

GE  
Intelligent Platforms

# applied image processing



imagination at work

# The key to an image processing solution is what you can't see.

The peace of mind and security you gain from working with a proven supplier is invaluable.

Image processing solutions from GE Intelligent Platforms are deployed in a wide range of military and paramilitary systems worldwide, including UAVs, air-to-ground, ground-to-air, ground-to-ground, naval tracking, remote control gun platforms and range instrumentation.

Our rolling program of research and development ensures that your image processing solutions remain at the forefront of the technology. Whether it is advanced algorithms to provide automated refueling of unmanned aerial vehicles, ultra miniature electronics to enable implementation in infantry weapon sights, or increased processing power to handle high resolution sensors, our research ensures the solution is available to meet the challenge.

We are world leaders in the design and manufacture of rugged, real-time image processing subsystems, and one of the leading independent suppliers of 'commercial-off-the-shelf' video tracking and image processing systems to the global defense, aerospace and security market.

The company is approved to ISO 9001:2000 and AS/EN 9100 for design and manufacture. The company is committed to long-term support of its customers, many programs running for up to 20 years, and a full Product Lifecycle Management package is available.



# Our experience includes the full range of applications.

Whether you have a ground, sea, or air application (or a combination), we have the kind of experience you need.

Developing and deploying an advanced electro optical system can be a difficult process. So it's comforting to know that you can turn to us with the assurance that we can provide cutting-edge image processing, plus the domain expertise to support the development of your system through deployment and throughout its life. Whether you require an individual board or a fully integrated system, we have untold hours of engineering experience designing, testing and validating rugged image processing solutions.

For over two decades, GE Intelligent Platforms has developed a wide range of real-time video image processing solutions to automatically extract the maximum amount of useful information from raw video data and present it to users in an easily digestible form so that system integrators can achieve superior electro optical system performance.

Each of these solutions is designed to provide optimum performance in compact, low power, environmentally-proven hardware packages. Most of our image processing solutions use standard 'off-the-shelf' products that meet interface and performance requirements without the need for major modification.

Image processing can be grouped into two areas 'Data Extraction', gathering intelligence from the video image and 'Visualization', processing the video image for easier understanding by the operator.



# Data Extraction – Target Detection and Tracking.

The detection and tracking of multiple small targets in high clutter environments.

Modern warfare on land, sea and in the air demands the capability to detect, classify and engage threats at extended ranges. Electro optical systems make a significant contribution to meeting this demand, and image processing provides a major performance-enhancing element.

Whether it is to increase system accuracy and reduce operator workload for manned systems, or facilitate autonomous operation of unmanned vehicles, GE Intelligent Platforms can provide an effective image processing solution.

The GE Intelligent Platforms ADEPT family of image processing modules has been optimized to perform real-time target detection and tracking across the full range of military electro optical system applications. Whether integrated in air-to-ground, ground-to-ground, ground-to-air or naval electro optical systems, the algorithms at the heart of the ADEPT family provide effective detection and tracking against the full spectrum of targets.

Automatic video tracking involves almost all image processing functionalities: from image enhancement and target detection/acquisition, to target tracking and system support functions.





Our video tracker hardware and proven algorithms are readily adaptable to your application.

## Image Enhancement

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The source video is fed to a pre-processor which uses verified mathematical algorithms to accomplish image enhancement, improve target contrast and suppress clutter, providing a more accurate separation of the target from 'noise' in the scene and more robust target acquisition and tracking. A range of different pre-processors are included as standard.

## Target Detection/Acquisition

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The system then identifies objects within an area or window of the video image which meet the user-defined target criteria. A range of different detection algorithms are built in to meet different situational requirements.

When one or more targets have been detected, the system can enter track mode, either automatically or under operator control. Automatic acquisition may be prioritized using several different factors, including target nearest boresight and largest target.

## Target Tracking

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In Autotrack Mode, the video tracker automatically tracks the selected target and can control almost any type of pan and tilt or gimbal system to keep the target centered in the field of view.

## Algorithms

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The GE Intelligent Platforms automatic video trackers feature a wide range of proven high-performance detection and tracking algorithms which can be tailored for the particular operational scenario, including centroid, phase correlation and edge. Algorithms may be combined to meet particularly demanding tracking scenarios.

