



## **White Paper -Shilat innovative technology**

### **Background**

Shilat Optronics Ltd. has developed a Low-Cost High Resolution Semi Active Laser (SAL) "Seeker" enabling precision operation in GPS+SAL mode of operation, or in GPS denied environments. The Seeker is based on a high-resolution CMOS image sensor that allows for automatic "Laser Spot Detection" with very high sensitivity, accuracy and other advantages. The seeker is operational in the IRON STING Precise Mortar for IDF (Israeli Defense Forces), and designed to withstand a very high g shocks, as typical in PGM (Precision Guided Munition).

Dual Pulsed-CW laser: The unique technology of Shilat's seeker supports the standard pulsed lasers and also the advanced Shilat designators, that are based on a CW laser diode dramatically reducing size and cost.

### **Description of the seeker and designator technology**

Shilat developed a unique technology enabling automatic detection of time-encoded light signals by a Silicon Image Sensor (CMOS). The CMOS sensor is Shilat's proprietary design tailored for the SAL application.

The Laser spot is optically encoded, and the embedded signal is extracted using a unique proprietary method, allowing the system to quickly detect and separate the Laser spot of the specified designator code, from the background image (and any other laser spots in different codes). The Seeker uses dedicated "filtering hardware for signal processing" versus image processing, allowing faster laser spot detection. In this concept, an absolute detection capability is achieved and only the desired signals are seen while the false alarms (FAR) are filtered, and high detection probability is obtained. The "heart" of the seeker is a proprietary, high-resolution, CMOS image sensor with high sensitivity in the near IR, and specific adaptations of Shilat's signal processing. This sensor is manufactured using standard CMOS image sensor technology, enabling the low cost and high reliability of the seeker, both of which are critical for wide usage in low-cost precise munitions.

Shilat's Laser Seeker enables automatic detection of pulse Laser designation using NATO codes (STANAG 3733 standard, bands 1 and 2). There are many advantages for using Shilat's Seeker technology. The integration of an imaging Laser Seeker in munitions significantly enhances the operational effectiveness of the precise munition, through target detection and tracking from a longer distance.

## **Comparing Shilat's Laser Seeker to the 4Q / Laser Seeker**

### **Detection sensitivity**

Shilat's Seeker Field of View (FOV) is divided between more than one million individual detectors (pixels), instead of 4 detectors (quadrants) in the 4Q Seekers. This architecture provides much higher detection sensitivity due to the pixel's very low internal noise, and very small instantaneous field of view (IFOV). This higher sensitivity translates into higher detection ranges of the laser spot in comparison to the 4Q Laser Seekers of the same FOV and optical aperture. By detecting the signals from a longer distance, enables the guidance system to cope with target location errors and improve the hit accuracy significantly.

### **Spot high angular precision over the FOV, with no dependency on SNR**

The seeker is based on an image sensor, thus the precision and resolution of the spot location measurement is very high over the entire FOV and is independent of the SNR (in comparison, the 4Q has an SNR-depended accuracy, which is good mainly around the center of FOV). The high precision and resolution, especially significant for munitions implementing proportional navigation that requires Line-Of-Sight (LOS) rate estimator. The estimator algorithm use IMU measurements together with the seeker's very low noise spot position information to obtain an accurate estimation of the LOS rate, even for low-amplitude maneuvering, in which it is necessary to perform small trajectory corrections in a precise and quick manner.

### **Using "stiff neck" seeker configuration**

The high precision, resolution and sensitivity of the image sensor, make it the best solution to implement the stiff neck seeker (no gimbals), in order to reduce cost and to increase the reliability of the seeker and the munition as well.

### **Complicated designation scenarios**

The use of an imaging Laser Seeker enables not only detection of the Laser's signal, but also analyzing the shape of the laser spot(s). Thus, it is possible to define various algorithms for coping with complicated designation scenarios such as a smeared spot, split spots etc.

### **High immunity against optical disruptions**

Due to the image sensor's structure, dividing the FOV into many small pixels and the ability to implement sophisticated image processing algorithms, Shilat's Seeker is significantly resistant to disruptions and dazzling as compared to the 4Q Seeker. Using an imaging sensor also provides the seeker with immunity to glitters, direct sun,

and saturation by the laser signal at short distance from the target, with practically no “blind range” close to the target.

### **Dual homing mode - SAL/EO**

In parallel to the laser detection, the seeker can output a video image of the scene that can be used for electro-optical-tracker guidance. Combined laser/video guidance can be performed, for example using the laser to briefly “cue” the seeker to the desired target, and continuing by image-tracking without the laser, to avoid laser spot detection by the target defense systems. This capability may increase the robustness of the SAL/EO seeker tracking and the munition hit probability.

### **“Shilat designators” based on a CW laser diode for designation application**

The unique technology of Shilat’s seeker supports not only standard laser designators (that use pulsed lasers), but also allows using “Shilat designators” that are based on a CW laser diode. These designators are very small and lightweight, with low power consumption, and are significantly cheaper than pulsed laser designators. Those designators adapted for infantry and small drones or UAV.

It is possible to incorporate both designators in any tactical observation devices or aerial platforms. Shilat received a contract for several programs related the laser guided munition and designators, in order to integrate on existing observation devices, UAV’s, drones and other light weight systems.

## **SHILAT PRODUCTS**



**CW Designator**



**Iron Sting Mortar  
GPS/SAL or SAL**



**CW/Pulse Seeker**

**Contact Information**

Hezi shalom - VP Business Development

Tel: 972-54-9273638

Email: hezi\_s@shilatop.com