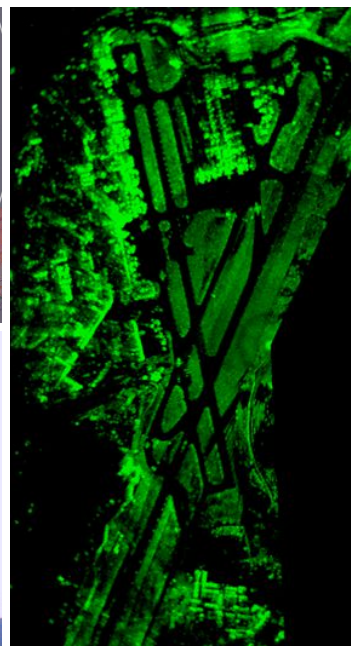
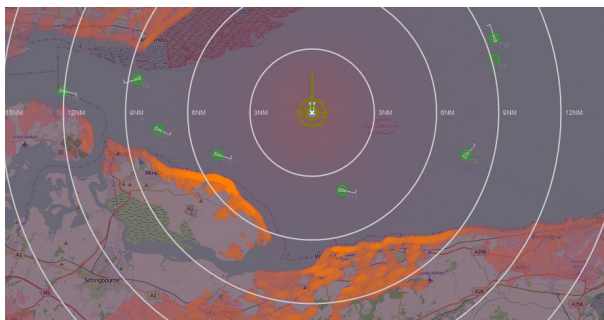
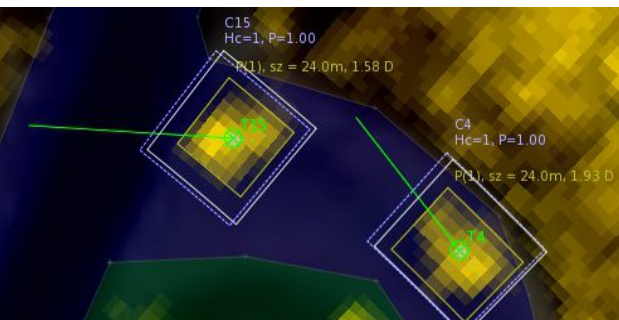


# SPx Radar Processing and Display

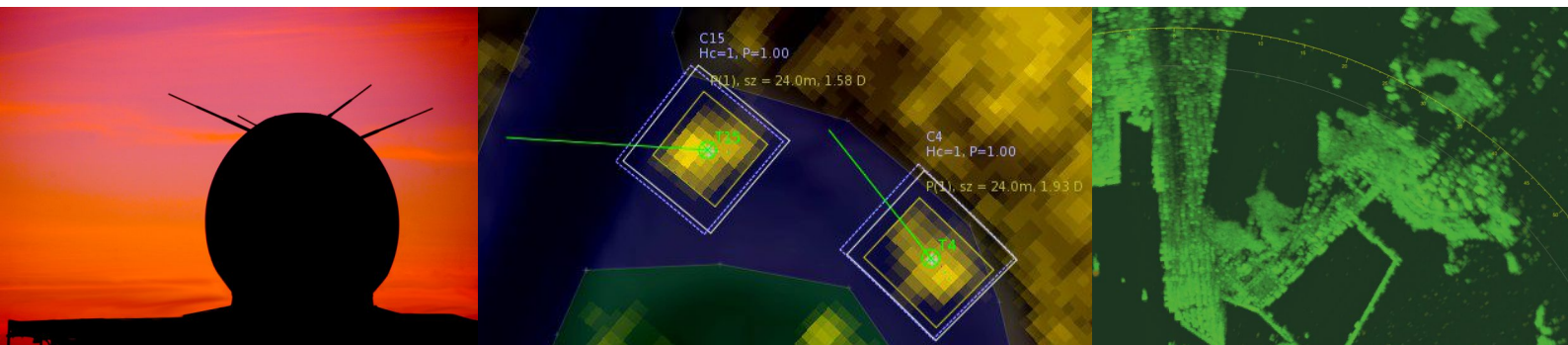
Radar acquisition, processing & display software for primary radar display in new or legacy systems



# Radar Display

Cambridge Pixel's SPx software provides high-quality radar display capabilities, offered as either ready-to-run applications or as an SDK for incorporation into existing display software.

