Risk Committee

In early 2004, the Range Safety Group of the Range Commanders Council initiated Phase II of a Risk and Lethality Commonality Team effort to revise RCC 321, *Common Risk Criteria for National Test Ranges*. The acceptable risk criteria defined in NASA Procedural Requirements NPR 8715.5; *Range Safety Program*, is based on the guidance provided by this document. Because injury criteria were not defined during Phase I of the Risk and Lethality Commonality Team effort, the Department of Defense major range and test facility bases have diverged from use of the standard since it addresses acceptable risk criteria pertaining only to fatalities.

Establishing Risk Criteria Based on Casualties

The second phase of the Risk and Lethality Commonality Team effort has focused on establishing acceptable risk criteria based on casualties. The Range Safety Group also recommended that RCC 321 be updated and expanded to include flight safety hazards in addition to inert debris. The second phase of the Risk and Lethality Commonality Team was initially established as an ad hoc committee under the Range Safety Group. However, after a few meetings, the identification of additional risk-related topics and the more detailed development of tasks, the need for a standing committee was realized.

In February 2005, the Risk and Lethality Commonality Team was renamed the Risk Committee with a specific objective to rewrite RCC 321. In 2007, the Risk Committee was formally recognized as a standing committee by the Range Safety Group. Over the last four years, the committee has focused on establishing updated acceptable risk criterion and developing detailed supporting rationale for inert debris and other range hazards, including distant focusing overpressure and toxics. The group has also decided to establish an aggregated risk criterion, evaluating the combination of all launch hazard risk against one acceptable level. Current practice consists of evaluating each hazard against hazard unique criterion.

Update of RCC 321, *Common Risk Criteria for National Test Ranges*

In June of 2007, RCC 321-07 was officially issued through the Range Commanders Council. Updates to the document included the following:

- Risk acceptability criteria and supporting rationale for additional flight safety hazards and consequences potentially generated by range operations
- The major activities required to conduct the entire risk management process and considerations to address hazards beyond just inert debris
- Top-level requirements for computational models used to analyze the risks posed by inert and explosive debris
- Updated hazard thresholds for inert and explosive debris, as well as screening criteria for other hazards including toxics, distant focusing overpressure, and ionizing and non-ionizing radiation
- Factors and considerations for acceptable debris risk assessment models

Risk Committee

Additional Topics Requiring Discussion

During the revised document development effort and through discussions at Risk Committee meetings, the group has identified a number of additional topics that require discussion. Following review by the Range Commanders Council Executive Committee, approved topics will be addressed by the committee and guidance provided in upcoming revisions to RCC-321. The topics include:

- *State of the art review of risk uncertainty and catastrophe aversion and development of approaches to launch risk uncertainty for application to risk acceptability.* A state-of-the-art review of how industries and governments which have technological endeavors that could produce high risk to the public deal with the uncertainties from their risk assessments and also with the quantification of catastrophe potential.
- *Treatment of conditional risk criteria for foreseeable conditions.* Development of guidelines and rationale for modeling the risk from controlled activities such as flight termination action, engine shutdown, and use of alternative flight paths for reusable launch vehicle aborts.
- *Asset protection.* Establishment of roles, responsibilities, guidelines, and criteria for the protection of critical assets.
- *Responsibility for satellite protection beyond orbital insertion.* Establishment of roles and responsibilities for satellite tracking beyond orbital insertion and for unmanned space systems.
- *Space craft protection for exo-atmospheric and orbital debris hazards.* Development of consensus criteria and characteristics for analyses used to address exo-atmospheric and orbital debris hazard risk to space craft.
- *Business jet vulnerability criteria.* Development of vulnerability thresholds and modeling characteristics for assessment of transoceanic business class jets.
- *Mitigation of large numbers of minor injuries.* Investigate the need to develop acceptable risk criteria and/or mitigation guidelines for minor injuries such as those resulting primarily from toxics and explosive debris.
- *Reusable launch vehicle and other controlled reentry related issues.* Development of policy and guidelines for range operations involving reusable launch vehicles and reentry issues associated with any vehicle.
- *Hazard threshold for land vehicles.* Development of hazard thresholds to protect land vehicles such as automobiles, buses, trucks, and trains from shock waves from explosions and impacting debris.

