SPx Server

Radar Acquisition, Processing, Distribution,
Detection & Target Tracking



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What is SPx Server?

SPx Server is a family of ready-to-run software products which run on commercial off-the-shelf (COTS) hardware for:

- Radar acquisition
- Radar processing, recording & display
- Network distribution of radar video, plot & track reports
- Plot extraction & proximity detection
- Radar target tracking

The server is a program that acquires radar data, and processes it. Optionally, it can extract plot and target information and output compressed radar data and track reports to one or more client applications via a network. In addition, it may also record the radar data to a local hard drive or NAS.

Radar data is received from one of a number of configurable sources, including internal test generators, network receipt and digitisation with a hardware acquisition card.

The software can identify target-like shapes called plots, according to highly configurable rules. These plots may be output directly after detection, or may be further processed to estimate speed and course.

Target Tracking

A radar tracker interprets radar observations to distinguish real targets from noise, and to construct models to describe the motion of the targets.

As radar measurements are imperfect, there will be noise from the detection process, in addition to clutter returns from the environment. SPx Server uses advanced algorithms and a highly reliable multiple-hypothesis process to give the best interpretation of noisy measurements from the target of interest.

Network Distribution

SPx Server can provide network distribution of radar video and track reports to remote clients, supporting output as UDP packets in a number of different formats including SPx, ASTERIX (CAT-240 for video and CAT-048/CAT-010 for tracks), NMEA 0183 "TTM", TAK CoT (Team Awareness Kit Cursor-on-Target) and SAPIENT.

Up to three separate video distribution channels are supported; each may contain the raw, processed, clutter or auxiliary radar video. The auxiliary video is derived from the primary input source, via a look-up table, and could be a selected portion of the input sample (such as the second input channel from an HPx radar input card).

SPx Server outputs plot and track data onto a standard Ethernet network to remote clients for data fusion or display. The time-stamped reports are delivered with low latency, and may include both the filtered and measured components of the track's state vector.

SPx Server's target track designator supports the distribution of a separate stream of selected tracks for tasks such as following specific targets with an optical tracker or supporting the output of tracks in multiple formats.

Additional Processing

Other SPx software or third-party applications may receive the video data for additional processing or scan conversion and display. Track reports may be received and conveniently decoded into data structures for processing or display.

SPx Fusion Server can be used to correlate track reports from multiple instances of SPx Server and/or secondary sources, such as AIS and ADS-B.

Trusted by Lockheed Martin, BAE Systems & the US Navy

SPx Server Versions

SPx Server is available in three main versions, which are progressively more feature-rich:

SPx Distribution Server

Entry-level product that supports radar acquisition, processing, recording, local display and network distribution of radar video to remote clients in SPx or ASTERIX formats.

SPx Detection Server

Includes radar plot extraction and proximity detection functionality for collision avoidance and autonomous navigation. (A version which supports IFF plot extraction is also available.)

SPx Tracking Server

Adds a high-end target tracking capability, which uses multi-hypothesis association and configurable target extraction parameters to provide highly accurate and reliable track data.

Note: all three versions are also available as embedded packages for the HPx-700 standalone unit.

New Features in V2

- Proximity detection for collision avoidance & autonomous navigation
- ARM platform & HPx-700 support
- TAK and SAPIENT output formats
- AI-assisted system configuration using Machine Learning
- Integrated radar coverage tool for visibility validation
- Enhanced track reporting & plot history visualisation
- Configurable track labelling for clearer displays

Available for Windows and Linux



Area-Based Processing

SPx Server supports the processing of radar video in user-defined areas. These areas may be sectors or complex polygons and may be relative to the platform or fixed, in world coordinates.

The built-in world vector shoreline database may also be used to provide a processing boundary, for example, suppressing tracking over land. The maintenance display provides a convenient graphical tool for defining areas.

Areas may also be used within the tracking process, so that different parameter values may be set in each defined area. This is an extremely powerful capability, allowing a single tracking process to be optimised for each area.