## Features

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Automatic video trackers from GE Intelligent Platforms offer a range of communication interfaces, video formats, platform PID filters, joystick shaping, graphics overlay planes, and field of view compensation. Tracker and system set up may be optimized via Microsoft® Windows®-based software.



# Image Stabilization.

Enhancing operational performance and reducing fatigue by providing a clear, stable image.

### Real-Time Image Stabilization

Many surveillance and targeting systems, particularly those with narrow fields of view, suffer from vibrations that can lead to unstable imagery being presented to the operator. These unwanted camera movements can be a huge obstacle to interpreting the video image, resulting in a significant detrimental effect on operator efficiency. While it is possible to remove this motion using mechanical inertial stabilization methods, this comes at the expense of size, weight, power consumption and cost, all of which can affect the viability of a program.

The GE Intelligent Platforms real-time image stabilization system will electronically remove unwanted global motion from a video stream. It uses our SceneLock<sup>®</sup> algorithm to detect image rotations, scaling and translations by tracking a large number of points in the image and then combining the motion estimates of each point to determine the overall scene motion from one video frame to the next.

Commands can be issued to the camera platform to pan and tilt based on this motion measurement in such a way as to keep the aimpoint at the centre of the image. In many cases, this results in a stable image. In some

situations, the camera platform cannot take out all of the motion due to data transmission and processing latencies or the frequency response of the platform. In these cases, the image will not be held totally stable. Here another technique can be employed.

To improve the stability of the image, the output of SceneLock can be fed into an image warping engine to electronically stabilize the image by introducing shifts, rotations and scale changes to cancel out the measured movements.

For example, if SceneLock calculates that the image is moving to the right, the image warping will be commanded to shift it to the left, to cancel out the motion. The measured motion can be filtered to remove unwanted, high frequency jitter, but true pans and zooms can be passed through if required.

This image warping technology from GE Intelligent Platforms provides a low latency, highly accurate warped video stream. The stabilization process is robust to small independently moving objects within the scene.



With real-time image stabilization, image quality is markedly improved in the video stream.

# Image Fusion.

Improving tactical understanding by fusing multiple images into a single intelligent picture.

## Image Fusion

The number of sensors on military vehicles is increasing rapidly, leading to a requirement for intelligent ways to present information to the operator without information overload, while reducing the power consumption, weight and size of systems.

Military and paramilitary imaging systems can include sensors sensitive to multiple wavebands including color visible, intensified visible, near infrared, thermal infrared and tera hertz imagers.

Typically, these systems have a single display that is only capable of showing data from one camera at a time, so the operator must choose which image to concentrate on, or must cycle through the different sensor outputs. Image fusion is a technique which allows us to combine the complementary information from each sensor into a single, superior image which can be displayed to the operator. GE Intelligent Platforms offers a range of real-time, full-frame video fusion solutions which aim to maximize scene detail and contrast in the fused output, producing superior fused image quality with maximized information content.

The image fusion algorithm embedded into our systems is a new approach to multi-scale fusion which benefits from



Image fusion combines multiple sensor inputs into a single, superior image.

much faster execution times and reduced memory overheads. This novel algorithm gives significantly improved results over the baseline weighted average algorithm while still performing in real time on live imagery.

This algorithm has been designed especially for a low latency, real-time implementation which is flexible enough to fuse images from a wide range of sensors.

Our built-in warp engine provides rotation, scaling and translation for each video source to compensate for image distortion and misalignment between the imagers, reducing the need for accurate matching of

imagers with a resulting reduction in overall system cost.

Compared to existing products (either software-based with limited performance or using non-ruggedized hardware) our video fusion solutions offer greater functionality in a ruggedized and compact form factor.

# Situational Awareness.

Making a significant contribution to crew safety  
by providing total awareness of the local situation.

