NATIONAL RECONNAISSANCE OFFICE
14675 Lee Road
Chantilly, VA 20151-1715

31 May 2017

Mr. John Greenewald, Jr.
[redacted]

REF: FOIA Case F-2016-00059

Dear Mr. Greenewald:

This is in response to your request dated 17 April 2016 and received by the National Reconnaissance Office (NRO) on 18 April 2016. Pursuant to the Freedom of Information Act (FOIA), you requested *"a copy of the Flight Ops GeoLITE Training, as referenced on the Intellipedia entry for GeoLITE, under the "See Also" heading."*

Your request has been processed in accordance with the FOIA, 5 U.S.C. § 552, as amended. A thorough search of our files and databases located two documents responsive to your request. They are being released to you in part.

Material redacted is denied pursuant to FOIA exemptions:

(b)(1), as information that is properly classified pursuant to Executive Order 13526, Sections 1.4(c) and 1.4(g); and

(b)(3), which is the basis for withholding information exempt from disclosure by statute. The relevant withholding statute is 10 U.S.C. § 424, which provides (except as required by the President or for information provided to Congress), that no provision of law shall be construed to require the disclosure of the organization or any function of the NRO; the number of persons employed by or assigned or detailed to the NRO; or the name or official title, occupational series, grade, or salary of any such person.

With regard to some of the information withheld pursuant to FOIA exemption (b)(1), NRO has determined that a series of unclassified items in the document in the aggregate reveals associations or relationships not otherwise revealed in the unclassified items individually; thus, in the aggregate, the information meets the standard for classification under E.O. 13526 1.7(e).

You have the right to appeal this determination to the NRO Appellate Authority, 14675 Lee Road, Chantilly, VA 20151-1715, within 90 days of the above date. You may also submit an appeal electronically by completing the form available on the NRO's public web site at http://www.nro.gov/foia/AppealInput.aspx. Please include an explanation of the reason(s) for your appeal as part of your submission. The FOIA also provides that you may seek dispute resolution for any adverse determination through the NRO FOIA Public

Liaison and/or through the Office of Government Information Services (OGIS). Please refer to the OGIS public web page at https://ogis.archive.gov/ for additional information.

If you have any questions, please call the Requester Service Center at (703) 227-9326 and reference case number **F-2016-00059**.

Sincerely,

Patricia B. Cameresi
for FOIA Public Liaison

Enclosures: (1) C05093604; GeoLITE Training Document
(2) C05093606; GeoLITE Training Course Material

(U) GeoLite Training

(U) Task Objective:

(U) Understand GeoLite [ ] mission operations

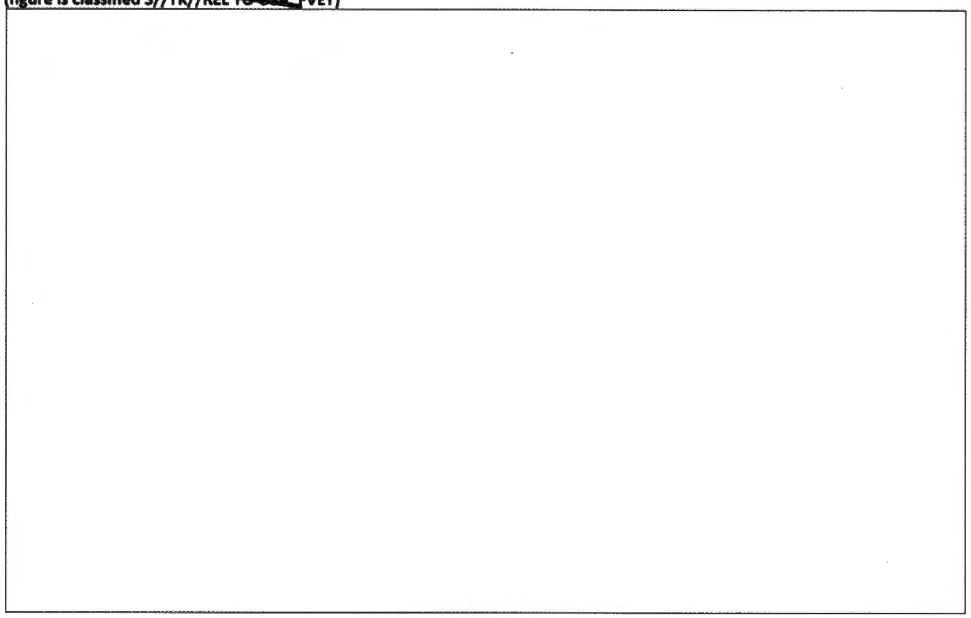
(U) The **Geo**synchronous **L**ightweight **T**echnology **E**xperiment [ ] was launched in May 2001. (b)(1) (b)(3)

(U) The **GeoLITE** program is managed and procured by the NRO. The prime contractor for the GeoLITE missions is TRW/DSD. The GeoLITE program mission operations ground station was originally the TRW Satellite Command and Control Center, SCCC, located in [ ]Va. The command and control has since been transferred [ ] for the IBS-S mission.

(U) The GeoLITE Spacecraft has two missions:

- (U) The original mission was:
  - Proof of concept of space/ground laser communication links.
  - GeoLITE Lasercom Optics Module (GLOM)
- (S//TK//REL) The current mission [ ] (b)(3)
  - To provide IBS coverage to the [ ] (b)(1)
  - The operation of a broadcast communication system is also in support of the IBS. (b)(3)

(figure is classified S//TK//REL TO USA, FVEY)



CL BY: [ ] (b)(3)
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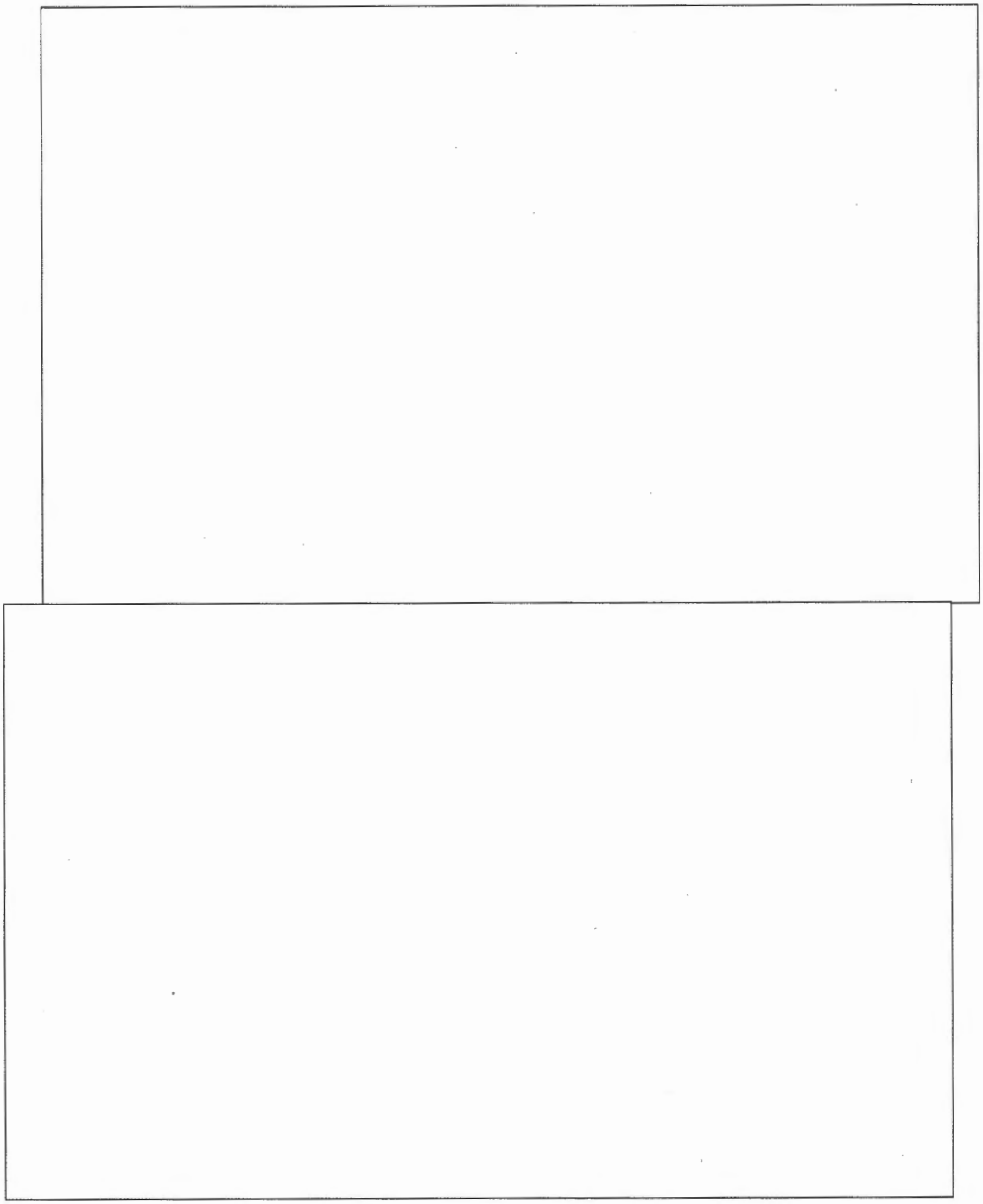
DRV FROM: INCG 1.0 13 Feb 2012



(b)(1)
(b)(3)

(figure is classified ~~S//TK//REL TO USA, FVEY~~)

(U) Overview

(~~S//REL~~) The Geosynchronous Lightweight Technology Experimental space system consists of one satellite launched in May of 2001 to test a new, space-to-ground laser communications payload. Because of its relatively low cost, compared to other NRO satellites, [redacted] (b)(1) (b)(3)

[redacted] The experiment, which included the use of the GLOM and Radiometer payloads [redacted] Following this time, GeoLITE was (b)(3)

drifted from its position over the SCCC in VA to its present location, where it services [redacted] Total expected mission life is [redacted] (b)(1) (b)(3)

(U) [redacted]

(S//REL) The GeoLITE vehicle's [redacted] (b)(1) (b)(3)

[redacted] Broadcast messages are repeated several times over a specific interval to achieve a statistical probability of assured delivery.

The GeoLITE Space Vehicle Contractor (SVC) is Northrop Grumman Space Technology of Redondo Beach, California.

[redacted] (b)(1) (b)(3)

(figure is classified ~~S//TK//REL TO USA, FVEY~~)

(U) GeoLite C2 Hardware and Software (refer to figure below)

[redacted] Front End Processor. The [redacted] hardware, located in the RT Area, allows the EPOCH [redacted] software running on the [redacted] workstations to interface to the GeoLITE spacecraft via the [redacted] (b)(3) (b)(1) (b)(3)

(U) The [redacted] is used to achieve: (b)(3)

- Telemetry frame synchronization.
- Command stream generation.
- Telemetry storage during the support.
- Archive pushed to [redacted]

(U) The [redacted] The [redacted] Box provides conversion of the ternary uplink command stream generated by the Sys500 into the EXU format [redacted] is hardwired into the GeoLITE ground Hardware. (b)(3)

(b)(1)
(b)(3)

[redacted]

(figure is classified S//TK//~~REL TO USA, FVEY~~)

(U) Ephemeris Upload

The purpose of an ephemeris upload is to maintain earth center pointing by uploading pointing coefficients that the Attitude Determination and Control System (ADCS) uses along with inputs [redacted] (b)(3)

(U) Momentum Unload

[redacted] (b)(3)

(b)(1)
(b)(3)

(b)(3)

(U) are conducted approximately once every couple months. It is important to verify signal strength following has forgotten to update the pointing following the maneuver.

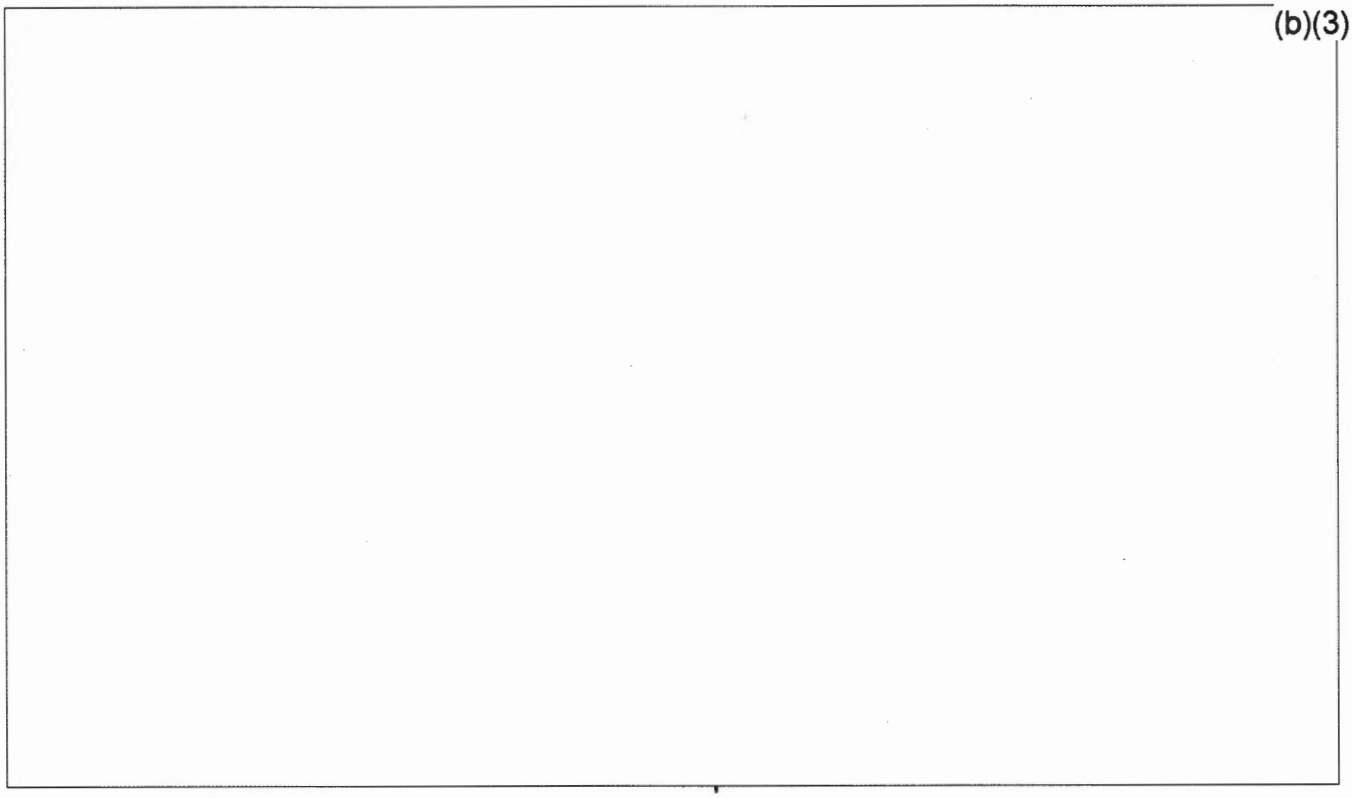
(b)(1)
(b)(3)

(U) Yaw-flip

(b)(1)
(b)(3)

(U) Daily Yaw Maneuvers

(b)(3)



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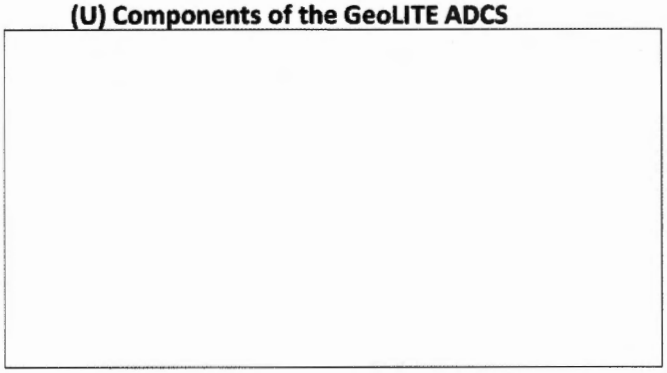
(U) Components of the GeoLITE ADCS

(b)(3)



(U) GeoLITE ADCS Operating Modes

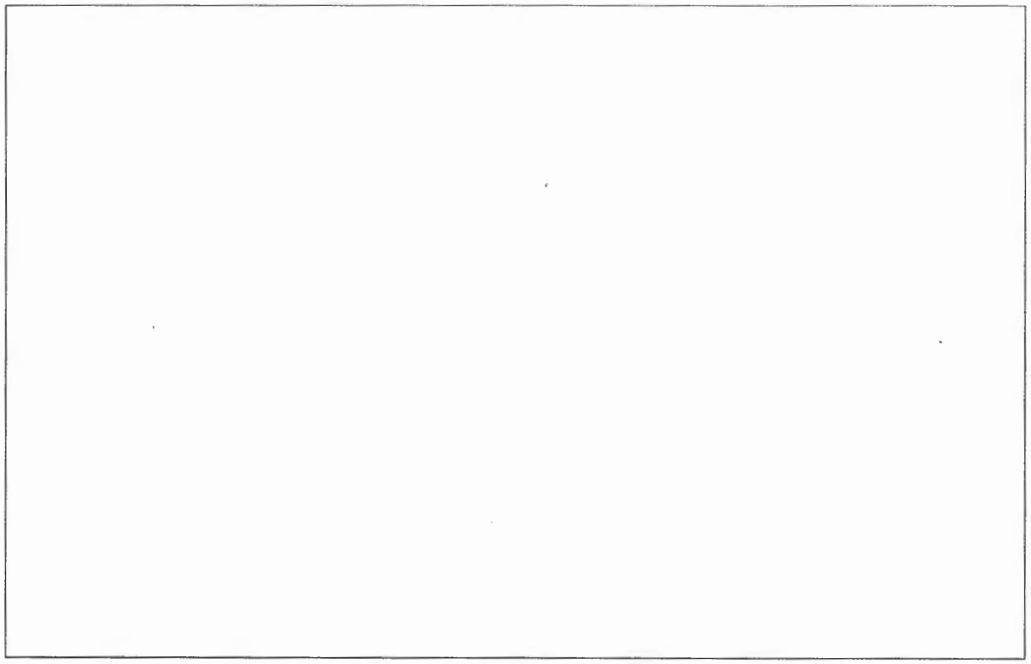
Spacecraft Mode	Software Mode	ADACS Mode	Attitude Maintenance
Survival	Survival	None	
Safe Haven	Sun Thruster	Sun Thruster	
Safe Haven	Wheel Sun	Wheel Sun	
Safe Haven	Stellar Reference Acquisition	Stellar Reference Acquisition	
Normal	Wheel Normal	Wheel Normal	
Maneuver	Delta V	Delta V	

(b)(3)

(Table ~~is UNCLASSIFIED~~)

(U) GeoLITE

• (U) Geosynchronous Lightweight Technology Experiment



(b)(1)
(b)(3)

(U) Class Overview

- (U) Mission
- (U) History
- (U) Roles and Responsibilities
- ~~(S//TK//REL)~~ [redacted] Payload (b)(1) (b)(3)
- (U) C&DHS
- (U) ADACS Modes
- (U) Stored Command Sequences
- (U) Ground Hardware
- (U) Sys500 Software
- (U) Epoch Software
- (U) Conducting a GeoLITE Contact
- (U) [redacted] SOH (b)(3)
- (U) Ending a GeoLITE Contact

- (U) Special Activities
  - (U) Support Scheduling
  - [redacted] (b)(3)
  - (U) Ephemeris Upload
  - (U) Momentum Unload
- (U) Other Activities
  - (U) [redacted] (b)(3)
  - (U) Yaw Flip
  - (U) Automated Yaw Maneuvers
  - (U) GLOM Out-Year Testing
  - ~~(S//TK//REL)~~ [redacted] (b)(1) (b)(3)
- (U) Eclipse Operations
- (U) Contingencies
  - (U) Shadow Supports
  - (U) Patching
  - (U) Loss of Telemetry
  - (U) Loss of Commanding

(U) Mission

- (S//TK//REL) GeoLITE is [redacted] (b)(1) (b)(3)
- (S//TK//REL) The GeoLITE Spacecraft has two missions:
  - (U) Original mission: The demonstration and validation of advanced laser communications (lasercom) technology.
    - (U) GeoLITE Lasercom Optics Module (GLOM)
    - (U) Radiometer
  - (S//TK//REL) Current Mission [redacted] To provide IBS coverage to the [redacted] (b)(1) (b)(3)
    - (S//TK//REL) The operation of a broadcast communication system in support of the Integrated Broadcast Service-Simplex (IBS-S).
- (S//TK//REL) GeoLITE is an unclassified program/spacecraft [redacted] (b)(1) (b)(3)
- (U) IRON: [redacted] (b)(3)

(U) History

- (U) Built by TRW (now Northrop Grumman) through the NRO AS&T Office.
- ~~(S//TK)~~ Launched in May 2001 from the Cape Canaveral Air Force Station launch facility .
- (U) Conducted laser communications tests until [redacted] (b)(1) (b)(3)
  - (U) Controlled by TRW from [redacted] VA for lasercom tests.
- ~~(S//TK)~~ [redacted] - control of spacecraft transferred to [redacted]
- ~~(S//TK//REL)~~ [redacted] - Began supporting IBS-S over [redacted]

(U) Roles and Responsibilities

- (S//~~TK~~)
  - (U) Interface with the Air Force Satellite Control Network (AFSCN) for satellite command and control.
  - (U) Verify State of Health of the vehicle.
  - (U) Perform GLOM out-year testing.
  - (S//~~TK//REL~~) Work with NMC and Uplink Sites to maintain coverage over the (b)(1) (b)(3)
- (S//~~TK//REL~~) Network Management Center (NMC)
  - (S//~~TK//REL~~) Coordinate with various organizations to manage IBS Uplink & provide IBS Data for uplink.
- (U) Northrop Grumman (TRW) factory in Space Park, CA
  - (U) Perform vehicle state-of-health analysis and anomaly resolution.