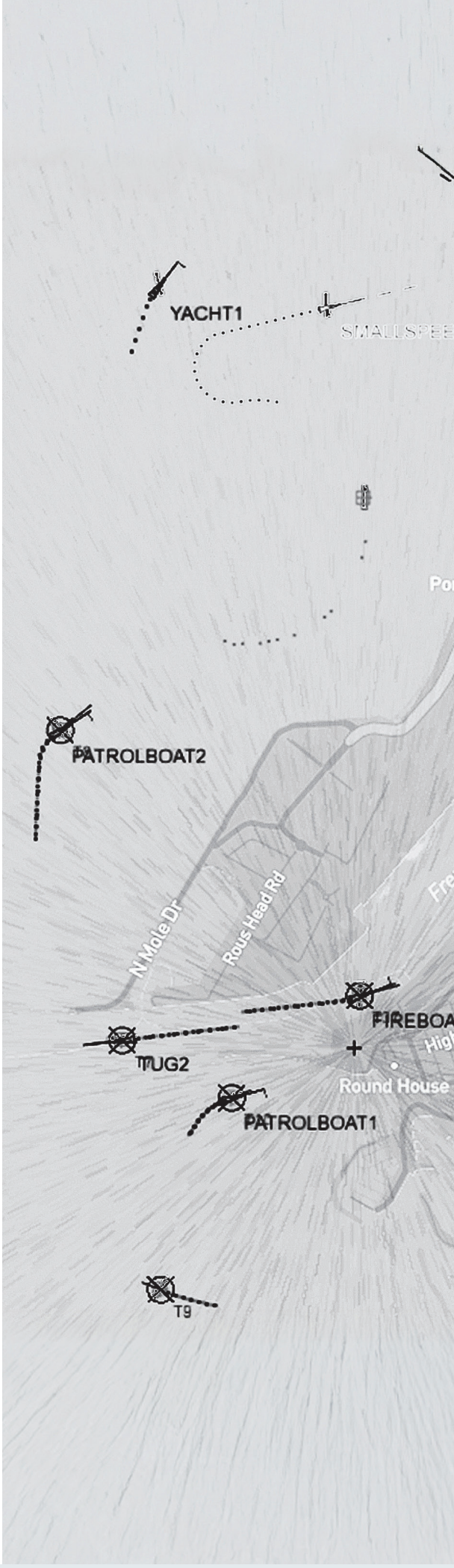
For example, in areas of high noise (woodlands, sandbanks, wind farms, etc.), it may be desirable to suppress the automatic initiation of tracks whilst still permitting established tracks to be maintained.

Model Based Tracker

The model based tracker (MBT) extensions to SPx Server provide a method for different sets of tracking parameters to be used to process the same input data.

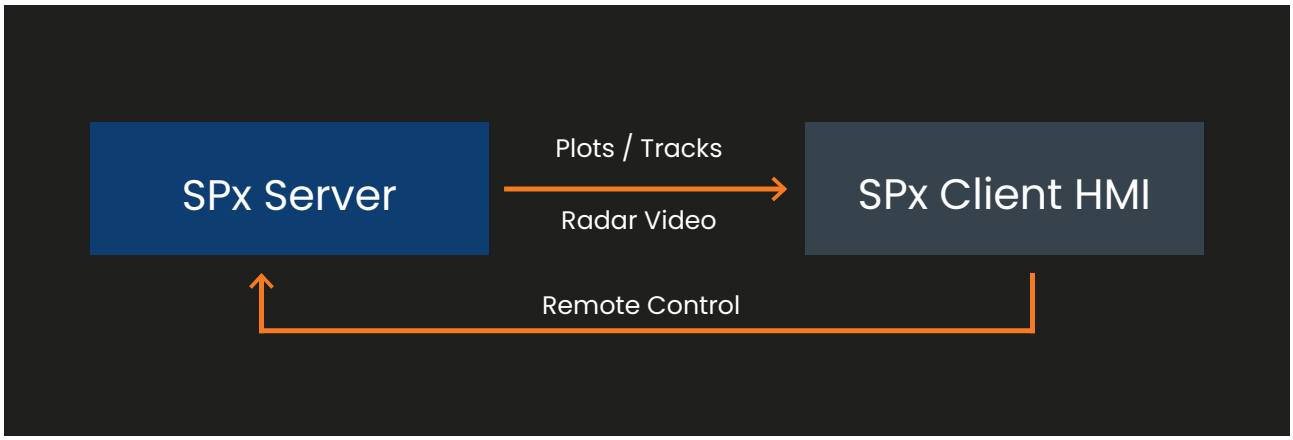
Models may be created that are tuned to look for specific types of target and multiple models may be run in parallel. This allows tracking sensitivity to be enhanced without compromising false alarm rate.

> “The software delivers considerable flexibility in the way radar information can be processed and distributed...”
>
> **BAE Systems**



Remote Client Control

SPx Server presents a network interface for control and monitoring, facilitating remote control from third-party applications. Commands may be sent to the server to configure and modify processing and tracking parameters.

