51/U.S.

Evolution of National Insignia, Coloration and Markings on USAF Aircraft

Charles G. Worman, Historian

U. S. Air Force Museum

Numerous styles of national insignia, markings, and color schemes have been displayed on aircraft used by the U. S. Air Force and its predecessor organizations during the half century following the appearance of the JN3 "Jennies" along the Mexican border in 1916. The use or discontinuance of these designs has been prompted by a variety of circumstances including technological improvements, mission changes, and wartime crises. The details of these changes are necessary to the historian, the model builder, and the aircraft "buff", but many of the facts are buried in obscure official specifications. Magazine articles which dealt with coloration and markings have appeared in leading aviation journals, but these frequently are limited in scope and often specific in their coverage. It is the purpose of this paper to clarify the historical evolution of the subject.

Beginning with the Army's first airplane, Wright Flyer Signal Corps Airplane No. 1 in 1909, until our nation's entry into World War I, the Army ordered and received only a few hundred planes. These aircraft appeared in clear finish and were usually marked with consecutive serial numbers allotted by the Signal Corps' Aviation Section. These serials were the only official markings and were displayed conspicuously in black in various positions. For example, on No. 28, a Burgess "H" model, the number was located well forward on the fuselage, but on airplane No. 30, a Curtiss JN1, it appeared on the rudder. Understandably, Signal Corps Airplane No. 1 did not carry a number, although the crossed flag

insigne of the Signal Corps was painted on its rudders after it arrived at Fort Sam Houston in Texas in February 1910.[1]

The next use of a distinguishing mark on Army aircraft apparently occurred during Pershing's Punitive Expedition into Mexico in 1916. Since the service's activities prior to the Mexican campaign had been limited to intra-country operations, little need for an identifying insigne for Army planes had previously existed. Various photographs of some of the Jennies used by the 1st Aero Squadron on the border prove that a five-pointed star was painted on their rudders.

Colonel H. H. H. Clark (USAF, retired) recalled some details of origin of this star marking. He relates that in early 1916 at North Island, California, Sgt. Jacob Kuntz and associates named Mackie, Sears, and Barney Barnhill were assigned to the Experimental and Repair Department under Capt. Bryon Q. Jones where they designed and first began using a star marking on the rudder or vertical stabilizer of some new aircraft they were assembling. However, they soon were ordered to cease using the design. Sergeant (later Lieutenant) Sears and others were transferred from North Island to the Mexican border later in the year and began using this insigne on planes stationed there. The star, as Col. Clark recalled, was red. When a circle or "border" was added later, the circle was white to duplicate the colors of the Signal Corps piping and hat cord, red and white. The Chief Signal Officer later ordered this "mutilation" of government property halted immediately.[2]

There were variations in position and details of the star design. Some aircraft were marked only with a plain star while others bore a star within a light colored circle. This marking appeared at the very

top of the rudder on some planes and a foot or more from the top on others. A similar rudder marking appears in photographs of JN4 aircraft stationed at the Signal Corps flying school at Driving Park, Memphis, Tennessee, early in 1917. Several former aviators who trained at the school recall the tail marking as a white star within a blue circle.[3]

The Aviation Section had neither sufficient war material nor an official national marking for its meager inventory of airplanes at the outset of American participation in the European war in April 1917. Colonel Edgar S. Gorrell, who served as Chief of Staff with the A.E.F.'s Air Service, related the story behind the adoption of the first official national insigne. The creation of an appropriate design was one of the tasks assigned to the small group of air officers in Washington in the spring of 1917. Using wrapping paper from a neighborhood grocery and children's water paints and colored pencils, Colonel Gorrell and his associates prepared sketches of various combinations of colors, circles, and stars, finally choosing one which ultimately received official approval.[4]

The design, approved in War Department Stencil No. 2 on 19 May 1917, consisted of a white five-pointed star centered in a circumscribed blue circle, equal in diameter to the chord of the wing on which the insigne was placed. A red circle occupied the center of the star but missed touching the inner star points "by an amount equal to 1/24th of the diameter of the circumscribed circle." Colors used were to be the same as those appearing in the American flag. The stencil also

prescribed the location for the newly-adopted insigne. It was to be placed on the upper surface of each upper wing, positioned so that the circumference of each circumscribed circle just missed contact with the wing aileron. Lower wings bore similar markings on their undersurface.[5]

A specification dated 15 October 1917 directed that the insignia be placed on the wings so that one point of the star faced directly forward. Fuselage sides were to be left unmarked except for those airplanes designated as trainers. These were to bear Signal Corps serial numbers on each side behind the pilot's seat in black figures 14 inches high.[6]

Both sides of that section of the rudder behind the rudder post on Air Service planes after the 19 May 1917 order were to be painted with three equally wide vertical bands; red, white, and blue. The blue band was adjacent to the rudder post while the band at the rudder tail was red. The serial number for each Army plane was painted in black figures three inches high on each side of the rudder at the top of the white band.[7]

Objections to the new insigne design came from Colonel William "Billy" Mitchell, named by General Pershing to command the A. E. F.'s Air Service, Zone of the Advance. Colonel Mitchell recommended the use of three concentric circles, similar to the national insignia on British and French aircraft, but with a different sequence of color.[8]

The suggestion had merit since quick, certain identification of airplanes in combat was a life and death matter, particularly during periods of poor visibility. The adoption of Colonel Mitchell's idea

would standardize Allied markings as tri-color cocardes, while color variations would serve as distinguishing marks for the various Allied nations. German airplanes and those of her allies, Bulgaria and Austria, were identified by formée and Greek crosses.

On 11 January 1918, the Joint Army and Navy Technical Aircraft Board did adopt a new insigne for aircraft manufactured in the United States for the Army and Navy. Wings were to bear a red circle with a diameter approximately equal to the chord length, an inner blue circle two-thirds the length of the chord, and a center white circle one-third the chord length in diameter. General Order No. 299 dated 8 February 1918, specified that the wing marking should appear on the upper wing so that the outer circle "just misses contact with the wing flap." Insignia were to be placed in a corresponding position on the underside of the lower wing. In March, the size of these wing markings was limited to a maximum diameter of 60 inches.[9]

Wing markings normally were placed inboard of the aileron on all United States-produced airplanes, but during the war they appeared at the wing tips on British and French craft. Some planes produced by France, including early Nieuport 28's, carried rudder markings with the white stripe at the front and red at the trailing edge, according to one authority. The fuselage on American combat aircraft remained unmarked except for insignia placed there in the field.[10]

Under the terms set forth in General Order No. 299, rudders retained the three vertical bands, although the red stripe was relocated at the rudder post and the blue moved to the rear position. Not all the

foreign-made aircraft used by United States' forces in Europe were repainted with American markings and the use of spare parts with one type of marking on an aircraft having another type of marking was not unknown. Serial numbers continued to appear at the top of the white band in three-inch high numerals. Temporary use of the former star design was permitted on training planes already in service and in production, but the new cockade emblem was to be applied immediately to American aircraft being shipped to Europe.[11]

The location of the wing marking was altered on 22 April 1918. On upper wings, the center of the roundel was to be one chord length from the wing tip. The lower wing's chord length marked the proper distance from the lower wing tip. Serials now appeared in figures limited to a height of four inches on both sides of the fin in front of the rudder post and above the stabilizer. During 1918, the letters "SC" were added as a prefix to the serial to identify the Signal Corps as the using organization. On aircraft with no fixed vertical tail area or with insufficient space, the serial number was painted on both sides of the fuselage with the rear element of the markings on a line with the front edge of the stabilizer surface. Serial markings on trainers were made more conspicuous, appearing in 14-inch high numerals on each side of the fuselage behind the pilot's seat. (All aircraft were to carry the serial number and prefix in 14-inch letters on the fuselage after a 30 August 1919 specification appeared. This same document changed the prefix from "SC" to "AS" for Air Service.)[12]

A bulletin issued by the Air Service on 7 May 1918 outlined other standard markings that were to be applied to combat aircraft in Europe.

