

# Engineering Process Guide: Lithium Battery Safety Program

## Background

This process guide focuses on the needs of the Small Business Innovation and Research (SBIR) companies and their sponsoring government Program Managers (PMs) and Technical Points of Contact (TPOCs) in navigating the Lithium Battery Safety Process (LBSP). Lithium batteries present a risk of fire to personnel, vessel/platform, or facility. All lithium batteries (including lithium-ion batteries) must be used IAW Naval policy as communicated in Naval Sea Systems Command (NAVSEA) INST 9310.1c and Technical Publication S9310-AQ-SAF-010 (Navy Lithium Battery Safety Program Responsibilities and Procedures) prior to use, presence, or transport on Naval vessels/platforms (surface, subsurface, air) and Naval facilities, regardless of source. This includes all primary (non-rechargeable) and secondary (rechargeable) batteries. It also includes active, thermal, and reserve lithium batteries as well as equipment powered by lithium electrochemical power sources.

Refer to the NAVSEA Technical Publication<sup>1</sup> for exceptions to testing, review and certification requirements, and best practices. This guide includes three appendices for reference: APPENDIX A provides a process flowchart; APPENDIX B provides information on battery types; and APPENDIX C provides a summary of LBSP process guidance and outlines some exceptions.

## The Process

**Lithium batteries** must adhere to the Navy's safety guidelines under the LBSP Responsibilities and Procedures for selection, design, testing, evaluation, use, packaging, storage, transportation, and disposal.<sup>2</sup> The process for confirming compliance under Battery Safety Guidelines is handled through the Naval Surface Warfare Center (NSWC) Carderock and Crane Divisions and takes approximately 90 days to complete. See Appendix A for a flow chart of the standard process.<sup>3</sup>

The standard process requires a Safety Data Package (SDP), which can be large and time-consuming for experimentation event participants to prepare, as well as for the LBSP team at NSWC Crane/Carderock to assess. In a move toward expeditious processing, the LBSP team has put into place a **tailored** process in relation to Fleet Experimentation (FLEX) and Advanced Naval Technology Exercises (ANTX) events. The battery information for all participants in the event will be gathered into a spreadsheet maintained by NSWC Carderock or Crane and one request letter will be sent with the accompanying spreadsheet for the event. Note: not every event will use the tailored process. In some cases, the standard process will be required.

The information required on the spreadsheet for the tailored process is as follows:

- **Vendor Info** – Address and website for the maker/seller of the battery
- **System** – The system that the battery powers

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<sup>1</sup> S9310-AQ-SAF-010, Rev 3 of 3, Nov 2020

<sup>2</sup> S9310-AQ-SAF-010, Rev 3 of 3, Nov 2020

<sup>3</sup> S9310-AQ-SAF-010, Rev 3 of 3, Nov 2020

- **Battery Manufacturer** – Name of manufacturer (likely will match vendor info, but not always)
- **Battery P/N** – Part number of the battery, which can normally be seen on the battery itself
- **End-Device Manufacturer** – Manufacturer of the device/system that the battery powers
- **End-Device P/N** – Part number for the device/system that the battery powers
- **UL Number** (if available) – Underwriters Laboratory provides a commercial third-party battery certification
- **Battery Chemistry** – Describes what the battery is made of: Lithium-ion, Lithium Polymer, Lithium iron phosphate, Lead Acid, etc. (See Appendix B for more descriptions of types)
- **Quantity** – Notates how many batteries, including any backup batteries
- **Electrical Energy Content** – May need to convert Amp Hours (Ah) or Milliamp Hours (mAh) to Watt Hours (Wh) and be sure total quantity of batteries is figured into calculations. Wattage calculators can be found on the internet, with an example [here](#).
- **Storage/Location for Charging** – The agreed location on the ship or at the facility for battery storage and charging; as well as what type of fireproof box the SBIR will provide for storage and charging. This is very important, and the model and part number of the chosen storage box MUST be provided.

In some cases, the SBIR may have recently participated in the same event at an earlier date, and maybe even on the same platform. This may cause the SBIR and others to assume that the information does not need to be submitted. This is a false assumption. The information may still be in the database, and it may help speed up the process; however, none of the previous information can be evaluated or found in the database until it is listed on the event spreadsheet. Therefore, it is essential for the SBIR and/or TPOC to fill out battery information completely and within the requested time limit to ensure smooth processing of battery information for the entire event.

