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AD 422 693

OPERATIONAL TEST AND EVALUATION

CAMOUFLAGE AND CORROSION CONTROL (RF-101)

OCTOBER 1963

HEADQUARTERS
TACTICAL AIR COMMAND
United States Air Force
Langley Air Force Base, Virginia

Publication Review

This report has been reviewed and is approved

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Major General, USAF
Deputy for Operations

HEADQUARTERS
TACTICAL AIR COMMAND
United States Air Force
Langley Air Force Base, Virginia

FOREWORD

The authority for conduct of this test is contained in AFR 80-14. This test was conducted by the 363rd Tactical Reconnaissance Wing at Shaw AFB, S. C. The following persons were responsible for conduct of the test and preparing the final report:

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ABSTRACT

The use of camouflage paint on low flying reconnaissance aircraft provides a marked reduction in their detectability. Both camouflage patterns used in this test were extremely effective over verdant terrain, however, no effect was evident over highly reflective terrain.

The acrylic paint used in this test is similar to the standard Jetskin finish, therefore, it is assumed it will provide the same corrosion protection.

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1. INTRODUCTION: The application of camouflage paint on aircraft is not new. It is an extremely fundamental principle and when visual interceptions are to be performed, it is as effective today as it was early in combat aircraft history.

2. BACKGROUND: Increased emphasis has been placed on low level reconnaissance, primarily to avoid detection and interception by modern air defense systems. Without exception, due to the line-of-sight limitations of these systems, visual interception by a manned aircraft must be relied upon heavily as the primary means of combating the low-flying aircraft. In an attempt to further limit an enemy's capability to visually intercept low-flying reconnaissance aircraft, Tactical Air Command camouflaged two RF-101's and directed that they be employed on low level test missions.

3. DESCRIPTION OF THE TEST ITEM: The two RF-101's were each painted differently; however, the color scheme chosen was one which provided good "cover" against a verdant terrain. One aircraft was painted a black first coat followed by a dull green mixed with a small quantity of black for the final coat. The second aircraft was painted two coats of the green and black mixture and, in an attempt to break up the silhouette and distort distinctive lines, irregular splotches of reddish brown paint and alternate black were applied. In both cases the undersides of the aircraft were similarly painted, as were the external fuel tanks. Only minimum allowable insignia and necessary markings were applied; these were miniaturized and off-colored to reduce highlights. In all cases the paints used were acrylic materials designed to produce a lusterless finish.

4. PURPOSE OF THE TEST: To determine the relative visual detectability of camouflaged aircraft flying at low levels when viewed from above and contrasted with standard painted or unpainted aircraft.

5. SCOPE OF THE TEST: The test was directed toward the following determinations:

a. Effectiveness of these camouflage patterns over various terrains.

b. Relative effectiveness of the two camouflage patterns.

c. Durability of the paint when consistently flown at high speeds and low altitudes to include flight through precipitation.

d. Specific tactics which may be applicable or which may improve the effectiveness of the camouflage.

6. CONCLUSIONS AND RECOMMENDATIONS:

a. It is concluded that:

(1) Both of the camouflage patterns are extremely effective in reducing the intercept probability of low-flying reconnaissance aircraft operating over a verdant terrain.

(2) The basic color of the paint provides the visual concealment; however, vigorous patterns of appropriate colorings, to break up the aircraft silhouette and produce a motley effect, provides the best overall camouflage and are easiest to maintain.

(3) The predominantly dark colors used in the camouflage patterns provide no reduction in visual detectability when the aircraft is flying over highly reflective terrain.

(4) The acrylic paint materials used to effect camouflage are extremely durable even when the aircraft is operated at high indicated air speeds. Precipitation effects on the paint are minimum.

(5) The flight profile of the camouflaged aircraft should, as much as possible, present to an interceptor the most difficult problem, i.e., a target which blends in with the landscape.

b. It is recommended that:

(1) Tactical reconnaissance aircraft, which are to be employed at low altitudes, be painted so as to provide the best camouflage effect consistent with the terrain to be overflown.

(2) Future consideration be given to developing and incorporating into deployment fly-away kits geographically orientated paint kits for camouflaging of aircraft in overseas areas.

