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John C. Stennis Space Center
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John C. Stennis Space Center Lightning Warning System

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	<i>Number</i>	<i>Rev.</i>
	Effective Date: July 9, 2010	
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Responsible Office: NASA QA00/Safety & Mission Assurance		
SUBJECT: Lightning Warning System		

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1.0 PURPOSE

The purpose of this work instruction is to establish a notification process for John C. Stennis Space Center (SSC) personnel regarding actual and potential hazardous lightning conditions.

2.0 APPLICABILITY

This work instruction applies to all SSC personnel, including NASA and its contractors, as well as SSC resident agencies and their contractors at SSC, as directed in their applicable agreement documents.

3.0 REFERENCES

All references are assumed to be the latest version unless otherwise specified.

NPR 1400.1, *NASA Directives System Procedural Requirements*

SPR 8715.1, *John C. Stennis Space Center Safety and Health Procedures and Requirements*

SSP-8715-0001, *John C. Stennis Space Center Safety and Health Handbook*

4.0 RESPONSIBILITIES

Responsibilities are as follows:

NASA Office of Safety and Mission Assurance (SMA) is responsible for the creation, implementation and verification of policy and procedures to ensure the highest level of warning of potential or actual lightning activity is available to all personnel at SSC.

NASA Center Operations Directorate is responsible for the procurement, maintenance and repair of equipment used to detect potential and actual lightning activity for SSC. Center Operations will also ensure the video feed for the lightning detection system is continuously distributed through the SSC cable television system and the SSC Intranet Portal Web Site.

NASA Security is responsible for the activation of warning systems to alert personnel of potential and/or actual lightning activity that may threaten SSC operations per the guidance in this work instruction.

Each employer shall be responsible for assuring an adequate means for communicating lightning advisories and warnings to all potentially affected personnel. This includes the organization's employees as well as contractor personnel which the organization has direct or oversight responsibility.

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5.0 PROCEDURES

The SSC Lightning Detection System shall be available twenty-four hours a day, seven days a week at the SSC Security Dispatch Office. When potential or actual lightning activity has been detected within a ten mile radius of SSC, SSC Security will issue an action per the following guidance and chart:

"Lightning Advisory" This notification advises that conditions in the atmosphere are developing or an observable weather system is approaching (within ten nautical miles of SSC) that is expected to produce, or is producing, lightning which may arrive at specified areas within 30 minutes. Advisories are intended to provide personnel conducting hazardous operations sufficient lead time to secure the operation before the forecasted weather system arrives.

"Lightning Warning" This notification implements the Lightning Warning Policy and is detailed in this section. All lightning notifications issued from the SSC Security will be announced as specified above, by the duty officer, at least every fifteen minutes until the lightning warning policy is terminated. The following criteria are used by the SSC Security to establish the existence of a lightning threat and are provided as a reference:

- a. A Lightning Warning Condition exists when any one of the following is observed:
 1. Cloud-to-ground discharges are observed within five nautical miles by the SSC Lightning Detection System.
 2. Thunderstorm cell producing cloud-to-ground discharge is within five nautical miles, but the observed lightning is outside five nautical miles.
 3. Thunderstorm cell producing in-cloud, cloud-to-cloud, and/or cloud-to-air lightning is within five nautical miles.
 4. Thunder is heard and/or lightning is observed by a reliable source and the parent cell or cloud is within five nautical miles.
 5. SSC Security determines the threat of lightning is immediate, i.e., explosive growth or rapid movement of a thunderstorm cell.

- b. A Lightning Warning Condition ends when:
 1. Lightning has not been observed within five nautical miles of SSC within the past fifteen minutes.

