

NASA Range Safety Program
2007 Annual Report
Range Safety Risk Process

The objectives of the range safety risk process, KDP-KSC-P-3628, for managing range safety risks for launch and entry at Kennedy Space Center are to ensure the safety of the Kennedy Space Center workforce and visitors during launches, to comply with KCA 1305, the Memorandum of Understanding for Range Safety between Kennedy Space Center, the Space Shuttle Program Office, and the 45th Space Wing, and to comply with NPR 8715.5, *Range Safety Program*, requirements. The process also outlines the requirements for the Kennedy Space Center risk assessment board should additional mitigation action be required to reduce risk to an acceptable level for launch and landing operations.

Definitions

The baseline definition for *risk* is the combination of the two criteria listed below:

1. The probability (qualitative or quantitative) that a program will experience an undesired event such as cost overrun, schedule slippage, safety mishap, or failure to achieve a needed technological breakthrough; and
2. The consequences, impact, or severity of the undesired event were it to occur.

For Range Safety, *risk* is expressed as casualty expectation, a measure that takes into consideration both the probability of occurrence and the consequence of a hazard to a population or installation. *Risk* is measured in the same units as the consequence, such as number of injuries, fatalities, or dollar loss.

For the purposes of range safety risk management, the *public* includes visitors and personnel inside and outside NASA-controlled property who may be on land, on waterborne vessels, or in aircraft. This category does not include *center essential personnel*.

Center essential personnel are government or contractor personnel who perform functions necessary for continued operations at a NASA Center or other site where NASA has control and responsibility. For a specific range operation, the *center essential personnel* include a workforce subset referred to as *mission essential personnel*.

Mission essential personnel are government or contractor personnel who are directly involved in ensuring the safety and success of range operations associated with a mission. This category does not include any crew on board a spacecraft.

Range Safety Analysis

With these definitions in mind, each range operation undergoes a range safety analysis to establish any design or operational constraints needed to control risk to people and property. Once the analysis is complete, Range Safety assesses the analysis and provides additional mitigation or suggests acceptance of increased risk, if required.

Launch Risk Notification

Approximately two weeks before a launch, Kennedy Space Center Program Office and Kennedy Space Center Range Safety Manager receive a Launch Risk Notification letter from the 45th Space Wing. This letter serves as documentation of results from risk analysis performed for the mission. The launch risk evaluation includes hazards resulting from launch vehicle debris impact, distant focusing overpressure, and toxic effluent dispersions, with respect to population

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and facility input data. If the risk meets acceptable criteria in NPR 8715.5, the results are documented and the launch will proceed.

Convening of the Space Flight Risk Assessment Board

If the risk exceeds acceptable criteria in NPR 8715.5, the Center Director has the discretion to convene a Space Flight Risk Assessment Board. The board consists of the following members:

- Safety and Mission Assurance Director, Chair
- Safety and Mission Assurance Deputy Director, Vice-Chair
- NASA Range Safety Manager
- Kennedy Space Center Range Safety Manager
- Kennedy Space Center Chief Counsel
- Launch Services Program (VA) Director
- Launch Vehicle Processing (PH) Director
- Cape Canaveral Spaceport Management Office (CCSMO) (JP) Director
- Constellation Project (LX) Director
- Launch Integration (MK) Director
- Center Operations (TA) Director
- International Space Station (ISS) and Spacecraft Processing (UB) Director
- External Relations (XA) Director
- Applied Technologies (KT) Director

The Kennedy Space Center Center Director may choose not to convene a board if the risk has been minimized to the maximum extent possible and the risk is documented and accepted using the standard range safety variance process. However, if an Assessment Board is convened, a minimum of four topics must be presented to the board at least one week before the mission.

