Optimizing Long-Range Surveillance with Image Stabilization

The continually evolving security landscape requires surveillance systems to detect, classify, and track threats at unprecedented ranges, often in excess of 10 kilometers. Greater distances provide more time to respond and monitor larger areas with fewer cameras. Demand for long-range video is growing in air and ground applications—from wide-area perimeter surveillance to remote threat identification.

High-performance, long-range cameras now incorporate advances in imagers, optics, and signal processing. As the distance covered by long-range surveillance cameras increases, so does the need for more powerful image stabilization. New approaches to electronic image stabilization are now less expensive, simpler, and more versatile, ready to support everyday needs in security, law enforcement, traffic monitoring, and business applications.

Surveillance range is directly related to image stabilization. Just like consumer digital cameras and camcorders, surveillance cameras require optical zoom to detect distant objects. Tight zoom results in high focal lengths, which correspond to narrow fields of view that may exaggerate platform motion.

What causes platform motion?

- Vehicle movement (unmanned aerial vehicles and manned or unmanned ground vehicles)
- System vibration (rotors and motors)
- Weather (wind on a tower mast)
Many long-range cameras are equipped with inertial measurement unit (IMU) or gyroscopic stabilization to counteract platform motion at conventional zoom ranges, but motion at long zooms tends to be at higher frequencies. This residual, high-frequency motion is particularly difficult to suppress. Even camera systems that perform superbly during typical wide-angle surveillance of nearby subjects may be unstable for long-range surveillance. Images with uncontrolled shaking are unpleasant to view and difficult to interpret, severely compromising the ability to detect, classify, and track objects of interest.

**Importance of Electronic Image Stabilization**

Electronic image stabilization (EIS or E-stab) applies image-processing algorithms to remove jitter and vibration from video. Implemented in computer software or hardware on an embedded system, EIS compares sequential video frames and computes an average motion based on the whole image (global motion estimation). The output frames are offset by this factor, and the resulting video looks smooth. EIS very effectively reduces and eliminates the small-displacement high-frequency motion found in long-range camera systems.

Despite its performance and benefits, adoption of EIS has been held back by:

**Cost:** Traditional EIS solutions are often priced higher than the cameras they support. There are several reasons for this including low-volume production and older designs that do not leverage the latest low-cost, high-performance components.

**Complexity:** Most EIS hardware solutions require integrators to understand how stabilization is implemented and to fine-tune parameters to specific applications. The algorithms are not adaptive, and require different settings based on motion types. Vibration isn’t distinguished from camera panning or vehicle motion, resulting in reduced image quality.

**Weight and bulk:** Conventional solutions are too large and heavy to integrate into camera systems, may draw too much power, and may not be suitable for outdoor environments.

**Inconvenience:** Typical EIS solutions require some configuration at start-up and may require a reboot when parameters are changed. Most do not provide an easy interface for switching stabilization on and off or setting key parameters in real time.
Breakthroughs Make In-Line Stabilization Attainable

SRI International has developed a suite of high-performance, next-generation embedded EIS solutions built on decades of image processing expertise. These lower-cost, easy-to-integrate EIS products incorporate the same advanced algorithms and exacting performance criteria as our first proprietary ASICs.

The most recent addition to our Acadia® In-Line Stabilizer (ILS) product family, the ILS-5000-SD™, represents the culmination of image processing, packaging, and manufacturability—incorporated into a small, economical design. Programmed with high-performance algorithms, it is adapted to perform well in airborne and ground-based applications, and in fixed and panning cameras.

Affordable: The ILS-5000-SD stabilizer is an off-the-shelf module that actually costs less than the camera. The single-unit list price is $495.00 with volume discounts available to OEMs.

Simple: Algorithms are optimized for the real world. Stabilization performs well on moving platforms and has been tuned to differentiate between linear or panning motion and camera shake. Customers do not have to adjust any settings, and the unit is compatible with both NTSC and PAL cameras.

Small: The ILS-5000-SD module is small enough to hide behind a credit card (50 x 50 x 9 mm) and weighs less than 15 grams. It’s suitable for even the smallest camera enclosures. It also mounts flush to Sony FCB-EX/EXE cameras, including the new FCB-EX2X00 series, making it a perfect accessory to these popular cameras. Power consumption is roughly 1.5W at 12VDC.

Configurable: Stabilization can be switched on or off, by hardware or software control via serial interface. OEM customers appreciate software control, since they can enable stabilization at the same time they send a zoom command to the camera. They can also disable stabilization if the platform motion is too extreme for the algorithms by using an IMU or gyroscopic input. The ILS-5000-SD also passes serial commands through to the camera.
The ILS-5000-SD includes a text generator, so security, traffic, and law enforcement customers can add on-screen text displays. A switchable sharpening filter enhances line structures, edges, and other image details. Both features are accessed through the VISCA® protocol or directly through a serial interface.

**Realize the Benefits**

The Acadia ILS-5000-SD stabilizer can help you realize the full potential of long-range surveillance. Contact SRI International to speak with one of our video processing experts and discover if the ILS-5000-SD is right for your application.