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PURPOSE

This procedure defines the process for managing technical anomaly events that occur on hardware and software for which Base Operations Support & Services (BOSS) contract has responsibility. This procedure provides a standardized method for documenting problems to capture data for performing trend analysis and for use as a historical reference. The process when applied provides the optimum level of attention and management visibility warranted for any problem resolution and subsequent closure. Procedure SMA-P-0016, *Event and Near Miss Reporting and Investigation*, provides instruction for reporting events.

SCOPE AND APPLICABILITY

This procedure is applicable to all BOSS personnel at Kennedy Space Center (KSC) who initiate, disposition, resolve, or close a technical anomaly work order within Maximo. This procedure takes precedence over all other procedures that refer to technical anomalies. This ensures that all problems including those involving Fixed Price Contractors (FPC) are addressed properly in a standard manner by the BOSS Engineering Team.

This procedure addresses both shop and engineering minimum level input requirements necessary to pass Quality initiated audits. Compliance is required to satisfy the BOSS Performance Work Statement (PWS) that specifies tracking all problem and failure histories and documenting corrective actions.

PROCESS

1. OVERVIEW

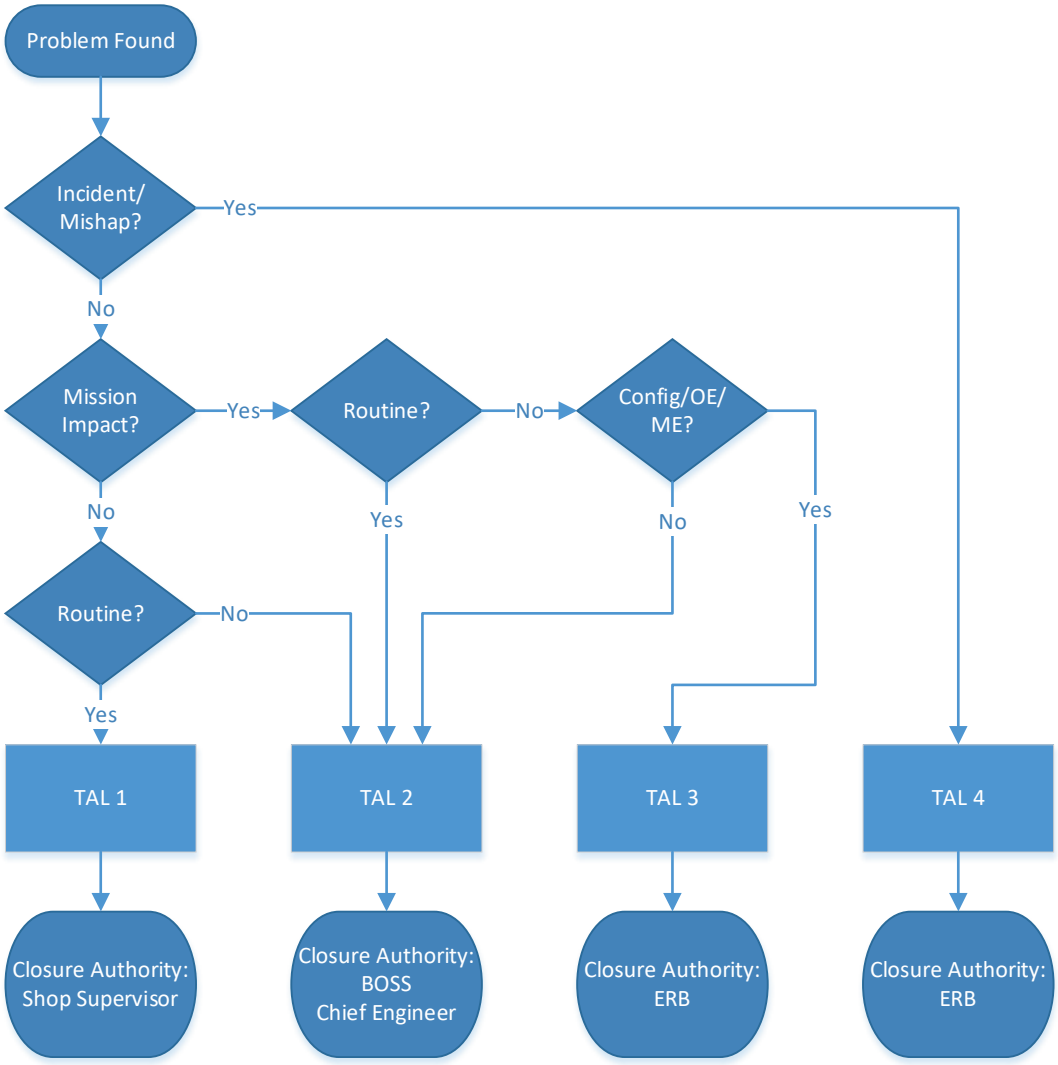
A technical anomaly is any failure of system hardware or software to perform as expected or designed. Also, it is the failure to follow established operations and maintenance policies/procedures and regulatory requirements that cause problems.

The training reference for this process, ENG-REF-0027, *Problem Reporting Training*, is available in TechDoc.

2. TAL CATEGORIES AND CRITERIA

Technical anomalies are categorized based on the significance of the anomaly as defined in this section and are summarized in Figure 1 - Technical Anomaly Categories. These categories are known as Technical Anomaly Levels (TAL), and they determine the actions and information required to process each anomaly from initiation to closure. Specific technical anomaly criteria for each type of system are further defined in the Appendices of this document.

Figure 1 - Technical Anomaly Categories



2.1. TAL1 Anomalies

Problems with well-understood accepted causes are considered routine and are categorized as Technical Anomaly Level 1 (TAL1).

2.1.1. General TAL1 Criteria

Examples of TAL1 anomalies include but are not limited to:

- Routine problems that do not impact mission support
- Routine or Emergency Trouble Calls (RTC/ETC)
- Reoccurring problems with an explained condition with pre-approved instructions for resolving problem documented in Preventive Maintenance Instructions (PMI) Job Plans.
- Return to Print/Like Item Replacement
- Preventive Maintenance (PM) Discrepancies

- Routine repair work orders (REP)

2.2. TAL2 Anomalies

Non-routine problems that occur on configured and/or Operationally Essential (OE)/Mission Essential (ME) systems or equipment are categorized as Technical Anomaly Level 2 (TAL2) if the problem does not create a mission impact.