Cambridge Pixel is a specialist provider of radar display solutions. Our advanced radar scan converter and display software from our SPx software family is a standard component in thousands of deployed systems in a diverse range of applications including: naval consoles, air traffic control displays, air defence systems and security applications. With an industry-leading feature set and highly flexible software options, radar display can be incorporated into new or legacy applications, often with minimal impact on existing software.



## SPx for System Integrators

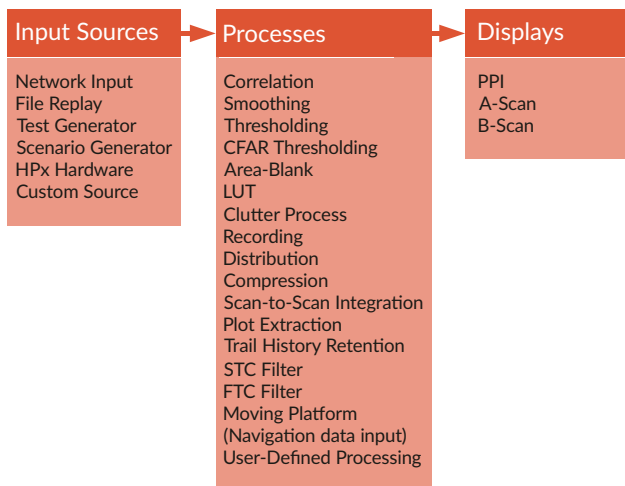
SPx provides system integrators with a powerful set of libraries, sample applications, tools, comprehensive documentation and first-class technical support. The software provides a modern, open and extensible framework that can

be used to build radar video servers, client applications or radar processors.

The ability to extend and customise SPx solutions gives system integrators the capability to add value, provide localisation and maintain close control of the solution for in-country support.

## Navigation Data

When building applications for moving platforms, the SPx Scan Converter supports true and relative display modes. A class is available for receipt of NMEA navigation data, which may be used to maintain a heading-up display as the platform moves. IMO-compliant solutions may also be built.



## Display

Scan-converted radar video may be displayed with underlay maps and overlay graphics.

Several radars may be displayed in a single window and any number of windows can be displayed across multiple screens.

## Video Distribution

Compressed radar video, in its native polar format, may be distributed across an Ethernet network. By using UDP multicast, any number of connected clients may receive the radar video.

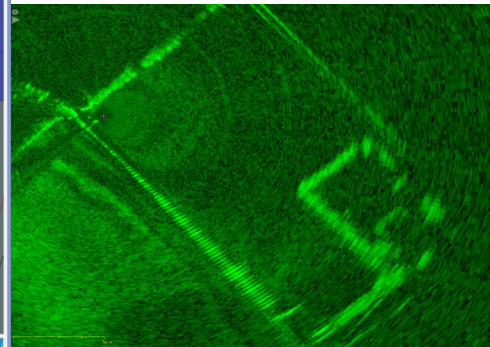
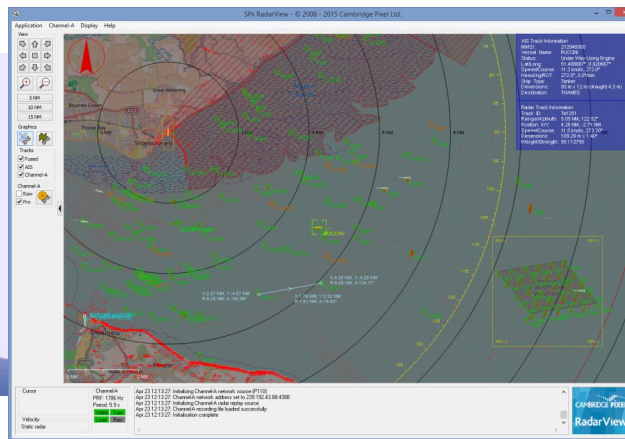
## Recording

Compressed radar video, in its native polar format, may be saved to disk. The recorded video may then be replayed at a later time and processed as if it were live.

