Space Data Corporation SkySite System Operators Instructions

Model SK8-900 SkySite
Model GST-900 Ground Station

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1.0 Introduction.

The Space Data Corporation SkySite network is designed to provide wireless paging service to remote areas that are not practically serviced by traditional terrestrial communication towers. This paging coverage is accomplished by mounting the functional equivalent of a communications tower on a high altitude weather balloon thereby overcoming service limitations.

The SkySite Network consists of 5 subsystems listed below.

1. SkySite Platform
2. Launch Facilities
3. Ground Station
4. Network Control Center.
5. SkySite Control Center

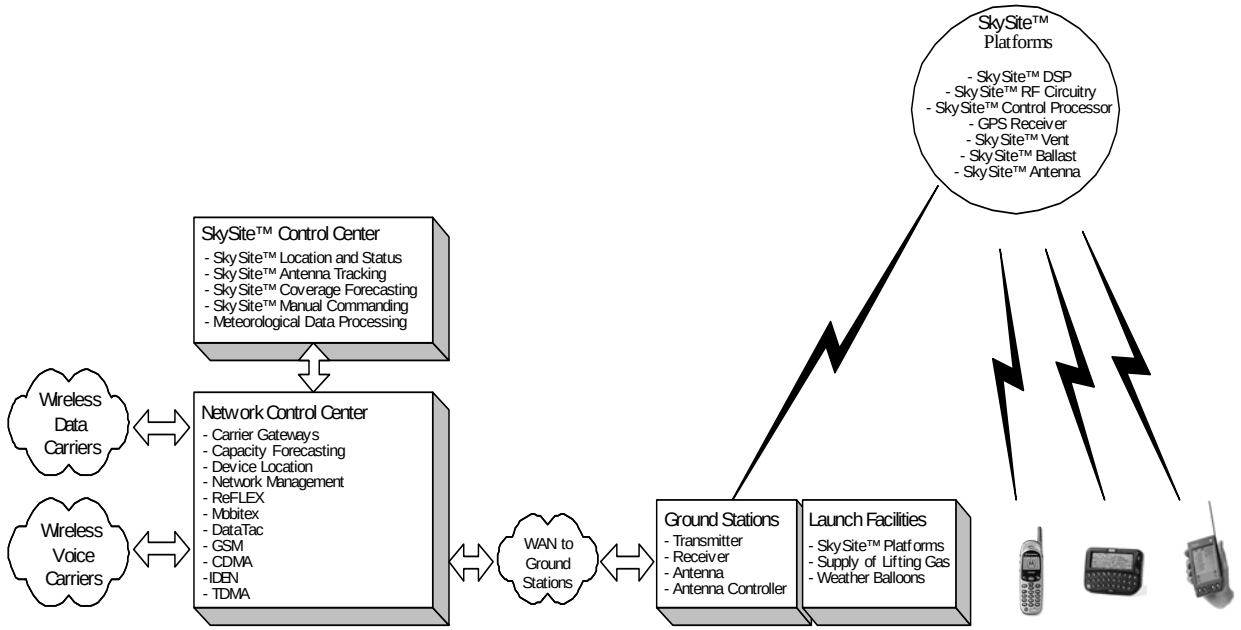

Figure 1.1: The SkySite Network

This document is a summary of the procedures used to deploy and operate the SkySite network. All equipment shown is manufactured, operated and serviced by Space Data Corporation and is therefore meant for internal use only.

2.0 Pre-Launch

Control Center operations are managed through the use of several Space Data Corp. proprietary software applications. These client applications run from EPS (Engineering Programming Software) server:
GST (Ground Station). The GST maintains the communication link from the ground to the SkySite. The GST also monitors and controls ground station functions such as

antenna auto-tracking, Receive signal strength, TX and RX power levels and frequency correction.
SkySite client. Monitors SkySite performance such as TX and RX power levels, GPS position, battery current and voltage, and AH consumed. Vent ballast controls and accumulated values release command.
Mapping client. This application utilizes the GPS coordinates sent from the SkySite and superimposes it on mapping software. Terrain and population density are easily determined from this screen and is used to plan recovery of the payload. The mapping client also has predictive capability. Using wind speed and direction information obtained on ascent, the software can predict where a SkySite will land if release at that moment from the balloon and descends using its parachute.

2.1 Pre-flight client preparation

Start all GST (Ground Station Transceiver) and SKS (SkySite) clients. Both software applications should connect to the EPS (Engineering Programming Software) server. During operation each client should appear as shown in figures 2.1 and 2.2 below.