(S//TK//REL) Payload

- (S//TK//REL)
  - (S//TK//REL) is the dissemination of processed mission data in support of the Integrated Broadcast Service-Simplex (IBS-S).
  - (S//TK//REL) GeoLITE covers the
- (S//TK//REL) Data Transfer
  - (S//TK//REL) Raw data is processed at NMC (b)(1) (b)(3)
  - (S//TK//REL) Processed data is uplinked from
  - (S//TK//REL) GeoLITE receives the processed data via its
  - (S//TK//REL) GeoLITE the data from its
    - (S//TK//REL)
    - (S//TK//REL)

(U) Command and Data Handling Subsystem (CDHS)

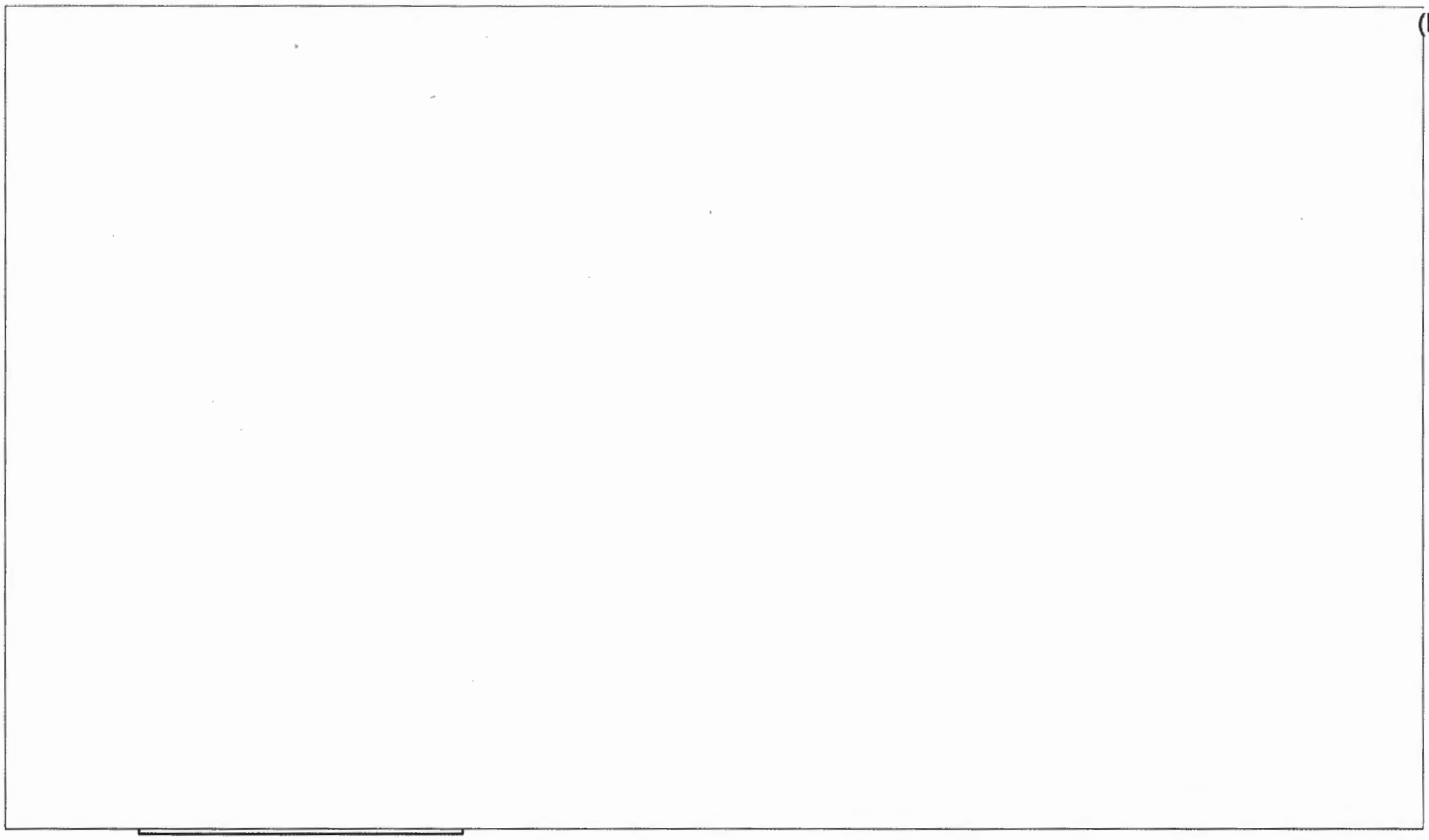
(b)(3)

(U) Command and Data Handling Subsystem (CDHS)

- (U) The C&DHS is responsible for:
  - (U) Exchanging commands and telemetry with the ground element via [redacted] (b)(3)
  - (U) Supporting all Flight Software (FSW).
  - (U) Providing processing and storage of command, telemetry and mission data to support spacecraft operations and payloads
  - (U) Routing, recording and retrieving spacecraft State of health telemetry.
- (U) The C&DHS consists of the following equipment:
  - (U) [redacted] (b)(3)
  - (U)
  - (U)
  - (U)
  - (U)
  - (U)
  - (U)

(U) [redacted] Antennas

(b)(3)



(b)(3)

(U) Transponders

(b)(3)

(U) Data Interface Units (DIU)

(b)(3)

(U) NoOps

- (U) A NoOp is a non-functional dummy command. They are used to establish a valid command path between the ground, the DIU, and the receiver.
- (U) There is a NoOp procedure for each transponder:

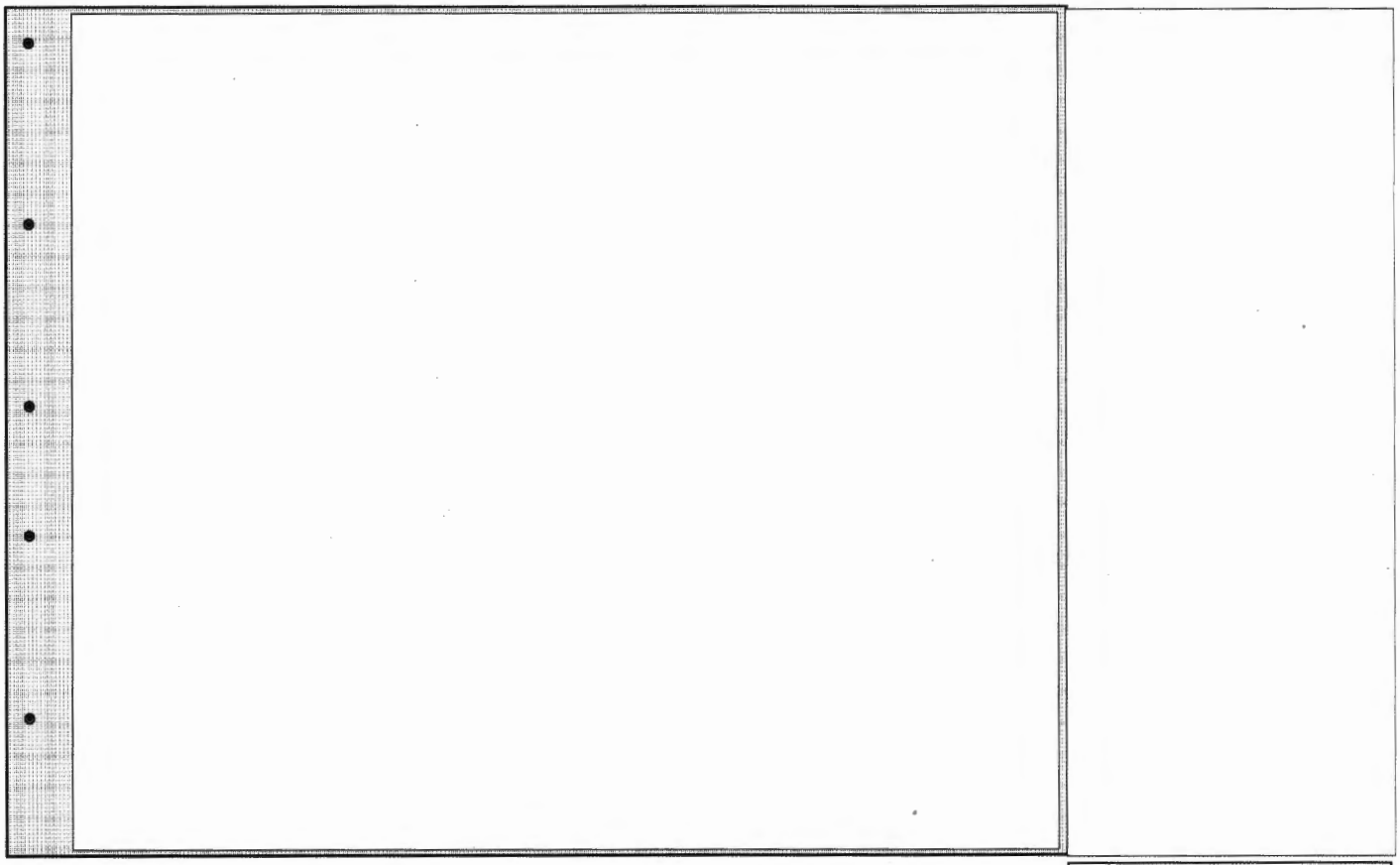
(b)(3)

(U) On-Board Computers (OBC)

(b)(3)

(U) Telemetry Storage Unit (TSU)

(b)(3)



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(U) Command and Data Handling Subsystem (CDHS)

- (U) Command rate
  - (U) The vehicle always receives [ ] commands and ranging data via its [ ] [ ] (b)(3)
  - (U) Commands are only decrypted and authenticated by [ ]
- (U) Telemetry rate
  - [ ]
  - **(U) Nominal rates:**
    [ ]
  - **(U) Non-nominal rates:** (b)(3)
    [ ]

(U) Stored Command Sequences (SCS)

- (U) SCSs are command sequences [redacted] of the OBC. (b)(3)
- (U) Once [redacted] SCSs can be activated autonomously or by ground command. (b)(3)
- (U) SCSs provide various functions for the [redacted] payloads. (b)(3)
- (U) The [redacted] (b)(3)
- (U) Commonly used SCSs include:
  - (U) **SCS-12** – [redacted] (b)(3)
  - (U) **SCS-17** –
  - (U) **SCS-25** – (used to confi

(U) SCS-12

- (U) The purpose of SCS-12 is to cycle through the [redacted] configurations in order to establish a downlink. (b)(3) (b)(3)
- (U) SCS-12 activates each time the [redacted] (b)(3) (b)(3)
- (U) SCS-12 will cycle through each configuration [redacted] (b)(3) (b)(3)
- (U) SCS-12 takes approximately [redacted] to complete. It should be (b)(3) (b)(3)
  - [redacted] (b)(3)
- (U) If SCS-12 completes, the final step will place the spacecraft into "Safe Haven."

(U) SCS-12

(U) Timeline:

(b)(3)

(b)(3)

(U) SCS-12

(U) Timeline:

(b)(3)

(b)(3)

(U) SCS-12

(U) Timeline:

(b)(3)

(b)(3)

(U) SCS-12

(U) Timeline:

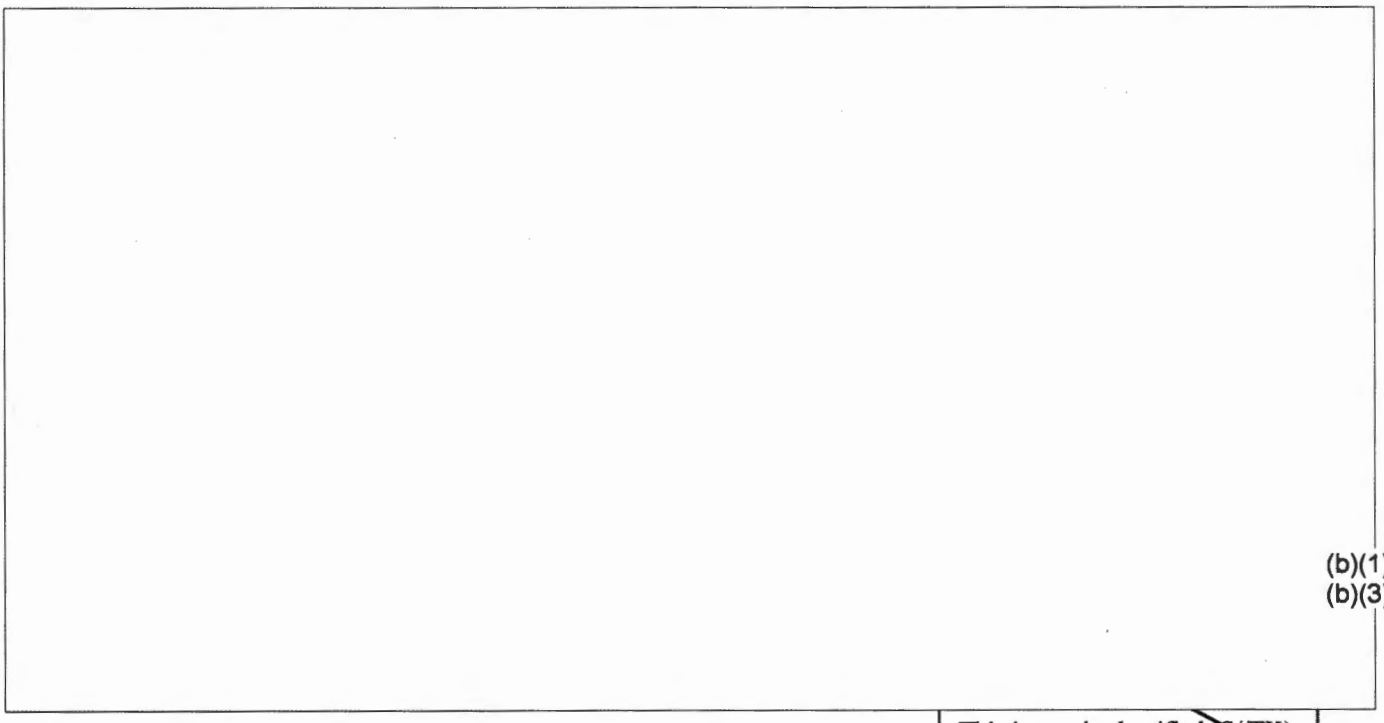
(b)(3)

(b)(3)

(U) SCS-12

- (U) Steps 38 – 39 will turn off [redacted] (b)(3)
- (U) Steps 40 – 71 will repeat the actions of Steps 8 – 39. At the end of Step 71, [redacted] would have passed since SCS-12 activated. (b)(3)
- (U) Steps 72 – 75 will reset [redacted] This will reset the [redacted] (b)(3)
  [redacted] (b)(3)
- (U) Steps 76 – 137 will repeat the actions of Steps 8 – 71. This will take [redacted] (b)(3)
- (U) Step 138 – 139 will enable and set the [redacted] (b)(3)
  [redacted] This will put the vehicle into Safe Haven. (b)(3)
- (U) If the [redacted] is unable to terminate SCS-12, the [redacted] (b)(3)
  [redacted] before the SCS-12 [redacted] (b)(3)
  in order to avoid safe haven.

(U) Ground Hardware



(b)(1)
(b)(3)

This image is classified (S//TK).

(U) Ground Hardware

(b)(3)

- (U)
  - (S//TK)
  - (U) Used to store archived data and perform data retrievals.
- (U)
  - (S//TK)
  - (U) Controller interface to EPOCH and SYS500 software.
- (U)
  - (S//TK)
  - (U) Controller interface to EPOCH and SYS500 software.
- (U)
  - (U) Used to perform bit error rate tests.
  - (S//TK) Located in the

(b)(1) (b)(3)

(b)(3)

(b)(1) (b)(3)

(b)(3)

(b)(1) (b)(3)

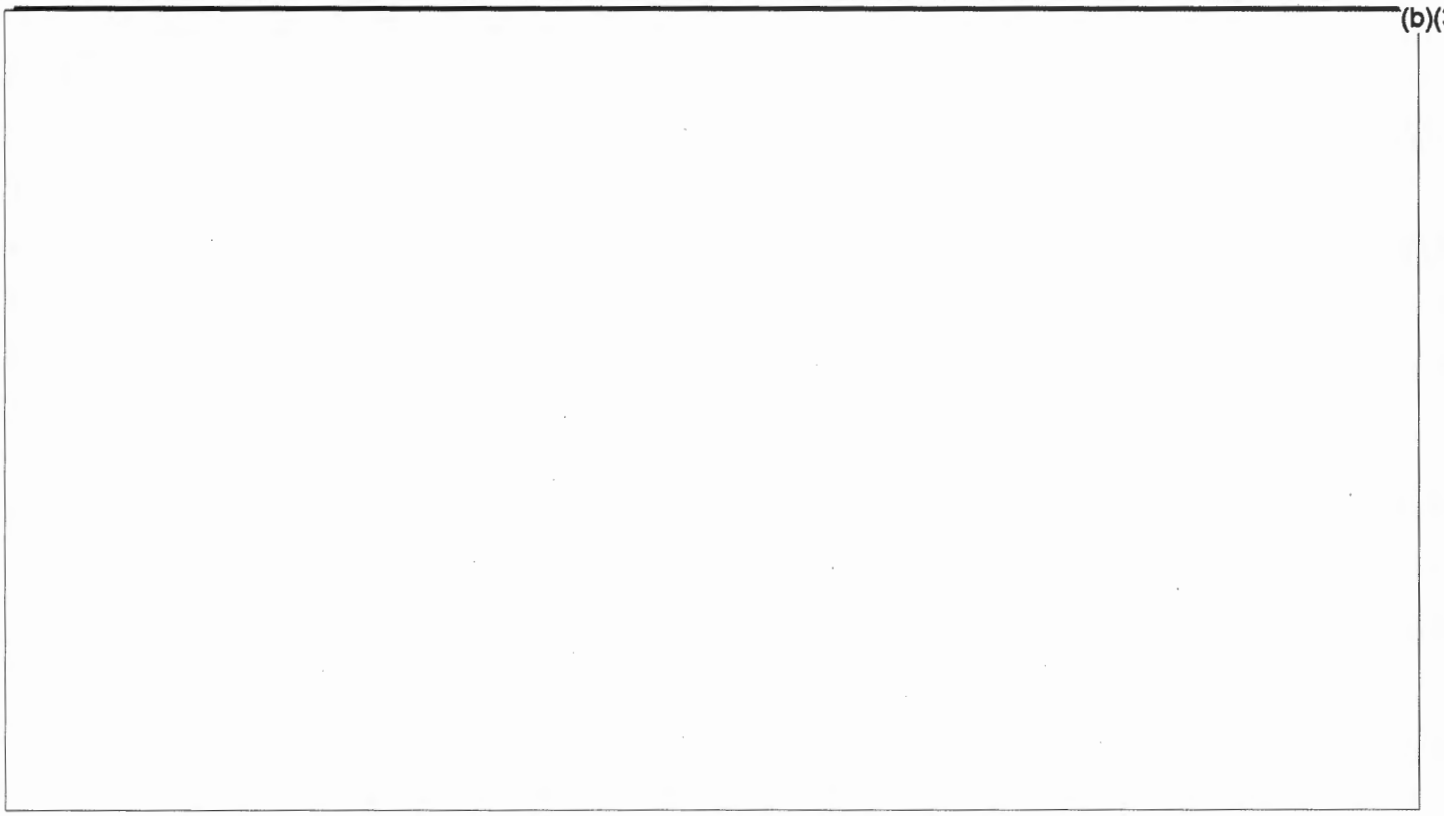
(b)(3)

(b)(1) (b)(3)

This image is classified (S//TK).

