



LYBIN – fast and accurate sonar performance prediction

FFI is responsible for commercial sale, testing, and development of the acoustic ray-trace software LYBIN.

LYBIN uses a broad set of parameters to accurately calculate the probability of detecting objects in a given area under water with the use of sonar technology. As this probability changes with environmental properties, LYBIN rapidly calculates the sonar coverage.

LYBIN is a well established and frequently used sonar prediction tool owned by the Norwegian Defence Materiel Agency (NDMA) and FFI. It is in operative use by the Norwegian Navy and in a number of other nations, and has been modified and improved for this purpose for more than 30 years. FFI has been responsible for testing, evaluation and development of LYBIN since 2000 and has been responsible for commercial sale and support since 2009.

LYBIN has become an important tool in both planning and evaluation of maritime operations. The software is integrated in combat system software, tactical decision aids and

tactical trainers. In addition, LYBIN is used in research and education. The calculation results from LYBIN are proven with measurements and have prediction accuracy similar to other acknowledged acoustical models.

Acoustic Model

LYBIN is a robust, user friendly and fast acoustic ray-trace simulator. Several thousand acoustic rays are simulated traversing the water volume. Upon hitting the sea surface and sea bed, the rays are reflected and exposed to loss mechanisms. Losses in the water volume itself, due to thermal absorption are accounted for. LYBIN estimates the probability of detection for a given target, based on target echo strength, the calculated transmission loss, reverberation and noise. Both active and passive sonar systems can be simulated.

Software

LYBIN can be used both with a graphical user

RANGE DEPENDENT ENVIRONMENTAL INPUT:

- Bottom type
- Bottom topography
- Sound speed
- Temperature
- Salinity
- Wind speed
- Wave height
- Bottom back scatter
- Volume back scatter
- Surface back scatter
- Energy loss at the surface

CHOICES OF CALCULATION OUTPUT:

- Ray trace
- Transmission loss
- Reverberation (surface, volume and bottom)
- Noise
- Masking level
- Signal excess
- Probability of detection
- Travel time
- Impulse response

interface and as a stand-alone calculation kernel. This duality enables LYBIN to interact with other applications, such as mathematical models, web services, geographic information systems, and more.

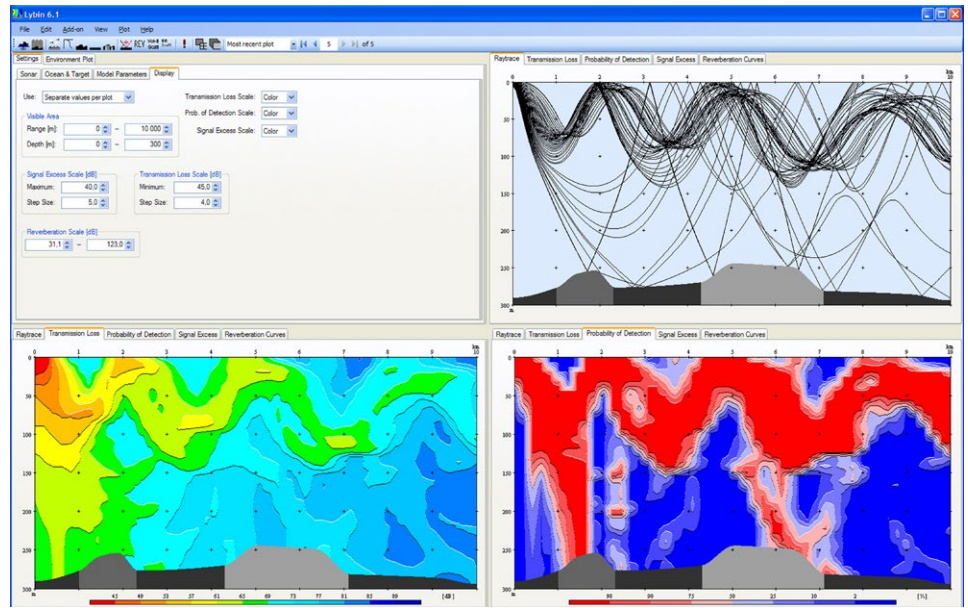
The graphical user interface represents the classical LYBIN application, where LYBIN is used as stand-alone software. Environmental data and information about the sonar and the sonar platform are sent to the calculation kernel by the operator through the graphical user interface. Thereafter, the calculation results are displayed by the graphical user interface.

