Kongsberg Norcontrol IT

VTS Extractor & Tracker VET5070

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The VET5070 is the latest generation of VTS Extractor and Tracker for use in the Vessel Traffic Management & Information System (VTMIS5060). Employing commercial off-the-shelf technology, the VET5070 is a high capacity, state-of-the-art system.
VET5070 is used at both local and remote radar sites to extract digital radar video and target track information from the analogue radar signal. The digital video and target tracks are transmitted to the VTS control centre over a Local Area Network (LAN). If the radar site is at a remote location, the LAN is extended by the use of LAN bridges and a narrow band communication link. The digitised video from the VET5070 provides a highly accurate representation of the actual radar video, but requires significantly less bandwidth for transmission. As a result, a variety of cost-effective communication techniques can be used to link remote radar sites to the VTS control centre.

Features

VET5070 main features can be summarised by the following:

- *High probability of detection*
- *Low false alarm rate*
- *Ability to discriminate between close targets*
- *Detailed masks for land and detection areas*
- *Excellent noise reduction through scan to scan correlation*
- *Stable tracking and rapid manoeuvre detection*
- *Digital radar video generation*
- *Adaptation to radar performance*

➢ Radar Interface

The Radar Interface and Filtering board can accept sync and analogue video inputs from two radar transceivers or digital video input from one transceiver, and azimuth position inputs from one antenna. The RIF board performs signal conditioning (gain and offset), low-pass filtering and video digitisation. It also includes floating threshold CFAR filtering of the digital signals.

➢ Scan Buffer

The main component of the Scan Buffer board is a 32MB buffer, which is used to hold the digital samples of one complete scan. Incoming video samples are subjected to a scan-to-scan correlation process. This function has the following advantages:

- *The number of video samples to be processed is reduced*
- *Clutter and interference are significantly reduced*

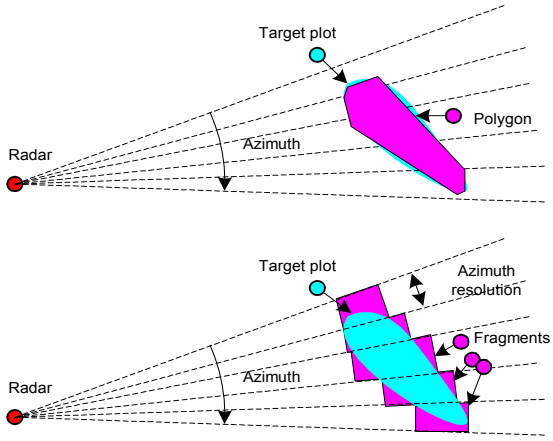
The resulting video echoes are used for plot and digital video generation.

➢ Plot Generation

The video echoes generated by the Scan Buffer board are collected into groups where the echoes are adjacent in azimuth and range. These plots may be used as target measurements for the tracking process.

➢ Digital Video Generation

The video echoes generated by the Scan Buffer board are also used to generate digital video. Similar to plot generation, groups of adjacent echoes are formed, and representations of each group are generated. Two different formats are available for presentation on the VOC5060 Operator Workstation, namely Polygons or Fragments, and the resulting radar picture approaches 'raw video' quality.



➢ Target Acquisition

Each plot is checked against the tracked targets and if certain criteria are fulfilled the plot is associated with a tracked target. Any plots that are not associated with a tracked target may be used for acquisition of new tracks.

➢ Target Tracking

Tracking is performed using Kalman filter techniques. In order to achieve stable vectors when the vessel is not manoeuvring, and to avoid large offsets during manoeuvres, two filters are run in parallel and a manoeuvre detector is used to switch between them. The Kalman filter is based on a dynamic mathematical model describing the vessel's movement. This model is used to predict the vessel's behaviour between measurements. Each time a plot is assigned to the target, a position measurement is derived, and this measurement is used to correct the state of the dynamic model.

➢ Geographical Processing

Four types of geographical masks or areas can be defined to distinguish between different processing modes.