2.2.1. General TAL2 Criteria

Examples of TAL2 anomalies include but are not limited to:

- Routine problems that impact mission support
- Non-routine problems on non-configured and non-OE/ME systems and equipment
- Non-routine problems on configured and/or OE/ME systems and equipment that do not pose a mission support impact
- Performance does not meet specification limits or is outside expected values from previous samples and experience
- Recurring problems
- Process Escape
- Problems caused by insufficient and/or a lack of task instructions
- Problems caused because of failure to follow written task instructions
- Adverse Trends (imminent failure of hardware or support function, reduction in life cycle of hardware)
- Design flaw/error
- Problems on obsolete equipment that require replacement
- SE support required for non-routine problems to
    - Assist troubleshooting efforts (non-software related)
    - Evaluate problem to determine repair strategy
    - Provide task instructions for repair
- Management directed
- Material Review (MR) dispositions per ENG-P-0039, *BOSS Material Review (MR) and Material Review Board (MRB)*.

2.3. TAL3 Anomalies

Non-routine problems that occur on configured and/or OE/ME systems or equipment and which may have a mission impact are categorized as Technical Anomaly Level 3 (TAL3).

2.3.1. General TAL3 Criteria

Examples of TAL3 anomalies include but are not limited to:

- Non-routine problems on configured and/or OE/ME systems and equipment that impact mission support
- Failure of a safety critical function
- System is found out of latest design configuration
- Unexplained Anomaly

- High visibility problems
- Costly problems requiring emergency funding
- Management directed
- Systemic Failures - Failures that affect multiple sites or parts of similar design
- Material Review (MR) dispositions per ENG-P-0039

2.4. TAL4 Anomalies

Anomalies that meet the criteria of an Incident, Mishap, or Near miss as defined in SMA-P-0016 are categorized as Technical Anomaly Level 4 (TAL4).

2.4.1. General TAL4 Criteria

A problem is categorized as TAL4 when it is a technical anomaly that meets the criteria for TAL1, TAL2 or TAL3 and either the National Aeronautics and Space Administration (NASA) or BOSS Safety has decided to perform an investigation. Safety investigations per SMA-P-0016 that are not related to a technical anomaly are not considered TAL4 anomalies.

3. GENERAL REQUIREMENTS

3.1. Changes to Configured Systems

If a change to a configured system is required as a corrective or preventive action as a result of a technical anomaly, regardless of TAL category, then approval of the change shall be obtained in advance in accordance with ENG-P-0002, *Configuration Management of Facilities/Systems/Equipment/Utilities (FSEU)*.

3.2. Anomalies Caused by Others that Affect BOSS Systems

3.2.1. When an anomaly is detected on a BOSS system and was determined to be caused by others (e.g., construction contractor, other KSC contractor, etc.) a TAL work order shall be required only when Management directed.

3.2.2. If a TAL work order for the anomaly already exists when it is determined to have been caused by others, then it shall be closed in accordance with section 5.2 of this procedure.

3.3. Related Work Orders

TAL2, TAL3, and TAL4 work orders often are a result of a TAL1 work order and/or require additional work orders to implement corrective action.

3.3.1. All additional work orders associated with a TAL2, TAL3, or TAL4 work order shall be linked by adding them in the Related Records tab in Maximo on the TAL2, TAL3, or TAL4 work order. Example related work orders include:

- The initial TAL1 work order
- Follow-up repair work orders
- Duplicate TAL work orders

- Other related TAL work orders (such as for events that affect multiple systems and/or launch constraints)

3.4. Transfer of Responsibility

When the investigation of a TAL2, TAL3, or TAL4 problem reveals that the probable cause is due to the failure of a supporting system, then the responsibility for the investigation and closure summary shall be transferred to the SE for the supporting system.

3.4.1. The SE shall enter the findings in the Problem Description with a note that the problem is being transferred to another system, close their task line and notify the SE Manager.

3.4.2. The SE Manager shall add a new task line and assign it to the new SE responsible for TAL work order.

3.4.3. The SE Manager shall stop then restart the Maximo Workflow on the TAL2, TAL3, or TAL4 WON to reset the workflow assignment to the new SE.

3.4.3.1. The SE to whom the problem is being transferred will see the new TAL WON on the Maximo Start Center however, no notification is sent by the Maximo workflow.

3.4.4. The SE Manager shall notify the SE of the new assignment.

When responsibility changes for a system or equipment that has an open TAL WON, then the WON shall be updated per section 3.4.2 through 3.4.4 above.

3.5. Changing the TAL Category of a Work Order

When technical anomalies arise, it is usually apparent to which levels they should be categorized. Occasionally, the technical anomaly level will need to be adjusted. When this occurs, it is typically to elevate the level but occasionally, the level may be lowered as well.

3.5.1. Elevating from TAL1 to TAL2 or TAL3

When it is determined that a TAL1 work order should be elevated to a TAL2 or TAL3 work order, the responsible SE shall request the appropriate level work order per section 4.2.1 of this procedure.

3.5.2. Elevating from TAL2 to TAL3

When management determines that a TAL2 work order should be elevated to TAL3, the SE Manager or BOSS Chief Engineer or representative shall perform the following:

- Enter a log note explaining that the technical anomaly level was elevated and the reason for doing so.
- Update the TAL field in Maximo to LEVEL3.
- Update the WON Title to TAL3.

3.5.3. Elevating to TAL4

If the investigation of a TAL1, TAL2, or TAL3 problem reveals conditions that warrants an upgrade to a TAL4 (section 2.4), then the SE Manager or BOSS Chief Engineer or representative shall perform the following:

- Verify/Submit a separate event report for the safety concern in accordance with SMA-P-0016.
- If the original problem is a TAL1, then initiate a new TAL4 WON in accordance with section 4.2.1.
- If the original problem is a TAL2 or TAL3, then perform the following:
    - Enter a log note explaining that the technical anomaly level was elevated and the reason for doing so.
    - Update the TAL field in Maximo to LEVEL4.
    - Update the WON Title to TAL4.
    - Note the new incident, mishap, or near miss event report in the Problem Description.

3.5.4. Downgrading from TAL3 to TAL2

A TAL3 work order may only be downgraded to a TAL2 work order with concurrence from the Engineering Review Board (ERB) co-chairs from BOSS and NASA. The BOSS Chief Engineer (BOSS ERB co-chair) or representative shall perform the following to accomplish the downgrade:

- Enter a log note that approval has been granted to downgrade the TAL3 to a TAL2.
- Update the TAL field in Maximo to LEVEL2.
- Update the WON Title to TAL2.