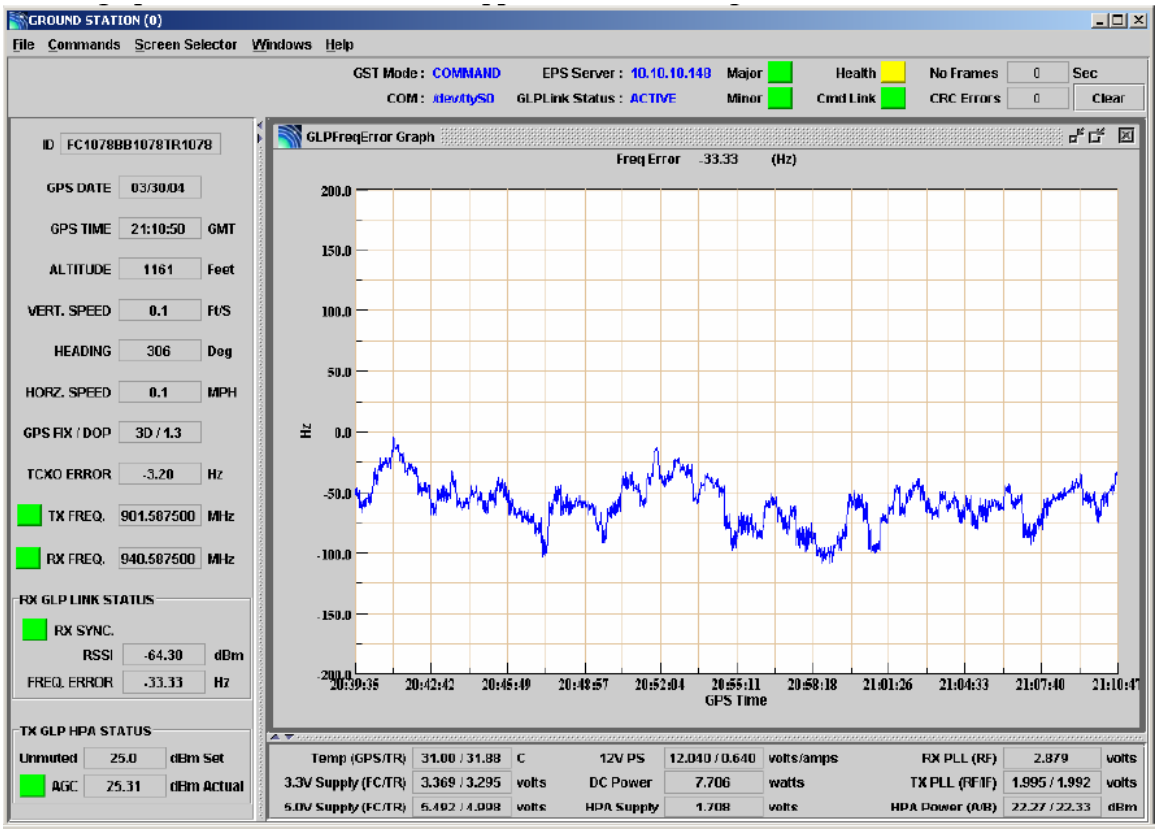

Figure 2.1 – GST Client Screen

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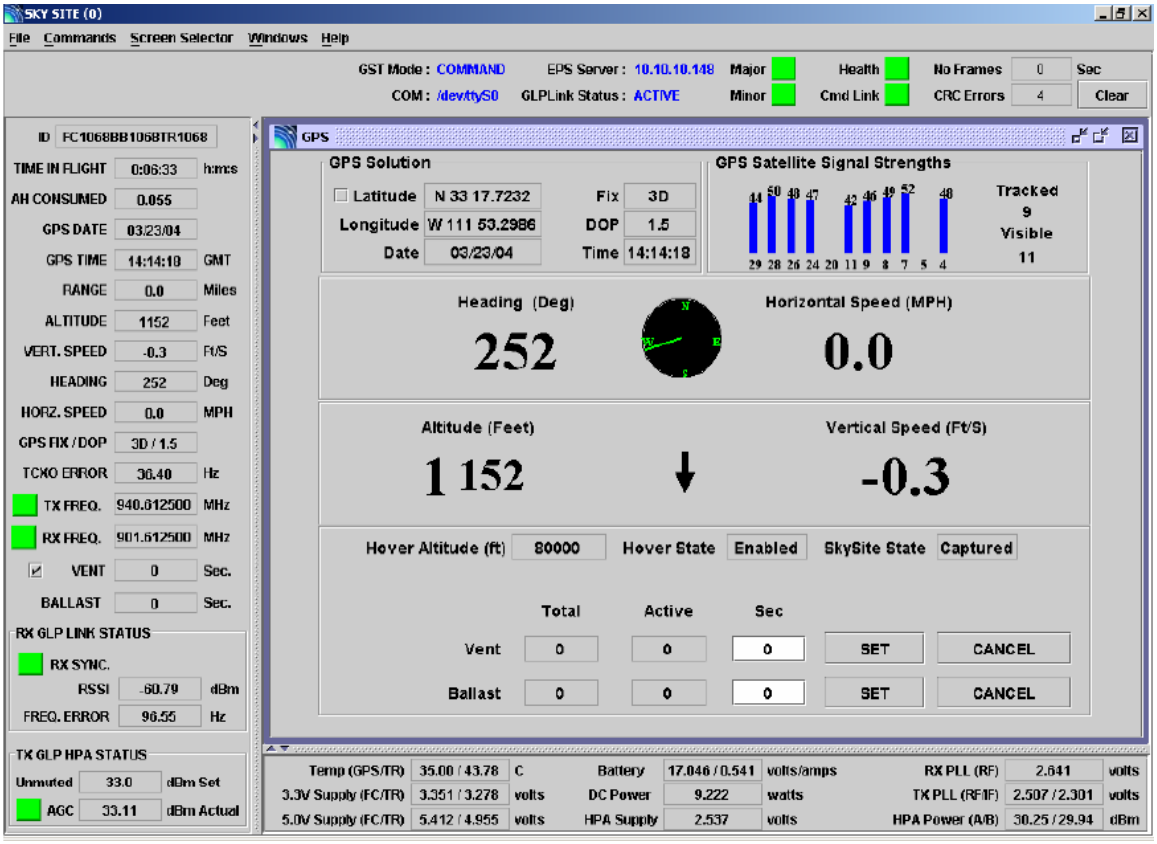

Figure 2.2 – SKS Client Screen

Determine the type of antenna used by the Ground station in operation. There are only two types of antennas used:

1. Omi-directional antenna (Max. Gain of 3dBi)
2. Yagi antenna (Max. Gain of 10dBi)

Caution:

In order to comply with FCC Part 24 and RF (Radio Frequency) exposure limits of this product the maximum GST ERP (Effective Radiated Power) must not exceed 7 Watts (38.45dBm).

Transmit power levels are shown in the bottom left corner of the GST client in the "TX GLP HPA STATUS" box. This value does not include the directional gain of the antenna. Therefore the maximum permissible power levels into the antenna as are as follows:

1. **Using the Omni-directional antenna the maximum power is 35dBm.**
2. **Using the high gain Yagi antenna the maximum power is 28dBm.**

- Start all GST and SKS clients.
  Ensure that GST clients connect to EPS server.
  On GST Client open the GLP RSSI and GPS screens

- On the SKS Client open the following screens:
  GPS.
  GLP RSSI.
  Altitude vs. heading graphs.
  Altitude vs. Horizontal speed.
  Vertical speed graph.

- Check Antenna Control:
  Disable tracking
  Ensure client is in “remote tracking” mode.
  For each GST client slew antenna in azimuth and elevation.
  Point antenna toward launch site at 0 degrees elevation.

- Start GPS client on mapping PC and ensure it connects to EPS server. The GPS client started must correspond to the GST that will be used to control the payload.

