2th Progress Report of ISO/TC22/SC17/WG2 (ISO 16505)

"Camera monitoring systems"

Scope

This International Standard gives minimum safety, ergonomic and performance requirements for Camera-Monitor-Systems to replace mandatory inside and outside mirrors for road vehicles (e.g. Classes I to IV and VII as defined in ECE-R 46).

It addresses Camera-Monitor Systems (CMS) that will be used in road vehicles to present the required outside information of a specific field of view inside the vehicle. These specifications are intended to be independent of different camera and display technologies unless otherwise stated explicitly.

ADAS Systems (such as parking aid) are not part of this standard.

Structure of ISO/TC22/SC17/WG2

The main topics to be discussed are

1. Viewing conditions
2. Image quality and real-time behavior
3. Ergonomics
4. Functional Safety
5. Commercial Vehicles

These five topics are handled in separate taskforces.

Meetings

Until now, four face-to-face meetings of WG2 had taken place:

- 1st meeting, 2010-11-05, London, United Kingdom (Kick-off)
- 2nd meeting, 2011-02-08 to 2011-02-09, Paris, France
- 3rd meeting, 2011-05-18 to 2011-05-20, Troy, USA
- 4th meeting, 2011-11-10 to 2011-11-11, Stockholm, Sweden
- 5th meeting, 2012-05-09 to 2012-05-11, Berlin, Germany

In addition, there have been several telephone conferences as well with the working group as with the task force leaders.

In parallel and in preparation, the task forces are working on the progress with regards to contents. The function of the WG2 meetings is to discuss, consolidate and approve the work done by the task forces.

Participants

In total, WG2 has 49 members from the following nationalities

- Germany
- France
- USA
- United Kingdom
- Japan
- Netherlands
- Sweden
- Italy

Current status with regards to contents

General

WG2 has decided to proceed along a depth-first approach: All the items to be investigated by the taskforces are focused on passenger cars (FOV III according to ECE-R 46) for a first step.

Differing and/or additional requirements for commercial vehicles (FOV II and IV according to ECE-R 46) are handled in a separate task force. Output of this taskforce will be a separate annex regulating the differences between passenger cars and commercial vehicles regarding requirements for CMS as mirror replacement.

Taskforce 1: Viewing conditions (finished)

Scope

The scope is to clarify requirements regarding the fields of view to be provided by camera monitor systems replacing legacy mirrors. This includes as well the width or the angle of the field of view as the required detection distance.

Finished tasks

Formulation of the following proposals:

1.1   The CMS field of view shall cover the FOV at least that is required by the national body for conventional mirrors.

1.2   The angular size α_{CMS} of a critical object within the drivers view angle provided by a CMS shall be at least as big as the angular size α_{Mirror} of the same critical object provided by the mirror to be replaced by the CMS.

This implicitly secures that the detection distance of the CMS is at least as large as the detection distance of the legacy mirror to be replaced.

α_{Mirror} hereby depends on

- The size of the critical object
- The distance between the critical object and the mirror
- The distance between the driver's eye points and the mirror
- The radius of curvature of the mirror

α_{CMS} depends on

- The size of the critical object
- The distance between the critical object and the camera

- The viewing angle of the camera

- The viewing angle of the monitor

- The size of the visible display of the monitor

- The distance between the driver's eye points and the monitor

- The angle between the monitor surface normal and the driver's line of sight

1.3   Compared to the usage of mirrors, the field of view of a camera monitor system cannot be enhanced by moving the driver's eye points. Therefore, it is proposed that the CMS may allow the user to select a temporarily changed field of view to be able to observe the relevant traffic in special situations.

Open tasks

- Taskforce 1 does no longer have any specific open tasks. It is therefore merged into taskforce 3.