3.5.5. TAL2 and TAL4 work orders shall not be downgraded further.

3.6. Duplicate TAL Work Orders

3.6.1. Only one TAL work order is required for each anomaly.

3.6.2. If more than one TAL work order is created for the same anomaly, then the responsible SE shall perform the following:

- Choose one TAL work order to provide the full closure summary.
    - The preference is that the first TAL work order reported is chosen but either may be used.
- Relate the duplicate TAL work orders to each other in the Related Records tab in Maximo.
- Close the duplicate TAL work order(s) by entering “N/A - Duplicate of XX.”, where “XX” is the chosen TAL work order number, in all four closure summary fields and submit for closure in accordance with section 4.2.3 of this procedure.

4. PROCESS

4.1. TAL1 Process

Anomalies categorized as TAL1 are processed and documented in accordance with this section. The investigation and closure are performed by the shops with SE oversight.

4.1.1. TAL 1 problems shall have a Maximo work order generated, processed, and closed in accordance with MSI-I-0001, *Master Schedule Integration Planning and Scheduling Instruction*.

4.1.2. The Shop Supervisor shall notify the System Engineer (SE) of any significant trends observed during closure of TAL1 work orders.

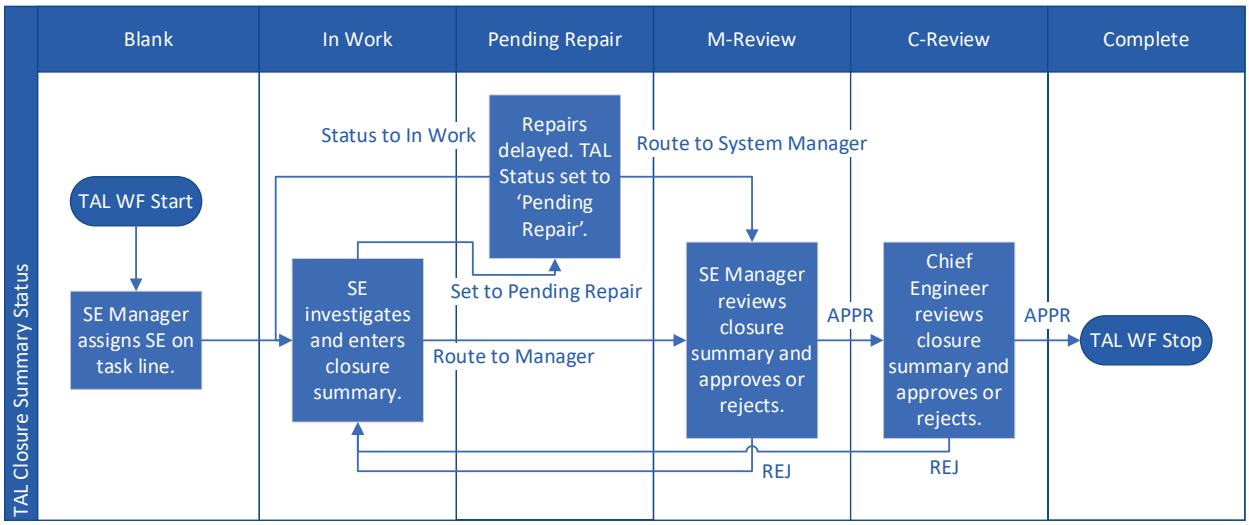
4.1.3. The SE shall randomly review the TAL 1 work orders for assigned systems weekly for the following reasons:

- Review anomalies for any significant trends.
- If the SE finds a work order that should be at a higher TAL, then the SE shall request the appropriate level work order per section 4.2.1 of this procedure.

4.2. TAL2, TAL3, and TAL4 Process

Anomalies categorized as TAL2, TAL3 or TAL4 are processed and documented in accordance with this section. The investigation and closure are performed by the SE with Chief Engineer's Office oversight. The process uses a Maximo workflow as shown in Figure 2 - TAL Workflow Diagram to assist this process and keep the TAL Closure Summary Status up to date.

Figure 2 - TAL Workflow Diagram



4.2.1. **Initiation**

4.2.1.1. If no event/near miss report exists for the anomaly, then the SE shall submit an event/near miss report in accordance with SMA-P-0016.

4.2.1.1.1. If an event involves multiple failures, such as for post-launch FOD assessment, then a single event report may be used to request multiple TAL WONs.

4.2.1.2. SE shall submit an EWR to request a TAL WON be created no later than the next business day following discovery of the anomaly.

4.2.1.2.1. Provide the following information in the EWR:

- *Request Type*: BSLN SO
- *Originating WON*: Original troubleshooting EWR/WON if one exists. This will be a related record on the WON.
- *Project Title*: TALX – SE Action - Short description of the anomaly
- *Need Date*: Today's date +30 days, unless known to need more time.
- *Technical Contact*: Enter the responsible SE for the asset/system.
- *Maximo Location* and *Asset Number*: Specific location and asset affected. If a specific asset number does not exist, then enter the system level asset for the location.
- *Job Description*:
    - Describe the anomaly and actions taken to date.
    - List the responsible SE that needs to go in the WON plan task inspector field(s).
- *Effect of Delay*: Describe the consequence if the anomaly is not corrected in a timely manner. For example, loss of redundancy, mission constraint, work stoppage, etc.

4.2.1.3. SE Manager shall assign the SE and add a Scheduled Finish Date on the task in Maximo and route the workflow. Verify the TAL Closure Summary Status is "In Work".

4.2.1.4. If equipment is out of service, including loss of redundancy, then SE shall verify/submit outage in accordance with MSO-P-0002, *Outage Procedure*.

4.2.2. **Investigation**

4.2.2.1. SE shall enter problem description within two business days of assignment on the WON.

4.2.2.2. If probable cause, corrective action, or preventive action is known, they may be entered at any time.

4.2.2.3. SE shall monitor status of repairs and continue to update the probable cause, corrective action, and preventive action fields as new information is discovered or actions taken.

4.2.2.4. If follow-up work is required, SE shall request a new WON in accordance with MSI-I-0001 and add the new WON as a related record per section 3.3. Also note the WON in the corrective action.

4.2.2.5. If the investigation and/or repairs cannot be completed within 30 days from initiation, then the SE shall perform the following:

4.2.2.5.1. Enter problem description, probable cause, and corrective action with EWR/WON and Estimated Completion Date (ECD) of repair.

4.2.2.5.2. Route the Maximo workflow and select “Set to Pending Repair”.

4.2.2.5.3. Verify the TAL Closure Summary Status is “Pending Repair”.

4.2.2.5.4. Update the assigned task line on the TAL WON with a new Scheduled Finish Date to match the ECD noted in the corrective action.

