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NIMBUS™ 4D – Threat Detection using VLF Magnetic Field Detection and Waveform Analysis

The NIMBUS™ 4D is a proprietary design combining high-sensitivity VLF (less than 10 kHz) magnetic field detection and software analysis of resulting waveforms for a variety of applications. The electronics and sensors can be scaled to a hand-held size (as shown in Figure 1 for the NIMBUS™ 4D storm detector product), and further modified depending on specific applications and needed sensitivity or resolution. The NIMBUS™ sensor array (Figure 2), was designed to capture the full geometry of low frequency magnetic fields for high resolution lightning and storm detection applications, as described in Provisional Patent 62/561,326. Field testing for storm and lighting detection have shown reliable detection in the hand-held design out to distances of 1,000 km and bearing resolution of three degrees at 50 km. False positives are virtually eliminated with full waveform detection combined with the capability of the NIMBUS™ 4D to map the local environment on a continual basis.

Magnetic Field Detection Applications: The detection and analysis of VLF magnetic fields allows for the detection of a variety of threats beyond lightning and storm activity. Modification of software algorithms to compensate for changes in charge transfer mechanisms, time duration of events, and distance functions also allows for the detection of:

- Sandstorms
- Small UAVs (through engine emissions), with applications in both UAS and AUV systems
- Incoming mortar fire (through detection of ground-seeking radar)
- Tunneling (using changes in local magnetic field profiles)
- A variety of other threats that produce any form of magnetic field disturbance or signature

VLF Communication Applications: The capability of the NIMBUS™ to receive full-polarity VLF waveforms creates the option for the use of polarity modulation in communication functions at short range in urban environments, or long-range in underwater applications.

NIMBUS™ 4D Operating Specifications

- Full polarity capture of low-frequency magnetic field waveforms at 10 kHz and below
- Direct-to-digital signal conversion for maximum resolution
- 3-microprocessor architecture supports 4-channel data collection, with expanded detection channels an option for non-weather applications
- 350 microsecond time window with microprocessor control for compression
- 100% elimination of false positives in storm detection applications
- Fully integrated compass and magnetometer for drone-mounted airborne applications
- Micro-controlled gain and signal timing functions for real-time transition between applications (weather/drone/mortar)
- Current NIMBUS™ 4D electronics package can be down-sized from current hand-held design for any field application. ASIC design would allow for a full sensor and electronics package of less than 3 cm in diameter

Embedded Architecture Options: The NIMBUS™ 4D sensors and electronics can be integrated into any existing system to allow the addition of the VLF data field into other systems. VLF magnetic field data would form a natural complement to acoustic, radar, or other high-frequency detection systems.

FIGURE 1

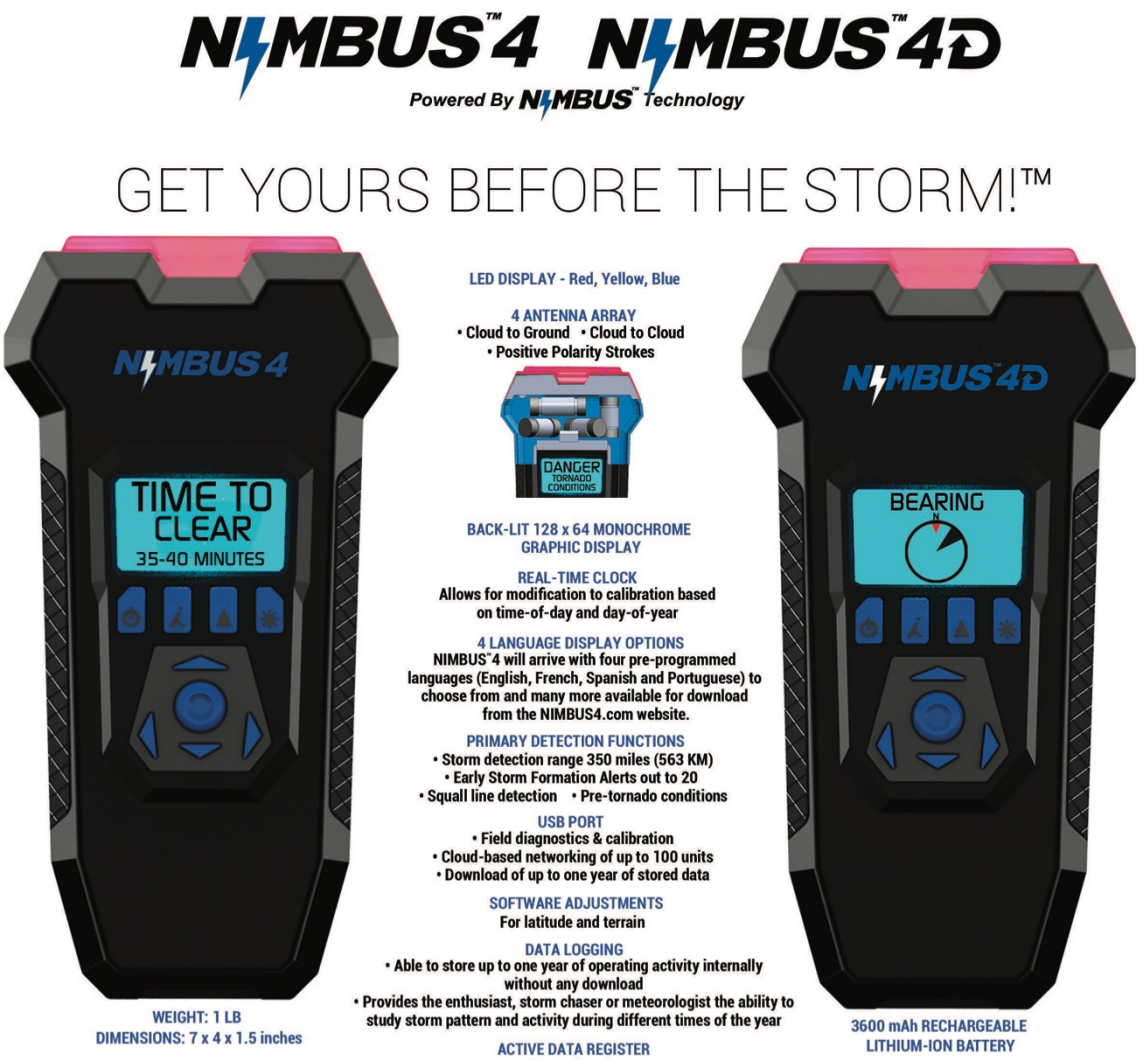

FIGURE 2