Taskforce 2: Image quality and real-time behavior

Scope
The scope is to

- describe all parameters worsening the ideal mapping of the real world scene via a camera-monitor-system and to define corresponding measure methods

- describe the real-time behavior of a camera-monitor-system and to define corresponding measure methods

Finished tasks
Proposals to define and measure the following parameters have been prepared:

2.1   Isotropy

2.2   Luminance and contrast rendering

2.3   Color rendering

2.4   Artefacts (smear, blooming, reproduction of point light sources, color noise, chromatic aberration, lens flare)

2.5   Aliasing (spatial aliasing, temporal aliasing, spatio-temporal aliasing)

2.6   Sharpness and resolution and depth of field

2.7   Geometric distortion

2.8   Pixel faults, flicker, dynamic range, visual artefacts, disability glare

Open tasks

- It has to be finally decided to adopt proposals 2.1 - 2.8

- In some cases, still requirements have to be derived by defining specific thresholds for parameters/tests (together with taskforce 3)

Taskforce 3: Ergonomics

Scope

The scope is to clarify requirements regarding

- the readability (is it possible to see an object) and legibility (is it possible to distinguish objects of the same size and shape from each other) of the CMS mapping of the real world scene.

  This includes as well the formulation of requirements regarding the system resolution as the definition of thresholds with regard to the parameters worsening an ideal mapping (see Taskforce 2)

- operating readiness and latency

- intended use and user interaction

Finished tasks

Proposals have been prepared to the following aspects:

3.1 System resolution: The visual actuity V_{CMS} of the CMS shall be at least as high as the visual actuity V_{driver} of the driver. This conclusion is the basis for deriving requirements for the CMS system resolution.

$$\tan \sigma = \frac{d}{b}$$

$$V = \frac{1}{\sigma} = \frac{1}{1'} = 1$$
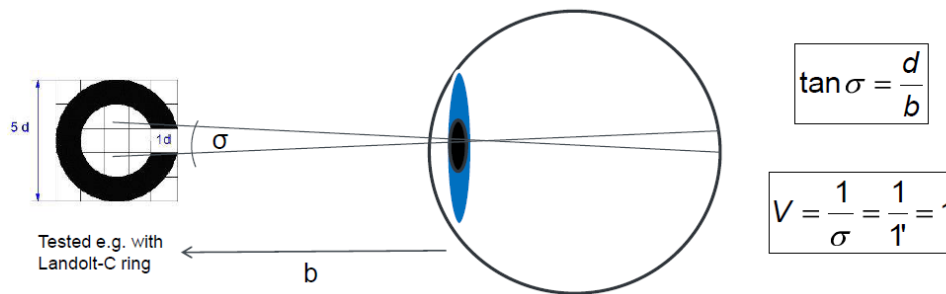
3.2 Magnification ratio

3.3 Operating readiness and latency

3.4 Intended use and user interaction

3.5 Overlays

3.6 Frame rate

3.7 Depth and velocity perception

3.8 Needs for older persons

3.9 Influences from weather and environment

Open tasks
- Proposals 3.1 - 3.7 have to be finally adopted

Taskforce 4: Functional Safety (finished)

Scope

The scope is to discuss ISO 26262 and its application for CMS and give guidelines for the manufacturers of CMS.

Finished tasks

- An example of a hazard analysis and risk assessment of a CMS according ISO 26262 was performed internally by a group of German OEMs

- In ISO 16505, CMS are declared as safety-relevant systems. Therefore, application of the safety standards relevant to the application domain (e.g. ISO 26262 for passenger car applications) shall be considered.

Open tasks

- Taskforce 4 does no longer have any specific open tasks. It is therefore closed.

Edition of ISO 16505

Scope

The scope is to edit a final standard document fulfilling ISO regulations.

Finished tasks

- Organizational structure to edit the standard

- Edition of committee draft (CD)

Open tasks

- Edition of draft international standard (DIS)

- Edition of final ISO standard

Roadmap

Presently, the committee draft of ISO 16505 in the ballot stage.

The next milestones will be:

End of CD ballot	2012-09-01
CD comment review / start developing the draft international standard (DIS)	6th meeting of WG 2 (2012-09-19 to 2012-09-21, Berlin, Germany)
Finishing the draft international standard (DIS)	7th meeting of WG2 (2012-11-14 to 2012-11-16, Yokohama, Japan)
Publish ISO 16505	End of 2013 (along an ideal procedure) A delay of half a year is possible, depending on the results of the DIS ballot