4.2.3. **Closure**

4.2.3.1. All TAL2, TAL3, and TAL4 WONs shall begin the closure process within 30 days of initiation.

4.2.3.1.1. If unable to complete the investigation within 30 days due to access, EWR approval, failure analysis, or any other issue that causes a delay, then update the closure summary and route the workflow per section 4.2.2.5.

4.2.3.2. If the investigation is complete and the Probable Cause is sufficiently understood but the repair cannot be completed within 30 days, then the TAL WON may be considered for early closure.

4.2.3.2.1. Complete all four sections of the closure summary per section 5.2.

4.2.3.2.2. Obtain SHARP Team approval for early closure and update the Corrective Action per section 5.2.3.2.

4.2.3.2.2.1. If not approved for early closure by the SHARP Team, then update the closure summary and route the workflow per section 4.2.2.5.

4.2.3.2.3. Route the Maximo workflow and select “Route to Manager”.

4.2.3.2.4. Verify the TAL Closure Summary Status is “M-Review”.

4.2.3.3. When repairs are complete and system is returned to service, the SE shall perform the following:

4.2.3.3.1. Complete all four sections of the closure summary per section 5.2.

4.2.3.3.2. Route the Maximo workflow and select “Route to Manager”.

4.2.3.3.3. Verify the TAL Closure Summary Status is “M-Review”.

4.2.3.4. SE Manager shall perform the following:

4.2.3.4.1. Review closure summary.

4.2.3.4.2. If closure summary meets requirements of section 5.2, then enter APPR in the TAL System Man Approval field and route the Maximo workflow. Verify the TAL Closure Summary Status is “C-Review”.

4.2.3.4.3. If closure summary needs correction, then enter REJ in the TAL System Man Approval and comments explaining what to correct in the TAL Rejection Comments field then route the Maximo workflow. Verify the TAL Closure Summary Status is “In Work”.

4.2.3.5. BOSS Chief Engineer or representative shall perform the following:

4.2.3.5.1. Review closure summary.

4.2.3.5.2. If the closure summary needs correction, then enter REJ in the Chief Engineer Approval field and comments explaining what to correct then route the Maximo workflow. Verify the TAL Closure Summary Status is “In Work”.

4.2.3.5.3. If the closure summary meets requirements of section 5.2, then perform the following:

- For TAL2 WONs, enter APPR in the Chief Engineer Approval field and route the Maximo workflow. Verify the TAL Closure Summary Status is “Complete”, and the WON status is “COMP”. Verify/complete all tasks on the WON. This completes the workflow and the TAL investigation.
- For TAL3/4 WONs, schedule an ERB presentation in accordance with section 5.2.5 of this procedure. Following ERB approval to close the TAL3/4, enter APPR in the Chief Engineer Approval field and route the Maximo workflow. Verify the TAL Closure Summary Status is “Complete”, and the WON status is “COMP”. Verify/complete all tasks on the WON. This completes the workflow and the TAL investigation.

5. CLOSURE REQUIREMENTS

5.1. TAL1 Closure Requirements

Anomalies categorized as TAL1 are closed in accordance with this section.

5.1.1. The Shop Supervisor has the closure authority for TAL1 work orders.

5.1.2. All TAL1 work orders shall meet all closure requirements in accordance with WCC-P-2002, *BOSS Electronic Work Order Procedure*, and include the following:

- Asset Number
- Problem-Cause-Remedy (PCR) Codes
- Work Log notes that describe the following:
  - As found condition
  - Troubleshooting steps taken
  - Corrective action (repair) steps taken, including details of any retest

5.2. TAL2, TAL3, and TAL4 Closure Requirements

Anomalies categorized as TAL2, TAL3, or TAL4 shall be closed in accordance with this section.

5.2.1. The Problem Description shall provide a full description of the anomaly.

5.2.2. Provide the lowest level Probable Cause practical. For example, do not simply state a part failed, explain why (e.g., age degradation, weather exposure, etc.)

5.2.3. The Corrective Action shall include one of the following:

5.2.3.1. If the repairs are complete, then the Corrective Actions shall include a statement that repairs are complete, a description of the actions taken, and the WON they were performed under.

5.2.3.2. If repairs cannot be completed within 30 days of initiation of the TAL WON AND the Probable Cause is sufficiently understood, then the Corrective Action shall include a description of the planned repairs, the EWR, WON, or other tracking number that has been submitted to perform the repairs, and a statement that signifies SHARP Team approval.

5.2.3.2.1. The SHARP Team approval shall be obtained at a meeting (not via email) and shall be recorded in that meeting's minutes in accordance with ENG-I-0026, *SHARP Team Instruction*.

5.2.3.2.2. The SHARP Team approval statement in the Corrective Action shall include the name of the SHARP Team that granted approval (e.g., HVAC, Fire & Protective Services, Controls, etc.) and the date the approval was granted. Example:

- This TAL WON was approved for early closure by the <system> SHARP Team on <date>.

5.2.4. Preventive Action shall describe future actions to take to prevent reoccurrence of the anomaly.

5.2.4.1. If the Preventive Action is a project, then an EWR number shall be provided as part of the Preventive Action.

5.2.4.2. If there is no action that can be taken to prevent a reoccurrence of the anomaly, then rationale shall be provided for why no preventive action is to be taken.

5.2.5. TAL3 and TAL4 anomalies shall be presented to the ERB for approval to close in accordance with ENG-P-0019, *BOSS Engineering Review Board (ERB)*.

5.2.5.1. Following approval, the ERB presentation shall be attached to the Maximo WON.

5.2.5.2. The closure presentation for TAL4 shall address the results of the related Safety investigation.

5.2.5.2.1. The Safety investigation report shall be attached to the Maximo WON.

APPENDIX A: AUTOMATION CONTROL SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE *AUTOMATION CONTROL SYSTEMS* *(Building Automation System (BAS), Programmable Logic Controller (PLC), Kennedy Complex Control System (KCCS))*	
TAL	**CRITERIA**
1	(1) Logic Faults - A Forced Restart (Reboot) of a controller in order to clear a logic fault to restore normal operation. (2) Graphic Display Errors - Correction of static graphic display discrepancies that have been first verified against actual field configuration. (3) Defined Error Codes - Clearing of defined error codes where the sensed anomaly required only minor adjustment and/or like item replacement to restore. (4) Mechanical Adjustments - Minor mechanical adjustments, lubrication, cleaning to restore proper configuration and operation (i.e., Limit switch adjustment, sensor cleaning, etc.).
2	(1) Server Failure - A Server failure condition where one or more controllers or workstations fail to connect with corresponding database systems. (2) Network Failure - A Network failure condition resulting in loss of any system monitoring and/or control. (3) Program Error - Any control logic programming error or inhibited routine in code that resulted in a failure of the system to perform as designed. (4) Undefined Error Codes - Any anomaly where the controller reports an undefined error code. (5) Intermittent Anomalies - A chronic intermittent anomaly where determining a cause and solution requires in-depth investigation. (6) Operator Alarms - Any condition that results in the inability of a system operator to properly acknowledge an alarm, such as an uncontrolled/undocumented inhibited alarm, an alarm routing error, hardware annunciator failure. (7) Original Equipment Manufacturer (OEM) Support - Any control system failure that requires the OEM representative to provide on-site support to resolve. (8) Animated Graphic Error - Any active/animated graphic anomalies discovered where tied to operator control points, automatic control logic, Genies, or Pseudo setpoints. (9) Loss of Program: Any failure that is, or is caused by, a loss of the application software on a controller due to a failure of the battery backup to retain the program during a planned or unplanned outage.
3	(1) Unauthorized Breach - Any failure as a result of an unauthorized breach or tampering of hardware or software.

