Administrative Appeals Tribunal

DECISION AND REASONS FOR DECISION

[2015] AATA 93

Division	**GENERAL ADMINISTRATIVE DIVISION**
File Number	**2014/1361**
Re	**John O'Brien**
	APPLICANT
And	**Civil Aviation Safety Authority**
	RESPONDENT

DECISION

Tribunal	**The Honourable Justice Benjamin** **Dr W Isles, Member**
Date	**20 February 2015**
Place	**Brisbane**

The Tribunal varies the decision of the Civil Aviation and Safety Authority dated 7 March 2014 and the conditions attached to the applicant's class 1 medical certificate by providing:

(a) The class 1 medical certificate is only valid for operations within Australia;

(b) The applicant is not permitted to conduct night time operations other than as or with a qualified co-pilot; and

(c) The applicant must disclose to his employer, any person lawfully training, assessing, endorsing or re-endorsing him on any aircraft in respect of his Air Transport Pilot Licence, and other assigned flight crew members of his colour vision deficiency.

..........................[Sgd]..

The Honourable Justice Benjamin

CATCHWORDS

CIVIL AVIATION – progression from co-pilot to captain – progression from co-pilot to pilot in command – progression from first officer to officer in command – colour vision deficiency (CVD) – protanopia – protanope – Air Transport Pilot (Aeroplane) Licence (ATPL) – Commercial Pilot (Aeroplane) Licence (CPL) – conditions imposed on class 1 Civil Aviation medical certificate – conditions imposed on applicant – Colour Assessment and Diagnosis (CAD) test – Precision Approach Path Indicator (PAPI) – Pseudo-isochromatic Plates (PIP) – Ishihara plates – lantern tests – applicant does not meet medical standard – failure to meet medical standard not likely to endanger the safety to air navigation – decision varied – conditions attached to class 1 Civil Aviation medical certificate varied – only valid for operations within Australia – applicant not permitted to conduct night time operations other than as or with qualified co-pilot – applicant must disclose colour vision deficiency to specified persons.

LEGISLATION

Civil Aviation Act 1988 (Cth)

CASES

Re Denison and Civil Aviation Authority (1989) 19 ALD 607

Re Becker and Minister for Immigration and Ethnic Affairs (1977) 1 ALD 158; [1977] AATA 12

Re Pape and Secretary, Department of Aviation (1987) 16 ALD 97; [1987] AATA 354

SECONDARY MATERIALS

Civil Aviation Safety Regulations 1998 (Cth), regs 11.055, 67.010, 67.150, 67.165, 67.180

Milburn NJ, Gildea KM, Perry DL, Roberts CA and Peterson LM, "Usability of Light Emitting Diodes in Precision Approach Path Indicator Systems in Individuals With Marginal Color Vision" (Civil Aerospace Medical Institute, Federal Aviation Administration, 2014)

National Transportation Safety Board, Collision With Trees on Final Approach Federal Express Flight 1478, Boeing 727-232 athttp://www.ntsb.gov/investigations/AccidentReports/Pages/AAR0402.aspx

Squire TJ, Rodriguez-Carmona M, Evans AD and Barbur JL, "Color Vision Tests for Aviation: Comparison of the Anomaloscope and Three Lantern Types", (2005) 76(5) Aviation Space and Environmental Medicine 421-429

UK Civil Aviation Authority "Minimum Colour Vision Requirements for Professional Flight Crew – Part 1: The Use of Colour Signals and the Assessment of Colour Vision Requirements in Aviation" (UK Civil Aviation Authority, 2006)
UK Civil Aviation Authority "Minimum Colour Vision Requirements for Professional Flight Crew – Part 2: Task Analysis" (UK Civil Aviation Authority, 2006)
UK Civil Aviation Authority, "Minimum Colour Vision Requirements for Professional Flight Crew – Recommendations for New Colour Vision Standards" (UK Civil Aviation Authority, 2009)
United States Federal Aviation Administration, "Guide for Aviation Medical Examiners", (United States Federal Aviation Administration, 2013)
Watson DB, "Lack of International Uniformity in Assessing Colour Vision Deficiency in Professional Pilots" (2014) 85(2) Aviation, Space and Environmental Medicine 148-160

REASONS FOR DECISION

The Honourable Justice Benjamin
Dr W Isles, Member

20 February 2015

INTRODUCTION

1. In 1989, a decision made in the Administrative Appeals Tribunal in *Re Denison and Civil Aviation Authority* (1989) 19 ALD 607 ("*Denison*") made it possible for some pilots whose eyesight is affected with forms of colour vision deficiency ("CVD") to be licenced to fly, or operate, aircraft as commercial pilots. *Denison* was expressed to be a 'test case' and a significant amount of evidence was received in relation to CVD and its impact on pilots in a commercial sense.

2. This review is an application by John O'Brien, a commercial pilot who has vision which is affected with the CVD 'protanopia', to be granted a class 1 medical certificate (class 1 Civil Aviation medical certificate) to enable him to exercise the privileges of an Air Transport Pilot (Aeroplane) Licence ("ATPL"). The Civil Aviation Safety Authority

("CASA") is aware of Mr O'Brien's CVD and has, over a number of years, conditionally approved him to fly regular public transport aircraft as a first officer.

3. Mr O'Brien now wishes to work as an airline captain, or pilot in command, with an unconditional ATPL.

4. On 7 March 2014[1] a delegate of CASA made a decision which imposed conditions on Mr O'Brien's class 1 medical certificate,[2] namely that:[3]

> 1 *[it was n]ot valid for ATPL operations[;]*
>
> 2 *[it was o]nly valid for operations within Australia[;]*
>
> 3 *The [applicant] is not permitted to conduct night time operations other than as or with a qualified co-pilot[;]*
>
> 4 *The [applicant] must disclose to his employer and other assigned flight crew members his colour vision deficiency[; and]*
>
> 5 *The [applicant] is limited to operating… specified aircraft unless otherwise approved in writing by CASA.*

5. We will refer to these as condition 1, condition 2, condition 3, condition 4, and condition 5, respectively.

6. Mr O'Brien objects to these conditions, or any one of them, being imposed upon his medical certificate and has sought an administrative review of the decision which imposed them.

7. The impact of the considerations are:

   (a) Condition 1 – Mr O'Brien may only fly as a co-pilot or first officer.

   (b) Condition 2 – limits his flying to within Australia.

   (c) Condition 3 – imposes a restriction that he must only fly at night with another qualified pilot or co-pilot.

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[1] Exhibit 1A, T3, p 5.

[2] Mr O'Brien's class 1 medical certificate that expires 7 January 2015 – Exhibit 1A, T55, p 944.

[3] See above n 1, p 6.

(d) Condition 4 – requires that he must disclose his CVD to his employer and other assigned flight crew members.

(e) Condition 5 – only Mr O'Brien could operate aircraft upon which he is endorsed. The effect of this condition is to add a 'double endorsement' for Mr O'Brien to operate aircraft. As such he would be required to undertake the normal requirements for initial and further endorsement on particular aircraft, and in addition he would need to be approved medically to operate that aircraft, given his CVD.

8. Mr O'Brien objects to any of the conditions imposed upon his class 1 and class 2 medical certificates (the class 2 medical certificate limited its application to flights conducted inside the Australian Territory).

9. Counsel for CASA submitted that Mr O'Brien's case was conducted on the basis of his objections to conditions 1, 3 and 5 excluding conditions 2 and 4, insofar as they relate to the class 1 medical certificate.

10. Given the scope of the evidence and the various submissions, we have treated Mr O'Brien's application as dealing with all five conditions, including that relating to the condition limiting flights to those conducted inside Australian Territory in the class 1 and class 2 medical certificates.

11. It was not in issue that Mr O'Brien seeks employment as a pilot in command, or captain, with a major airline and is seeking endorsement to fly a different type of aircraft. In that context and during the hearing, we made it clear that there was no reason why CASA could not determine, in the context of Mr O'Brien's current class 1 medical certificate, whether he could seek endorsement to operate, or if he was endorsed to operate, that different type of aircraft.

12. To put this review in context, no issues were raised by CASA that Mr O'Brien is not fit and qualified to operate commercial and complex aircraft at a high level. The question for CASA is whether he moves on to be pilot in command and thus would be able to

exercise the full privileges of an ATPL. He has a Commercial Pilot (Aeroplane) Licence ("CPL") and has qualified to hold an ATPL. The evidence of Associate Professor Navathe[4] was that a pilot's licence goes on forever, but it is the medical certificate which enables the person to use the licence.

13. Associate Professor Navathe gave unchallenged evidence, and we accept, that in the context of granting or refusing a medical certificate, and subject to the relevant provisions of the *Civil Aviation Act 1988* (Cth) ("the Act") and *Civil Aviation Safety Regulations 1998* (Cth) ("CASR"), the determination was an individual decision based upon the particular circumstances of the individual pilot. As such, this decision related only to Mr O'Brien and should not be seen as a 'test case' as was and is the decision of *Denison*.

14. There is no issue that Mr O'Brien is a competent pilot who has flown commercial aircraft for many years, without incident. His ability to operate aircraft in the context of being an airline pilot is not in issue and his skills as a pilot are very well regarded by colleagues who are competent pilots. Such are his professional skills and capacity that his present employer has promoted him to be a flight simulator instructor for both flight captains and first officers.[5]

15. The evidence is that Mr O'Brien displays very good personal characteristics and professional skills as would otherwise enable him to be an airline captain, or pilot in command, with an ATPL.

16. Some of the factors we need to consider since the decision of *Denison* are:

    (a) Whether there has been more research in respect of pilots with CVD.

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[4] Whose unchallenged evidence was that he is the Principal Medical Officer with CASA, having held that position since December 2008, and had several regulatory responsibilities of the Director of CASA lawfully delegated to him: see Exhibit 1A, T24, p 547.

[5] Transcript of proceedings, evidence of John O'Brien, 21 October 2014, p 17.

(b) The relevant impact of the FedEx accident at Tallahassee ("FedEx accident"),[6] where the CVD of the co-pilot may or may not have been a contributing factor.

(c) The newly developed Colour Assessment and Diagnosis ("CAD") test.

(d) The change in cockpit instrumentation to the so called 'glass cockpits'.

17. It is noted that CASA had been aware of many of these factors for some years and was not prompted to change the conditions of Mr O'Brien's medical certificate. It was only after Mr O'Brien underwent the CAD test in February 2014 that the additional conditions 3, 4 and 5 were imposed.

18. CASA have a statutory obligation to determine who should operate aircraft, particularly in the case of aircraft carrying the general public.[7] Almost no human activity is without risk and CASA have a statutory obligation to measure the risk against the consequences that may arise from such risk. Those two assessments must then be weighed against each other.

Aeronautical Background

19. Mr O'Brien:

(a) was born in 1983 and was aged 31 at the time of this decision;
(b) was granted a CPL in 2002;
(c) was issued with an ATPL on 19 December 2005;
(d) was awarded a Bachelor of Aviation from Griffith University in 2006;
(e) has logged up to more than 6000 flying hours consisting of at least:[8]
    (i) Pilot in Command: 3707 hours
    (ii) Dash 8 experience: 3707 hours
    (iii) Night experience: 575 hours
    (iv) Instrument experience: 445 hours

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[6] As discussed in report of Dr John Parkes dated 4 October 2014, p 25.
[7] Contained in the *Civil Aviation Safety Regulations 1998* (Cth).
[8] See above n 5; Respondent's further submissions dated 19 November 2014.

(v) Instructor: 3180 hours;

(f) currently holds conditional class 1 and class 2 medical certificates. The conditions prevent Mr O'Brien from performing duties authorised by his ATPL;

(g) is endorsed to fly a variety of single engine and multi-engine aircraft, including the Dash 8;

(h) was the Senior Base Pilot and Dash 8 simulator instructor as at the date of hearing;

(i) has a colour deficiency in terms of his sight, he is a dichromatic protanope. This comes as no surprise to CASA and when he was asked to undertake a CAD test[9] it was uncontroversial that, given his deficiency, Mr O'Brien would and did perform poorly; and

(j) in the context of the evidence of Associate Professor Navathe,[10] Mr O'Brien asserts (and we accept) that in all of his flying experience he has never confused lights, including the glideslope assistance, provided at some airports in the form of a Precision Approach Path Indicator ("PAPI").