All planes in a squadron were to be numbered serially, from one to 19 in black on both sides of the fuselage near the stabilizer, on the upper right wing's top surface, and on the underside of the lower right wing. A later memo dated 28 June 1918 stated: "All planes in a squadron shall be numbered . . . . in yellow or red." Each squadron would have an official insigne painted on the middle of each side of the fuselage. Squadrons were to design their own insigne during the period of organizational training. In addition, the planes in some squadrons displayed on the upper side of the top left wing and underside of bottom left wing a stripe or series of stripes of any color as specified by the group commander to facilitate recognition by pilots of the same squadron from above and below.[13]

Squadrons newly arrived in the combat zone were prohibited from arbitrarily adopting and using an insigne, however. No unit was permitted to place any distinctive insignia on its craft without written authorization from the Office of the Chief of the Air Service. Before applying for this authority, certain requirements had to be met. An observation squadron must first have served one month at the Front or have received a citation for distinguished services in orders from higher authority. Bombing squadrons also were required to serve a month at the Front before making application to adopt their insignia. Pursuit squadrons were required to receive official credit for three enemy planes brought down in aerial combat or earn a citation similar to that demanded of observation groups before applying.[14]

Distinguishing marks also were authorized for flight commanders and their deputies. A plane flown by a flight commander had distinctive streamers attached to the tips of the lower wings and one from the rudder. A squadron commander's craft was painted with two bands of red, white, and blue stripes running diagonally from the rear of the cockpit to the rear of the fuselage at the foot of the rudder post. (Some World War I photos show a single band of red, white, and blue although the specification called for two.) Officers who commanded groups and higher organizations were permitted to mark their planes at their own discretion.[15]

On 15 July 1918, AEF Headquarters approved the adoption of the French balloon service's practice of placing air service insignia on all captive balloons. Each was to be marked with the familiar red, blue, and white cocarde on each side about one-third of the length of the balloon from its nose. The insigne was placed on the 11th panel from the front, equidistant from each seam, with the lower edge tangent to the suspension band. Two weeks later on 2 August, the cocardes were ordered placed with the lower edges two meters above the suspension band.[16]

Six months after the signing of the Armistice, the Secretaries of the Navy and War agreed to resume the use of the original national insigne on United States military aircraft, the star in the circle. On each upper and lower wing, the circumference of the blue circle was to be tangent to the wing tips. One point of each star would point

forward and unless otherwise specified, the insigne diameter would be 60 inches. Rudder markings would be the familiar three vertical bands, with blue nearest the rudder post.[17]

A 1920 Air Service report noted that the use of the star marking was based more on an emotional or patriotic impulse than on scientific observation. Tests had shown that at a short distance, the star's outside points began to merge with the surrounding color while the inside corners tended to loose their sharpness and become rounded off. As the distance increased, the blending became more pronounced until the insigne couldn't be distinguished from the former concentric circle design. The report recommended the adoption of three parallel bands of red, white, and blue as a national insigne, positioned across the upper and lower wing surfaces.[18] The suggestion was not approved.

The return to the star insigne was not immediate. All aircraft already constructed would continue to employ the "three circle" design, but all planes delivered after 17 May 1919 which were not already marked would carry the star insigne. The change would be effective on all planes not later than 1 January 1920. Although the Armistice had been signed six months earlier, the order contained the restriction that under no circumstances would the star be used on aircraft stationed in Europe "until after the end of hostilities."[19]

The colors used on American aircraft during World War I presented a varied array of patterns and hues. Prior to the war, fabric-covered aircraft generally were left unpainted and merely had a coating of

clear dope or varnish, giving them a cream-colored appearance. After the U. S. entered the war, however, planes purchased from Britain and France for the A.E.F. often carried the color scheme used by that particular nation. Colors on British craft varied, with olive drab, green, or brown fuselage sides frequently encountered with clear or silver undersides. France employed a number of color schemes including irregular brown, green, and beige patterns for the top and sides with clear undersurfaces for some of their camouflaged aircraft. Some French planes were finished with a solid cream color throughout while others tested the merits of light blue, sky blue, or silvery gray undersides. Some of the French Nieuports and SPAD Scouts used on the Western Front were a silvery-gray scheme. The initial American-built De Havilland 4's sent to Europe were unpainted or painted olive drab only on the upper surfaces of the wing and tail, and on the top quarter of the fuselage. Later, American-built planes arriving in Europe were painted an olive drab shade all over. This scheme was retained until 1927.

During the years of uneasy peace between 1918 and 1941, no change in the basic star insigne appeared, although succeeding Air Corps specifications frequently noted minor changes in position and size. On 21 January 1926, the diameter of the wing insigne was fixed at three-fourths of the available chord length at the location of attachment, with a maximum size of 60 inches. Available chord length was defined as the whole chord on wings without ailerons and the chord length from the aileron cut-out to the leading edge on wings with ailerons. The insignia were positioned tangent to the cut-out on wings with ailerons;

on those without, the insigne center fell midway of the chord. Later specifications required that the marking on fabric and metal covered wings be placed on the metal covering, tangent to the point between the two materials. Subsequently, the location for the emblem's center was specified as a distance from the wing tip equal to one-sixteenth of the wing span on straight wings and one-eighth of the wing span on tapered wings. The outside edge of the blue circle was not to approach the wing tip closer than six inches.[21]

National insignia adopted for heavier-than-air craft were also applied to non-rigid airships after 25 May 1920. The standard Air Service ensign was painted on a single ply of balloon fabric cemented to the envelope at the upper and lower extremities of a vertical plane passing through a point two-fifths of the distance back from the ship's nose or eight feet forward of the "N" nationality marking, assigned to the United States by the International Air Navigation Convention. One point of each star pointed forward and a 60-inch circle was specified. Each rudder and elevator bore the insignia used on aircraft, with stripes on the elevators at right angles to the airship's longitudinal axis and applied on both the upper and lower surfaces.[22]

Army airships and spherical balloons took on a distinctive appearance after 20 January 1923 with the addition of the marking "U. S. ARMY"; observation or kite balloons were ignored in the specification. Two national insignia were to be mounted on each airship at the top and bottom. The upper marking was positioned at the envelope's greatest diameter while the center of the bottom emblem appeared three feet back

of a point midway between the front of the car and the tip of the envelope's bow. "U.S. ARMY" preceeded three sets of registration markings on the envelope, one on each side and one under the bow. On spherical balloons, only two insignia appeared, one at each end of the diameter inclined 45 degrees to the vertical axis of the ship. "U.S. ARMY" markings also were used on these vehicles, centered on each end of a horizontal diameter. Observation kite balloons carried one star insigne on top and another at the bottom of the envelope.[23]

It had been advantageous during World War I for the rudder insigne on American planes to resemble those of the other Allied nations. Following the war, each of these countries modified its insigne to a more distinctive design to permit nationality identification. Credit for the American Army design adopted in January 1927 appears to belong to Mr. Charles N. Monteith, a former World War I aviator working for the Boeing Airplane Company in Seattle at the time of his suggestion in 1926. Monteith recommended a rudder marking which more closely resembled "Old Glory." One blue stripe was placed parallel to and just behind the rudder post. Its width equalled one-third the maximum width of the rudder to the rear of the post. The remaining area behind the post was divided evenly into 13 parallel horizontal stripes, seven red and six white, alternating colors.[24]

Other alterations in Army aircraft markings were approved during the 1920's and 1930's. On 31 January 1925, a two-part serial number marking was adopted consisting of two digits representing the fiscal

year the plane was ordered followed by a hyphen and the number representing the sequence of purchase during that year. 26-140 would identify the 140th plane ordered during fiscal year 1926. Serial numbers were moved to a location on the fuselage immediately in front of the leading edge of the stabilizer at the same time for reasons of economy. The numerals were reduced to a four-inch size to reduce labor and cost. The "U. S. ARMY" marking appeared on the fuselage in four-inch letters above the serial number after authorization on 15 October 1926.

On 2 July 1926, the Air Corps Act became law and redesignated the Army's Air Service as the Army Air Corps; this necessitated a change in serial number prefix from "A. S." to "A. C." The letters and number designating the aircraft model together with the manufacturer's name had been authorized on 31 January 1925 for placement on each side of the rudder about one-fourth the height of the rudder from the top and in figures no larger than three inches high. The words "corporation" and "company" were not to be used. After 18 October 1927, the maker's name and type designation were moved to the fuselage as a separate line of four-inch letters to preclude the transfer of the markings each time the rudder was changed.