# SPx Solutions

SPx provides ready-to-run software products for radar visualisation, radar video distribution, plot extraction and target tracking (SPx Server). These products are themselves built from the SPx library. For many users, it is this underlying library of software components, which may be integrated into customised applications, that is the attraction of SPx. By leveraging the existing toolbox of software components, a user of the SPx library can combine standard and customised processing to gain the benefits of COTS, without sacrificing the ability to customise, maintain and enhance their own solution.

The SPx library provides a rich processing toolbox as a Windows or Linux C++ class library. An application can use a single SPx class, for example to provide radar capture or compression, or may combine a number of classes into a server or client application. The flexibility of the solution comes from the ease-of-use of the class library and the ability to modify and expand it with custom code.



## Radar Video Processing

The SPx library includes a number of processes for common tasks such as:

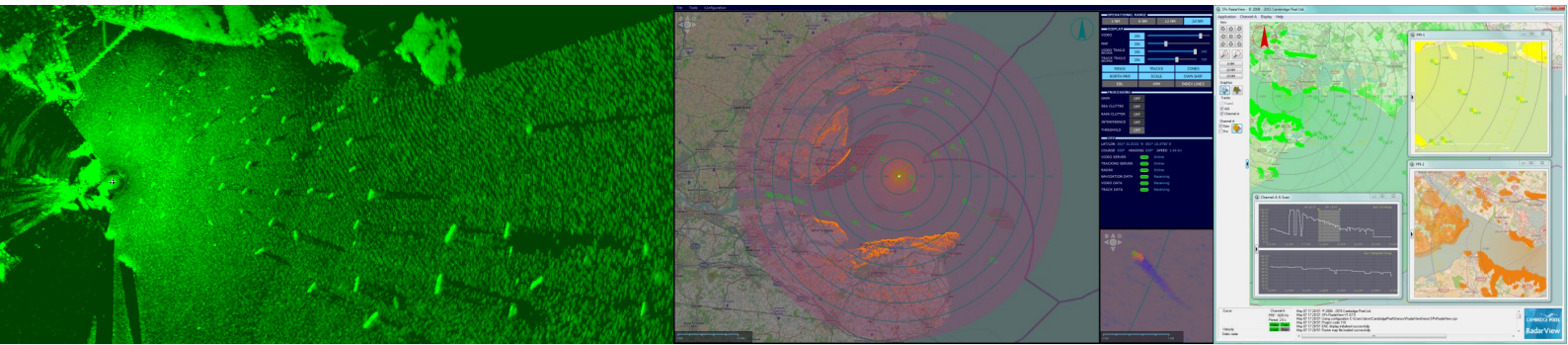
- **Filtering:** STC and FTC filters are available to help reduce sea clutter and weather effects.
- **Thresholding:** Video may be thresholded using a dynamic CFAR threshold, which is adaptive to the local signal average, or a fixed level threshold.
- **Clutter processing:** A clutter map is calculated based on a long-term average of correlated video. This clutter map may then be combined with the original data to produce the processed video. A simple application of this is to remove static video and display moving targets in the processed channel.
- **Area Mask:** An area for processing may be defined as a complex polygon. Video inside (or outside) the defined area is not displayed. This can be used to mask out areas that are not required for display or, alternatively, video inside selected areas may be displayed differently.



# SPx Radar Scan Conversion

In 2007, Cambridge Pixel became the first company to introduce a commercially available software scan converter that could work with third party graphics applications. SPx provides industry-leading, software-based radar scan conversion using a high-performance double transform method, which ensures that all window pixels are filled from the best radar sample, and that all radar samples contribute to the display picture. There are no holes, no missing spokes and no missing data.

Working under Windows or Linux, the SPx Scan Converter adds scan-converted radar video into any graphic application, exploiting the full power of modern multi-core CPU and GPU architectures. Cambridge Pixel's Radar Insertion technology allows radar to be added into an existing Windows or Linux application with minimal changes to the existing software. This is especially important when considering the upgrade of existing legacy solutions that might have a considerable investment in the application's graphics.