The regulatory framework

20. We need to identify the legislative provisions in terms of aeromedical certification.

21. Regulation 67.180(1) of the CASR provides as follows:

> *(1) Subject to subregulation (7) and regulation 11.055, on receiving an application under regulation 67.175, CASA must issue a medical certificate to the applicant if the applicant meets the requirements of subregulation (2).*

22. Regulation 67.180(2)(e) of the of the CASR provides that Mr O'Brien must either meet the medical standard or satisfy the decision-maker that such failure to meet that standard is not likely to endanger the safety of air navigation.

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[9] See para 51 of this decision.

[10] See statement of Associate Professor Navathe dated 3 October 2013, Exhibit 1A, T24, p 568: "Looking outside the aircraft, aviation uses colours in several places. Airfield lighting is arranged in a manner that has differences for taxiways and runways, and there are differences in colours to indicate where to stop the aircraft etc. The aircraft wing tips carry a red and a green navigation light, and these also help to identify the direction of flight of the aircraft. There are also documented examples of pilots losing orientation by reference to an approaching aircraft because of an inability to correctly identify the colours of the navigation lights [PAPI]".

23. We note that Mr O'Brien bears the onus of establishing this fact. In terms of Mr O'Brien's current status he has satisfied, and has continued to satisfy, CASA that as a co-pilot operating commercial aircraft, subject to the existing conditions, he is not likely to endanger the safety of air navigation. A substantive question is whether the change of status of Mr O'Brien from co-pilot to captain is possible, which carries with it the associated higher standards, greater responsibility and the impact of the so called trans-cockpit gradient.[11]

24. Regulation 67.180(2)(a) of the CASR empowers CASA to require an applicant for a medical certificate to undergo:

> *(a) ... any relevant examinations that, in the opinion of CASA, are necessary in the particular case.*

25. Regulations 67.180(2)(c) and (d) of the CASR provide that the purpose of any such examination is to help CASA to decide whether Mr O'Brien meets the relevant medical standard.[12]

26. CASA has power, pursuant to reg 67.165 of the CASR, to require an applicant to submit to a medical or specialist examination carried out by a medical practitioner or other specified qualified professional.[13] CASA is required to take into account the results of such an examination, in the context of its fundamental obligation to ensure that issuing a medical certificate to a particular pilot would not endanger the safety of air navigation.[14]

27. Subject to reg 67.180(2)(e) of the CASR, in considering the issue of a class 1 medical certificate, an applicant must demonstrate that he or she meets the criterion (set out in item 1.39 in the Table 67.150 in reg 67.150 of the CASR); that is Mr O'Brien "[c]an

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[11] Exhibit 1A, T29, p 693, statement of Ian Banks dated 11 October 2013 at para 39, in which he details the meaning of this term: "the fact that captains must establish an optimal working relationship with other crewmembers such that the captain's role and authority are neither over- or under-emphasised (Helmreich & Foushee, 1993)".

[12] Regulation 67.010(a) and (b) of the *Civil Aviation Safety Regulations 1998* (Cth) define 'relevant medical standard' as class 1 medical certificate—medical standard 1, and class 2 medical certificate—medical standard 2, respectively.

[13] See reg 67.165(1)(a) of the *Civil Aviation Safety Regulations 1998* (Cth).

[14] See reg 67.180(2)(f) of the *Civil Aviation Safety Regulations 1998* (Cth).

readily distinguish the colours that need to be distinguished for the safe exercise of privileges, or performance of duties".

28. This criterion can be established by way of the tests set out in reg 67.150(6) of the CASR by:

> *(a) in daylight, or artificial light of similar luminosity, readily identifying a series of pseudo-isochromatic plates of the Ishihara 24-plate type, making no more than 2 errors; or*
>
> *(b) for somebody who makes more than 2 errors in a test mentioned in paragraph (a), readily identifying aviation coloured lights displayed by means of a Farnsworth colour-perception lantern, making:*
>
> *(i) no errors on 1 run of 9 pairs of lights; or*
>
> *(ii) no more than 2 errors on a sequence of 2 runs of 9 pairs of lights; or*
>
> *(c) for somebody who does not satisfy paragraph (a) or (b), correctly identifying all relevant coloured lights in a test, determined by CASA, that simulates an operational situation.*

29. Mr O'Brien asserts that the CAD test[15] does not fall within the statutory description contained in reg 67.150(6)(c) of the CASR. CASA submits and we accept that that question is not relevant to our review of the substantive decision.

30. We accept the submissions made on behalf of CASA that the determination of the test by CASA for the purposes of reg 67.150(6)(c) of the CASR is not in itself a reviewable decision. We may have regard to the test in our review of the decision in particular, and we have made no determination nor do we intend to make a determination as to whether or not the CAD test fulfils the statutory imperative contained in reg 67.150(6)(c) of the CASR. That decision is ultimately a matter for CASA.

31. We accept the submission by CASA that Mr O'Brien has not passed the prescribed tests and consequently he does not meet the relevant medical standard for a

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[15] Exhibit 1A, T24, p 547, statement of Associate Professor Navathe dated 3 October 2013 at para 97 detailed (which CASA is considering the use of), "a new test called the CAD test, which is an aviation specific test developed by the City University in London in conjunction with the UK CAA. This test considers all the external and internal colours in aviation, and they did this by practically working with a modern Boeing and Airbus cockpit. The test has been extensively validated for aviation purposes. Details of this test are to be found in the 2009 report, Minimum Colour Vision Requirements for Professional Flight Crew". Professor Barbur's evidence dealt with this test, its advantages and limitations extensively.

class 1 medical certificate. Consequently CASA may not issue a medical certificate to Mr O'Brien unless they are satisfied that he is not likely to endanger the safety of air navigation (reg 67.180(2)(e) of the CASR). If Mr O'Brien does not so satisfy CASA, then he has not satisfied the requirements of the CASR and CASA must not issue the medical certificate (reg 67.180(7)(b) of the CASR).

32. Ameliorating this regulation is reg 11.055 of the CASR which relevantly provides:

> *(1) This regulation applies despite any other provision of these Regulations that provides for the grant or issue of an authorisation, but subject to section 30A and paragraphs 30DY(2)(b), 30DZ(2)(b) and 30EC(2)(b) of the Act.*
>
> *…*
>
> *(1A) … if a person has applied for an authorisation in accordance with these Regulations, CASA may grant the authorisation only if:*
>
> > *(a) the person meets the criteria specified in these Regulations for the grant of the authorisation; and*
> >
> > *…*
> >
> > *(e) granting the authorisation would not be likely to have an adverse effect on the safety of air navigation.*

33. Consequently we accept the submission made on behalf of CASA that:[16]

> *The power to impose conditions conterminously with the issue of an authorisation is set out in [reg] 11.056 [of the CASR] which, relevantly for present purposes, provides that CASA may grant an authorisation subject to any condition that CASA is satisfied is necessary "in the interests of the safety of air navigation".*
>
> *Read with s 9A of [the Act] it is plain that the repeated emphasis on aviation safety is the key (and paramount) consideration in any determination of whether an applicant satisfies the requirements of those regulations that call for the exercise of judgment by the administrative decision-maker.*

34. In undertaking this review we have adopted the underlying approach that consideration of aviation safety is paramount. Our review is whether the conditions imposed in the class 1 medical certificate, any one or combinations of them are such as to meet this paramount consideration.

35. In its further submissions dated 19 November 2014, CASA asserted, and we accept, that the considerations need to be carried out in the construct of the following:[17]

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[16] Respondent's further submissions dated 19 November 2014, p 5, paras 16 and 17.

The application of the provisions set out above in all cases requires a sophisticated level of risk assessment in the context of aeromedical certification decision-making. That assessment is affected by a number of policy considerations.

Policy

First, at the level of legislative policy it is clear from the express terms of the regulations in Part 67 of the CASR that colour perception (ie the ability to readily distinguish the primary colours used in aviation) is an important safety matter relating to the "safe exercise" of the privileges of any pilot licence.

The use of pseudo-isochromatic plates, or the Ishihara plates test, (prescribed by [reg] 67.150(6)(a) [of the CASR])is the fundamental test used around the world, in the aviation context, consistently with the Chicago Convention obligations of member States. Ishihara plates are primarily used to classify red-green [CVDs]. Lantern tests such as the Farnsworth lantern test ([reg] 67.150(6)(b) [of the CASR]) are designed to simulate signals using specific colours encountered in aviation and are directed to testing the required ability directly. The test usually involves recognising and distinguishing two different green colours, two red colours and a white light. (Lights are usually shown in pairs of two, low or high brightness, and the applicant is asked to name the colours.)

It is clear from the wording of the prescribed tests that the colours considered by the legislature as safety-relevant in the aviation field are those colours (primarily red and green) to which the tests are directed. (Emphasis added.)

36. Primary tests performed with pseudo-isochromatic plates ("PIP") detect those pilots with any degree of CVD but provide no indication as to the type or severity. The most commonly used PIPs are the Ishihara plates. Others, such as the Dvorine plates, may also be used in other jurisdictions. The application and interpretation of these tests varies considerably amongst states.[18] For example, in Australia more than two errors on the Ishihara plates is considered as a fail, while in the United States of America ("United States"), the pilots are allowed up to six errors on the Dvorine plates and up to five, six or eight errors on the Ishihara plates depending on which edition is used.[19] Once a pilot has passed this primary screening test they are free to exercise the full privileges of their licence.

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[17] See above n 15, p 6, paras 19- 21 and 22.

[18] See Exhibit 1A, T58, p 952, Watson D B, "Lack of International Uniformity in Assessing Colour Vision Deficiency in Professional Pilots" (2014) 85(2) Aviation, Space and Environmental Medicine 148-160.

[19] Exhibit 2, document 6: extracts from the United Stated Federal Aviation Administration, "Guide for Aviation Medical Examiners" (United States Federal Aviation Administrative, 2013).

37. Mr O'Brien failed the PIP test administered on 28 May 1999. In Australia and most other jurisdictions, failure of the PIP test will require a secondary test.

38. Mr O'Brien then failed the Farnsworth Lantern tests administered on 25 and 28 May 1999.

39. Regulation 67.150(6)(c) of the CASR allows those who fail both the primary and secondary tests to undergo another test "*determined by CASA, that simulates an operational situation"*. CASA had adopted the signal light test and the practical lantern tests to meet this requirement. The signal light test is standardised in its application and is designed to simulate the coloured signal lights emitted by the control tower in the event of a failure of radio contact with an aircraft. Associate Professor Navathe said that the test was discontinued in 2013 because of concerns about the standardisation of the administration and interpretation of the test as well as concerns about the suitability of the colours used.[20] Mr O'Brien is reported to have failed three signal light tests on 6 November 2000,[21] 3 March 2005,[22] and 15 August 2005[23]although he disputes the result of the August 2005 test as he felt that the test was not administered in appropriate lighting conditions. He also underwent and failed a practical lantern test with the Victorian College of Optometry on 20 September 2005.[24] This detailed assessment also diagnosed him as having a "*congenital protanopic colour vision deficiency"*.[25]

40. CASA in their submission went on to provide the following information:[26]

> <u>Secondly</u>, *at the level of international aviation policy, Articles 38, 39 and 40 of the Chicago Convention make provision for the filing by member [S]tates of a 'difference' where the national standard falls below or is different from the standard prescribed by the ICAO*[27] *Annexes. Such a notification does not relieve the state of its international obligation to conform to the Annexes such that a state may not allow international flights*

[20] Transcript of proceedings, evidence of Associate Professor Navathe, 23 October 2014, p 177.

[21] Exhibit 1B, T8.

[22] Exhibit 1B, T15.

[23] Applicant's statement dated 2 August 2013; Exhibit 1B, T9, p 118.

[24] Exhibit 1B, T22.