Example:

U. S. ARMY
(Manufacturer's name—Model designation)
A. C. 27-461

The second and third lines were transposed in a specification issued on 25 January 1929.

Use of this marking was brief, for after 3 December 1930 the manufacturer's name was eliminated and the other data reappeared on the left side of the fuselage near the cockpit in one-inch letters in an

information block which was still in use in 1968. (During World War II, "W" or "Q" was stenciled beneath the type, model and series designation on the fuselage in two-inch letters to identify war-weary aircraft returned permanently from service in an overseas theater; "S" identified aircraft which had been designated as excess or surplus property.)[25]

The appearance of "U. S. ARMY" on the undersides of wings resulted from some confusion the general public experienced in identifying Army planes and those belonging to other executive departments, commercial concerns, or private individuals. Station commanders at first were given the option of adding "U. S. ARMY" to the lower wings and fuselage sides, in a technical order dated 4 February 1924. "U. S." would appear on the right wing, and "ARMY" on the left with the top of the letters toward the wing's leading edge. Bold, white letters 24-inches high were to be used on dark surfaces, and black letters on light backgrounds. On 15 October 1926, the wing marking had become mandatory.[26]

Demands for increased aircraft visibility sparked a series of changes in the over-all color scheme of Air Corps aircraft as the olive drab finish gave way to ones promoting greater safety. In 1927, yellow wings and tail varied the coloration, although the fuselage, landing gear, and struts retained the familiar olive drab finish. A light blue color three years later replaced the olive drab on observation planes and on primary and basic trainers. However, more efficient maintenance and overhaul practices were possible through the standardization of one color for all fuselages; such a move also would simplify distribution of aircraft from the manufacturer's plant and the repair depot, eliminating concern over whether the plane was scheduled for use for training or tactical purposes.[27]

On 23 May 1934, the Army adopted "Light Blue" as the approved color for fuselages, cowlings, struts, and wheel pants. Wings, ailerons, elevators, fins, flaps, and the balanced portions of the rudder and stabilizer were to be painted yellow. This colorful scheme remained standard for all Army aircraft until 9 September 1938 when new specifications called for aluminum finish for tactical planes. Trainers, amphibians, and seaplanes retained the two-color scheme.[28]

The Production Engineering Section at Wright Field recommended in mid-1940 that the color of exterior surfaces on all training planes be the same as for tactical aircraft. Such a plan would reduce initial aircraft costs and facilitate production of all-metal aircraft while simplifying maintenance and repair. Support for the proposed change was not unanimous since experience at training center indicated that the aluminum finish was not as easily seen in the Air as was the blue and yellow combination. Primary and basic training planes should retain the two-color finish, objectors argued. Officials modified the applicable specification to direct that advanced trainers constructed of fabric and wood after 1 May 1941 would be finished in aluminum; metal airplanes would be finished naturally. Primary and basic trainers continued to display their former colorful appearance for reasons of increased safety, "Orange Yellow" and "True Blue" as the colors were designated after 10 January 1940.[29]

The creation of the General Headquarters (GHQ) Air Force required the introduction of special identifying markings for the combat and training planes assigned to the new force. Organized in March 1935 as an independent, strategic striking force, it existed until 20 June

1941 when it merged with the Army Air Corps to form the Army Air Forces. (TO. 07-1-1)

In addition to standard markings, under a 5 January 1938 directive all aircraft assigned to the GHQ Air Force were to be marked to identify them as to organization and tactical function. The cowlings of pursuit, attack, and bombardment squadrons were to be painted a solid red, white, or yellow, or blue in a four-squadron group. Aircraft assigned to group headquarters and to headquarters squadrons were also identified by colorful cowling markings. The cowling was divided into three equal sections by longitudinal lines (four equal sections for a four-squadron group) with one area painted red, one white, another yellow, and the fourth, if present, blue. Commanders of reconnaissance squadrons were permitted to specify the cowling markings for their unit's aircraft. No recognition colors were to be used for headquarters squadrons of wings, air bases, and the GHQ Air Force.[30]

Command airplanes of the GHQ force were identified by painted stripes five inches wide encircling the fuselage immediately behind the rear cockpit. This was the first time since WW I that specific markings were authorized for such airplanes. These stripes were to be of the same color as the squadron identification marking, but black would replace blue on blue fuselages and would replace white on unfinished aircraft. Squadron command aircraft bore two stripes five inches apart, encircling the fuselage at right angles to the plan's axis. Flight command aircraft carried a single stripe. In "A" flight, the stripe was positioned at a right angle to the plane's axis, "B" flight's stripe encircled the fuselage at a 45 degree angle from the horizontal with the uppermost part of the stripe inclined toward the front. The "C" flight stripe

also was placed at a 45 degree angle but was inclined toward the rear. No command identity stripes were used by headquarters squadrons of air bases, tactical groups, wings, or the GHQ Air Force.[31]

Each GHQ airplane also bore a distinctive letter and number painted in black on each side of the vertical fin in two lines and in a single line on the top and bottom of the left wing identifying the organization and airplane designation. For example, $\frac{AC}{18}$ identified the number 18 airplane of the 3rd Attack Group. In addition, the airplane number was painted on the engine cowling or on the forward portion of the fuselage. A letter designator indicating the type of unit ("W" for Wing, "A" for Attack, etc.) was followed by a second letter indicating the number of the unit with one to 26 represented by the corresponding letter of the alphabet, followed by the plane's unit number. For tactical squadrons which were not a part of a group, the group letter was omitted and a block of numbers was assigned to each squadron.[32]

By mid-1940, all Air Corps aircraft were ordered marked with designators in black or in yellow on camouflaged airplanes. The unit identifying number was followed by a letter or letters designating the type of aircraft, followed by a number assigned by group and station commanders or by higher authority to designate a particular airplane. For example, 9B1 and FAD1 identified the first aircraft of the 9th Bombardment Group and Fairfield Air Depot, respectively. For uncamouflaged aircraft, the black designator appeared on each side of the vertical stabilizer in two lines, such as $\frac{12}{31P}$ to represent the number 12 aircraft of the 31st Pursuit Group. On camouflaged aircraft, the designator utilized the

necessary area of both the vertical stabilizer and rudder. The designator appeared in one line on the upper and lower sides of the left wing on monoplanes, or on the upperside of the left upper wing and undersurface of the lower left wing on biplanes. An airplane identification number also appeared on the engine cowling or on the forward portion of the fuselage. On 28 October 1941, radio call letters replaced the former designator symbols. (T.O. 07-1-1A)

These call numbers consisted of at least four numerals, the first being the last digit of the year in which the airplane was ordered followed by the serial, using zeros when necessary to make up the minimum number of digits. The radio call number of an airplane produced in 1942 having serial number 42-7 thus would be 2007, while the call number of aircraft 42-5434 would be 25434. The figures were to be of sufficient size so they could be seen from a distance of 150 yards. Radio call numbers also were placed on the underside of the wings on aircraft operating solely within the continental limits of the United States during the early 1940's. Local using agencies were given latitude in determining the size and placement on the wings, but call numbers were not required on primary trainers which were not equipped with radios and which bore field identifying numbers.[33]

The use of camouflage finishes was largely abandoned during the 1920's; it was not until the following decade that their limited use was revived to conceal aircraft in flight and on the ground. Wright Field's Materiel Branch issued a report dated 24 July 1930 which outlined the need for some form of concealment. The ease with which the

aircraft finishes then in use could be seen made it difficult to carry out some of the tactical problems which were encountered in the Air Corps' annual maneuvers. The report recommended water paints which could be used as a temporary finishing coat. Olive drab was preferable unless the camouflage pattern was to be applied in a varied scheme. Aircraft programmed to participate in maneuvers during the 1930's were given temporary paint jobs in various colors and pattern arrangements selected to blend with the average coloration of the terrain over which the aircraft was to operate. These temporary paints resembled calcimine and could withstand normal weather conditions for approximately 30 days.[34]

The Materiel Division prepared recommendations for camouflage schemes in 1932 which were partially incorporated in a new technical order issued in January 1933. Three basic schemes were recognized; a day and a night sky camouflage pattern and a third designed to provide concealment while on the ground. Optimum concealment against the sky in daylight hours called for light blue undersurfaces mottled with irregular patches of purple. The mottling effect extended upward on the sides of fuselages with oval or round cross-sections. Upper surfaces were finished with dark shades of green, olive drab, and purple or mauve to reduce visibility when viewed against the background of the earth. If the fuselage had a square or rectangular cross-section, the ground camouflage colors extended over the entire sides. "Day sky camouflage" produced the illusion that the aircraft was at a much higher altitude, and at altitudes above 10,000 feet the aircraft became difficult to

locate. Night sky camouflage consisted of black undersides.[35]

The type of missions flown by bombardment, observation, and pursuit planes dictated the camouflage finish that was applied during the war games. Attack airplanes were painted with ground colors since missions typically were flown at low altitudes. Routes to a target were selected so that the greatest possible amount of flying would be over terrain providing a minimum of contrast with the camouflage colors employed.