## Organization and Process POCs

A good starting point for contact with the LBSP team is to send an email to [libatts@navy.mil](mailto:libatts@navy.mil). This is the general LBSP address which is checked daily.

## Locations of Process Facilitation

Naval Surface Warfare Center, Carderock Division  
Attn: Code 636  
Bldg. 11  
9500 MacArthur Boulevard  
West Bethesda, MD 20817-5700

Naval Surface Warfare Center, Crane Division  
Attn: JXM Bldg. 3235  
300 Highway 361  
Crane, IN 47522-5000

## Timeline

The process takes about 90 days from request letter and package submission to the granting of certification. If more information is needed by the reviewers, the process could take longer. It is important to submit complete information as soon as possible to minimize processing time.

## Challenges

Contract End Date – Ensure SBIR has enough contract length available to accommodate both the LBSP process and participation in the event.

Schedule – Allow enough time to research battery information to get through the LBSP review and still make it to the experimentation event.

Technical – Accurate battery information may seem difficult to obtain, especially if it is an unfamiliar undertaking. Product information and specification sheets are helpful and can sometimes be found online at the manufacturer's website. If not, contact them by phone.

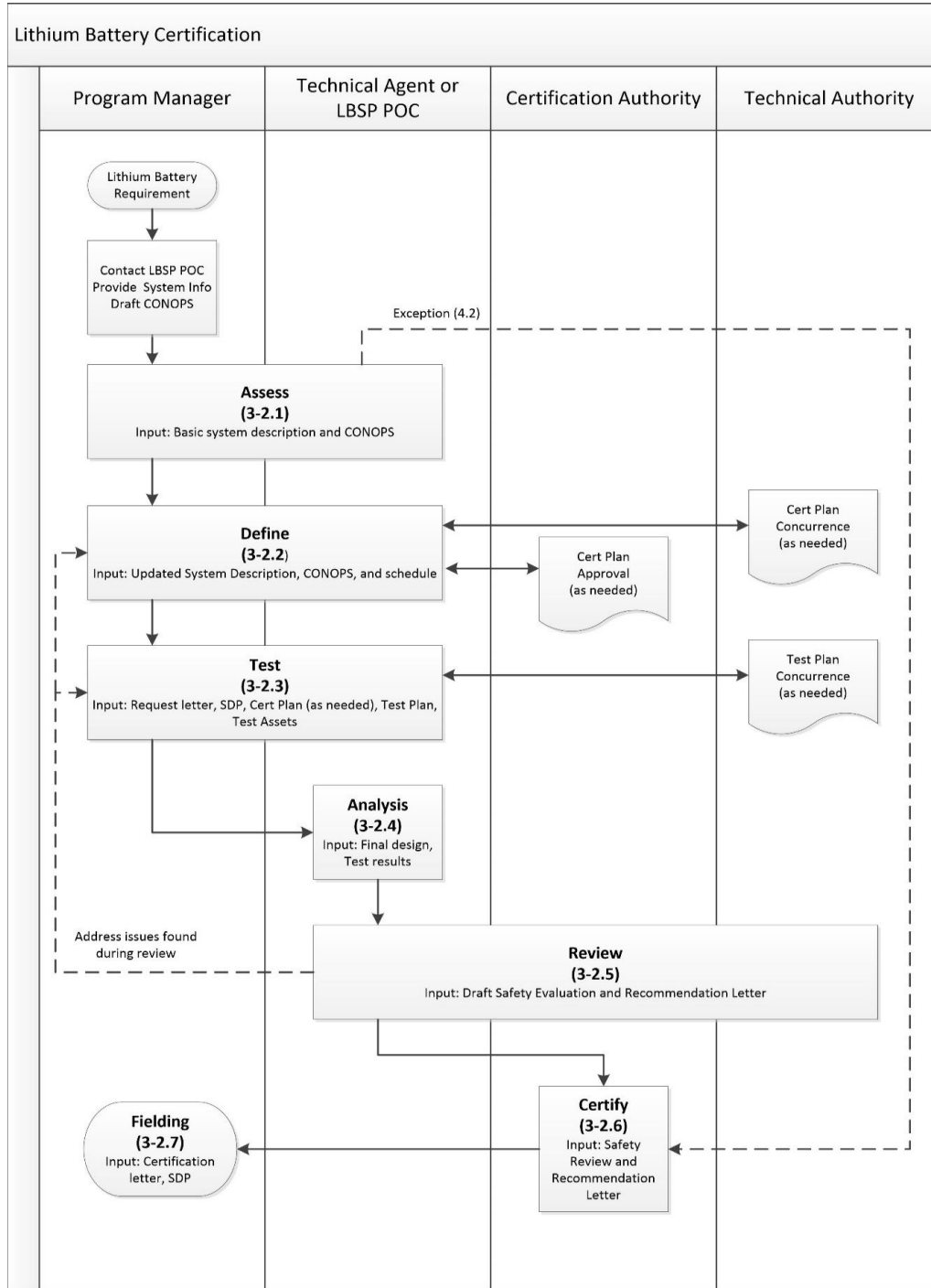
## How to get started

Work with sponsoring organization, TPOC, and the Deputy Technical Agent for the Navy's Lithium Battery Safety Program to get the Command Letter and Data Package completed. This usually starts with the email listed in the above Process POCs.

## References

1. Commander, Naval Sea Systems Command. (2015, August 12). NAVSEAINST 9310.1C: Naval Lithium Battery Safety Program.
2. Commander, Naval Sea Systems Command (SEA 05Z). (2021, August 25). Implementation of the Criteria for Application for Naval Research and Development Establishment Lithium Battery Safety Certification, NAVSEA Itr 9070 Ser 05Z/472.
3. Commander, Naval Sea Systems Command (SEA0SZ). (2011, April 27). Promulgation Of High Energy Storage System Safety Manual, 9310, Ser 05Z/067.
4. Commander, Naval Sea Systems Command. (n.d). SG270-BV-SAF-010: High-Energy Storage System Safety Manual.
