RISK COMMUNICATION STRATEGY DEVELOPMENT USING THE AEROSPACE SYSTEMS ENGINEERING PROCESS

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Abstract
Though the risk of injury or fatality from NASA missions is comparably low to that of other regularly occurring risks, some members of the public perceive the risk as very high. The perception is fueled by several factors. The first is the difficulty in translating mission risks into language non-scientist can understand. A second factor is the doubt that failure of some highly visible projects create, and finally people are skeptical of government agencies. Experience has shown that public opposition to missions is not reduced by presenting only probabilistic risk assessments or a good risk management plan. The risk information presented is often too complex for the audience or the benefits and risks presented are not acceptable to those that may be at greater risk. This paper explains the goals and challenges of NASA's risk communication efforts and how the Aerospace Systems Engineering Process (ASEP) was used to map the risk communication strategy used at the Jet Propulsion Laboratory (JPL) to achieve these goals.

Not until the Challenger accident in 1986, did NASA find it needed to communicate mission risks to the public. The launch of Galileo in 1989 began NASA's development of a risk communication area. The Galileo mission, with its two radioisotope thermoelectric generators (RTGs) met with much more Congressional, media, and public concern than any previous mission. Since the Galileo mission, NASA has made it its goal to anticipate potential areas and issues within its programs that may be of public concern, and to develop information and channels of communication through which the public can both air concerns and expect that questions or issues will be meaningfully addressed by the Agency.

Risk communication addresses concerns about the potential environmental, safety and health risks of NASA missions that involve the use of nuclear materials, return of samples to Earth or experiments in pristine Earth or space environments. The goal of risk communication is to earn and maintain the public's confidence by ensuring that clear, accurate, timely, and consistent information is readily available and that an open and inclusive environment exists, in which the process by which missions are chosen, designed and operated is made transparent, and the perspectives of others outside of NASA is sought and considered.

Key to achieving these goals is the development of a risk communication strategy that is well-reasoned and founded on the thorough understanding of a mission's risk communication objectives and on how to best meet those objectives. The JPL risk communication department has through the years developed risk communication strategies for their missions that do just that. To provide a method for demonstrating how these strategies are developed at JPL, the risk communication strategy development process was mapped using ASEP. ASEP is a systematic problem solving methodology developed by The Aerospace Corporation in 1996 as a systems engineering standard for the company. ASEP consists of a series of eight fluid and dynamic steps that are tailorable, flexible, and scalable to various tasks, customers, and programs. See Figure 1.

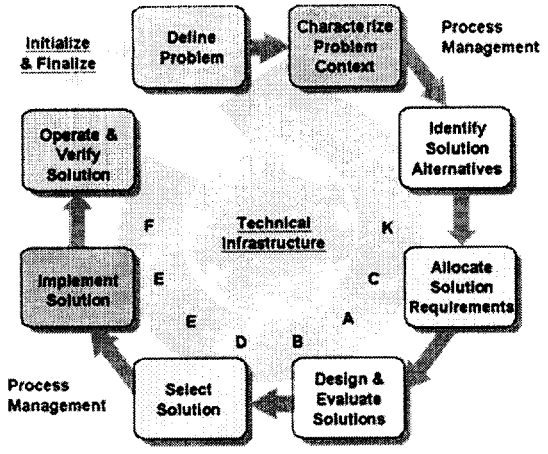

Figure 1 – Aerospace Systems Engineering Process (ASEP)

The successful development of a risk communication strategy depends heavily on the accurate definition of the risk communication objectives and on the characterization of the mission context (political, budgetary, organizational, etc.) that these goals will be achieved under. Only after the risk communication objectives and their context are well understood can attention be directed to identifying and evaluating all possible options for meeting these objectives, and developing a plan for implementing and monitoring the effectiveness of the strategy developed. These steps in developing a risk communication strategy process where mapped using ASEP as shown in Figure 2.