[25] Report of Ka-Yee Lian dated 20 September 2005, Exhibit 1B, T22, p 76.

[26] See above n 16, pp 7 – 11, paras 23 – 35.

[27] International Civil Aviation Organization.

to occur without the express permission of the other countries that are entered or over-flown. Member nations of ICAO are required to comply with ICAO Annex 1 medical standards domestically unless adequate justification can be advanced to explain a difference.[28]

[Associate Professor] Navathe has given evidence of the 'difference' that Australia notified to ICAO in respect of the colour vision requirements in about 1994 (Ex 11). In a memorandum dated 13 October 1995, Dr Liddell (former Director of Aviation Medicine and acting General Manager, Personnel Licensing with CASA) referred to a table that notes a difference between the ICAO Annex 1 medical standards and Australian medical standards in these terms: "Candidates failing pseudoisochromatic plates [PIP] [sic] *and colour perception lantern may be given dispensation in class 2, and class 1 to commercial level but no higher".*

[Associate Professor] Navathe observes that this notified difference is said to have "Result(ed) from a successful legal challenge". The effect of the notification of the 1994 difference did not allow for the provision of a class 1 medical certificate to an ATPL holder who failed the relevant Lantern test. The records referred to by Dr Liddell confirm the historical position taken by CASA as a matter of long-standing policy consistent with Australia's international obligations that ATPL operations are not included in the notified difference to ICAO. (Under s 11 of the Act CASA must "perform its functions in a manner consistent with the obligations of Australia under the Chicago Convention".)

In its published material relating to Frequently Asked Questions about the accepted medical standards, ICAO has said this:

> It is very rare for someone to be colour "blind" i.e. cannot see any colour at all. Most of those with a deficiency can see some colours quite well but not all colours or all shades of colour. The ICAO medical provisions in Annex 1 — Personnel Licensing, state that an applicant "shall be tested for the ability to correctly identify a series of pseudoisochromatic plates". Such a test displays different numbers (or shapes or letters) that are made up of dots that are coloured differently from background dots. Colours are chosen so that individuals with a [CVD] cannot reliably differentiate the number from the background.
>
> Individuals who fail to achieve an adequate score in this test can nevertheless be accepted for licensing if they can "readily distinguish the colours used in air navigation and correctly identify aviation coloured lights". Depending on the country in which the application is made, this secondary test may take the form of a device (called a "lantern") that requires an applicant to identify different coloured lights e.g. red, green and white and sometimes, depending on the exact lantern type, additional colours. There are other tests becoming available that make use (of) computer technology for assessing colour vision. As different countries apply different tests it is necessary to inquire of a particular Licensing Authority (as to) the details of the test it employs.
>
> For private pilots only, an applicant who fails both tests can be licensed as long as his/her licence is restricted "Valid daytime only [*sic*]. (Footnote omitted.)

It is apparent that ICAO has recognised the utility of "computer technology for assessing colour vision". To this end, the CAD test developed by Professor Barbur for the United

[28] See above n 16, pp 8-9, footnote 7: "An overview of Annex 1 to the Chicago Convention is provided by Dr P Clem, Ex 1A, Vol 2, p 458".

Kingdom Civil Aviation Authority[29] *is now used by "many national aviation authorities, hospitals and research institutions throughout the world" (Ex 14, Barbur, page 1). Unlike the CAD test, lantern tests do not assess the nature and severity of a colour vision defect. The CAD test "quantifies accurately (in CAD units) the severity of Red /Green (RG) and Yellow/Blue (YB) colour vision loss.....A threshold of 6 standard normal (CAD) units means that the subject requires 6 times the colour signal strength to just see either RG or YB colour signals"*[30]

In the context of use of the CAD test by the [UK CAA], the threshold test levels are "based on a detailed analysis of the use of colour in commercial aviation and in particular on those situations when there is no redundancy involved (ie there are no other cues to carry out safety-critical tasks)... The correct naming of PAPI lights at night from a distance of 5 to 6 kms is made more difficult when large pupils are involved and the retinal image quality is made worse by increased higher order aberrations and scattered light" (Ex 14 Barbur p 2).[31] *The contrast between red and white lights can be variable; at night "the intensity may be adjusted to a lower value to preserve pilot night vision".*[32]

The findings of the UK CAA/Barbur study show that "deutan-like subjects with CAD thresholds of ≤ 6 [Standard Normal Units ("SNU")] and protan-like subjects with thresholds of ≤ 12 SNU performed the PAPI task with the same accuracy as normal trichomats" (Ex 14, Barbur, p 3).[33]

In the UK, consistently with EU regulations, Ishihara testing is the first stage of colour vision testing for medical certification. In the UK, "if the Ishihara test is failed the examiner will proceed to CAD testing. If the CAD pass criteria are not met unrestricted [c]lass 1 certification would be refused. In this circumstance, if requested by [Mr O'Brien], an EU [c]lass 1 certificate could be issued under the MED.B.001[34] *flexibility clause with limitations; flying is restricted to daytime only and no commercial air transport operations are permitted" (Ex 13, Evans, p 3). As such, the [United Kingdom] policy is far more stringent than the policy adopted in Australia. As noted in a 2005 research paper: "Historically, it was assumed that [colour]-deficient individuals would not make suitable professional pilots as they would be unable to discriminate the [colours] used in aviation, so would be unsafe… Although the appropriate use of [colour] signals can undoubtedly improve visual performance, the benefits of requiring normal [colour] vision in the aviation environment are difficult to assess, largely because of redundancy in the [colour]-coding of visual information such as the use of*

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[29] UK CAA.

[30] This assertion of fact needs to be tempered or considered in the light of the findings and comments made elsewhere in these reasons.

[31] See above n 16, pp 8-9, footnote 7: "PAPI… primarily assist pilots by providing visual glide slope guidance in non-precision approaches to a runway. These systems generally comprise a row of 4 equi-spaced light units normally installed on one side of the runway with the glide path indications represented as two red and two white lights (2 red) when on proper glide path angle of approach. Light combinations indicate when slightly high (3 white), significantly high (4 white), slightly low (3 red) and significantly low (4 red). (Ex 1A, Vol 2, at 398). PAPI is used in the final visual segment of an approach to land following an instrument approach (Ex 1A, Vol 3 Scrimes at 938). The US FAA is researching replacing incandescent lamps with more efficient Light Emitting Diode (LED) lamps but at present, in Australia, LEDs are not used".

[32] Exhibit 1A, T22, report of Fred van der Heide dated 3 October 2013, p 389.

[33] Mr O'Brien, a protan, failed the CAD test with an SNU of 26.27.

[34] See above n 16, p 9, footnote 9: "EASA (European Aviation Safety Agency) Rules, Subpart B, Requirements for Medical Certificates".

flashing lights, audio cues, or text information". The researchers go on to observe that "luminance contrast, object shape, size and location in the visual field are more often used to distinguish objects rather than, or in addition to, using specific [colours]".[35]

This research paper highlights the policy difficulties in determining how to apply existing standards – based on a requirement of colour perception not on an acceptance of 'redundancy cues' or 'luminance contrasts' or other cognitive messages – and how to approach the task of evaluating and mitigating risk in the context of aeromedical certification.

The further, more recent research paper by Dr Dougal Watson of the New Zealand Civil Aviation Authority, underscores the adoption of a general policy by ICAO member [S]tates of precluding an applicant who fails the prescribed testing from undertaking airline operations or night flying: Ex 1A, Vol 3, p 957. (In one state a profoundly CVD pilot is able to operate as an airline co-pilot.) Dr Watson also concludes that the high degree of variation in the assessment of CVD applicants for medical certification stems not from the ICAO-based wording of the medical standards but from the administrative application of those standards which inhibit the achievement of the international objective of uniformity in aeromedical certification.

*The clear and long-standing policy position adopted by CASA (which takes into account and is consistent with earlier decisions of the Tribunal in [*Re Pape and Secretary, Department of Aviation *(1987) 16 ALD 97; [1987] AATA 354] and* Denison *as analysed in the attached SFIC) is to set the bar at the ATPL level. The underpinning rationale for this policy position is plainly supported by the UK CAA and New Zealand CAA research papers and the NTSB report into the loss of Flight 3407 (Ex 17) together with the further adumbration provided by [Associate Professor] Navathe in both his oral and written evidence (Ex 1A Vol 2 Tab 26 3/10/13). The overseas research and consequent policy development further support the decision of CASA to restrict solo night flying by the applicant.*

The Tribunal has, with a high degree of consistency, adopted the view endorsed by the Federal Court, as noted by academic commentators, that it may have regard to policy followed or taken into account by a primary decision-maker but it must not "determine the issue simply by resolving whether or not the decision conforms with the policy".[36]

In Confidential and Social Security Appeals Tribunal *[2009] AATA 197; (2009) 108 ALD 209 the Tribunal cited the above quoted passage from Professor Dennis Pearce's work "Administrative Appeals Tribunal" (2nd edition at pp 194,195) referring in turn to passages from* Re Drake v Minister for Immigration and Ethnic Affairs *(1979) 2 ALD 60 at 69-70; 24 ALR 577 at 590, per Bowen CJ and Deane J. The Tribunal went on to further quote the learned author as follows:*

"The approach to be followed by the AAT in reaching an accommodation between the role stated for it by the Federal Court and published government policy was taken further by President Brennan J in Re Drake and Minister for Immigration and Ethnic Affairs (No 2)(1979) [1979] AATA 179; 2 ALD 634. Policy was seen by the President as being a key factor in attaining consistency in decision-making. Consistency was said to be a

[35] See above n 16, p 9, footnote 10: Squire TJ, Rodriguez-Carmona M, Evans AD and Barbur JL, "Color Vision Tests for Aviation: Comparison of the Anomaloscope and Three Lantern Types", (2005) 76(5) Aviation Space and Environmental Medicine 421-429.

[36] See *Re Becker and Minister for Immigration and Ethnic Affairs* (1977) 1 ALD 158; [1977] AATA 12.

> *desirable goal in administration, as the application of differing standards in the exercise of a power by administrators cannot do other than result in unfairness and a consequent lack of confidence in the executive. The AAT ought therefore to apply lawful ministerial policy unless there are cogent reasons to the contrary. It would, however, be a cogent reason if the application of the policy would work an injustice in a particular case. Consistency is not preferable to justice (see particularly 2 ALD at 644)".* (Emphasis added.)

41. We accept the evidence and submissions as to legislative and administrative structure. However, we reiterate that this is to be considered in the context that CASA has already conditionally authorised Mr O'Brien to engage in regular public transport flight operations of complex aircraft – that is not in issue and from that we must infer that CASA was, and continues, to be satisfied that Mr O'Brien's *existing conditional* class 1 medical certificate is not contrary to the interests of the safety of air navigation.

42. Further, that the determination in issue is about the individual and whether he or she is able to satisfy the decision-maker that the authorisation he or she seeks is not contrary to the interests of the safety of air navigation.

Colour deficiency

43. CASA contends that the imposition of five conditions on Mr O'Brien's class 1 medical certificate was and remains necessary to ensure the safety of air navigation.

44. Mr O'Brien has the CVD protanopia. He has undergone and failed the prescribed CASR tests, as detailed above.

45. He agreed to undergo the CAD test. There is an issue as to whether that test fits within the meaning of CASR; in that it is or is not a test that 'simulates an operational situation'. If it is within the meaning of reg 67.150(6)(c) of the CASR, he has not passed it. If it is not, then he has complied with the reg 67.150(6)(c) of the CASR as there was no valid test.

46. Thus Mr O'Brien has not met the criteria in item 1.39 of Table contained in reg 67.150 of the CASR by passing one of the prescribed tests set out in reg 67.150(6) of the CASR.

47. Notwithstanding these outcomes CASA have authorised him to fly as a first officer subject to the specified conditions.

