

Bolt's worldwide leadership as a supplier of seismic energy sources has been maintained by an on-going commitment to research and development. Bolt Technology Corporation prides itself in a long tradition of service to our customers.

The company's commitment to service and excellence is demonstrated by extensive quality control procedures and tests. In addition to in-plant inspection, Bolt maintains an extensive test facility where each marine, land and bore-hole air gun is rigorously tested under conditions which simulate actual applications.



▲ Aerial View of Bolt's Test Facility

Bolt is committed to being the premiere supplier of seismic energy sources for geophysical exploration.



▲ Bubble Venting from a 9000 in<sup>3</sup> Air Gun at 10 m. depth

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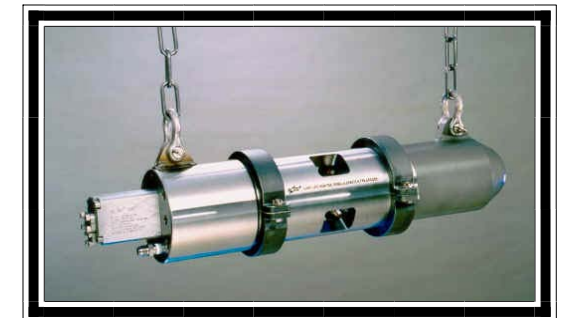
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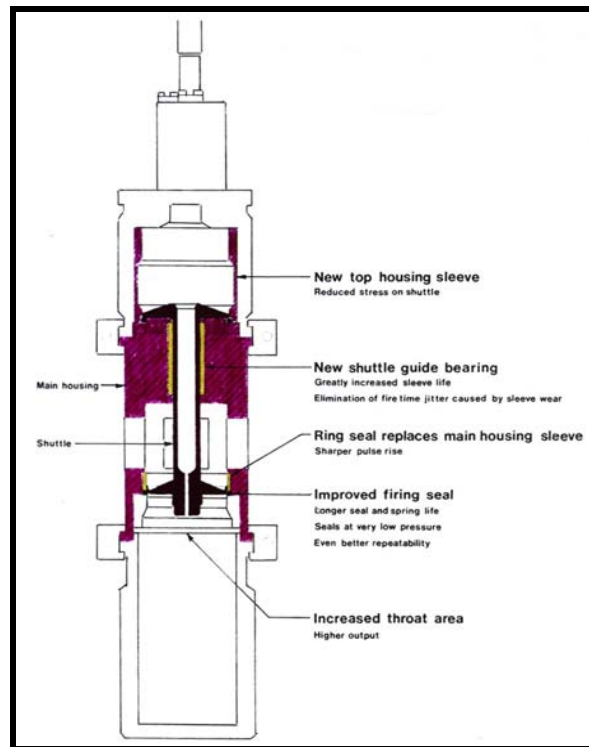
# *The Long-Life™ Air Gun*



**Long-Life™ Technology Solution**

During the early 1990s, the marine seismic industry began to develop larger and substantially more complex multi-streamer vessels capable of efficiently acquiring vast amounts of 3D seismic data. Bolt Technology Corporation introduced the *Long-Life™* Air Gun in 1991, in response to demands by seismic contractors for a stable high endurance energy source that would match the efficiency of these vessels. The *Long-Life™* design has resulted in air guns that consistently produce 500,000 or more trouble-free shots before requiring significant maintenance.

Since March of 1993 Bolt Technology Corporation has sold in excess of 4,800 *Long-Life™* Air Guns, which equates to more than three fourths of the Western World's seismic fleet. The following diagram illustrates the principle features of the *Long-Life™* Air Gun.