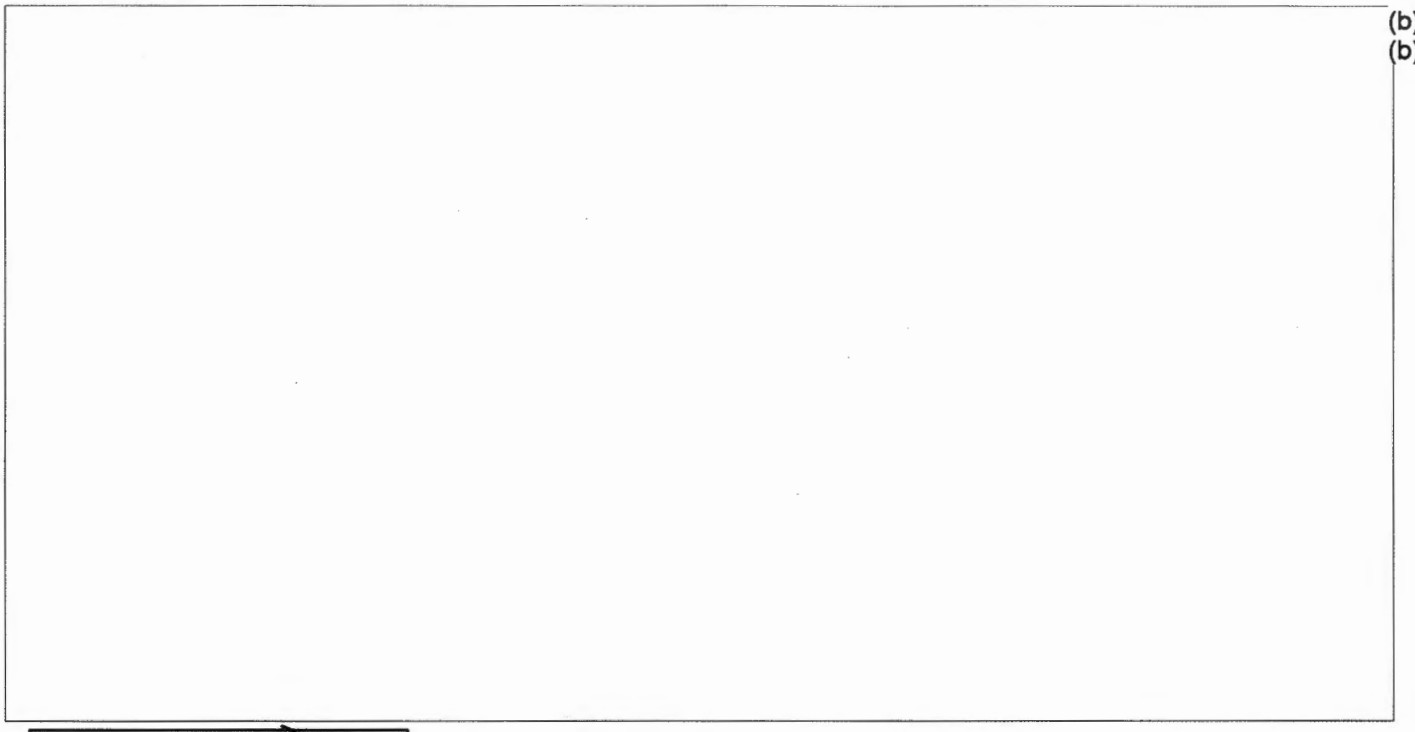
(U) Ground Hardware

(b)(3)



(U) Ground Hardware

(b)(1)
(b)(3)



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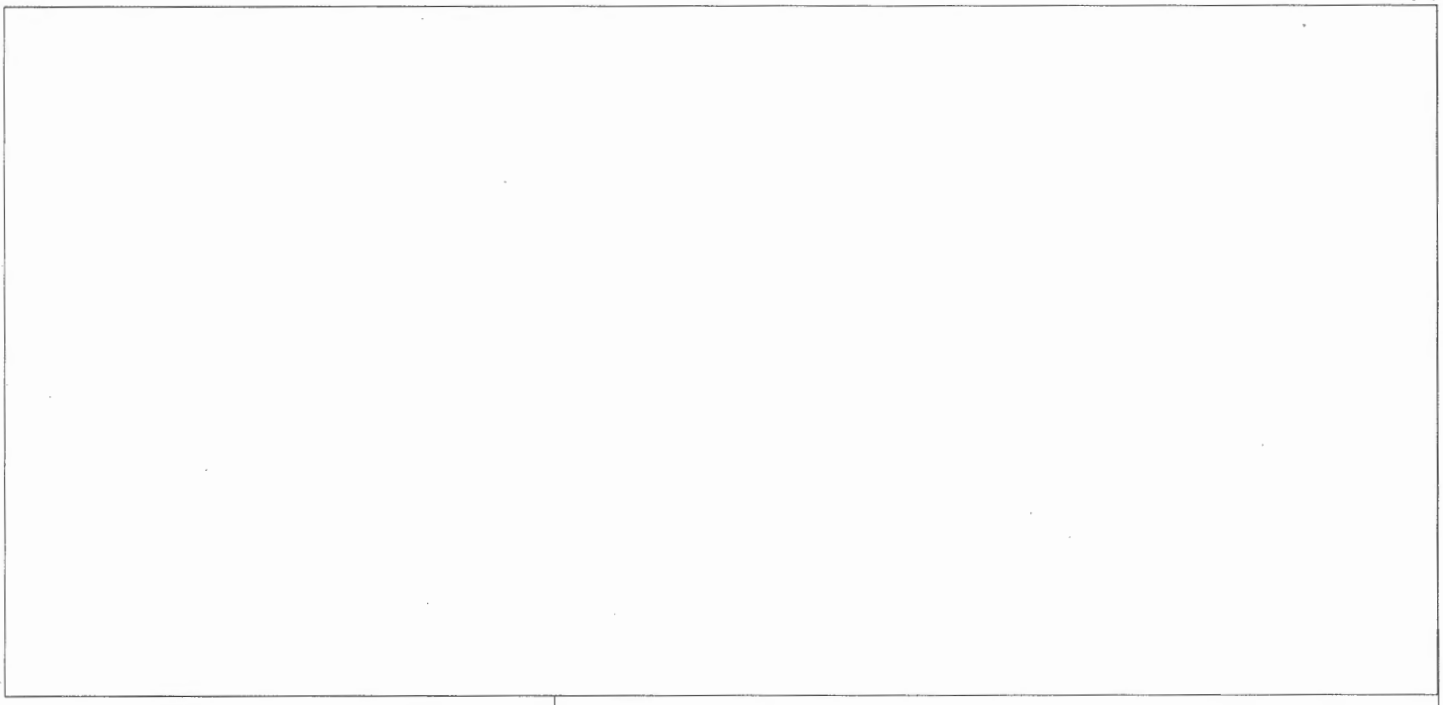
(U) Ground Hardware

(b)(1)
(b)(3)



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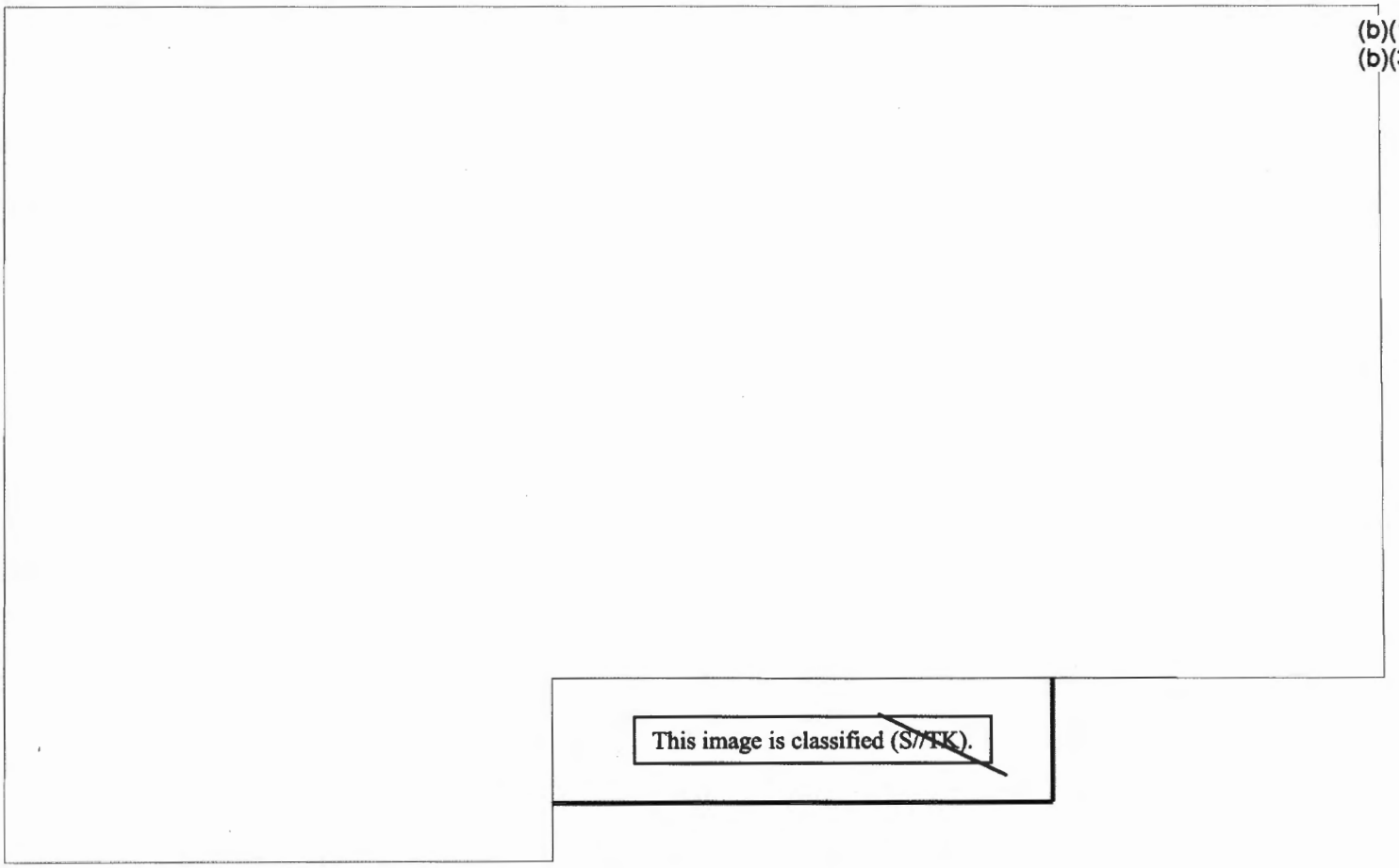
(U) Ground Hardware

(b)(1)
(b)(3)



(U) Sys500 Software

- (U) Sys500 is used to control the [redacted] command and telemetry front end. Part of the software runs on the [redacted] hardware, and part runs on the [redacted] (b)(3) (b)(3)
  - (U) It allows us to configure the ground hardware for proper telemetry rates.
  - (U) It allows us to archive recorded telemetry by copying (or "pushing") the file to the [redacted] (b)(3)
  - (U) It provides a graphical indication for [redacted]
  - (U) It allows us to control the [redacted] which is located within the [redacted] (b)(3)

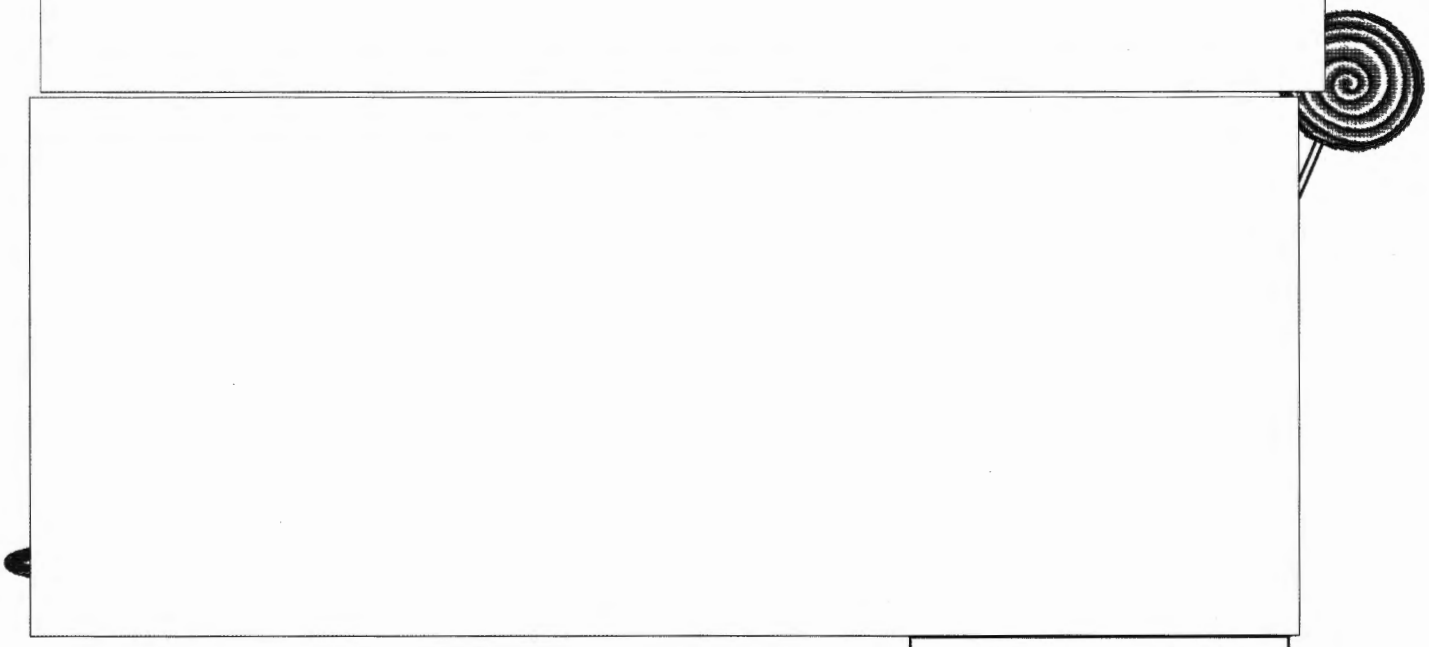
(U) Initializing Sys500

(b)(3)

(b)(3)

-
-

(b)(3)



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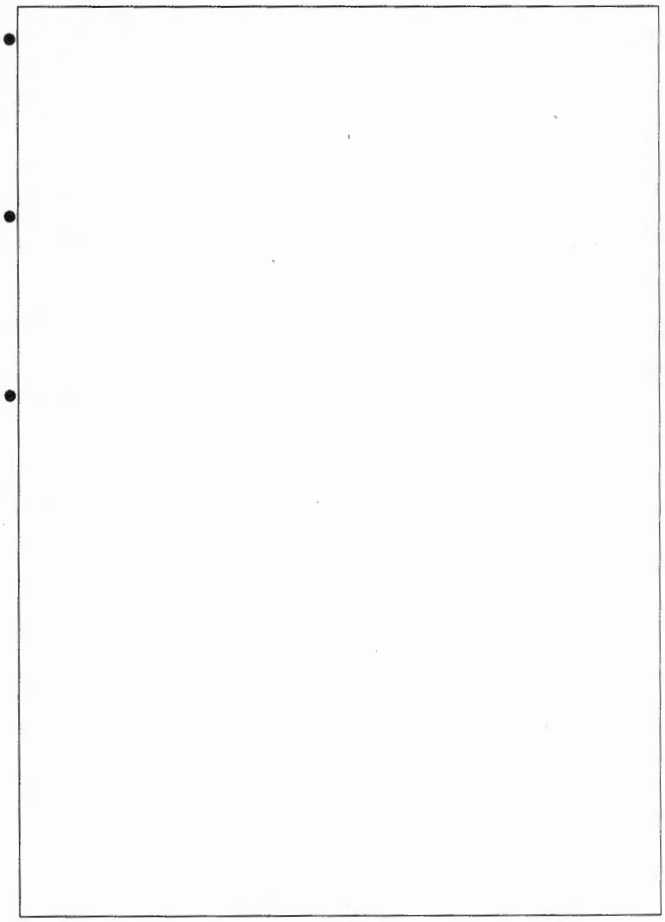
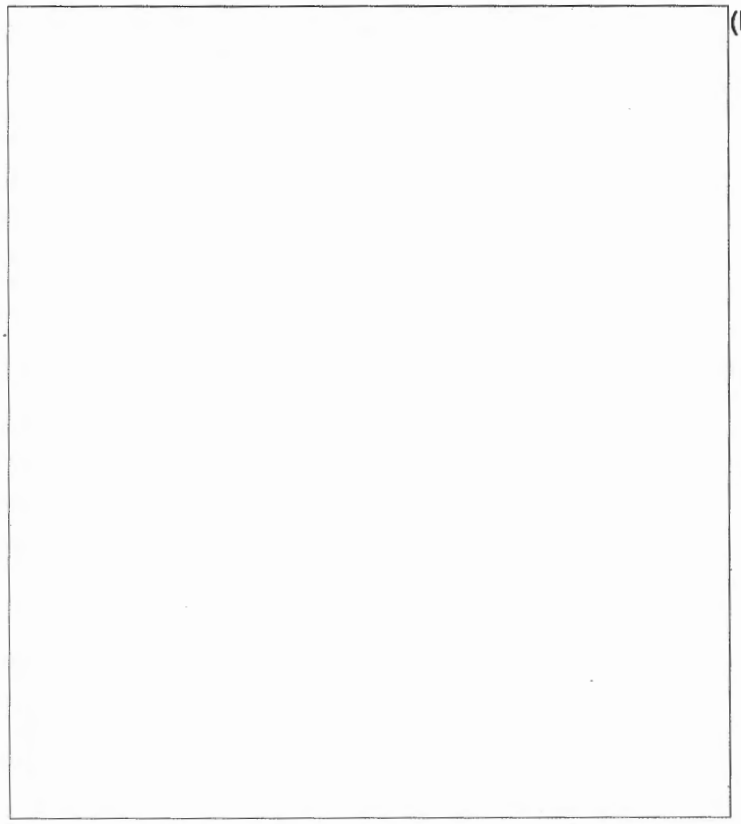
(U) Sys500 Menu

(b)(3)





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Sys500 Control Panel

- (U) Click the *500* icon on the toolbar to load the Sys500 Control Panel.
- (U) The Control Panel allows you to

(b)(3)

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(b)(3)

(b)(3)

(U) Sys500 Control Panel

- (U) The control panel also allows us to manage how data is stored.
- (U) First click the button located on the bottom right of the control panel. This will bring up a new menu.
- (U) In this new menu, click *to* bring up the *System 500* menu.
- (U) Once this new menu is open, you may close the menu by double-clicking the top-left corner of the window.

