



TIGAR

TSS Integrated
Ground-based Air Radar



We've Got Your Track™

TSS Solutions TIGAR at a Glance

Description:

Fully modernized transportable 3D radar system, designed to provide a long-range air picture that detects, tracks, and automatically classifies the full threat spectrum.

3D Range:

Up to 240 nautical miles.

Mobility:

Fully transportable by air, land, or sea, with rapid setup and teardown capabilities.

Reliability:

Designed for minimal maintenance and high operational availability, even in harsh environments.

Modernization

imperative: The TIGAR system is equipped with TSS-designed and integrated subsystems that deliver significantly improved performance, reliability, and operability over the current AN/TPS series of radar systems.

Introducing TIGAR

TSS Solutions matches emerging tech to modern defense needs

TSS Solutions is the recognized leader in supporting and modernizing radar systems around the world. Building on our tradition of excellence, we proudly introduce the **TSS Integrated Ground-based Air Radar (TIGAR)**, a fully upgraded and modernized AN/TPS-43 radar system.

We have leveraged our industry-leading expertise and our reputation for innovation to create TIGAR, powered by integrated, state-of-the-art subsystems that deliver significantly improved performance, reliability, and operability over the current AN/TPS series of radar systems.

In developing TIGAR, TSS Solutions has added a significant number of emerging technology upgrades to the TPS-43 radar system that greatly improve air surveillance detection, tracking, and classification for our partner nations. Our radar depot in Melbourne, FL, enables cost-effective technology insertions that greatly extend the service life of these systems, and our field service teams conduct installation and training required to assist our defense partners.

Having completed upgrades of the TPS-70 and TPS-75 for the U.S. Air Force, TSS Solutions is well positioned as the leader in technically refreshing legacy radar systems in support of our global defense customer base.

Investing in the TIGAR system ensures:

- Enhanced detection ranges and accuracy.
- Improved resistance to jamming and electronic warfare tactics.
- Seamless integration with contemporary defense systems and networks.
- Extended service life and reduced maintenance burdens.

With the addition of the new Signal Processor, IF Receiver, Frequency Generator, RF Driver, and Array Signal Amplifiers, TIGAR is fully modernized for current and future threat scenarios, delivering a robust, adaptive, and sustainable asset, ready to tackle the challenges of today and tomorrow.



Don DiFrisco, President and CEO
TSS Solutions

System Upgrades and Replacements

The following major asset components are removed, replaced, or relocated from the AN/TPS-43/72 for the TSS Solutions TIGAR Modernization:

Upgraded

Amplifier Assembly, RF (new)

Antenna

Upgraded with 6 ASAs, 13 new Solid-State Receiver Protectors, and 13 Circulators

Console Assembly, PPI (new)

Radar Processor (new)

Manifold and Hose Assembly, Return (new)

Manifold and Hose Assembly, Supply (new)

OEM Tx Control Panel Assembly

Updated

Power Distribution Panel Assembly

Modified and added new

IFF Interrogator Mode 5/S

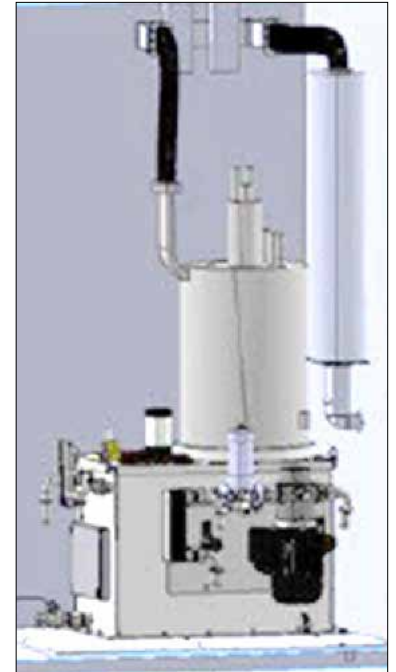
Upgraded

Rotary Joint And Tilt Sensor

Upgraded, including Modes 5 and S

Frequency Generator

Upgraded



Replaced

Focus Coil Assembly, Power Supply

Focus Coil (recommended)