Various tests were conducted during the mid-1930's to devise appropriate paint schemes for aircraft flying over areas which were normally snow covered or over desert regions. Officials also explored the possibility of using fish nets, burlap, or similar lightweight fabrics to conceal aircraft while on the ground. These materials would have had to be designed to cover one plane, to permit repainting as the terrain changed, and each would have been capable of carriage in the plane it was designed to conceal.

The fall of Holland and Belgium to the whirlwind German onslaught and the complete collapse of France in June 1940 brought much closer the threat of the European war. Americans suddenly realized that national defense was a national concern. From this point, appropriations for the expansion of American's air arm were no longer a significant problem. One phase of the Army's preparations for possible involvement in the hostilities was a concerted effort to determine the most effective scheme of protective coloration for combat aircraft. Drawing on the results of discussions and experiments during the 1930's, the Air

Corps on 22 October 1940 adopted a camouflage design for its tactical planes. All upper surfaces, except for insignia, were to be painted dark olive drab, extending downward on the sides of the fuselage. All undersurfaces except for markings and insignia were to be finished in a neutral gray shade. The lines of demarkation were minimized by overspraying the permanent colors to blend them at the junction line.[38]

The new color combinations were displayed by all Air Corps and Federalized National Guard airplanes except trainers, aircraft of other types regularly used for training purposes, and planes operating in the Alaskan Department or other area having similar climatic and terrain conditions. Unless tactical requirements dictated otherwise, planes assigned to the arctic regions bore contrasting colors to aid in spotting aircraft which had made forced landings.[39]

Advanced trainers constructed of wood and fabric were coated with an aluminized finish with greater durability than the yellow and blue paint scheme; all-metal trainers remained in a natural metal finish. The colors of primary and basic trainers remained unchanged, "orange yellow" and blue until 20 July 1942 when an aluminum color was adopted for uncamouflaged aircraft.

One coat of medium green paint could be used on upper surfaces of those camouflaged planes operating over a terrain which was predominately green in color. After 1 June 1942, the Army specified the use of additional permanent shades in specialized situations; black for the undersurfaces of night-flying aircraft; "sand" for the upper areas on planes operating over desert terrain, and sea green

for use on the tops of airplanes assigned to localities with predominately green coloration.[40]

Units of the U. S. Army Middle East Air Force in the summer of 1942 were finished with "sand" paint; the finish's tendency to reflect the desert's red hues won the name of "Desert pink" for the color. B-25's of the 340th Bombardment Group (Medium) in 1943 carried the sand finish as did P-40F's assigned to the 79th Fighter Group in North Africa. Sand-colored B-24's of the 376th Bombardment Group (Heavy) participated in the famed Ploesti raid on 1 August 1943.[41]

In-service use of camouflage patterns and color combinations soon permitted a more valid evaluation of those selected. After July 1942, splotches of medium green were applied along leading edges, tips, and trailing edges of wings, vertical and horizontal stabilizers, and rudders to break the continuity of these edges. These green patches extended inward from the edge for various distances ranging from zero to 20 per cent of the width of the member. Procuring agencies possessed some latitude in altering colors to meet local requirements; theater commanders also were permitted to authorize deviations in coloring.[42]

The application of temporary camouflage paints on top of permanent finishes was permitted using sea green, black, and sand colors when required to meet existing local conditions and when directed in combat theaters. Insignia white could be used as a permanent finish for undersurfaces and leading edges, and olive drab on all upper areas of aircraft assigned to sea search duty. Included among those types of aircraft which were excluded from the requirements for camouflaged

coloration were those planes which were not regularly assigned to or normally located in the combat areas, and aircraft of other types regularly used for training purposes by flight training commands.[43]

The presence of cocardes on wings did not appear to interfere significantly with daytime sky and ground camouflage. As early as World War I, however, some doubt had existed about the advisability of using insignia in pairs on upper and lower wing surfaces. Air Vice-Marshall Raymond Collishaw of the British Royal Naval Air Service reported that the national roundels on his flight's Sopwith Triplanes in 1917 were "severely toned down" to render them much less conspicuous. Experiments had shown that hostile pilots could use the balanced markings as aiming points, firing between them. An Air Service circular issued in August 1920 reported on the comparative merits of various insignia and confirmed the desirability of using only a single wing insignia, "as it is a means of keeping the enemy fire away from the heart of the airplane."[44]

On 22 October 1940, the Army adopted an unbalanced presentation of wing insignia on its camouflaged airplanes. Thereafter, the national insigne was to appear on the upper left and lower right wing surfaces. This arrangement also was an aid in recognition, contrasting with the German and Japanese practice of applying wing markings on the top and bottom of both wings. The unbalanced pattern of wing marking was later adopted for all Army planes and has continued to the present on Air Force craft. World War II exceptions to the newly adopted specification included certain P-38, P-47, and P-51 aircraft which bore insignia

on the underside of both wings. These aircraft apparently were assigned to the 8th Air Force in Europe and performed bomber escort missions. The wing markings on these planes were often oversize in an attempt to convince gunners on board the B-17's and B-24's that they were friendly craft.[45]

To facilitate the recognition of combat planes when viewed from the side, the Air Corps' Experimental Engineering Section recommended that the fuselage be marked similarly to the wings. Following this suggestion, the Army on 22 October 1940 ordered that camouflaged aircraft display the national star insigne on each side of the fuselage midway between the trailing edge of the wing and the leading edge of the horizontal stabilizer. The circle diameter for the marking was to be three-fourths the "length of the projection of the fuselage side." On 18 December 1940, an amendment to the original order directed that one point of each star on the fuselage point directly upward when the aircraft was in normal horizontal flight. Fuselage markings were adopted for uncamouflaged aircraft soon after this. A 22 October 1940 specification ordered that all vertical tail surfaces be left free of any nationality marking on airplanes finished in camouflage colors. "U. S. ARMY" appeared in blue on the undersurface of camouflaged wings after 22 October 1940 until removal of the marking was ordered on 10 July 1942. A few months later, on 2 November, the Army Air Forces* eliminated this marking entirely from its planes.[46]

Experience under combat conditions early in the war revealed the inadequacy of the existing national insigne. To reduce the possibility of confusion between the star insigne and the red "meatball" used on

*On 20 June 1941, the Army Air Forces was established, combining the Office of the Chief of Air Corps and the Air Force Combat Command (formerly the GHQ Air Force), with Maj. Gen. H. H. Arnold named as Chief of the AAF.