5. Commander, Naval Sea Systems Command. (2017, April 11). Interim Safety Requirements for Aggregate Stowage of Lithium Batteries on Submarine and Surface Vessels. 9310, Ser 05Z/219.
6. Commander, Naval Sea Systems Command (SEA0SZ). (2019, November 7). 05Z Standard Operating Procedure 19-02 Lithium Battery Safety Certification on Ships and Submarines, 9077, Ser SOP/19-02.
7. Commander, Naval Sea Systems Command (SEA 05Z). (2022, July 25). Update to Process for Lithium Battery Safety Certification Extensions, 9070 Ser 05z/328.
8. Commander, Naval Sea Systems Command (SEA 05Z). (2023, July 7.) Preferred Batteries for Applications Requiring Lithium Power Sources, 4120, Ser 05z/242.
9. Commanding Officer, Naval Ordnance Safety and Security Activity (NOSSA). (2015, September 14). Lithium Battery Safety Program Requirements for Ordnance and Weapon Systems, NOSSA INST 9310, LTR N841-1311.
10. Flux Power. (2019, November 27). *Lithium-ion Battery Materials and Why Their Chemistry Matters*. <https://www.fluxpower.com/blog/lithium-ion-battery-materials-and-why-their-chemistry-matters>
11. Naval Sea Systems Command (NAVSEA). (2020, November 3). S9310-AQ-SAF-010: Navy Lithium Battery Safety Program Responsibilities and Procedures. Rev 3 of 3.

## APPENDIX A



*Figure 1 Lithium Battery Safety Program Process<sup>4</sup>*

<sup>4</sup> S9310-AQ-SAF-010, Nov 2020

## APPENDIX B

Some lithium battery information that may be of interest:

### Lithium-ion Battery Materials

- Lithium iron phosphate (LFP)
  - More compact and energy dense. Good for equipment like forklifts and power jacks. Has low resistance, longer life cycle, and greater thermal stability.
- Lithium nickel manganese cobalt oxide (NMC)
  - Very energy dense with high-level performance. Good for electric vehicles like e-bikes and cordless power tools.
- Lithium cobalt oxide (LCO)
  - Ideal for mobile phones, laptops
- Lithium manganese oxide (LMO)
  - Inexpensive, non-toxic, used in smoke alarms and security devices
- Lithium nickel cobalt aluminum oxide (NCA)
  - Ideal for electric cars, cordless vacuums
- Lithium titanate (LTO)
  - Ideal for electric cars and charging stations, wind and solar storage, traffic signals

Material handling equipment is typically powered by either lithium iron phosphate or lithium nickel manganese cobalt oxide chemistries.

