runs the whole show, tells the birds where to go,
Selects headings and type of attack,
Watches for strangers and imminent dangers,
Guards their safety, and then brings them back.
A pilot's up there, somewhere in the air,
Pressure's dropping; he's out of the race.
The Controller's on call to get on the ball
And give him a steer for the base.
He'll moan and he'll groan, he'll cry into the phone
Until contact is made with his chicks.
But there's one lonesome call that he dreads most of all:
"Where are they? Get me a fix!"
When nothing is flying, he'll stand around lying,
Telling tall tales of his skill
At nighttime tomcatting, and daytime combatting
And how he moved in for the kill.
When the mission's all through, and the bleary-eyed crew
Adjourns to the Club for a snack,
The pilots come in and they say with a grin:
"Good show! We came right down the track."

This flying's a game that brings pilots great fame,
But just half the team flies, as a rule.
The other half is found away down on the ground --
The Controllers -- a good one's a jewel.

The preceding jingle, of unknown origin, has been around for many years; it attempts, in a lyrical sense, to explain the role of the air defense controller. However, to the uninformed, it will raise more questions than it answers. What does a controller do; how and where does he do it? This paper will trace the historical development of the equipment and mission of the Marine Air Control Squadron (MACS), commonly known among United States Fighter and Interceptor aircrews as simply "Marine GCI".

THE HUMBLE BEGINNING

Today's Marine Air Control Squadron can trace its roots back to the Air Warning Squadrons of World War II. First formed in 1943, these squadrons were created to fill a critical need for early-warning and intercept direction for both day and night fighters. They were an outgrowth of the ground controlled intercept (GCI) section of the Marine

Night Fighter Squadron (VMF(N)), the first recorded use of radar in the Marine Corps.

The original Marine Corps plan called for the activation of 32 Air Warning Squadrons for the Pacific theatre. (13:MACS) However, in actual fact only about half that number were formed, and only 11 squadrons saw duty in the Pacific. (10:442)

These AWSs were equipped with various types of ground-to-ground and ground-to-air radios and a mixed suite of long, medium and short range radars: two SCR-270 long range search radars, one SCR-527 medium range control radar, and usually three SCR-6O2 early-warning short range radars. (An interesting aside about the SCR-527 radar -- when the Marine Corps took delivery of its second SCR-527 from the General Electric Company in Syracuse, New York, the radar was considered obsolete by the Royal Air Force, which had already been using it. (10:162)) The coordination of the various inputs received by the radar operators from these different radar sets, sometimes spaced more than 50 miles apart, was accomplished at the Air Defense Control Center (ADCC), located at the squadron headquarters. The various ADCCs would in turn forward tracking information to the overall area Air Defense Coordinator.

The initial mission of the Air Warning Squadron was to "furnish early-warning information on approaching air and sea attack and to provide fighter direction against this attack." (13:MACS) This mission was modified a short time later to read:

> Warn of approach of enemy aircraft, to control interceptions by friendly planes and to receive, evaluate, collate and disseminate all information on air and surface craft furnished by an Air Defense Control Center. (13:MACS)

Following a six month period of intensive training, the first of the Marine Air Warning Squadrons was ready for combat. On 20 February, 1944, Air Warning Squadron One (AWS-1), under the command of Captain W. D. Felders, arrived on Engebi Island in the Marshall Islands and on 1 March assumed responsibility for the control of all friendly aircraft in the area. (10:233) Marine Air Warning Squadrons took part in all of the major campaigns throughout the remainder of the war in the Pacific. This effort reached its zenith during the battle for Okinawa, when five Air Warning Squadrons (AWSs 1, 6, 7, 8 and 11) were used to completely encompass the island within its air warning/defensive umbrella. An interesting point concerning AWS-7 -- "on 19 August, 1945, Pineapple Base [AWS-7's operational callsign] was the first [Radar] station to pick up the Japanese peace envoy's aircraft on its way to Ie Shima." (13:MACS)

Following the end of hostilities in the Pacific, in October, 1945, two Marine Air Warning Squadrons (AWS-7 and 11) deployed to Peiping, China with Marine Air Group 24 in support of the Nationalist Chinese in their civil war with the Communist Forces. Air Warning Squadron Seven remained in China until January, 1949.

During that time, many changes were underway concerning

the future and structure of Marine Aviation. As is commonly the case following wars, force structure cuts were in the offing; numerous AWSs were decommissioned, their equipment and personnel parceled out to the remaining units, while others were combined to make a third unit.