## Situational Awareness Systems

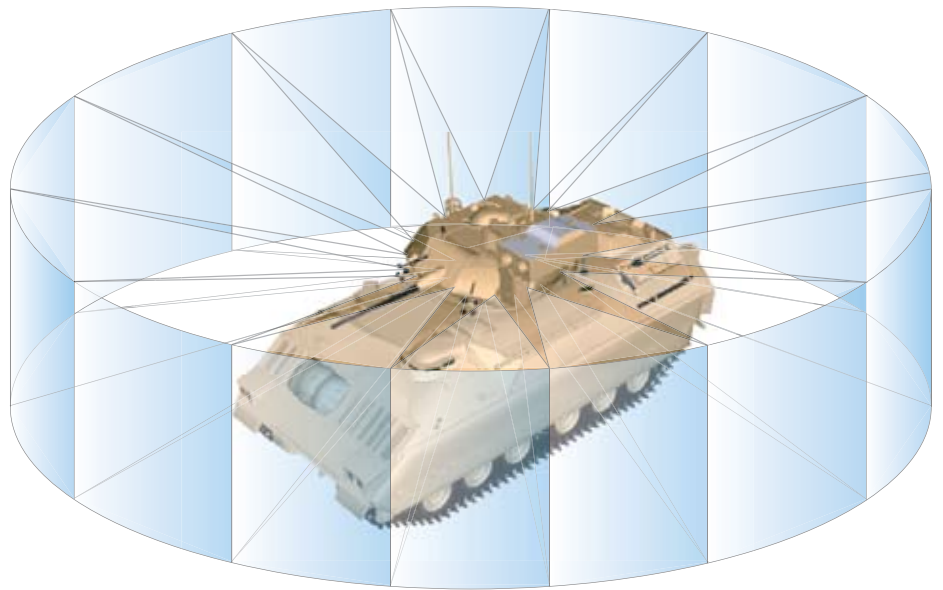
### The Challenge

Surveillance of large areas has historically been achieved by using an array of sensors connected to a bank of monitors, with separate or multiplexed displays for each video stream. Such arrangements present the operator with a confusing array of disparate video feeds, require a great deal of space and consume a large amount of power. In a dynamic, real-time scenario, there is also a danger of information overload for an operator attempting to consume and interpret such large volumes of imagery.

### The Solution

The GE Intelligent Platforms IPS5000 and IPS500 systems provide an optimized solution for local situational awareness by seamlessly merging the video signals from multiple sensors into a real-time interactive 360° panoramic image which can be displayed on a single monitor, saving space and power. It offers a previously unattainable level of situational awareness to platforms such as armored vehicles, aircraft, remote unmanned platforms and security and surveillance systems.

The operator is able to interact with the panoramic image through a range of interface options including touch screen, joystick and game-style controller. These devices facilitate scrolling through the panorama



**Our image processing subsystem greatly improves the performance of surveillance assets and their operators.**

and zooming in and out on selected images through a technique known as 'virtual camera.' Used in this way, the panorama is very intuitive to use and interpret. The panorama can also be integrated with a head-mounted display to form a 'virtual control room' effect.

The IPS5000/IPS500 display layouts can be adapted to meet specific customer requirements. It has been designed to offer an intuitive user interface with a natural looking, seamless and undistorted perspective when seen by the virtual camera

The panorama can be formed with video images from all types of sensors including visible, image intensified and thermal and

where appropriate can be fused into composite panoramas

The IPS5000 and IPS500 systems can be integrated to cue a pan and tilt unit (such as a commander's sight) to offer high resolution images of panorama targets.

In addition the IPS5000 and IPS500 systems can perform 'data extraction' on the sensor images and carry out both short term 'loop recording' and long term 'archival recording.'

# Research and Development.

To keep you on the leading edge, we continuously explore new image processing technology.

For over two decades, our rolling program of research and development has delivered innovative technology in video tracking and image processing for customers around the globe. Our goal is to build on this heritage, so that you stay at the forefront of video image processing technology in the future.

Working to the exacting standards of ISO 9001:2000, our engineers are developing the next generation of image processing products while incorporating ongoing product improvements.