7. METHOD OF CONDUCTING THE TEST: A total of 15 sorties were flown on each of the camouflaged aircraft. In addition eleven sorties were flown by standard unpainted aircraft employed as the visual interceptor and to obtain relative comparisons as targets. A typical sortie involved both camouflaged aircraft (dull aircraft) and a standard aircraft (bright aircraft). In an attempt to obtain the maximum number of pilot opinions per mission and to evaluate all of the three possible combinations of two aircraft, i.e., dull-dull, bright-dull (plain) and bright-dull (splotched), prebriefed changes in aircraft tasks were effected. In this manner, during a sortie each pilot had the opportunity to make as many comparisons as

possible with the dull and bright aircraft as well as function as the low-flying reconnaissance aircraft or the higher-flying interceptor. The low level aircraft operated at 500 feet above the terrain using indicated air speeds from 360 knots to 450 knots. The interceptor was flown between 2000 feet and 5000 feet at indicated air speeds between 360 knots and 450 knots. Radar controlled intercepts were attempted on four missions; however, in spite of the excellent techniques of the controller, these intercepts were generally unsuccessful due primarily to the limited range of the radar with respect to the low-flying aircraft. All other test missions were flown using calculated separation techniques; one of the three pilots functioned as the mission director and upon his command a series of timed turns and pre-computed patterns were flown. In this way, as many as 12 intercepts were effected during one mission. The type intercepts were those most likely to be encountered, i.e., quartering and dead astern overtaking, head-on, and random from an orbiting search pattern. All except two missions were flown against a vegetated background varying from the dark hues encountered over swamps to varied patterns and reflectivities over southeastern U. S. farmland. During two sorties, evaluations were made in flights over coastal waters, also, two 2-ship sorties were flown by a dull and bright aircraft over the highly reflective terrain encountered in New Mexico and southwestern Texas. In all cases, the participating pilots were familiar with the concept of the test and as potential targets for day interceptors they were fully aware of the need for a truly reduced detectability.

8. TEST RESULTS AND DISCUSSION:

a. A total of 114 interceptions were made during the flight test, 17 of which occurred over water. Of this number, 52 were flown with the dull aircraft alone and 62 included dull and bright aircraft. Flight test data from 11 participating pilots in the form of qualitative assessments was the basis for the evaluation.

b. Without exception, all of the pilots stated that the camouflage provided a marked degree of concealment from visual detection when viewed from above.

c. Following are the results of the intercepts. Figure 1 shows the results of those intercepts in which only dull aircraft were targets; figure 2 is for those intercepts in which a bright aircraft was included as a target.

