# Expendable Launch Vehicle (ELV)
# System Safety Milestones and Process Flow

## INTRODUCTION

System safety assessment and engineering support for ELV missions includes the efforts outlined in the following paragraphs.

## DELIVERABLES

### Safety Plan

A written Safety Plan shall be created to assure that a comprehensive hazard analysis program is implemented for the entire life cycle of mission development and execution. The safety plan will include the safety organizational relationships; safety program milestones; safety requirements and criteria; and, safety data/reporting requirements.

### Preliminary Hazard Analysis

Eastern and Western Range Safety Requirements EWR 127-1 require a Preliminary Hazard Analysis (PHA). The PHA will be performed to document the initial risk assessment of the system. Identified hazards will be evaluated for severity and probability, and recommendations will be made for their elimination or control. Safety provisions and alternatives needed to eliminate hazards or reduce their associated risk to an acceptable level must be included.

### EWR 127-1 Tailoring

Tailoring EWR 127-1 requirements to the payload will be conducted prior to preparing the draft Missile System Prelaunch Safety Data Package (MSPSP). The PI team will work with applicable range representatives, and GSFC Code 302 as necessary, to determine applicability of the various requirements of EWR 127-1.

### MSPSP

Preliminary and final versions of the MSPSP shall be provided in accordance with the requirements of Appendix 3 A of EWR 127-1. The MSPSP will include a detailed description of hazardous and safety critical ground support and flight hardware equipment, systems, and materials and their interfaces. The document will also detail the design characteristics and actions taken to eliminate and control hazards during the life cycle of the payload until launch. The PI team personnel will be responsible for providing the necessary supporting technical information related to the payload.

### Mission Reviews

A safety overview and status presentation will be prepared for presentation at the System Level Preliminary Design Review, Critical Design Review, the Pre-Environmental Review, and the Pre-Ship Review.

### Review of Test , Evaluation, and Handling Procedures

All hazardous procedures must be reviewed and approved by the range prior to use. This assures that test procedures recommend actions to reduce, correct, or control hazards in the test and evaluation environment, and will assure inclusion of appropriate warnings, hazards and cautions.

**On Site Support**

On site safety support must be provided during delivery of the satellite to the range and as needed during range processing to assure the Range Safety Office that any open safety issues are resolved in a timely manner and to assure that the mission flight hardware is processed safely.

**SCHEDULE**

A generic conceptual flowchart is provided below as an example of the activities that may be used to generate ELV safety documentation. It will be necessary to time scale the flow chart to the actual mission development period and its uniquely scheduled milestones. Assistance with this planning process can be provided through the Explorers Program Office.

| **Milestone** | **Approximate Dates** | |
|---|---|---|
| | ***Start*** | ***Finish*** |
| Safety Plan | | |
| Preliminary Hazard Analysis | | |
| Critical Design Review Presentation | | |
| MSPSP Outline | | |
| Tailoring EWR 127-1 | | |
| MSPSP Draft Ready | | |
| MSPSP Review Meeting (Internal program review) | | |
| MSPSP First Submittal (for delivery to Range) | | |
| MSPSP First Submittal Safety Review | | |
| MSPSP Final Submittal Draft | | |

| **Milestone** | **Approximate Dates** | |
|---|---|---|
| | ***Start*** | ***Finish*** |
| MSPSP Final Submittal Meeting (Internal program review) | | |
| Pre-Environmental Review Presentation | | |
| MSPSP Final Submittal for delivery | | |