Another change then affected the Marine Air Warning Squadrons, a change in designation. During the period June to August, 1946, the Marine Air Warning Squadrons were recombined and redesignated as Marine Ground Control Intercept Squadrons. Some examples of these combinations were: AWSs 1 and 11 combined to become MGCIS-2; AWS-13 was redesignated MGCIS-4, while the original AWS-4 was decommissioned; and AWS-7 became MGCIS-7. (13:MACS) At the same time, and perhaps even more significantly, the MGCISs received improved communications equipment and several new radar sets: the AN/CPS-5 primary air search radar; the AN/MPS-4 height finding radar detector; and the AN/TPS-B early-warning radar. These new items of equipment, vastly superior in capabilities to the systems that the AWSs had taken to war in the Pacific, came at a critical time, for in little more than a year after MGCIS-7 had returned from China, the drums of war began to beat anew and on 17 September, 1950, landing through Inchon, the radar crews of MGCIS-1 again found themselves in combat. (6:169)

Along with the new equipment and the new designation, the Marine Ground Controlled Intercept Squadrons found themselves with a new mission:

> The Marine Ground Controlled Intercept Squadron is to provide, operate and maintain radio -- radar facilities for air surveillance and fighter direction within an air defense system. (13:MACS)

By March, 1951, enemy air power in Korea had increased significantly, and the problems of United Nations air defense multiplied. As a result, General Harris, Commanding General, 1st Marine Aircraft Wing, requested a second MGCIS be sent to Korea to help cope with this situation. On 5 March, MGCIS-3 sailed from San Francisco. (5:90) During the Korean War, the MGCISs participated in most of the major operations in support of the United Nations air effort. Following the armistice in July, 1953, as they did after World War II, the MGCISs would remain in Korea to help insure peace. MGCIS-1 left Korea in April, 1955.

THE TRANSITION (CIRCA 1954) -- A NEW ERA DAWNS

As was the case following World War II, the end of hostilities in Korea caused considerable activity with regard to the future of Marine Corps aviation. Numerous conferences were held concerning the number and types of aircraft needed to meet the challenges of the cold war, the concern over nuclear weapons, and the future of jet aviation. In fact, the overall missions and tasks of Fleet Marine Force Aviation organizations -- their scope, design and structure -- were all discussed and considered for change. The future of the Marine Ground Controlled Intercept Squadrons was to be no exception. The first major change realized was in the form of another redesignation; by the end of April, 1954, the Marine Ground Controlled Intercept Squadron was renamed the Marine Air Control Squadron

(MACS). The driving force behind the recommendation for this redesignation is interesting, to say the least: "For purely functional identification purposes, the board recommends the title designation for the MGCIS be changed to Marine Air Control Squadron." (14:IV-2)

The mission statement for this newly named organizations was also changed:

> As the basic air control unit of the Tactical Air Control Center of the Marine Aircraft Wing, install, operate and maintain ground electronics equipment for the detection and interception of enemy air targets and control of aircraft of the Marine Aircraft Wing in support of Fleet Marine Force operations. (13:MACS)

Of note here is the increasingly more complex wording of the mission statements as opposed to the rather simply stated missions of World War II.

Not only did the name of the basic unit change during this period, so did the internal structure. The Air Defense Control Center (ADCC) was replaced by the Counter Air Operations Center (CAOC). The CAOC was defined as:

> A subordinate operational component of the [Marine] Air Control System designed for control and direction of air defense operations. It is under the operational control of the/a TADC (Tactical Air Direction Center) or TACC (Tactical Air Control Center), as appropriate. (12:1)

During this same period, and in response to a better understanding of the threat posed to the Marine Corps by guided missiles during and after an amphibious operation, the Marine Corps again modified the mission statement of the MACS to read:

> Install, maintain and operate ground facilities for the detection and interception of hostile aircraft and missiles and for the navigational direction of friendly aircraft in the accomplishment of support missions. (16:24)

Along with the cosmetic changes came technological improvements in radar sets. These new MACS started swapping out their older sets and taking delivery of newer radars during this time frame. Radars such as the AN/TPS-17 search radar, AN/TPS-15 radar, and AN/TPX-17 radar interrogator system, along with improvements to the AN/TPS-1B, all combined to give the MACS a considerably improved detection and controlling capability.