APPENDIX B: BRIDGE SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE *BRIDGE SYSTEMS*	
TAL	**CRITERIA**
1	(1) Minor adjustments - Required to bring system back into specification. (2) Minor corrosion control. (3) Controls Errors – See APPENDIX A.
2	(1) Structural assessments following significant impacts to fenders/bridge structure, Alignment out of spec, significant structural cracks, significant corrosion. (2) Controls Errors – See APPENDIX A.
3	(1) Bridge Load rating reduced below mission transport requirements. (2) Structural integrity defects resulting in significant reduction in load carrying capacity. (3) Problems resulting in significant transportation impacts. (4) Controls Errors – See APPENDIX A.

APPENDIX C: COMPRESSED AIR SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE *COMPRESSED AIR SYSTEMS*	
TAL	**CRITERIA**
1	(1) Initial Troubleshooting - Non-OE equipment and systems, such as air compressors used for shop air. (2) Direct Replacements – Replacement of worn/defective belts, filter elements, degraded hoses, corroded/leaking pipe, failed compressors, dryers, valves, etc. (3) Repairs on Non-OE Compressors – refurbishment of failed compressor. (4) Distribution System Repairs – Corrosion control requiring light sanding and paint. (5) Controls Errors – See APPENDIX A.
2	(1) Repeat Equipment/Parts failures. (2) Capacity Problems – System cannot meet users' demand. (3) Environmental or Safety related compliance issues. (4) Controls Errors – See APPENDIX A.
3	(1) Corrective actions requiring major changes in configuration - Such as upgrades to controls, compressors, pressure vessel, and piping. (2) Failures that result in loss of support requirements to OE facilities - Total failure of compressed air system that provides pneumatic activation of fire protection deluge system, loss of compressed air supply supporting mission essential activity, etc. (3) Controls Errors – See APPENDIX A.

APPENDIX D: ELEVATOR SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE *ELEVATOR SYSTEMS*	
TAL	**CRITERIA**
1	(1) Mechanical Adjustment Issues - Problems resolved through minor mechanical adjustments, lubrication, cleaning to restore proper configuration and operation (e.g., limit switch adjustment, debris removal, door alignment, etc.). (2) Trapped Passenger - Elevator failures resulting in trapped passengers where technicians resolve the problem without engineering support. (3) Controls Errors – See APPENDIX A.
2	(1) Previously identified problems associated with a change in code where ERB has already approved of mitigation/corrective action plan. (2) Original Equipment Manufacturer (OEM) Support - Any failure that requires the OEM representative to provide on-site support to resolve. (3) Trapped Passenger - Elevator failures resulting in trapped passengers where technicians require engineering support to resolve the problem. (4) Controls Errors – See APPENDIX A.
3	(1) Regulatory Compliance - An Elevator compliance problem resulting in a regulatory citation and/or fine. (2) Critical Processing Impact - Any failure that resulted in damage or compromise of integrity to critical processing and/or flight hardware. (3) Newly identified problem associated with a change to code that hasn't previously been addressed by the ERB. (4) Controls Errors – See APPENDIX A.

APPENDIX E: EXTERIOR ENCLOSURE SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE *EXTERIOR ENCLOSURE SYSTEMS*	
TAL	**CRITERIA**
1	(1) Caulking. (2) Minor leaks or insignificant damage repairs. (3) Other similar routine problems.
2	(1) Any anomaly where there is significant structural damage to the exterior envelope including doors, windows, etc. (2) Anytime there are three or more leaks in the same window or door.
3	(1) Major damage to OE facility exterior.

APPENDIX F: FIRE SUPPRESSION PROTECTIVE SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDEANCE TABLE *FIRE SUPPRESSION PROTECTIVE SYSTEMS*	
TAL	**CRITERIA**
1	(1) Device working outside intended functional parameters - Device adjusted and/or replaced and tested in accordance with manufacturer's instructions such as flow/pressure switch, time delay relay, outside of spec, low cylinder pressure, maintenance pump setting. (2) Problems corrected using approved internal technical documents listed on work order - Repaired and tested according to documented shop standard. (3) Minor corrosion control - Painting, sanding, wire brushed, relabeled, etc. (4) Problems corrected by replacement of seals or gaskets showing signs of minor leakage or damage in accordance with manufacturer's instructions - Main drain or Inspectors Test drips, solenoid operating but does not seat, minor pressure leak at fitting. (5) Inadvertent fire pump starts resulting from downstream water use where no damage to hardware occurred.
2	(1) System found out of documented configuration standard - Unauthorized change to protected area or equipment/hazard protected. (2) Device or system failure causing an emergency evacuation. (3) System or device operating in a previous unobserved fashion - Pressure spike, unusual noise or system status indicator. (4) Improper operation of any required built-in personnel safety device/parameter - Carbon Dioxide (CO2) system time delay, pressure that exceeds specification. (5) Any repair to a system protecting designated OE, USSF ME equipment where protected zone encompasses flight hardware - Deluge system at Multi-Payload Processing Facility (MPPF). (6) Any hardware damage that occurs as a result of Fixed Price Contractor (FPC) work that requires more than 8 man-hours of labor to repair or restore service - Cut cable, inadvertent system activation resulting in no hardware damage. (7) Inadvertent fire pump start resulting from failed hardware, transmitters, or transducers, where no damage to equipment occurred.
3	(1) Any inadvertent fire suppression or deluge release. (2) Inadvertent fire pump start resulting in damage to hardware.