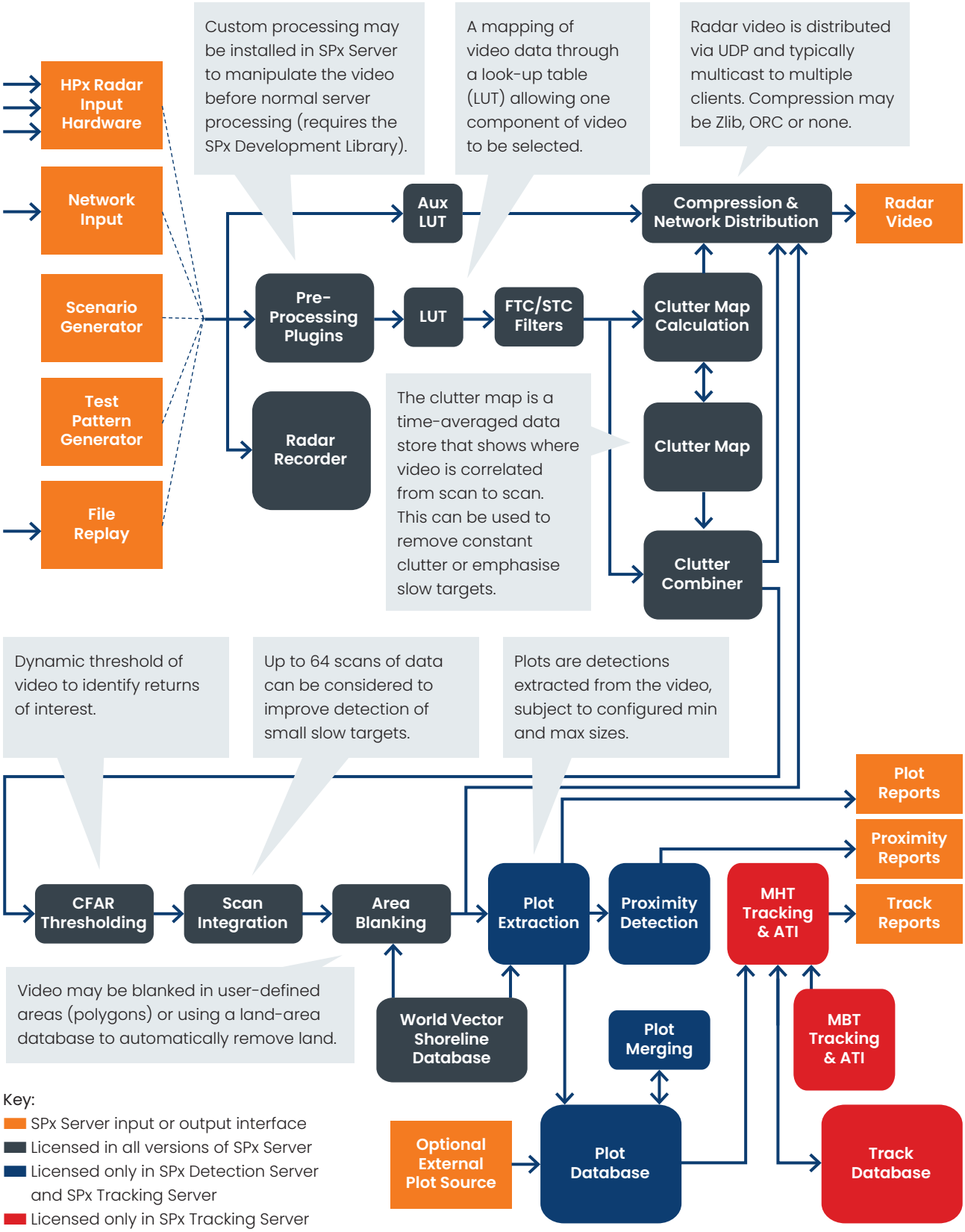


Commands include:

- Change current radar source
- Change parameters of source object
- Change network addresses for output
- Enable/disable processing objects
- Change parameters of processing objects
- Start/stop radar recording
- Start/stop network distribution
- Control HPx hardware input source
- Manually initiate, repair or delete a track
- Create new tracking area polygons
- For radars that have embedded control support, change parameters such as scan rate, gain, sea clutter and FTC



SPx Server Modules



Processing from Video to Tracks

1. Plot Extraction

The plot extraction process examines the processed video to search for returns that form a connected target-like shape. A set of configurable parameters defines the target size of interest, eliminating small noise returns or larger clutter or land masses early in the processing.

