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Tech Tips

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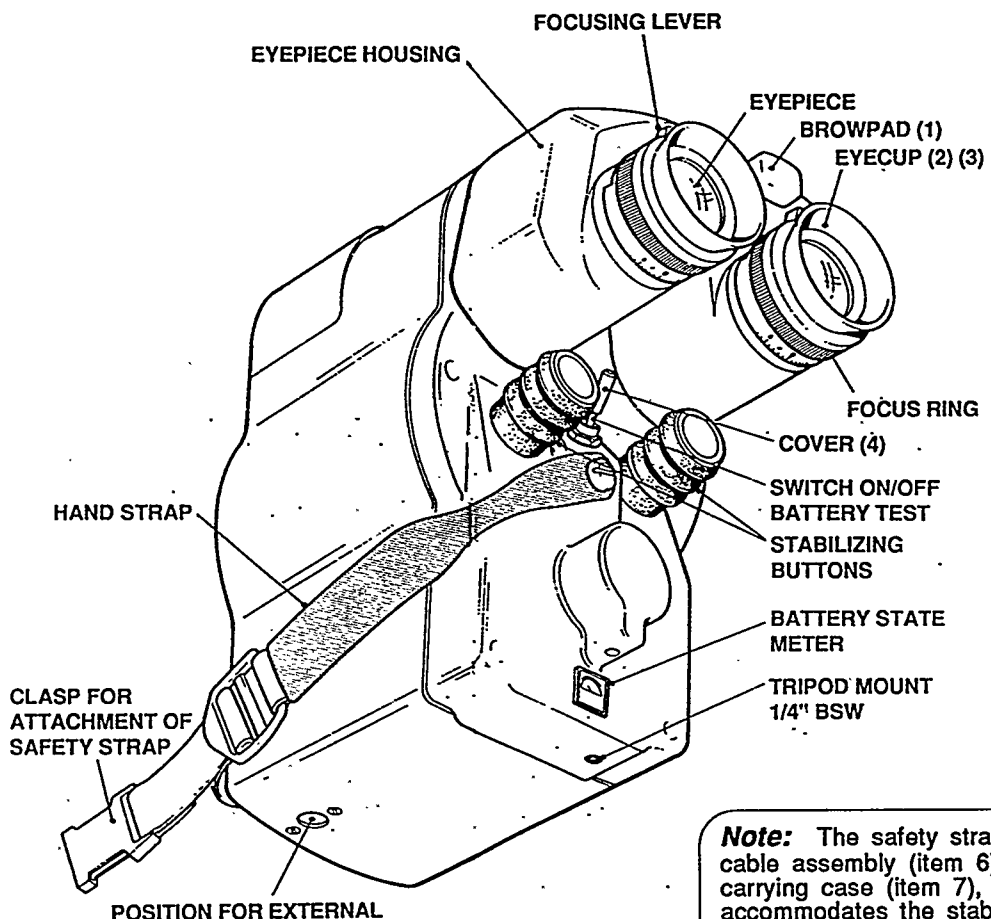
SMALL TARGET IDENTIFICATION—BINOCULARS VS. MONOCULARS

INTRODUCTION

In February 1984, the San Dimas Technology Development Center (SDTDC) reported (Report No. 8457 1202, "Small Target Identification") on the performance of British Aerospace Corporation (BAC), Precision Products Group, stabilized monoculars used as an aid for observing raptors and eggs in their nests by simulating as closely as possible, in a controlled manner, the actual conditions encountered during observation of raptors from fixed-wing aircraft. Since that report was issued, BAC has introduced three models of stabilized binoculars. The objective of the work described in this ***Tech Tips*** was to compare the performance of the proven monocular to one of the new binoculars.



Note: The safety strap (item 5), cable assembly (item 6), and the carrying case (item 7), which accommodates the stabilized binocular, are not illustrated.

Figure 1. Stabilized binocular rear view.

The BAC binoculars are available in 10, 12.5, and 14 power magnifications. However, only the 12.5X was available for this test. The field of view of the 12.5 power unit is 5 degrees. Stabilization of the line-of-sight is achieved with a gimbal-mounted mirror that is controlled by a battery-powered gyroscope. The binocular is lightweight (4.4 pounds), portable, and may be handheld in any attitude. Two eyepiece housings, with individual focusing adjustments of -5 to +5 diopters, are provided. There are left- and right-hand stabilizing buttons. Eyepiece separation (interocular distance) is adjustable from 58 to 72 mm. The maximum steering rate is at least 6 deg/sec in the stabilized mode. Figure 1 presents a rear view of the stabilized binocular.

