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ASSEMBLY — 36TH SESSION

EXECUTIVE COMMITTEE

Agenda Item 18: Passenger and crew health and the prevention of spread of communicable disease

NEW POTENTIALITIES OF THE ANALYSIS OF THE BINOCULAR VISION ABNORMALITIES OF CIVIL AVIATION PILOTS

(Presented by the Interstate Aviation Committee[2])

EXECUTIVE SUMMARY	
A new approach to the analysis of the binocular vision abnormalities is proposed. The method is based on the analysis of the bifixation reflexes and merging vision reflex of civil aviation pilots in the process of discharging their professional duties.	
Strategic Objectives:	This working paper relates to Strategic Objective E – *Continuity.*
Financial implications:	Not applicable.

1. INTRODUCTION

1.1 The visual system is the key organ of sense for the pilot, reliability of the pilot's work is being ensured by the keen binocular vision, which is characterized by:

a) high vision acuity;

b) capacity for precise space orientation; and

c) capacity for producing visual motor skills.

[1] English and Russian version provided by the Interstate Aviation Committee.

[2] Interstate Aviation Committee (IAC) is the executive body of the interstate Agreement on Civil Aviation and Airspace Use (international agreement, participants of which include Azerbaijan Republic, Republic of Armenia, Republic of Belarus, Georgia, Republic of Kazakhstan, Kyrgyz Republic, Republic of Moldova, the Russian Federation, Republic of Tajikistan, Turkmenistan, the Ukraine, Republic of Uzbekistan).

2. STATE OF THE ISSUE

2.1 Expert check-up of the binocular vision is carried out at present on the colour four-point Yord device and on the synaptofore. However, these methods are not very informative and make it possible to reveal only gross abnormalities of the binocular vision.

3. WAYS OF SOLVING THE PROBLEM

3.1 We have worked out methods of the binocular vision analysis based on the campimetria principles, i.e. setting the pilot's observation plane to different working distances. The peculiarity of these methods is pilot's binocular vision training with the sensory/information field of vision and giving type exercises on stereotype visual lines in motor visual fields.

3.1.1 **Figure 1** presents the scheme of restoring the correspondence of the pilot's abnormal binocular vision by way of training in setting Binocular Angle of Retinal Merging (BARM) to the campimetric distance of the instrument display.

3.1.2 **Figure 2** shows correspondence abnormalities of sensorial area accompanied by the emergence of the areflex latent strabismus (10 angular degrees) and double imaging of the observed objects, which is frequently the case under the night conditions of work. Special exercises make it possible to restore the binocular merging reflex.

3.1.3 **Figure 3** gives the general scheme of the campimetric setting of the eye correspondence to the long distance (5 000 mms), to the instrument panel observation distance (1 000 mms), reading distance (300 mms) and maximum convergence distance (100 mms). For each distance the pilot was trained for a special BARM angle (Binocular Angle of Retinal Merging) – 0.73 angular degrees, 4.0 angular degrees and 32 angular degrees accordingly.

3.2 Approbation of the system of campimetric analysis of the binocular vision of 259 pilots aged from 27 to 59 showed that all the pilots had keen binocular vision at the distances from 0.3 to 5 ms. However, in the conditions of low illumination or vision fields' dissociation half the pilots acquire latent strabismus of a low degree, which increases at short distances for the fourth part of the pilots. Campimetric analysis at the time of performing transmeridian flights shows the decrease of the area of the binocular merging intensity connected with the deterioration of the eye-motor muscle tone. There are reasons to consider that tone abnormality is reflected in the lowering of the pilot's working capacity and development of the visual fatigue phenomenon.

3.3 Pilots with the initial binocular vision abnormalities are to be given a system of exercises based on the principles of campimetria. Correction of the binocular vision abnormalities and eye training restore the eye resource capability, improve the quality of the vision keenness and orientation reactions of the visual system. Such measures may considerably increase pilots' mental and visual working capacity. These methods may be recommended for carrying out expert estimation of the state of the aviation pilots' binocular vision.

