

TDI-Brooks Installs a Kongsberg EM-710 (1° x 1°) Multibeam System on the R/V GEOEXPLORER

March 2009

In February / March 2009, TDI-Brooks contracted Kongsberg engineers to install a Kongsberg EM-710 multibeam system on its research vessel, the R/V GEOEXPLORER, while in a dry-dock period in Colombo, Sri Lanka. The system upgrades the survey and geophysical capability of the R/V GEOEXPLORER that primarily works the SE Asia and southern Asia regions. Specifics of the system include the following:

Kongsberg EM-710 (1° x 1°) Multibeam Echo sounder with

- SIS Operator Station and Software
- Seapath 200 Motion and Positioning Reference System
- AMS Surface Sound Velocity and Temperature Measurement Sensor
- AMS SVPlus Sound Velocity Profiler
- CARIS (HIPS/SIPS) Post-Processing Software and Workstation

Figure 1 shows a drawing of the EM-710 system installed on the R/V GEOEXPLORER.

System drawing

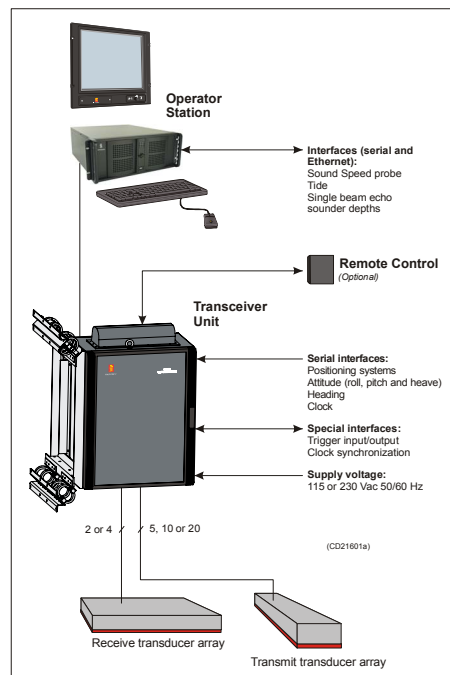


Figure 1. Kongsberg EM-710 System Diagram

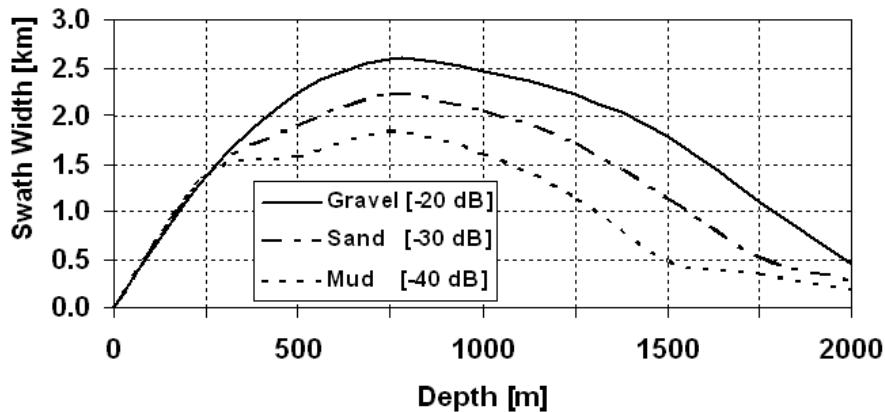
The EM-710 multibeam echo sounder is a high-resolution seabed mapping system capable of meeting all relevant survey standards. The system allows for choice of beamwidths as well as transmission modes. The minimum acquisition depth is from less

than 3 meters below its transducers, and the maximum acquisition depth is up to 2000 meters. Across-track coverage (swath width) is up to 5.5 times water depth to a maximum of more than 2000 m. The sounding density is very high, allowing even the very demanding LINZ special order survey specification for object detection to be met in full.

The EM-710 operates at sonar frequencies in the 70 to 100 kHz range. The transmit fan is divided into three sectors to maximize range capability but also to suppress interference from multiples of strong bottom echos. The sectors are transmitted sequentially within each ping, and uses distinct frequencies or waveforms. Both CW pulses of different lengths and even longer, compressible waveforms (chirps) are utilized. The along-track beamwidth transducer configuration installed on the R/V GEOEXPLORER is a 1 x 1 degree system. Focusing is applied individually to each transmit sector to retain the angular resolution inside the near field. A ping rate of up to 25 per second is possible. The transmit fan is electronically stabilized for roll, pitch and yaw with a SeaPath 200 motion and positioning reference system. The EM-710 has a receive beamwidth of 1-degree. The number of beams is 128, with dynamic focusing employed in the near field.

Swath Widths – The figures below show the calculation swath widths vs. water depth results for three (3) bottom types, characterized by backscatter strengths of -20, -30, and -40 dB at 30 degrees incidence angle. This corresponds to bottom surfaces composed theoretically of gravel, sand and mud, respectively. Experience shows that most real-life bottoms will fall between the -30 dB and the -40 dB curves (the two lower ones).

**EM 710 Coverage, Chirp Mode 1x1 Degrees
Pulse Compression - BT=100**



Survey Speed - At 100 m depth, with full swath width +/-70 degrees the system has 2 pings per second, or 4 sounding profiles. The maximum survey speed while maintaining 100% bottom coverage is then 3.4 m/sec or 6.8 knots. By reducing the swath width to +/- 55 degrees, the ping rate is increased to 3.4 and the survey speed can then be raised to 11.5 knots. Each sounding profile consists of 400 soundings.