Submittal of the above tasks has been completed with Executive Committee review anticipated in January 2008.

Flight Termination Systems Committee

The Flight Termination Systems Committee provides a forum for all issues and technologies related to flight termination systems. Members from several different ranges support this effort and come together to discuss various flight termination issues and concerns that need to be addressed. Some of the major efforts and issues that the committee discussed in 2007 included the following:

- RCC 319, *Flight Termination Systems Commonality Standard* rewrite
- The enhanced flight termination system
- The autonomous flight safety system/autonomous flight termination system
- Frequency interference
- National Security Agency High Alphabet decertification

RCC 319, *Flight Termination Systems Commonality Standard*

RCC 319 was revised to include new technologies and lessons learned that were used to update and clarify various flight termination system requirements. This task began in 2003. The standard was completed and released in 2007.

Enhanced Flight Termination System

A major topic of discussion in 2007 was the enhanced flight termination system. Members of the Flight Termination Systems Committee supported various testing and operations associated with this program in 2007 and continue to play an important role in developing this system. Some of the issues the committee is working on are listed below:

- The process for communicating with possible new vendors wishing to design enhanced flight termination system receivers and/or ground equipment
- How the enhanced flight termination system will be incorporated into RCC 319
- How the enhanced flight termination system will affect RCC 313, *Test Standards for Flight Termination Receivers/Decoders*

Many milestones were accomplished this year as the enhanced flight termination system continues to progress toward becoming a certified system while the committee continues to support this program and its endeavors.

Autonomous Flight Safety System/Autonomous Flight Termination System

The committee also discussed various uses and implementations of the autonomous flight safety system/autonomous flight termination system. Right now, there is no plan to use this system on any of the major ranges. More testing and qualification will have to be done on this technology before the ranges will consider using it.

Flight Termination Systems Committee

Frequency Interference

Frequency interference is still a major concern at several ranges. There is still some concern with PAVE PAWS radars located at Beale Air Force Base in California and at Cape Cod in Massachusetts. However, through coordination with these operators, a mitigation effort has been used for all launches from the Eastern and Western ranges.

At other missile ranges, the enhanced position location reporting system is also a major concern. Along with other organizations, the Flight Termination Systems Committee is working hard to come up with a viable, long-term solution to the frequency interference issue.

National Security Agency High Alphabet Decertification

Another issue that has been discussed recently is the decision to decertify High Alphabet as a secure system. Today High Alphabet is the most secure flight termination system available. However, the National Security Agency has stated a desire to move toward a more secure and encrypted system.

High Alphabet is used on numerous launch vehicles around the country and those programs will be forced to move to a new system if High Alphabet is decertified. As of now, the National Security Agency has stated that they will no longer support High Alphabet after 1 January 2015. The Flight Termination Systems Committee will be working with ranges and programs to help provide a smooth transition and ensure that range operations are not adversely affected during this timeframe.

Flight Termination Systems Committee Meetings

During 2007, the Flight Termination Systems Committee participated in two meeting held by the Range Commanders Council, Range Safety Group. The meetings took place in June in Florida and in November in New Mexico. Topics discussed are presented below.

June Recap

In June, the Flight Termination Systems Committee met at the Range Safety Group meeting at Patrick Air Force Base to discuss ongoing issues relevant to flight termination systems. The main topic of discussion was the enhanced flight termination system. Major milestones accomplished by the program as well as future applications and implementation of the system were discussed. Members of the enhanced flight termination system program presented the status and future of the program to the committee.

Other topics discussed were the release of RCC 319, *Flight Termination Systems Commonality Standard*, the autonomous flight termination system/autonomous flight safety system, frequency interference at various ranges, and National System Agency decertification of the High Alphabet system.

Flight Termination Systems Committee

November Recap

At the November meeting in Albuquerque, the Flight Termination Systems Committee discussed ongoing issues relevant to flight termination systems. Once again, the main topic of discussion was the enhanced flight termination system. The current status of the program as well as future milestones and applications were presented. Other topics discussed included emerging unmanned aerial vehicle programs and the impacts to RCC 319, Herley flight termination system receiver issues, and directed energy applications and their impact on flight termination system components and requirements.