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APPENDIX

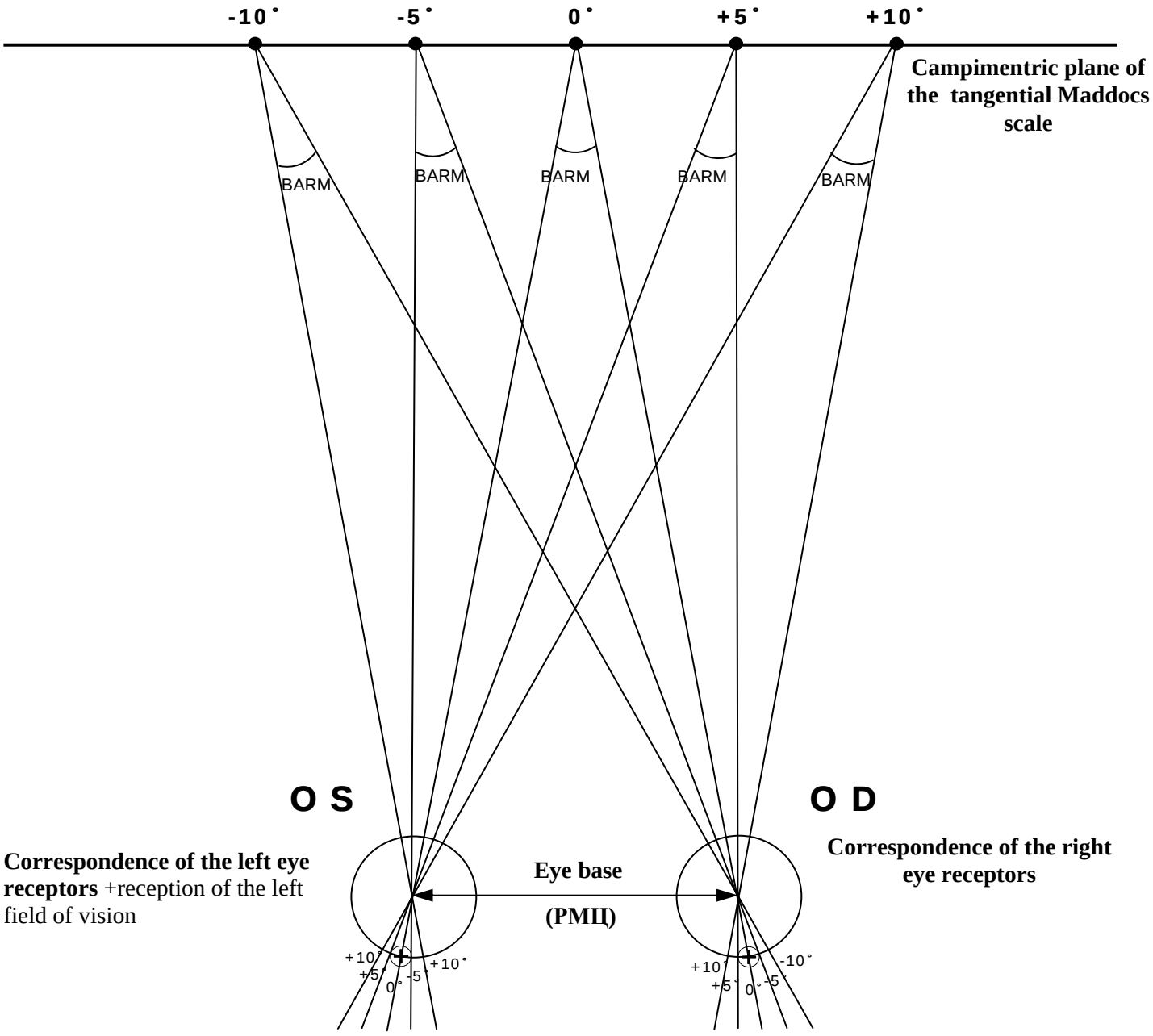
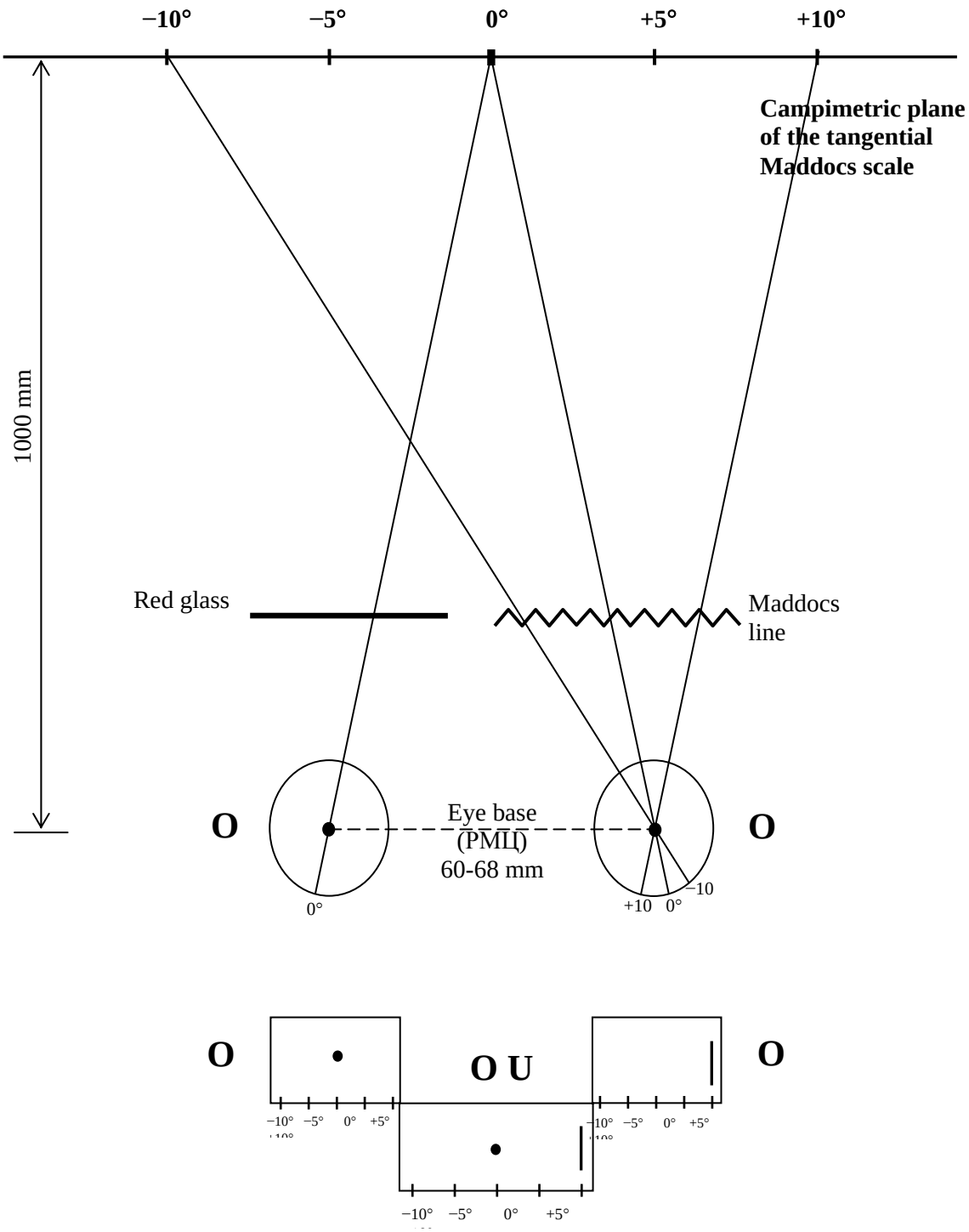