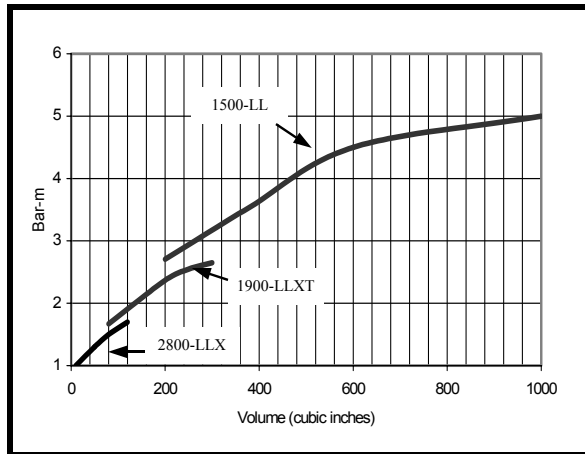


▲ 1500-LL *Long-Life™* Air Gun

The *Long-Life™* Air Gun is available both as a completely new gun or as an upgrade kit for conventional 1500CT and 1900CT Bolt Air Guns.

**High Acoustic Output**

A combination of increased throat area and improved shuttle speed has resulted in a significant improvement over conventional Bolt Air Guns in both peak output and peak-to-bubble ratio. The following graph illustrates peak output vs. chamber volume for Bolt *Long-Life™* Air Guns, measured through an Out-128 Hz filter.



▲ Peak Output vs. Volume (Out-128 Hz Filter)

The *Long-Life™* Air Gun is available in three models spanning volumes from 5 in<sup>3</sup> to 1,500 in<sup>3</sup>.

**2800-LLX**

The 2800-LLX Air Gun is designed for volumes ranging from 5 in<sup>3</sup> to 120 in<sup>3</sup>. The gun is very light-weight, and is ideally suited for shallow water source vessels with limited deck space. For maximum energy output, it can be easily configured in 2-gun and 3-gun cluster elements.



▲ 2800-LLX Air Gun



**1900-LLXT**

The 1900-LLXT Air Gun is designed for volumes ranging from 10 in<sup>3</sup> to 250 in<sup>3</sup>. The gun is extremely versatile, and is sufficiently light-weight for shallow draught vessels while powerful enough for blue-water seismic surveys.



▲ 1900-LLXT Air Gun

**1500-LL**

Due to its large throat area, the 1500-LL Air Gun is capable of generating very high peak output with the excellent low-frequency content associated with large chamber volumes. Using heavy-duty cluster spreader bars, it is possible to configure cluster elements in excess of 1,000 in<sup>3</sup> without sacrificing peak output.



▲ 1500-LL Air Gun

The 1500-LL Air Gun produces the highest peak output over the largest range of chamber volumes. The gun can be configured with chamber volumes ranging in size from 40 in<sup>3</sup> to 1,500 in<sup>3</sup>. Large chamber sizes require heavy duty towing frames to withstand the shock generated by the gun.

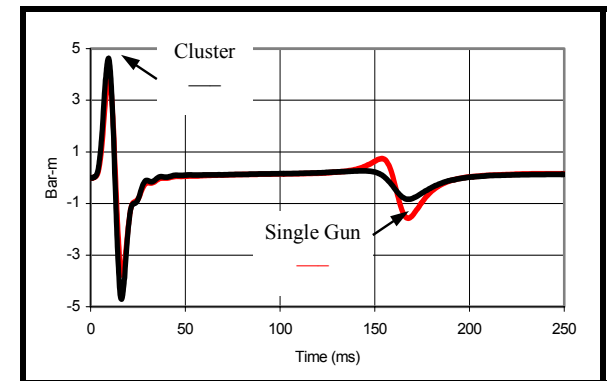
**1500-LL 2-Gun Cluster**

The preceding graph illustrating Peak Output vs. Volume for Bolt Air Guns clearly shows the effect of throat limitation on output. For each model of Air Gun, there is a volume limit beyond which the normal increase in output with volume is diminished.



▲ 2-Gun Cluster Frame (2 x 300 in<sup>3</sup>)

A solution to this problem is found in Bolt's heavy-duty cluster spreader bar assembly. The increase in peak output for the 2-gun cluster compared to a single 600 in<sup>3</sup> is shown in the following far-field signatures.



▲ Single 600 in<sup>3</sup> vs. 2 x 300 in<sup>3</sup> cluster

The far-field signature clearly shows the 20% improvement in efficiency that results from a 2-gun cluster compared with a single 600 in<sup>3</sup> air gun.

Carefully engineered and thoroughly tested, Bolt's *Long-Life™* Air Gun has proven to be the marine seismic industry's most reliable source for a decade.

