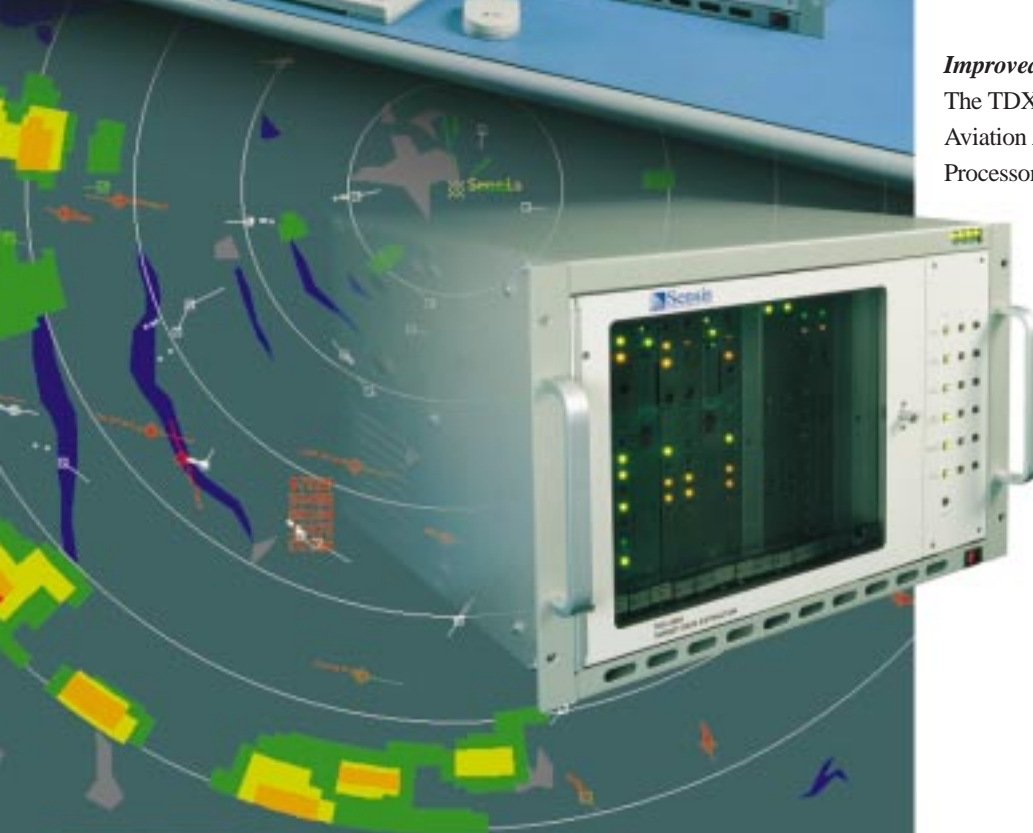# TDX-2000 Target Data Extractor

The TDX-2000 is a high performance radar processor which transforms primary radar and beacon video outputs - from virtually any air surveillance radar - into high quality digital target reports or track messages suitable for integration into modern control centers. The TDX is modular in design and can be configured in any combination of primary radar, secondary radar (beacon) or weather extractor. The system is interfaced to a control and maintenance console to provide real-time PPI, RHI and weather contour displays while providing complete system monitoring, maintenance and recording functions.
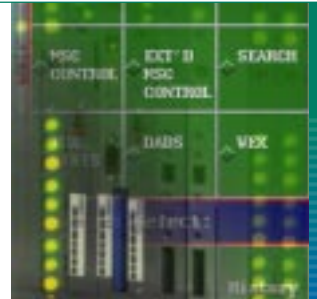
- **Radar Data Extractor**
- **Beacon Data Extractor**
- **Weather Data Extractor**
- **Control and Maintenance Console**

Improved Surveillance Picture
The TDX software includes a field proven, Federal Aviation Administration (FAA) certified Sensor Data Processor which dramatically reduces radar false plots from weather, bird flocks, road traffic, ground clutter and anomalous propagation. False plots are reduced up to 95% providing a clearer and more accurate surveillance picture. Additional data processing features include primary/secondary radar plot association, beacon false target limiting, message filtering and coordinate transformations.