to Range

MSPSP Final Submittal Safety Review

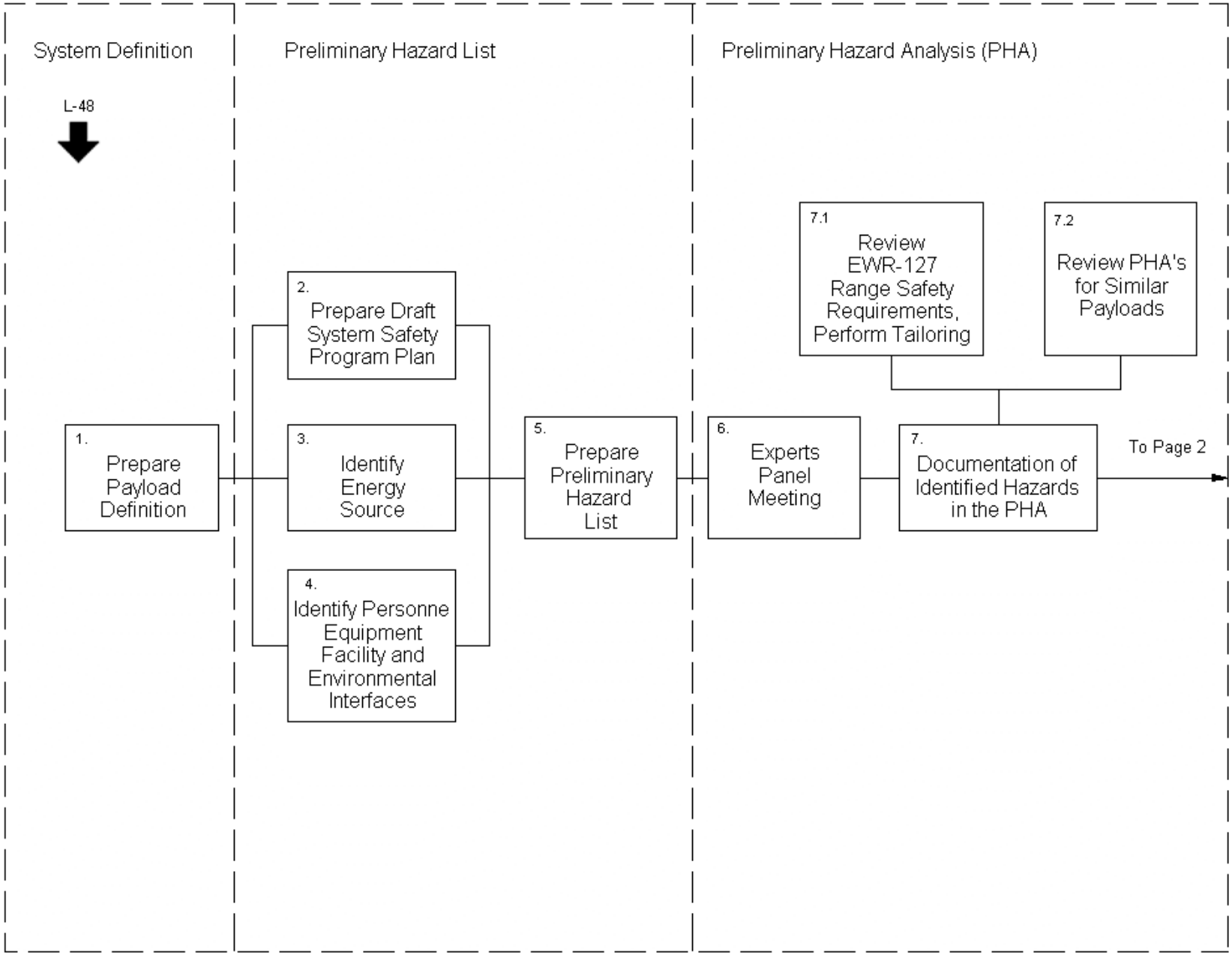
Review of Hazardous Procedures

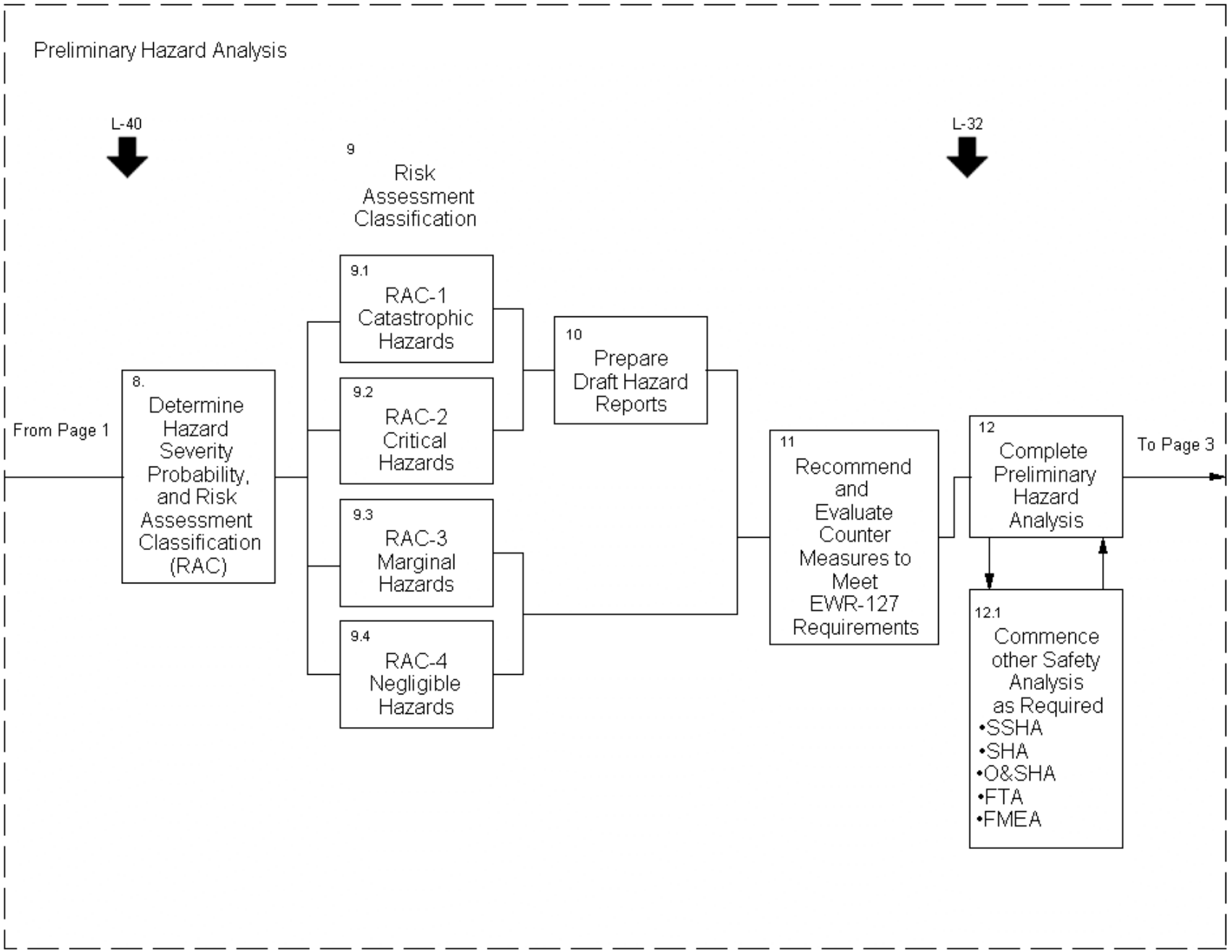
Pre-Ship Review Presentation

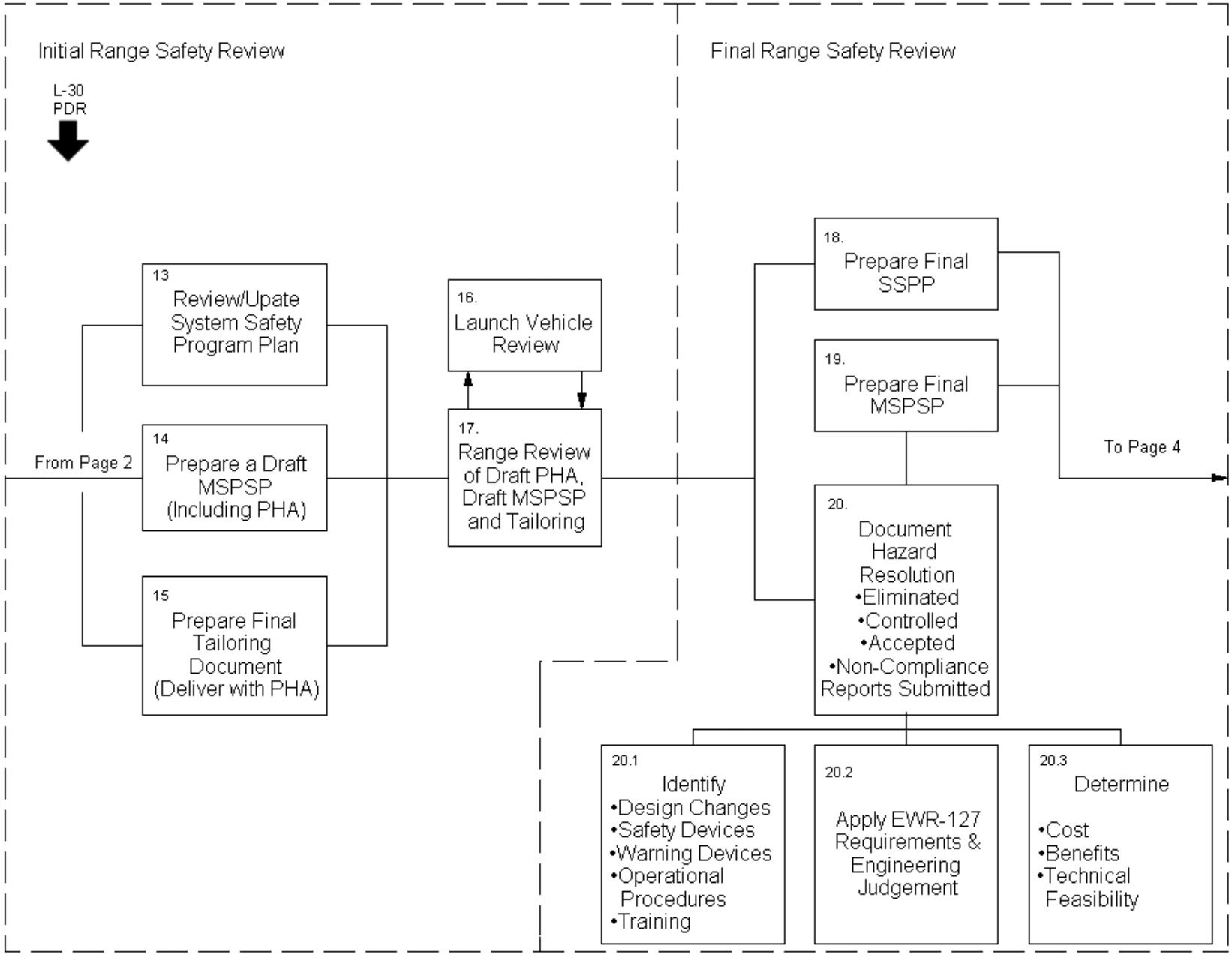
Initial hand-off meeting with Range

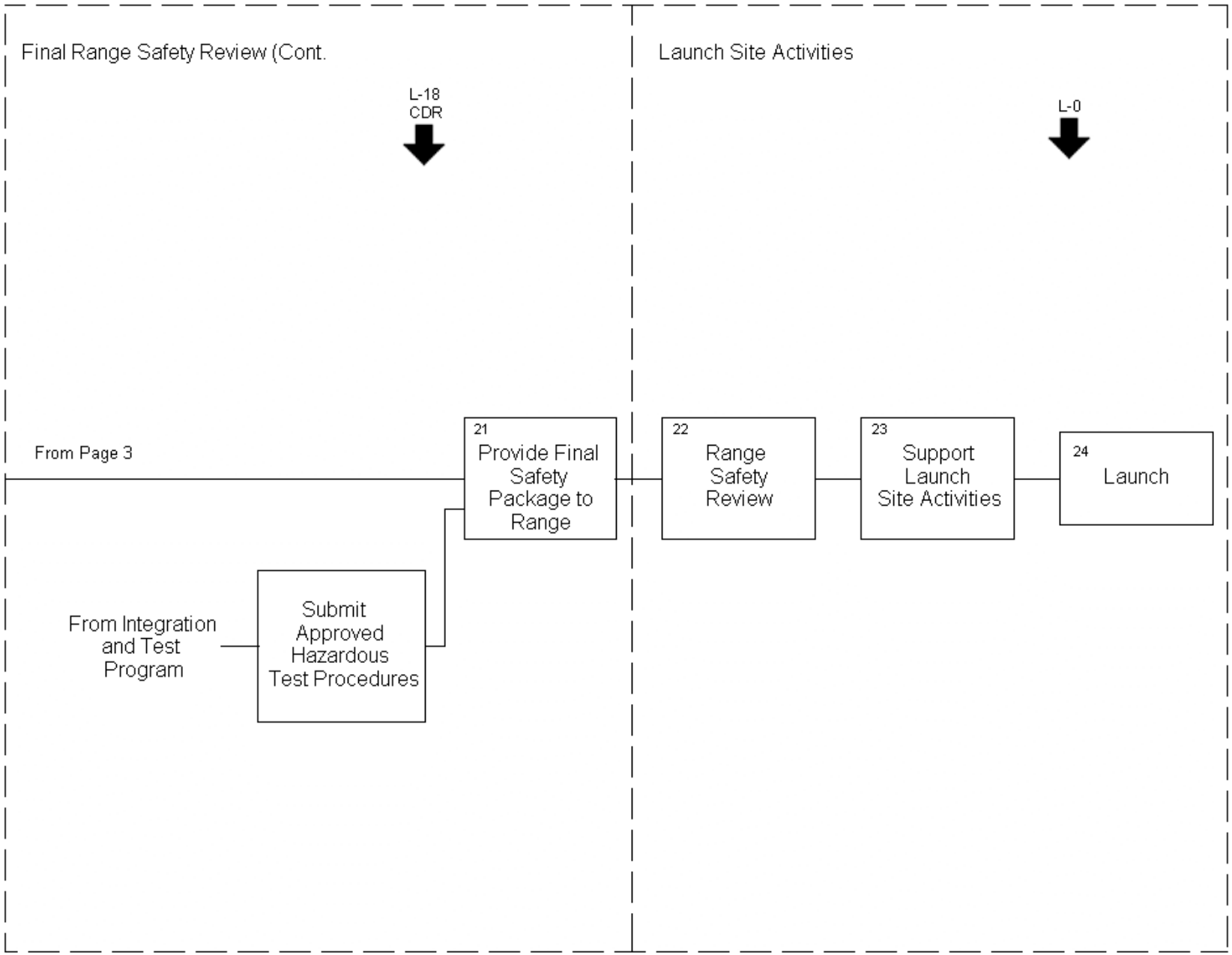
On Site Support

Attend Technical Interface Meetings and/or Ground Operations Working Group Meetings as needed.


System Definition
Preliminary Hazard List
Preliminary Hazard Analysis (PHA)
L-48
1. Prepare Payload Definition
2. Prepare Draft System Safety Program Plan