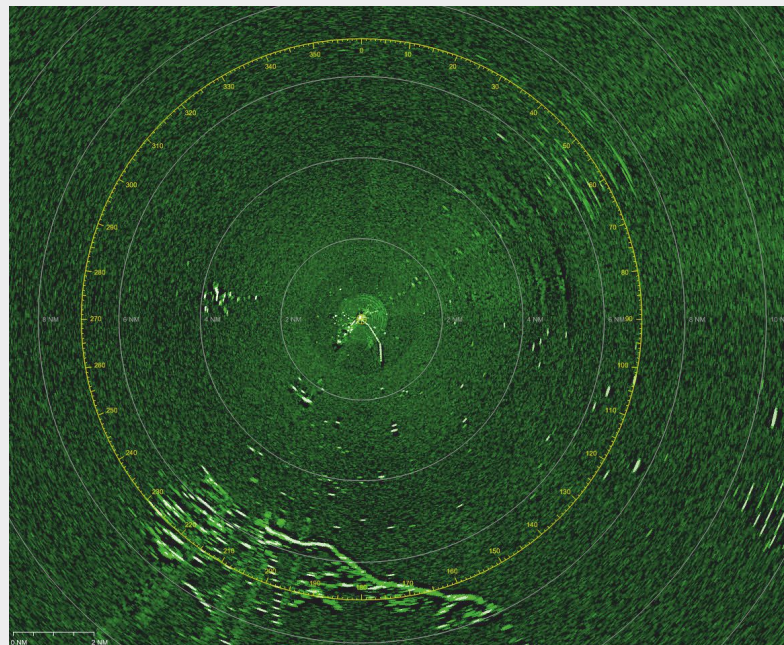


## Flexible Architecture

The SPx Scan Converter is compatible with many different software architectures. As a C++ library, the scan converter can be included into a client application using a simple class interface that takes the client's existing graphics window as an input and inserts scan-converted video as an overlay or underlay. For Microsoft .NET programmers, the scan converter can be accessed from any of the standard .NET programming languages.

## Radar Display Coprocess (RDC)

As an alternative to using the SPx scan conversion classes directly within a custom application, it is possible to use the Radar Display Coprocessor (RDC) instead. The RDC is supplied with the SPx library as a ready-to-run application for Windows or Linux that handles radar receipt, processing and scan conversion. The RDC can be considered as a service that runs on the client processor and is controlled from your application using a simple API, which is responsible for sending it control commands. The RDC scan converts the radar and updates the client's nominated graphics window with the radar image.



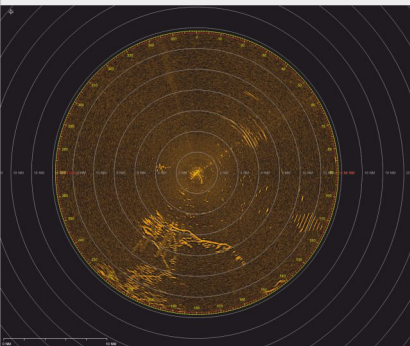
# Radar Display Options

Cambridge Pixel's high-performance radar scan conversion software supports PPI, B-Scan and A-Scan display presentations and allows multiple videos to appear in a window, and multiple windows to appear on a screen.

The SPx Scan Converter provides a full range of capabilities from multi-window, multi-channel PPI windows, through to parallax-compensated B-Scan views for fire-control radars. A comprehensive collection of sample applications (with source code) provides examples for most requirements.

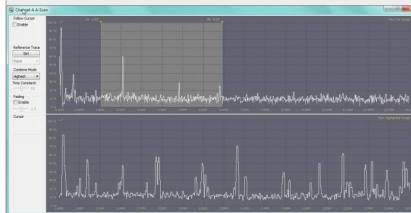
## PPI Display Mode

The PPI (Plan Position Indicator) view displays the radar as if looking at a plan view of its coverage. It shows a rotating sweep that corresponds to the movement of the antenna.



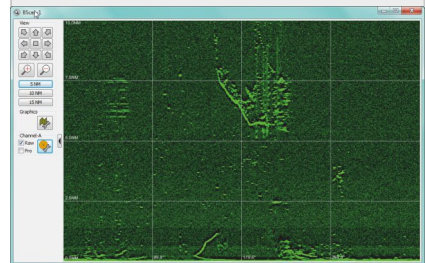
## A-Scan Display Mode

In A-Scan (or A-Scope), the data is displayed as a signal strength or amplitude against time (equivalent to range) for each return. The display is what would be seen if the radar video were displayed on an oscilloscope.



