

1.2M Ku-Band Trailer



VoIP & VSAT Trailerized Earth Station Terminal



1.0 TECHNICAL DESCRIPTION

1.1 Physical Description: The Satcom Scientific 1.2 Meter trailerized earth station is designed to be a self-contained mobile earth station terminal capable of transmission of voice, compressed digital video and data over a Voice over Internet Protocol (VoIP) satellite network. Each trailer is supplied with the necessary RF and baseband gear to support the use of 12 wireless laptop computers and 24 wireless telephones. The computers and phones can also be provided as part of the package. The terminal also supports the use of secure fax and digital video transmissions up to 2 MHz in bandwidth.

The terminals can be used over any private network, or network space segment can be provided using a seamless global network like that owned and operated by Hughes Network Systems or Maritime Telecommunications Network (MTN).

The trailer is capable of being towed by any commercial or military vehicle, or can be transported safely by truck, rail, ship or aircraft. The trailer can be equipped with an on-board 4 KW diesel or gasoline power generating system and an optional rack-mounted air cooling system for the rack area.

1.1.1 Size: The 1.2 Meter trailerized earth station is built on an all aluminum transport frame that is sixty-three (63) inches wide and features a single **TORFLEX** torsion bar suspension type axle rated at 3,500 pounds. The axle is equipped with two ST205/75R15 heavy duty trailer tires with a capacity of 1,820 pounds each. The tires should be inflated to 50 psi.

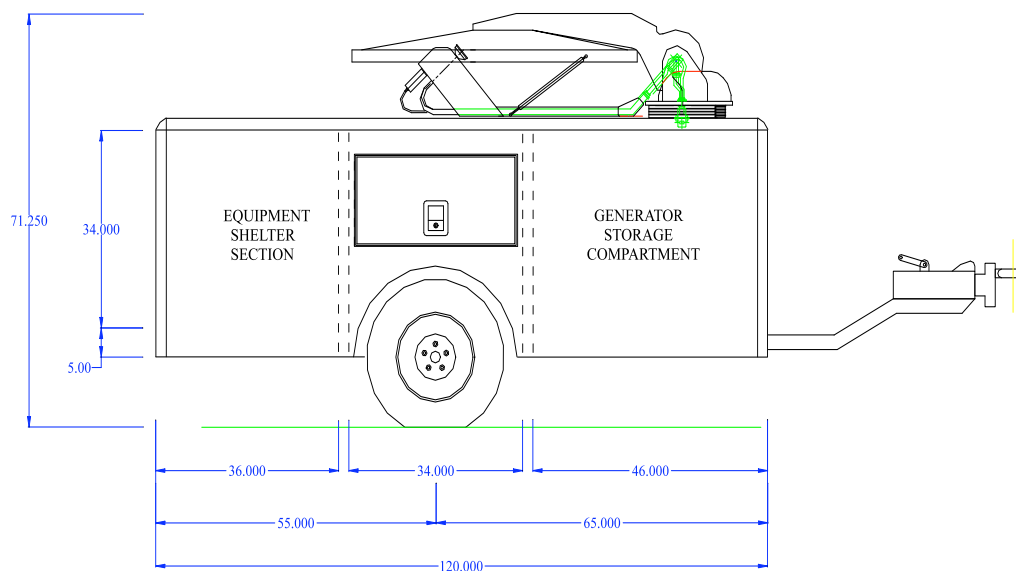
When the tongue assembly is entirely removed for air shipment, the overall unit length is one hundred-twenty (120) inches. The overall width of the trailer is sixty three (63) inches. The overall height of the unit when the antenna is stowed is sixty-nine (69) inches. The lowest part of the trailer deck is thirteen (13) inches above ground level to provide a low center of gravity and increased handling stability during high speed travel.

The longest dimension when the trailer tongue is attached and configured for towing is one hundred-fifty six (156) inches, and this occurs along the axis of travel.

1.1.2 Weight: The completed (rack ready) 1.2 Meter trailerized earth station vehicle weighs 1,500 pounds. The tongue weight of the unit is approximately 350 pounds.

1.1.3 Composition: A major design goal in the development of the 1.2 Meter trailerized earth station product was to achieve a high degree of structural strength and integrity at a low weight. The trailer frame is constructed of 6063-T5 type-AA six-inch structural channel aluminum which has the same strength and load bearing capacity but none of the corrosive properties associated with steel.