2. Track Initiation

The tracker maintains an active track database. The contents of the database are updated with new plot data derived from the extraction stage. New tracks are added to the database either from a manual request or else automatically.

Automatic track creation occurs when plots entered into the database are seen to be uncorrelated with any existing known target. A new preliminary track is created and is updated with future detections until confidence is established that the track is likely to be a target of interest.

3. Track Association

Established tracks are updated using new measurements provided by the extraction process.

The first stage of this is association by which a measurement is attached to the most likely track. In a simple situation, a true target will give rise to a single plot that can be directly associated with the expected target position. However, in the general case, there may be ambiguity as to which measurement relates to which track. A gating function is used to calculate an area around the expected position of a track, within which the next measurement must lie for it to be considered for association.

4. Track Filtering

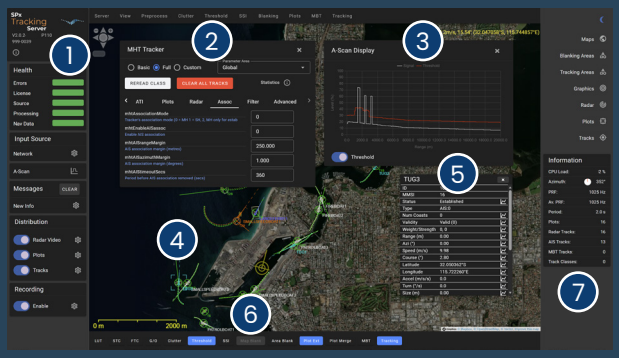
The tracker updates the current estimated position using the new measurement. If the measurement were known to be completely accurate, the update process would entirely believe the measurement and the new estimate would be exactly the measured value.

However, the measurement will contain errors, so the update process must use filtering to take a weighted combination of the expected position and the measured position. The filter works by computing a dynamic gain, based on estimated system noise and measurement noise models.

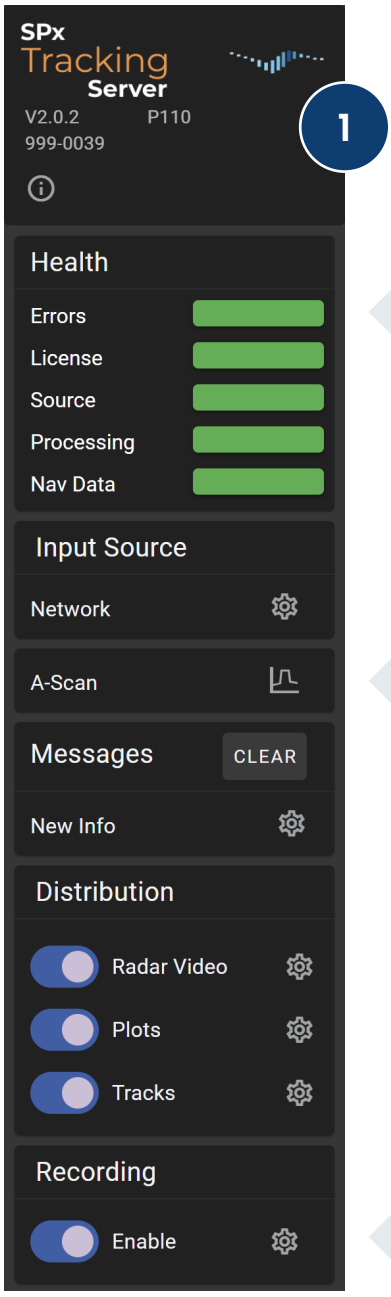
Local Engineering and Maintenance Display

SPx Server provides a web-based user interface for set-up, monitoring and configuration. The Windows version also supports a native user interface.

The server software can be configured without an interface, but for most situations it provides an extremely valuable display capability to assist in the initial deployment and maintenance of the software.



Details of SPx Server type (Distribution, Detection or Tracking), software version number and licence number.



Server health indicators provide an instant visual warning of any problems.

