LYBIN is a well established and frequently used sonar prediction tool owned by the Norwegian Defence Logistic Organisation (NDLO). It is in operative use by the Norwegian Navy and has been modified and improved for this purpose for more than 20 years.

On behalf of NDLO, FFI has been responsible for testing, evaluation and development of LYBIN since 2000. During this period, several new versions of LYBIN have been released. LYBIN 6.1 was released in August 2012. Since 2009, FFI is also responsible for commercial sale and support of 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 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.

**Acoustic Model**

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**Range dependent environmental input:**
- Bottom type
- Bottom topography
- Bottom back scatter
- Volume back scatter
- Sound speed
- Temperature
- Salinity
- Wind speed
- Wave height

**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

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

LYBIN can be used both with a graphical user 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, called LybinCom, enhances the potential applicability of LYBIN by enabling connectivity and communication between systems. LybinCom 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.

LybinCom has two different interfaces for data exchange with other software. The two interfaces are the binary interface and the eXtensible Markup Language (XML) interface. The binary interface enables fast transportation of large amounts of data to and from LybinCom. The XML interface is not as fast, but is more robust because the format of the input files is not as strict. The XML interface discards any parts of the input file it does not recognize.

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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