Power Supply

Power Supply, Vacuum Pump

Soft Start Assembly (Replaced with VFD)

Waveguide Assembly (Reused/replaced)



Reused, Relocated

Harmonic Filter (Reused)

Track Assembly (Relocated)

Removed

Shunt Regulator

Module Assembly, Pulse Forming Network

Amplifier Assembly, Trigger Modulator

Resistor Array

OEM Oil Tank Assembly

SF6 Tank Assembly

Diode Assembly

DISPLAYS

Legacy displays will be replaced with our new touchscreen LCDs to deliver significant usability enhancements, including software that provides superior tactical interfaces for operators. All tracked and untracked videos are output from the video processor as ASTERIX Ethernet signals in CAT-240. The additional capabilities added to the AN/TPS-43 signal and post-processing functions include ADS-B data incorporated and available at the output and on the display. Legacy maintenance display functions can optionally be integrated into and handled by the TSS PPI display. A 3D Tracker is also an available option.



Upgraded PPI Display

PROCESSOR

The new processor provides an IF receiver, signal/data processing, radar control, and self-test/monitoring while retaining all the functionality of the legacy processor. Improved system characteristics include:

Pulse Correlator

Adaptable pulse compression technique ensures optimal S/N while maintaining sufficient range resolution

Dual Beam Processing or Vertical Clutter Canceler (VCC)

Improved clutter mitigation and interference suppression

Median Filter

Interference suppression and improved detection performance

Doppler processing

Improved target detection and false target processing over legacy MTI processing

CFAR/clutter maps

High-resolution clutter maps and CFAR processing for each Doppler filter

Slow Clutter Canceler (SCC)

Enhanced Anomalous Propagation performance

Plot Extractor

Improved positional accuracy (in both range and azimuth) and false target mitigation

TRANSMITTER

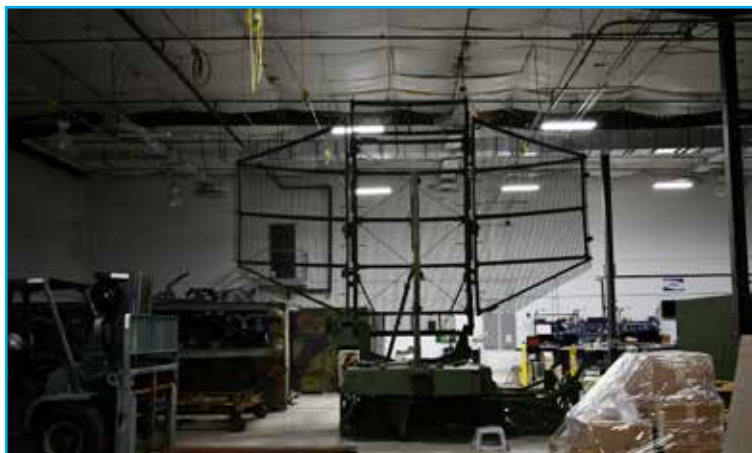
The TSS transmitter incorporates the new TSS solid-state RF driver. The solid-state modulator has scalable output modulator power. This allows the modulator to decrease the brute force pulsing that was required in the past, adding the benefits of redundancy and longevity as a result of reduced pulse intensity. The output can be adjusted as a portion of the total in increments, which allows even degraded systems to continue to operate.

Extended Service Life

The new Klystrons can output up to 4 MW but will allow longer service when a lower output is selected

Redundancy

Solid-state modulators allow full power operation with one modulator failure and reduced power operation with two failed modulators



Our facilities on Florida's Space Coast have been specifically organized and equipped to provide a full range of technical support services to the communications, radar, and sensor industries, including the ability to fully construct and test systems in our High Bay shelter integration area.