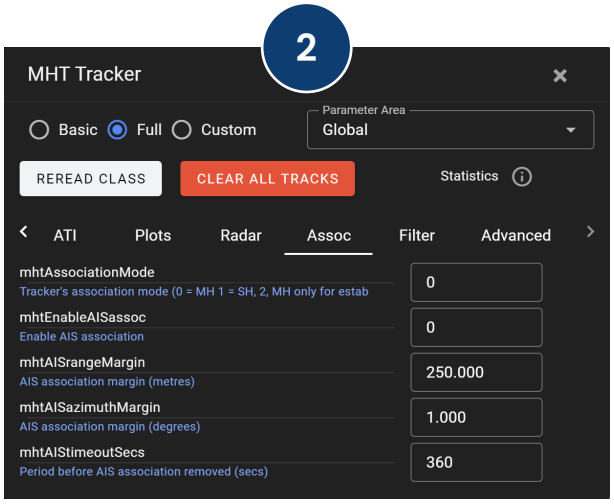
Input source selection.

A-Scan window on/off.

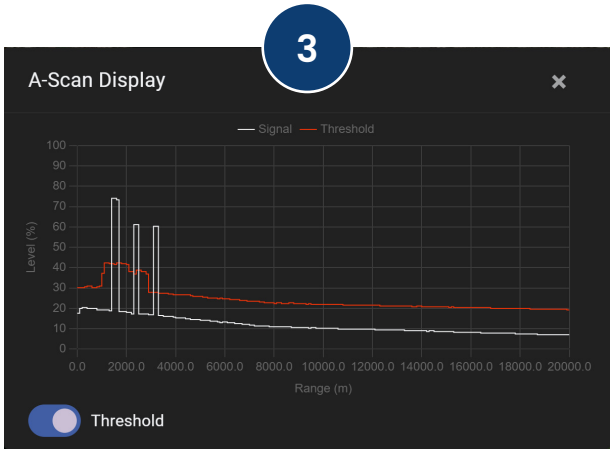
View status, warning and error messages.

Radar video, plots and tracks distribution controls (enable/ disable, set distribution IP address, message format, compression method).

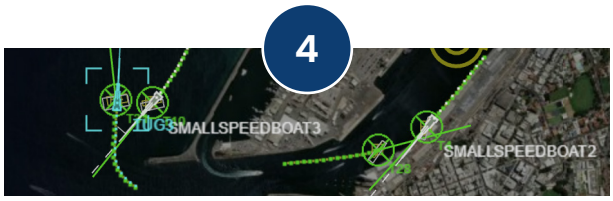
Built-in radar video recorder, which can capture, compress and store radar video to disk. This happens without affecting tracking or network distribution activities. If available, platform navigation data and AIS data is also captured, allowing full analysis of the recorded scenario at a later date.



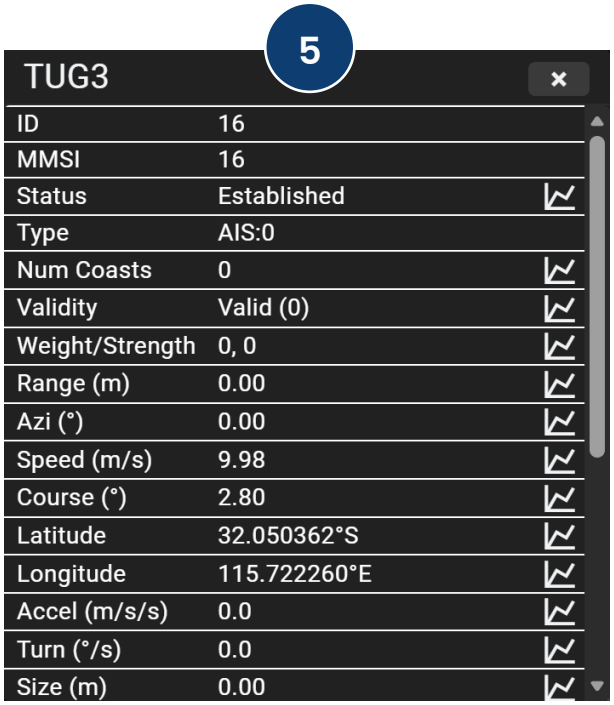
Controls are provided to configure parameters for each of the processes in SPx Server, including tracking. An area editor is also available, to assist with configuration of area-based processing.



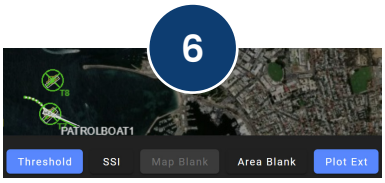
Graphical tools, such as an A-scan display, are available to assist with process configuration.



