



# RANGE ONLY RADAR

**The ROR blends proven tracking techniques with the reliability, flexibility and cost effectiveness of off-the-shelf components and PC based hardware and software.**

## RANGE ONLY RADAR

Autonomous range data allows an intelligent optical tracking mount (or host system) to produce:

- Single-station X, Y, Z position
- Auto-focus of optical sensors
- On-Axis Cartesian tracking
- Real-time Azimuth, Elevation, and Range slaving

The addition of range data to an otherwise highly accurate but two-dimensional optical mount is valuable in nearly all testing situations but is particularly crucial for the testing of smart munitions; a scenario in which events happen too quickly and unpredictably to permit more traditional tracking methods to provide the necessary data consistently and efficiently.

A major consideration in a radar which needs to be light and small is its operating frequency. In this case, tradeoffs between X and Ka-bands were evaluated:

Ka-band radars have a narrower beamwidth than X-band units for a given antenna size. For a Range Only Radar this results in higher loop gain and less clutter in the beam. However, Ka-band also has higher atmospheric losses and greater susceptibility to weather interference. A very narrow beam may also not be desired, especially during acquisition. Higher transmitting powers are readily available at X-band which helps offset the lower loop gain.

Cost was a major consideration in our design. Ka-band components are significantly more expensive than X-band both to purchase and to repair. Considering the expense of the components as well as test equipment and the ready availability of proven X-band modules in the commercial marine and aviation field, X-band was the more attractive alternative.

The basic low-cost Range Only Radar consists of a small lightweight electronics package with a parabolic antenna and a simple, yet versatile interface to the system operator. The electronics package contains a proven off-the-shelf Receiver/Transmitter unit and PC-based range data processing and interface hardware and software. The electronics package is designed to mount on a single sensor station such as a Photo-Sonics, Kintec, Contraves or other small optical mount. The antenna attaches to the front of the electronics package.

## KEY FEATURES

- Adds Range Capability to existing optical platforms
- Real-time autonomous range data to optical tracking mounts

**BAE SYSTEMS**

INSPIRED WORK

## TYPICAL SYSTEM CONFIGURATION

The radar Receiver/Transmitter unit is an integrated unit proven in commercial service worldwide. The R/T unit operates at 9.4 GHz with an output peak power of 10 kW. Two pulse widths are selectable: 0.25 and 0.5  $\mu$ s. Pulse repetition frequencies are programmable within duty cycle limitations up to 1280 pps. The radar receiver uses MIC low noise technology, matched IF filters, and a 60 MHz IF output. With a 0.8 meter (31 inch) parabolic antenna and operating at 0.5  $\mu$ s pulse width, the radar will track a 0.1 meter RCS target to at least 10 km.

The antenna typically provided is a 0.8 meter Cassegrain design with a beamwidth of 2.8° and a gain of 35 dB. A larger or smaller antenna can be provided as needed with applicable differences in performance. The antenna may be mechanically interfaced to the electronics package to allow for constraints in the configurations of the mount, other sensors, or the mount cover.

A ruggedized PC-ATbus off-the-shelf controller is included with the radar. Input, output, and interrupt is passed between the range processor board and the host controller over the PC-ATbus. The controller has a software range tracker already proven in our VMEbus design and ported to the PCbus.

The software range track loop is a Type II computed in floating point processor for maximum granularity of data. A software alpha-beta filter is used which provides velocity memory. The Type II tracking loop provides good track response and zero-lag on non-accelerating targets. A programmable track bandwidth is available to match the range track servo loop performance to the target dynamics.

The hardware tracker card includes a precision 21 MHz on-board oscillator for range clocking. The assembly also contains the PRF generator, the radar video digitizer and the means to accept external time tag interrupts. For graphical video display purposes, a peak detector and FIFO memory are used to capture each PRF video. The ROR design minimizes requirements for real-time operator interface. Once the optical mount is aligned on the proper target, the operator only needs to push one button to place the range tracker into an automatic acquisition mode. In the auto-acquisition mode, the radar automatically searches a preset range window for a valid target return. After target acquisition, the range tracker provides a continuous realtime parallel range data output. If track is lost, the operator activates the same single button to re-start the auto-acquisition process.

A keyboard input and VGA output is provided on the radar host controller for access to internal parameters of the radar such as search window, PRF, pulse width, range bias and other pre-mission setup values. The operator can configure the radar to fit various mission profiles through a menu-driven sequence.

## ABOUT US

At BAE Systems, Inc. in the United States, our employees design and deliver advanced defense, aerospace and security solutions that keep the nation at the forefront of modern technology. Our pride and dedication show in everything we do, from innovative electronic systems to intelligence analysis and cyber operations, from combat vehicles and weapons to the maintenance and modernization of ships, aircraft and critical infrastructure.

## FOR MORE INFORMATION

BAE Systems  
557 Mary Esther Cut-Off, NW  
Fort Walton Beach, FL 32548  
Telephone 850-664-1354  
Fax 850-664-1365  
www.esdradar.com  
esdinfo@baesystems.com

The open architecture of the radar hardware and software enables various options and customized features to be incorporated without lengthy and costly re-engineering.

## SPECIFICATIONS:

Range Accuracy: 3 meters 1 Sigma  
Max Range: 64 km

Antenna:

- Diameter: 0.8m
- Gain: 35 dbi
- Beamwidth: 2.8 degrees

Transmitter:

- Peak Power: 25kW
- Pulse Width: 0.25, 0.5
- PRF: Programmable up to 1280PPS
- Frequency: 9.4 GHz

Tracks 0.1 Square Meter >10km

## OPTIONS INCLUDE:

- Expanded host processor functions such as coordinate conversion, special sequential search commands, parallel data outputs, and real-time data recording.
- Expanded and customized control panels including touch screen controls and target selection.
- Output video either for display on a Color A-Scope or superimposed on standard video signals.
- Integration of the ROR with other PC-ATbus based hardware such as annotators, encoders, clocks, recorders, serial and parallel data communications devices and fiber optic interfaces.
- Extended range performance using either a larger antenna or higher power transmitter.