- 45th Space Wing Safety Office or Johnson Space Center, Flight Design and Dynamics Office provides:
 - Assumptions in the analysis and calculation methodology
 - Risk assessment results
- Space Shuttle Program or Launch Services Program – provides program inputs
- External Relations – presents visitor population numbers
- Safety and Mission Assurance – provides mitigation options and the effect, if any, on the Risk Measure of Collective Casualty Expectation, E_c

Risk Assessment Board Recommendations

After receiving and reviewing all the information presented, the Assessment Board will make one of two recommendations to the NASA Range Safety Manager.

1. Mitigate residual risk to an acceptable level, or

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2. Request the NASA Range Safety Manager to waive residual risk, with Center Director acceptance of the increased risk.

If the risk can be mitigated, the Kennedy Space Center Range Safety Manager will be notified and mitigation efforts will be documented and a copy forwarded to the Space Wing Chief of Safety and the NASA Range Safety Manager. However, if a waiver is required, the Kennedy Space Center Range Safety Manager will write the waiver and coordinate it for acceptance with the Program Manager and the Center Director.

If neither the Program Manager nor the Center Director accepts the waiver, the issue will be sent back for further mitigation efforts. But once the waiver has been accepted, the Chief of the Office of Safety and Mission Assurance and Office of the Chief Engineer will be notified. Additionally, a copy of the approved waiver will be forwarded to the Space Wing Chief of Safety and the NASA Range Safety Manager and the mission will proceed with a clear understanding of the risks associated launch.

Shuttle Landing Activities Process

The process is similar for Shuttle landing activities with the exception that the risk analysis is performed by the Johnson Space Center, Flight Design and Dynamics Office, not the 45th Space Wing. Risk analysis data is forwarded to the Kennedy Space Center Range Safety Manager approximately two weeks before the scheduled landing of the Shuttle. This analysis is updated three days before landing and may be updated again one day before landing based on events such as a change in weather or extension of the mission. If the risks are deemed to be unacceptable, risk mitigation efforts will be implemented to help ensure the safety of the public and workforce before the Shuttle lands.

A flowpath of the Kennedy Space Center space flight risk assessment process is shown in the graphic below.