Lithium-ion batteries are rechargeable. When recharging, the lithium-ions go through the same process, but in the opposite direction. This action restores the battery for additional use.<sup>5</sup>

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<sup>5</sup> <https://www.fluxpower.com/blog/lithium-ion-battery-materials-and-why-their-chemistry-matters>

## APPENDIX C

### Lithium Battery Safety Certification Guidance from NSWC

(NOTE: links have been adapted to document numbers for PDF)

The U.S. Navy requires safety certification for all lithium batteries prior to use. This requirement is defined in NAVSEA INST 9310.1c. This instruction applies to all Navy and Marine Corps activities and all lithium battery powered devices intended for use or transport on Navy facilities, ships and aircraft, regardless of source. Material to which this instruction applies includes all primary and secondary, active, thermal and reserve lithium batteries, and all equipment powered by lithium electrochemical power source(s) throughout all phases of the life of such systems. The full text may be viewed in NAVSEA INST 9310.1c.

There are three paths to lithium battery safety certification which are summarized below. The processes are defined by NAVSEA Technical Manual S9310-AQ-SAF-010 Rev 3 of 3 Nov 2020 and the full text can be viewed.

**CASE 1: Exceptions.** Batteries meeting certain criteria as listed below are blanket approved, but are required to be reported.

**CASE 1a: Blanket certification for certain coin cells used in single cell and two-cell applications.**

Section 4-2.1 of NAVSEA TM S9310-AQ-SAF-010 Rev 3 provides blanket certification for the use of lithium coin cell batteries meeting the following criteria including authorization for naval personnel and on naval activities, surface ships, submarines, and aircraft:

- a. Unmodified, commercial-off-the-shelf (COTS) item;
- b. Used in single cell or two-cell configurations;
- c. Maximum nominal output voltage of 3 volts;
- d. Maximum rated capacity of 1 ampere-hour (Ah).

This option only requires reporting of the initial procurement of the items. This data will be compiled to provide a basis for notice and recall in the case of unexpected incidents. The report shall include the listed information and can be emailed to libatts@navy.mil.

- a. Manufacturer/brand name of the device and battery
- b. Model identification (name and number) of the device and battery
- c. UL file number, or equivalent marking/listing for third party testing
- d. Use scenario/environment including platform (e.g., laptop for office use, system equipment on surface ship, etc.)
- e. Point of contact (name, email and phone number)

**CASE 1b: Blanket certification for COTS Electronics and Equipment Powered by Lithium-Ion Batteries.**

Section 4-2.2 of NAVSEA TM S9310-AQ-SAF-010 Rev 3 provides blanket certification the use of COTS

electronics and equipment powered by lithium ion secondary (rechargeable) batteries meeting the following criteria for use by Naval personnel and on Naval activities, surface ships, submarines, and aircraft:

- a. Commercially available, UL listed or equivalent, unmodified, and used in the device as recommended by the manufacturer. Modifications to the devices may only be made IAW manufacturer's recommendations (addition of memory, etc.)
- b. Recharged only by devices expressly designed for recharge of the specific battery in use
- c. Less than or equal to 21-volt nominal output
- d. Rated for no more than 100 Watt-Hours (as listed in the manufacturer's specification or calculated by multiplying capacity in ampere-hours by the maximum working voltage)

Batteries meeting the above criteria shall be exempt from safety testing and evaluation processes, but initial procurement must be reported. This data will be compiled to provide a basis for notice and recall in the case of unexpected incidents. Electronic notification is authorized. The report shall include the following and can be emailed to libatts@navy.mil.