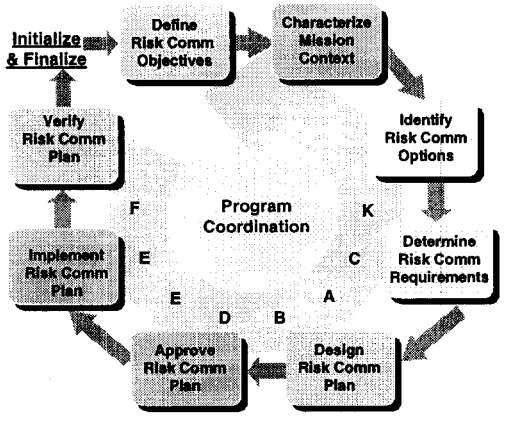

Figure 2 – Risk Communication Strategy Development Process

Define Risk Communication Objectives

Defining the risk communication objectives is the first step in developing a risk communication strategy and perhaps one of the most important steps. Lots of questions and decisions must be made early on. See Figure 3. It requires deciding what the scope of the risk communication effort must be; How much risk communication is enough? To answer this question the issues and questions the risk communication effort must address and the context within which they will be addressed needs to be understood. If the risk communication issue of concern is launch safety, for example, and there has been a recent launch accident, then the risk communication objective might be to distinguish a mission launch safety from that of the failed launch. Also instrumental in defining the risk communication objectives is identifying any constraints such as limited resources or schedule constraints that may limit how risk communication objectives can be met. Finally how well the risk communication objectives need to be met is defined and a real measurable standard is set. For example if early in the program fifty percent of launch site citizens felt apprehensive about a launch, but after holding a public meeting only twenty percent said they were apprehensive, was the risk communication effort successful?

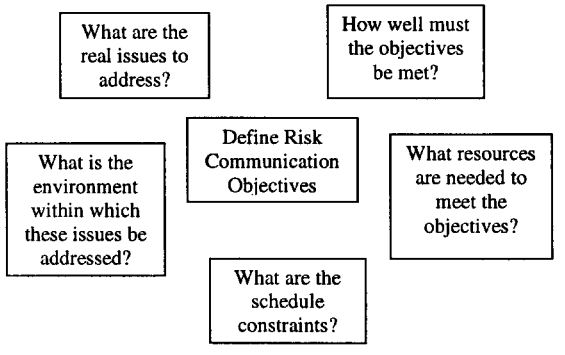

Figure 3 – Questions For Defining Risk Communication Objectives

Characterize Mission Context

Risk communication objectives need to be met within the constraints imposed by a mission's context. Decisions, commitments, and assumptions made early on in a mission's development need to be explored. Decide what impact programmatic mission constraints such as schedule, budget and politics have on meeting the risk communication objectives. Will the mission's system performance requirements and timelines impose some constraint on how the risk communication objectives can be met? By understanding all the constraints imposed by the mission and identifying any uncertainties, a worst case scenario is developed to decide what options are feasible for meeting the risk communication objectives.

Identify Risk Communication Options

With the risk communication objectives understood and the environment within which they will be obtained characterized, a wide range of risk communication options to meet these objectives can be explored. The range of options considered include: doing nothing, doing what has been done before, and trying something new. Doing nothing is an option when the issue is outside the scope of what any risk communication effort could achieve, such as when an issue concerns national policy.

Traditionally risk communication efforts at JPL include developing two types of risk communication products for addressing topics of concern. Proactive products are those that are developed in anticipation of concerns, such as fact sheets, web pages, workshops and various venues for public engagement. Risk communication products that are by nature essentially responsive, such as responses to queries and requests for information, are developed using procedures that permit quick and accurate responses.
In addition to these risk communication products, spokespersons and technical experts that are likely to be approached by the media are provided training so they can more effectively address public concerns when asked to do so. The training provides them the opportunity to learn how to answer questions concisely and with technically correct information. Another commonly used option is holding public meetings and information fairs to both engage and inform the public and other stakeholders.

Missions or mission environments that are different than those traditionally encountered at JPL may require seeking outside expert advice or training. New procedures, products, and methods of public engagement may also be required at these times.