Japanese airplanes, the red center was eliminated from the national insigne on U. S. combat planes on 28 May 1942. At the same time, officials ordered that no insignia should be placed on the rudders of combat aircraft, although the original star design and rudder markings were retained temporarily on trainers. Some A-20 aircraft were observed late in 1942 still displaying rudder stripes although these had been abandoned officially.[47]

Additional changes were made when it was shown that the combination of the star and circle when viewed at a distance merged into an indistinguishable circle as did the Japanese disc and the German cross insignia. The British in 1937 had found it necessary to outline their red, white, and blue Royal Air Force cocarde in yellow on their camouflaged aircraft. Several AAF squadrons operating with the RAF and others participating in the North African invasion in late 1942 added a similar yellow ring around the star insigne to facilitate recognition. Color photographs of B-24's flying from North African bases in the summer of 1943, such as those that bombed Ploesti on 1 August, confirmed the use of the yellow circle. Other B-24's and B-17's operating in the European theater about this time are sometimes seen in black and white photographs with a similar light-colored circle about the national insigne, presumably yellow. Maj. Gen. Carl Spaatz, commanding the Eighth Air Force, on 1 October 1942 authorized the use of a two-inch yellow outline encircling the fuselage insignia.[48]

Proposals for an improved design for a national marking included a single blue star bordered by a narrow white band and superimposed on a red star, and a suggestion for a design composed of two blue stars placed in a white oval and encircled by a red band. Test engineers from the Proving Ground Command at Eglin Air Base, Florida, conducted visibility tests on these and other experimental designs before recommending the adoption of the second major change in the star insigne.[49]

This modification, authorized on 29 June 1943, was the addition of a white rectangle to each side of the blue circle, one radius of the blue circle in length and one-half this distance in width. The top edges of the bars formed a straight line with the top edges of the two star points beneath the top point. The entire design was outlined with a red border one-eighth of the blue circle's radius in width. Application of the new marking was to be effective no later than 1 September 1943. Engineers estimated that the modified design was 60 percent more recognizable than the unaltered star insigne.[50]

The new emblem was to be mounted on the wings tangent to the aileron cut-out, one-third the distance from the wing tip to the fuselage. Standard sizes for wing insignia were established at a minimum circle diameter of 30 inches and a maximum of 60, with variations in multiples of five inches. The proper insigne for display on wings was the standard size closest to, but not exceeding, 75 percent of the distance between the leading edge and the aileron cut-out at the point of application.[51]

Fuselage insignia were not to be placed closer than 35 inches to the trailing edge of the wing if windows prevented centering the emblem between wing and stabilizer. The nearest standard size approaching but not exceeding three-fourths the height of the fuselage at the application point was the suitable size. Maximum and minimum circle diameters were 50 and 20 inches, respectively. The insignia white color was to be replaced with gray when marking upper wing surfaces finished in a semi-gloss sea blue shade.[52]

On 14 August 1943, red was completely eliminated from the national insigne for the remainder of the war, when a blue border was substituted for the red outline. On the same date, dimensions for fuselage insignia on night fighters such as the P-61 "Black Widow" were limited to a 25-inch maximum diameter and all wing insignia on these specialized aircraft fixed at a 25-inch size. Specifications also noted that while fuselage insignia on all aircraft might extend over doors and emergency exits, an insigne was not to overlap windows or openings used during combat which might alter the marking's pattern. On 26 December 1943, the AAF's Training Command received authorization to omit fuselage insignia if there was insufficient space for both the national emblem and necessary field identification numbers.[53]

The same specification of 26 December discontinued the widespread use of camouflage except "as may be directed otherwise by the Commanding General Army Air Forces." Paint was to be removed from camouflaged aircraft at the discretion of the commanders concerned, as local facilities permitted and if no interruption in operations resulted. Some special mission aircraft such as pale blue F-5 photographic airplanes retained their unique paint schemes. By April 1944, the specification had been revised to exclude helicopters, liaison aircraft, gliders, and night fighters from the restriction on using camouflage paints. By June 1946, however, camouflage finishes were no longer in use on night fighters. The black lustreless finish for propellers was no longer mandantory after April 1944, although the safety requirement for four-inch yellow tips on blades inaugurated in 1941 was retained.[54]

The short span of peaceful years between World War II and the Korean Conflict brought other alterations in aircraft markings. After 10 June 1946, the insignia blue circle and border surrounding the star insigne were omitted when these markings were placed on a sea blue, dark blue, or a black background.. The adoption of the present national emblem took place on 14 January 1947 with the addition of a red horizontal stripe centered in each of the white rectangles at each side of the blue circle. The width of the stripe equalled one-sixth of the star's radius. Once again the marking bore the three colors of the nation's flag. As during the previous decades, dimensional limits changed occasionally after the selection of the tri-color "star and bar" marking.[55]

Special identity markings, "buzz numbers," for fixed-wing aircraft operating within the boundaries of the United States were authorized after 7 June 1946. Two letters followed by a dash and three numerals appeared on the lower surface of the left wing and, if relocation of the national insignia wasn't required, on each side of the fuselage. The first letter identified the type of aircraft, the second letter the model, and the digits represented the last three numerals of the serial number. A P-38J with serial number 42-67126 would be marked PA-126, while an A-26B attack bomber number 43-22465 would be marked as AC-465. By 1955, these identification markings appeared only on the fuselages of fighters, trainers, light bombers, and liaison aircraft including those assigned overseas but excepting National Guard and Army planes. The minimum size for these figures was eight inches by 12 with a maximum size of 32 inches by 48 inches. A change in the technical order eliminated use of these marks on 5 January 1965, however.[56]

Swept-wing fighters employed during the Korean Conflict appear in photos displaying wing insignia with one point of the star pointing directly forward. A specification change dated 15 September 1954 assured uniformity as it outlined the procedures for proper alignment. Henceforth, a line through the top point and the star's center would be perpendicular to a line formed by the constant 50 percent chord line of the wing which passed through the center of the star.[57]

Aircraft assigned to specialized mission roles during the 1950's and 1960's provided numerous exceptions to the usual Air Force marking and painting practices. Unable to bear the wing markings required for fixed-wing aircraft, helicopters were marked with four national insignia positioned so as to be visible from the sides, below, and from above. Thermal resistant finishes for aircraft were authorized with the advent of the nuclear era. All planes programmed to participate in thermonuclear testing were given added protection by the use of a white enamel thermal resistant paint on the undersurfaces authorized in July 1959. No nationality markings were applied to this finish. A solar resistant cap of white paint on the upper surface of the cabin hull of military personnel carriers helped to reduce interior temperatures subsequent to its authorization in November 1956, following an example set by commercial airlines.[58]

Unique color arrangements also appeared on other special purpose aircraft. A black finish was authorized on intruder aircraft such as the B-57; B-29's flying predominately night raids during the Korean Conflict displayed black undersides, contrasting with the natural aluminum-colored

upper areas. Drone airplanes were given a bright, insignia red overall paint job; after 8 January 1961, drones and remotely-controlled target aircraft or missiles were painted a conspicuous fluorescent orange color.[59]

The difficult task of locating aircraft forced down in snow-covered areas was eased somewhat by the use of a special color scheme during the 1950s for most aircraft assigned to operate during any part of the year in or through any portion of the cold weather area outside the zone of the interior. Insignia red paint applied to the upper and lower surfaces of the outer wing sections covered 25 percent of the wing span while the entire aft portion of the fuselage from the tip of the tail forward for about one-fourth of its length was similarly painted. Red stabilizers completed the colorful yet functional appearance. After mid-1959, fluorescent paint was authorized to replace the insignia red enamel or lacquer.[60]

Air attache planes bore unique markings as did search and rescue aircraft. The standard marking for the former was an American flag painted on both sides of the vertical stabilizer. Since the World War II period, search craft were identified by orange-yellow areas outlined in black on wings, fuselage, and tail and black "RESCUE" markings. Until 25 March 1965, Air National Guard aircraft bore special markings, but after that date they were authorized to display standard Air Force markings and finishes.[61]

Between June 1957 and May 1958, 1,600 aircraft assigned to the Air Training Command received conspicuity markings as part of a test program designed to lessen the frequency of mid-air collisions. These planes were marked with "blaze orange" fluorescent paint on tails, nose, and

wing tips. With certain exceptions, after 11 May 1959 all USAF aircraft were to receive conspicuity markings consisting of four or six-foot bands about the nose, aft fuselage, and wing tips or center line tip tanks or pods. Those exempted included active combat force strike aircraft, helicopters, century-series fighters, and delta wing aircraft. Air attache, Military Assistance Advisory Group, and Air Force liaison aircraft were later exempted, also. Experience revealed that the flourescent red-orange color offered approximately a 25 percent increase in service life over the fluorescent yellow. Although planes bore these dashing red-orange markings for several years, the paint was hurredly removed from those aircraft alerted during the Cuban crisis in 1962.[62]