The equipment shelter is framed with two-inch (2" x 2" x .125") 6063-T5 square aluminum tubing and covered with a non-riveted skin of .090 aluminum. The interior wall section is then covered with blown-in urethane foam which provides an R-factor of +15. Another .090 aluminum skin is used to seal the inside wall section. Each wall section and the roof rails are fitted to locking extrusions, and are welded in place to add strength and rigidity to the shelter. The roof section corners are also fitted with welded caps. The resulting structure, in our opinion, not only provides superior rigidity, but also increases insulation and improves structural integrity. The entire trailer is etched, primed, and painted with two coats of white polyurethane enamel.





1.2 Transportability:

1.2.1 The 1.2 Meter trailerized earth station is designed to be towed safely at speeds of up to 55 MPH on paved roads or highways. The unit can be towed over rough terrain or unpaved roads as long as safe towing speeds are maintained. Always refer to the tow vehicle manufacturer's specifications for maximum towing weight and towing configuration. The 1.2 Meter trailerized earth station meets or exceeds all Federal Highway Administration regulations for interstate transport and Department of Transportation guidelines as set forth in Title 49, subparts B, C, E, F, and J.

1.2.2 The trailer incorporates a single, torsion bar suspension axle rated at 3,500 pounds. The axle is fastened to a five-inch aluminum structural channel frame to provide a smooth, low vibration ride for electronic components. Tire ply and size is sufficient to support weights up to the limitations of the axle. The axle is equipped with electric brakes that will greatly reduce stopping distance and enhance over-the-road travel safety and handling.

1.2.3 The trailer has four tie-down eyelets installed in the 5-inch channel of the trailer load frame. These eyelets are used as tie-down points when the trailer is transported by truck, rail, ship or aircraft. They can also be used as sling points when the trailer is to be lifted by any lifting device. Each of the tie-down blocks is rated for a load capacity of 5,000 pounds.

1.2.4 Brake lights, running lights, and turn signal indicators are included on the trailer, recessed and flush-mounted into the shelter. A quick-disconnect 12-volt DC commercial connector is supplied with each vehicle for connection to the tow vehicle tail light circuit.

1.2.5 The trailer tow bar is fitted with a 2-inch ball type hitch, or optional lunette eye which is used when the tow vehicle is equipped with a pintle hook. A breakaway at the end of the tongue assembly allows quick installation of either this type or another type of device: The 2-inch coupler is designed to be used with a Class III hitch and ball. The hitch coupler is designed for tow heights of twenty (20) inches to twenty-seven (27) inches, accommodating military and commercial type tow vehicles.

1.2.6 The trailer tongue is entirely removable from the trailer frame and stows away in a compartment for compact air mobility. The trailer tongue assembly is constructed of 1/4-inch wall, 2-inch by 4-inch rectangular steel tube, and is installed onto the trailer by sliding the tongue assembly into a 2-1/2 inch steel tube that is secured to the structural frame of the trailer in two different locations. When the tongue is installed for towing, it is positively locked into the proper position by installing the two tongue locking pins.



1.3 Mechanical:

1.3.1 Four permanently-mounted, manually activated stabilizer mechanisms have been outfitted to the corners of the vehicle to provide manual leveling of the vehicle and additional antenna stability during high wind conditions. The stabilizers are recessed on the underside of the vehicle to preclude protrusion greater than two (2) inches below the vehicle when retracted, but they will have sufficient displacement to level the vehicle on any axis to compensate for up to 5° of slope. The jacks are controlled from a panel located in the power compartment. In areas of very uneven terrain the jacks can be manually adjusted for a maximum degree of level and stability.

1.4 Electrical System

1.4.1 Utility Power System: The *Satcom Scientific* 1.2 Meter trailerized earth station can be operated from any 120 VAC single phase utility power source from 47 to 63 hertz. An optional Transformer can be added so that the unit can be operated from a 240VAC supply. A Voltage regulator or UPS system can also be quoted as an option. A 100-foot power cable is included that stows in the tool compartment. The trailer is connected to the utility power source using the 100-foot SO 3 cable and plug provided with the unit. The power inlet is a 115 VAC, 30-amp stainless steel marine connector

1.4.2 Power Interface Panel: A Power Interface Unit (PIU) is located in the lower part of the left equipment rack. The PIU is the interface point for the power cable. The power cable is fed into the trailer from a removable cover located in front of the PIU. In this manner, all cords and cables can be connected and the trailer doors can be locked during operation. All subsystem circuit breakers are mounted on the face of the PIU. There are circuit breakers for the Antenna Motors, Air Cooler and two equipment racks located on the trailer. Since the PIU is a line replaceable unit (LRU), all outbound connections are made using standard 15 amp 120 VAC power plugs that plug into sockets on the rear of the PIU.