- a. Manufacturer/brand name of the device and battery
- b. Model identification (name and number) of the device and battery
- c. UL file number, or equivalent marking/listing for third party testing
- d. Use scenario/environment (e.g., office computer or test set, submarine)
- e. Point of contact (name, organization, email, and phone number)

**CASE 1c: Blanket certification for certain primary (non-rechargeable) lithium batteries.** Section 4-2.3 of NAVSEA TM S9310-AQ-SAF-010 Rev 3 provides blanket certification for the use of systems powered by primary lithium batteries meeting the following criteria for use by Naval personnel and on Naval activities, surface ships, submarines, and aircraft:

- a. Batteries built using one single 9-volt PP3 size, snap connector battery or one or more (but no more than four) BR123 or BR2 type lithium/carbon monofluoride, CR123 or CR2 type lithium/manganese dioxide, or L91 type lithium/iron disulfide cells;
- b. UL listed cells;
- c. Each device can use only one type of battery, and each battery can use only one type of cell;
- d. Total energy content of the battery shall be no greater than 25 Wh; and System design is compliant with charging prevention of paragraph 4-1.3

Batteries meeting the above criteria shall be exempt from safety testing and evaluation processes, but initial procurement must be reported. This data will be compiled to provide a basis for notice and recall in the case of unexpected incidents. Electronic notification is authorized. The report shall include the following information and can be emailed to libatts@navy.mil.

- a. Manufacturer/brand name of the device and battery.
- b. Model identification (name and number) of the device and battery.
- c. UL file number, or equivalent marking/listing for third party testing
- d. Use scenario/environment (e.g. office computer or test set, submarine)
- e. Point of contact (name, organization, email and phone number)



**The following Best Practices for COTS Lithium Batteries are being disseminated due to the rapid growth of devices in this category:**

The following are recommended best practices and restrictions that apply to the use and storage of these items:

- a. For batteries that are removed for charging (such as power tools) ensure the battery and charger being employed are manufactured by the tool manufacturer and the charger is identified for charging the intended battery pack.
- b. Verify all batteries bear a UL listing, or equivalent third-party testing marking/listing.
- c. Inspect batteries for signs of droppage, physical damage or corrosion. Promptly remove poor performing, damaged or corroded batteries from service. Do not attempt repair.
- d. Devices/batteries shall be charged, stored, and/or used on non-combustible surfaces.
- e. Charging/storage areas shall be kept free of combustibles on the same surface, behind/near surface, and under surface (i.e., no papers in drawer beneath storage location).
- f. Manned charging should be performed when possible.
- g. Ensure adequate ventilation around charging areas to prevent overheating.

The following restrictions apply to usage and storage aboard ships and submarines:

- a. The quantity of batteries shall be limited in any single location (of batteries or charging stations) to an aggregate energy content of 1,000 Wh or less.
- b. The ships Damage Control Assistant (DCA) and Fire Marshal shall be informed of and approve the storage and charging locations of the lithium batteries. The chosen compartment shall not be within or contiguous to (aside or below) hazmat/flammable liquid storage compartments, ammunition magazines, fuel (ships or aviation) storage, pumping or handling areas, or any other areas the ship's DCA or Fire Marshall deem inappropriate. Access to a ship's telephone with access to Damage Control Central (DCC) shall be available.

**CASE 2: Naval Research and Development Establishment (NR&DE) Certification.** NAVSEA Itr 9070 Ser 05Z/472 of 25 Aug 21 was developed to support associated blanket lithium battery certifications and to facilitate DoN R&D efforts while maintaining the safety of personnel and facilities. It defines a streamlined process for the use of small lithium-ion batteries and lithium-ion battery powered systems to be non-destructively tested at NR&DE shore facilities and range craft usage. The NR&DE criteria is defined in enclosure (1) of NAVSEA Itr 9070 Ser 05Z/472 of 25 Aug 21. It is inclusive of all NAVSEA, Naval Air Systems Command (NAVAIR), Naval Information Warfare Systems Command (NAVWAR), Marine Corps System Command (MCSC), Office of Naval Research (ONR), Naval Research Laboratory's (NRL) and Naval Facilities Engineering Systems Command (NAVFAC) Naval technical labs, detachments, ranges, and the Naval Postgraduate School (NPS).

Following the receipt of an NR&DE Certification, personnel using batteries covered by NR&DE Certifications following these criteria are required to report the information listed below. The report shall include the following information and can be emailed to libatts@navy.mil.

1. Subject: NRDE Report for use of [battery/device or system] at [facility] [MM/YYYY]
2. Manufacturer/brand name of the device and battery

3. Model identification (name and number) of the device and battery
4. Battery characteristics: voltage, ampere-hours, configuration
5. Use scenario/environment
6. Total number of systems and batteries
7. Point of contact (name, organization, email, and phone number)
8. Local Battery Management Standard Operating Procedure (SOP) developed in accordance with these criteria and concurred to by one of the Technical Agents.