Specific Air Force wing markings had not been authorized since the service's elevation to departmental status in July 1947. Service markings were restored on 16 May 1955 with "USAF" appearing on the lower surface of the left wing and again on the upper face of the right, thus balancing the placement of the "star and bar" insignia on the wings. The height and location of these letters were to correspond as far as possible with the national star insigne appearing on the opposite wing. On aluminized finishes, these letters were to be painted in blue or black, in red paint on black surfaces, and in white on red drone aircraft. Using a similar color arrangement, "U. S. AIR FORCE" was added to each side of the fuselage with the aircraft's configuration dictating the position as outlined in the specific technical order for each aircraft model. The size and location of the letters were to be the same on all aircraft

of the same model, however. Serial numbers and the model designation with the words "U. S. AIR FORCE" stenciled in one-inch letters continued to appear on all Air Force planes on the left side of the fuselage near the pilot's compartment.[63]

Radio call letters had first appeared in 1941 on Army Air Corps planes; their use continued into the 1960's. By 1955, the minimum number of numerals had been increased from four to five. "0-" placed before the first number identified an aircraft that was older than 10 years and precluded duplication of call numbers. After 15 July 1959, the number of digits was set at five, being the last five figures of the serial number. This marking reflected the last figure of the contract year only if the serial number consisted of fewer than five numbers. The technical order no longer exempted primary trainers from the requirement to display call numbers; use of the "0-" on older aircraft continued. Throughout this period, rotary-wing aircraft bore their call numbers on the fuselage.[64]

During the Korean Conflict, a bare metal finish had been almost universal on Air Force planes, as the slight increase in speed of the unpainted aircraft was more advantageous than the concealment potential. The involvement of Air Force planes a decade later in the war in Vietnam brought about the reappearance of colorful camouflage finishes. By the fall of 1965, many of the combat and support aircraft being assigned to Southeast Asia were receiving mottled tan, olive drab, and dark green color schemes as dictated by the individual aircraft's mission and configuration. Camouflaged aircraft after 31 March 1966 were authorized

to show the star and bar insigne in a 15-inch size on both sides of the fuselage and on the upper left wing. Four months later on 22 July, the Pacific Air Force received permission to deviate from the requirement to paint the undersides of camouflaged planes gray and to substitute black. A similar prerogative was granted to the Strategic Air Command so it might use black on the undersides of the B-52's operating in the Southeast Asian theater. "U. S. Air Force" was eliminated from camouflaged fuselages and the letters "USAF" were moved from the wing to the tail in reduced size. The star and bar emblem reappeared on the underside of the right wing on camouflaged aircraft after January 1967.[65]

Air Force missiles normally carried the same national markings as did their manned counterparts, although their configuration obviously demanded variations in placement and size. Missiles with wings or guide vanes, such as the Bomarc, displayed the national insignia on the top left and lower right wing surfaces. When a missile's configuration permitted, the national insignia was placed midway between nose and tail and "U. S. AIR FORCE" one-eighth of the overall missile length from the nose. The Air Force authorized the elimination of the national insignia from the fuselage after 30 October 1959, if there was not enough space for the emblem and the "U. S. AIR FORCE" markings.[66]

Fuselage insignia on horizontally viewed missiles were to be positioned so that a line through the top star point and the insignia's center was perpendicular to the missile's longitudinal line. Vertically viewed missiles, those seen in an attitude of 60 degrees or greater to

the horizon, were marked with "U S AIR FORCE" (without periods) as near to the nose as practical. The national insignia was to be located so that a line through the top star point and the center of the design would be parallel to the missile's longitudinal center line.[67]

All markings except for the serial number were eliminated from operational ballistic missiles in 25 and 100 pounds per square inch hardened configurations following an 8 January 1961 change to the technical order covering aircraft and missile markings. These same missiles were to carry all identification markings when on public display and in parades, or when appearing in publicity photos and in training films, however, this order was extended on 6 January 1965 to eliminate all missile markings except for serial numbers and engine warning stripes. Those used for display, training, or publicity purposes would continue to bear all Air Force identification markings including the national star insigne.[68]

1. "The United States Army Air Arm, April 1861 to April 1917," USAF Historical Studies: No. 98, May 1958, pp. 196-197; Aircraft Camouflage and Markings 1907-1954, Bruce Robertson, Garden City Press Limited, Letchworth, Herts, 1959, p. 54, hereinafter cited as Robertson.

2. Ltr., Col. H. H. H. Clark, USAF (Ret) to Royal D. Frey, (no subject), 10 Sept. 1967.

3. Robertson, p. 51; "Development of National Aircraft Insignia for the USAAF and USAF 1915-1956," John C. Durand, Journal of the American Aviation Historical Society, Oct.-Dec. 1956, p. 120, hereinafter cited as Durand; ltr., Charles R. D'Olive to Royal D. Frey, (no subject), 4 July 1967.

4. "History of the Air Corps Insignia," Col. Edgar S. Gorrell, (copy), U. S. Air Service Magazine, Feb. 1933, p 31, hereinafter cited as Gorrell.

5. Gorrell, p. 31; War Department Stencil No. 2, Office of the Chief Signal Officer, approved 19 May 1917, hereinafter cited as Stencil No. 2.

6. U. S. Army Specification No. 24,102-A, 1917-10-15, hereinafter cited as Specs.

7. Stencil No. 2.

8. Gorrell, p. 31.

9. Durand, p. 120; U. S. Army Stencil No. 1063, 15 March 1918; U. S. Army General Order No. 299, 8 Feb. 1918, hereinafter cited as General Order No. 299.

10. Durand, p. 120; Spec. No. 24-102-C, 22 April 1918.

11. Profile Publications No. 37, Curtiss JN-4, p. 10; General Order No. 299.

12. War Department Orders No. 38, 30 August 1919; Spec. No. 24,102-C, 22 April 1918; Spec. No. 24-105-C, 20 May 1919; "U. S. Army Air Force Airplane Markings," Peter M. Bowers, Air Progress, 1957-1958, (no page no.), hereinafter cited as Bowers.

13. Bulletin of the Information Section, Air Service, A. E. F., 7 May 1918; "Squadron Markings of the Air Service, AEF," Thomas G. Miller, Jr., Cross & Cockade, Summer 1964, p. 145.

14. Ibid.

15. Bulletin of the Information Section, Air Service, A. E. F., 7 May 1918.

16. Balloon Notes, A. E. F., No. 41, 19 July 1918.

17. War Department Orders No. 20, 17 May 1919, hereinafter cited as Orders No. 20.

18. Rpt., "Report on Comparative Merits of Various Insignia," Air Service Information Circular, 20 August 1920, prepared by Engineering Division, McCook Field.

19. Orders No. 20.

20. Camouflage '14-18 Aircraft, O. G. Thetford, Harborough Publishing Co., Ltd., Leicester, (England), 1943; "Escadrille Lafayette", H. Hugh Wynne, Cross & Cockade, Spring 1961, p. 12; Cross & Cockade, Summer 1961, p. 154.

21. Spec. No. 98-24102-G, 21 Jan. 1926.

22. Spec. No. 2,050, 25 May 1920.

23. Spec. No. 2,050-A, 20 Jan. 1923.

24. Spec. No. 98-24102-H, 24 Jan. 1927.

25. Spec. No. 98-24,105-H, 31 Jan. 1925; Spec. No. 98-24,105-J, 10 Feb. 1927; Spec. No. 98-24,105-M, 3 Dec. 1930; Spec. No. 98-24,105-L, 25 Jan. 1929; Bowers; T. O. 07-1-1, 25 Aug. 1944; U. S. Army Technical Order 01-1-16, 15 Oct. 1926, hereinafter cited as T. O.'s; T. O. 01-1-16, 18 Oct. 1927;

26. T. O. 01-1-16, 4 Feb. 1924; T. O. 01-1-16, 15 Oct. 1926; T. O. 01-1-16, 18 Oct. 1927; Spec. No. 98-24,105-J, 10 Feb. 1927; Spec. No. 98-24,105-M, 3 Dec. 1930.