Figure 1. Outline of retina correspondence



Phenomenon of the object's double imaging in case of convergent dystonia of the same double

Figure 2. Outline of the areflex setting in case of latent strabismus of 10˚angular degree

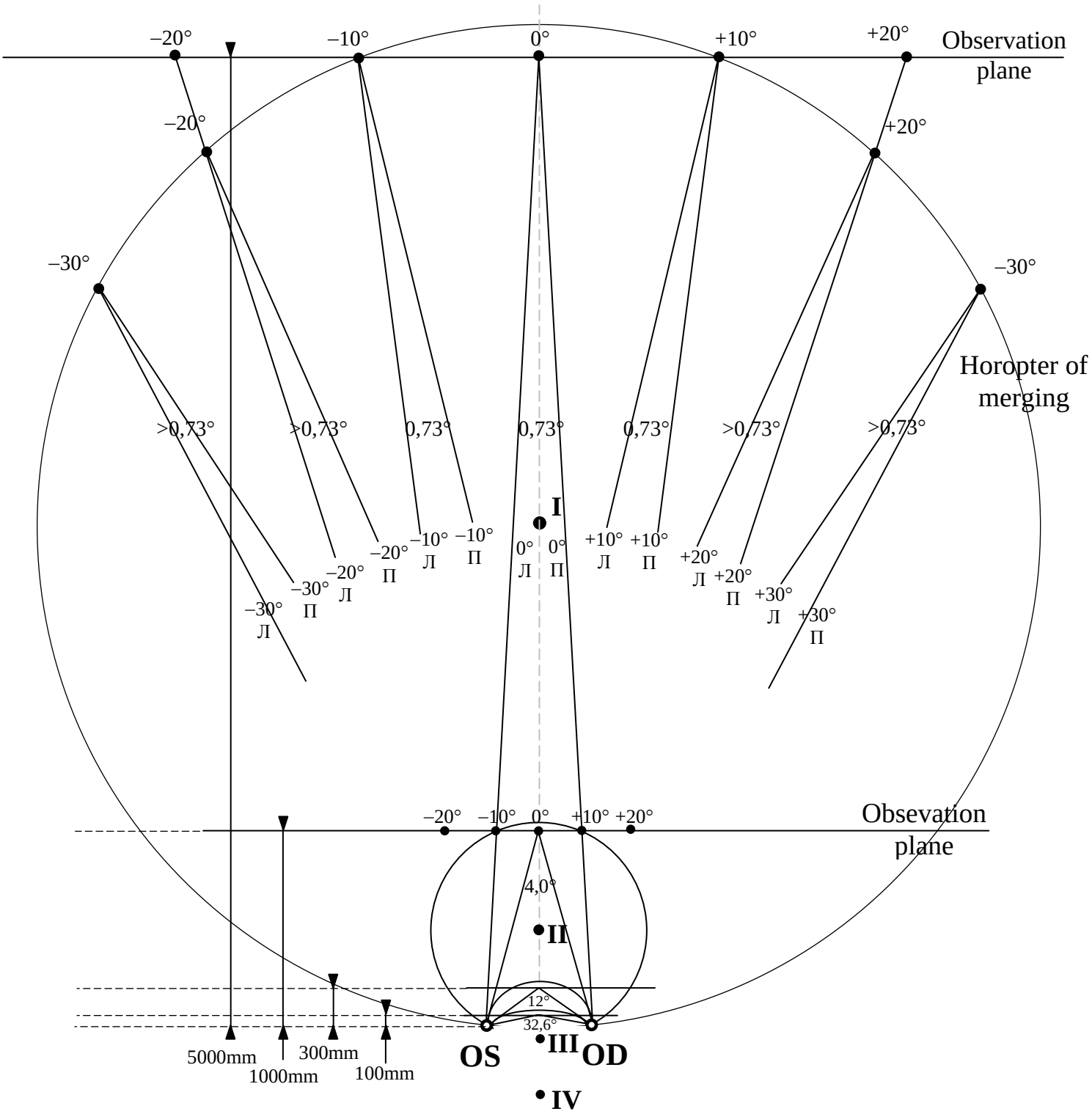

−20°
−10°
0°
+10°
+20°
Observation plane
−20°
+20°
−30°
−30°
Horopter of merging
>0,73°
>0,73°
0,73°
0,73°
0,73°
>0,73°
>0,73°
I
−30° Л
−30° П
−20° Л
−20° П
−10° Л
−10° П
0° Л
0° П
+10° Л
+10° П
+20° Л
+20° П
+30° Л
+30° П
−20°
−10°
0°
+10°
+20°
Obsevation plane
4,0°
II
12°
32,6°
III
OS
OD
IV
5000mm
1000mm
300mm
100mm

Figure 3

— END —