48. In *Denison*, the nature of CVD was discussed and, as a general outline, it was conceded by the parties to be accurate:[37]

> *Before discussing the contentious parts of the evidence, it is desirable that we set out some facts regarding which there was broad agreement among the witnesses expert in the nature of defective colour vision.*
>
> *Within the retina of the human eye there are nerve end cells, usually referred to as cones, which are sensitive to colour. The cones are situated in the very centre of the retina. They "pick up" colour, that is to say colours are stimuli to which they react, in objects at which the person is looking directly. Away from the centre of the retina there are also nerve end cells, usually referred to as rods, which are stimulated by light but appear to be almost insensitive to colour.*
>
> *Colour is dependent on the wavelength of light; each different colour and each different shade of colour has a different wavelength. That can be readily displayed by means of a chromaticity chart. The chart discloses a shape roughly triangular in form with three primary colours, deep red, deep green and deep blue, in the respective corners; within the triangle are all the different colours and shades of colour. Each colour and shade of colour is either one of those primary colours or a combination of them. In the retina of a human with normal colour vision there are cones of three types. Each type is sensitive principally to one of the primary colours; for that reason persons with normal colour vision are referred to as trichromats. Where a person has defective colour vision, his cones either totally lack sensitivity to one or more of the primary colours or are not fully sensitive to one of those colours. A person whose cones totally lack sensitivity to one of the primary colours, that is to say who has sensitivity to only two of the primary colours, is referred to as a dichromat. A person whose cones totally lack sensitivity to two of the primary colours, that is to say who has sensitivity to only one of the primary colours, is referred to as a monochromat…*
>
> *Where a dichromat lacks cones sensitive to red, he is referred to as a protanope. Deuteranopes and tritanopes are those dichromats who lack, respectively, cones sensitive to green and blue. Anomalous trichromats who have cones not fully sensitive to red are referred to as protanomals. Those with cones not fully sensitive to green and blue are respectively referred to as deuteranomals and tritanomals. A person is described as suffering from mild, moderate or severe protanomaly, deuteranomaly or tritanomaly depending on how nearly his cones are to being, at one end of the scale, fully sensitive and, at the other, totally insensitive to the particular primary colour. Protanopes and protanomals are referred to compendiously as protans; deuteranopes and deuteranomals, and tritanopes and tritanomals, are likewise referred to as deutans and tritans respectively.*
>
> *The perception of colour is not by the retina but by the brain through the medium of the retina and the nerves leading from it to the brain. At some stage in the process of perceiving colour the stimuli received by the cones from light of varying wavelengths are*

[37] *Denison* (1989) 19 ALD 607 at 615-616.

combined to produce perception of colour of a particular wavelength. It is impossible to be sure that all persons with normal colour vision perceive identically colour of the same wavelength; but the perception of each from time to time is generally consistent, so that what is perceived each time is colour of that wavelength. In persons with defective colour vision the effect of the absence or the reduced sensitivity of cones of a particular type leads to the combination of the stimuli resulting in perception of colour of a wavelength different from that perceived by persons with normal colour. However, as in persons with normal colour vision, the colour perceived by any person as the result of the combination of particular stimuli of the cones alone is generally consistent. That generalisation is subject to the qualifications that perception of colour may be temporarily affected by such factors as hypoxia, which usually occurs at altitudes of over about 10,000 ft, or by bright light or striking images seen shortly before. There is also some divergence of views in respect of instability of colour vision in those suffering from severe deuteranomaly, a matter which we discuss in some detail later in this statement. Further, where colour stimuli are received in large quantities from a bright light source, the colour perceived approaches to a greater or lesser extent that seen by a person with normal colour vision. The mechanism of this is not entirely clear. Possible explanations are that in that situation some cones respond to stimuli other than those to which they are principally sensitive, or that the rods have some minimal colour sensitivity.

Not only do persons with defective colour vision perceive the wavelength of colours differently from persons with normal colour vision, but also there are zones of wavelengths of colour, 27 in the case of deuteranopes and 16 in the case of protanopes, within which the colours, although of different wavelengths, are all seen as the same. They are commonly referred to as confusion zones. Such persons will usually confuse colours whose wavelengths lie within the same confusion zone. In the case of both protans and deutans the confusion zones run in the shape of a fan from the red segment of the chromaticity chart to the blue/green boundary…

Light, whether direct or reflected from the surface of any object, comprises colour, i.e. wavelength, and intensity, i.e. energy. Although a deutan or a tritan may perceive incorrectly the wavelength of the colour of any light, his perception of its intensity is practically the same as that of a person with normal colour vision. That means, in effect, that he sees lights of the same intensity from the same distance. Except for red lights, a protan similarly perceives the intensity of any light as practically the same as that perceived by a person with normal colour vision. However, it is generally accepted by optometrists and ophthalmologists that the intensity of a red light perceived by a protan is considerably reduced. This is a matter of considerable significance in relation to the ability of pilots who are protans to become aware of the existence of red obstruction lights. Nevertheless, we received evidence from Dr Samuel which cast doubt on whether all protanomals suffer that reduction. At present the colour vision standard in ANO 47.3 cannot be attained by any protan. As a matter of policy, when protans are granted pilot licences pursuant to reg 63, a condition is imposed prohibiting them from piloting an aircraft at night. We discuss the question of reduced perception of intensity of red light by protans, and its consequences, at length later in this statement.

49. Associate Professor Navathe told the Tribunal that there are not a large number of pilots with CVD flying class 1 operations in Australia subject to class 1 medical certification qualification. He estimated that about 330 colour deficient pilots who are in possession of a class 1 medical certificate failed the PIP test and 195 of those passed the subsequent

tests and consequently have no restrictions on their certificates.[38] He pointed out that CASA is not concerned about this group. Presumably the approximately 135 who failed the subsequent tests are the group that is of concern. Australia has for many years permitted these colour vision deficient pilots to operate aircraft on a commercial basis.

50. Colour vision deficiency is not, as commonly said, to be ‘colour blindness’. Some pilots who are colour vision deficient can operate aircraft and meet the underlying philosophy of the legislation which is not to endanger the safety of air navigation and consequently, the safety of the flying public.

51. CASA approved Mr O’Brien to fly and the one of the new developments that has occurred since that time that is different, and perhaps ‘better’, testing however that does not reflect in any way Mr O’Brien’s operation of, or ability to operate, an aircraft.

The CAD test

52. The CAD test is a valuable innovation in the field of CVD and aviation but is not without its limitations. The information obtained by CASA from such testing of Mr O’Brien is little more than that to which they were already aware, having had the diagnosis of protanopia confirmed in previous tests.

53. Evidence was provided by CASA that ICAO[39] “requires Contracting States to maintain a colour vision standard to ensure pilots can recognise the colours of signal lights used in aviation”[40] correctly:

> *The applicant shall be required to demonstrate the ability to perceive readily those colours the perception of which is necessary for the safe performance of duties*.[41]

54. The UK CAA (United Kingdom Civil Aviation Authority) undertook a process to firstly assess the colour vision demanding tasks for pilots and then go on to develop a

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[38] See above n 20, p 176.

[39] International Civil Aviation Organisation.

[40] Exhibit 13, p 1, report of Dr Sally Evans dated 23 May 2014.

[41] Exhibit 2, document 9, UK Civil Aviation Authority “Minimum Colour Vision Requirements for Professional Flight Crew – Part 1: The Use of Colour Signals and the Assessment of Colour Vision Requirements in Aviation” (UK Civil Aviation Authority, 2006); Exhibit 13, p 2, report of Dr Sally Evans dated 23 May 2014.

standardised colour vision test which would meet the requirements of the ICAO regulation.

55. In their paper 2006/04,[42] the UK CAA identified two tasks as being the most safety critical, demanding of colour vision and without redundancies. These were the coloured red green parking lights for positioning a plane at an aerobridge and the PAPI lights.

56. The parking lights at the terminal consist of two lights which can be red or green thus requiring appropriate colour discrimination. Mr. O'Brien pointed out that he had no trouble seeing these lights and in any case, explained that most airports are now moving to a different system which involved symbols instead of colour. He also does not use parking lights as the aircraft he currently works with do not use aerobridges. The UK CAA also decided that the PAPI lights were the more demanding and more safety critical of the two and decided to set the performance criteria of their new CAD on successful performance by subjects in a simulated PAPI test. During the hearing, the Tribunal was shown an example of the CAD test on a screen in the hearing room. The test requires the subject to observe on a computer screen a series of squares of changing hue that appear as moving colours. The subject must then identify the direction of perceived movement. As Professor Barbur pointed out, the CAD test is a test of colour vision which can quantify the degree of loss of colour sensitivity in either red/green or yellow/blue ranges. The degree of colour sensitivity for any individual is expressed as SNUs.[43] The lower the SNU, the better the colour sensitivity will be.

57. The UK CAA and Professor Barbur also developed a practical test which simulated the PAPI light system and went on to assess CAD scores against performance on their PAPI test in a group of normal trichromats as well as protans and deutans. From this they were able to set a threshold, or pass mark, for protans at 12 SNUs and deutans at 6 SNUs above which they could be certain all who passed would be able to pass the PAPI test. The CAD test is thus an indirect measure of the practical PAPI test and uses the PAPI as

[42] Exhibit 2, document 9, UK Civil Aviation Authority "Minimum Colour Vision Requirements for Professional Flight Crew – Part 1: The Use of Colour Signals and the Assessment of Colour Vision Requirements in Aviation" (UK Civil Aviation Authority, 2006).

[43] Standard Normal Unit.

the "gold standard". In this way, the CAD test may fulfil the criteria of the ICAO Standard. Whilst the test can also diagnose a protan or a deutan it cannot determine whether a person is a dichromat or an anomalous trichromat. The details of these studies are outlined in the UK CAA paper 2009/04.[44]

58. Mr O'Brien underwent a CAD test on 4 February 2014. Dr Elizabeth Livingstone provided a full report of the results.[45] Mr O'Brien achieved a score of 26.27 SNUs which is a fail, being well above the threshold for protans of 12 SNUs. CASA were already aware that he was a protanope and would have expected his score to be high but were concerned about this very high score. Associate Professor Navathe stated that if Mr O'Brien's score had only marginally failed with for example, only 13 SNUs, they would have been less concerned.

59. The evidence of Professor John Barbur is that the PAPI is the most appropriate test of colour recognition for pilots as it is very demanding in terms of colour vision[46] and there is little or no redundancy in that system which is, in essence, a redundant system to the primary systems in any event.

60. Professor Barbur's evidence was clear and it seemed to be accepted by the experts from CASA and by Associate Professor Geoffrey Stuart.

61. Mr O'Brien has very poor red/green colour vision; however he has exceptional or very good yellow/blue colour vision[47] which perhaps reflects his abilities as displayed in his practical tests.

62. There was some disconnect in the evidence of Professor Barbur. Initially he said pilots who pass the CAD test or just missed out should be given the PAPI test but later said that pilots who fail the CAD test should be excluded in terms of pilots.

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[44] Exhibit 2, document 9, UK Civil Aviation Authority, "Minimum Colour Vision Requirements for Professional Flight Crew – Recommendations for New Colour Vision Standards" (UK Civil Aviation Authority, 2009).

[45] Exhibit 1A, T45, pp 911 – 912, report of Dr Elizabeth Livingstone dated 4 February 2014.

[46] Transcript of proceedings, evidence of Professor Barbur, 23 October 2014, p 200.

[47] Ibid, p 207.

63. The evidence of Mr O'Brien was that he has never had difficulty identifying the PAPI light guidance throughout his years of flying; he said he had never incorrectly identified the lights. The concern raised by CASA was in the context of low visibility close to the runway, such as in the FedEx accident or at 5 km. This is in the context that the PAPI is an additional aid to the primary system within the aircraft, and presumably an aid to a pilot's visual identification of the runway during approach and landing.

64. The evidence of Associate Professor Stuart and Dr John Parkes is that whilst the CAD test is a good screening tool, it has its limitations. Due to its expense and complicated application, the CAD is too impractical to be used widely as a screening tool. Hence in the United Kingdom the PIP test is still used as the primary screening tool, and the CAD is a secondary test.

65. In his report dated 30 July 2014,[48] Associate Professor Stuart opines that the CAD test itself is not a practical test by likening it to being an enhanced Ishihara plate test.[49] CASA and the UK CAA are aware of this but point to the extensive validation that the CAD has undergone with the PAPI test, which they believe is a suitable practical additional test to the PIP.