RF DRIVER

The new TSS solid-state RF driver reduces the cost of future repairs and delivers several performance benefits. The increased phase stability of the output pulses allows better MTI performance on the receiver side. The TSS RF driver is part of the TSS transmitter but is also available in a FFF chassis to upgrade OEM RF drivers in the AN/TPS-43, 70, 72, and 75 radars. This design eliminates DMS issues.

ROTARY JOINT

The TSS Solutions rotary joint is a proprietary design utilizing Roll-Ring Technology, upgraded bearings for longer life, and a carbon face seal to control pressure leakage. Benefits of this custom design include:

Enhanced S-Band Component

Supports the TSS transmitter

Enhanced Power Coupler

Provides additional power capacity at the antenna for upgrades

Connectivity

Support for IFF Mode 5 and Mode S

Added Fiber Optic Channel

FREQUENCY GENERATOR

Our new design incorporates 16 individual protected oscillators, which output the full suite of TPS frequencies typically selected by processor settings. This design eliminates the synthesizer and frequency drooping at the upper and lower frequency bands that was inherent in the older technology. The upgraded frequency generator uses solid-state, ultra-reliable components, replacing crystal set/synthesizer modules. Key benefits include:

Reliability

Enhanced MTBF and phase stability; much more stable MTI operation

Streamlined Design

Eliminates DMS issues and re-utilizes the legacy frequency generator chassis as a base

IFF

The TSS Solutions IFF Mode 5 and Mode S upgrade incorporates AN/UPX-44A, which is the first IFF interrogator to achieve the more stringent test requirements of the new "B" level AIMS certification. The first AN/UPX-44A IFF production system has been delivered to JASDF U.S. The AN/UPX-44A is DoD AIMS program office certified. The TSS IFF upgrade requires the capabilities of the TSS rotary joint and makes antenna system modifications to support Mode 5 and Mode S.

ARRAY SIGNAL AMPLIFIERS

Our upgrade includes 6 TSS array signal amplifiers (ASAs). Our design delivers increased antenna gain while lowering the noise floor.

Solid-State Receiver Protection

TSS ASAs incorporate Solid-State Receiver Protection, which helps compensate for degrading gas tube protectors in the waveguide system and provides a test signal input. This gives the radar extensive control of the video processor tracker, working on a higher signal amplitude above the inherent noise floor.

Enhanced Processing

The design works in conjunction with modern high-performance TSS IF receivers, allowing additional processing after detection and throughput to the new TSS video processor.

IF RECEIVERS

The TSS Solutions IF receivers upgrade the legacy receivers, eliminating DMS issues. Enhanced gain and noise floor performance adds stability under temperature variations and is a form-fit-function replacement for the older units.

PROCESSOR TRACKER

Our video tracker software adds multiple video post-processing enhancements to the display system, allowing the operator to deal with clutter areas in the environment of the sited radar.

DATA DELIVERY

All tracked and untracked videos are output from the video processor as ASTERIX Ethernet signals in CAT-240 and CAT-48. Data delivery via Ethernet.


TIGAR Specifications

The advanced features of the TSS TIGAR Upgrade rival even those of top-of-the-line radar surveillance systems at a fraction of the cost. The following pages detail key specifications of the legacy TPS-43, Northrop Grumman’s AN/TPS-78 (regarded as the most advanced air surveillance radar in widespread use today), and the TSS Solutions TIGAR Upgrade of the TPS-43.



PERFORMANCE


TSS Solutions’ TIGAR Upgrade delivers superior small target detection, probability of detection, range resolution, height accuracy and more:

| | TPS-43 Legacy Radar | TPS-78 Northrop Grumman |  TIGAR TSS Solutions TPS-43 Upgrade |
|-----------------------------|---|---|--|
| 3D Range | 445 km / 240 nmi | 445 km / 240 nmi | 445 km / 240 nmi |
| Small Target Detection | 2.5 m ² at 408 km / 220 nmi | 2.5 m ² at 408 km / 220 nmi | 1.5 m ² at 220 nmi (75% increase in detectability) |
| Probability of Detection Pd | 80% | 80% | ± 90% |
| False Alarm Rate Pfa | 1x10 ⁻⁶ | 1x10 ⁻⁶ | 1x10 ⁻⁶ |
| Data Rate | 10 seconds (6 rpm antenna) | 10 seconds (6 rpm antenna) | 10 seconds (6 rpm antenna) |
| Elevation coverage | to 20 degrees | to 20 degrees | to 20 degrees |
| Height Accuracy | ± 457 m at 185 km ± 1500 ft at 100 nmi | ± 457 m at 185 km ± 1500 ft at 100 nmi | ± 300 m at 185 km ± 984 ft at 115 nmi |
| Azimuth Resolution | 1.1 degrees | 1.1 degrees | 1.1 degrees |
| Range Resolution | 152 m (500 ft) | 152 m (500ft) | 107 m (350 ft) |
| Availability | Greater than 95% | MTBCF greater than 5 years | MTBCF greater than 5 years |
| ECM and DCCM Capabilities | 13-bit fixed barker code | 13-bit fixed barker code plus CPACS | Linear frequency chirp, Timed sidelobes, Pulse compression |



TRANSMITTER

The TIGAR leverages 64 frequencies and a solid-state RF driver to deliver stable transmission power that meets or exceeds that of the TPS-78.

| | TPS-43 Legacy Radar | TPS-78 Northrop Grumman |  TIGAR TSS Solutions TPS-43 Upgrade |
|-------------------------------------|--|---|--|
| Frequency | S-Band | S-Band | S-Band |
| Power Output | 3.5 MW typical 6.5 μ s pulse fixed | 32 kW Pk Minimum RF output | 4 MW adjustable by % of modulation |
| Frequency Modes | Fixed, Agile, MTI agility (16 frequencies) | Fixed, Agile, MTI agility, MTD, STAE, MTD, VIP, Stagger | 64 frequencies: fixed dual frequency, single frequency mode, dual interleaved mode |
| Type | Twystron driven by broadband TWT | Solid State Final Power Amplifier | Klystron/Twystron driven by Solid State Driver |
| Stability of Transmitter | | 1x10 ⁻¹¹ Year GPS-supervised | 1x10 ⁻¹¹ Year GPS-supervised |
| Duty Cycle | | .0065% @ 6.5 μ s pulse .005% @ 50 μ s | .0065% @ 6.8 μ s pulse |
| Modulator Output Pulse | | 100-125 kV 80-100 Amps (tube dependent) | 100-125 kV 80-100 Amps (tube dependent) |
| Vision Upgrade: RF Driver | | LPRF output 23 dBm \pm 3 dB | 2 kW solid state |
| Vision Upgrade: Frequency Generator | | GPS-supervised accuracy and stability, JATS, MTI Pulse, Pulse Stagger Mode. New modes: Long Pulse, Extended Pulse, Extended Barker Code, Digital Chirp | GPS-supervised accuracy and stability, JATS, Pulse Correlator, Pulse Stagger Mode. Dual Beam Processing or Vertical Clutter Canceler, Median Filter, Doppler processing, CFAR/clutter maps, Slow Clutter Canceler, Plot Extractor, Digital Chirp, 64 channels |



RECEIVER/PROCESSOR

Equipped with ~8 MHz for Doppler Processing, the TIGAR delivers robust electronic counter-countermeasure (ECCM) processing with double the MTI improvement factor