27. "U. S. Army Aircraft Color Schemes," Peter M. Bowers, Air Trails Model Annual, 1957; ltr., Brig. Gen. H. C. Pratt to Chief of the Air Corps, subj: Color Scheme for Army Airplanes, 31 Jan. 1934; Wright Field Materiel Division, Routing and Record Sheet, subj: Ltr. from Second Corps Area, Sept. 15th (1938).

28. Spec. No. 98-24113, 23 May 1934; Spec. No. 98-24113-A, 9 Sept. 1938.

29. Ltr., Maj. K. B. Wolfe, Chief, Production Engineering Section, to Chief, Field Service Section, subj: Advance Training Airplanes, 14 Oct. 1940, hereinafter cited as Wolfe ltr.; Spec. 98-24113A, Amendment No. 1, 10 Jan. 1940; Spec. 98-24113A, Amendment No. 2, 1 May 1941.

30. T. O. 07-1-1, 5 Jan. 1938.

31. Ibid.

32. Ibid.; "Identification of Army Aircraft," Roger F. Parkhill, Air Trails, Nov. 1939, pp. 17, 48.

33. T. O. 07-1-1, 8 April 1940; T.O. 07-1-1, 15 May 1940; T. O. 07-1-1, 28 Oct. 1941; T. O. 07-1-1, 25 Aug. 1944.

34. T. O. 07-1-1, 23 Jan. 1933; rpt., "Report on a Water Paint Camouflage Coating for Airplanes," Materiel Division, Air Corps, Wright Field, 24 July 1930.

35. T. O. 07-1-1, 23 Jan. 1933.

36. Ibid.

37. Rpt., "Engineering Section Memorandum Report on Camouflage Study for Desert Regions of Southwestern United States," 9 May 1935; rpt., "Engineering Section Memorandum Report on Winter Camouflage with Snow Cover," 30 April 1934.

38. Spec. No. 24114, 22 Oct. 1940.

39. T. O. 07-1-1, 8 April 1941.

40. T. O. 07-1-1, 1 June 1942; Wolfe ltr.; Spec No. 98-24113-A, Amendment No. 4, 20 July 1942.

41. "9th Air Force in the Desert," Kenn C. Rust, Journal of the American Aviation Historical Society, Winter 1964, pp. 275-277, hereinafter cited as Rust article.

42. T. O. 07-1-1A, 10 July 1942; Spec. No. 24114-A, 4 Sept. 1942.

43. T. O. 07-1-1, 1 June 1942; T. O. 07-1-1, 15 June 1943.

44. "Notes on the Black Flight," Wayne R. Braby, Cross & Cockade, Winter 1965, p. 353; Air Service Information Circular, "Report on Comparative Merits of Various Insignia," 20 Aug. 1920.

45. Aircraft of the Fighting Powers, Vol. V, 1944, Harborough Publishing Co. Ltd., Leicester (England), p. iiii; Spec. No. 24114, 22 Oct. 1940.

46. Spec. No. 24114, 22 Oct. 1940; Spec. No. 24114, Amendment No. 1, 18 Dec. 1940; Spec. No. 98-24015-Q, 1 Oct. 1942; Spec. No. 98-24105-Q, Amendment No. 1, 2 Nov. 1942; T. O. 07-1-1A, 10 July 1942.

47. Durand, plate no. 4; Spec. No. 98-24105-K, Amendment No. 3, 28 May 1942.

48. Rust article, p. 275; G-2 Report No. 38854, "Camouflage of Aircraft," 6 July 1937, from Military Attache, London; Flight to Everywhere, Ivan Dmitri, McGraw-Hill Book Co., Inc., New York, 1944, pp. 113, 120, 129, 133; Aircraft Markings of the World, 1912-1967, Bruce Robertson, Harleyford Publications, Ltd., Letchworth, Hertfordshire, England, 1967, p. 189.

49. Durand, pp. 121-127.

50. Spec. No. AN-1-9a, 20 June 1943.

51. Ibid.

52. Ibid.

53. Spec. No. AN-1-9b, 14 August 1943; T. O. 07-1-1, 26 Dec. 1943.

54. T. O. 07-1-1, 26 Dec. 1943; T. O. 07-1-1, 6 June 1946; ltr., Maj. Alfred H. Johnson, Chief, G. F. E. Branch, Production Engineering Section, to Chief, Specification Branch, Production Engineering Section, Wright Field, subj; Air Corps Specification No. 24114, Amendment No. 3, dated May 9, 1941, Camouflage Finishes for Aircraft, 14 August 1941; T. O. 07-1-1, 25 April 1944.

55. Spec. No. AN-1-9b, Amendment 1, 10 June 1946; Spec. No. AN-1-9b, Amendment 2, 14 Jan. 1947.

56. T. O. 07-1-1, 7 June 1946; Spec. No. MIL-M-25047 (USAF), 16 May 1955; T. O. 1-1-4, change dated 6 Jan. 1965.

57. Spec. No. MIL-1-6140A (ASG), 15 Sept. 1954.

58. T. O. 1-1-636, 1 Nov. 1956; T. O. 1-1-636, 15 July 1959; T. O. 1-1-636, 24 Feb. 1960; T. O. 1-1-636, change dated 8 Jan. 1961.

59. T. O. 1-1-636, change dated 8 Jan. 1961.

60. T. O. 1-1-636, change dated 24 Feb. 1960.

61. T. O. 1-1-636, change dated 8 Jan. 1961; "Finishes and Markings on USAF Aircraft," George J. Letzter, Journal of the American Aviation Historical Society, Spring 1960, p. 30, hereinafter cited as Letzter article; T. O. 1-1-4, change dated 25 March 1965; T. O. 07-1-1, 7 June 1946.

62. Letzter article, p. 26; T. O. 1-1-667, 11 May 1959; T. O. 1-1-667, 15 March 1960.

63. T. O. 1-1-636, change dated 8 Jan. 1961; Spec. No. MIL-M-25047 (USAF), 16 May 1955.

64. Spec. No. MIL-M-25047 (USAF), 16 May 1955; T. O. 1-1-636, 15 July 1959.

65. Air Force Times, 20 Oct. 1965; T. O. 1-1-4, change 2, 22 July 1966; T. O. 1-1-4, 19 Jan. 1967.

66. T. O. 1-1-636, 15 July 1959; T. O. 1-1-636, change dated 8 Jan. 1961.

67. T. O. 1-1-636, change dated 30 Oct. 1959; T. O. 1-1-4, change 2, 22 July 1966.

68. T. O. 1-1-636, change dated 8 Jan. 1961; T. O. 1-1-4, change dated 25 March 1965.

CHRONOLOGY

Mar-Aug. 1916:	1st Aero Squadron "Jennies" supporting the Mexican Punitive Expedition displayed red five-pointed star rudder insigne.
19 May 1917:	First national insigne approved for Army Signal Corps aircraft, consisting of a red-centered star within a blue circle for use on wings. Rudder marking consisted of three vertical bands of red, white, and blue, with blue closest to the rudder post.
11 Jan 1918:	Joint Army and Navy Technical Aircraft Board adopted new wing insigne for use in Europe composed of concentric red, blue, and white circles.
8 Feb. 1918:	Tail marking altered to place red stripe at rudder post and blue stripe at rear of rudder.
7 May 1918:	Air Service bulletin of this date outlined standard squadron markings approved for use by American combat aircraft in Europe.
20 May 1918:	"SC" prefix added to serial number on Signal Corps aircraft.
15 July 1918:	AEF Headquarters approved use of Air Service insignia on all captive balloons.
17 May 1919:	War Department ordered a return to use of national star insign no later than 1 January 1920.
30 Aug. 1919:	Serial number prefix changed from "SC" to "AS" to signify Air Service. All Air Service aircraft directed to display serial number on fuselage in 14-inch figures.
25 May 1920:	National insigne adopted for heavier-than-air craft was approved for use on non-rigid airships.
20 Jan. 1923:	"U. S. ARMY" marking approved for use on airships and spherical balloons.
4 Feb. 1924:	"U. S. ARMY" approved for use on underside of wings and on fuselage at discretion of station commanders.
31 Jan. 1925:	Serial number was reduced in size to four-inch numerals and relocated in front of stabilizer. Aircraft model designation and manufacturer's name authorized to appear on rudder. Two-part serial number adopted indicating fiscal year in which airplane was ordered followed by number representing the sequence of purchase.
2 July 1926:	Air Corps Act redesignated Army Air Service as the Army Air Corps requiring change in serial number prefix from "A. S." to "A. C."