- *Land Mask: No digital video or target tracking.*
- *Littoral Mask: Digital video, but no target tracking.*
- *Auto-Acquisition Area: Digital video and target tracking. Both automatic and manual acquisition.*
- *Remaining area: Digital video and target tracking. Manual acquisition.*
- *Shadow Area: Tracking is based on prediction.*

Technical Specifications

General

- *Computer Type: Industry Standard PC*
- *Operating System: Microsoft Windows 2000/XP®*
- *Interface Type: Ethernet IEEE 802.3 10/100BaseT*
- *Link Protocol: UDP/IP or TCP/IP*
- *Data Link Rate: Minimum 64 kbps*

Video Processing

- *Video Bandwidth: 25 MHz*
- *A-D Conversion: Programmable 10 to 50 MHz sampling at 8-bits resolution.*
- *Thresholding: Digital moving-window CFAR, programmable window lengths and strategies. Azimuth filtering.*

Digital Video Generation

- *Detection Sensitivity: With optimum setting of operator controls, maximum 2 dB degradation in MDS measured on VOC5060 display at VTS control centre, compared to MDS measured on similar display at VET5070 input.*
- *Video Presentation Delay: ≤ 300 ms from detection to transmission.*
- *Video Shape*:
  - Polygons*: 4-, 5-, 6-, 7- or 8-edged polygons closely circumscribing correlated echo groups*
  - Fragments*: Juxtaposition of sector segments, each formed by the intersection of two radial lines and two concentric circles centred on radar position. Granularity configurable according to link bandwidth and desired video density.*
- *Video range resolution: equal to sampling resolution, e.g. 6 meters at 25 MHz sampling rate.*
- *Video azimuth resolution: 0.088° for Polygons and Fragments. Additionally also 0.176°, 0.35° or 0.70° configurable for Fragments.*
- *Video Amplitudes: 16 discrete levels (4 bits)*

Operator Adjustments

- *Clutter Suppression: 0 to 100% in 100 increments*

Target Tracking

- *Maximum Number of Moving Targets: 500*
- *Maximum Number of Stationary Targets: 250*
- *Maximum Number of Surveyed Navaids: 250*
- *Target Speed Limits: Configurable. Typically 0 - 50 m/s.*
- *Detection Rate: 25% required for tracking at constant speed and course and 67% required for tracking at maximum manoeuvres.*
- *Acceleration: 1 m/s^2 (0 to 2 Kt/s), maximum*
- *Turning Rate: Dependent on target speed. Typically 5 °/s at 20 Kt or greater, 10 °/s at 10 Kt and 20 °/s at 5 Kt.*
- *Navaid Surveillance: Stationary navigation aids are surveyed according to a pre-defined map of nominal positions and search areas.*

Communication

- *Update Time: 300 ms*
- *Baud Rate: ≤ 256 kbps*
- *Echo Priority: Tracked targets and surveyed Navaids have highest priority.*

Target Accuracy

Typical figures for moderate manoeuvres at short range are given below. The following assumptions are made about the radar; 67% detection probability, 3.7 second antenna rotation period, 1000ns pulse, PRF of 900 Hz and 0.45 degrees horizontal beam width. For a target with these characteristics; target speed 5 m/s (10 knots) and length 100 m, the following accuracy applies:

- Position: 9m
- Speed: 0.1 m/s
- Course: 0.9º

Radar Video Analogue Interface

- *Amplitude: 1.0 volt, minimum; 4.0 volts, maximum*
- *Polarity: Positive or negative*
- *Impedance: 75 ohms or high impedance (> 1 kohm)*
- *DC Offset: Up to ±25% of peak amplitude*

Radar Video Digital Interface

- *Amplitude Resolution: 8 bits*
- *Format: Differential data lines in compliance with EIA-644 (LVDS)*
- *Data Rate: Up to 50 MHz*

Radar Trigger Interface

- *PRF: Up to 6 kHz, maximum*
- *Amplitude: 2.5 volts, minimum; 15 volts, maximum*
- *Polarity: Positive or negative*
- *Impedance: 75 ohms or high impedance (> 1 kohm)*
- *Pulse Width: ≥ 100 nanoseconds, mark-to-space ratio < 1:10*
- *Rise Time: < 100 nanoseconds*
- *Overshoot: < 1 volt on baseline*
- *Sync Delay: From -2 µsec to 200 µsec at a 25 MHz sampling rate*

Antenna Azimuth Data Interface

- *Interface Types:*
  - *(1) Single-ended: RS232C/RS423 or TTL*
  - *(2) Balanced line: RS422*
- *Azimuth Clock Pulses: 512, 1024, 2048, 4096 or 8192 pulses per revolution*
- *Azimuth Reset Pulse: 1 pulse per revolution*
- *Pulse Duration: 1 µsec, minimum (each ACP and ARP)*
- *Rotation Rate: 60 RPM, maximum*

Options

- ***Equipment Rack -** The VET5070 can be mounted in a 19" equipment rack or placed on a desk or table.*
- ***Redundancy -** Dual VET5070s can be supplied working in an Active/Standby relationship.*

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