Sensis
CORPORATION

TDX-2000 Target Data Extractor

Format and Protocol Flexibility—
The TDX is designed with user configurable format and protocol capabilities providing for highly effective data translation and distribution functions. The product supports a multitude of protocols (e.g., synchronous, asynchronous, HDLC), electrical standards (e.g., RS-232C, RS-422, EIA-530) and message formats (e.g., CD-2, ASR-9, ASTER-IX, Hughes ADGE, Thomson AirCat). New formats are constantly being added to meet customer needs.

Distribution and Integration of Data—
In addition to providing data via traditional serial channels, target data is distributed using standard TCP/IP and UDP/IP communication protocols over an Ethernet local area network (LAN). This LAN based data is available for integration into local or remote ATC and C⁴I systems or cross-telled to remote command and control centers. Data can be fused with other sensors using a Sensis Surveillance Data Server into a single, unified air picture. Fusing and sharing of data decreases the costs of operating autonomous overlapping systems or purchasing new systems. Additionally, refined data can also be output as reconstituted radar video based to support legacy video display systems.

Available in either single channel or redundant channel configurations, the TDX is a stand-alone system in a rack mountable enclosure requiring only triggers, ARPs, ACPs and video signals to interface with a radar. The TDX 2000 has been chosen by the United States Air Force to upgrade over 25 radar systems throughout the world. International users of the Sensis TDX include several Northern European, Middle Eastern and Asian countries.

PRIMARY VIDEO

SECONDARY VIDEO

WEATHER VIDEO

TRIGGERS
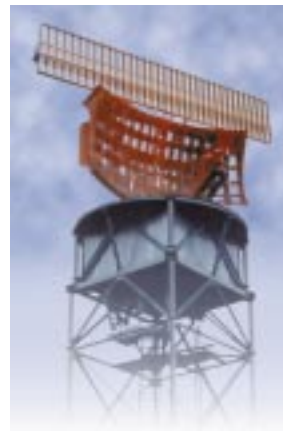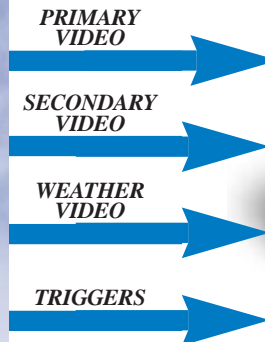
Sensis TDX