66. Associate Professor Stuart in the same report criticises the analysis originally performed of the cockpit displays and signal lights saying that due to the fact that colourimetic measurements were not made of the displays and signal colours, it is impossible to ascertain if they would actually be confused by colour deficient subjects. Depending on the hue of a colour it may not be confused by subjects with CVD. Changing hues in traffic lights, for example, enables colour deficient drivers to discern the red and green signals as they do not appear to be the same colour for CVD subjects. Associate Professor Stuart points out these recommendations were made in the UK CAA 2006/04 paper but were not conducted. Associate Professor Stuart also opines that pilots should have been used in the studies as they would be able to use other learnt cues to identify various lights and colours.

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[48] Exhibit 7, report of Associate Professor Stuart dated 30 July 2014, see section 4.2 and 4.3.3.
[49] Ibid section 4.2.

67. Associate Professor Stuart is also critical of the fact that the redundancy provided by the contrast in luminosity of the white lights in the PAPI system was removed or reduced by the randomising of their luminance in the test sequences. Professor Parkes, relying on the comments of Barry Leighton Cole, Emeritus Professor, dated 20 August 2014,[50] iterated that despite the randomisation, a certain difference was always maintained. In later concurrent evidence with Associate Professor Stuart and Professor Barbur, this was brought into question again.

68. Associate Professor Stuart said that the hues of the colours used in the UK CAA PAPI test did not adequately represent the true colours of the current incandescent PAPI lighting system. He pointed to a study by Milburn et al[51] ("the Milburn study") which he felt more accurately represented the true colours.[52] In this study the CVD subjects performed much better on the PAPI than those in the UK CAA studies. Professor Parkes urged caution in accepting the Milburn study as it was not certain if any protanopes who would be expected to perform poorly, had been included.[53] This suspicion was heightened by the fact that no protans failed the PAPI test. By contrast we note that 50 percent of protans failed the PAPI test in the UK CAA study using standard white light.[54]

69. Another issue with the CAD test is the group of CVD subjects who, like Mr O'Brien, failed the test. In the UK CAA study using standard white light, 7 out of the 27 protans (25.9 percent), and 5 out of the 48 (10.4 percent) deutans who failed the CAD passed the PAPI test.[55] This is a significant group, particularly in protans. Professor Barbur agreed that this happens because the pass/fail thresholds were set by the UK CAA at a level where a CAD pass would predict with certainty that the person would also pass the

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[50] Transcript of proceedings, evidence of Professor Parkes, 22 October 2014, p 89; Exhibit 9, page 7, statement of Barry Leighton Cole, Emeritus Professor, dated 20 August 2014.

[51] Exhibit 2, document 1, Milburn N, Gildea K M, Perry D L, Roberts C A and Peterson L (S), "Usability of Light Emitting Diodes in Precision Approach Path Indicator Systems in Individuals With Marginal Color Vision" (2014) Civil Aerospace Medical Institute, Federal Aviation Administration.

[52] Transcript of proceedings, evidence of Associate Professor Stuart, 22 October 2014, p 91.

[53] Response of Dr Parkes dated 12 September 2014, Exhibit 16, p 7.

[54] See above n 44, p 39.

[55] See above n 44, pp 38 – 39.

PAPI.[56] However, this is at the expense of the groups identified above who fail the CAD but also pass the PAPI. The paper deals with these groups by also looking at their performance in other tests such as the Ishihara, Dvorine, Alternate Lantern Test and the Nagel Anomaloscope.[57] A score is derived from the sum of the results of these as well as the inverse score of the CAD and expressed as "chromatic sensitivity" for each person. Professor Barbur points out that the overall chromatic sensitivity index of these groups is poor and they would be expected to perform poorly on other colour related tasks.[58] It is not clear from the paper if there is any supporting evidence for this index. In evidence Professor Barbur also said that he felt that these groups were likely to have been borderline fails and thus their CVD was less severe allowing them to pass the PAPI test. This seems to be at odds with their having poor overall chromatic sensitivity.[59] It was interesting to note that Professor Barbur did say that the UK CAA which has adopted the CAD test did allow some pilots who had a borderline fail to undergo PAPI testing. We presume that if they passed they would have been treated more favourably.

70. Professor Barbur also pointed out that performance on the PAPI test could be variable amongst subjects for reasons other than their level of CVD. Some examples of these variables include:

(a) Experienced pilots may perform better because they have learnt to use cues such as luminance differences between the reds and whites of the test and there is also a natural variability between subjects in their ability to do this.

(b) The PAPI test can be made more difficult by decreasing the luminance of the white lights to simulate adverse atmospheric conditions such as fog, rain or dust.

(c) The quality of the white light is also important. If a light with more blue added is used, PAPI performance increases greatly. This was shown in the Milburn study which was aimed at assessing potential introduction of LED lighting which has a

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[56] See above n 46, pp 172-173.
[57] See above n 44, p 35.
[58] Exhibit 14, report of Professor Barber dated 22 May 2014, para 10.
[59] See above n 46, p 194.

similar blue white light quality. Also the UK CAA study performed PAPI tests with “standard” and “modified” white lights. The modified lights had a blue tint to better simulate LED lighting. The deutans in particular, performed better on the modified light PAPI test with the pass rate increasing from 34 to 57 of the 77 tested. This improvement was not as noticeable for protans with an increase from only 20 to 23 of the 40 tested.[60]

(d) The PAPI test is based on viewing the lights at a distance of 5.54 kms. Professor Barbur pointed out that PAPI performance could be greatly improved by shortening that distance to perhaps 3 or 4 kms. At night when the pupil is larger, the task of identifying the PAPI lights is much more difficult for CVD subjects and those with normal colour vision.

(e) As discussed in *Denison*, the pilot's visual acuity is important in discerning coloured lights. A pilot with excellent visual acuity, such as Mr O’Brien, will perform better.

(f) Professor Barbur also noted that Mr O’Brien’s Yellow/Blue colour sensitivity threshold was exceptionally good (1.08 SNUs)[61] and explained this could also assist him to better discern the luminance differences between the red and white lights.

71. Professor Barbur and others urged us not to become overly focused on the PAPI test, reminding us that there are many other colour demanding tasks for the pilot. Nevertheless the CAD test thresholds on which pilots will be passed or failed have been based on PAPI performance and the results of Mr O’Brien’s CAD test influenced the decision by CASA to impose further restrictions on his ATPL.

72. Professor Barbur’s view was that the CAD test was a good determiner as an operational test. That was, to some extent, different from his approach given that he also said that the

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[60] See above n 44, pp 39 – 40, figs 27 and 28.
[61] See above n 45.

CAD was designed to assess colour vision and to detect colour vision in an accurate way and was not necessarily a practical test.[62]

73. Some evidence was sought to be tendered in relation to another Australian pilot who had an ATPL and where there had been some interaction between CASA and that pilot. That evidence was rejected as its prejudicial value outweighed its probative value.

74. Mr O'Brien relied upon the determination of *Denison* in relation to whether he ought to have any conditions imposed upon his medical certificates (either class 1 or class 2) at all.

75. Mr O'Brien contended that many facts relevant to his application were found as facts by the Tribunal in *Re Pape and Secretary, Department of Aviation* (1987) 16 ALD 97; [1987] AATA 354 ("*Pape*") and *Denison*, particularly with the later decision having been run and decided as a test case, in which extensive expert evidence was given and considered. *Denison* addressed broad issues relating to defective colour vision and underpins the current approach by CASA in terms of colour deficient pilots. CASA contended that the approach taken on behalf of Mr O'Brien referring to specific findings made in the previous Tribunal decisions was 'flawed and overly simplistic'. CASA said that it failed to take account of the issues which must be determined specific to Mr O'Brien's circumstances. We accept that part of CASA's submission, but it must be considered in the context of the limited area of issue and the particular circumstances of Mr O'Brien.

76. CASA went on to contend that the earlier decisions were made some 25 years ago in a different context, in a different aviation environment, and that Mr O'Brien's medical condition is different to that of the pilots *Pape* and *Denison*. We have made this determination in light of that submission.

77. We have made observations in consideration of CASA's submission that at the time of *Pape* and *Denison*, there was a different certification regime, legislation applied different

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[62] See above n 46, p 155.

tests and air operations and technology have subsequently changed in the intervening period since that time. Also, there has been a greater awareness of the safety risk posed by pilots with CVD based upon conclusions drawn from accident investigations and incidents.

78. It is significant that in all of those years when many pilots with various forms of CVD have flown there has been little research made available to us upon which that contention was based. In any event this Tribunal is considering whether the conditions imposed upon the medical certificates of Mr O'Brien should remain or be rejected, and we repeat that this determination does not pertain to his authority to fly.

79. It was contended by Mr O'Brien that even if a pilot with CVD saw all navigation lights of other aircraft as white, that would not pose any risk to his safe piloting of his aircraft. CASA responded that this was a matter for medical and technical evidence, that CASA did not agree with that particular finding made in *Denison* and that it remains an essential skill for the pilot to be able to determine the course of other aircraft by reference to navigation lights. To that end, CASA referred to an incident in 1980 involving the ejection of a United States naval pilot from an F4J Phantom and the subsequent FedEx accident in 2002, to which later report we were referred.

80. In terms of Mr O'Brien, we again repeat the context and his flying history set out elsewhere.

81. It was argued by Mr O'Brien that perception of colour was not vital to the safe use of airport lighting. CASA contended in reply that the correct perception of airport lighting is an essential requirement and cannot be safely accommodated by a pilot with CVD inferring by position and location what specific airport markings mean. CASA also contended that the international movement of standardisation of coloured airport lighting makes the ability to correctly perceive colours of greater significance for pilots then at the time of the *Denison* decision. Further, the respondent considers that the use of the

word ‘vital’ in the finding of *Denison*[63] is telling in that it acknowledges a safety risk is inherent in a pilot being unable to correctly perceive airport lighting. Specific reference is made at page 37 of the Tallahassee National Transport Safety Board (“NTSB”) report to an accident where:[64]

> *[A] general aviation pilot with a medical waiver for red/green [CVD] was involved in an accidently because he failed to recognise an [orange coloured] warning barrier indicating a closed runway.*

82. The evidence is that Mr O’Brien has no difficulty identifying airport lights and this is not a question of Mr O’Brien flying.

83. There were submissions about the impact of Mr O’Brien’s CVD on airport approach guidance lights. On the evidence before us in terms of Mr O’Brien and his sight deficiency, we are satisfied that with the conditions we propose to confirm, he will not be a risk to the safety of air navigation as a consequence of his sight deficiency.

84. It was further submitted by Mr O’Brien that for the purpose of a commercial pilot licence (and ATPL), as per *Denison*,[65] a protan will not be at a significant disadvantage compared with a pilot with normal colour vision if, and for so long as, his distant visual acuity is 6/5 or better in each eye with or without the use of correcting lenses.

85. Unsurprisingly, CASA disagreed claiming it should be noted that a different licensing system now applies than at the time of the *Pape* and *Denison* decisions which includes provision for both CPL and ATPL licencing. Also, the Tribunal in its finding in the *Denison* decision acknowledged some disadvantage exists although it did not consider it to be significant. The finding by the Tribunal that an increased distant visual acuity would sufficiently compensate is not accepted by the respondent for a number of reasons. This includes that the current medical standards do not prescribe imposing an increased distant visual acuity level to reduce the risks posed by a colour perception deficiency nor,

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[63] *Denison* (1989) 19 ALD 607 at 627.

[64] National Transportation Safety Board, *Collision With Trees on Final Approach Federal Express Flight 1478, Boeing 727-232* at http://www.ntsb.gov/investigations/AccidentReports/Pages/AAR0402.aspx, p 37.

[65] *Denison,* (1989) 19 ALD 607 at 626.

in the case of a protanope, does it take into account the inability to perceive the colour red.