Metering of voltage, current and frequency is also provided at the power interface panel. An AC voltmeter, Frequency meter and Ammeter are part of the panel so that inbound power can be monitored by the operator.

1.4.3 Diesel Generator: The 1.2 Meter trailerized earth station features an on-board 4KW diesel generator that is rated at 4,000 watts continuous. The generator is powered by a single-cylinder, vertical 4-stroke, air cooled, direct injection engine. The engine runs at 3600 rpm and features electric starting. The lube oil and filter should be changed every 250 hours of use.

A 20-gallon fuel tank is included which is mounted underneath the trailer. The tank has fuel drains for ease of service. Only clean #2 diesel fuel should be used in the generator. The generator uses fuel at a rate of 0.64 GPH at full load. The fuel filter should be changed every six months or 500 hours of use.

1.5 Compartment Design:

1.5.1 The shelter has a large free storage compartment that runs the full width of the trailer. The compartment has a clear opening of 14-inches high by 28-inches wide by 48-inches deep. The storage compartment is fitted with watertight doors featuring continuous stainless steel hinges and locking, flush-mounted handles. The storage compartment is designed to support weights of up to 300 pounds. Tools, cables, spare parts, alternate feed systems or other components may be housed in this compartment.

1.5.2 Access to the electronic equipment is provided through a large door located at the rear of the unit. This door is hinged at the top using 1/4-inch stainless steel hinge, and is held open with pneumatic type interlock arms at each end of the door. This compartment is sealed air and water tight, and is double insulated for maximum protection of the mounted electronic equipment. The equipment compartment houses two 24 ½ inch tall equipment racks for mounting any customer supplied electronics. The rack sections provide 28 RU of rack space. The rack sections are mounted on pull-out slides so that the equipment racks can be pulled out from the trailer for ease of integration and maintenance.



A 3½ inch (1RU) Signal Input/Output panel for signal interface cables is included within this rack space. The Power Interface Unit (PIU) is also included within the rack section. The PIU is 5¼ inches tall (3RU).

1.5.3 A large door in the front of the trailer, over the tongue, allows access to the antenna azimuth motor drive and electrical system conduits. When the unit is to be configured without the tongue, the tongue is stored inside this compartment. If supplied, a diesel generator is isolation mounted to the vehicle frame and is housed inside a sound attenuated compartment located in the front of the trailer. The large access door allows the operator to service and maintain the generator air and oil filters, the battery and the oil drain.

1.5.4 The electrical power system for the vehicle is located in the equipment rack section. All system circuit breakers, metering and generator controls are located in this panel.

1.5.5 All of the doors covering the compartments are fitted with keyed-alike locks that provide a two-point positive closure when actuated.



1.6 Antenna System

1.6.1 Antenna Reflector:

The 1.2M SNG Antenna System is a prime focus, full offset Ku-band reflector mounted on an elevation over azimuth positioner. The reflector is a SMC high strength plastic with solid back cover. The Roto-Lok drive system produces high reliability with superior stiffness using a low backlash, gear box and DC motors. All drive components are high strength steel, housed in lubricated for life housings which results in the most reliable, no maintenance system with the minimum of weight. The polarization drive rotates the feed horn $\pm 75^\circ$ with light weight miniature gear motor.



Block converters and lightweight SSPAs can be mounted on the feed spar. For rack-mounted converters and amplifiers, the waveguide run from the antenna can be either rigid and twist-flex or rigid and rotary joints. The system can be configured for either 2-port or 4-port. Optional manual drives are available allowing easy antenna positioning if the controller malfunctions. The entire antenna weighs from 125 to 150 pounds depending on options selected.