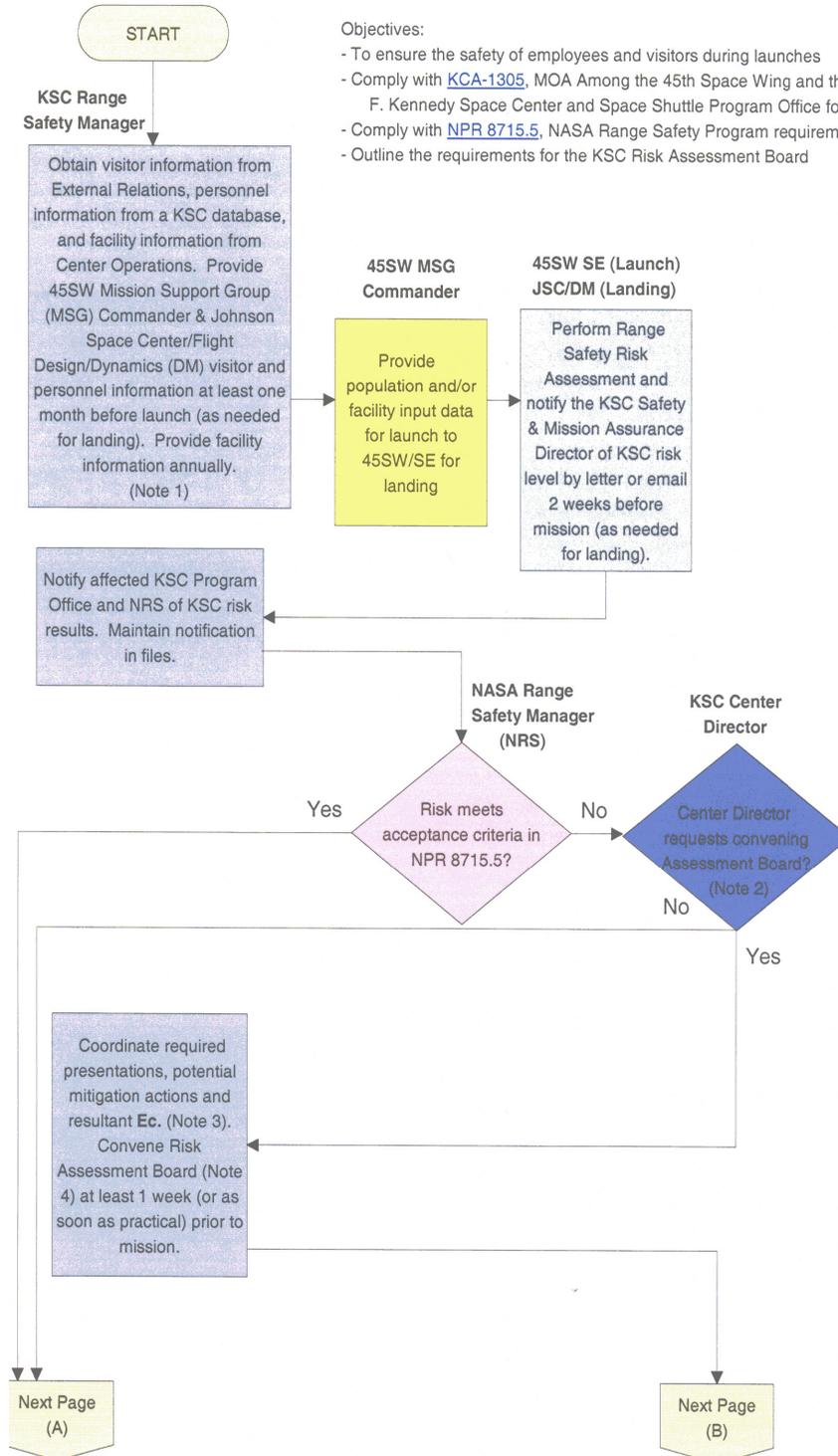
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[Signature]

Approved: *[Signature]*
Deputy Director, Kennedy Space Center

KSC Space Flight Risk Assessment Process



Objectives:

- To ensure the safety of employees and visitors during launches
- Comply with [KCA-1305](#), MOA Among the 45th Space Wing and the John F. Kennedy Space Center and Space Shuttle Program Office for Range Safety
- Comply with [NPR 8715.5](#), NASA Range Safety Program requirements
- Outline the requirements for the KSC Risk Assessment Board

Note 1:

- For Launch, 45SW performs Risk Assessment.
- For Landing, Johnson Space Center /DM performs Risk Assessment
- KSC Range Safety Manager will obtain personnel numbers and locations from the Self Service Management Tool (or equivalent) database.
- XA Director will provide the number of visitor requests and locations for launch to the KSC Range Safety Manager who will provide the data to the 45SW MSG Commander and for landing to Johnson Space Center /DM via email with a CC: to 45SW Chief of Safety (SE, KSC Safety & Mission Assurance Director (SA), and NASA Range Safety Manager (SA-G) no later than 1 month prior to launch (as needed for landing).
- TA Director will also provide structural information for buildings on KSC property used in risk assessment calculations to the KSC Range Safety Manager, as required.

Note 2:

The KSC Center Director has discretion not to convene the board only when the risks are known to be minimized to the maximum extent possible and those risks are documented and accepted via the standard safety variance process.

Note 3:

At a minimum, there will be 4 topics presented to the board. The topics will be coordinated by SA with support from TA, XA, SSP or VA, and the 45SW. The following will be discussed:

- 1) 45SW/SE or Johnson Space Center /DM
 - Assumptions in the analysis and calculation methodology
 - Risk assessment results
- 2) SSP or VA
 - Present program input
- 3) XA
 - Present visitor numbers
- 4) SA
 - Provide mitigation options and the effect if any on the Risk Measure of Collective Casualty Expectation, Ec.

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