86. A cockpit warning light for an 'Engine Fire' was used as an example of the redundancies available for most colour coded warnings. Mr O'Brien contended that because of the aural warning he is unlikely to take significantly longer to identify any serious malfunction, as is demonstrated by his experience.[66] CASA observed that this was a *Denison* finding but that it wrongly assumes that an aural warning is used in conjunction with a visual sign on the EFIS (electronic flight information system) and that warnings are replicated multi-modally. This contention went on to refer to the issue of the weather radar, with which Mr O'Brien has demonstrated no difficulty using.[67]

87. We repeat our earlier comments about this pilot and this dispute.

88. The *Denison* decision appears to be an authority enabling pilots who are deutans to operate aircraft in Australia, with the limitations of being within Australia and having a working radio which facilitates two-way communication on appropriate frequencies.[68] With pilots who are protans there seems to be two paths, [69] that is visual acuity of 6/5 or 6/6 – no further restrictions, or if they cannot meet that standard – no night flying. Alternatively, if such pilot fails the practical test, there can be no night flying. However, if they pass, there will be no further restrictions.

89. In terms of the *Denison* decision, they were clear that pilots who had great visual acuity should, subject to their other qualifications, satisfy the requirements to operate aircraft. The Tribunal in *Denison* said with visual acuity of 6/5, no restriction should be in place apart from a working radio which facilitates two-way communication contained within Australia.

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[66] See above n 5, p 31.
[67] See above n 5, p 46.
[68] *Denison* (1989) 19 ALD 607 at 611.
[69] *Denison* (1989) 19 ALD 607 at 611, "the Tribunal recommended that licences be granted to protans subject to… for a commercial pilot licence, where the pilot has a distant visual acuity of at least 6/5; for a private or student pilot licence, where the pilot has a distant visual acuity of at least 6/6".

90. There is a concern by CASA that in the absence of restrictions on Mr O'Brien's ATPL is crossing a line. It is likely that that line was already crossed with the decision of *Denison*.

91. With this pilot's impeccable flying record, one would have thought that if Mr O'Brien had encountered difficulties, there would be a record of such. We accept the submission by CASA that it is not a matter of waiting for an accident or incident to occur; it is a matter of risk assessment.

92. The risks associated with this pilot must be considered, given that the primary issue is of course Mr O'Brien's CVD and how it will impact on his duties as the pilot in command, or captain, as distinct from his role as a first officer.

The role of captain versus co-pilot

93. CASA has concerns regarding the trans-cockpit authority gradient. Mr O'Brien clearly has the personal qualifications to operate as a captain and he has shown significant skills in all aspects of flying including those personal attributes.

94. Human Factors consultant, Mr Ian Banks,[70] gave evidence about the trans-cockpit authority gradient, when he said:[71]

> *As noted above the capacity of the co-pilot to have meaningful input into crew decisions is impacted by the assertiveness of the co-pilot however it is also true that the captain can encourage open lines of communication and encourage assertiveness. Trans-cockpit authority gradient refers to the fact that captains must establish an optimal working relationship with other crewmembers such as the captain's role and authority are neither over- or under-emphasised (Helmreich & Foushee, 1993). A co-pilot who becomes overly dependent on the decision making of the captain and does not assert themselves sufficiently is of reduced value to the safety of the flight. In a simulator study by Harper, Kidera, and Cullen (1971), captains pretended to be incapacitated on final approach to land and in this study 25[percent] of approaches resulted in an accident because the co-pilot did not take over even when the aircraft went well below the glide slop. It is foreseeable that a captain with a deficiency in colour vision in the situation where the appropriate trans-cockpit authority gradient has not been established may be unaware of a mistake they may have made due to that [CVD] and the co-pilot, aware of the mistake is unwilling to offer a correction.*

[70] Exhibit 1A, T29, report of Dr Ian Banks dated 11 October 2013, p 681.
[71] Ibid, p 693, para 39.

95. In his report dated 3 October 2013, Mr van der Heide provided evidence with regard to the role of a captain. His evidence included concerns in relation to the operation of larger aircraft and more complex aircraft. This evidence seemed more directed to the question of whether a pilot should be permitted to operate aircraft rather than the move from the role co-pilot to captain.

96. In his report, Mr van der Heide said he is an experienced captain with approximately 18,600 hours flight time on B747 aircraft and other aircraft, and was a check and training captain.[72] He is the Flying Operations Inspector with CASA.

97. As to the trans gradient issues he says:[73]

> *The co-pilot always has the ability and, in fact, the duty to challenge the Captain where safety of the flight is in doubt. This is usually described in the company Flight Operations Manual, and referred to as the Mutual Support Process… The Captain is required to respond and take corrective action if warranted. A lack of response raises reaction by the co-pilot up to physically taking control.*
>
> *The lack of an appropriate response could be because of a subtle incapacitation or a psychological aberration. Incapacitation checks are made during each take off and approach to land.*
>
> *There are some time critical decision points in every flight. The decision to reject a takeoff* [sic] *has to be made rapidly, the certification criteria allow only a brief time for recognition of the problem, a decision made and, if stopping, for braking actions to begin. A delay in any of these phases could result in there being insufficient runway remaining which to become airborne or insufficient runway remaining in which to stop. Quick Reference Handbooks clearly place responsibility for the GO/NOGO decision on the Captain…*
>
> *Similarly in low visibility approaches the decision to continue to land at the published minimum altitude is solely the Captain's. At other times the Captain is obliged to consider all factors before making decisions and one of these is to consider the opinion of the other pilot(s).*

98. Given the personal attributes of Mr O'Brien, his flying experience, his skills as a pilot (including as simulator trainer) and his dedication to attain and maintain these professional skills, he has satisfied us that such a change (from co-pilot to captain) in this context, is not likely to endanger the safety of air navigation.

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[72] See above n 32, p 386.
[73] See above n 32, p 395.

99. Many of the concerns raised by CASA relate to operating aircraft but most of those concerns are dissipated, given the approach underpinned by the reasoning in *Denison* and that CASA have already licenced Mr O'Brien to operate an aircraft as a co-pilot. One of the conditions, which we will leave in place, will be a requirement upon Mr O'Brien to notify his employers and relevant flight crew (namely those with whom he is flying) of his CVD issues. He is otherwise a highly qualified and well regarded pilot.

100. Given the nature of this application and having regard to the concerns expressed by Mr Banks and Mr van der Heide, we are satisfied that Mr O'Brien has established that he is not likely to endanger the safety air navigation in moving from the role of co-pilot to captain.

101. As to the question of colour recognition, Mr van der Heide said that there could be a concern in that:[74]

> *If a colour deficient Captain was exhibiting confusion or uncertainty due to an interpretation of a colour image it is highly unlikely that the co-pilot would assess this as being due to a vision issue.*

102. Given that evidence and the recommendation by Mr van der Heide that the other pilot be aware of the CVD, we see no reason why the condition to inform other flight crew members of that condition should not remain in place and continue. There is no evidence that it has been a major burden to either Mr O'Brien or other flight crew members in the past.

The FedEx accident at Tallahassee

103. Given the regular reference to the FedEx accident; we have read and considered the executive summary, conclusions and recommendations of the Aircraft Accident Report NTSB/AAR-04/02.[75]

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[74] See above n 32, p 396.
[75] See above n 70, p 698.

104. It reports that on 26 July 2002, Federal Express flight 1478, a Boeing 727, struck trees on a short final approach and crashed short of the runway at the Tallahassee Regional Airport.[76]

> *The captain, first officer and the flight engineer were seriously injured, and the airplane was destroyed by impact and resulting fire. Night visual meteorological conditions prevailed for the flight, which operated on an instrument flight rules flight plan.*
>
> *The [NTSB] determine[d] that the probable cause of the accident was the captain's and first officer's failure to establish and maintain a proper glide path during the night visual approach to landing.*
>
> *Contributing to the accident was said to be a combination of the captain's and first officer's fatigue, the captain's and first officer's failure to adhere to company flight procedures, the captain's and flight engineer's failure to monitor the approach, and the first officer's [CVD].*

105. As for the first officer, it was reported he had difficulty adapting to his schedule and frequently changing sleep cycles were conducive to the development of fatigue impairment that contributed to his degraded performance during the approach to Tallahassee Regional Airport; however, there were also other factors affecting the first officer's performance (for example, his CVD). The question as to whether or not this was a contributory factor to the accident remains unclear.

106. Professor Cole, an Emeritus Professor, in his statement dated 2 October 2013, also raised the question of the FedEx accident in his report where he said:

> *The FedEx crash at Tallahasse Regional Airport in 2002 is the end-point evidence that abnormal colour vision is a risk factor in aviation. It is, as far as I am aware, the only recent example of an aircraft crash in which normal colour vision has been identified as a casual factor. Because it is rare for abnormal colour vision to be identified as a casual factor there may be a tendency to dismiss this incident as a chance occurrence. This may be unwise since the* modus operandi *of investigations of individual aviation incidents is that if a factor caused an accident on one occasion it can do so again.*[77]

107. He went on to explain the responses of pilots with CVDs such as Mr O'Brien. As we have said earlier, the impact of the report into the FedEx accident is ambivalent. There were three pilots in the cockpit at the time and one pilot, the co-pilot, had a CVD. It was not established that the CVD was a casual factor; it is a mere possibility that it was a

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[76] National Transportation Safety Board, *Collision With Trees on Final Approach Federal Express Flight 1478, Boeing 727-232* at http://www.ntsb.gov/investigations/AccidentReports/Pages/AAR0402.aspx.
[77] Exhibit 1A, T22, p 375, statement of Barry Leighton Cole, Emeritus Professor, dated 2 October 2013.

causal factor. In any event, in this case it is not a question as to whether Mr O'Brien is able to operate and pilot an aircraft at a high level; it is a question as to whether he takes that next step to transition from co-pilot to captain.

108. Dr Douglas Ivan prepared a statement.[78] He has had many years' experience conducting ophthalmological examinations of aviators in the United States. His qualifications were not challenged. He gave evidence as to the impact of CVD in relation to pilots and approaches to this in the United States. Much of it related to the military. He opined that, in the United States, Mr O'Brien would not be expected to pass tests employed in the United States and would subsequently "not be qualified for entry into pilot training".[79]

109. Dr Ivan led the multi-disciplinary team conducting the clinical evaluation of a first officer in the FedEx flight 1478 accident in 2002.[80] He made comments about the FedEx accident with regard to the evidence of Dr Pape. Given the conflict in respect of that evidence, on balance we prefer the evidence of Dr Ivan.

110. The FedEx accident should be considered in the context of enormous numbers of commercial aircraft flights to and within the United States of which this one commercial flight incident in Tallahassee has been identified as having a possible contributing issue of "a colour deficient co-pilot". It is also possible that due to the more generous pass/fail limits applied in the United States to the primary PIP screening tests that there may be a considerable, but unknown, number of pilots flying in the United States with some degree of CVD. Associate Professor Navathe cautioned that there could well have been more incidents that may have involved CVD but that "reporting is less than optimal", particularly in the class 2 environment, and investigators would not be able to identify those pilots who had passed the PIP tests but had some degree of CVD.[81]

111. The concerns of CASA about Mr O'Brien as we have said are not about him operating an aircraft *per se* but about doing so as a captain rather than as a first officer, or co-pilot.

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[78] Exhibit 1A, T22, p 325, statement of Dr Douglas J Ivan dated 1 October 2013.
[79] Ibid p 346.
[80] Ibid p 348.
[81] See above n 20, p 176.

112. Mr Banks gave evidence in accordance with his report dated 11 October 2013.[82] Mr Banks works for CASA and his qualifications were not challenged.

113. He gave evidence in response to submissions made by or on behalf of Mr O'Brien minimising or challenging the findings made in respect of the FedEx accident. We have read his comments in relation to that accident and had regard to them in the context of this proceeding.

114. We have considered the circumstances surrounding the FedEx accident in this context. The crew in that flight were fatigued, there were significant other issues, and the first officer's CVD may or may not have been a casual factor. In the FedEx accident there were three flight crew members in the cockpit, and only one had CVD. We do not believe those circumstances have any significant bearing on the proposed move of Mr O'Brien from first officer to captain.