In addition to the newer radars, another item to assist the MACS was on the drawing board -- the Marine Tactical Data System (MTDS). The requirement for MTDS evolved from a 1956 Marine Corps study of air defense problems. (13:MACS) The study determined that the manual air control system then available could not effectively deal with the current and projected requirements of the Marine Corps. An automated information processing and data exchange system was required to reduce the defensive reaction time created by a high speed threat. In 1961, a MACS (MTDS Test Unit) was formed for the purpose of determining the feasibility of the MTDS project. (13:MACS) The MTDS program was planned to be compatible with similar U.S. Navy programs: Navy Tactical Data

System (NTDS) and the Airborne Tactical Data System (ATDS).

Throughout the period following Korea, Marine Air Control Squadrons polished their skills in exercises and day to day garrison operations. Improvements in early-warning and fighter-controlling techniques were continually being tested and evaluated. Technological advancements in radar systems and communications were also being incorporated. These new skills and systems were immediately put to the test, when on 19 May, 1962, MACS-4 packed up its AN/TPS-15, the AN/MPS-16 and the MPS-11 search radar and deployed as an element of the Provisional Marine Air Group, 3rd Marine Expeditionary Unit to Udorn, Thailand. The mission given to the 3rd Marine Expeditionary Unit was to assist Thailand in defending her northern and eastern borders against Communist incursion from Laos. "...In its northern location, MACS-4 has become the northern most element of U.S. Forces in Thailand with the Laotian border lying only 23 miles north." (13:MACS) MACS-4 remained in Thailand until July, 1962.

During the early 196Os, testing and evaluation was being conducted on a myriad of new radars and equipment. A whole new family of radars had emerged and was being fielded to the MACSs as replacements for the old and outdated radars then in use: the AN/TPS-22 long range search radar, the AN/TPS-34 search radar, the AN/TPS-37 height finding radar, and the AN/UPS-l medium range search radar. These new radar sets all gave the MACS increased surveillance and detection capabilities. In addition to the improvements in equipment, the MACS was also undergoing an organizational change; the old CAOC was phased out and replaced by the Tactical Air Operations Center (TAOC).

Further, Litton Industries was well on its way in the process of developing, in conjunction with the Marine Corps, the first of the Tactical Data Communications Centrals (TDCC), the "brains" of the Marine Tactical Data System. Marine Air Control Squadron Three took delivery of the first MTDS system for operational testing in July, 1966. (13:MACS)

However, July, 1966 would prove to be not soon enough. In May, the MACS went back to war, this time in Viet Nam. Marine Air Control Squadron Nine was directed to deploy from its base in Atsugi, Japan to Viet Nam in May, 1965; its mission was to provide early-warning from Phu Bai. The squadron installed a second radar site and the manual TAOC at Chu Lai and functioned as a Control and Reporting Post (CRP) for the U.S. Air Force's "Panama" radar station. MACS-9 operated out of these locations until September, 1965, when it was replaced by Marine Air Control Squadron Seven, which had just arrived from Okinawa. This was the first combat for MACS-7 since World War II. (13:MACS)

MODERNIZATION ARRIVES ON THE BATTLEFIELD

During this period, MACS-3 was making rapid progress with the certification of the MTDS system. Marine Air Control Squadron Four had taken delivery of its various sub-systems from July to December, 1966, and had established a vigorous training program for its personnel, operators and technicians alike, in preparation for assignment to combat.

The automated system exceeded all expectations in its improvements over the older manual system. MTDS gave the

controllers the ability to handle more than 20 simultaneous intercepts and the computer could track up to 250 air targets. The system and controllers of MACS-4 were ready; it was time to go to war. MACS-4 deployed to Da Nang, Viet Nam, in June, 1967, replacing MACS-7, which redeployed to Camp Pendleton, California. (13:MACS)

Litton provided and MACS-3 certified MTDS systems for delivery to the remaining MACS as soon as they were available off the assembly line. However, the production schedule was such that from 1968-1971, there were two separate types of MACS within the Marine Corps: MACS (Table of Organization 8630) and MACS/MTDS (Table of Organization 8631); the former was a manual TAOC and the latter an automated TAOC. It was not until 1972 that all the TAOCs were automated.

The acquistion of new and revolutionary technology was not limited to the MTDS; the Marine Corps was also exploring greatly improved and updated radars. In 1968, MACS-3 began testing the AN/TPS-32, a unique radar in that it, a single radar, provided the controller with a three-dimensional picture. Previous radars had been two-dimensional, and required a separate height finding radar to provide altitude information on contacts. (13:MACS)

Marine Air Control Squadron Four left Viet Nam in February, 1972. Before it left, its MTDS had provided a foundation for all future operations with the Navy and Air Force through the successful operation of the South East Asia Interface, which forwarded digital track data on a continual basis between the 7th Air Force and CTF 77. (13:MACS) Today, data interchange of this type is considered routine, as is reflected by the number of joint operations in which the Marine Corps participates. In 1969, with a new and relatively untried system, this was quite an accomplishment.