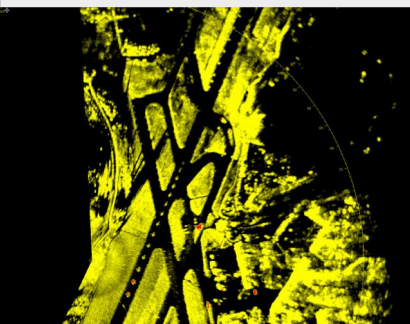
## B-Scan Display Mode

Typically used in fire-control situations, the B-Scan mode shows range against azimuth. As the radar rotates, the display updates across the window, from left to right.



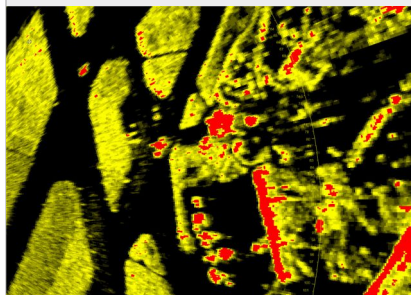
## Trail History Retention

With the SPx scan-converter, trail history can be accumulated over time (several radar sweeps) and, significantly, can be retained automatically across zooms or scrolls of the display.



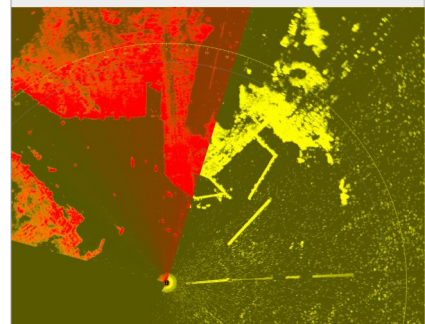
## Multiple Colour Display

Separate radar sources or different versions of the same source may be displayed in different colours. This makes it possible to distinguish different sources, but also allows for more complex scenarios. For example, by processing radar video from a single source to remove static clutter it is then possible to display moving targets in a separate colour, providing an instant visual target detection.



## Fade Control

The SPx scan converter supports different fade modes, providing control over the appearance of the radar within a sweep or from sweep-to-sweep. This means users can select views of the radar video that fade quickly, replicating phosphor displays or persist over many scans, allowing history trails to build up.



## Multiple Layers

The SPx radar insertion and display software supports both underlays and overlays, relative to the radar video layer. Radar video is blended with underlay graphics (for example maps and charts), and overlay graphics are then drawn opaquely on top. This allows developers to design complex multi-layered display applications in which the radar video does not completely obscure any underlay graphics.



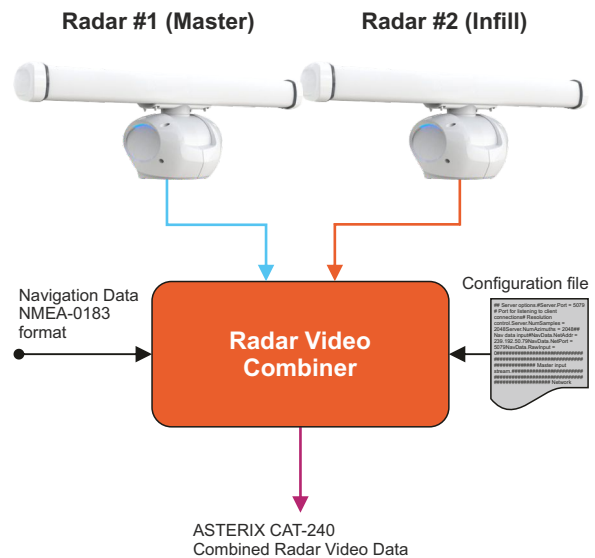


# Radar Video Combining

The SPx Radar Video Combiner application takes in two streams of network radar video and combines them into a single, unified radar video output. The SPx Radar Video Combiner is the ideal solution for merging independent radar feeds together, to form a seamlessly-blended data stream. Output radar video data is still in the polar domain and therefore appears as if it were a real radar feed to any receiving software. Additionally, since the output network stream is fully configurable, independently of the input streams, the Radar Video Combiner may be used as a lightweight distribution server.

