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Standard Guide for Selection and Operation of Vessel-mounted Camera Systems[1]

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1. Scope

1.1 This guide provides information and criteria for the selection of camera remote sensing systems that are vessel-mounted for the detection of oil on water.

1.2 This guide applies to the detection of oil-on-water involving cameras of IR, visible, ultra-violet, or night vision types.

1.3 The context of camera use is addressed to the extent it has a bearing on their selection and utility for certain missions or objectives.

1.4 This guide is generally applicable to all types of crude oils and most petroleum products, under a variety of marine or fresh water situations.

1.5 Many camera technologies exhibit limitations with respect to discriminating between the target substances under certain states of weathering, lighting, wind and sea, or various camera settings.

1.6 In general remote sensing systems are used to detect and delineate the overall slick. Vessel-mounted systems are used only to provide a tactical image in the vicinity of the recovery vessel.

1.7 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.9 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F2327 Guide for Selection of Airborne Remote Sensing Systems for Detection and Monitoring of Oil on Water

3. Significance and Use

3.1 The contributions of an effective vessel-mounted camera system:

3.1.1 Provide a tactical image of the portion of spill in the vicinity of the vessel upon which the system is mounted,

3.1.2 Assist in detection of slicks when they are not observable by persons operating at, or near, the water's surface or at night,

3.1.3 Provide assistance identifying the area of heaviest oil concentration,

3.1.4 Provide input for the operational deployment of equipment,

3.1.5 Extend the hours of clean-up operations to include darkness and poor visibility,

3.1.6 Locate reported oil-on-water, and

3.1.7 Guidance for operational crews to the slick(s).

4. Overview of Remote Sensing Equipment Capabilities and Limitations

4.1 The capability of camera equipment is determined by the physical and chemical properties of the atmosphere, the water, and the target oil. There may be variations in the degree of sophistication, sensitivity and spatial resolution of sensors using the same portion of the electromagnetic spectrum and detector technology. Sensors within a given class tend to have the same general capabilities and typically suffer from the same limitations (see Guide F2327).

4.2 Combinations of camera types may offer broader spectral coverage that permit better probability of detection, better

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

discrimination, and effective operation over a broader range of weather and lighting conditions. Certain combinations, or sensor suites, are well documented, and their use is particularly suited to oil spill response missions.

4.3 Camera performance can be enhanced by a variety of real time or post processing techniques applied to the acquired data or imagery. Furthermore, image or data fusion can greatly enhance the utility of the camera output or product.

4.4 In a deployment of camera systems, general location and type of oil would have been reported in advance of the launch of the vessel upon which the camera system is mounted. The planning for spills in different situation influences the selection of cameras.

4.5 Vessel-mounted cameras can provide tactical imagery, such as to determine the response vessel maneuvers to enhance the oil encounter rates during daytime and nighttime.

4.6 In rough sea conditions, some form of camera stabilization may be needed to produce a useful image.

4.7 No sensor is currently available to give information on actual oil thickness. Only relative thickness information, thick or thin, can be derived from an infrared camera.

4.8 Table 1 lists cameras based upon their mode of operation. Summary information on their positive features and limitations is presented.

4.9 Table 2 presents a summary of key attributes which generally influence the selection of cameras.

5. Summary

5.1 The information presented in this guide should be considered a starting point for camera selection. In addition to the context of use and the attributes of the various types of sensors. Both camera technology, and image and data analysis capabilities are evolving rapidly. Some equipment is not commercially-available.

5.2 After selecting the camera, one must select the correct mounting angle and position. A nomogram is presented in Table 3 to assist in mounting the camera and selecting view angles. Cameras for surveillance applications are suited to oil spill vessel applications as they are available with remote angle and pan controls as well as narrow fields of view (vertical and horizontal view angles). Fig. 1 shows the essential cross section of a camera mount.

5.2.1 It is important then to purchase a camera with the vertical and horizontal view angles that will permit the vessel to look forward sufficiently to enable steering into the slick. It is important that the camera have a good view of the slick and of the boom, if used, where the skimmer is positioned. Calculations were made on optimal angles, etc. and are presented in Table 3.

5.3 *Setting the Camera Angle*—The camera is best set at Brewster's angle, which is about 53° from the vertical. At Brewster's angle, reflection from the water surface is minimized. This angle however may not permit sufficient forward view for some applications. Thus an adjustable camera is desirable. See Fig. 2.

6. Conclusions

6.1 Vessel mounted cameras can provide useful imagery to assist in maneuvering the vessel during oil recovery to enhance oil encounter rate.

6.2 Four types of cameras are used, infrared, visible, ultraviolet and night vision. Infrared is common and can provide imagery discriminating between sheens and thicker oil. Infrared cameras are often used together with visible cameras. Ultraviolet cameras may be less useful as they highlight sunlight and other glare. Night vision cameras may enhance night recovery operations.

6.3 The height and angle mounting of the camera are important both to provide a useful image as well as to provide desired coverage of sea surface. Cameras should be mounted at or near Brewster's angle (about 53° from the vertical).

6.4 Cameras with pan, tilt, zoom capability are best for vessel-mounted applications.

7. Keywords

7.1 mast-mounted sensors; oil spill detection; oil spill remote sensing; ship-mounted sensors