

# **The Expedition ANTARKTIS-XXIII/2 of the Research Vessel „Polarstern“ in 2005/2006**

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**Edited by  
Volker Strass  
with contributions of the participants**

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# **ANT-XXIII/2**

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**Cape Town - Lazarev Sea - Punta Arenas**

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## 17. MARINE MAMMAL AUTOMATED PERIMETER SURVEILLANCE (MAPS)

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### Objectives

Ship based detection of marine mammals has a broad range of applications. Ecologists with focus on marine mammal abundances and migratory patterns are interested in effective methods for conducting a census of marine mammals. On the other hand users of hydroacoustic instruments (e.g. scientific sonars) are interested to most effectively implement reliable mitigation methods if adverse reactions of marine mammals to the ship's presence may be apprehended.

MAPS combines a passive hydroacoustic system (towed linear hydrophone array) and an optical system (visual and infrared cameras) to achieve highest possible detection rates. While the acoustic system is build to detect submerged marine mammals by their underwater vocalizations, the infrared system is detecting whales resting on the surface by their warm blow standing out against the cold Antarctic environment.

During the ANT-XXIII/2 expedition the MAPS system was operated during the transit from Cape Town, South Africa to Neumayer Station, Antarctica. The work focused on the installation of new camera housings for the infrared and visual cameras in the crow's nest of RV *Polarstern*.

### Work at sea

**Passive Acoustic Streamer:** Three 10 meter long, oil (ISOPAR M) filled streamer sections, each containing 5 hydrophones, were towed at a distance of 200, 500 and 600 meters behind the ship (Fig. 17.1). They were connected by a steel armed tow cable containing 48 wires. The hydrophone separation within each group was 1.2 meters. Hydrophone sensitivity, including a 20 dB preamplifier, was -184 dB re 1 V / 1  $\mu$ Pa, the frequency response 20 Hz to 200 kHz (3 dB points). The streamer was deployed using a 10 kN, IP 67 protected Nyblad winch, certified to -50°C and equipped with a slip ring for continuous connection to the electronics in the lab. The winch maintained a hauling speed of 1 m/s, independently of the ship's speed. Deployment and recovery of the streamer lasted about 10 minutes each and required one scientist and one member of the crew. The analogue signals were conditioned by a 16 channel KEMO VBF40 filter/amplifier with programmable high/low-pass settings from 1 Hz to 256 kHz and gains from -20 dB to 90 dB. A studio sound device, RME Fireface, continuously recorded 6 selected channels at full bandwidth (192 kHz sampling rate and 24 bit resolution) to a disc using the ASIRecorder - an

recording software developed in cooperation with the University of Kaiserslautern. Data rate was about 12 GB per hour. Data was stored in one minute blocks as ‘wav’ files on exchangeable 500 GB external hard discs, which could each host about 41 hours of uncompressed audio data. For monitoring purposes several channels could be mixed and processed for optimal human perceptibility with Bose NoiseCancelling™ headphones. The free available software Ishmael running on a second computer was used to visualize the acoustic data online. The streamer’s maximum operating depth is 60 meters, while its survival depth reads 120 meters. As the actual depth, measured by depth gauges in each streamer segment, was speed dependent (Fig. 17.2) the system had to be recovered when RV *Polarstern* slowed down below a speed of 5 knots. The streamer was deployed regularly between stations during cruising for a total of 734 nm and 66 hours, respectively (Tab. 17.1). It was also used under ice-covered conditions as long as RV *Polarstern* could cruise with at least 5 knots. During these occasions it was towed several times across ice floes without any damage.