(b)(3)

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(b)(3)

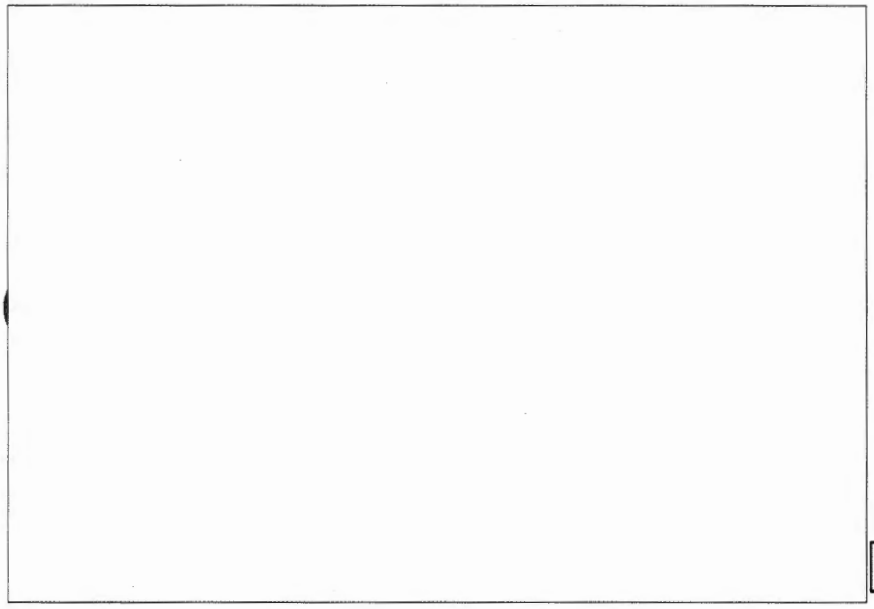
(b)(3)

(U) Sys500 Storage

(b)(3)

- (U) Telemetry should be recorded in the folder on the SCSI Disk, which is held in the (b)(3)
  - (U) The Workstation storage option GeoLITE telemetry generates. (b)(3)
- (U) To select the storage device, click the menu and select Click the icon to manage the stored data. (b)(3)

(b)(3)



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(U) Clearing the Archive

(b)(3)

- (b)(3)
- (b)(3)
-
-

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(U) Sys500 Storage

- (U) To start recording, middle-click the [redacted] folder and drag it to the drop site. (b)(3)
- (U) The [redacted] status light should change from green to orange when it is recording. (b)(3)

[redacted] (b)(3)

[redacted] (b)(3)

This image is unclassified.

(U) Archiving Data

- (U) As was previously stated, [redacted] (b)(3)
  [redacted] At the end of every support, the data on [redacted] analysis by OAs and TAs.
- (U) Before archiving data, you must first stop recording.
  [redacted] (b)(3)
- (U) On the Sys500 ***menu*** HMI, click the [redacted] button. (b)(3)
- (U) [redacted] verify the data was archived using workstatation1 [redacted] (b)(3)

[redacted] (b)(3)

These images are unclassified.

(U) Verifying Archived Data

- (U) double-click on **Internet Explorer** located on the desktop. Use the following login ID and password are required as follows: (b)(3)
  - **Login ID:** **Password:** (b)(3)
- (U) This will bring up the On this page, click on then click under the section. This will bring you to the (b)(3)
- (b)(3)
- (U) If you suspect that the data in the archive file that you have created is corrupt, data again and check it. (b)(3)

(b)(3)

(U) System 500 IRIG Status

(b)(3)

- (U) To see IRIG status, click the button on the Sys500 Control Panel.
- (U) On the pop-up window, click to bring up the IRIG status display.
- (U) In the new pop-up window, verify that the is zero at the end of the support and before switching data rates.
-
- (U) Notify a GeoLITE TA if are experienced during a support.

(U) Epoch Software

- (U) The Epoch [redacted] software is used to command the vehicle and display telemetry. (b)(3)
  - (U) It processes incoming telemetry and displays it in a user-friendly fashion.
  - (U) It formats outgoing commands into [redacted] and sends them to the [redacted] for ternary conversion. (b)(3)
  - (U) It provides an interface to various command procedures that are stored on the workstations.

(U) Initializing Epoch

- (U) Type [redacted] workspace to launch the Epoch software. (b)(3)
- (U) [redacted] (b)(3)
  - [redacted] (b)(3)

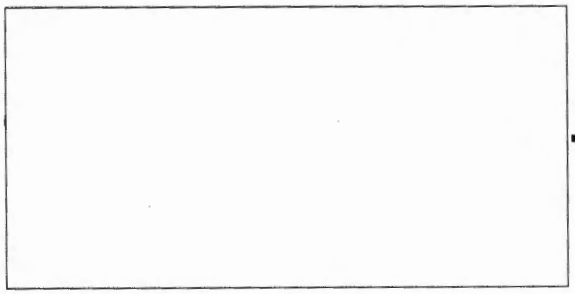
[redacted] (b)(3)

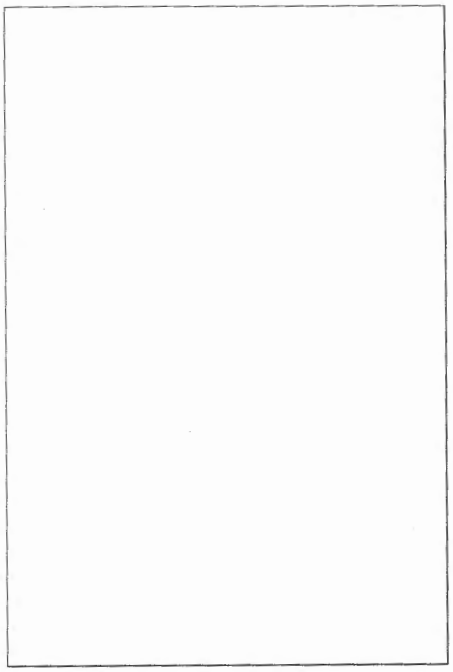
These images are unclassified.

(U) Initializing Epoch

- (U) Press the [ ] button on the [ ] pop-up box. (b)(3
- (U) Select [ ] from the [ ] [ ] window and click *OK*. (b)(3
  - (U) This database contains the telemetry limits.
- (U) Back on the [ ] box, click *OK*. (b)(3)

(b)(3)





These images are unclassified.

(U) Initializing Epoch

- (U) Now select [redacted] from the EUI manager. (b)(3)
- (U) After the database appears in the [redacted] window, wait 20 seconds to allow it to initialize. (b)(3)
- (U) Then highlight the activated stream and press the [redacted] button. The windows will automatically spawn in their proper workspace. (b)(3)

(b)(3)

[redacted]

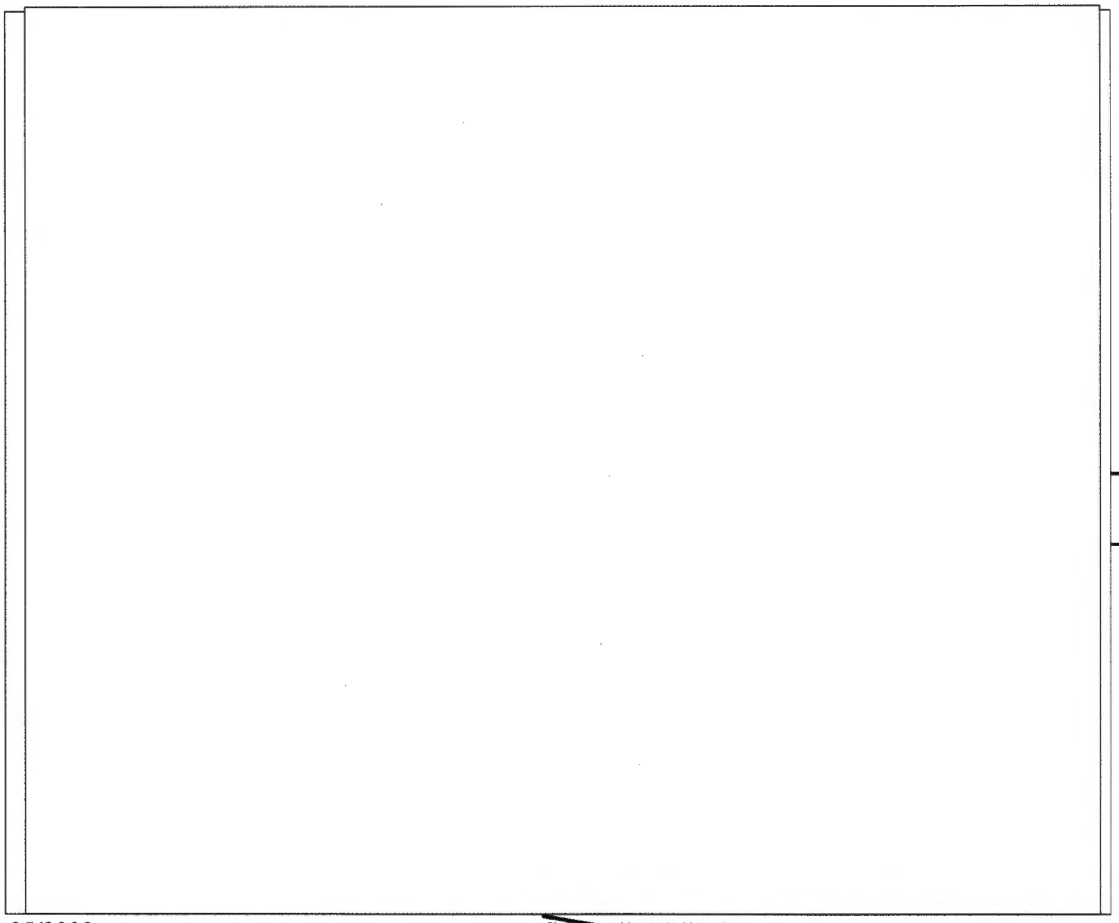
These images are unclassified.

(U) Epoch [redacted] Window

(b)(3)

- (U) This is the [redacted] HMI, which spawns in the "Main Ops" workspace. (b)(3)

(b)(1)
(b)(3)



This image is classified ~~Secret//TK~~.

(U) Epoch [redacted] Window

(b)(3)

- (U) From this display, you are able to open up the other HMI that were spawned automatically.
- (U) This is done by clicking on [redacted]..., and selecting the name of the HMI you want to spawn. You can then place the window in the proper workspace. See [redacted] for a list of the HMIs that are used during normal operations.

(b)(3)

(b)(3)

[redacted]

This image is unclassified.

(U) Epoch [redacted] Window

(b)(3)

- (U) This display gives you access to the various commands and procedures used to operate GeoLITE.
  - (U) Clicking the [redacted] button will display a list of subsystems. Selecting a subsystem will display a list of single commands for that subsystem.
  - (U) Clicking the [redacted] button will also display a list of subsystems and their related [redacted]
  - (U) The [redacted] button displays the pre-pass procedure used when conducting a GeoLITE contact.
- (U) The other HMIs provide SOH telemetry and will be discussed in the upcoming slides.

This image is unclassified.

[redacted]

(b)(3)

(b)(3)

(b)(3)

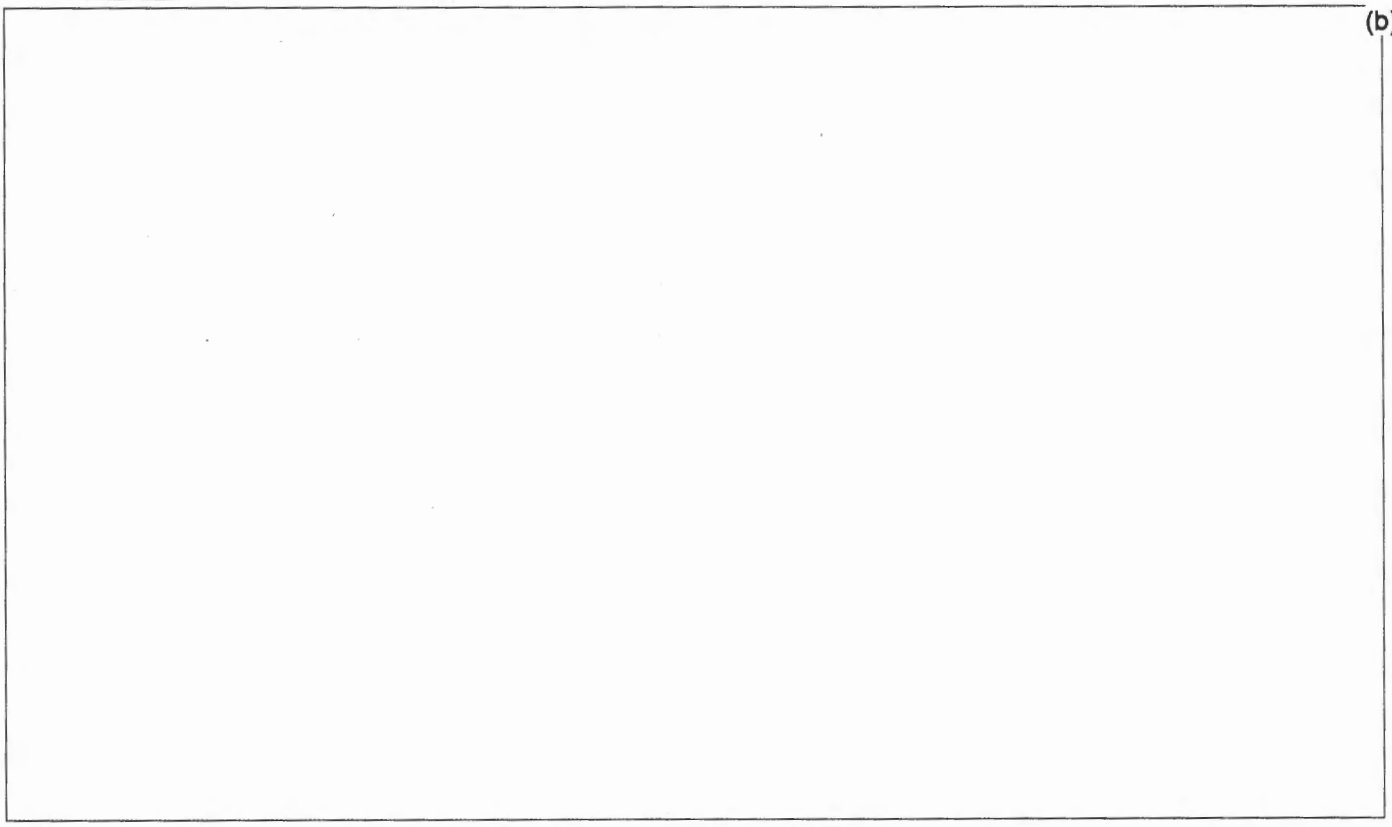
(b)(3)

(b)(3)

(U) Conducting a GeoLITE Contact

- (U) Log into the workstation and initialize the Sys500 and Epoch software per [ ] All supports start the same way in general: (b)(3)

(b)(3)



(U) Pre-pass Brief

(b)(3)

(b)(1)
(b)(3)

(U) Pre-pass Checks

3. (U) After the brief, you should receive a [ ] for each telemetry rate that was briefed. (b)(3)
   - [ ] (b)(3)
4. (U) After the [ ] perform a Command Test. (b)(3)
   - [ ] (b)(3)
5. (S//TK) Once the Command Test is verified, [ ] (b)(1) (b)(3)

[ ]

This image is unclassified. (b)(3)

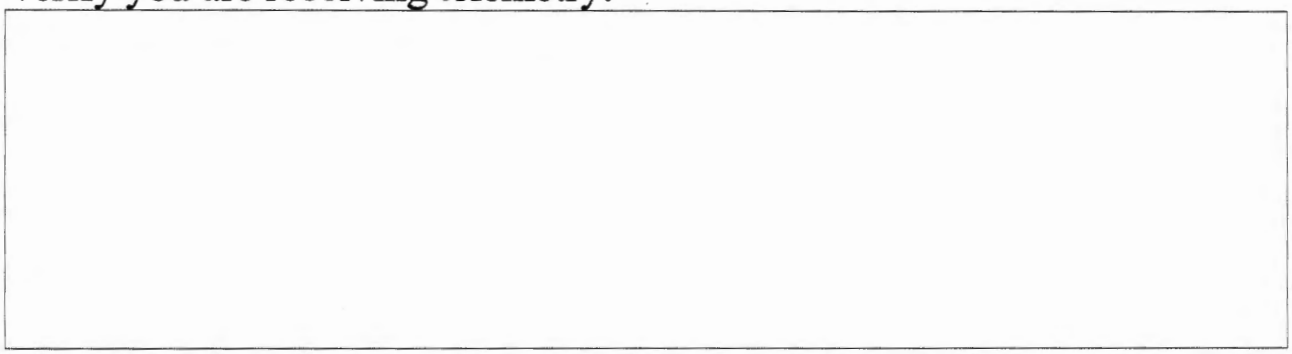
[ ] (b)(1) (b)(3)

The above image is classified (S//TK).

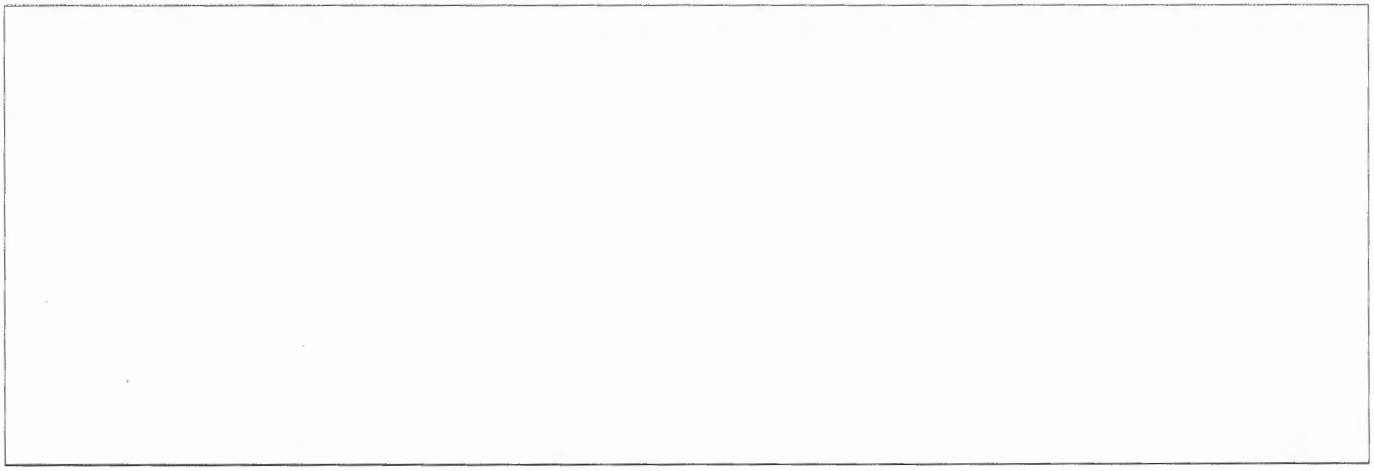
(U) Active Time

5. (U) When the RTS goes active, GeoLITE will start sending telemetry. Verify you are receiving telemetry:

(b)(3)

- 

(b)(3)



This image is unclassified.

(U) Disarm SCS-12 [redacted]

(b)(3)

8. (U) After going active, SCS-12 will activate. It will usually be on step 13 before we send the command to terminate it.

- (U) Once you have valid command path, click the [redacted] button, and click continue in the pop-up window. (b)(3)
- (U) Once the command executes, the mnemonics for Step 8 should read [redacted] (b)(3)

[redacted] (b)(3)

This image is unclassified.

(U) SW Mode and

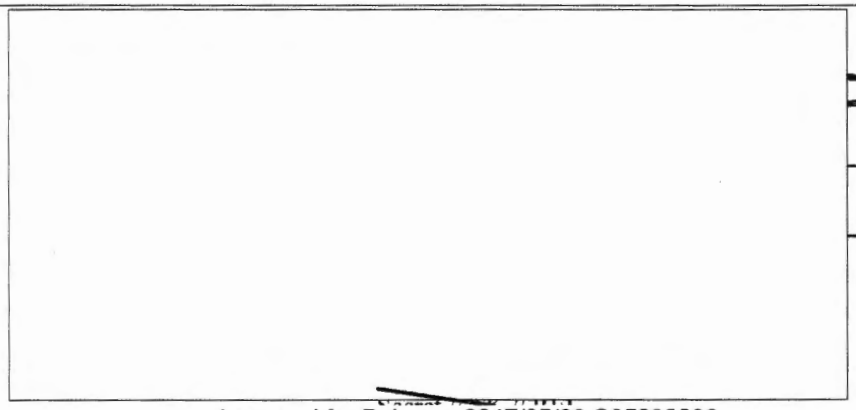
(b)(3)

9. (U) The nominal software mode is (b)(3)

10.- 11. (S//TK) Once the software mode is verified, (b)(1) (b)(3)

(b)(3)

(b)(3)

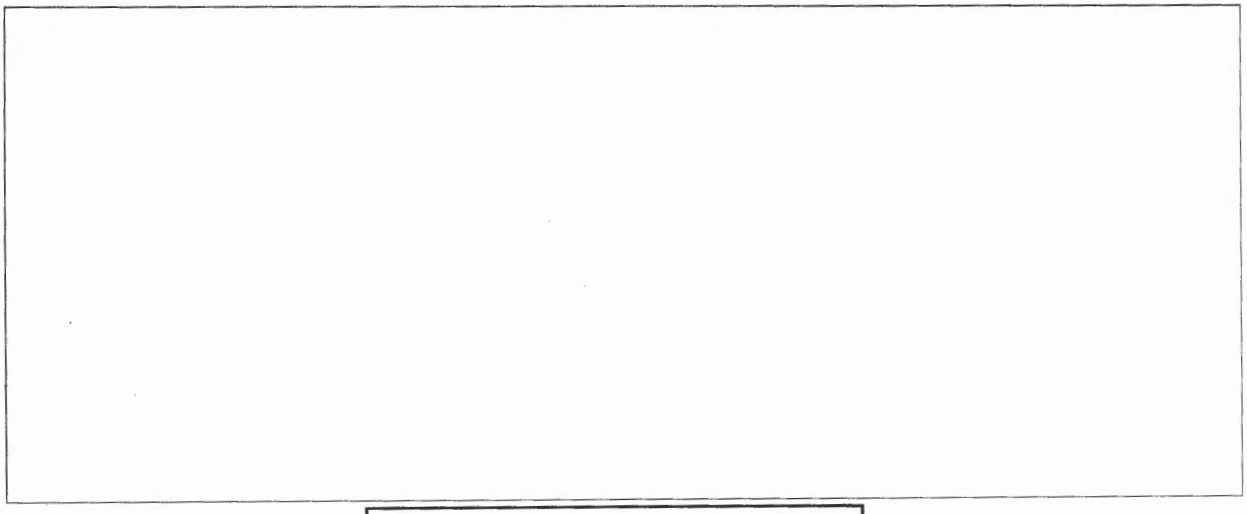


(U) Verify

(b)(3)

12.- 13. (U) Verify the telemetry points (b)(3)

(b)(3)



This image is unclassified.