THE MARINE AIR CONTROL SQUADRON TODAY

The Marine Air Control Squadron of today is the product of some 40 years of evolution -- truly a far cry from the humbly equipped Air Warning Squadrons activated in September, 1943. The mission statement of the MACS now reads:

> The mission of the TAOC is to detect, identify, and control the intercept of hostile aircraft and missiles, and to provide navigational assistance to friendly aircraft in the accomplishment of support missions. (19:54)

To accomplish this mission, the MACS has a fully automated and upgraded TAOC, and an extremely advanced suite of communications equipment. As for radars, the AN/TPS-32 remains reliable and is still in use. The AN/TPS-22 and the old AN/UPS-1's were phased out in the early 198Os. In theirs place, the current TAOC employs state-of-the-art digitized radars: the AN/TPS-63, a lightweight, helicopter-transportable, short-range, Moving Target Indicator (MTI) equipped two-dimensional radar; and the AN/TPS-59, a long range, three-dimensional, phased-array, solid-state surveillance radar which has been in the inventory since about 1985. While the services of the Marine Air Control Squadron have

not been needed in war since Viet Nam, the squadrons remain at a high level of operational readiness through numerous combat exercises throughout the world i.e., Korea, Norway, the Philippines and Japan. Should the drums of war beat again, the MACS of today is ready to answer the call to arms.

WHAT DOES THE FUTURE HOLD?

To continue to meet the challenge presented by the ever-changing threat, the Marine Air Control Squadron must continue to evolve, as it has for the past 40 years. To this end, several programs to improve the capabilities of the squadron are in various stages of development. One such program is the AN/TYQ-23 -- originally called TAOC-85, now simply referred to as the Tactical Air Operations Module (TAOM). Designed by Litton Data Systems of Van Nuys, California, as a second generation replacement for the current TAOC, the TAOM is revolutionary in design, in that four shelters, or OMs, replace the grouping of approximately 23 shelters previously required.

> The basic system element is the Operations Module (OM). A single OM, housed in a standard 20 foot, ANSI ISO shelter, contains all mission essential equipment with the exception of search radar, IFF and prime power equipment. Full system functional capability is provided by a single shelter which weighs approximately 10,000 pounds with all OM equipment, including signal and power cables, installed for transport. (11:1)

Considering the limited strategic lift capability available to the Marine Corps for equipment movement, this new system will provide advantages far beyond those realized by the MACS alone. An important tactical advantage of the new Tactical Air Operations Module is the ability gained to remote the radars up to two kilometers away from the system with fiber optics. (11:1) At present, the MACS is required to locate its primary radars within 1000 feet of the shelters due to cable/system constraints. Considering the threat's ability and apparent intention to use antiradiation weapons (ARM), the current MACS is therefore seen (at least by those controllers who man it) as a "missile magnet".

In keeping with the desire to upgrade and increase the inherent capability of the MACS to counter the modern threat, the Marine Corps is also researching the feasibility of adding an airborne early-warning (AEW) asset to the inventory:

> To aid in preventing a surprise air attack, the capability to detect low-flying targets in any weather and terrain conditions, is a necessity. An airborne early-warning aircraft would provide the most reliable, easily deployable and effective method of over-the-horizon detection and targeting of a low level threat. (18:1)

It is usually assumed that the concept of airborne early-warning in the Marine Corps is a fairly new concept. In fact, the topic was first raised as early as 1955:

> Although the Board feels that the Marine Corps has no airborne early-warning (AEW) capability today, it is to be reiterated that technical progress should be

monitored, and, if equipments become available, every advantage should be taken of them as an effective AEW aircraft could materially assist in providing the detection so urgently required. (17:14)

In this search for upgrades to improve the MACS, what else does the future hold? Space technology, advancing faster today than ever before, causes discussions of future developments to sound like science fiction: passive sensors with which the ground station would simply receive and track the threat based solely on the aircraft's inherent electromagnetic radiation; the use of data provided by satellites to control aircraft and run ground controlled intercepts. No one can really know where technology will lead us. With regard to the control of aircraft and missiles, and the future of the Marine Air Control Squadron, perhaps even the sky is not the limit.

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