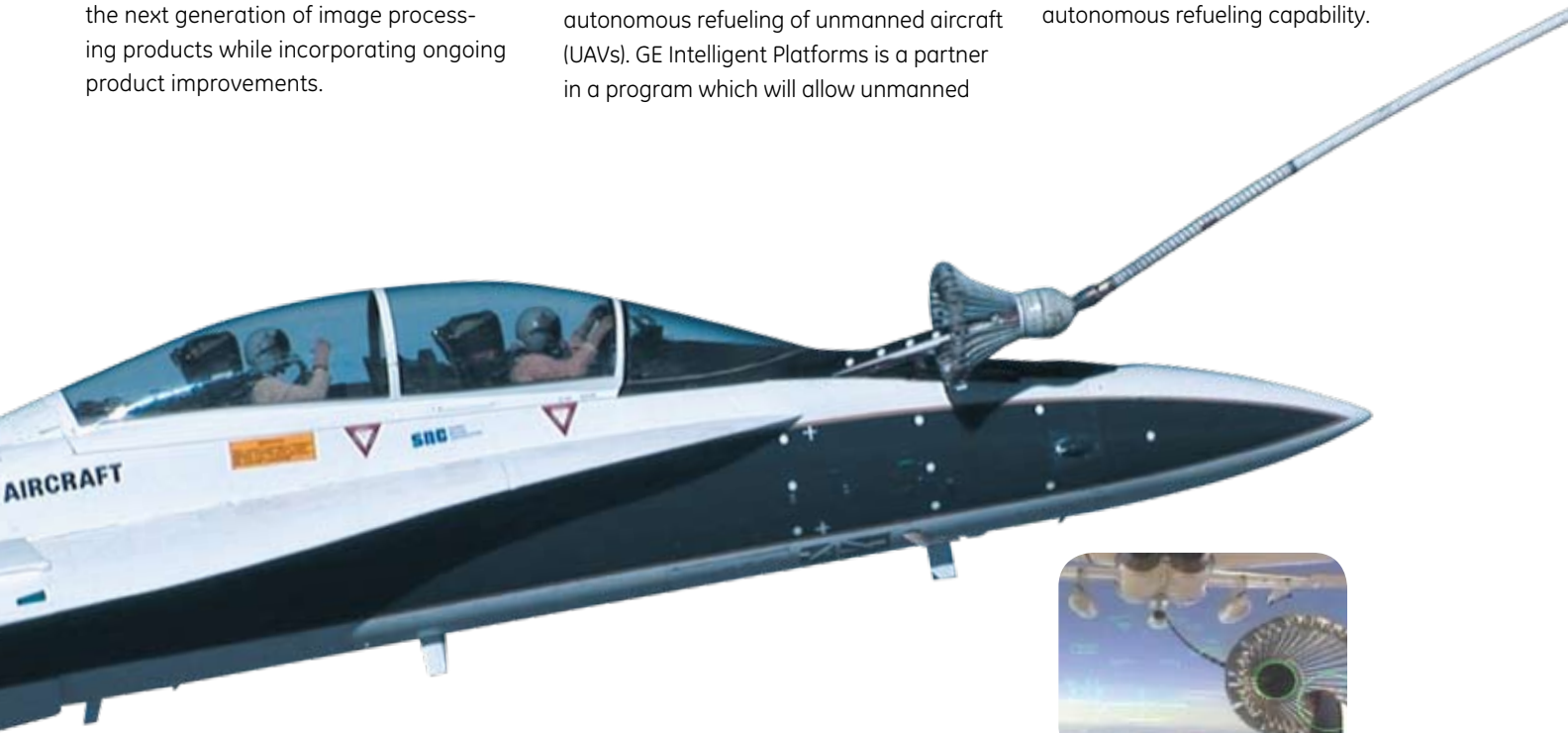
Because we are at the cutting edge of new product design and development, we can meet the challenges of new applications head on and give you a range of products you can rely on.

## Spectacular Performance

One of the most spectacular applications of our image processing technology is in the autonomous refueling of unmanned aircraft (UAVs). GE Intelligent Platforms is a partner in a program which will allow unmanned

aircraft to autonomously refuel in flight. Our video processing system locates, recognizes and tracks the refueling connector and outputs data to the flight control system to close the loop and effectively steer the UAV to dock with the refueling aircraft.