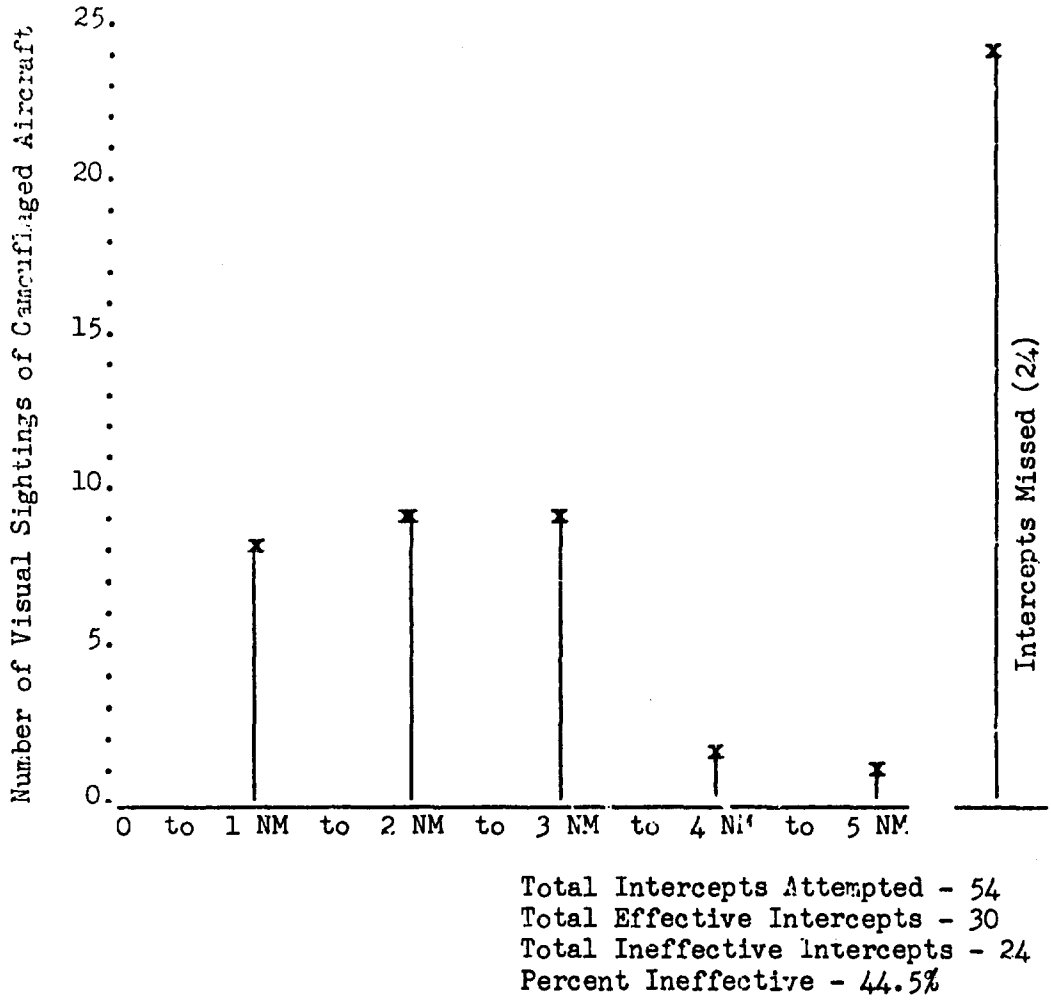
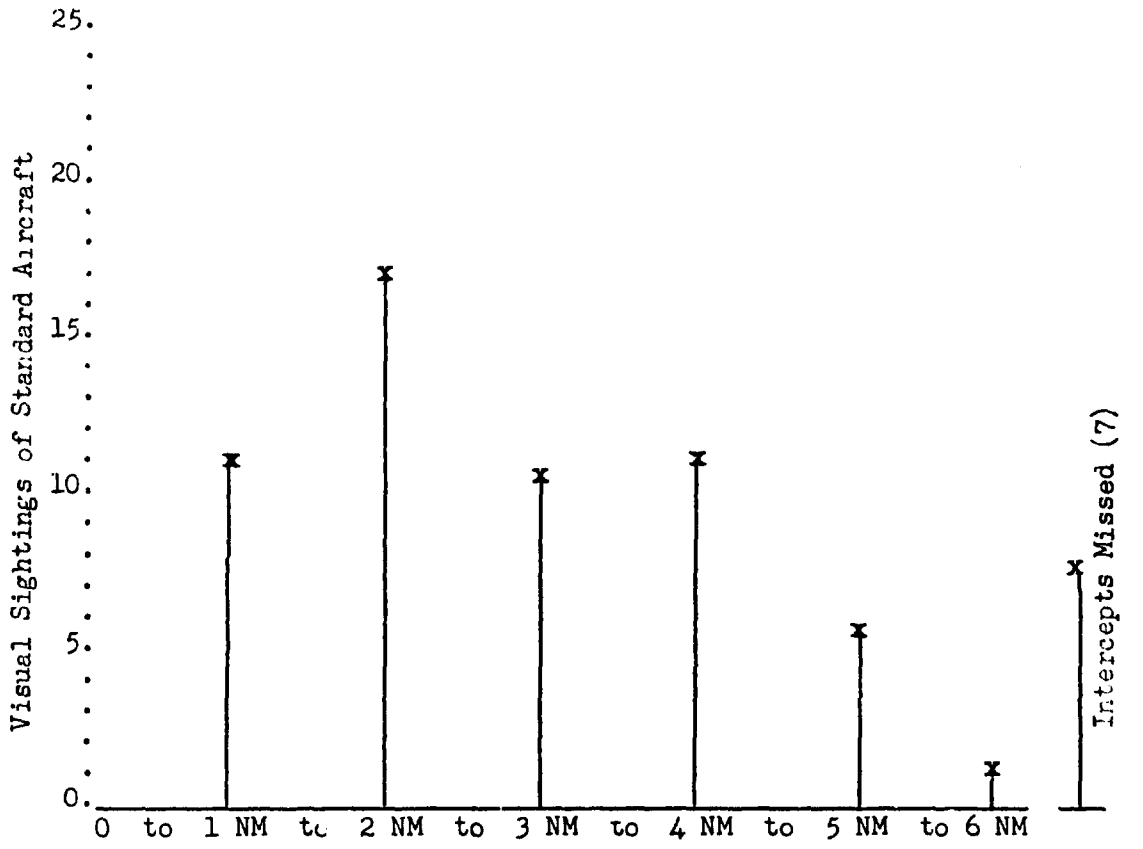