Condition	Action Level
Lightning within 10 miles of SSC, but not within 5 miles	"Lightning Advisory"
Lightning indicated within 5 miles of SSC	"Lightning Warning"
Lightning has moved past 5 miles for at least 15 minutes, but is still within 10 miles of SSC	"Lightning Advisory"
Lightning has moved past 10 miles of SSC for 15 minutes	"All Clear"

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Use of automated system is preferred, and shall include the following notifications. In case of automation failure, the SSC Security Dispatcher shall perform the following actions in fifteen minute increments:

1. Issue proper action level on all radio frequencies.
2. Issue proper action level over the E-Complex paging system. (688-6000)
3. Issue proper action level over the A/B Test Complex paging system. (688-1112)
4. Place a telephone call to the Wellness Center informing them of action level. (688-3950)
5. Place a telephone call to the Child Care Center informing them of action level. (688-3224)
6. Place a telephone call to the Visitors Center informing them of action level. (688-2134)
7. Place a telephone call to the NAVSCIATTS informing them of action level. (813-4050)
8. Place a telephone call to the SBU 22 informing them of action level. (813-4004)
9. Place a notation in the SSC Security Dispatcher Log stating date, time, and action level and indicating a positive or negative response to all phone calls.

5.1 ANNOUNCING SYSTEM PAGES AND RADIO CALLS

For Lightning Advisory: “Attention all personnel. A Lightning Advisory has been issued for the Stennis Space Center. A Lightning Advisory means conditions exist that indicate lightning is possible for this location. Personnel should monitor conditions and be prepared to take protective measures if required.” (REPEAT)

For Lightning Warning: “Attention all personnel. A Lightning Warning has been issued for the Stennis Space Center. A Lightning Warning means lightning, or the potential for lightning has been detected within five miles of the Stennis Space Center. All personnel shall immediately secure outside activities and take shelter in a secure location.” (REPEAT)

For All Clear: “Attention all personnel. All Clear. All Lightning Advisories and Lightning Warnings have been cancelled for SSC.” (REPEAT)

The above process will provide notice for any operations requiring advance termination activities and also permit other activities to continue until the policy implementation notice is given.

The Lightning Warning Policy will be implemented upon notification of a Lightning Warning issued by SSC Security. The following restrictions apply, unless specifically identified otherwise:

5.2 ALL AREAS DURING LIGHTNING WARNING

- a. Control of personnel and their activities within that area are the responsibility of supervision and individual self-protection.
- b. Personnel access to roofs or top levels (overhead open areas) of structures is prohibited.

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5.3 SELF PROTECTION FROM LIGHTNING

- a. When no lightning warning has been announced and personnel observe lightning conditions in their work area, they have the right and obligation to advise their supervision and request that lightning warning actions be initiated. If lightning is within five (5) miles, the individual has the right to remove himself from exposure to lightning or from the effects of lightning. An on-site safety representative observing, developing or actual, lightning events has the right to implement the lightning policy for that location.
- b. Working in open areas and on decks exposed (with no overhead protection) to weather is prohibited during Lightning Warnings.
- c. A task manager may authorize emergency maintenance, repair work, and close out work required to remedy an unsafe condition with concurrence of the on-site Safety representative.
- d. A facility is "*lightning protected*" when it implements a properly maintained and fully functional Air Terminal or Catenary Wire Lightning Protection System (SSC employs Air Terminal systems). This applies to buildings and facilities within the test complex areas. Normally occupied office buildings outside of the Test Complex do not always employ a Lightning Protection System. Personnel may remain within these normally occupied office buildings.
- e. All buildings and metal structures which are daily work areas are considered lightning protected shelters for personnel, unless specifically designated to be evacuated during Lightning Warnings.
- f. In areas outside of the test complex, including the guard shacks, personnel shall seek shelter in buildings or metal enclosed vehicles. Persons inside a building shall avoid open exterior doors or windows.
- g. In test stand areas, personnel shall seek shelter in buildings, metal structures identified as "*lightning protected*" areas per 5.3.d, or metal enclosed vehicles. Persons inside a building shall avoid open exterior doors or windows. In these areas (such as the engine decks of the A and B complex that are exposed to the weather), work shall be permitted as long as the following criteria are met to make them "*lightning protected*" and safe for working during lightning warnings:
 1. Personnel are to remain within the lightning protected areas which have been designated as "*safe working*" with respect to lightning protection. Areas designated as "*safe passage*" are provided for personnel to traverse to a "*safe working*" area. Personnel are NOT to remain in a "*safe passage*" area, nor shall they be allowed to return to a "*safe passage*" area following entry into a safe area. SSC Safety shall be responsible for determining the proper demarcation for delineation of the lightning protected areas. Areas designated as "*safe passage*" or "*safe working*" for lightning protection shall be identified on drawings for each test stand and shall be determined by the following criteria:

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- a) "Safe passage" and "Safe working"
 - i. For metal items within six (6) feet of the perimeter that are not directly bonded to the facility ground system, a clearance distance of six (6) feet minimum shall be maintained from the item.
 - ii. All metal objects projecting from the Test Stand perimeter (handrails) shall be properly bonded to facility ground system at or near the point-of-entry and periodically tested per the requirements identified in 5.3.g.1 (b).
- b) "Safe working"
 - i. The criteria in 5.3.g.1 (a) is met, and in addition, provides overhead cover, such as a roof.
2. The facility or test complex stand meets the Lightning Protection Requirements for bonding, grounding, and testing of the resistance-to-counterpoise values of all lightning protection system components and grounded equipment as specified in Section 5.27 of the SSC Facility Electrical Standard, SSC SSTD-8070-0081-ELEC.
3. Electrical system maintenance and repair: Defined as worker in physical contact with electrical conductors [AC power, telephone lines, operational intercom communications, operational television cables, RF and microwave transmission cables, hardwire safing systems, DAS and Control System trunk cables from the hardcore and/or Signal Conditioning Buildings (SCBs) to the exterior Receptacle Boxes (RBs) or Terminal Equipment Boxes (TEBs)].
 - a) Outside all facilities and inside non-lightning protected facilities, electrical systems maintenance and repair is prohibited.
 - b) All inside electrical maintenance and repair work on systems that are connected to outside conductive sources will terminate upon notification of a Lightning Warning.
 - c) Inside lightning protected facilities, electrical maintenance and repair work may be performed only if systems are physically disconnected by a minimum of six (6) inches from the outside conductive sources, i.e. metal pipes, wires, transformers, antenna cables, power cables, and conduits, etc.
 - d) If the "lightning protected" facilities have underground electrical utilities, and all above ground electrically connected conductive sources are in the zone of the lightning protection system, a one (1) inch gap disconnect is sufficient to protect work inside against induced voltage caused by a lightning strike. The one (1) inch gap disconnect may be satisfied by opening a circuit breaker, then electrical maintenance and repair work may continue.
- h. No specific protective zone can be ascribed with complete confidence to a vertical lightning rod, pole, or tree. A person near a light pole, mast, tree, or fence is in danger from the lightning side flash effects. Side flashes occur when lightning strikes a tall object and jumps to a nearby object, which may be an individual if they are standing closer than six (6) feet.

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- i. If caught in the open, without protective shelter, personnel should avoid being the highest point. Standing erect makes a person extremely vulnerable. Assume a crouched position with both feet close together, knees under chin, arms around knees and head down. Avoid lying flat on the ground as lightning ground currents may cause a voltage potential across the body sufficient to cause death.

6.0 RECORDS AND FORMS

All Records shall be retained in accordance with latest version of the NASA Records Retention Schedule, NPR 1441.1.

All records and forms are assumed to be the latest version unless otherwise indicated. Quality Records are identified in the SSC Master Records Index.

7.0 DEFINITIONS/ACRONYMS

NASA	National Aeronautics and Space Administration
NPR	NASA Procedural Requirements
RB	Receptacle Box
SCB	Signal Conditioning Building
SMA	Office of Safety and Mission Assurance
SPR	Stennis Procedural Requirements
SSC	John C. Stennis Space Center
SWI	John C. Stennis Space Center Work Instruction
TEB	Terminal Equipment Box