



**Waggoner**

The Color Vision Testing Suite

Clinical Studies and Validation  
of Waggoner PIP24

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## Clinical Research & Studies: Waggoner PIP24

### Waggoner PIP24 Description

The PIP24 received its name because PIP represents pseudoisochromatic plates, the type of test images used to identify color vision defects, and the fact that the book has 24 plates in total. The PIP24 screens for protan (red weak), deutan (green weak), and tritan (blue/yellow weak) color vision deficient individuals. This test is the perfect choice when testing both adults and children because it has a section to test each demographic. This product is accepted and used by the U.S. Navy, Army, Marines, Coast Guard and FAA.

### Waggoner PIP24 Validation & Research Use

Capo-Aponte, J. E., Temme, L. A., Robinson, J., & Still, D. (2013, May). *The US Army Color Vision Study*. Presented at the Aerospace Medical Association.

#### Summary:

The objective of the study was to describe the effectiveness of commercially available color vision tests, using the anomaloscope as the gold standard. Effectively, the overall goal of the study is to gather information on color vision tests and then provide recommendations for color vision tests that that would be utilized by the U.S. Army. A total of 91 participants, 46 with normal color vision and 45 with a color vision deficiency were given a battery of 8 color vision tests. The Waggoner PIP24 had a sensitivity of 100% and a specificity of 100%, giving it the highest score among the 8 color vision tests. The PIP24 also had the lowest time to administer the test that other comparable test, making it more efficient to use.

Chidester, T., Milburn, N., Peterson, S., Gildea, K., Roberts, C., & Perry, D. (2013, September). Development, Validation, and Deployment of a Revised Air Traffic Color Vision Test: Incorporating Advanced Technologies and Oceanic Procedures and En Route Automation Modernization Systems. Office of Aerospace Medicine: Federal Aviation Medicine.

#### Summary:

The Aerospace Human Factors Research Division (AAM-500) of the Civil Aerospace Medical Institute developed the Air Traffic Color Vision Test (ATCOV) to determine whether individuals with color vision deficiencies (CVDs) have adequate color vision to perform critical color-related tasks involved in air traffic control. New research was required to integrate Advanced Technologies and Oceanic Procedures (ATOP, or Ocean21) and En Route Automation Modernization (ERAM) display systems into the ATCOV. The research team conducted a study to validate the addition of Ocean21 and ERAM items into ATCOV subtests. Several validated Waggoner color vision tests were used in this study to help detect color vision deficiencies, including the Waggoner PIP24, Waggoner HRR, and Waggoner CCVT.

Lester, H. (2010). Color Vision Testing. *Federal Air Surgeon's Medical Bulletin*, p. 4.

#### Summary:

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Dr. Lester, on behalf of the FAA, provides a list of all color vision tests that FAA aviation medical examiners can use when performing the annual medical examination on licensed pilots. Both the Waggoner PIP24 and Waggoner HRR are both accepted by the FAA for testing licenses pilots.

Makunyane, P. (2016). An update on diagnostic tests for colour vision defects in individuals working in the aviation industry : Back to basics. *Back to Basics. Occupational Health Southern*, 22(3), 12–16.

**Summary:**

To provide an update on colour-vision tests approved by the International Civil Aviation Organization and to highlight the importance of choosing appropriate colour-vision tests that can be used with confidence to detect colour-vision deficiency, to classify the type of deficiency involved, and to quantify the severity of loss. The authors recommend using either the Waggoner HRR or Waggoner PIP24 as a screening tool and the Waggoner CCVT as a secondary precision test.

Milburn, N., Chidester, T., Peterson, S., Roberts, C., Perry, D., & Gildea, K. (2013, May). *Pilot Color Vision Research and Recommendations*. Presented at the Aerospace Medical Association.

**Summary:**

This presentation explains the color vision test process, exceptions, procedures, and color vision tests that can be used by aviation medical examiners according to the FAA.

Walsh, D. V., Robinson, J., Jurek, G. M., Capó-Aponte, J. E., Riggs, D. W., & Temme, L. A. (2016). A Performance Comparison of Color Vision Tests for Military Screening. *Aerospace Medicine and Human Performance*, 87(4), 382–387. <https://doi.org/10.3357/AMHP.4391.2016>

**Summary:**

the overall goal of the study is to gather information on color vision tests and then provide recommendations for color vision tests that that would be utilized by the U.S. Army. A total of 133 military personnel were the participants of this study with a total of 68 individuals with normal color vision and 65 with a color vision deficiency. The Waggoner PIP24 demonstrated the highest sensitivity (98%) and specificity (98%) against all eight other color vision tests used within the study.

Rings, M., Picken, D., & Waggoner, T. (2014, March). *Validation of a Computerized Color Vision Test*. Presented at the Aerospace Medical Association, San Diego, CA.

**Summary:**

As the title points out, this study was completed to validate the Waggoner CCVT. The Waggoner CCVT was compared against the Nagel anomaloscope with 300 participants, 236 has normal color vision and 64 had a color vision deficiency. The Waggoner CCVT had a 100% sensitivity and 100% specificity. The Waggoner PIP24 was also used in this study and had a 100% sensitivity and 89% specificity.