FIGURE 1. Results of Attempted Visual Interceptions of Camouflaged Aircraft (RF-101)



Total Number Interceptions Attempted-62
Total Intercepts Effective - 55
Total Intercepts Ineffective - 7
Percentage of Ineffective Intercepts-
11.3%

FIGURE 2. Results of Attempted Visual Interceptions of Standard Painted Aircraft (RF-101)

d. As shown by the graphic results, when sightings were effected the intercept distances of the dull and bright aircraft were approximately the same. However, that the dull aircraft was not seen on 44.5 percent of the attempted intercepts is considered to be the significant fact. This becomes more significant when compared to the bright target, which was missed on only 11.3 percent of the intercepts attempted. This degree of reduced detectability, attributed to the camouflage, was realized during interceptions on which the interceptor was constantly receiving azimuth and range information directly from the target aircraft pilot. This type of guidance is inherently more descriptive and timely than that which could be obtained from an intermediate source, such as a radar controller. In all cases, the interceptors were RF-101 aircraft and the intercept techniques were identical.

e. No extensive assessment was made of intercepts effected over water but pilot assessments pointed out that the dull aircraft was definitely more difficult to pick up than the bright aircraft.

f. The interceptions on which a dull and bright aircraft were flown in formation as targets provided interesting results. The bright aircraft invariably was seen first. On several of these intercepts, although the interceptor knew the dull aircraft was in close proximity to the sighted bright aircraft, he was unable to see it because of the blend-in with the terrain. During several of these sorties, the target aircraft became separated when the dull aircraft was visually "lost" by the pilot of the bright aircraft. On one intercept the bright aircraft was sighted at five miles; although the dull aircraft in the wing position was within 100 feet of the sighted bright aircraft, the dull aircraft was not seen until closure by the interceptor had reduced the range to less than one mile.

g. During the intercepts for which the targets were purely dull aircraft, oftentimes the intercepting pilot would see the targets, call them out, take his eyes off the targets, attempt to pick up the targets again and never succeed in the attempted re-acquisition. All the pilots felt that when the dull aircraft were beyond two to three miles, it was practically impossible to see them even when looking directly at them. With this condition, the intercepting pilot must wait until the target aircraft could be viewed against ploughed fields or other shadings of terrain which provided a contrast with the dull aircraft. At times the visual pickup of the dull aircraft was cued by reflections from the canopy. Pilots stated that the canopy of the dull aircraft looked like an air bubble floating on clear green water. Visual acquisition of the dull aircraft was easier when viewed from below and especially in heavy haze.

h. With respect to the paint, maintenance personnel readily accepted the camouflage. The frequency of aircraft washing was necessarily increased slightly due to the dull finish of the paint on which surface soilings accumulated easier. The maintenance people were quick to see the advantage of camouflage painting in corrosion control; routine chipping and scratching of the paint can be quickly repaired without particular care for extremely accurate matching of the spotting paint applied. The paint used, being acrylic, is composed of the same basic ingredients as is the Jetskin finish which is standard. Although no real assessment of the ability of this paint to provide corrosion control was made, since it is similar it can be expected to provide the same protection as does the Jetskin acrylic paint. It was the expressed opinion of the chief of maintenance of the organization possessing the camouflaged aircraft that his entire fleet should be camouflage painted.

i. The application of the camouflage paint to each aircraft required 3 days flow time, 150 manhours for stripping and cleaning, and 4 days flow time, 160 manhours for painting. Quantity of paint used was as follows: Camouflage paint 16 gallons; wash primer, 1 Kit; acrylic primer, 4 gallons and 18 gallons of thinner. The camouflage colors were mixed and application was directed by U. S. Army personnel from the Experimental Research and Development Labs at Ft. Belvoir, Virginia.

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