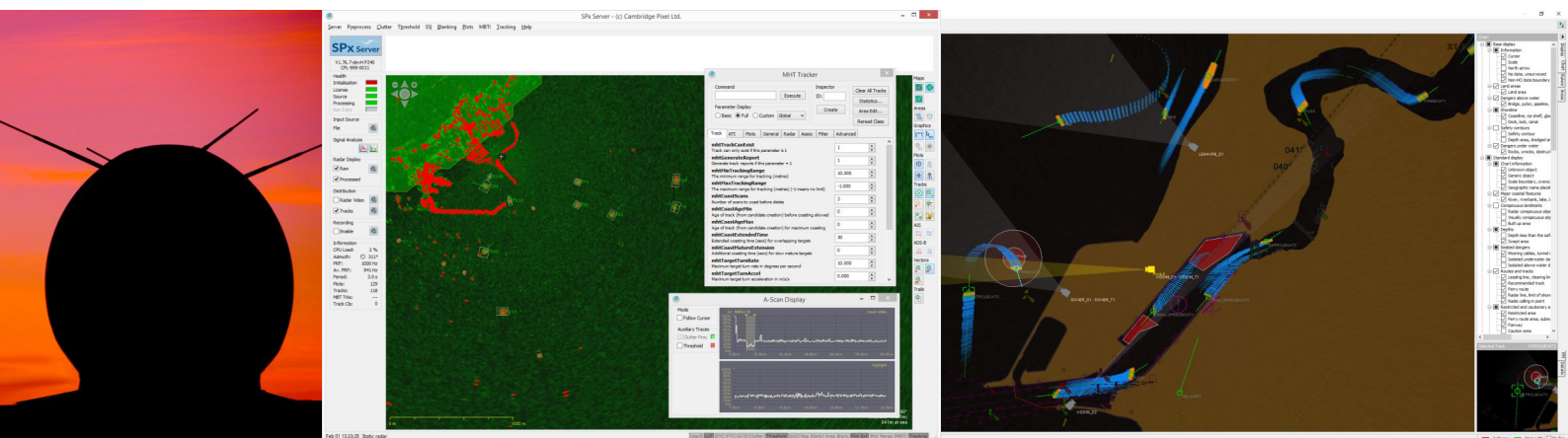
The radars providing the input videos may be completely independent, operating asynchronously and physically offset from each other. Additionally, there is no requirement for the radars to be operating at the same range or even to have the same rotation rate. The output data is slaved to the rotation of one of the radars, designated the “master” radar, in order to minimise latency.

Where the radars have overlaps in their coverage, the Radar Video Combiner can select which data is used, effectively mosaicing the inputs together and preventing timing artefacts. Furthermore, video samples may be “tagged” with the input source, allowing receivers to know which radar contributed to the sample and process/display them differently if required.



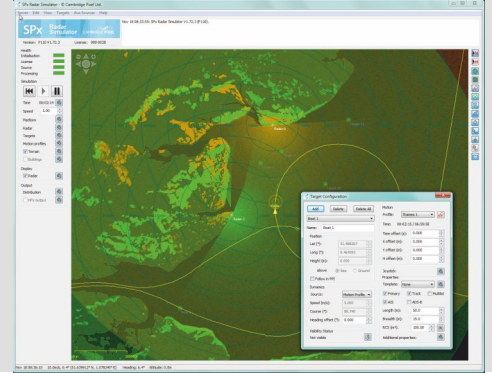
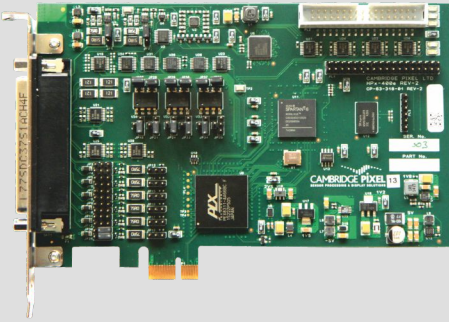
# Development Support

SPx Development is supplied with a collection of utility applications and over 50 examples with source code. The utilities are useful programs that support developers with test data, converters, viewers and analysis tools. Based on its experience of building solutions and supporting customers, Cambridge Pixel provides the software tools and technical know-how that helps developers build complex radar processing products efficiently and effectively.