| | TPS-43 Legacy Radar | TPS-78 Northrop Grumman | TIGAR TSS Solutions TPS-43 Upgrade |
|--|--|--|--|
| Type and Number | 7 log Rx channels, 6 for Rx, 1 for reference channel, sidelobe blanking and JATS | 7 log Rx channels, 6 for Rx, 1 for reference channel, sidelobe blanking and JATS | 7 log Rx channels, 6 for Rx, 1 for reference channel, sidelobe blanking and JATS; 6-level weather via Cat 008. All receivers changed to 32 MHz and modernized circuits |
| Receiver Bandwidth | | Approx. 8 MHz for Doppler Processing | Approx. 8 MHz for Doppler Processing |
| Dynamic Range | | 100 dB w/STC | 100dB w/STC |
| Signal to Noise Ratio | | 2 dB improvement | 2 dB improvement |
| ECCM | JATS, CPACS, agility, CFAR, PRF Stagger | Fixed, Agile, MTI agility, MTD, STAE, MTD, VIP, Stagger | JATS, Fixed, Agile, MTI agility, MTD, STAE, Doppler processing, Vertical Clutter Canceler, Stagger, Pulse Correlator |
| Digital MTI | 4 separate MTI channels, 3 Pulse Cancelers, digital integration* | | Digital Doppler processing |
| MTI Improvement Factor | 30 dB | 30 dB | ≥ 60dB |
| Minimum Target Speed | | TBD | TBD |
| PRF Baseline | | 250 Hz 500 Hz | 235 Hz 250 Hz 275 Hz |
| PRF MTD | | 250-500Hz for future special modes, power level dependent. 55kW to 3MW | Dual interleaved mode, fixed dual frequency, JATS, random |
| PRF Stagger | | 7 PRTs around 275Hz, 7 PRTs around 250Hz | 7 PRTs around 275Hz, 7 PRTs around 250Hz |
| MTI Processing Details | | 21-bit coding | Linear frequency chirp, Improved target detection and false target processing |
| Normal/Search Processing Detection Threshold details | | 1 m Swerling @ 120 miles (104 nmi) | 0.8m Swerling @ 207 miles (180 nmi) |

* 4 Pulse Cancelers available as plug-in option.



ANTENNA

The TIGAR antenna upgrade includes our proprietary Enhanced Rotary Joint, which utilizes Roll-Ring Technology and other enhancements for longer life and greater control over pressure leakage.

| | TPS-43 Legacy Radar | TPS-78 Northrop Grumman |  TIGAR TSS Solutions TPS-43 Upgrade |
|-------------------------------|--|--|--|
| 3D Radar Antenna | Multiple 6 beams 40.6 dB gain | Multiple 6 beams 40.6 dB gain | 15 beams, 6 channels 60 dB gain; 6 ASAs |
| IFF Antenna | Hi-res ISLS antenna mounted on primary antenna | Hi-res ISLS antenna mounted on primary antenna | Hi-res ISLS antenna mounted on primary antenna |
| Enhanced Rotary Joint | | | 4 mW roller rings, fiber connection |
| RF receivers Updated | | | Units ingest at 32 Mhz powered by DC power supply |
| ASA (small signal amplifiers) | | | ASAs give 55 dB of high signal protection and 23 dB of small signal gain |



Your World-Class Partner

Put TSS Solutions' expertise and experience to work for you

TSS Solutions, an Acorn Growth Company, is a professional defense electronics engineering and manufacturing company that specializes in upgrading, reengineering, repairing, and operating ground-based tactical and fixed-position Radar and SATCOM systems. We serve the global defense, telecommunications, and commercial industries.

Since 1991, TSS Solutions has built its global reputation by fusing innovation and evolution, incorporating technological advancements into legacy systems that were developed by the world's leading aerospace and defense brands. TSS Solutions' innovation is supported by our full-service in-house Depot operations.

Headquartered on Florida's Space Coast, TSS Solutions is uniquely positioned to deliver the optimal mix of:

- **Low cost of acquisition**
- **Fast delivery**
- **Service life extension**
- **Global maintenance and operations**



TSS Solutions' Global Footprint

TSS Solutions has decades of success in engineering, modernizing, installing, maintaining, testing, and commissioning more than 1,000 worldwide earth stations, antennas, and electronics.





RADAR
Solutions



DEPOT
Solutions



SATCOM
Solutions

TSS Solutions has been integral to national defense, homeland security, and counter-drug and counter-terrorism initiatives for more than 30 years.

We have established a reputation as a proven and capable business partner, integrating our engineering, manufacturing, service, and operational expertise to benefit the customers we serve.

We are at the cutting edge of Radar and SATCOM modernization technology, sharing and leveraging our expertise with customers across the globe.

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