The stand-alone calculation kernel enhances the potential applicability of LYBIN by enabling connectivity and communication between systems. The calculation kernel can be integrated with external applications, and both input and calculation results can be handled automatically from outside applications. The integration with third parties software can be done without needing access to LYBINs source code. The calculation kernel can be built both for Windows and Linux platform.

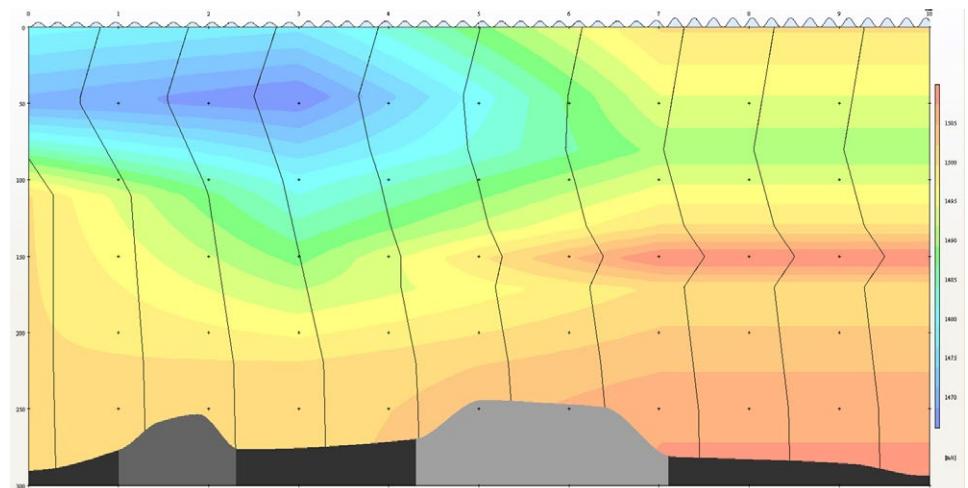
APPLICATIONS:

- Sonar coverage
- Optimization of sonar settings
- Evaluation of sonar systems
- Education in underwater acoustics
- Tactical decision aids
- Tactical trainers
- Acoustic communication
- Acoustic positioning systems

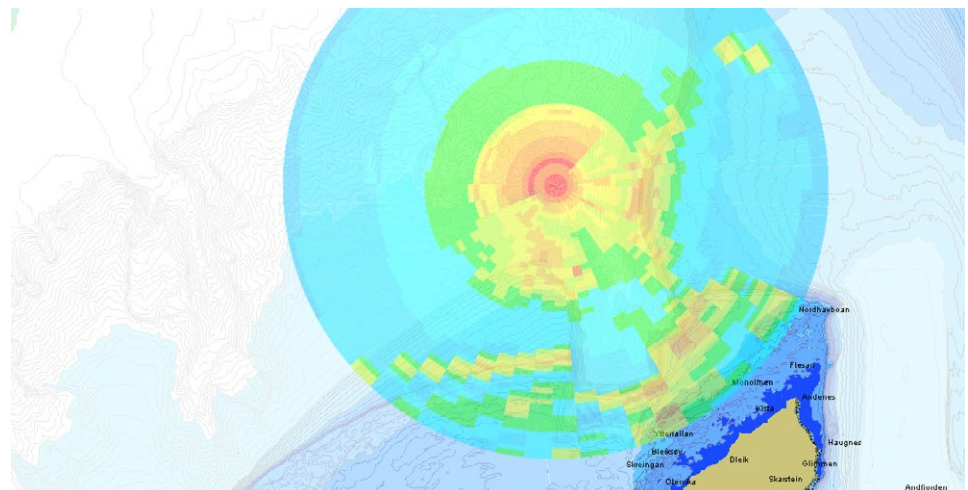
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▲ Snapshot of LYBINs graphical user interface. The screen is divided in four separate parts, one for data input, and three for simulated results. The simulated results can be altered in any desired position. Ray trace, transmission loss and probability of detection can be seen on this snapshot.



▲ Snapshot from the environmental plot in LYBIN. Wave height is shown by the waves at the top of the figure, the sound speed in the water is displayed as colours through the water volume. The bottom topography is shown at the bottom of the plot with different shadings in gray indicating bottom type.



▲ Sonar coverage varies with bottom topography. The LYBIN calculation kernel is here integrated with a geographical information service and simulation results are displayed on top of a map. High reverberation is indicated with red, and areas with low reverberation are blue.