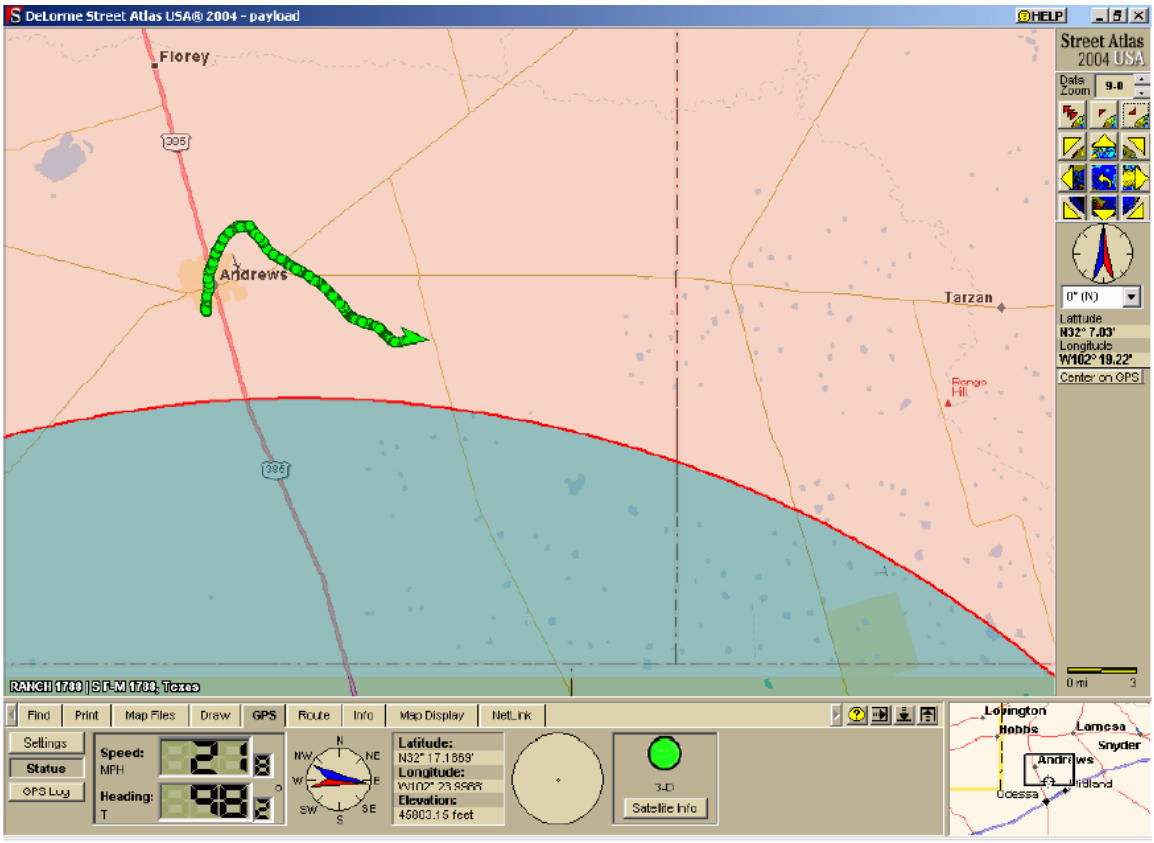

Figure 2.3 – Mapping Client Screen

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- Start predictor software on mapping PC
- Start Delorme payload and predictor programs on mapping PC.

- Start Delorme payload and predictor programs on mapping PC. The mapping client should look like figure 2.3 as shown above.

3.0 Balloon Fill Steps

3.1 Initial Preparation

- Arrive 1 hours before scheduled launch
- Obtain pre-flight checklist
- Turn on handheld radio for communication with local airport traffic (if applicable)
- Verify channel and that comms are operating

Figure 3.1 – Ground Wire clip

3.2 Area Preparation

- Remove any obstacles from launch area
- Place launch table in middle of area
- Remove protective cover from launch table
- Use brush to sweep off any debris from table
- Attach ground wire from wall (Figure 2.1) to ground lug on table wrapping wire twice around table leg

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- Connect power to ESD monitor under table
- Place on the launch table the following items needed for launch
    - Latex gloves
    - Wrist grounding straps
    - Proper gas regulator (hydrogen or helium) with fill cup attached

3.3 Balloon Inflation

- Determine payload weight and required excess lift
- Enter this data onto pre-flight checklist
- Get balloon from balloon storage cabinet
- Enter balloon serial number onto checklist
- Using "Excess Lift Calculator" on Flight Ops vault
    - Line 2 columns D and E enter date and time of launch
    - Line 21 column C enter payload weight
    - Line 24 column C enter balloon weight
    - Line 30 column C enter desired excess lift
    - Line 34 column C take number and round to next 100 grams (example: 2,343 grams would become 2,400 grams)
    - Line 37 column C enter rounded figure as well as on pre-flight checklist
- Save data in the corresponding flight number folder
- Using excess weight total, configure weight holder with proper amount of weights from bin under launch table and place 1,000 gram weight in standby position to be used at a later time
- Get key for gas cage, green gas bottle hand truck, and hydrogen from cage
- Position gas just outside fill facility
- Remove protective cover from tank and place on ground beside tank
- Connect regulator to gas bottle
- Put on latex gloves
- Remove balloon from box and plastic bag
- Carefully roll out half of the balloon on the launch table
- When ready to fill, one person will put on the wrist grounding strap and monitor / handle the balloon while the other person is positioned next to the gas bottle
- Wear hat to ensure skin oils do not come in contact with balloon
- Ensure gas regulator is turned off (closed)
- Have person manning gas bottle turn on gas
- Slowly turn on gas regulator until pressure is between 20 and 25
- The person monitoring the balloon checks for gas leaks around fill mechanism or from the balloon and also ensures the balloon does not fall on the table
- When the balloon begins to lift the fill mechanism, attach weight as shown in Figure 2.2
- When balloon begins to lift the weights, turn off regulator and the gas supply, then add 1,000 gram weight onto holder
- Move table to a location that allows plenty of room to take balloon out of fill bay for launch