Range Commanders Council
Range Safety Group Meeting Recap

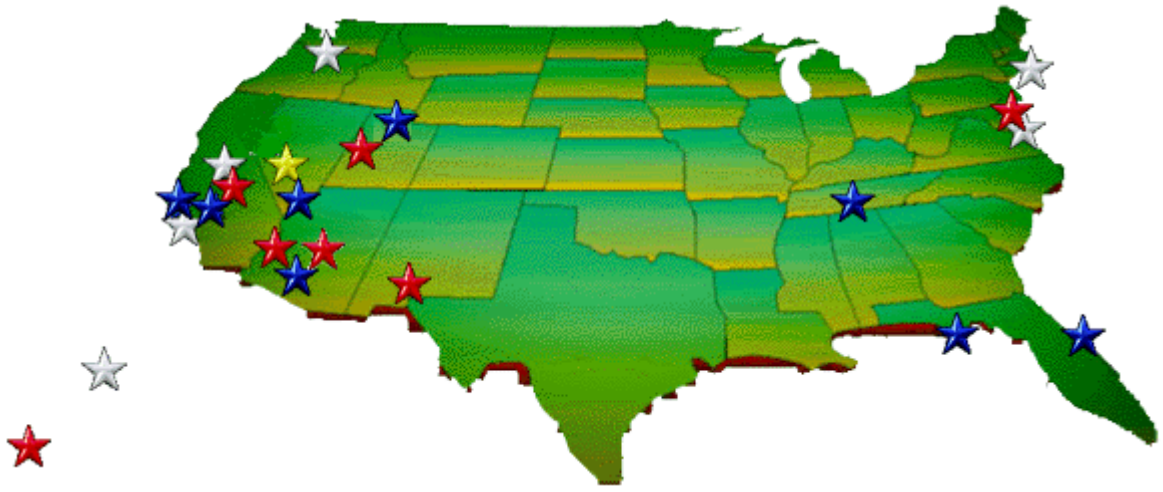
Founded in 1951, the Range Commanders Council is dedicated to serving the technical and operational needs of the United States test, training, and operational ranges. The council was organized to preserve and enhance the efficiency and effectiveness of member ranges, thereby increasing their research and development, operational test and evaluation, and training and readiness capabilities.

The Range Commanders Council provides a framework wherein common needs are identified and common solutions are sought, technical standards are established and disseminated, joint procurement opportunities are explored, technical and equipment exchanges are facilitated, and advanced concepts and technical innovations are assessed and their potential applications identified.

As an associate member, NASA maintains active participation in the Range Commanders Council and many of its working groups, including the Range Safety Group.

Member Ranges

Members include Army, Navy, Air Force, and DOE ranges. Their locations are shown in the graphic below and identified in the following table.



Army Air Force Navy DOE

Range Commanders Council
Range Safety Group Meeting Recap

Locations of Member Ranges

Army	Air Force	Navy	Department of Energy
Aberdeen Test Center, Aberdeen Proving Ground, Aberdeen, MD	30th Space Wing, Vandenberg Air Force Base, CA	NAVAIR Atlantic Ranges, Patuxent River, MD	Department of Energy Nevada Test Site
Dugway Proving Ground, Dugway, UT	45th Space Wing, Patrick Air Force Base, FL	NAVAIR Pacific Ranges, China Lake and Point Mugu, CA	
Electronic Proving Ground, Ft Huachuca, AZ	Air Armament Center, Eglin Air Force Base, FL	Naval Undersea Warfare Center Division Keyport, Keyport, WA	
National Training Center, Fort Irwin, CA	Air Force Flight Test Center, Edwards Air Force Base, CA	Naval Undersea Warfare Center Division Newport, Newport, RI	
Reagan Test Site, APO AP	Arnold Engineering Development Center, Tullahoma, TN	Pacific Missile Range Facility, Kekaha, HI	
White Sands Missile Range, White Sands, NM	Goldwater Range, Luke Air Force Base, AZ		
Yuma Proving Ground, Yuma, AZ			

Range Safety Group

Through standardization, development, and continuous improvement, the Range Safety Group of the Range Commanders Council supports the safe conduct of hazardous operations on the test, training, and operational ranges and related facilities. Hazardous operations include, but are not limited to, ordnance and expendable releases, directed energy and laser operations, missile flight, space launch and reentry, unmanned vehicle operation, gunfire, explosive use, and hazardous emissions.