Ethernet LAN

Analog Radar

Control and Maintenance Console

Radar Data Extractor

The Sensis Radar Data Extractor (RDX) extracts digital target information by processing primary radar video. The RDX is designed to accommodate scan rates and signal bandwidths of both short and long-range radars and utilize both normal and MTI video signals. After parallel A/D conversion of a radar's normal and MTI video signals, the RDX performs non-coherent integration and applies fixed and adaptive thresholds to maintain a constant radar false alarm rate. It detects targets via a M-of-N sequential observer process which applies adaptive thresholds derived from a rank-value background-normalizer and high-resolution clutter map. This eliminates "splitting" a single range-extended target, and "merging" two targets occupying adjacent azimuth cells. All processing functions are fully configurable to adapt to specific customer needs.
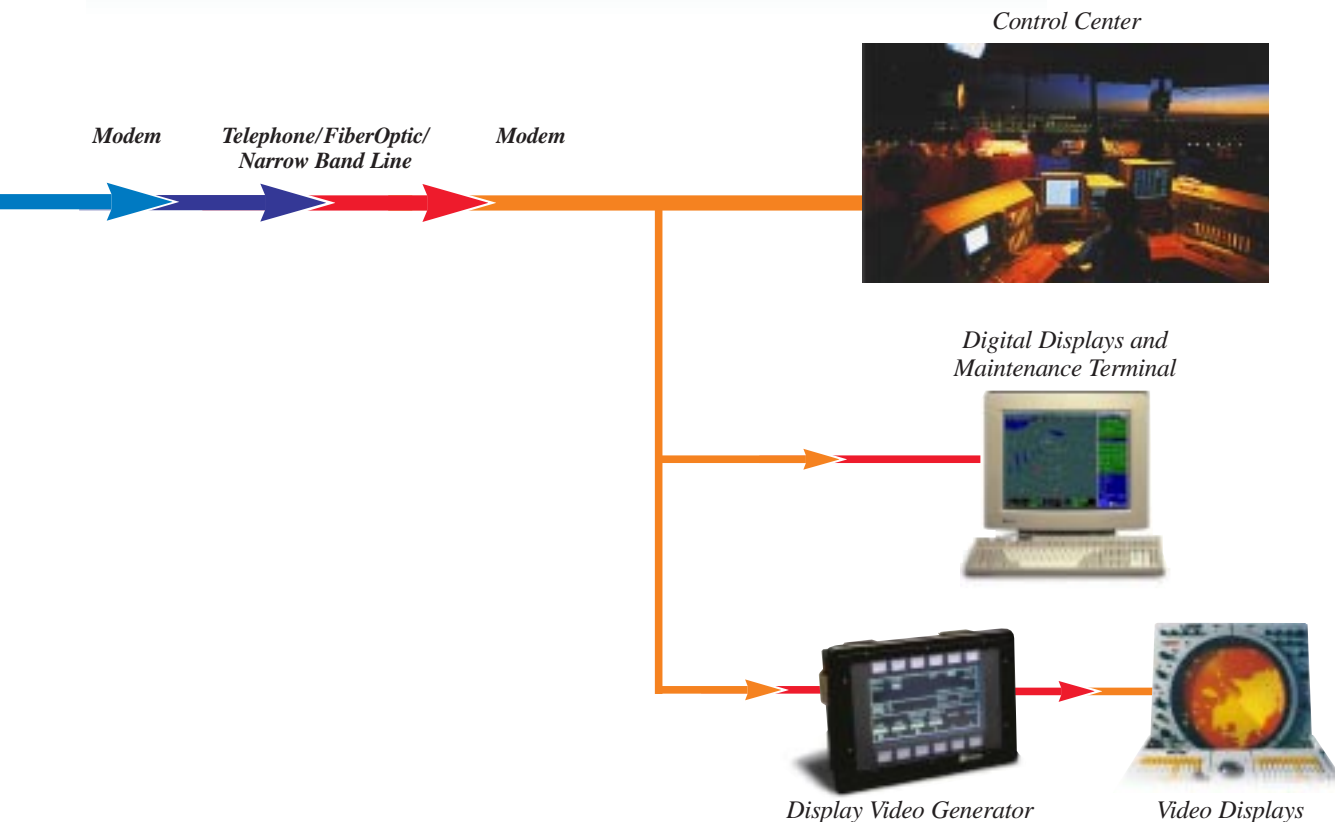
In addition to providing high quality digital primary reports, the Sensis RDX will:

- Accept digitized beacon secondary radar (SSR & MSSR) inputs and perform primary-secondary target correlation.
- Dramatically reduce false alarms from ATC and Air Defense radars.
- Output track data or track-filtered plot data.
- Upgrade easily and integrate with a variety of systems for accurate, effective and rapid site optimization.

Radar Data Extractor (RDX) Characteristics

- Processing Channels: Parallel independent processing of normal and MTI video with range-azimuth gating
- Radar Video Sampling: 12-bit A/D conversion; 0.25 to 5.0 MHz sample rate
- CFAR Processing: Ordered-statistic background normalize; range-varying threshold map; integral clutter map
- Detection Capacity: Up to 4,000 detections per second
- Adaptation Processing: Automatic adaptation for environmental conditions
- Target Capacity: Up to 1,000 reports per scan
- Detection Performance: Pd = 90% (8dB target SNR)
- Accuracy Performance: Range accuracy = 1/16 nmi; azimuth accuracy = 0.2° (for 1.5° beamwidth)

The TDX 2000 has been chosen by the United States Air Force to upgrade over 25 radar systems throughout the world.