# Radar Sources

SPx software works with Cambridge Pixel's HPx range of radar interface cards and is also capable of receiving network radar video from SPx applications that distribute radar video or from radars which provide a network video output directly, including ASTERIX CAT-240.



## HPx Radar Interface Cards

HPx cards are compatible with a wide range of commercial and military radars using video, trigger and ACP/ARP or parallel azimuth signals.

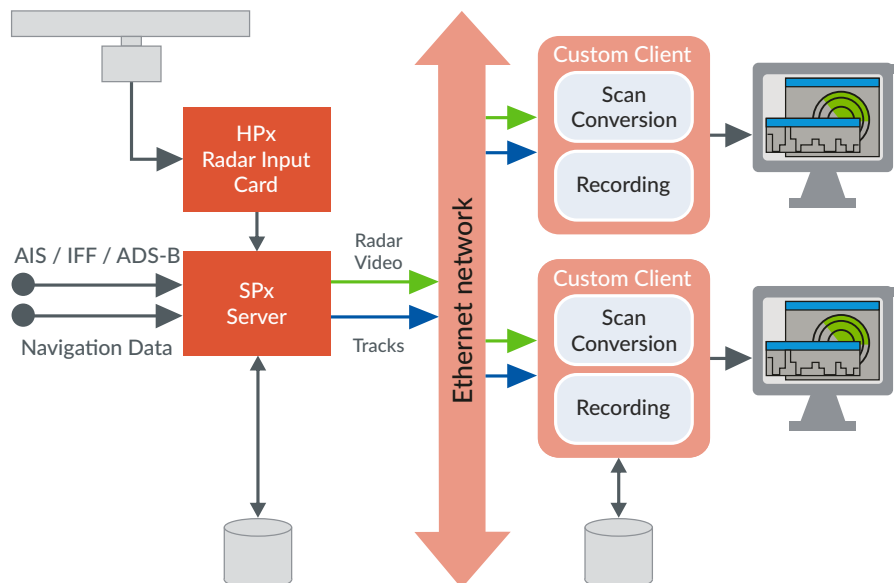
HPx cards provide a flexible range of options to support dual analogue and up to 8 digital video inputs. The cards are software programmable to allow the analogue and digital video inputs to be mixed to a single intensity level for each sample.

HPx cards are available in PCI, PCIe and PMC form-factors.

## Typical Applications

The SPx software provides a rich toolbox of components. System integrators can use the SPx library, the ready-made applications, or a combination to meet the requirements of their project.

A common configuration is a server-client based architecture wherein the server is connected to the radar and processes the incoming video. The server then distributes the radar video over a standard Ethernet network to any number of connected clients.



## Network Sources

SPx applications can accept input from other SPx applications that are distributing radar video across an Ethernet network. This enables a common server-client configuration to be adopted, with a single server system distributing radar video to any number of receiving clients. It is also possible for SPx applications to receive the network video data directly from certain radars.

## Simulation

Cambridge Pixel's SPx Radar Simulator provides a powerful capability to generate representative radar video for complex target and platform motion.

The Simulator provides a valuable development and testing tool before software is connected to a real radar.

# SPx Licensing

## SPx Development Licence

An SPx Development Licence is needed when developing custom SPx applications, but is not required when running standard applications, such as SPx Server or RadarView. The Development Licence is available for Windows or Linux and for one, two or multiple developers (site or project licence).