100th Meeting of the Range Commanders Council Range Safety Group

The 100th meeting of the Range Safety Group was hosted by the 45th Space Wing Safety Office at Patrick Air Force Base. The meeting was held in Indialantic, Florida from June 5 through June 7. This conference included a number of special topics briefings, including:

- Demo-2 test flight of the autonomous flight safety system
- Unmanned aerospace vehicle and systems range safety requirements document development
- Directed energy test and evaluation capability
- Range reports from all participating Major Range Test Facility Bases

NASA provided range safety related training status reports and range reports for Kennedy Space Center, Wallops Flight Facility, and Dryden Flight Research Center. The Flight

Range Commanders Council
Range Safety Group Meeting Recap

Termination Systems Committee and Risk Committee also met. NASA participated in the meetings of both these committees.

Flight Termination Systems Committee Meeting

The Flight Termination Systems Committee met at Patrick Air Force Base to discuss ongoing issues relevant to flight termination systems. The main topic of discussion was the enhanced flight termination system. Major milestones accomplished by the program as well as future applications and implementation of the enhanced flight termination system were discussed. Members of the enhanced flight termination system program presented the status and future of the program to the committee. Other topics discussed were the release of RCC 319, *Flight Termination Systems Commonality Standard*, autonomous flight termination system/autonomous flight safety system, frequency interference at various ranges, and National Security Agency decertification of the High Alphabet system.

Risk Committee Meeting

During the Range Safety Group meeting, the Risk Committee selected a new chairperson, Mr. Paul Rosati from the 45th Space Wing. The primary focus of the Risk Committee was the determination of task proposals to the Range Commanders Council for 2008. All task proposals were briefed, and it was decided to submit the following task proposals to create or expand on risk criteria in RCC 321-07, *Common Risk Criteria Standards for National Test Ranges*:

- Risk Committee Secretariat Position
- State of the art review of risk uncertainty and catastrophe aversion and development of approaches to launch risk uncertainty for application to risk acceptability
- Treatment of conditional risk criteria for foreseeable conditions
- Asset protection
- Responsibility for satellite protection beyond orbital insertion and space craft protection for exo-atmospheric and orbital debris hazards
- Business jet vulnerability criteria
- Mitigation of large numbers of minor injuries
- Reusable launch vehicle and other controlled reentry related issues
- Hazard threshold for land vehicles
- Toxic concentration levels for toxic hazard corridors
- Voluntary public risk

101st Meeting of the Range Commanders Council Range Safety Group

Sandia National Laboratories in Albuquerque, New Mexico hosted the 101st meeting of the Range Commanders Council Range Safety Group, held November 27 through 29. This conference included a special topic briefing on Sandia National Laboratories and range reports from all participating Major Range Test Facility Bases, as well as a session for the Flight Termination Systems Committee. The Risk Committee did not meet during this session.

Range Commanders Council
Range Safety Group Meeting Recap

NASA provided range safety related training status reports and range reports to the group for Kennedy Space Center, Wallops Flight Facility, and Dryden Flight Research Center and participated on the Flight Termination Systems Committee during this session.

The Flight Termination Systems Committee discussed ongoing issues relevant to flight termination systems. The main topic of discussion was the enhanced flight termination system. An overview of the system, as well as improvements and enhancements by the program were discussed. Additionally, future applications and implementation of the system were briefed.

Other briefings included the following:

- Directed energy and flight termination system requirements
- Herley Industries flight termination receiver 60-1 issues and requalification processes
- Emerging unmanned aerial vehicle programs and RCC-319
- Enhanced flight termination system documentation and concept of operations
- Enhanced flight termination system database discussion focusing on range identifications and other command fields

The discussion about range identifications brought to light the possibility of using the Flight Termination Systems Committee as the clearinghouse for issuing enhanced flight termination system range identifications and perhaps vehicle identifications. It was determined that more discussion was necessary before the committee would undertake this task.