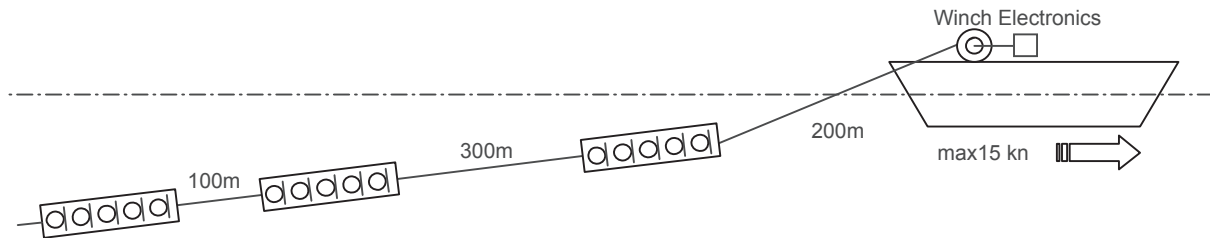


Fig. 17.1: Schematic drawing of the acoustic streamer

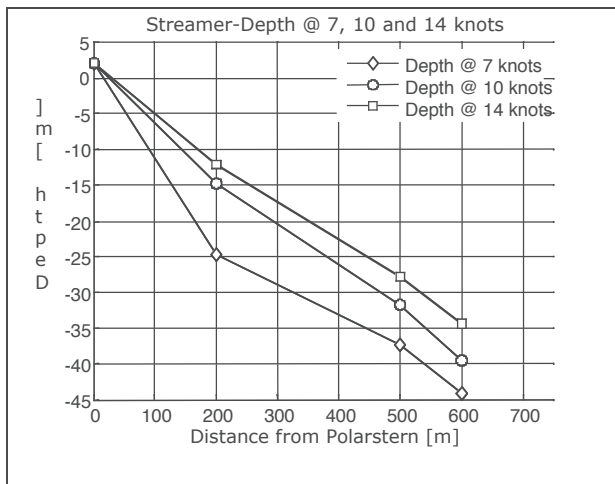


Fig. 17.2: Streamer depth as a function of tow speed. The markers at zero distance indicate the height of RV *Polarstern*’s working deck



**Tab. 17.1:** Streamer Deployments during ANT-XXIII/2 (November 2005)

Deployment			Recovery			Hours	Miles
1: 20.11. 01:19	34° 04,59' S	18° 10,46' E	21.11. 13:36	39° 24,70' S	14° 42,87' E	36:17	357,5
2: 28.11. 15:16	58° 51,71' S	01° 23,85' E	28.11. 17:29	59° 10,25' S	01° 06,61' E	02:13	20,6
3: 29.11. 08:02	61° 09,08' S	00° 06,81' E	29.11. 12:24	61° 37,29' S	00° 09,64' E	04:22	28,2
<b>Total:</b>						<b>42:52</b>	<b>406,3</b>

**Infrared Cameras:** During the ANT-XXIII/2 expedition, a new camera housing was installed under the roof of the crow's nest of RV *Polarstern* (see Fig. 17.3). The housing had been developed by Erich Dunker, head of the AWI workshop in Bremerhaven. After the mechanical and electrical installation was finished, the cameras were implemented in the data acquisition system and the whole system was rebooted.



*Fig. 17.3: Camera housing for 2 infrared and 1 visual cameras (small housing on top)*

One FLIR ThermoVision A40 infrared (IR) camera with a spatial coverage of 24° and a resolution of 320 x 240 pixels at 25 frames per second was used for the detection of whale spouts. The camera is connected to a PCs in the “wissenschaftlicher Arbeitsraum” via an optical FireWire link, where the image stream is displayed and the pictures and movies are stored. The computer based system is running quasi continuously. Some interruptions occurred, mainly resulting from system crashes due to software problems. The IR image data stream was fed into a Matlab based software, designed to automatically detect whale blows (developed in cooperation with the University of Chemnitz).

### **Preliminary Results**

The acoustic streamer was deployed 3 times (see Table 17.1). The acoustic system worked flawlessly. During the first transect, close to the African continent, three sperm whales were detected by their typical clicks. No vocalizations were detected

during the subsequent, very short transects 2 and 3. The acoustic data were stored on LTO2 tapes for further analyses at AWI in Bremerhaven.

After alteration of the camera system, the IR camera (24°) and a visual camera were operating continuously. The data acquisition system, however, failed regularly due to a software problem, which became fixed after the cruise. No whale spouts were detected by the automatic detection algorithm, in agreement with sparse visual whale sightings during the transit from the African to the Antarctic continent. Those animals visually sighted, passed RV *Polarstern* athwartship and outside the field of view of the camera system.