Once all options for meeting the risk communication objectives have been considered several storylines are drawn of how the selected options will be used under the worst case scenarios developed earlier. The storylines identify who does what and describe the interfaces between agencies. The required budget and schedule associated with each of the possible solutions is estimated and the likelihood of exceeding schedule and budget constraints is evaluated. The solutions that are not expected to meet the levels of success established in the first step of this process are eliminated from consideration.

Determine Risk Communication Requirements

Having identified the best set of risk communication solutions, the process of evaluating these candidates and selecting the "best" can begin. How well will each solution meet the constraints and requirements of the risk communication objectives? The answer is not straightforward. Unlike engineering systems, there is little data to go on to decide which solutions will be the best. Lessons learned and the advice of experts are relied upon to select the best solution. Almost as soon as a solution is chosen it will need to be changed because issues and their environment change often. Although changes to the initial solution are inevitable, the all solutions must be:

- Developed in coordination with the program schedule to ensure availability in a timely manner;
- Developed, reviewed, and approved according to agreed upon procedures to ensure accuracy and consistency; and
- Available to target internal and external audiences in an easily accessible manner.

In addition, the risk communication products developed must balance the science and the public's understanding of the science. Terms used in risk communication products should be identified and defined, many times if necessary. Only information that is actually useful should be included into risk communication products. Too many numbers and concepts may add confusion to the understanding of the key message trying to be delivered. The products should address topics using short and straightforward explanations. The key point being delivered should always be kept up front and there should be no use of jargon in the product.

Design Risk Communication Plan

The risk communication plan is designed to summarize the initial starting solution selected from the completion of all the previous steps. Included in the risk communication plan are the risk communication objectives; descriptions of the roles and responsibilities of agencies and individuals for implementing the plan; descriptions of products and activities planned and their target audience; and the procedures for developing, reviewing, and approving of risk communication products, activities and inquiries. Also included in the risk communication plan is a description of the strategy chosen for meeting the risk communication objectives. This strategy would be analogous to the storyline developed under the "Identify Risk Communication Options" step. It lays out how the proposed products, activities and procedures developed would be implemented to meet the desired objectives.

Approve Risk Communication Plan

The agencies and individuals included in the plan, as well as, top management at JPL and NASA review the plan and make suggestions for changes. The approval process is an important one, because it sets in motion the coordination of all future risk communication efforts. Once approved the risk communication plan will begin the implementation of the risk communication effort.

Implement Risk Communication Plan

This is the step in the process where the preparation of the planned risk communication effort begins. A detailed schedule of the risk communication effort is created and the products and activities covered in the risk communication plan are developed. The implementation step is a dynamic one. New issues continually emerge and environments change. While both the schedule and the planned efforts are changing, the procedures outlined in the risk communication plan do not change. These procedures control the flow of the risk communication efforts and ensure that proper review and approval are obtained. This prevents inconsistencies in materials and misunderstandings of plans that can jeopardize the objectives of the risk communication effort.

Verify Risk Communication Plan

To ensure the risk communication efforts are meeting their intended goal, feedback mechanisms are put in place to monitor their effectiveness. Feedback gathered from websites, public meeting surveys, and other sources are instrumental in fine tuning the risk communication effort and provide valuable lessons learned that are incorporated in subsequent risk communication development efforts. Lessons learned are only valuable if they

are documented and can be easily accessible by all that would benefit from them.

Mastering the development of a risk communication strategy takes years of experience and diligence. By mapping the JPL risk communication strategy development process using ASEP, it's hoped that those outside the risk communication area will gain a better understanding of how the process works and how the public's trust in a mission is gained and maintained so that and the mission's goals may be attained.

ASEP used here to map the risk communication strategy development process is versatile enough to map most any process. More information on the ASEP process and resources to support risk communication strategy development are available on the ASEP website. The versatility of the site is exemplified in the examples portion of the website, which presents how ASEP was used to map the process of purchasing a new car and how is was used to design a early warning missile defense system. Also provided on the website are explanations of the ASEP steps, analysis methods and other resources for understanding and applying the process. The website can be reached outside of the Aerospace Corporation at [illegible].

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