15 Oct. 1926:	"U. S. ARMY" marking on underside of wings and on fuselage above serial number became mandatory for all Army aircraft in service.
1927:	Approved color for wings and tail changed to yellow on Army planes although fuselage retained former olive drab color.
24 Jan. 1927:	New rudder insigne adopted consisting of one vertical blue stripe and 13 horizontal stripes of alternate red and white.
18 Oct. 1927:	Maker's name and aircraft type designation marking moved from rudder to fuselage in four-inch figures.
1930:	Light blue replaced olive drab fuselage color on observation planes and on primary and basic trainers.
3 Dec. 1930:	Manufacturer's name eliminated from fuselage and serial number relocated in an information block near cockpit in one-inch figures.
23 May 1934:	"Light Blue" adopted for fuselage, cowling, struts, and wheel pants on Army aircraft. Wings and tail remained yellow.
5 Jan. 1938:	Special identification markings in the form of cowl markings, fuselage stripes, and letter and number designators were authorized for all aircraft assigned to GHQ Air Force to identify them as to organization and tactical function. By mid-1940 designators appeared on all Air Corps aircraft.
9 Sept. 1938:	Aluminum finish adopted for tactical aircraft.
22 Oct. 1940:	Camouflage finish adopted for tactical planes (olive drab upper surfaces and neutral gray undersides). National marking eliminated from vertical tail surfaces on camouflaged aircraft. Camouflaged planes authorized to display national star insigne on each side of fuselage and on upper left and lower right wing surfaces.
1 May 1941:	Aluminum finish authorized for advanced trainers constructed of wood and fabric. Those made of metal were to be finished naturally.
28 Oct. 1941:	Radio call letters replaced former designator symbols.
28 May 1942:	Red center eliminated from national star insigne.
1 June 1942:	Army authorized use of various camouflage finishes in specialized situations including "sand" for desert terrain.
10 July 1942:	"U. S. ARMY" no longer authorized for use on camouflaged wings.

20 July 1942:	Aluminum finish adopted for uncamouflaged aircraft including trainers formerly painted yellow and blue.
1 Oct. 1942:	Maj. Gen. Carl Spaatz, Eighth Air Force commander, authorized use of a two-inch yellow circle outlining star insignia on fuselage.
2 Nov. 1942:	"U. S. ARMY" no longer authorized for use on Army planes.
20 Feb. 1943:	VIII Fighter Command inaugurated use of special identification markings on P-47s due to similarity between P-47 and FW-190 configurations. These included white bands on engine cowling and tail surfaces with addition of national insigne on underside of left wing.
29 June 1943:	National insigne design revised with addition of a white rectangle outlined in red on each side of blue circle. Application of new marking was to be completed no later than 1 September 1943.
14 Aug. 1943:	Blue border substituted for red outline in newly adopted national insigne, completely eliminating red from the design. Dimensions for national insigne on night fighters limited to 25-inch maximum diameter with wing insigne on these aircraft fixed at a 25-inch diameter.
20 Dec. 1943:	IX Fighter Command authorized use of white bands on tail surfaces, wings, and spinners on P-51s to facilitate recognition. These markings were discontinued on 23 Mar 1944.
26 Dec. 1943:	Use of camouflage finishes discontinued except in special situations.
7 June 1946:	Identification markings reflecting aircraft type, model, and last three digits of serial number were approved for aircraft operating within the United States.
14 Jan. 1947:	Red horizontal stripe added to white rectangle at each side of national insigne.
15 Sept. 1954:	Wing insignia on swept-wing aircraft were ordered placed so that a line through top point of star and center of star would be perpendicular to a constant 50 percent chord line of wing.
16 May 1955:	"USAF" marking approved for use on lower surface of left wing and upper surface of right wing. "U. S. AIR FORCE" to appear on each side of fuselage.
1 Nov. 1956:	Solar resistant cap of white paint authorized for use on personnel transports to reduce cabin temperature.

15 July 1959: Use of thermal resistant paint authorized on undersides of aircraft scheduled to participate in thermonuclear testing. Number of digits in radio call number marking was set at five.

30 Oct. 1959: Removal of national insigne from missile fuselages authorized if space was limited.

8 Jan. 1961: All markings except serial number eliminated from operational ballistic missiles in 25 and 100 pounds per square inch hardened configurations. Drones and remotely-controlled target aircraft ordered painted flourescent orange color in place of insignia red finish.

6 Jan. 1965: All missile markings eliminated except serial numbers and engine warning stripes unless missile to be used for display, training, or publicity purposes. Fuselage identification markings identifying aircraft type, model, and last three digits of serial number were eliminated from aircraft.

25 March 1965: Air National Guard aircraft authorized to display standard USAF markings and finishes.

Sept. 1965: Camouflaged aircraft being assigned to Southeast Asia at this time.

31 March 1966: Camouflaged aircraft authorized to display star and bar insigne in a 15-inch size on both sides of fuselage and upper left wing. This insigne reappeared on underside of right wing after January 1967.

22 July 1967: Pacific Air Force given permission to substitute black for gray undersides on camouflaged aircraft. Strategic Air Command received similar option. "U. S. AIR FORCE" marking removed from camouflaged fuselages and "USAF" moved from wing to tail in reduced size.

1. JN-3's stationed along the Mexican border in 1916 display two different rudder markings.

2. Both the roundel used in Europe and the star insigne used in the U. S. appear on JN4-D's over Texas in November 1918.

3. Rickenbacker's camouflaged Spad XIII bears the numeral "1" on wing and fuselage identifying it as the number one aircraft in the squadron. The diagonal stripe on the upper left wing facilitated recognition from above by his squadron members.

4. The "BIRD-O-PREY" A-3A aircraft flown by Col. C. L. Tinker, commander of the 10th School Group. Fuselage marking is typical of the period from October 1927 to December 1930.

5. The star on the fin of this O-1C indicates its use by a brigadier general. The use of script instead of block letters on the rudder is unusual.

6. The lead P-35 is the 69th aircraft of the 1st Pursuit Group. Two parallel fuselage stripes designate the squadron commander's plane. The front edge of cowlings were painted either red, white, yellow, or blue.

7. P-36's of the 1st Pursuit Group display a variety of temporary camouflage patterns during maneuvers prior to World War II. The P-36 fourth from the left with a single vertical fuselage stripe is that of the commander of the "A" flight.

8. An O-52 photographed about 1940, the number 100 aircraft assigned to the 10th Air Base Squadron, illustrates the cowl, fin, and under wing markings of that period.

9. Pilots of the 8th Pursuit Group race to their P-39's during maneuvers in 1941. The designator markings on the fins were replaced by radio call letters after 28 October 1941.

10. A Y1B-17 finished with a temporary camouflage scheme about 1939. Such finishes were expected to resist weathering for about 30 days.

11. This B-17F miraculously brought its crew home without injury after colliding with a German fighter in 1943. The fuselage insigne is outlined in yellow to facilitate recognition.

12. B-24D's over the Ploesti oilfields on 1 August 1943 finished in "sand" color for desert service with a yellow insigne border.

13. The similarity of 8th Air Force P-47's and German FW-190's caused the addition of the national insigne to the underside of the right wing and white tail and cowl markings in February 1943.

14. Black and white recognition stripes were added to wings and fuselage on these P-51B's only hours prior to the Normandy invasion of June 6th, 1944.

15. B-26's return to Japan following a strike against Communist positions in Korea in May 1951. The letter type designation on the fuselage identifies the aircraft as to type ("BC" for B-26).

16. A white cap painted on this C-124A was authorized on 1 November 1956 to reduce cabin temperature.

17. Bands of flourescent paint about the fuselage and wing tips as displayed by these T-38A jet trainers lessened the change of mid-air collisions.

18. Conspicuity markings on this H-21 helicopter and SA-16 in the background provide a vivid contrast with the snow-covered landscape.

19. The national insigne appeared on camouflaged aircraft in Southeast Asia in reduced size as on this AC-47 "dragon ship".