Modem　　*Telephone/FiberOptic/ Narrow Band Line*　　*Modem*

Control Center

Digital Displays and Maintenance Terminal

Display Video Generator　　*Video Displays*

Beacon Target Extractor

The Sensis Beacon Data Extractor (BDX) provides digital target extraction for all ICAO and AIMS compliant beacon interrogators. The BDX interfaces directly to control centers or other downstream processors, (for example - combiners, trackers and display pre-processors), using the same flexible digital output processor as other Sensis products. The BDX maintenance display console provides the ability for authorized technicians to modify key parameters for decoding and detection logic including: pulse and garble tolerances, detection thresholding, run-length / target split criteria and code validation criteria. This in-service flexibility allows users to configure the BDX to provide optimal performance in their environment and according to their operational preferences.

Additionally, the Sensis BDX will:

- Provide standard bracket detection, degarbling, phantom elimination and code extraction.

- Perform in the densest FRUIT environments through its "loss-less" defruiter.

- Resolve simultaneous interleaved replies from aircraft.

- Provide code integrity even in less than ideal environments using built-in logic that minimizes the effects of dropped code bits, multipath and reflections.

- Integrate with nearly all beacon interrogator systems quickly and easily, eliminating beacon performance problems.

Beacon Target Extractor Characteristics

- Processing Modes: 2, 3/A and 4
- Reply Processing: Selectable reply pulse tolerance; selectable defruiter with arbitrary interlace
- Target Extraction: Selectable detection and validation criteria; parallel processing of triple-interleaved conditions
- Reply / FRUIT Capacity: 10,000 replies per second; 128 replies per sweep; 20,000 FRUIT replies per second
- Target Capacity: Up to 1,000 reports per scan; 60 reports per beamwidth
- Detection Performance: Pd = 99% (assuming 8 interrogations per mode; all modes responding)
- Accuracy Performance: Range accuracy = 1/16 nmi; azimuth accuracy = 0.2º (for 1.5º beamwidth)

Digital target extraction for all ICAO and AIMS compliant beacon interrogators

Weather Data Extractor

The Sensis Weather Data Extractor (WDX) extracts and reports real-time weather contours from primary radar video signals. Contours are transmitted in digital format via standard telecommunication lines. The WDX utilizes both radar generated MTI video and a clear day map to minimize false weather declarations due to ground clutter. Modern weather processing techniques including M of N detection, contour smoothing, and programmable beam fill, provide high quality advisory weather outputs. Data rate flexibility allows output data every N scans or to interleave each level output on successive scans to aid in digital bandwidth management.

The Sensis WDX will:
- Report from two to six National Weather Service (NWS) levels (depending on the dynamic range characteristics of the radar) using non-coherent video from a radar's MTI and normal channels.
- Accommodate a wide variety of radar types and site requirements.
- Provide accurate mapping of ground clutter for optimal weather detection.
- Provide a local or remote display of weather data and controls for maintenance and fault monitoring.