115. As indicated throughout these reasons, this is not a test case; it is about this pilot in these particular, unique circumstances.

116. The other concerns that CASA identified are as follows:

(a) The PAPI lights – the evidence of Mr O'Brien was that he had no difficultly with the PAPI lights. The concerns raised by CASA are more in the context of whether he should be licenced but these lights are improving with incandescent lighting which will enhance their operation.

(b) The parking lights – these are changing within Australia and very few use the old style which, in context, does not present any meaningful risk in terms of flying.

117. Part of the evidence about the PAPI lights came from Professor Cole, an Emeritus Professor from the University in Melbourne who was the Foundation Professor of optometry at that university from 1978 to 1979, and Head of the Department of

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[82] See above n 70, p 681.

Optometry and Vision Scientist. His qualifications were not challenged. He provided a report where he said in terms of the PAPI signal system:[83]

> *5.4 Investigations of the PAPI signal system. About 1992 CASA asked me to conduct an investigation into the recognition of the PAPI glide path signal system by persons with abnormal colour vision. CASA expressed the view that this as a safety critical signal light system that was used often and had very limited non-colour redundant cues. A report to CASA and two publications… resulted from this investigation. The investigation showed that observers with normal colour vision make few errors naming the red and white colours of a simulated PAPI signal light under a good visibility condition but that the majority of observers with abnormal colour vision make more errors than the worst performing observers with normal colour vision.*
>
> *5.5 Figure 1[not included in these reasons] shows a plot of errors made by the various classes of observers under the high intensity (good visibility) condition. Thirty-seven of the 38 age-matched colour-normal observers made no errors. One colour-normal observer made one error in the 90 presentations. The majority of the observers with abnormal colour vision made more errors than the worst performing colour normal observers (i.e. more than one error). There were 52 observers with abnormal colour vision of whom one third performed as well as the worst colour-normal observer.*
>
> *5.6 Protanopes and protanopes [*sic*] made fewer errors than their deutan counterparts because the brightness differences of the red and white PAPI signals were preserved in the simulation. Red colours look very dark to protans because of their reduced sensitivity to red light, which exaggerates the brightness difference and enabled them to better distinguish the red and white signals.*
>
> *5.7 However protanopes and protanomals fail to see the red PAPI signal on about 4[percent] of presentations because of their reduced sensitivity to red light, an error made by the deutan or colour-normal observers.*

118. Protans seem to do better than deutans, however, given that Mr O'Brien has operated aircraft and used these PAPI systems without difficulty over many years, it is more of evidence in terms of the 'line in the sand' rather than his capacity as a pilot whether a co-pilot or in command as a captain.

119. As to the CAD testing, CASA are clearly interested in using the CAD test as an alternative or addition to the lantern test. Given the problems which led to the discontinuance of the signal light test, it can be seen why the CAD test would be more the attractive option. The CAD test has many advantages and strengths. It can accurately assess the level of colour vision sensitivity, it is well researched, standardised, can be

[83] See above n 77, pp 370 – 371.

delivered relatively easily, cannot be learned by subjects and does not carry a risk of observer error. It is hoped that it may be widely adopted by various regulators around the world thus introducing more uniformity. CASA have included it in their range of available tests for colour vision but have not yet adopted it as a required test for those who fail the first two steps of the Ishihara plates and the Farnsworth lantern tests.

120. While CASA has not yet formally adopted the CAD test, it is something which has been adopted overseas particularly in the United Kingdom

121. It is not our purpose to comment on the general suitability of the CAD test for use by aviation regulators but rather to consider how it assists us in making a specific decision about Mr O'Brien's application.

122. However, whether it is being used as a testing device under reg 67.150(6)(c) of the CASR is a matter to be determined in each individual case and depends upon each individual set of circumstances. We do not exclude it or include it; it is a matter for CASA to consider.

123. It is a matter for this Tribunal, when re-exercising the discretion of CASA, what tests CASA consider appropriate in the circumstances. The CAD test is just one of a number of tools that may be used in the assessment of a pilot's CVD, if any, in the context of the overall and underlying scheme of the process which is to ensure safety in relation to air navigation.

124. The information presented to the Tribunal as it applies to Mr O'Brien leads us to assign less weight to his CAD test results. We remain cautious because of Mr O'Brien's high SNU score but we are not convinced that he would fail a PAPI test. Even if he were to fail, other factors mentioned earlier could mitigate, such as some concerns about the applicability of the PAPI test, and variability of PAPI performance amongst individuals and within the test itself such as distance, luminance and quality of the white lights. Finally, the personal attributes of Mr O'Brien such as his experience, excellent record, his good visual acuity and strong yellow/blue colour sensitivity could also be mitigating factors. These factors may well explain the paradox between his apparent "moderate to

severe" degree of CVD and excellent performance as a pilot. Again, given that it was already known that Mr O'Brien was a protanope, his failing the CAD test was not unexpected. The CAD test did not reveal any significant new or relevant information about Mr O'Brien's CVD or circumstances (other than the SNU score).

The conditions imposed by CASA

125. In the light of our findings and other factors, we now consider the evidence in relation to each of the conditions of Mr O'Brien's class 1 medical certificate and set out our findings as follows.

Condition 1 – that Mr O'Brien's class 1 medical certificate is not valid for an ATPL operation

126. This is the most contentious and difficult aspect of the determination. If this condition remains, Mr O'Brien will be able to continue operating aircraft as a first officer but will not be permitted to fly in a command position as a captain.

127. This will seriously and significantly reduce Mr O'Brien's ability to reach his full potential in his chosen career.

128. The change in roles as it relates to technical skills is, in many respects, relatively minor. CASA has accepted that Mr O'Brien is safe to conduct flights as a first officer and in those circumstances would fly sectors and undertake almost all of the roles that a captain would undertake in an aircraft.

129. The concern from CASA's point of view seems to fall into two areas.

130. Firstly, as we have discussed earlier in these reasons, and as is described by Mr Banks in his evidence:[84]

> *The role of the captain versus that of the co-pilot.*
>
> *37. CASA requires a higher minimum standard for aircraft captains than co-pilots which allows for the development of the co-pilot from a minimum acceptable*

[84] See above n 70, pp 692 – 693.

> *standard to participate competently in the role of co-pilot to a standard where they can perform the role of captain. While the technical skills required are often of a similar standard in which greatest development is expected in terms of aviation relating to knowledge and non-technical skills such as those required for effective Crew Resource Management (CRM).*
>
> *38.* *Ultimately the captain is responsible for decisions made by the crew and therefore typically has the final say although achieving effective crew coordination and cooperation typically enables better quality decisions as other perspective and options can be considered. As noted by Don Harris (2011), delivering the message is easier to achieve for the captain than the co-pilot as the co-pilot must be both assertive and subordinate. In highly time constrained situations it is the captain who will likely take control of the aircraft and respond based on experience rather than seeking input from crew members. This naturalistic decision making method is less likely or appropriate for a co-pilot who doesn't have the authority or potentially the necessary experience to act in this expert fashion. It does however mean that the deficiencies in colour vision of a co-pilot are potentially less critical of that of the captain as decisions taken by the co-pilot are more likely to be subject to consideration and input by the entire crew.*

131. In terms of that evidence, it must be seen that the issue raised in the 1971 and the 1993 references referred to above in paragraph 93 of these reasons, have to some degree been addressed in training of cockpit management since those times.

132. Counsel for CASA also relied upon a report of Professor Algis Vingrys dated 13 October 2013,[85] in particular in relation to his concerns that Mr O'Brien will have limitations imposed upon him due to colour vision; the first being "making colour confusions with colour coded tasks and the second, is his limited visual range for red coloured lights". [86]

133. In terms of that, it was the evidence of Professor Vingrys that there is a small possibility that the protanope will only make correct decisions between approximately 94 and 96 percent of the time, whereas a person with normal colour vision will make correct decisions approximately 99 percent of the time.[87]

134. He went on to say that this would impede his capacity to perform at a level expected of an ATPL pilot.

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[85] Exhibit 1A, T29, report of Professor Algis Vingrys dated 13 October 2013, p 828.
[86] Ibid p 832.
[87] Ibid p 833.

135. The problem with this evidence is that Mr O'Brien has effectively operated as an ATPL pilot for many years (albeit as a first officer) and has done so without apparent difficulty. This includes his operations as a first officer over thousands of hours conducting ATPL flights but as a co-pilot, as well as cockpit management to the extent that he now instructs on the simulator both as first officer and captain.

136. This evidence was part of the case presented on behalf of CASA that the 'line in the sand' should remain where it is.

137. That falls into the second aspect of their objection to Mr O'Brien operating as a pilot in command. The submissions of CASA, set out in detail in their closing submissions, are that Mr O'Brien is a protanope with congenital protanopic red/green colour deficiency of a high order. The consequence of this, which is unchallenged, is that he has a longer reaction time to red stimuli which could lead to "increased identification errors and enhanced susceptibility to hypoxia and reduced performance under deprived (sub-optimal) conditions".[88] It is, in the evidence of Professor Barbur, extremely likely that Mr O'Brien would make errors in a PAPI task, but for reasons stated elsewhere we are not convinced that this is the case with Mr O'Brien. They have set out significant evidence as to the impact of being a protanope on this pilot. At the same time, much of the evidence indicated that Mr O'Brien is a very fine pilot and able to operate at the highest levels.

138. Australia has an individual based determination process with regard to pilots and does not necessarily set arbitrary standards. Hence the ability for the granting of a class 1 medical certificate, but with conditions.

139. It is the submission of CASA that a line needs to be drawn, having had regard to the "consideration of the [applicant's] age, experience, type of flying, currency, extent of

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[88] See above n 16, p 15, paras 39 – 41.

flying, the medical condition, the treatment and possible side effects of treatment" and arrangement of "similar and interrelated issues".[89]

140. In terms of drawing that line, CASA has referred us to the approaches adopted in other States, including the United Kingdom, New Zealand[90] and the United States.

141. CASA acknowledges that it is 'out of step' with other ICAO member States but, given the approach and the evidence, it is satisfied, in all of the circumstances, that the extent that they have gone to does not create a risk to the safety of air navigation.

Condition 2 (and also the condition of the class 2 medical certificate) – that Mr O'Brien is limited to flights conducted inside Australian Territory

142. The evidence is that the approach to CVD Australians is much different to that in New Zealand, the United Kingdom and possibly the United States. Australia is a signatory to the Chicago Convention which in turn makes provision for the filing by member States of a 'difference' where the national standard falls below or is different from the standard prescribed by the ICAO annexes.

143. There was no argument contrary to the assertion that Contracting State of ICAO are required to comply with ICAO Annexe 1 medical standards domestically unless adequate justification can be advanced to explain a difference.[91]

144. The difference in Australia is that arising from the decisions of *Pape* and *Denison*.

145. Given the international approach and the evidence given by Associate Professor Navathe, we are satisfied that the requirement limiting Mr O'Brien's medical certificate within Australian Territory is, in all of the circumstances, a reasonable condition, and we see no reason to remove it.

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[89] See above n 16, pp 19 – 20.

[90] See Exhibit 1A, T22, p 464.

[91] Exhibit 1A, T 22, p 456, report of Dr Peter Clem dated 3 October 2013.

Condition 5 – that Mr O'Brien is limited to operating specified aircraft unless otherwise approved in writing by CASA

146. This condition seeks to provide a requirement that Mr O'Brien not only obtain endorsement in terms of flying operations with regard to particular aircraft, but also requires Mr O'Brien to obtain further consent from CASA, given his CVD. The basis of this condition arises out of the significant, and at times contradictory, evidence as to colour and use of colour in various cockpit configurations and displays.

147. This condition relates to cockpit lay out and the glass cockpit configurations as against the analogue cockpit layout. Mr O'Brien has shown no difficulty at all in terms of the current cockpit layout, which is part analogue and part glass. His evidence, and those of his witnesses, appears to present the argument that the glass cockpit would be more suitable to him rather than the analogue cockpit which he has been operating primarily.

148. The evidence of Associate Professor Navathe is that the glass cockpits may be unhelpful. The evidence of Dr Barbur is that the difference is not obvious.