APPENDIX G: HEATING, VENTILATION & AIR CONDITIONING (HVAC) SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE *HEATING, VENTILATION & AIR CONDITIONING SYSTEMS*	
TAL	**CRITERIA**
1	(1) Initial Troubleshooting - Non-OE equipment and systems, such as no cooling, failed or unexpected operation. (2) Simple Requests - Override scheduled temperature setbacks, Set point changes on Non-Configured systems, data collection. (3) Repairs on kitchen refrigeration - Ice machines, Reach-in coolers, Walk-in coolers. (4) Repair minor wear/deterioration - Insulation, Corrosion requiring light sanding and paint. (5) Controls Errors – See APPENDIX A.
2	(1) Repeat Equipment/Parts failures - Motors, Drive train, controls. (2) Major Water leaks - When repairs require outages and drain plans. (3) Environmental or Safety related compliance issues. (4) Controls Errors – See APPENDIX A.
3	(1) Corrective actions requiring major changes in configuration - Such as upgrades to controls, power system, and piping. (2) Failures that result in loss of support requirements to OE facilities - Total failure of chilled water system affecting facility with sensitive humidity control. (3) Controls Errors – See APPENDIX A.

APPENDIX H: INTERIOR FINISHES AND INTERIOR SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE *INTERIOR FINISHES AND INTERIOR SYSTEMS*	
TAL	**CRITERIA**
1	All problems associated with this category are considered level 1. History has shown that the significant problems in this category have a root cause from an outside source or other system and therefore shall be addressed under that specific system with the corresponding TAL.

APPENDIX I: LOW VOLTAGE ELECTRICAL SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE *LOW VOLTAGE ELECTRICAL SYSTEMS*	
TAL	**CRITERIA**
1	(1) Routine adjustment of equipment authorized by preventative maintenance instructions (PMI) or job plan - Lubrication, set screw adjustments, replace filters, etc., where trending is not an issue. (2) Minor corrosion control - Superficial corrosion requiring light sanding and painting (3) Relabeling equipment or updating directories. (4) Reset of tripped circuit breaker - Reset of overloaded convenience circuits where no damage or trending is found. (5) Motor replacements meeting normal expected service life. (6) KCCS loss due to COMM failure requiring outside organizational support or available direct part replacement to resolve. (7) Infrared findings - INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA) defined level 1 or 2. (8) Controls Errors – See APPENDIX A.
2	(1) Equipment/component failure - OE or USSF ME equipment fails to maintain operating conditions, branch circuit failures. (2) Unscheduled outages - Loss of branch feeders, total loss of facility power, loss of redundant feeders, generator failures, Uninterrupted Power Supply (UPS) units greater than 5 Kilo Volt Amperes (KVA) failures, transfer switch failures. (3) Motor control failures - Starter or circuit breaker settings issues and repetitive failure issues. (4) Reoccurring failure - Component or hardware is not meeting its normal life expectancy and failing frequently. (5) Excessive corrosion - Corrosion with pitting, galvanic corrosion, coating issues, excessive degradation. (6) Code compliance issue - Any (National Electric Code (NEC)/NETA/National Electrical Manufacturers Association (NEMA) compliance issues requiring engineering disposition to correct. (7) KCCS loss - Server issues or network issues related to the system in question. (8) Procedural error - System failures or near misses associated improperly written procedures or improperly followed procedures. (9) Infrared findings - Any NETA defined finding of 3 or above indicating a need for hastened or immediate attention. (10) Controls Errors – See APPENDIX A.
3	(1) Failures with Mission Support impacts - Loss of systems or components with direct impact to OE or USSF ME facility support requirements. (2) High visibility failures requiring corrective action responses to the customer as directed by the Lead SE. (3) Controls Errors – See APPENDIX A.

APPENDIX J: HIGH VOLTAGE ELECTRICAL SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE *HIGH VOLTAGE ELECTICAL SYSTEMS*	
TAL	**CRITERIA**
1	(1) Routine adjustment of equipment authorized by PMI - Lubrication, set screw adjustments, replace filters, etc., where trending is not an issue. (2) Minor corrosion control - Surface rust, paint touch-up. (3) Relabeling equipment - Repainting of equipment identifiers, reinstallation of labels. (4) KCCS loss - Due to COMM failure related to outside organizational support or shop part replacement. (5) Infrared findings - NETA defined level 1 or 2. (6) Transformer Oil Sample - Recommended retest after 1st sampling. (7) Controls Errors – See APPENDIX A.
2	(1) Equipment/component failure - OE or USSF ME equipment fails to maintain operating conditions. (2) Unscheduled outages - All protective relay actions. (3) Reoccurring failure - Equipment/part failure rate is higher than normal frequency. (4) Excessive corrosion - Corrosion with pitting, galvanic corrosion, coating issues, excessive degradation. (5) Code compliance issue - Any NEC/NETA/NEMA compliance issues requiring engineering disposition to correct. (6) KCCS loss - Direct failure of medium voltage hardware or software. (7) Procedural error - System failures or near misses associated improperly written procedures or improperly followed procedures. (8) Infrared findings - Any NETA defined finding of 3 or above indicating a need for immediate attention. (9) Controls Errors – See APPENDIX A.
3	(1) Failures with OE (OE) impacts to support - Loss of systems or components with direct impact to mission support. (2) Significant code compliance issue - NEC/NETA/NEMA/Underwriters Lab (UL) non-compliance that has the potential to impact support mission requirements. (3) Supporting mission out of approved design configuration - Loss of redundancy, Feeder 606 down from splice short therefore Configured system to transfer load to Feeder 518. (4) Inability to meet Commercial/Industrial Load Control (CILC) requirements. (5) Significant events that affect upstream or downstream connected utility suppliers or users. (6) Controls Errors – See APPENDIX A.

APPENDIX K: MOBILE/HEAVY EQUIPMENT SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE *MOBILE/HEAVY EQUIPMENT SYSTEMS*	
TAL	**CRITERIA**
1	(1) Minor corrosion control corrective action - Superficial corrosion requiring light sanding and paint. (2) Replacement of warning signs, labels, stickers, etc.
2	(1) Reoccurring equipment failures in the same area - light bulbs continue to burn out, indicators failing on high frequency, etc. (2) Major corrosion control corrective action - Severe corrosion affecting structural integrity of hardware. (3) Regulatory issues - American Society of Mechanical Engineers (ASME), Occupational Safety and Health Administration (OSHA), National Fire Protection Association (NFPA), NASA-STD-8719.9 STANDARD FOR LIFTING DEVICES AND EQUIPMENT, Use of equipment with expired Certification, etc. (4) Failure of equipment that is directly utilized for mission support or a non-mission support equipment failure of a major component such as engine or transmission.
3	(1) There are no specific TAL3 criteria for this system.