(b)(3)

- (U) After verifying the conduct State of Health per before performing any other activities.

(U) [redacted] SOH

(b)(3)

- (U) The purpose of [redacted] SOH is to verify the vehicle's state of health and collect range data while configured for [redacted] telemetry. (b)(3)
- (U) This includes:

[redacted] (b)(3)

- (U) For GeoLITE, [redacted] SOH supports are [redacted] (b)(3)

[redacted] (b)(3)

- (U) [redacted] SOH should be performed before and after all other activities

[redacted] (b)(3)

(U) Ranging

(b)(3)

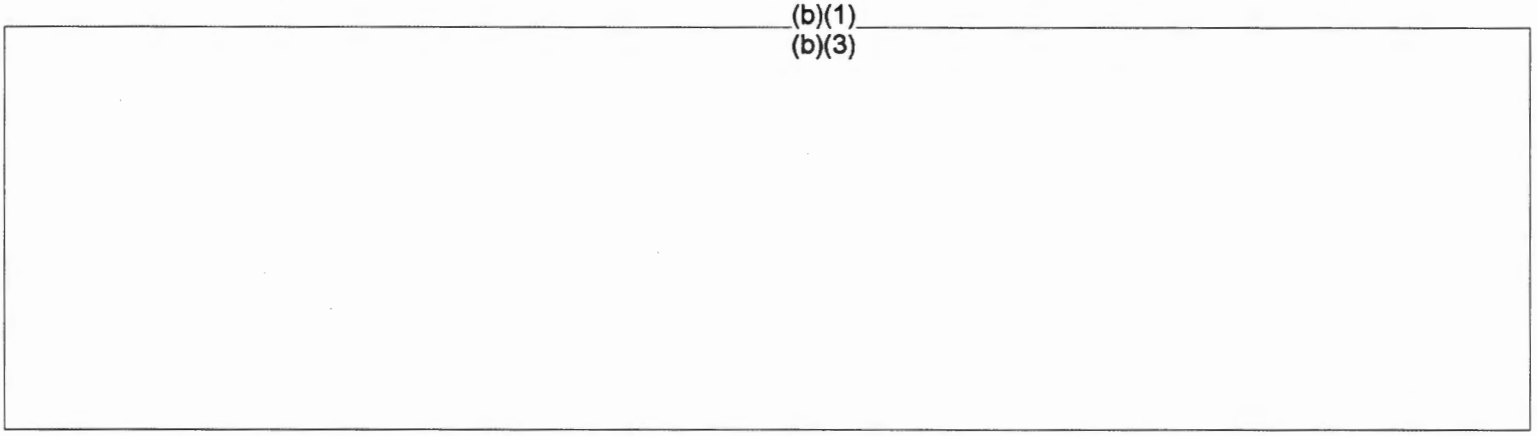
- ~~(S//TK)~~ All range data is captured at and sent to the Orbit Analysts at the (b)(1) (b)(3)
- (U) The Range code signal is transmitted in the (b)(3)
  - (U) This means when GeoLITE is
- (U) The expected range is located on the Contact Summary Sheet. (b)(3)
- (U) No status for ranging can be seen with the (b)(3)
- ~~(S//TK)~~ You must verify with (b)(1) (b)(3)

(U) Performing a SOH Check

(b)(3)

- (U) Click the in the upper-right window to open the SpaceCraft Status page and click on the button.
- (U) This will bring up a page with all of the vehicle subsystems.
- (U) Clicking on a button will bring up a list of measurands and their values for that subsystem.
- (U) Check for warning (yellow) or critical (red) alarms for each subsystem. Refer to for instructions on how to respond to alarms.

(b)(1)
(b)(3)



This image is unclassified.

This image is classified Secret//TK//REL

This image is unclassified.

(U) Performing a SOH Check

- (U) The [redacted] HMI is in the SOH workspace. Verify the following: (b)(3)

[redacted] (b)(3)

[redacted] (b)(3)

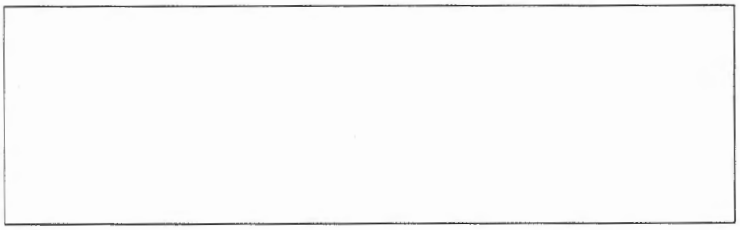
(U) Performing a SOH Check

(b)(3)

- (S//TK//REL) On the (b)(1) (b)(3)
  - (S//TK//REL) The should be greater than The nominal value for this measurand is dependant on which
  - (U) Be sure to record this value on the (b)(3)

(b)(3)

- (S//TK//REL) On the (b)(1) (b)(3)
  - (S//TK//REL) The should be greater than and the Power for each should be greater than
  - (S//TK//REL) What about ?

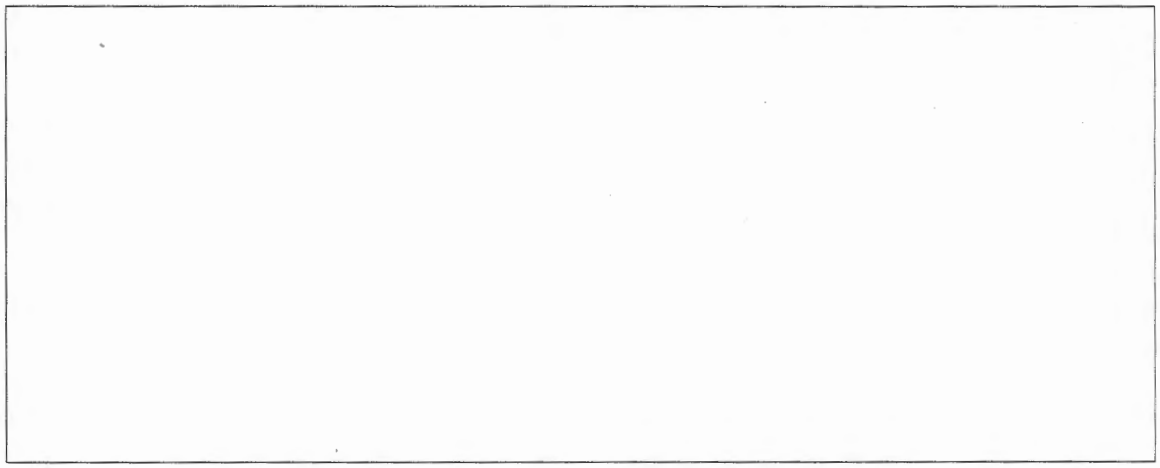


These images are classified Secret // TK // REL.

(U) Performing a SOH Check

(b)(3)

- (S//TK//REL) On the monitor the plot according to (b)(1) (b)(3) (b)(3)
  - (S//TK//REL) Any spikes above for the power or above for the the may indicate a possible failure. (b)(1) (b)(3)
  - (U) Notify the of all suspicious plots. (b)(3)



(b)(1) (b)(3)

This image is classified Secret // TK // REL

(U) Performing a SOH Check

(b)(3)

- (U) On the [redacted], verify there are no alarms present. (b)(3)
- (U) On the [redacted] verify the speed of each Reaction Wheel is within tolerance. (b)(3)
  - (U) Report the values if they are in excess of [redacted] (b)(3)

(b)(3)

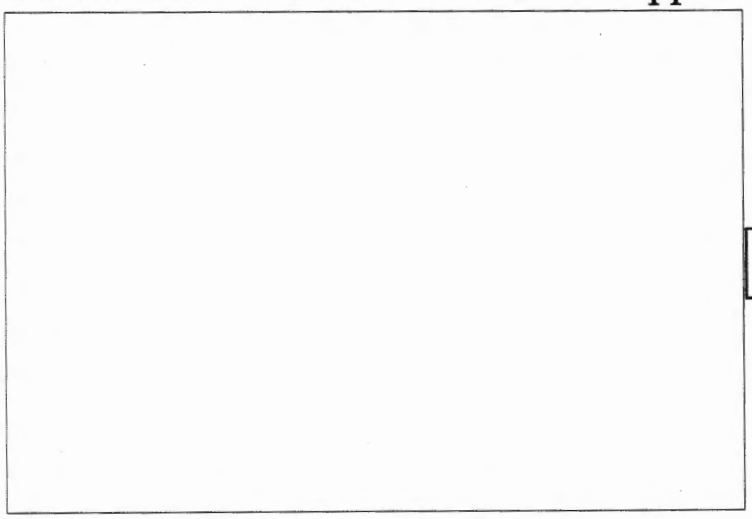
This image is unclassified.

(U) Ending a GeoLITE Contact [redacted] (b)(3)

- (U) After verifying the SOH, check for [redacted] on the Sys500 workspace. (b)(3)
- (U) Back on the [redacted] (b)(3)

  [redacted] (b)(3)
- (U) Record the VCC, command accepts, and rejects onto the [redacted] (b)(3)
- ~~(S//TK)~~ Have [redacted] rate the support, and brief them on the next GeoLITE support. (b)(1) (b)(3)

(b)(3)



(U) Archive the Data

(b)(3)

- (U) Click [ ] in the System 500 Storage HMI to stop recording. (b)(3)
- (U) On the Sys500 ***menu*** HMI, click the [ ] button. (b)(3)
- (U) After pushing, verify the data was archived using [ ] (b)(3)
  - (U) Open up *Internet Explorer* and login using the [ ] geolite U/N and password. (b)(3)
  - (U) On the [ ] click on [ ] then click on [ ] This will bring you to the [ ] (b)(3)
  - (U) A list of telemetry archive files exists under the Data Set Specification section of this form.
  - (U) Look for the appropriate date/time group of your file to verify that it has been created.
  - (U) If you suspect that the data in the archive file that you have created is corrupt, [ ] data again. If it still looks bad, notify the [ ] GeoLITE TA.

(b)(3)

(U) Closing the Software [redacted]

(b)(3)

- (U) Once you verify the data [redacted] you may shutdown the software. (b)(3)
- (U) Type [redacted] to shut down the Sys 500 software. (b)(3)
- (U) Type [redacted] window to shut down Epoch software. (b)(3)
- (U) Log off the workstation and file the [redacted] in the Contact Summary Sheet binder. The latest sheets should go on top. (b)(3)

(U) Special Activities

(U) GeoLITE Support Scheduling

(b)(3)

(U) Ephemeris Uploads

(U) Momentum Unloads

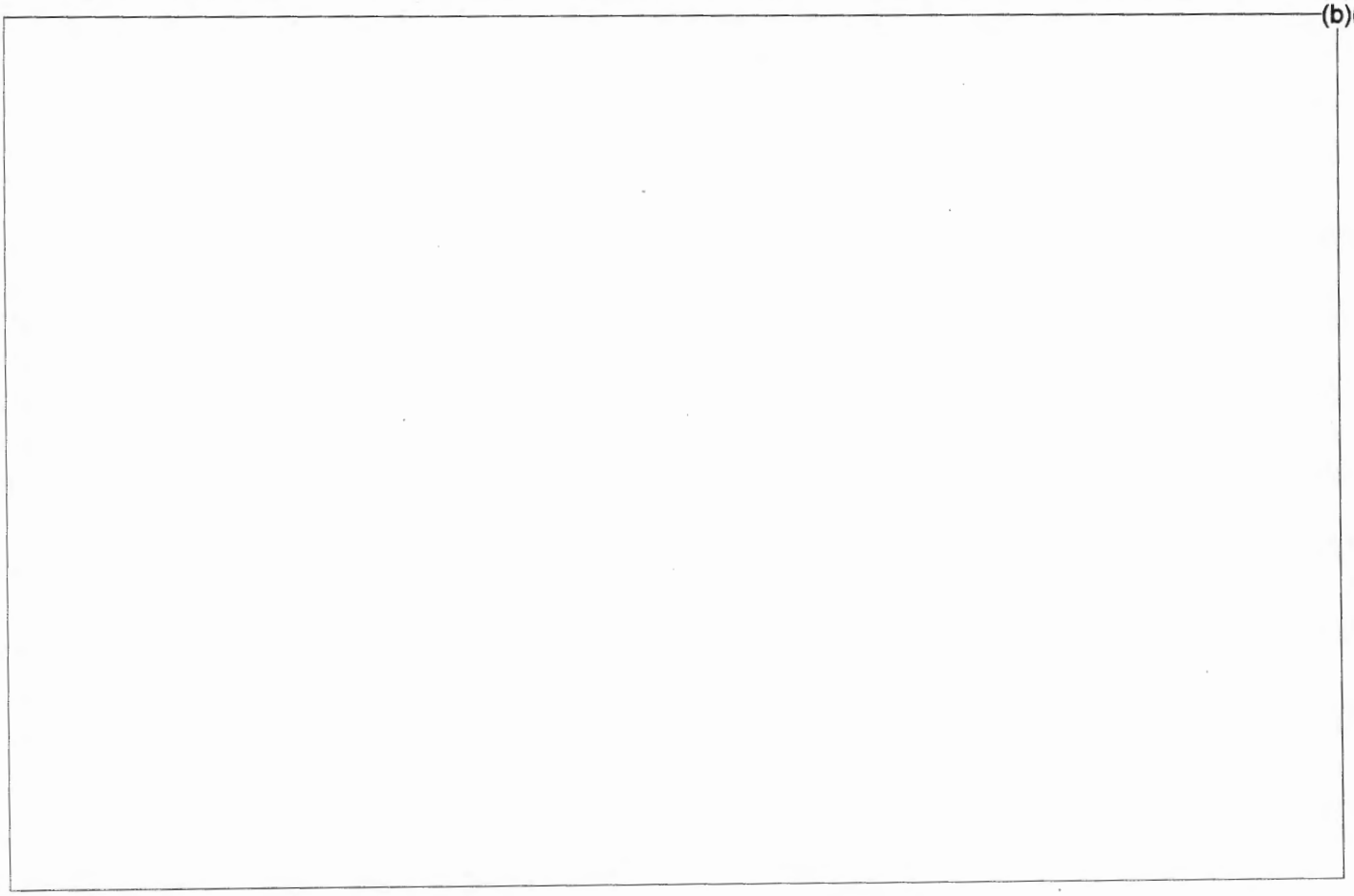
(U) GeoLITE Support Scheduling

- (U) General Supports
  - (U) GeoLITE supports are nominally scheduled [redacted] (b)(3)
  - (U) The support is either a [redacted] or it is [redacted] and the duration will vary depending on the activity.
- [redacted] (b)(3)
- (U) Ephemeris Upload
  - (U [redacted] (b)(3)
- (U) Momentum Unloads
  - [redacted] (b)(3)

(U)

(b)(3)

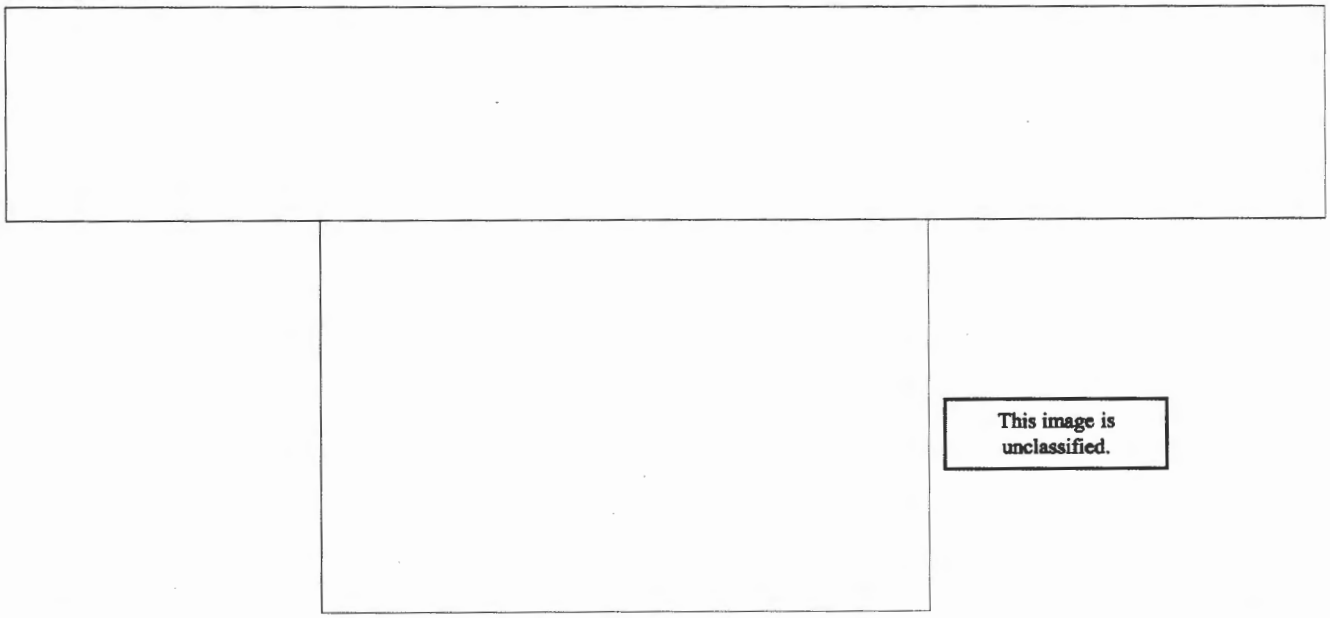
(b)(1)
(b)(3)



(U)

(b)(3)

- (U) During the prepass brief, brief (b)(3)
- (U) During the prepass checks, verify (b)(3)
- (U) Go active and perform SOH. (b)(3)
- (U) On the HMI, bring up the page in the bottom-right window. (b)(3)



(b)(3)

This image is unclassified.

- (U) On the [ ] HMI, click [ ] and select either

(b)(3)

(b)(3)

This image is unclassified.

(U) [redacted]

(b)(3)

1. (U) Verify [redacted] is on. (b)(3)

[redacted] (b)(3)

2. (U) Verify [redacted] are properly configured. (b)(3)
   - (U) If they are not, stand down and notify the GeoLITE TAs or Vehicle manager.

(b)(3)

[redacted]

These images are unclassified.

(U) [redacted]

(b)(3)

3. (U) Stop recording telemetry on the [redacted] (b)(3)

[redacted] (b)(3)

4. (U) Stop sending data from the [redacted] (b)(3)

(b)(3)

[redacted]

This image is unclassified.