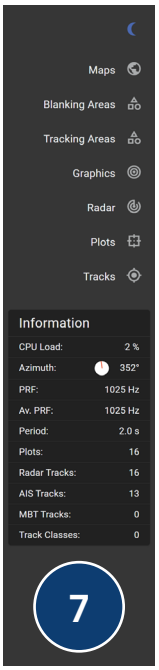
Tracked targets are drawn with a symbol, label, velocity vector and history trail.



Track monitor provides detailed information about a selected radar track, including position, speed, course and other characteristics.



Indicators show which processes are currently enabled.



Local radar display controls and live status information, including an indication of the source PRF and current antenna azimuth.

SPx Server Feature List

- Primary and secondary (IFF) radar processor
- Radar video from HPx cards or network
- Radar processing:
  - Filtering
  - CFAR thresholding
  - Area-based video filtering/masking
  - Clutter map generation
- Plot extraction and merging
- Proximity detection
- In-built AIS association
- AIS track display and recording
- Doppler video support
- Multi-hypothesis target tracking
- Model-based tracking extension
- Fully configurable tracking
- Area-dependent tracking parameters
- Full automatic track initiation
- Redundant operation, with automatic failover
- Built-in world coastline database
- Integrated radar coverage tool
- Static or moving platform
- NMEA navigation input for mobile systems
- Network distribution in SPx, ASTERIX & SAPIENT (BSI Flex 335 V2.0) format
- TAK CoT (Team Awareness Kit Cursor-on-Target) support
- Radar, NMEA and AIS record/replay
- Web Interface for control and monitoring
- Sidelobe suppression
- Intel and ARM platform support
- Windows and Linux versions
- Network remote control
- Receipt and tracking from plot data
- Receipt and distribution of lidar data
- Video, plot and track output to network
- AI-assisted system configuration

+ Regular updates with new features

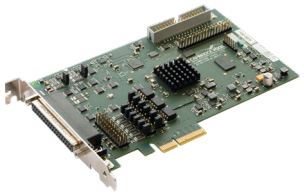
System Requirements

Processor	Intel Core i5 (10th gen. or newer) with 16 GB RAM, ARM Cortex-A72 (or better) or HPx-700 radar input & processing unit
Operating System	Windows 11 and Linux (Fedora, Ubuntu & RHEL) For other operating systems, please consult Cambridge Pixel
Graphics	GUI requires a graphics display resolution of at least 1024x768 for configuration (Note: use of GUI is not essential)
Network Interface	1 Gbit Ethernet adaptor recommended
Analogue Input Option	HPx-410 PCIe or HPx-450 XMC cards (for Intel/PC systems) HPx-700 has built-in signal acquisition hardware

Radar Input Sources

SPx Server works with Cambridge Pixel's HPx range of radar input hardware and is also capable of receiving network radar video from SPx applications that distribute radar video or from radars that provide a network video output directly (ASTERIX CAT-240 and various proprietary formats).







HPx Radar Input Hardware

HPx radar input hardware is compatible with a wide range of commercial and military radars using video, trigger and ACP/ARP or parallel azimuth signals. A flexible range of options is included to support dual analogue and up to eight digital video inputs. The hardware is software-programmable to allow the analogue and digital video inputs to be mixed. Available form factors include standalone devices like the HPx-700 radar input and processing unit, as well as PCIe and XMC cards such as the HPx-410 and HPx-450.

Network Sources

SPx Server can accept network radar video input directly in a number of different formats, including SPx format and ASTERIX CAT-240. This makes it possible for software applications to send data into SPx Server for processing.

It is also possible for SPx Server to receive the network video data directly from certain radars, such as Kelvin Hughes' SharpEye, Simrad, Furuno, ICS and Raymarine.

Ordering Information

SPx Server (Software Only)	Linux/Intel	Windows/Intel	Linux/ARM
SPx Distribution Server runtime licence	110-640	110-641	110-647
SPx Detection Server runtime licence	110-710	110-711	110-717
SPx Detection Server (IFF) runtime licence	110-730	110-731	N/A
SPx Tracking Server runtime licence	110-702	110-703	110-707

HPx-700 & SPx Server (Hardware & Software)	Standalone Unit (inc. mains PSU)	OEM Card
HPx-700 Distribution	700-160	700-110
HPx-700 Detection	700-170	700-120
HPx-700 Tracking	700-180	700-130

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Cambridge Pixel is driving innovation for a safer, more secure world.

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