3. Identify Energy Source
4. Identify Personne Equipment Facility and Environmental Interfaces
5. Prepare Preliminary Hazard List
6. Experts Panel Meeting
7.1 Review EWR-127 Range Safety Requirements, Perform Tailoring
7.2 Review PHA's for Similar Payloads
7. Documentation of Identified Hazards in the PHA
To Page 2


Preliminary Hazard Analysis
L-40
9
Risk Assessment Classification
L-32
9.1
RAC-1 Catastrophic Hazards
9.2
RAC-2 Critical Hazards
9.3
RAC-3 Marginal Hazards
9.4
RAC-4 Negligible Hazards
10
Prepare Draft Hazard Reports
From Page 1
8.
Determine Hazard Severity Probability, and Risk Assessment Classification (RAC)
11
Recommend and Evaluate Counter Measures to Meet EWR-127 Requirements
12
Complete Preliminary Hazard Analysis
To Page 3
12.1
Commence other Safety Analysis as Required
•SSHA
•SHA
•O&SHA
•FTA
•FMEA


Initial Range Safety Review
L-30
PDR
From Page 2
13
Review/Upate System Safety Program Plan
14
Prepare a Draft MSPSP (Including PHA)
15
Prepare Final Tailoring Document (Deliver with PHA)
16.
Launch Vehicle Review
17.
Range Review of Draft PHA, Draft MSPSP and Tailoring
Final Range Safety Review
18.
Prepare Final SSPP
19.
Prepare Final MSPSP
To Page 4
20.
Document Hazard Resolution
•Eliminated
•Controlled
•Accepted
•Non-Compliance Reports Submitted
20.1
Identify
•Design Changes
•Safety Devices
•Warning Devices
•Operational Procedures
•Training
20.2
Apply EWR-127 Requirements & Engineering Judgement
20.3
Determine
•Cost
•Benefits
•Technical Feasibility


Final Range Safety Review (Cont.
Launch Site Activities
L-18
CDR
L-0
From Page 3
21
Provide Final Safety Package to Range
22
Range Safety Review
23
Support Launch Site Activities
24
Launch
From Integration and Test Program
Submit Approved Hazardous Test Procedures