(U) [redacted] (b)(3)

5. (U) [redacted] (b)(3)

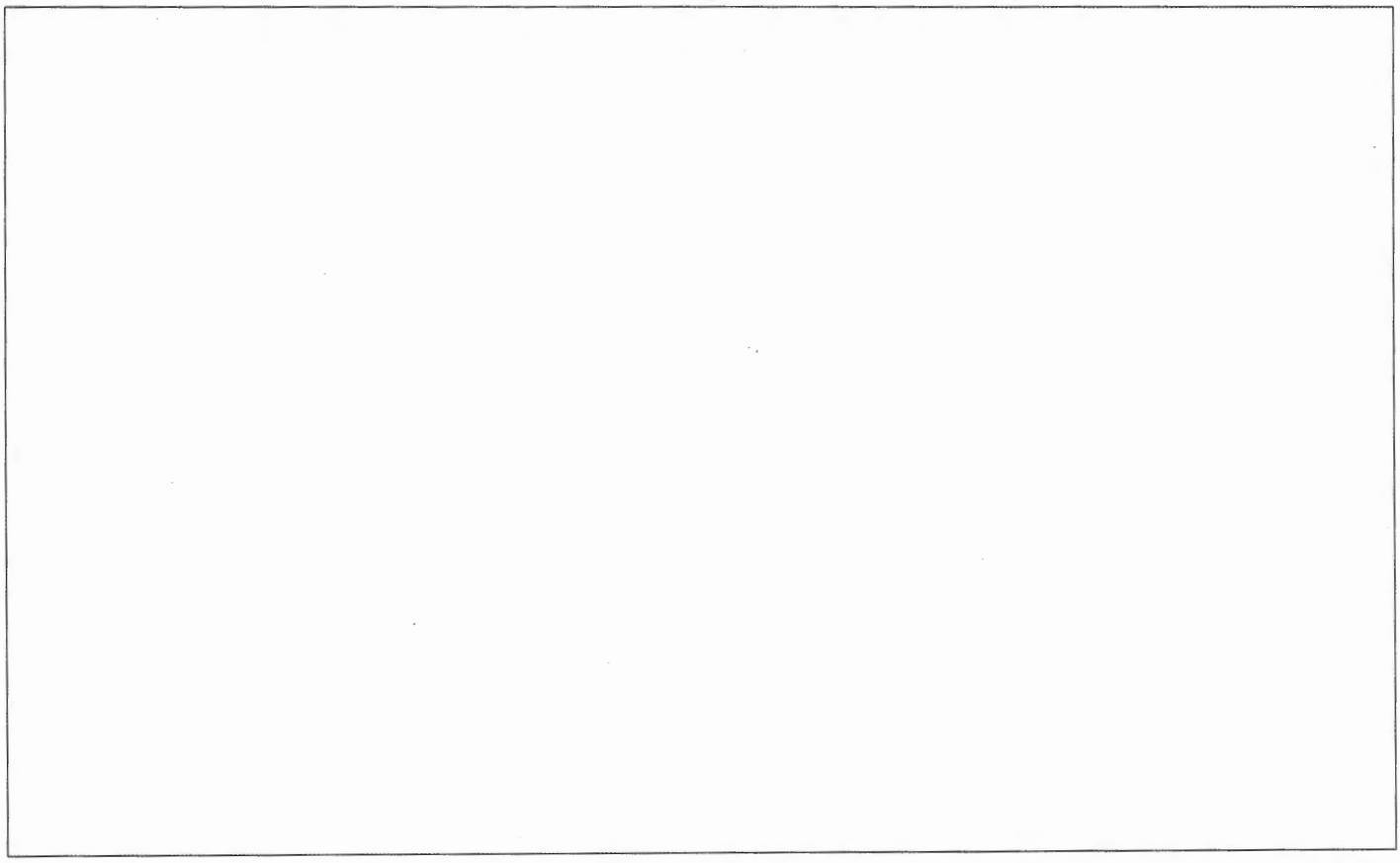
[redacted] (b)(3)

6. (U) Turn off the [redacted] (b)(3)

[redacted] (b)(3)

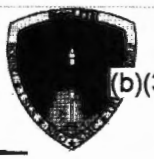
This image is unclassified.

(U)



(b)(3)

This image is unclassified.



(b)(3)

8. (U) Command [redacted] to transmit data [redacted] (b)(3)

– (U) Click on the [redacted] button to command the vehicle to [redacted]

(b)(3)

[redacted]

This image is unclassified.

(U) [redacted] (b)(3)

8. ~~(S//TK)~~ Once you have lost telemetry, notify [redacted] (b)(1) (b)(3)

[redacted]

- (U) Disarm the recorder and push the [redacted] to the [redacted] Verify on the [redacted] (b)(3)
- (U) [redacted] using the **System 500 menu** HMI. Verify the current database reads [redacted] (b)(3)
  - (U) Click "OK" on any pop-windows that appear during the configuration.

[redacted] (b)(3)

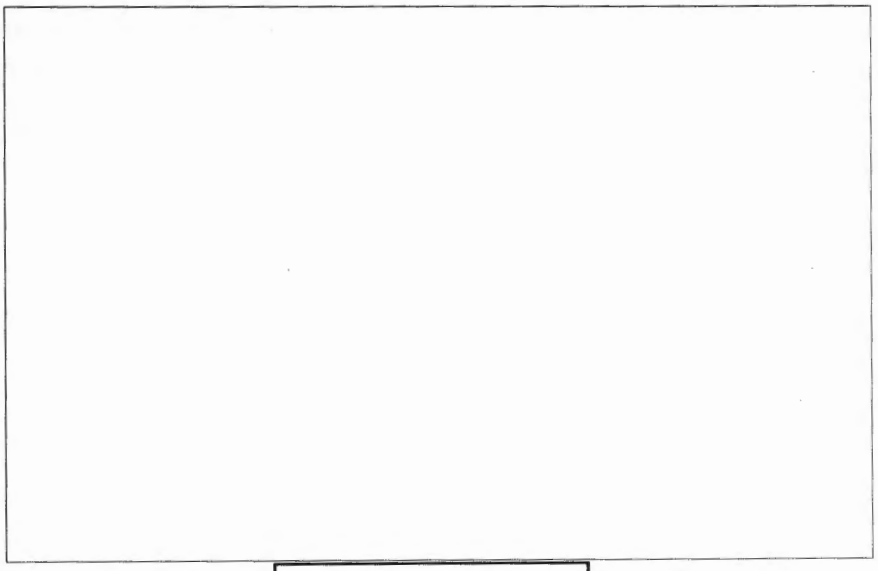
- (U) Clear the remainder and start recording. Verify the [redacted] (b)(3)

[redacted]

- (U) Back on the [redacted] in Step 8 shows [redacted] (b)(3)

9. (U) Before starting the [ ] verify Sys500 is [ ] (b)(3)
   data rate.
   - (U) Click on the [ ] button, [ ] (b)(3)
     [ ]
   - (U) [ ] which is done when the (b)(3)
     vehicle enters Safe Haven for unknown reasons.

(b)(3)



This image is unclassified.

9. (U) Do not continue until the [redacted] (b)(3)
   - (U) The [redacted] Verify [redacted] (b)(3) (b)(3)
   - (U) It takes about [redacted] of data, and [redacted] of data. (b)(3)
   - (U) Once the [redacted] is complete, navigate to the Sys500 workspace, disarm the [redacted]

[redacted] (b)(3)

This image is unclassified.

(U) [redacted] (b)(3)

(b)(3)

9. (U) Verify the [redacted] was archived by using the [redacted]

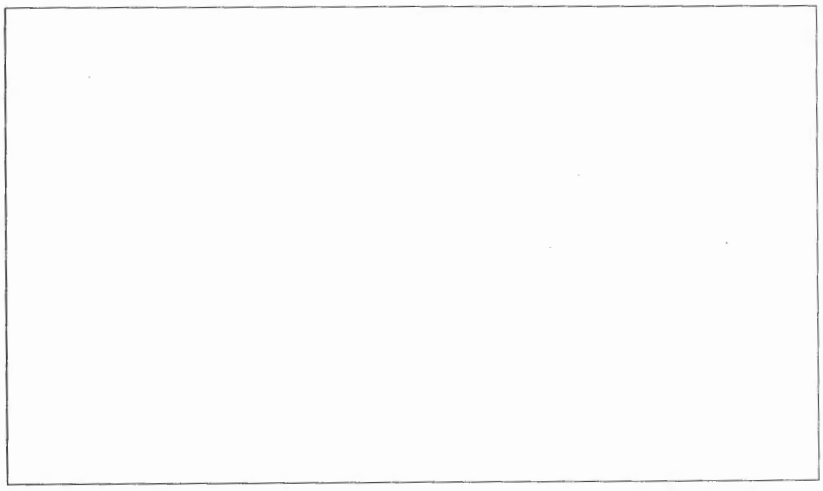
– (U) Open Internet Explorer, click on [redacted] then click [redacted] (b)(3)
[redacted] Refresh the page if the new file is not properly displayed.

[redacted] (b)(3)

This image is unclassified.

10. (U) Go back to the workspace and command the vehicle to transmit

(b)(3)
(b)(3)
(b)(3)
(b)(1)
(b)(3)
(b)(3)



This image is unclassified.

10. (U) [redacted] using the **System 500 menu** HMI. Verify the current database reads [redacted] (b)(3)

- (U) Click "OK" on any pop-windows that appear [redacted] (b)(3)
- (U) All commanding that is performed at [redacted] can be performed at this data rate. (b)(3)

- (U) Clear the remainder and start recording. Verify the [redacted] (b)(3)

- (U) Back on the [redacted] workspace, verify the telemetry mode in Step 10 shows [redacted] (b)(3)

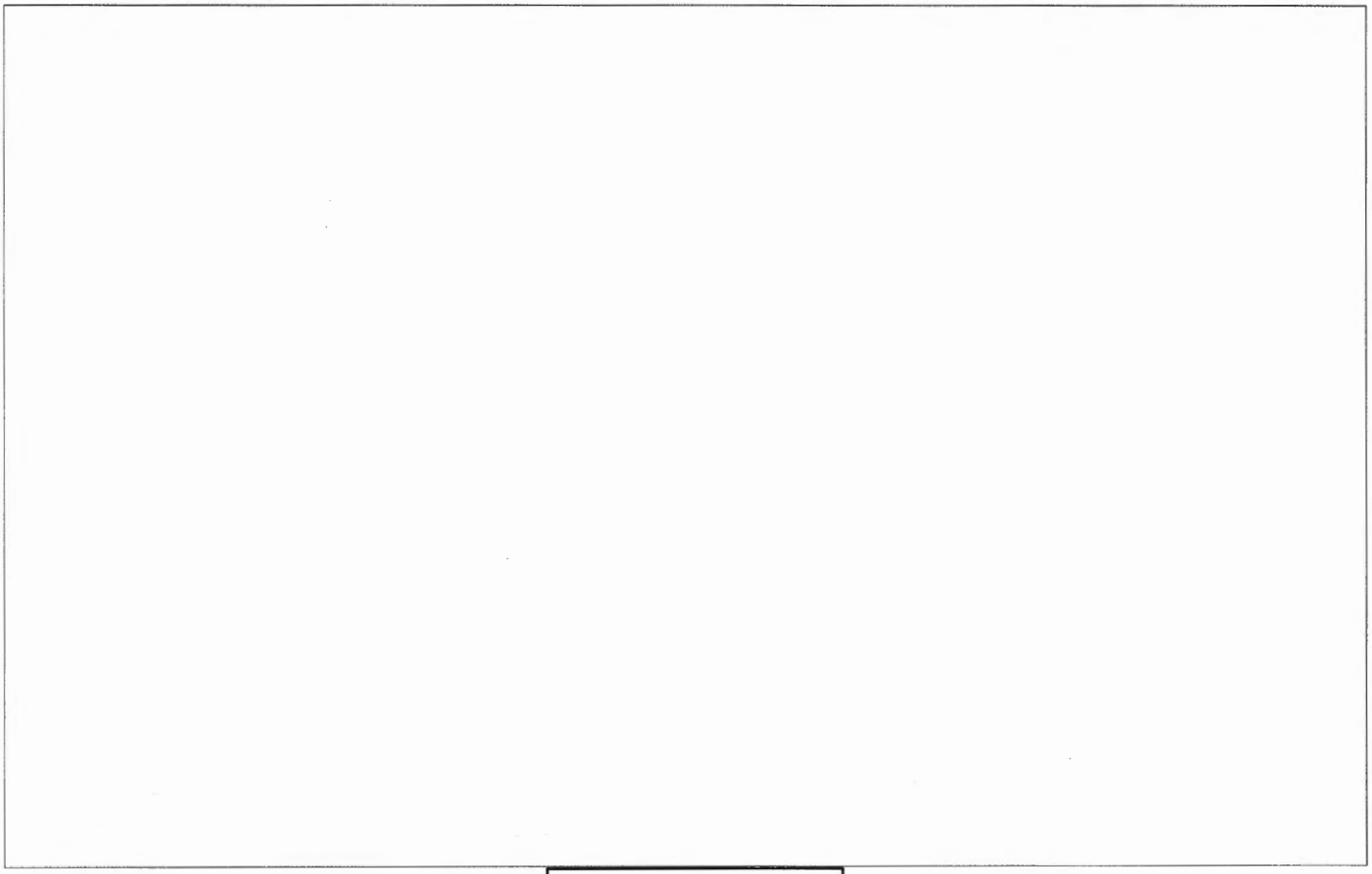
(b)(3)

[redacted]

This image is unclassified.

(U)

(b)(3)



(b)(3)

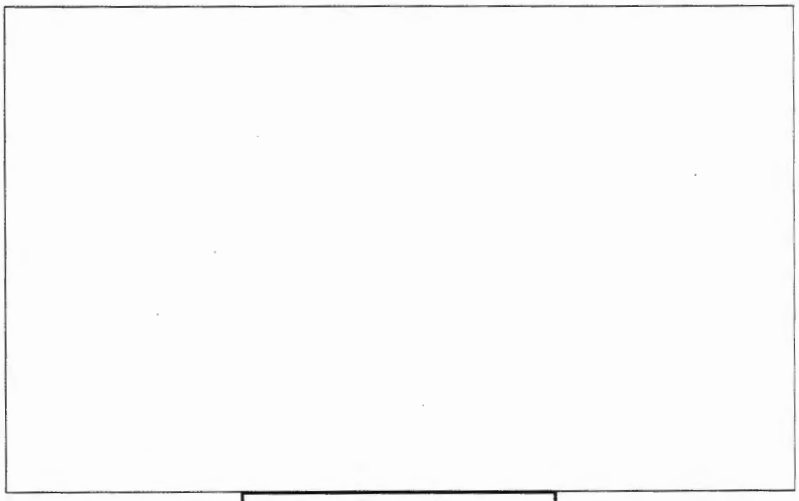
These images are unclassified.

14. (U) Command the (b)(3)

(b)(3)

15. (U) Enable data transactions between the and the newly powered on (b)(3)

(b)(3)
(b)(3)



This image is unclassified.

(U)

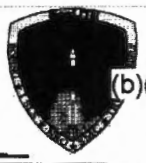
(b)(3)

(b)(3)

(b)(3)

These images are unclassified.

(U)



(b)(3)

(b)(3)

These images are unclassified.

(U) Ephemeris Upload

(b)(3)

- (U) Purpose: To update the vehicle's (b)(3)
- (b)(1) (b)(3)
- (U) GeoLITE can adjust its (b)(3)
- (b)(3)
- (U) Ephemeris Uploads (a.k.a. Ephemeris Inits) are performed (b)(3)
- (U) It is advised that the CC verify the date, epoch time, and checksum of the hardcopy Ephemeris sheet matches the values in the software before conducting the support.

(U) Ephemeris Upload

(b)(3)

- (U) What's a Low Speed dump?
  - (U) A low speed dump is when the vehicle telemeters the values located at certain memory addresses while using [ ] data rate. (b)(3)
  - (U) The values in an Ephemeris Load consist [ ] but the low speed dump allows the transmission [ ] (b)(3)
  - (U) [ ] (b)(3)
    [ ] The CC loads the desired start and stop memory addresses and then enables the dump.

(b)(3)

[ ]

This image is unclassified.

(U) Ephemeris Upload

(b)(3)

- (U) Perform a nominal SOH after going active. (b)(3)
- (U) To bring up the Ephemeris Upload procedure, in the HMI, click (b)(3)

1. (U) Check the difference between the satellite clock to the ground clock.
   - (U) Enter the ground station name for the test (b)(1) (b)(3)

(b)(3)

(b)(3)

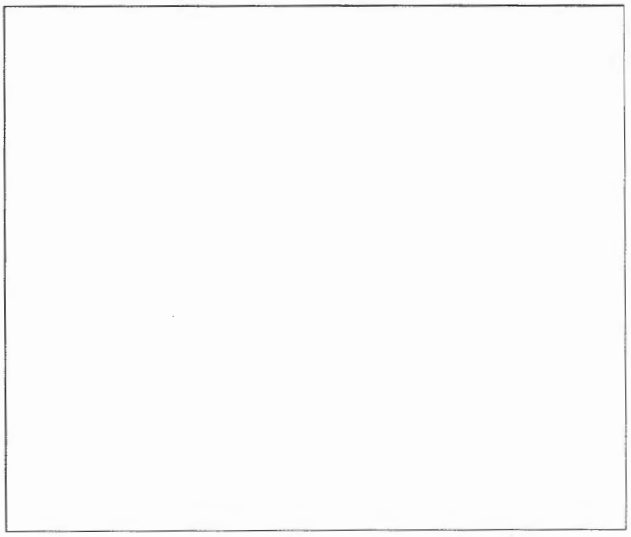
This image is unclassified.

(U) Ephemeris Upload

(b)(3)

2. (U) Disable the low speed dump in case it was left enabled on the last support.
3. (U) Load the start and stop address for the [redacted] low speed dump, verify them in telemetry, and enable the dump. (b)(3)
   - (U) The values for the given range of addresses will show up in telemetry later in the procedure.
   - (U) The values that currently show up are from the current ephemeris on the vehicle.

(b)(3)



This image is unclassified.

(U) Ephemeris Upload

(b)(3)

4. (U) Uplink the new ephemeris file to the satellite.
   - (U) Click the [ ] button and verify the date and time on the button in the pop-up matches the epoch time on the hardcopy ephemeris sheet. (b)(3)
   - (U) Click the button and verify the date, time, and checksum number also match the hardcopy.
   - (U) Click [ ] to load the ephemeris to the vehicle. (b)(3)
   - [ ] (b)(3)

(b)(3)

(U) Ephemeris Upload

(b)(3)

- (U) What's a checksum?
  - (U) A checksum is a code used to verify that no data in the ephemeris file is corrupted during transmission to the satellite. If it is, the file will be rejected and the controller would have to send the file again.
  - (U) When we verify the checksum on the software against the hardcopy we're verifying that we have the correct ephemeris file from the OA's.
  - [redacted] (b)(3)

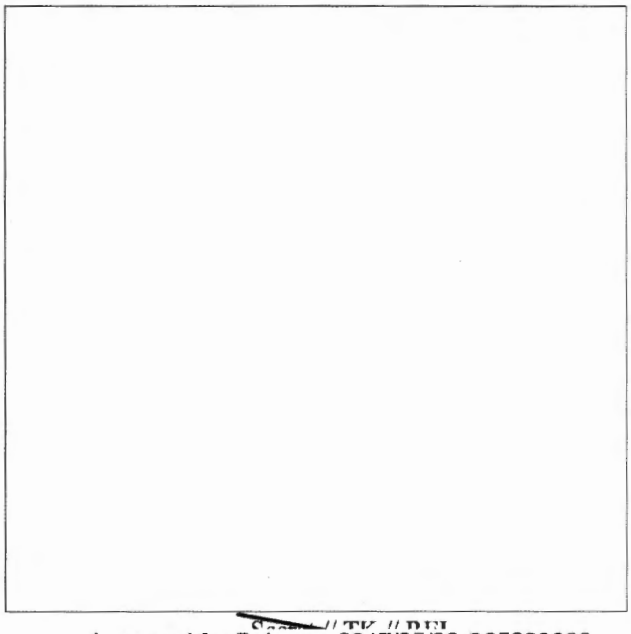
[redacted] (b)(3)

(U) Ephemeris Upload

(b)(3)

(b)(3)

(b)(3)



This image is unclassified.

