

Use of the Colour Assessment and Diagnosis (CAD) Test for the testing and assessment of applicants for JAA Compliant Class 1 and 2 Medical Certificates and ATCO European Class 3 Medical Certificates

Background

Existing colour signal tests prescribed in JAR – FCL 3 are substantially an adoption of 19th Century maritime standards. They bear little relation to the aviation task, and the deficiencies of inter-test pass variability and test-retest validity are well known. These deficiencies lead to litigation by applicants and applicants seeking re-tests at multiple centres. In response to this issue the UK CAA sponsored a task analysis of the colour dependence of piloting tasks. This study was undertaken by Qinetiq and led to the publication of 2 papers in 2006; Part 1 The Use of Colour Signals and the Assessment of Colour Vision Requirements in Aviation and Part 2 Task Analysis.

Reference:

<http://www.caa.co.uk/application.aspx?catid=33&pagetype=65&appid=11&mode=detail&id=2408>
or

www.caa.co.uk → 'publications' → 'search for a publication' → type '2006/04' in search box.

This study demonstrated that the interpretation of the Precision Approach Path Indicator (PAPI) lights was one of the most colour safety critical piloting tasks.

Development of the Colour Assessment and Diagnosis (CAD) Test

Following on from this study the UK Civil Aviation Authority and the Federal Aviation Administration co-sponsored City University, London to develop a colour vision test appropriate for use in the assessment of medical certificate applicants that would determine whether an applicant's colour vision meets the minimum requirements for flight safety.

The City University team employed a Colour Assessment and Diagnosis (CAD) test to establish levels of colour deficiency. In this test the subject observes on a computer screen a pixelated background of changing shades of grey. Against this background a coloured pixel group of precisely known colour and colour signal strength appears and moves diagonally across the screen (Figure 1). The coloured pixels have the same luminance (brightness) as the grey background. The subject indicates that they have seen the direction of travel of the coloured pixels by clicking a button.

The use of an isoluminant background prevents the applicant using luminance cues to distinguish between colours. The use of varying colour signal strength establishes a threshold for the subject's colour vision. The CAD test has 100% sensitivity and specificity for separating colour deficient individuals from normal trichromats. From testing of normal trichromats a median chromatic sensitivity was established. This median is termed 1 Standard Normal Unit (SNU).

The CAD test quantifies accurately the severity of red /green and yellow / blue colour vision loss.

Pass/Fail Criteria for Pilot Medical Certification Assessment

The City University team constructed a PAPI simulator and established a level of colour deficiency at which subjects could interpret the PAPI at the same level of accuracy as normal trichromats. Deutans with less than 6 SNU and Protans with less than 12 SNU pass the PAPI test with the same accuracy as colour normals, and so these limits have been set as the pass/fail criteria for the test. Subjects that pass the test have sufficient overall chromatic sensitivity to undertake the wider colour related aviation tasks in addition to the PAPI task. Using these criteria 35% of colour deficient pilot applicants will pass the CAD test.

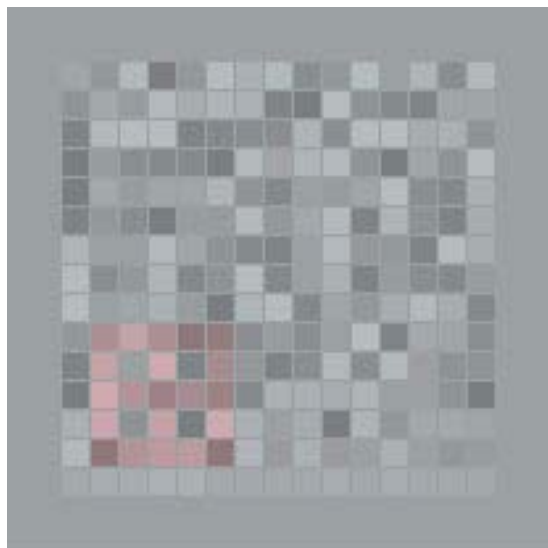


Figure 1: The CAD test. Coloured pixels projected against an isoluminant grey background

Pass/Fail Criteria for ATCO Medical Certification Assessment

The European Class 3 medical standard for ATCOs requires applicants to be normal trichromats. Hence, in contrast to the pilot medical standards, a degree of congenital colour vision deficiency is not acceptable. For those ATCO applicants failing any plates on the Ishihara test they will be tested on the CAD test and passed if they demonstrate normal trichromacy.

Reference

The full paper is available at www.caa.co.uk/caa_paper_200904. Ref: Civil Aviation Authority, Safety Regulation Group. Minimum colour vision requirements for professional flight crew. Recommendations for new colour vision standards. Paper 2009/04.

Regulatory Impact Assessment:

The introduction of an evidence based, task orientated, reasonable, fair and consistent test that has 100% sensitivity and specificity provides social benefit in preventing unfair refusal of certification to individuals with mild colour vision deficiency who are able to undertake the safety critical colour vision tasks required whilst exercising the privileges of a pilot's licence. .

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