

Influence Map Methodology for Evaluating Systemic Safety Issues

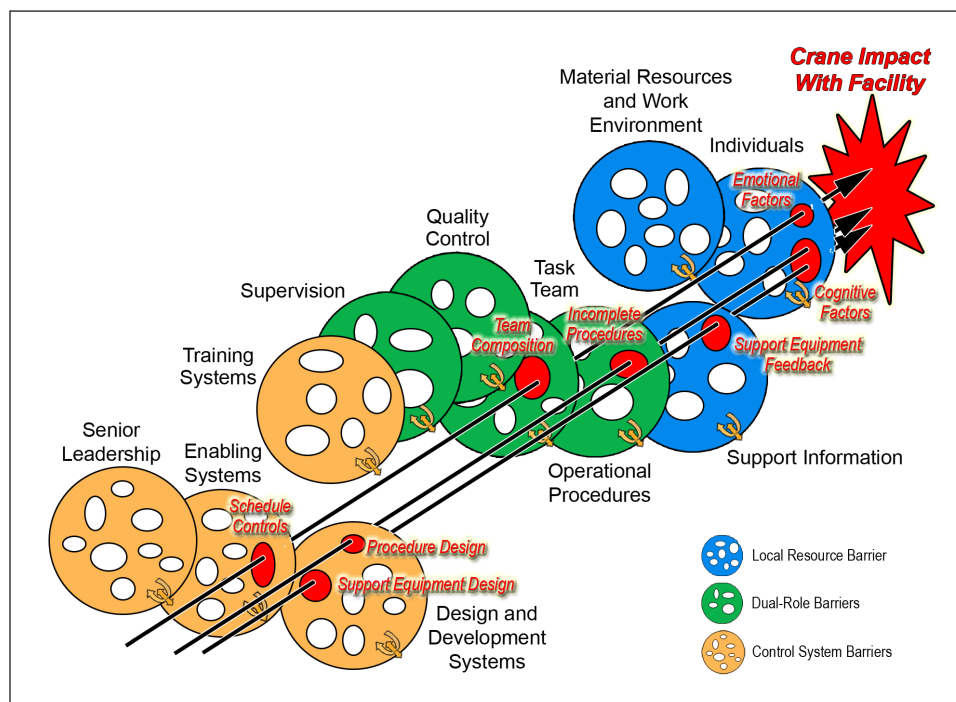


Task/Process
Modeling and
Simulation

“Raising the bar” in safety performance is a critical challenge for many organizations, including Kennedy Space Center. Contributing-factor taxonomies organize information about the reasons accidents occur and therefore are essential elements of accident investigations and safety reporting systems. Organizations must balance efforts to identify causes of specific accidents with efforts to evaluate systemic safety issues in order to become more proactive about improving safety.

This project successfully addressed the following two problems: (1) methods and metrics to support the design of effective taxonomies are limited and (2) influence relationships among contributing factors are not explicitly modeled within a taxonomy. The primary result of the taxonomic-relationship modeling efforts was an innovative “dual-role” taxonomy that is more comprehensive and has better diagnostics than existing contributing-factor taxonomies. The influence map methodology graphically and analytically combines the dual-role taxonomy and influence relationship models.

Influence maps were developed for an initial sample of safety incidents at Kennedy Space Center. A team of experts used the new dual-role taxonomy and influence chain methodology to evaluate the accuracy and completeness of contributing factors identified during formal incident investigations. Using the influence map methodology, the team identified 116 contributing factors. Only 16 percent of these events or conditions were identified as contributing factors, contributing causes, or root causes with traditional tools during the formal incident investigations, and over half of the 116 contributing factors were not addressed by the findings and recommendations in the formal incident reports.



Influence chains of contributing factors in mobile crane mishap.



Type of mobile crane that impacted the crossover between the KSC Vehicle Assembly Building and a utility annex.



Location and close-up of damage to the crossover between the KSC Vehicle Assembly Building and a utility annex.

Accomplishments of this ongoing project include the following:

- comparatively analyzing industry and government contributing factor taxonomies (2002),
- developing the dual-role taxonomy (2003),
- developing the influence chain methodology (2004),
- initially testing and evaluating the influence map methodology with incident data from Shuttle Ground Operations and applying taxonomy analysis results to the efforts of the NASA Engineering and Safety Center's taxonomy working group (2005),
- refining the influence map methodology and documenting the approach (2006),
- analyzing a representative sample of Shuttle processing incidents occurring since February 2003 with the influence map methodology (2007),
- delivering recommendations to (1) address the most significant systemic safety issues in Shuttle Ground Operations, (2) prevent recurrence of specific mishap types, (3) address design considerations that will benefit Constellation systems, and (4) improve the quality of incident investigations (2008), and
- applying the influence map tool to Orion processing, historical NASA events, and additional safety domains (2008).

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