(U) Ephemeris Upload

(b)(3)

(b)(3)

(U) Ephemeris Upload

(b)(3)

- (U) After the Ephemeris is uploaded and verified, perform a final SOH check before ending the support.
- (U) File the Ephemeris sheet in the back of the GeoLITE (b)(3)

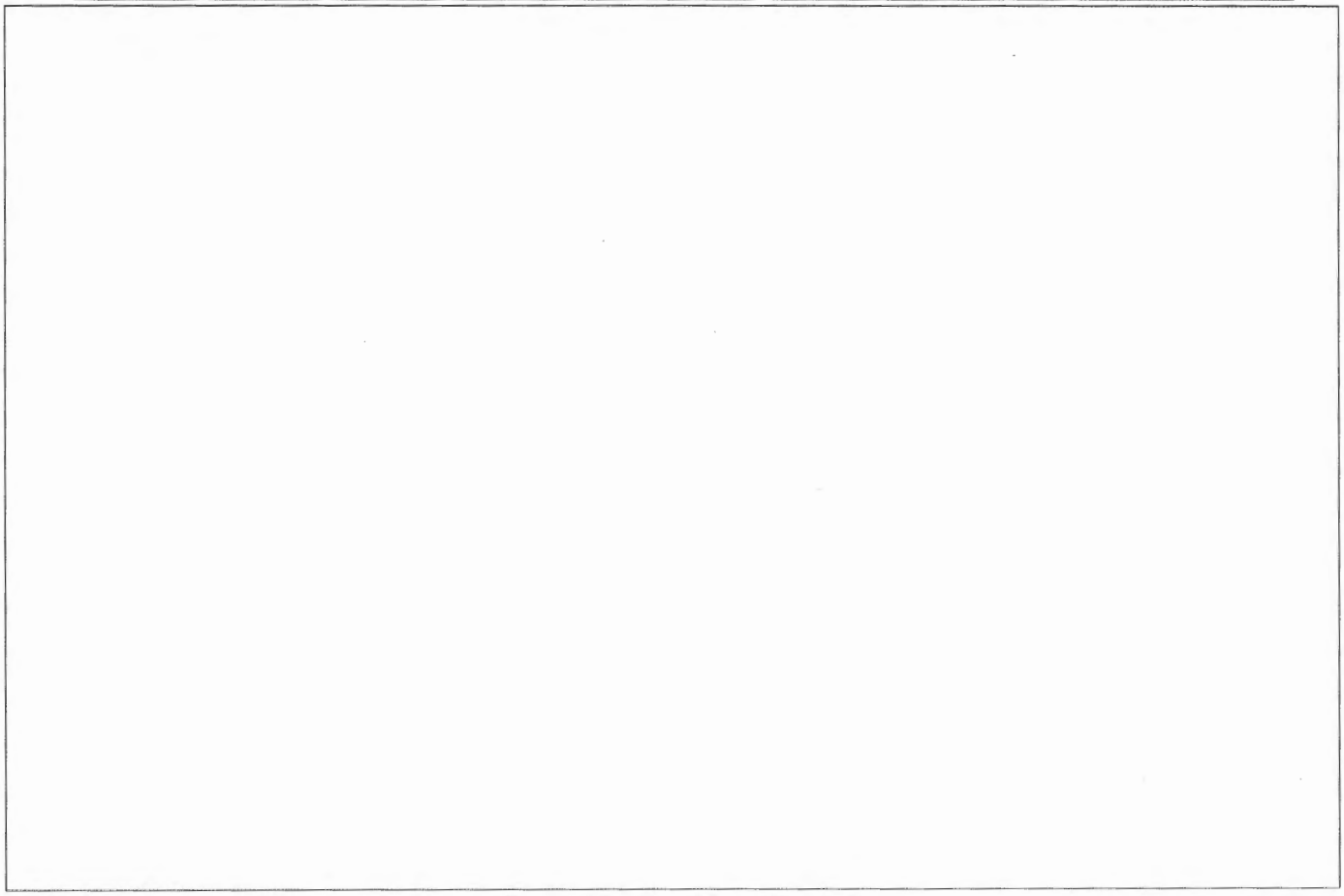
(U) TROUBLESHOOTING

(b)(3)

(U) Momentum Unload [redacted] (b)(3)

- (U) Momentum is present on each axis of the vehicle and has a daily cycle that is determined by various environmental torques. This cycle follows a [redacted] pattern. (b)(3)
- [redacted] (b)(3)
- (U) Momentum unloads are performed [redacted] (b)(3)

(U) Spacecraft Momentum: Daily Cycle

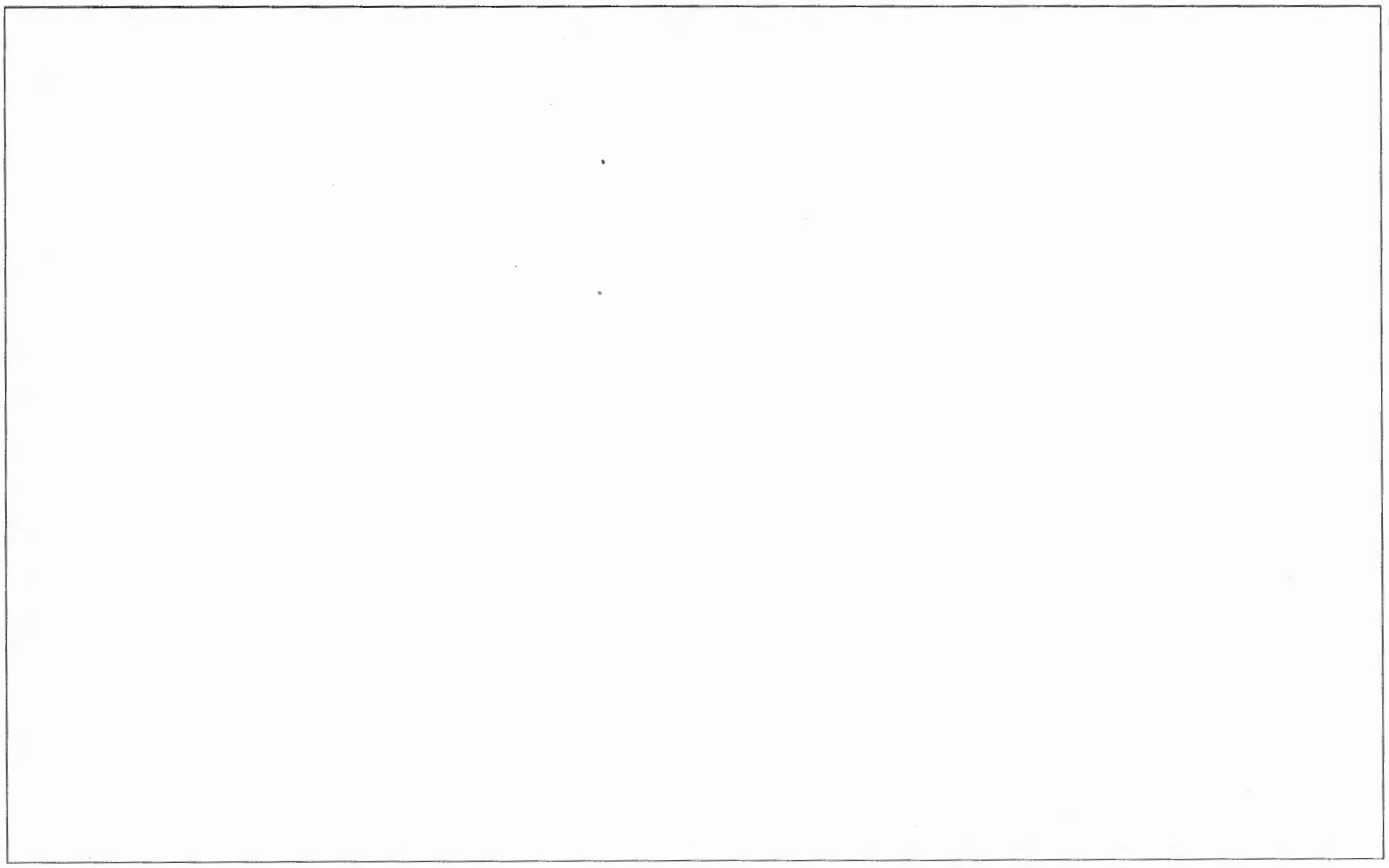


(b)(3)

This image is unclassified.

(U) Spacecraft Momentum Unload

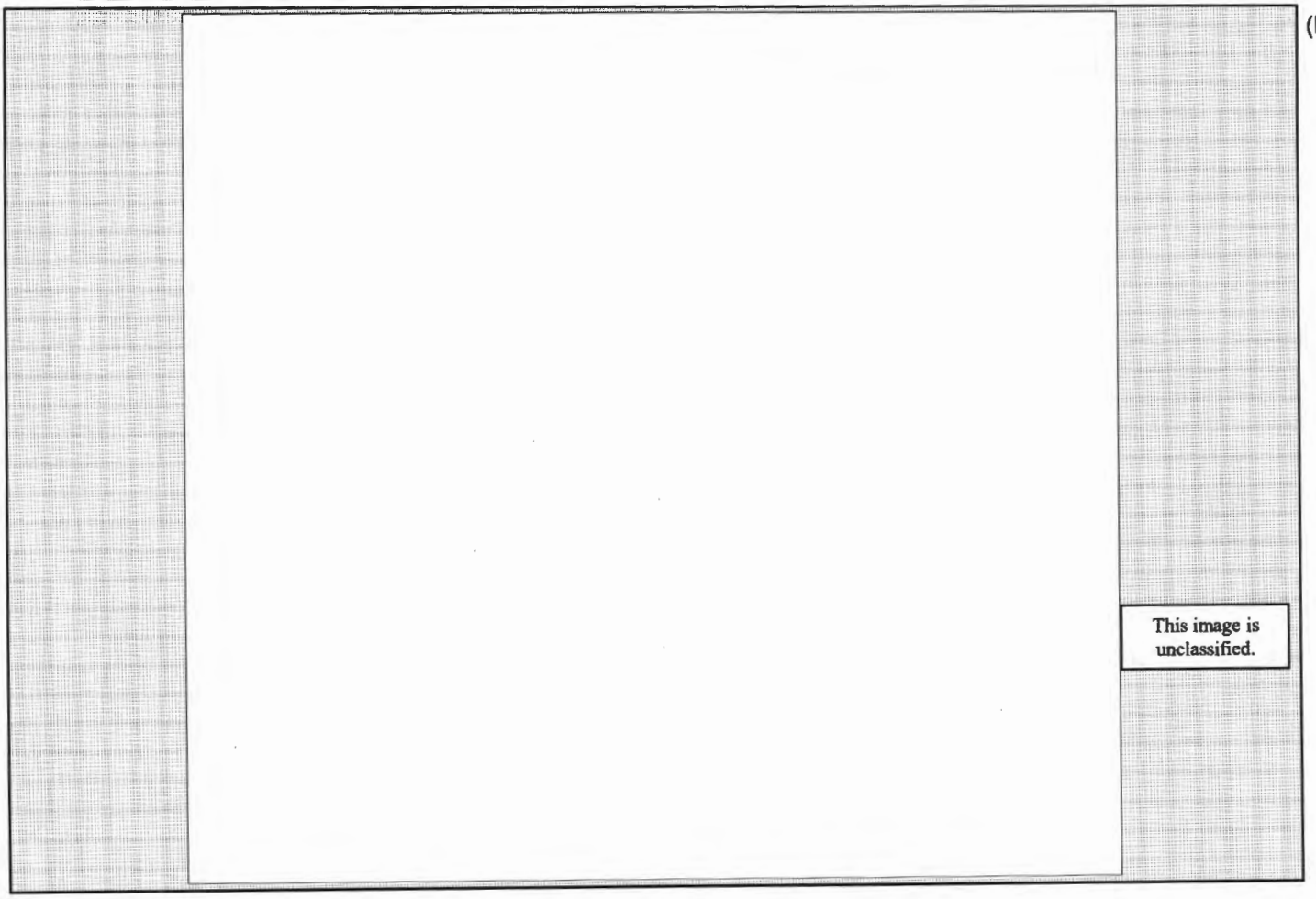
(b)(3)



This image is unclassified.

(U) Command Parameters Sheet

(b)(3)



(U) Momentum Unload

(b)(3)

1. (U) Before the support, verify that the OA's have provided the "GeoLITE Momentum Unloading Command Parameters Sheet." Verify the date and times [redacted] occur during the support. (b)(3)
2. (U) [redacted] before you start the support. If not, stand-down and notify the [redacted] and GeoLITE TAs. (b)(3) (b)(3)
3. (U) [redacted] should already be powered on. If they are, skip this step. If not, power them on. (b)(3)

(b)(3)

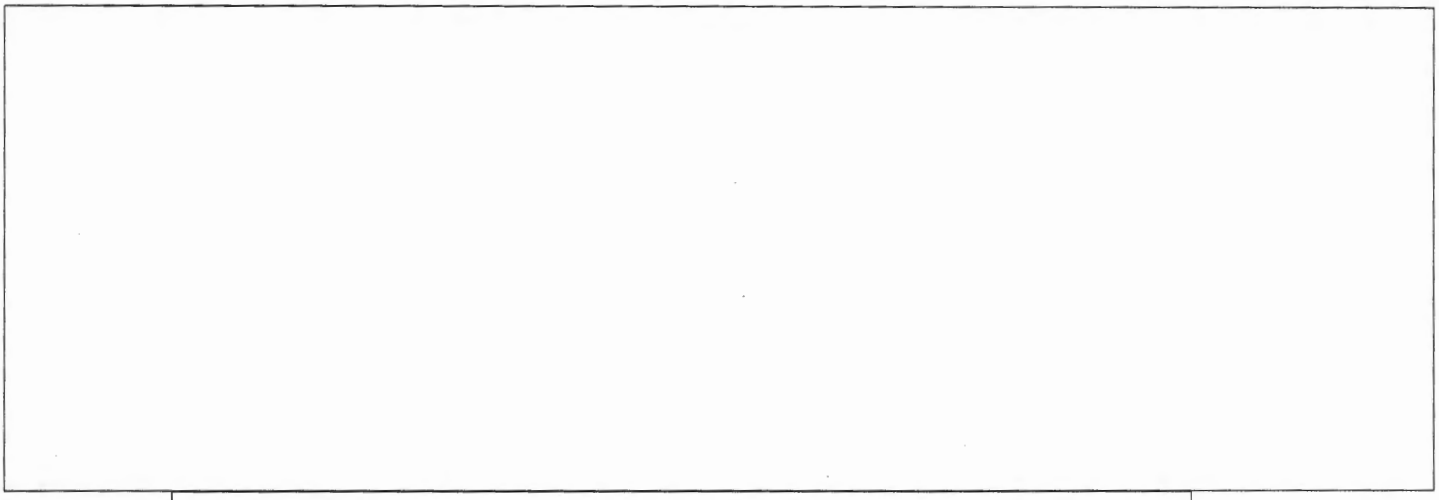
[redacted]

These images are unclassified.

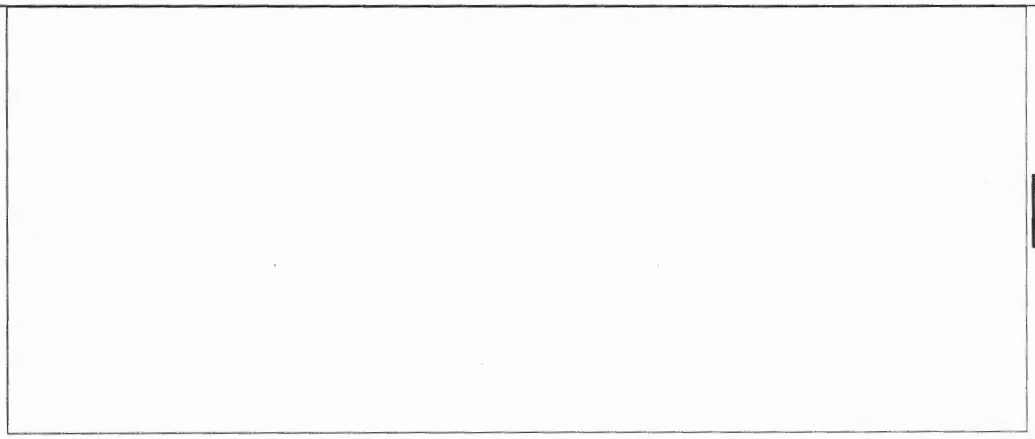
(U) Momentum Unload

(b)(3)

(b)(3)



(b)(3)



These images are unclassified.

(U) Momentum Unload

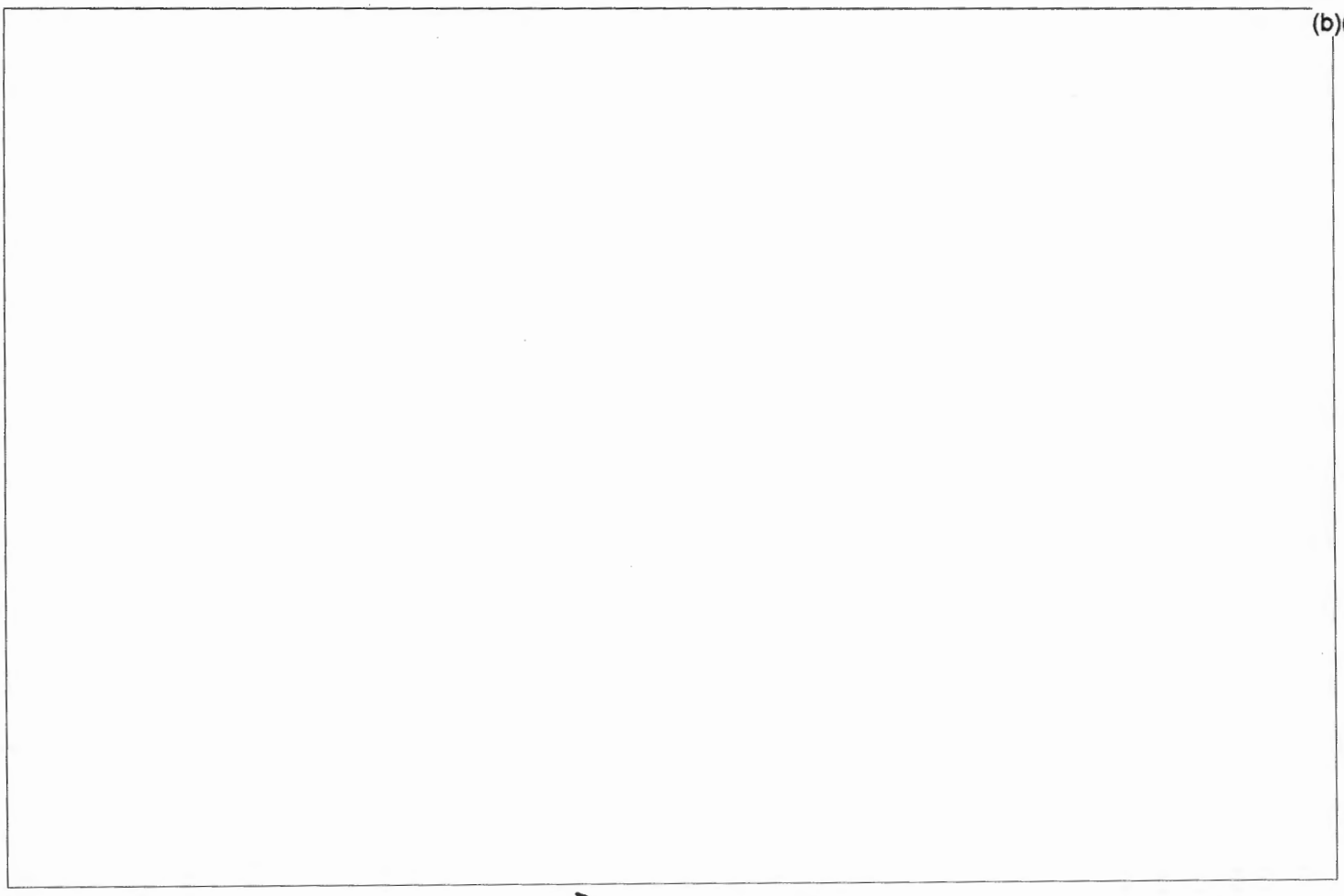
(b)(3)

(b)(3)

(U) Momentum Unload

(b)(3)