TESTS

A flight test was conducted from a Cessna 182 to compare the performance of monoculars and the binocular. The stabilized optical units used in the test were:

1. Steadyscope GS 907-4E (S.N. 4094) monocular with a 10 power magnification. The left eye observes while the right eye is blanked off.

2. Steadyscope GS 907-5A (S.N. 0630) monocular with a 7 power magnification. The right eye observes while the left eye is blanked off.

3. Stabilized Binocular Type G.S. 982-03C (S.N. 12012) with a 12.5 power magnification.

Test Subjects

Three people participated in the flight test. Only observer R from the previous testing, reported in February 1984, was available for this current test. Observer P had previous experience using binoculars to make wildlife observations and, as in the original study, this experience proved to be of benefit in correctly identifying the target. Observer J had minimal experience with binoculars.

Test Procedure

The test procedure was the same as used in the 1984 test—a controlled observation of a Landolt C target while flying. The flight pattern was 500 feet above and 500 feet to the side of the target. The C was designed to have a contrast of 100 percent. The small, medium, and large targets were used for the observations. It should be noted that the significant dimension in the target is the gap. The gap was adjusted to one of four positions so that the observers could report the position to a technician on the ground.

Radio communication was maintained between the aircraft and the ground crew. The test site configuration was the same as in the original test. A ground speed of 75 to 80 mph was used for the data-gathering passes. All observations were made from the front right seat of the aircraft. The weather was hot and dry; visibility was in excess of 60 miles. Data were gathered on two separate days. For the first observations on both days the air was calm; but by the time the last observations were made, there was enough turbulence to begin to interfere with the observations.

TEST RESULTS

Observation Trials

The results of the observational trials are shown in table 1. A "correct observation" was scored when the observer acquired the target and correctly reported the position of the Landolt C. An observer's failure to acquire the target was counted as an attempt.

Table 1. Percent of attempts resulting in correct observations

Observer	Target	% Correct Observations 7X Monocular	10X Monocular	12.5X Binocular
J	Large	100 (n=4)	—	20 (n=5)
R	Medium	80 (n=10)	50 (n=4)	10 (n=10)
P	Medium	80 (n=10)	0 (n=4)	50 (n=8)

Note: n = No. of attempts

Optical Equipment Features

The following observations were made regarding the working aspects of the various binocular/monoculars:

1. The binocular ON/OFF switch can easily be inadvertently shut off between observations by rotating the left ocular lens, or when preparing to stow the instrument. There is no indication that the unit has been shut off, since the binocular still functions like a normal binocular and the lack of stabilization might go undetected.

2. The binocular was difficult to focus precisely. It displayed considerable paralax error until the interocular distance was precisely adjusted.

3. The levers on the ocular lens focus rings are good and handy. On the samples tested, some other binocular lens adjustments were too loose and changed by themselves.

4. The binocular can be used with one hand through the strap, but a second hand is needed for good control.

5. The binocular seems more susceptible to aircraft minor bumps that either monocular.

6. There was a major problem with the lens cap blowing over the lens on both the 7X and 10X monoculars during observations.

7. The monocular is clearly a two-handed instrument with good grip positions for both hands.

8. All units were handy and easy to use.

9. The monocular is physically longer; the binocular is taller.

10. All units are rugged and well constructed.

11. The operation of all units was not difficult. A certain skill level was required to be quick enough to make observations.

12. With both the binocular and the monocular, it was easy to acquire target at a distance and track inbound. The most common difficulty experienced was that from the time that one was close enough to distinguish the "C," any minor bumps would cause target loss and it was difficult to restabilize on the target quickly enough to determine the position of the C.

CONCLUSIONS

The trained observers had no trouble acquiring either the large or the medium Landolt C while using either monocular. In contrast, observations with the binoculars were plagued with missing the target. None of the observers were able to correctly identify the position of the small target.

Although the flight testing was of limited scope, certain conclusions may be reached regarding the relative suitability of the two systems. The 12.5 binocular is inferior to both the 7X and 10X monocular. The 7X monocular appears superior to the 10X monocular, but this is only a tentative conclusion due to the limited sample size. In general, field of vision seems to be more important than power. Training of the observers is very important. It was the impression of all three observers that even in the limited time that they flew with these instruments, their performance improved towards the end of their test session. Stabilization is definitely an asset compared to an unstabilized unit.

The monocular was easier to use and more consistent than the binocular. It also was judged less susceptible to aircraft minor bumps than the binocular.

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