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Figure 3.2 – Adding weights

3.4 Launch Preparation

- Once the balloon is filled, you are ready to attach the balloon to the payload
- Ensure both personnel have grounding straps on and connected to the ESD monitor
- Have one person hold the balloon neck (ensure a good grip on the neck since it has a lot of lift / pull) while the other person disconnects the fill cup from the balloon and moves it and the hose out of the way
- Remove wrist straps, unplug ESD monitor and disconnect ground wire and return it to its spool
- The person holding the balloon will crouch down as needed while the other person goes outside to monitor wind conditions and be prepared to watch and guide the other individual through the door opening
- The person outside instructs the balloon holder when to exit the fill bay
- At that time, the balloon holder exits quickly while staying crouched / low to the ground
- Holder will then proceed to the launch area and await instruction to launch
- The other individual will ensure gas is off, disconnect regulator from the tank, reinstall the tank's protective cover, and return the tank to the cage

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- Once the balloon has been launched, the launch table / bay will be returned to original state in preparation for a future launch

4.0 Launch procedure:

- Switch GST client to launch frequency
- Watch RSSI level. When Rx Sync has indicator turn green call launch team and give them the OK to release the SkySite.
- When SkySite is picked up by the GST and signal is stable call launch team and have them go to listen mode.
- When you see the RSSI signal level drop on the SkySite enter command mode on GST.
- Confirm auto hover is engaged and set for the correct altitude
- Switch SkySite to operational frequency at high power:
- On configuration screen select an operational frequency, select "non-volatile" and click set.
- On the GST client go to the configuration screen and switch it's frequency to the one that the SkySite is using and re-acquire the SkySite.
- On the SkySite client go to the "configuration" screen and select an output power of 33 dB. Select "non-volatile" and click set.
- Reduce the power of the SkySite to the minimum power required. Ensure that it is a "volatile" change.
- Confirm that ReFLEX is enabled.

5.0 Flight control procedure

- Auto-hover will vent and ballast as required to maintain it'd desired altitude. Monitor the following during flight:
    1. GPS quality using the DOP value, lower than 2.0
    2. Temperature TR S/B lower than 80 C
    3. RSSI. S/B Better that 100 dBm
    4. Ballast cum 900 seconds
    5. Battery power consumed. The capacity of the battery pack is 12Amp hours

6.0 FM Repeater Operation

- To operate the SkySite™ Platform in FM Repeater mode, select repeater mode under the Command pull-down menu.
- This will put the SkySite™ Platform into repeater operation for 15 minutes, interrupting telemetry and command & control functions for that period.
- At the end of the 15-minute period, the platform will begin transmitting telemetry so the operator can establish if any flight parameters need changing. The Flight Computer continues to operate during repeater operation.
- To return to FM Repeater operation, simply re-select the repeater mode on the Command pull-down menu.

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7.0 Flight termination

- When the useful life of the SkySite, turn command over to the recovery team and let them know the SkySite will be switching over to a recovery frequency.
- Switch SkySite to a recovery frequency.
- Change the SkySite frequency to a recovery frequency through the "configuration screen click non-volatile and click.
- Change the GST client to the recovery frequency and re-acquire the skysite.
- Set the skysite power level to 33 dBm (max. power) ensures that this is a non-volatile change. This will give the recovery team the best opportunity to acquire the SkySite.
- Switch GST into listen mode. Monitor the SkySite GLP RSSI to ensure that that recovery team successfully takes control.

Caution: Equipment changes / modifications not approved by the responsible party could void the user's authority to operate the equipment.

NOTE: This Equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