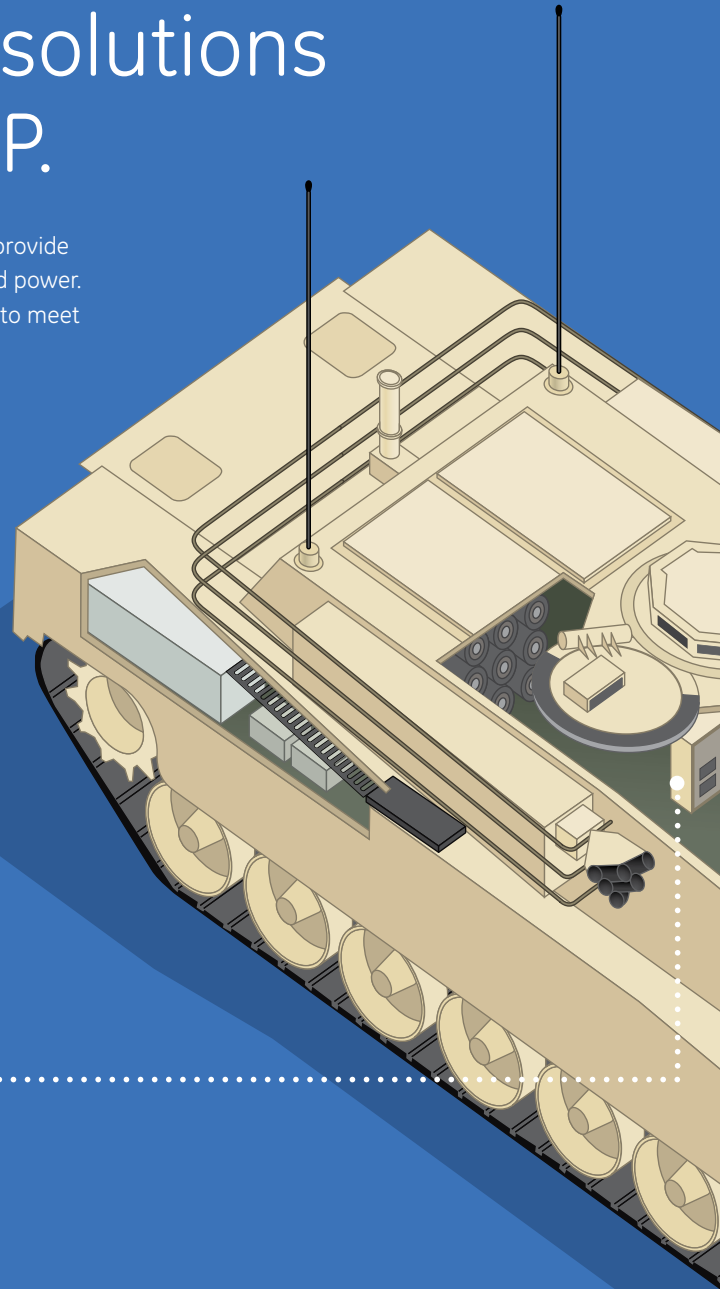
Initial demonstrations used a NASA aircraft to simulate the UAV with the pilots hands-off. Subsequent flights will lead to a fully autonomous refueling capability.



Our video tracker played a key role in the first ever, autonomous probe and drogue airborne refueling demonstration.

# Image processing solutions optimized for SWaP.

GE Intelligent Platforms COTS-based image processing solutions provide high performance while requiring the minimum space, weight and power. The SWaP optimized hardware design can be easily reconfigured to meet restricted space applications such as within armored vehicles.



## Fusion



→ Combine inputs from several imager types to create a single, superior image.

## Stabilization



→ Clear, stable images are always less confusing and more useful to the operator.



### Situational Awareness



→ The IPS5000 provides local situational awareness by merging video from multiple cameras into a real-time, interactive, 360° panoramic view.

### Detection



→ The system identifies objects within the video image which meet your target criteria.

### Tracking



→ Choose from an array of tracking capabilities, based on your application needs.



### GE Intelligent Platforms Contact Information

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Global regional phone numbers are listed by location on our web site at [www.ge-ip.com/contact](http://www.ge-ip.com/contact)

[www.ge-ip.com/imageprocessing](http://www.ge-ip.com/imageprocessing)

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