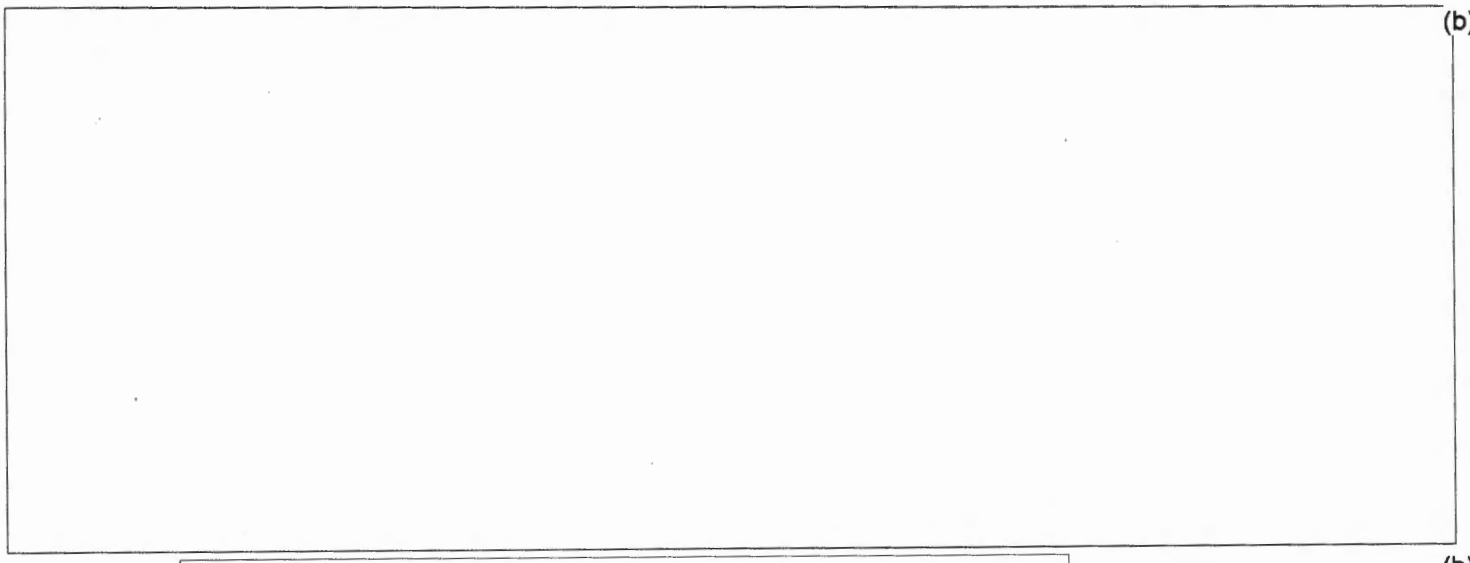
(b)(3)



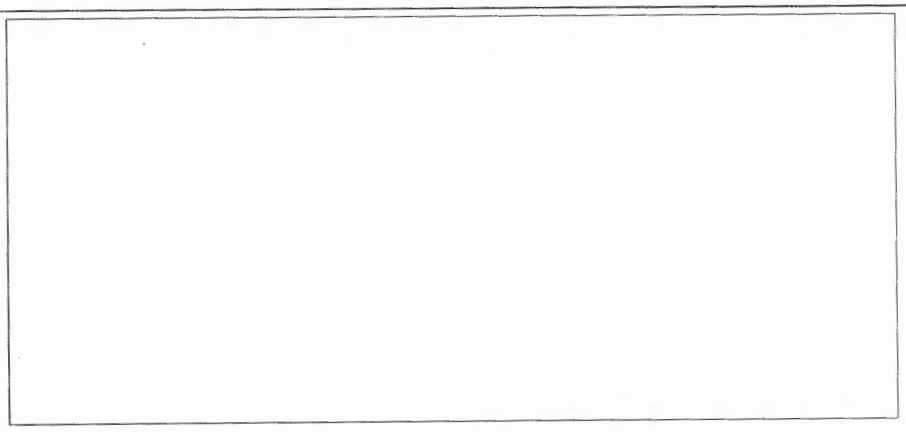
(U) Momentum Unload

(b)(3)

(b)(3)



(b)(3)



This image is unclassified.

(U) Momentum Unload

(b)(3)

(b)(3)

(U) Momentum Unload

(b)(3)

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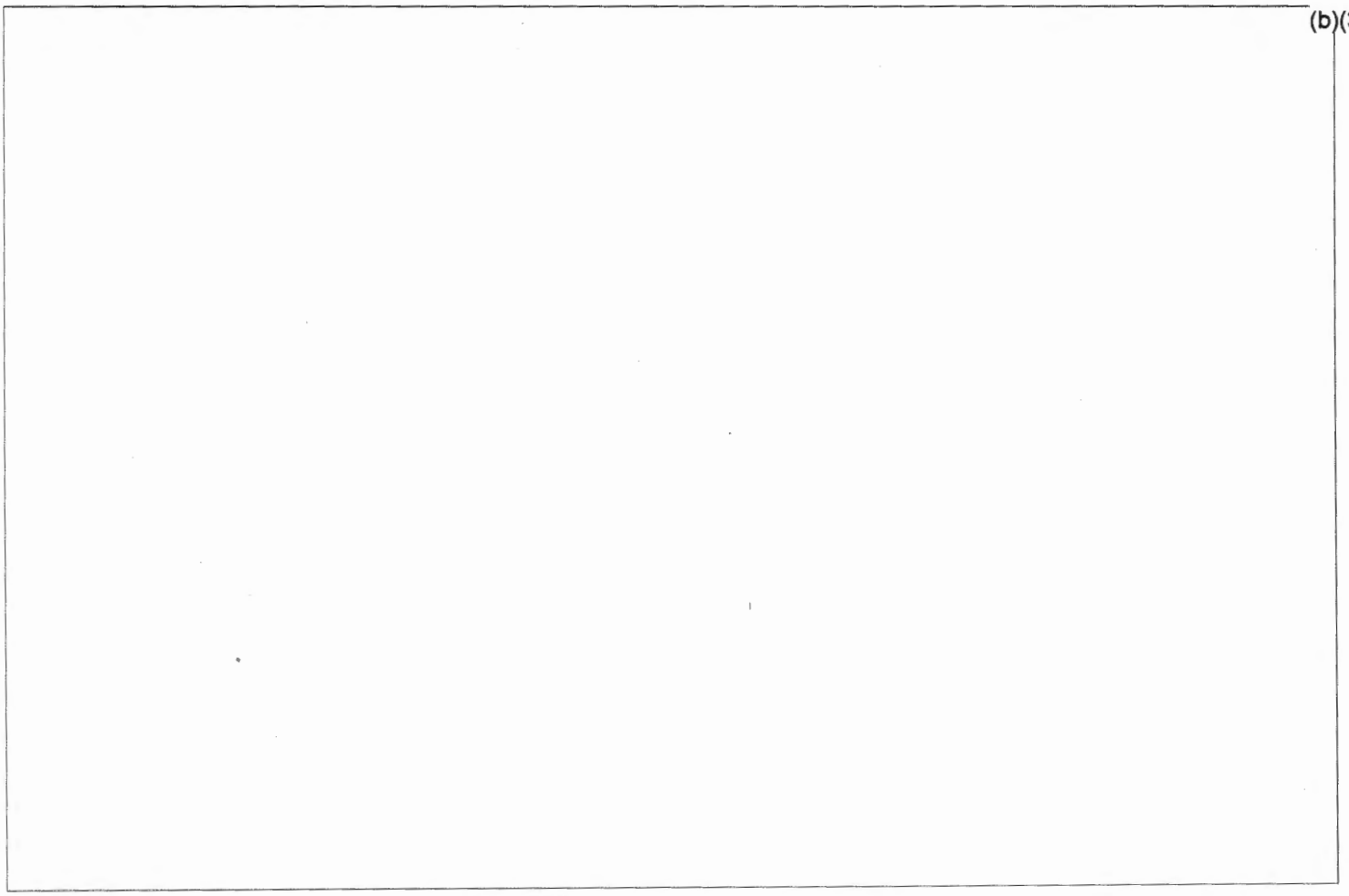


(U) Momentum Unload

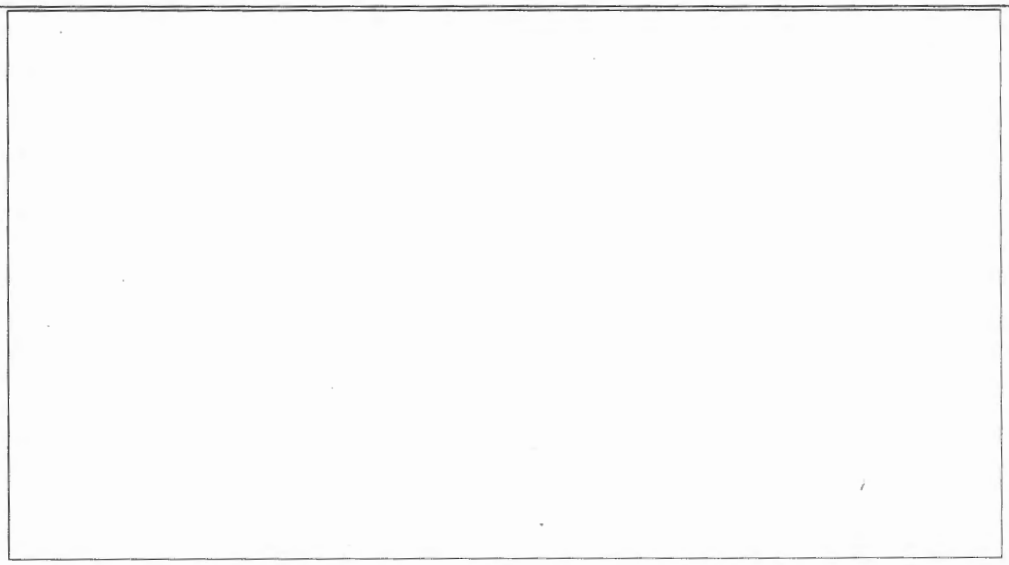
(b)(3

(b)(3)

(U) Momentum Unload

(b)(3)

(b)(3)



(b)(3)

This image is unclassified.

(U) Momentum Unload

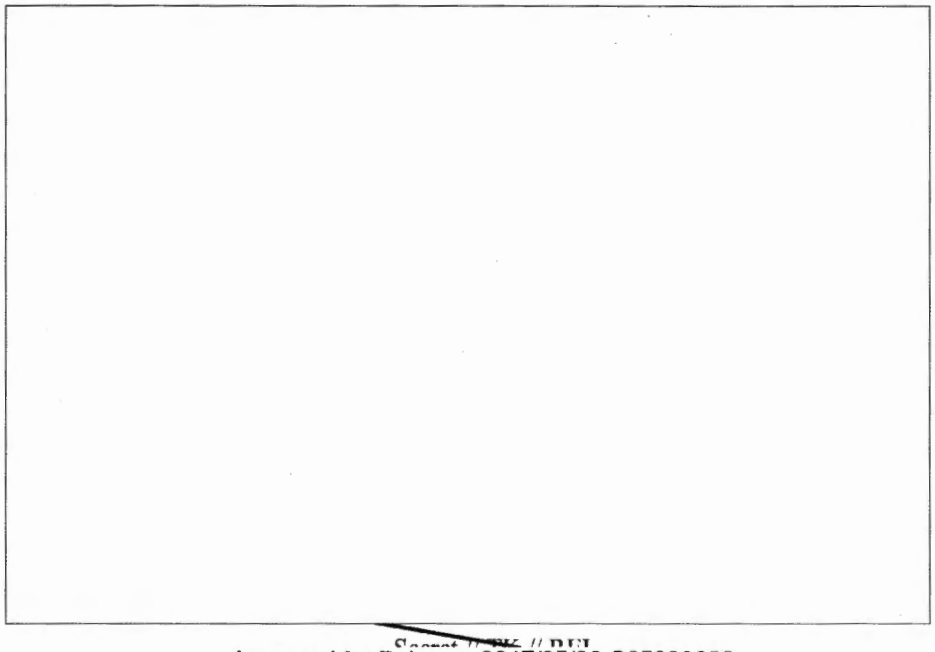
(b)(3)

6. (U) Verify that there are no major fluctuations in the rate and error. (b)(3)

7. (U) Skip this step. The [redacted] should always be left on. *Why?* (b)(3)

8. (U) Perform a final SOH check before ending the support.

(b)(3)



This image is unclassified.

(U) Other Activities

(U) [redacted] (b)(3)

(U) Yaw Flip

(U) Automated Yaw Maneuvers

(U) GLOM Out-Year Testing

(S//TK//REL) [redacted] (b)(1) (b)(3)

(U)

- (b)(1) (b)(3)
- (U) The maneuver is performed (b)(3)
- (U) It utilizes the mode. (b)(3)
- (U) are followed by an Ephemeris Update and (b)(3)
- (b)(3)
- (b)(1) (b)(3)

(U) Yaw Flip (CONOPS Training Document)

- [redacted] (b)(1) (b)(3)
- (U) This maneuver is performed using the [redacted] (b)(3)
- (U) Yaw Flips are done every [redacted] (b)(3)
- [redacted] (b)(3)
- [redacted]
- (S//TK//REL) [redacted] yaw flip. (b)(1) (b)(3)

(U) Automated Yaw Maneuvers

- [redacted] (b)(1) (b)(3)
- (U) These maneuvers are executed [redacted] (b)(3)
- [redacted] (b)(3)
- [redacted]
- [redacted]

(U) GLOM Out-Year Testing

- (U) During the GeoLITE Optical Module (GLOM) Out-Year Testing, [ ] (b)(3) [ ] uploaded to the vehicle and activated.
- (U) [ ] will turn on the GLOM and perform a sequence that will later determine [ ] (b)(3)
- (U) The data from the test is collected during the following [ ] and is sent to [ ] (b)(3)
- (U) This activity is performed [ ] (b)(3) [ ]

(b)(1)
(b)(3)

- (U) Due to more efficient results from the automated yaw mitigation maneuvers, (b)(3)
- (b)(1) (b)(3)
- (U) (b)(3) This was usually done after the GLOM out-year testing completed.
- (b)(3)

(U) Eclipse Operations

- **(U) Non –Eclipse Season**
  - (U) The flight software (FSW) controls the EPS and power distribution.
  - (U) Power is generated from the solar arrays.
  - [redacted] (b)(3)
- **(U) Pre-Eclipse Season**
  - (U) The [redacted] voltage is increased from [redacted] three days prior to the first eclipse of the season. This assures that battery full charge control is returned to [redacted] (b)(3) (b)(3)
- **(U) Eclipse Season**
  - (U) When the vehicle is in eclipse, power is generated from the batteries. Once out of eclipse, [redacted] (b)(3)
- **(U) Post-Eclipse Season**
  - (U) The [redacted] voltage is decreased from [redacted] after the last eclipse's battery full charge cycle completes. This assures that battery full charge control is returned to [redacted] (b)(3)

(U) Contingencies

(U) Shadow Supports

(U) Patching

(U) Loss of Telemetry

(U) Loss of Commanding

(U) Shadow Supports [redacted]

(b)(3)

- (U) A shadow contact is typically used when software patches have been implemented on a particular string and are being tested, or [redacted] (b)(3)

[redacted]

- (U) Shadow supports are possible because telemetry is ported through [redacted] (b)(3)

[redacted]

- (U) The workstation that actively runs the support is determined by the ground hardware configuration. If the ground hardware is [redacted] (b)(3)

[redacted]

- (U) [redacted] is unnecessary for the workstation running the shadow support. (b)(3)

- (U) The shadowing contact will [redacted] (b)(3)

(U) Shadow Supports

(b)(3)

- (U) To conduct a shadow support:

(b)(3)

(U) Patching [redacted]

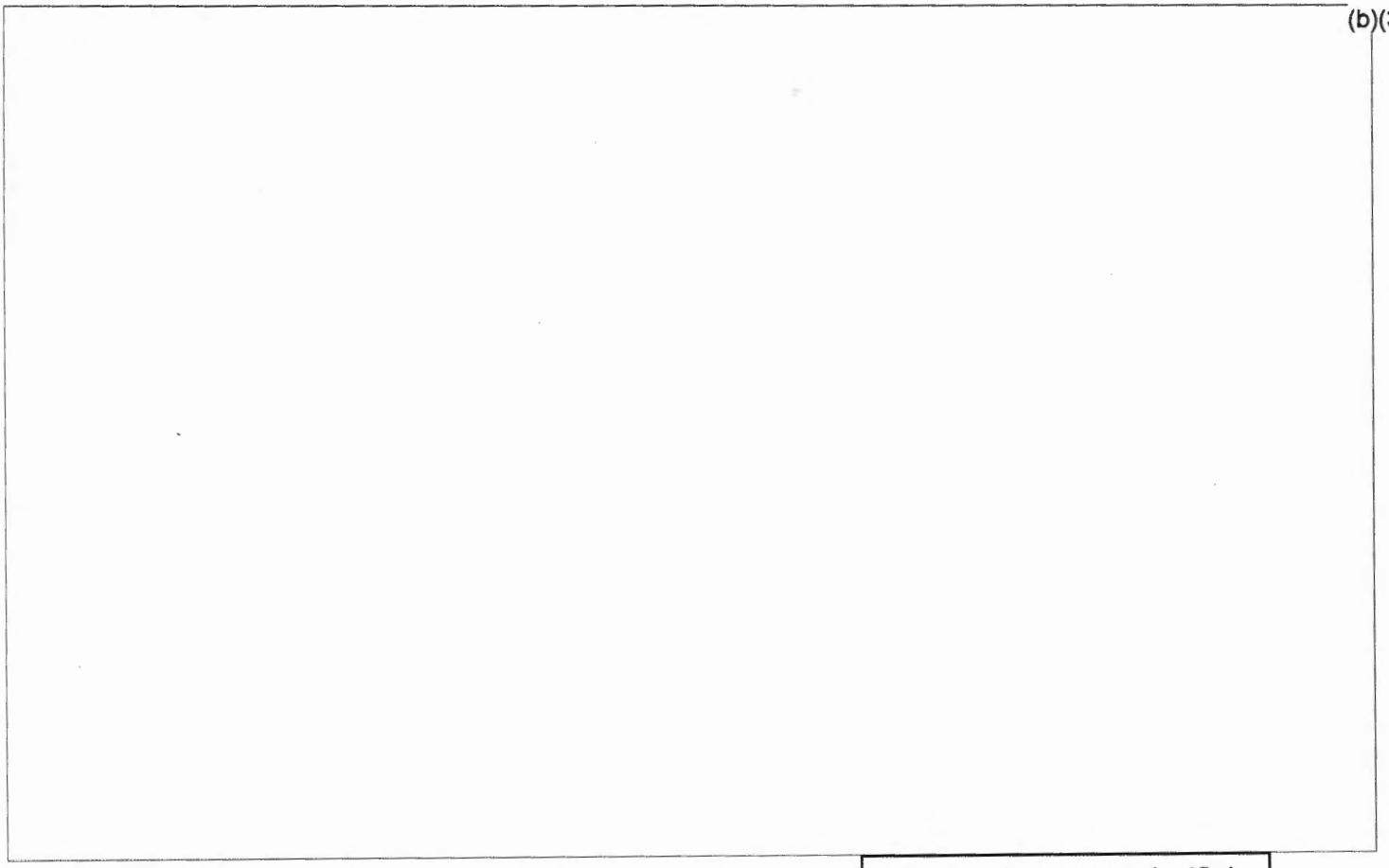
(b)(3)

- (U) For nominal operations, GeoLITE uses [redacted] primary telemetry line for telemetry and [redacted] for commanding. (b)(3)
- [redacted] (b)(3)
- [redacted]
- (U) Commanding and telemetry do not have to use [redacted] you can use [redacted] for telemetry and [redacted] for commanding. (b)(3)
- [redacted] (b)(1) (b)(3)

(U) Command Patching

(b)(3)

(b)(3)



The above images are unclassified.

(U) Telemetry Patching

(b)(3)

- (b)(1) (b)(3)
-

(b)(3)

(U) Loss of Telemetry

(b)(3)

- **(U) Indications of "Loss of Telemetry":**

(b)(3)

- **(U) If there is no telemetry at the RGF:**

(b)(1)
(b)(3)

(b)(3)

(U) Loss of Telemetry

(b)(3)

- **(U) If there is no telemetry at Ground Commo:**

(b)(3)

- **(U) If there is no telemetry at the Workstation:**

(b)(3)

(U) Loss of Commanding

(b)(3)

- **(U) Indications of "Loss of Commanding":**

(b)(3)

- **(U) First Things First:**

(b)(3)

(U) Loss of Commanding [redacted] (b)(3)

- **(U) If Ground Commo doesn't see** [redacted] (b)(3)

[redacted] (b)(3)

- **(S//~~TK~~) If** [redacted] **doesn't see Commands:** (b)(1) (b)(3)

[redacted] (b)(3)

- **(U) If the vehicle doesn't see commands:**

[redacted] (b)(3)