APPENDIX L: PAVEMENT SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE *PAVEMENT SYSTEMS*	
TAL	**CRITERIA**
1	(1) Repair of potholes, shoulder, etc. (2) Replace illegible, or damaged signage. (3) Other similar problems resolved without SME support.
2	(1) Any anomaly involving the sinking or settlement of the paved surface.
3	(1) Major failure preventing traffic to OE area with potential impact to mission operation.

APPENDIX M: PROTECTIVE SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE *(Fire Detection, Security, Traffic, Tornado Area Warning System (TAWS))* *PROTECTIVE SYSTEMS*	
TAL	**CRITERIA**
1	(1) Devices working outside intended functional parameters - Adjusted and/or replaced and tested in accordance with manufacturer's instructions. Device cleaned and/or replaced. (2) Problems corrected using approved technical documents listed on work order - Repaired and tested according to documented shop standard. (3) Problems corrected by reestablishing mechanical operations in accordance with code and/or manufacturer's installation instructions - Reset manual pull station, plunger reset, pressure switch restored, etc.). (4) Minor corrosion control - Painted, wire brushed, relabeled, etc. (5) Emergency evacuation, associated system shutdown or Fire/Security response due to alarm caused by construction work, user error (e.g., manual pull station activated) or other situations where the system worked as designed.
2	(1) Device or system failure causing an emergency evacuation, associated system shutdown or Fire/ Security response - Fire alarm evacuation, Air Handler Unit (AHU) shutdown, Traffic intersection failure requiring security, card reader failure requiring security to man post, etc. (2) Duct Smoke Detector Special Case - When a duct smoke detector alarms due to condensing water, the TAL 2 action shall be transferred to the HVAC SE for resolution. (3) Reporting/ communications failure - 2120 point failure, network or radio fire reporting failure, Security communications failure, TAWS communications failure, etc. (4) System or device operating in a previous unobserved fashion. Marked for Engineering Attention - Traffic Signal light cycling to early/late, Intelligent System Controller persistent intermittent power loss).
3	(1) There are no specific TAL3 criteria for this system.

APPENDIX N: ROOF SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE *ROOF SYSTEMS*	
TAL	**CRITERIA**
1	(1) Roof leaks: minor, no significant damage. (2) Repair or replacement of leaking gutters, downspouts, flashing, vents, hydrostop coating, sealants, caulking, ceiling tiles, Gazebo, skylights. (3) Application of sealants, caulking.
2	(1) Any anomaly where there is significant structural damage to the roof. (2) Reoccurring leaks on the same roof in the same area. (3) Any roof leak on an OE facility in vicinity of flight hardware or hardware supporting flight operations. (4) Roof leaks on electrical equipment such as Comm. equipment, fire alarm control cabinets, servers etc.
3	(1) Structural damage to OE facility. (2) Roof leaks resulting in damage exceeding $10,000. (3) Any roof leak on an OE facility where damage occurs to flight hardware or hardware supporting flight operations.

APPENDIX O: STORMWATER SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE *STORMWATER SYSTEMS*	
TAL	**CRITERIA**
1	(1) Repairs to culvert. (2) Drain system responses to restrictions.
2	(1) Any anomaly which causes a violation of existing Environmental Resource Permit (ERP) or other permit: Kentucky Diatom Bioassessment Index (DBI), Control Structures, Skimmers or other elements.
3	(1) Stormwater violations resulting in fines.

APPENDIX P: STRUCTURES AND TOWER SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE *STRUCTURES AND TOWER SYSTEMS*	
TAL	**CRITERIA**
1	(1) Preventative Maintenance (PM) driven engineering requirements. (2) Repairs indicated on PMs.
2	(1) Any anomaly where there has been significant structural damage, severe corrosion, or structural evaluation is needed. (2) Any anomaly where the repair is something other than return to print.
3	(1) Structural integrity defect resulting in significant reduction of load carrying capacity.

APPENDIX Q: WASTEWATER SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE WASTEWATER SYSTEMS	
TAL	**CRITERIA**
1	(1) Replacement or repair of hardware authorized in PM - packing gland adjustment, replacement of packing, valve handle replacement, pump or motor repair/rebuild, pump/motor alignment, hose/flexline replacement, drainpipe replacement, sump pump replacement, pressure gage replacement, gasket/seal replacement, indication light replacement, etc.
2	(1) Sewage spills or other possible Department of Environmental protection (DEP) violations. (2) Repeated blockages of wastewater collective system. (3) Disruption of service to OE or USSF ME facility. (4) Problems requiring design change to resolve - System capacity not capable of handling flow or demand during peak times. (5) Breach in containment or sump resulting in leakage of wastewater. (6) Sewer Main rupture.
3	(1) Spills resulting in fines. (2) Significant events that affect upstream or downstream connected utility suppliers or users - Main distribution line break resulting in loss of service to multiple sites, substance, material, or agent within distribution system resulting in disruption of treatment capability at main plant.

APPENDIX R: WATER SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE *WATER SYSTEMS*	
TAL	**CRITERIA**
1	(1) Replacement or repair of hardware authorized in pm - packing gland adjustment, replacement of packing, valve handle replacement, backflow preventer repair/rebuild, pump/motor alignment, hose/flexline replacement, drainpipe replacement, sump pump replacement, pressure gage replacement, safety shower/eyewash repair or replacement, gasket/seal replacement. (2) Minor corrosion - Coating issues, degradation on non-pressurized hardware; removal and replacement of hardware for Non-OE facility, and touch-up recoating of light surface corrosion. (3) Line break with pipe diameter 3 inches or less. (4) Minor Regulatory Code violations - Labeling, signage, etc., minor infractions with no fines.
2	(1) Line break with pipe diameter greater than 3 inches. (2) Pressure loss in line less than 20 Pounds per Square Inch Gauge (PSIG) supplying a facility. (3) Water quality standards out of acceptable limits per UTI-P-0004, *Water Treatment Plant Operations Plan*. (4) Support to Fixed Price Contractor requiring more than 8 man-hours of labor to repair or correct damage caused by FPC - includes securing and restoring service, repairs, additional validations or retest beyond original scope of project. (5) Regulatory Code violations resulting in fines. (6) Major corrosion - Severe oxidation of hardware supporting OE facility.
3	(1) Line breaks resulting in significant unscheduled outages to multiple facilities or facilities housing flight hardware. (2) Significant events that affect upstream or downstream connected utility suppliers or users .