**Case 3:** All other batteries require the submission of a request letter and SDP. A sample request letter can be found in the appendices of S9310-AQ-SAF-010 Rev 3 and the SDP to accompany it is outlined in 5-1 SDP of S9310-AQ-SAF-010, Rev 3.

**CASE 3a: Batteries exempted from testing requirements.** Certain lithium batteries and lithium battery-powered equipment with the general design characteristics described in Case 4a1 or Case 4a2 are exempted from testing requirements.

Case 3a1: Equipment Designed for Commercial Use. Equipment designed for commercial use and procured from commercial sources carrying approval of Underwriters Laboratory that uses a primary (non-rechargeable) lithium battery of no more than two identical cells, with a maximum rated capacity of 3.0 ampere-hours per cell, shall be exempted. A single 9-volt PP3 size, snap connector battery is included in this category. For this exemption to apply, UL-approved equipment shall not be modified to include replacing the battery with one of a different chemistry or size.

Case 3a2: Equipment Designed for a Specific Navy (military) Use. Equipment designed for a specific Navy use, utilizing no more than two identical primary cells with a maximum rated electrical capacity of 3.0 ampere-hours per cell, shall be exempted provided that no other source of electrical power to the unit exists, or the battery is protected from other sources of electrical power by appropriate combinations of blocking diodes and resistors. This exemption applies to normal repair and maintenance of the equipment, including procurement and storage of replacement batteries.

**CASE 3b: Batteries not exempted from test requirements.** NAVSEA TM S9310-AQ-SAF-010 includes a standard test regime specifically for active primary, reserve, thermal and secondary (rechargeable) batteries. It may be determined that sufficient safety test data are available from other sources. Analyses or comparisons with comparable cells/batteries in comparable applications may be sufficient to eliminate the need for some or all testing. This will depend on the uniqueness, size, configuration, and application parameters. SDP submission is required to determine if testing can be waived.

**CASE 3c: Large form lithium batteries aboard Navy forces afloat.** NAVSEA 05Z34 has imposed additional requirements for batteries aboard Navy platforms (all vessels owned or leased by the Navy) with total stored electrical energy 1 kWh (kilowatt hour) or greater per single battery pack or a system with total stored electrical energy of 2 kWh or greater. Details are provided in the promulgation letter and manual. Additional interim requirements were issued for aggregate storage in 2017. The lithium battery safety certification approval process on ships and submarines is defined by NAVSEA 9077 ltr Ser SOP/19-02 of 7 Nov 19. See the following documents for additional information: 9310, Ser 05Z/067, 27 April 2011; HIGH-ENERGY STORAGE SYSTEM SAFETY MANUAL, SG270-BV-SAF-010; 9310, Ser 05Z/219, 11 Apr 17; and 9077, Ser SOP/19-02, 7 Nov 19.

**CASE 3d: Ordnance and Weapon Systems.** The Naval Ordnance Safety and Security Activity (NOSSA) has issued additional guidance for use of lithium batteries in ordnance, weapons, and weapon systems or stowed in weapons areas which are found in NOSSA INST 9310.LTR N841-1311.

**Final notes:**

1. Lithium battery safety certifications are specific to an application, i.e., a battery approved for one application is not approved for all applications. A record of all lithium battery safety certifications is maintained and can be searched to determine if a certification already exists.
2. Lithium battery certifications can be temporary or permanent. Temporary certifications can be extended, typically per the process defined in 9070 Ser 05z/328, 25 Jul 22.
3. Applications crossing SYSCOMs, for example, a Marine Corps system being transported aboard a NAVSEA vessel or Naval aircraft, are routed through all applicable Technical Authorities. Technical Authorities include NAVSEA, NAVAIR, MCSC, NOSSA, and Military Sealift Command (MSC). The NAVSEA Technical Authority review procedure is defined in the embedded document below.
4. NAVSEA has issued a listing of preferred batteries in 4120, Ser 05z/242, 7 Jul 23. The use of preferred batteries can reduce the cost and schedule of future system development and reduce the quantity of batteries requiring logistics to enable fielded applications.

Record of Changes

Revision Number	Date Published	Summary of Changes
1	11/30/2023	New Version