1.6.2 Specifications

| Electrical RF | Receive | Transmit |
|--|---|-----------------|
| Operating Frequency | 11.7 – 12.2 GHz | 14.0 – 14.5 GHz |
| Gain @ Midband | 42.0 dBi | 43.5 dBi |
| VSWR | | 1.30:1 |
| -3 dB Beamwidth | 1.5 | 1.2 |
| -10 dB Beamwidth | 2.6 | 2.1 |
| First Sidelobe Level (± 2 dB) | -20 dB | -20 dB |
| Radiation Pattern | Meets or exceeds FCC requirement for 2° Satellite Spacing. | |
| Antenna Noise Temperature | 30° K | |
| Polarization | Linear | Linear |
| Power Handling Capability | | 25 Watts |
| Cross Pol Isolation (On Axis) | 35 dB | 35 dB |
| Cross Pol Isolation (Off Axis 0.5 dB BW) | 32 dB | 32 dB |
| Cross Pol Isolation (Off Axis 1.0 dB BW) | 30 dB | 30 dB |
| Feed Port Isolation RX to RX | 30 dB | |
| Feed Port Isolation TX to RX | 60 dB | 60 dB |
| Operational Wind Speed | 45 mph deployed @ 60° F. | |
| Survival Wind Speed | 60 mph antenna deployed, 80 mph antenna stowed | |
| Temperature | Operational -20° F. to +125° F. Survival -40° F. to +140° F | |



1.6.3 Antenna Positioner:

The patented Roto-Lok drive system utilizes highly reliable aircraft control cables in a redundant configuration to achieve a zero backlash, light weight, very stiff drive system. It achieves this high tech performance using low tech components by simply wrapping the cable around the driver capstan several times before wrapping the larger driven drum. The method used to wrap the capstan results a minimum free length of cable. The load in the cable on the main drum is exponentially reduced as it is wrapped around the drum. Therefore the total elongation of the cable when under load is minimized. The Roto-Lok system results in stiffness of up to 10 times that of comparable gear or harmonic drive systems. The cables are pretensioned and spring loaded at the main drum attachment point which eliminates backlash at installation and from any unexpected cable stretch in the future.

The Az and El Roto-Lok drive systems are driven by a low backlash worm gear set with a 40:1 ratio. The factory low back lash of the worm gear set is reduced further by the Roto-Lok drive ratio resulting in a lash equivalent to only .06 dB as seen by the RF system. The gear sets are housed in a sealed housing which allows the gear set to be continuously lubricated in synthetic oil which maximizes gear efficiency and minimizes wear.

Servo quality DC motors with integral gear box are used for Az, El and Pol drives. These motors were selected because they are lightweight, reliable and provide the best torque to weight ratio as well as allowing dual speed operation for slewing and peaking. These motors produce constant torque over the speed range with no cogging at low speeds which ensures smooth operation when peaking antenna. The 18V DC design provides current limiting torque control and will allow vehicle battery operation if necessary.

The system will interface with a jog controller which allows remote control of the system. Each axis position is displayed as well as limit indications. The unit will also interface with a full function controller with features such as automatic stow, GPS/flux-gate input and automatic satellite pointing and tracking.

Except for the drive components and bearings, the trunion and backing structure and covers are all aluminum. The fabrication of parts and assembly will be of world wide quality standards AvL is noted.

This antenna positioner has been modified by TracStar and bears the serial number 194



1.6.4 Antenna Controller:

The MVS series ACU used with this system is designed to provide the simplest method of locating and peaking on any communications satellite of interest. A one-time “SkyScan” setup aligns the antenna system with the satellites in a given geographical location. The only entry the operator must make is the orbital location of the satellite of interest.

Upon power up and deployment, the following acquisition sequence takes place:

- The compass aligns the antenna with South (if in the northern hemisphere, to the North if in the southern hemisphere).
- The antenna acquires the GPS signal for high precision geographic location information.
- The antenna precisely sets the elevation angle and sweeps through a pre-selected reference satellite, monitoring signal characteristics of the reference satellite.
- The antenna peaks on the reference satellite until the center of the antenna beam is located as a calibration.
- The antenna then moves to the satellite of interest and peaks on the satellite by performing a high precision alignment process using the signal from the satellite of interest.
- The antenna then sends the GPS information to the satellite modem (if applicable).
- The satellite modem then initiates contact with the network operations via the satellite.

This TracStar MVS Series ACU bears the serial number 10582