APPENDIX S: PRESSURE VESSEL SYSTEMS

TECHNICAL ANOMALY LEVEL GUIDANCE TABLE *PRESSURE VESSEL SYSTEMS*	
TAL	**CRITERIA**
1	(1) There are no specific TAL1 criteria for this system.
2	(1) Pressure Vessel System (PVS) related items identified through design engineering Pressure Vessel System Certification (PVSC) inspections. (2) PVS Certification expired or not performed on low pressure systems less than or equal to 150 PSIG.
3	(1) Certification expiration (e.g., PVSC, equipment calibrations, hydrostatic tests, validations, proof tests) for systems with pressures greater than 150 PSIG.

RECORDS

The following records are retained by the organizations listed below:

Record	Responsible Organization	NRRS/Item#	Retention Period
Maximo Work Order	BOSS Work Control	08/107.0	TEMPORARY. DESTROY/DELETE BETWEEN 0 AND 30 YEARS AFTER PROGRAM/PROJECT TERMINATION.

ROLES AND RESPONSIBILITIES

System Engineer: Identifies and investigates technical anomalies, dispositions TAL Closure Summaries, prepares and presents TAL3 closure presentations at ERB.

System Engineering Manager: Ensures content of TAL Closure Summaries meets the requirements of the procedure and adequately explain the anomaly and resolution.

Chief Engineer: Ensures content of TAL Closure Summaries meets the requirements of the procedure and adequately explain the anomaly and resolution.

REFERENCE DOCUMENTS

The following documents are referenced in this procedure:

Document Number	Title
ENG-I-0026	SHARP Team Instruction
ENG-P-0002	Configuration Management of Facilities/Systems/Equipment/Utilities (FSEU)
ENG-P-0019	BOSS Engineering Review Board (ERB)
ENG-P-0039	BOSS Material Review (MR) and Material Review Board (MRB)
ENG-REF-0027	Problem Reporting Training
MSI-I-0001	Master Schedule Integration Planning and Scheduling Instruction
MSO-P-0002	Outage Procedure
SMA-P-0016	Event and Near Miss Reporting and Investigation
UTI-P-0004	Water Treatment Plant Operations Plan
WCC-P-2002	BOSS Electronic Work Order Procedure

ACRONYMS

AHU	Air Handling Unit
ASME	American Society of Mechanical Engineers
BOSS	Base Operations Support & Services
CILC	Commercial/Industrial Load Control
DEP	Department of Environmental Protection
DBI	Diatom Bioassessment Index
ECD	Estimated Completion Date
ERB	Engineering Review Board
ERP	Environmental Resource Permit
ETC	Emergency Trouble Call
FPC	Fixed Price Contractor
FSEU	Facilities, Systems, Equipment and Utilities
HVAC	Heating, Ventilation, and Air Conditioning
KCCS	Kennedy Complex Control System
KSC	Kennedy Space Center
KVA	Kilo Volt Ampere
ME	Mission Essential
MR	Material Review
MRB	Material Review Board
NASA	National Aeronautics and Space Administration
NEC	National Electric Code
NEMA	National Electric Manufacturers Association
NETA	InterNational Electric Testing Association
NFPA	National Fire Protection Association
OE	Operationally Essential
OEM	Original Equipment Manufacturer
OSHA	Occupational Safety and Health Administration
PCR	Problem-Cause-Remedy
PM	Preventive Maintenance
PMI	Preventive Maintenance Instruction
PSIG	Pounds per Square Inch Gauge
PVS	Pressure Vessel System
PVSC	Pressure Vessel System Certification
PWS	Performance Work Statement
REP	Repair
RTC	Routine Trouble Call
SE	System Engineer
SMA	Safety & Mission Assurance
TAL	Technical Anomaly Level
TAWS	Tornado Area Warning System
UPS	Uninterrupted Power Supply
USSF	United States Space Force

DEFINITIONS

Closure Summary: A complete summary of the details associated with the rationale for closing a technical anomaly. This includes the Problem Description, the Probable Cause of the problem, the Corrective Action taken to resolve the problem, and Preventative Action taken to reduce the likelihood of a reoccurrence.

Corrective Action: Action taken to restore a system or piece of equipment to service.

Equipment: A tangible asset that is functionally complete for its intended purpose, durable, nonexpendable, and needed for the performance of a contract.

Failure: The inability of a system, subsystem, component, or part to perform the required function within specified limits and conditions for a specified duration.

Mission: An operation intended to carry out specific program objectives.

Mission Constraint: An anomaly or event on a facility system that has the potential to delay or prevent a customer planned mission objective from occurring on scheduled time.

Mission Essential: Term used to address a facility, system, or equipment that is required to accomplish a specific mission. This specifically addresses USSF facilities.

Operationally Essential: Facility System, Hardware, Software, or Personnel that are required to support a mission objective.

Preventive Action: Action taken to reduce the likelihood of a reoccurrence of a problem.

Problem: Any anomaly on design, project or operational hardware, software, facilities, systems, procedures, or processes. An event that is occurring or has occurred, as opposed to a “risk” that is a future event that has a likelihood and consequence.

Process Escape: Any problem found after it should have been detected during normal processing. Escapes include problems found during surveillance sampling, inspection (including random), or audit after closeout or test. Also, if an assessment determines that the problem would not have been caught during closeout or test, the problem shall be considered a process escape.

Return to Print: Removal and replacement of like item or rework using standard repair or maintenance procedure.

Probable Cause: A fundamental deficiency that results in an anomaly and must be corrected to prevent recurrence of the same or a similar anomaly.

Technical Anomaly: An unexpected event, hardware or software damage, a departure from established procedures or performance, or a deviation of system, subsystem, and/or hardware or software performance outside certified design/performance specification limits.

Trouble Call: Unplanned requests for non-facility work (not of a facility maintenance or repair nature).

Unexplained Anomaly: A technical anomaly that has been investigated in depth but has not revealed an underlying probable cause.

REVISION RECORD

The following revisions have been applied to this document:

Revision Number	Change Description	Date
0-9	Previous Contract.	NA
10	Update to BOSS, Expansion of process flow and terminology	05/22/19
11	Update to remove Engineering scheduler function	08/22/19
12	Complete revision. - Added instructions for using the new TAL Workflow in Maximo. - Added requirements for new Pending Repair status. - Clarified upgrade/downgrade process. - Clarified instructions for disposition of duplicate TAL WONs. - Added requirement to add related WONs in Related Records tab. - Moved PVS TAL2/3 requirements from General Criteria to Appendix S.	06/01/23
13	- Added instructions to allow early closure of TAL WONs. - Added criteria to allow creation of multiple TAL WONs with a single Event Report.	04/15/24

DOCUMENT APPROVALS

X

Sandra Burchfield
Division Manager, Engineering

X

Randy Christianson
Chief Engineer