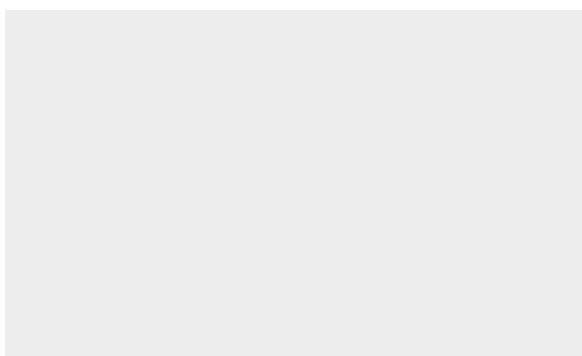
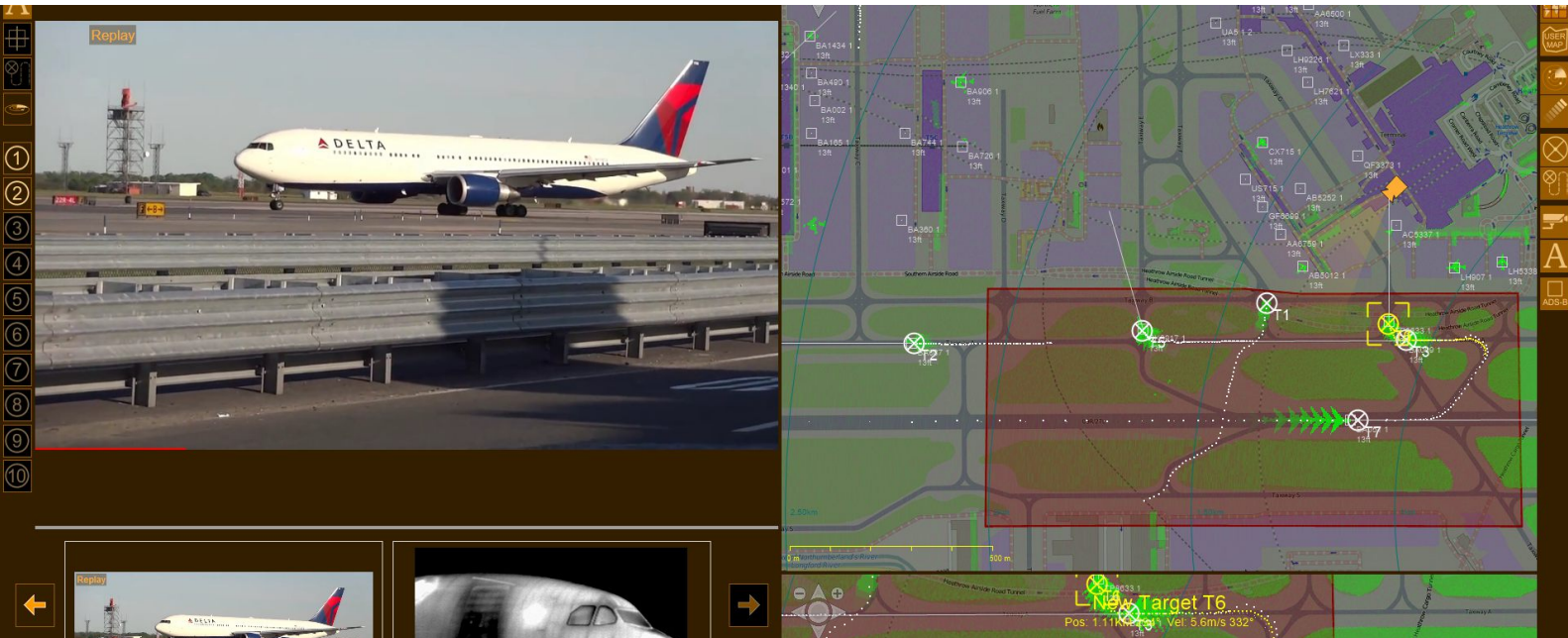
The Development Licence provides the following:

- The SPx development libraries and include files, including the C++ class library and .NET interface.
- Printed documentation for the class library, developer support manuals and tutorials.
- Source code of sample applications, framework solutions, test and demo programs.
- Programmed dongle (two dongles supplied for two seat or multi-user licence) to be used for testing of developed applications.

- First-class technical support direct from Cambridge Pixel engineers, available by telephone or email. Cambridge Pixel engineers offer a wealth of expertise and practical experience in radar processing and software engineering and this is available to you for the duration of your project development (subject to the specific terms of the licence).
- Free software updates with access to all new features (subject to the specific terms of the licence).
- Utility programs, including network record and replay, test utilities, debug tools etc.

## SPx Runtime Licence

When an SPx application has been developed using the Development Licence, the software may be deployed with a Runtime licence. This is a perpetual (never-expiring) software licence that enables the SPx capabilities on the deployed hardware. There are different licences for deployed SPx capabilities.



New Cambridge House, Litlington  
Royston, Hertfordshire, SG8 0SS UK

T: +44 (0) 1763 852749  
E: enquiries@cambridgepixel.com  
W: cambridgepixel.com  
@CambridgePixel