Weather Data Extractor Characteristics
- Operating Configuration: configurable to receive normal and MTI input or separate weather video
- Detection Performance: Provides up to 6 NWS weather levels, depending on radar configuration
- Weather Level Reporting: Up to 6 user selectable thresholds (number of levels reported can be different than number detected)
- Clutter Rejection: Automatic generation of two clutter maps, allowing complete selection of processing channel based on least clutter
- Serial Channel Reporting: Provides flexible level reporting to avoid overloading the capacity of existing communication channels; CD-2 and ASR-9 output message formats
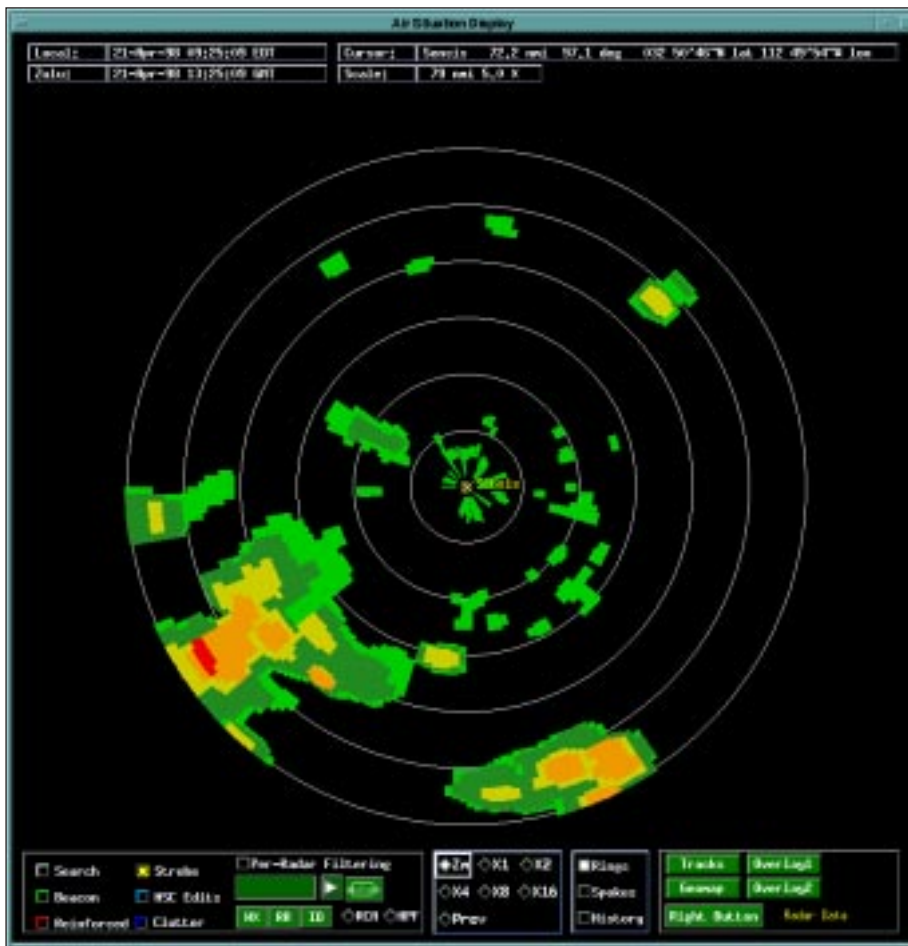
Provides up to 6 weather levels

Control & Maintenance Console (CMC)

The Control and Maintenance Console (CMC) provides real-time PPI, RHI and weather contour displays while providing the ability to control all of the TDX 2000 system parameters. Configuration is maintained through the use of multi-level password control. A large number of statistical performance measures are displayed in real-time to the operator. These statistics combined with the extensive on-line fault detection and isolation capability give the maintenance operator the insight required to identify any performance problems and remedy them quickly and efficiently. The CMC also provides data recording and playback capabilities for all radar data and operator actions. The CMC can be stationed either on-site with the extractor system or remotely at the operations or maintenance center.

Control & Maintenance Console CMC characteristics:

Local Monitor and Control:
- Real-time PPI display of report/track data and performance monitoring;
- Extensive on-line data recording and off-line playback

Open Platform:
- "C" software hosted on SUN Workstation

Menu-Driven Control:
- Easy access to all TDX operational parameters

TDX-2000 Series Characteristics

System Characteristics
- Unattended Operation: On board non-volatile memory for self-initiation including site-specific parameters
- Scan Rate: 3.5 to 12.0 seconds
- Processing Range: 0 to 300 nmi
- Azimuth Encoder Inputs: 4096 (12-bit) to 16, 384 (14-bit) ACPs per scan

Interface Characteristics
- Data Output: Serial synchronous or asynchronous interface; internal or external clock source; up to 19.2K baud per channel; selectable clock/data phase
- Report Data Formats: CD 1/2, FPS-117, ASR-9, TRACS, TPS-70, ITTRS-320, FPS-124, ARSR-4, ASR-9M
- Electrical: RS232, RS-422, EIA 530
- Ethernet LAN Interface: TCP/IP or UDP/IP protocol

Physical Characteristics
- Size: 21"W x14"H x 20"D rack mountable
- Weight: Approximately 50 lbs.
- Operating Temperature: 0^0 to $+50^0$C
- Operating Humidity: 0 to 90 % non-condensing
- MTBF: >10,000 hours (single channel configuration) >50,000 hours (redundant configuration)