149. Mr O'Brien will need to be endorsed on the different aircraft he seeks to operate and will need to satisfactorily complete periodic tests, both on simulators and in the air. He will be assessed by professionals lawfully training, assessing, endorsing or re-endorsing him, with knowledge of his CVD. This testing has been the case for many years and we will impose the additional requirement to inform them, if that is not already happening. As such Mr O'Brien has satisfied this Tribunal that such an approach would not present a risk to air safety. In that circumstance, the requirement for the additional 'medical' endorsement is superfluous.

150. We reject this condition.

Condition 4 – that Mr O'Brien must disclose to his employer and other assigned flight crew members his colour deficiency

151. Given the comments made elsewhere in these reasons in relation to Mr O'Brien's CVD, we see no reason to disturb this part of the reviewable decision. As far as is able to be

determined, the likelihood of a negative impact is relatively small in terms of the safety of air navigation.

152. Mr O'Brien will be obliged to inform other pilots of his CVD which, in the circumstances of this case, can only add to the safety of air navigation. In terms of notifying his employer, if there are other pilots with CVD flying in their systems, it will enable them to consider with whom Mr O'Brien should share a cockpit from time to time.

153. In addition, he will be required to similarly inform any person lawfully training, assessing, endorsing or re-endorsing him on any aircraft in in respect of his ATPL licence.

Condition 3 – that Mr O'Brien is not permitted to conduct night time operations other than as or with a qualified co-pilot

154. If Mr O'Brien had persuaded us that there were no issues with regard to his CVD, then removal of this condition (and all other conditions) would be a sensible and reasonable approach. However, given our finding that there is a risk (albeit a minor one, and one to which CASA has accepted given the high quality of this pilot in other areas) and given that Mr O'Brien will only ever fly as or with a co-pilot, this condition can hardly be regarded as being onerous or unreasonable.

CONCLUSION

155. Associate Professor Navathe agreed that there is always some risk inherent in flight. We find, in terms of Mr O'Brien, that any risk has been properly and effectively managed, and as a captain, given the conditions, that approach will continue. We say this having regard to Mr O'Brien's visual acuity and high levels of flight competence, and at the same time noting what we have said earlier and the following.

156. Stephen John Dain:[92]

> *56 This ability to use brightness clues can also be a problem and the dichromat can be induced to make lots of errors if the normal hierarchy is abandoned. In practical reality the light being observed could be dimmer or distant yellow or a brighter or closer red. The best example of the effects of removing the brightness clue is in PIC tests where the colours used are made to reflect equal amounts of light. In all lantern tests, the stimuli are deliberately varied in luminous intensity (the total amount of light).*
>
> *57 So, under some circumstances, the congenital dichromat can compensate, with acute observation, for their loss of colour discrimination. However, this is far from being a reliable clue.*

157. Dr Dougal Watson:[93]

> *Increasingly, during recent decades, the cockpit instrumentation of aircraft has included complete multifunctional colour displays.*
>
> *The ubiquity of color-coded [*sic*] information in the aviation environment has resulted in recognition of the importance of pilots and air traffic controllers being able to rapidly and accurately differentiate and identify colours…*
>
> *10* ***Is it possible to safely mitigate the risks that apply to a colour defective pilot? If so, how would this be achieved?***
>
> *Some of the risks relating to particular coloured elements of the aviation environment could be mitigated for some CVD applicants. For example it might be possible to design charts and instruments interfaces to better accommodate certain types of CVD. I doubt that any such re-engineering would be practical for all CVD subtypes, without reducing the speed and quality (and redundancy) of information transfer to the colour normal majority.*
>
> *Some regulators attempt to mitigate the risk associated with a particular part of the operational environment, by using some sort of specific take simulator to screen pilots for their ability to perform that task. The validity of such methods is very limited, although the underlying reasoning has some attraction or face credibility.*
>
> *Some regulators attempt to mitigate some of the operation risk of CVD applicants by precluding them from night-time operations. It is not always clear whether this is because night flight presents less room for error during critical phases of flight, whether the combination of night instrument flight and visual approach aids in borderline weather is considered a problem, whether the restriction is intended to steer such applicants away from the higher profile airline operations, or some combination of a number of these factors.*
>
> *Some regulators attempt to mitigate some of the third-party risk posed by CVD pilots by precluding them from airline operations.*
>
> *Many regulators mitigate the professional pilot risks associated with CVD pilots by precluding all except the most minor examples from licensing / certification.*

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[92] Exhibit 1A, T23, p 500, report of Stephen John Dain, dated 27 September 2013.

[93] Exhibit 1A, T25, pp 625 and 647, report of Dr Dougal Watson, dated 3 October 2013.

11 ***In relation to O'Brien, please provide comments on his ability to differentiate colour inside and outside the cockpit, and the implications thereof (if you consider you are sufficiently briefed to do so).***

Given my understanding that the appellant is unable to pass the Ishihara screening test, and also has been unable to pass any formal colour vision test he has taken, I find it difficult to believe that he would be interpreted as having "the ability to perceive readily those colours then perception of which is necessary for the safe performance of duties".

158. Dr Elizabeth Livingstone:[94]

His sensitivity for red is below that to meet aviation requirements. A pass for red requires that the subject to <=12 SNU. Mr O'Brien has a threshold in this hue of 26.27 SNU. Mr O'Brien has normal sensitivity for blue-yellow.

Mr O'Brien has moderate to severe protanopia and fails the colour vision requirements for aviation as determined by the CAD test.

159. In terms of *Denison* we were taken to paragraphs 50, 51 and 55 which provide:

50 In reconsidering the conclusions to which we came in Re Pape*, we have noted the rules set by and under the Civil Aviation Regulations for flying an aircraft at night and the meteorological minima set for individual aerodromes. We have concluded that their effect is that, except in an emergency, a pilot, whether he has normal or defective colour vision, has ample time to identify obstacles before descending to the height at which they will be encountered. An emergency can arise either because equipment of the aircraft has become defective during flight or because the aerodrome which is the intended destination and all alternative aerodromes are covered with cloud extending to below the meteorological minima for those aerodromes. It is, therefore, such emergency situations to which we have to turn our attention.*

51 In regard to emergency situations during night operations we consider the following facts to be significant. First, the intensity of an obstruction light will be perceived similarly by a deutan pilot and by a pilot with normal colour vision; this is important as, because not all obstructions are marked by red lights, there is a need for all pilots to have regard to all lights, whatever their colour. Unless a light is very small and of very low intensity, the deutan will usually perceive its colour as red. A protan may not see a red light from the same distance as the deutan or the pilot with normal colour vision. We shall discuss separately the significance of that as, although in these proceedings we have been asked to reach conclusions applicable to protans, we are concerned primarily with the applicant, who is an extreme deuteranomal. The second fact which we consider significant, as already noted, is that a red light cannot safely be assumed to be an obstruction light; so a pilot who is able to perceive a red light as red is not able simply because of that to establish his aircraft's position in relation to it and other obstacles and to the aerodrome by identifying it as marking a particular obstacle. In training a pilot is taught — and a competent pilot always remembers — that, at least in civil aviation, he must not react to any information he receives until he has satisfied

[94] See above at n 45.

> *himself that it is correct. So a pilot who perceived a red light and thereafter proceeded on the erroneous assumption that it marked a particular obstruction might put his aircraft into greater danger than a pilot who did not see it as a red light…*
>
> *55 An interesting demonstration of the ability of a protanope with above average visual acuity to recognise very small red dots at a distance when a person without such good visual acuity did not see those dots at all was given by Captain R Cronin. A number of photographs taken from an aircraft at night by Dr Pape were projected on to a screen. Captain Cronin stood about 10 ft from the screen and members of the Tribunal were nearer to the screen than he was. He identified the red dots, which in the scene photographed by Dr Pape were red lights, when they were not visible at all to some of us. Captain Cronin gave evidence that he was a protanope and that he had distant visual acuity of 6/5 without correcting lenses. It was apparent to us that, if the Allard's law formula were correct, the furthest distance at which a protanope with 6/6 distant visual acuity could see a red light would be approximately the same as the furthest distance at which a person with normal colour vision but a distant visual acuity of 6/12 could see it.*

160. *Denison* must be read in context and it is not without concerns with regards to a protanope colour deficiency. As mentioned earlier, *Denison* is seen to be the 'test case' for commercial pilots, however different and unique circumstances require thoughtful consideration of this case, as air safety concerns are likely to vary between pilots with CVD. There are some distinctions to be drawn between Mr O'Brien's circumstances and those presented in *Denison*. The difference which renders all others redundant is that Mr O'Brien's ability to operate aircraft safely with CVD is not in question, but rather the focus here is Mr O'Brien's request to progress to the role of captain from his current co-pilot position.

161. Having regard to CASA's obligation to measure risk and Mr O'Brien's flight experience and record, the possibility of an accident occurring whilst Mr O'Brien is in command of an aircraft can be equated to the possibility of an accident occurring under the command of any captain of an aircraft as no human activity is without risk.

162. According to Associate Professor Navathe the application by Mr O'Brien in terms of becoming a captain raises "highly important air safety issues". As to air safely Associate Professor Navathe says:[95]

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[95] Exhibit 1A, T24, p 547, statement of Associate Professor Navathe dated 3 October 2013 at paras 82 – 84.

> *82 Apart from identifying the specific safety issues their context in the case of air safety needs to be assessed by reference to the risks posed to air navigation. That raises more fundamental questions about what is safety. At its simplest and by reference to definitions in relation to health matters, safety is the reduction of risk, rather than the absence of accidents. Professor James Reason explains the basis for mitigation as a series of defences each of which serves to reduce risk and improve safety. None of these safety measures is perfect, and it is the "holes" in the successive layers that allows unsafe outcomes or losses to occur. Professor Reason also posits that when a number of these "holes" line up, the action trajectory can lead to an accident. This Swiss cheese model is depicted pictorially as below.*
>
> *…*
>
> *83 An every-day example of this lining up of the "holes" is speeding. While many drivers drive over the speed limits only a relatively small percentage have accidents. Based on the Reason model this is because it is only when other factors (eg, a curve in the road, a slippery surface, momentary inattention, another driving doing something unexpected, driver error etc) all "line up" that an accident occurs.*
>
> *84 The question that confronts CASA is assessing the role of colour vision in aviation, the risks which arise if a pilot has a [CVD], the magnitude of the risk, the likelihood of the risk resulting in an adverse outcome and whether this is also consistent with regulatory and international requirements and standards. In essence this all goes towards the aviation medicine management of aviation safety risks.*

163. At the risk of being pedantic, we repeat that this must not be seen in the context of Mr O'Brien presenting a risk to air safety in undertaking the complex task of operating a complex aircraft carrying fare paying passengers, but in the context of him moving from the role of first officer to captain.

164. We are satisfied that Mr O'Brien does not meet that medical standard required by the CASR in terms of his protanopia. However, with the conditions set out below, we are satisfied that he has established that his failure to meet the medical standard is not likely to endanger the safety of air navigation in the role of captain.

165. Accordingly, we will vary the conditions attaching to Mr O'Brien's class 1 medical certificate by providing;

(c) It is only valid for operations within Australia;

(d) Mr O'Brien is not permitted to conduct night time operations other than as or with a qualified co-pilot; and

(e) Mr O’Brien must disclose to his employer, any person lawfully training, assessing, endorsing or re-endorsing him on any aircraft in respect of his ATPL licence, and other assigned flight crew members of his CVD.

I certify that the preceding 165 (one hundred and sixty five) paragraphs are a true copy of the reasons for the decision herein of Justice R Benjamin, Dr W Isles, Member

........................[Sgd]..

Associate

Dated 20 February 2015

Dates of hearing	**21, 22, 23 October 2014 and 24 November 2014**
Date final submissions received	**10 February 2015**
Solicitors for the Applicant	**Rod Lawson, Porter Davies Lawyers**
Counsel for the Respondent	**Ian Harvey QC**
Solicitors for the Respondent	**Joe Rule, Civil Aviation and Safety Authority**