

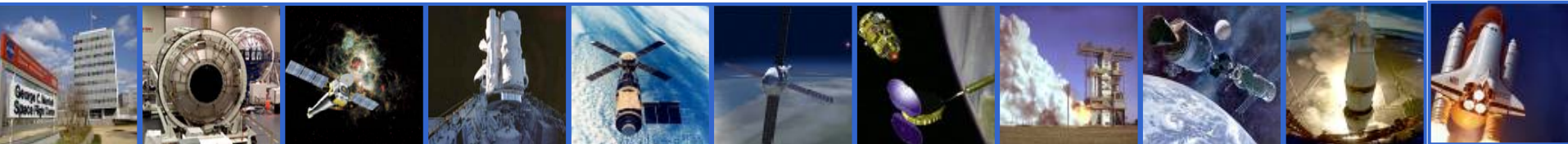


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Changing the S&MA Paradigm

HRC INCOSE Meeting
Sept. 21, 2006

Roy W. Malone, Jr., Director
Safety & Mission Assurance (S&MA)





Overview

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- Creating the S&MA Paradigm**
- Root Causes**
- Changing the S&MA Paradigm**
- S&MA Professional Development**
- Roadmap Process**
- The New Vision**



Creation of the Paradigm

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- **Following the Space Shuttle Challenger accident, the Rogers Commission reported in 1986:**
 - S&MA was not included in technical issue discussions.
 - Inadequate S&MA staffing at MSFC – “Reductions in the safety, reliability and quality assurance work force at Marshall and NASA Headquarters have seriously limited capability in those vital functions (safety program responsibility) to ensure proper communications.”

“A properly staffed, supported, and robust safety organization might well have avoided these faults (addressing faults within the S&MA organization that contributed to the Challenger Accident)....”

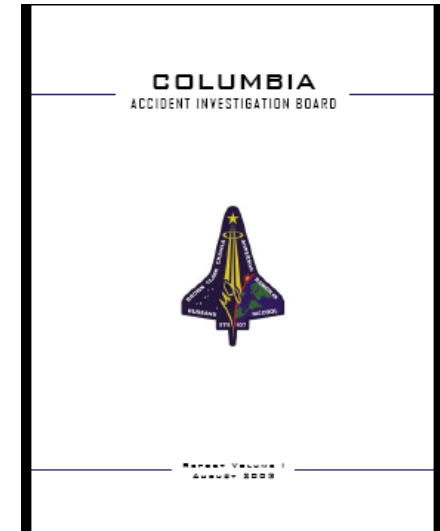




Creation of the Paradigm

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- **Following the Space Shuttle Columbia accident, the Columbia Accident Investigation Board (CAIB) reported in 2003:**
 - “Throughout its history, NASA has consistently struggled to achieve viable safety programs and adjust them to the constraints and vagaries of changing budgets”
 - “The Board believes that the safety organization, due to a lack of capability and resources independent of the Shuttle Program, was not an effective voice in discussing technical issues or mission operations pertaining to STS-107.”





Creation of the Paradigm

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- **The 2006 NASA Exploration Safety Study (NESS) Team found that NASA “*Safety and Mission Assurance is ineffective in carrying out its assigned responsibilities as given in the Governance document in many, but not all, NASA Centers.*” They cited:**
 - **Lack of leadership**
 - **Lack of clearly defined lines of authority for action**
 - **Lack of clearly defined levels of responsibility for SMA requirements**
 - **Lack of technical excellence of personnel in the safety disciplines**
 - **Lack of personnel with domain knowledge**
- “All of the above have led to lack of peer level respect from programmatic and engineering personnel and has rendered SMA ineffective.”***



Creation of the Paradigm

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■ Common Themes

- Lack of resources
- Lack of independence
 - Funding
 - Authority
- Lack of discipline and domain expertise
- Lack of engagement in technical decision making
- Lack of respect for technical capability



Creation of the Paradigm

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ROOT CAUSES

INADEQUATE RESOURCES

LACK OF INDEPENDENCE

LACK OF DISCIPLINE EXPERTISE



Root Causes

Inadequate Resources

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■ Level of Resources

- S&MA often not funded at required levels.
 - S&MA directly funded by programs and projects
 - Requires S&MA to compete for funding with engineering and program/project requirements
 - Often seen as overhead to Centers, programs, and projects
 - Lack of customer understanding of S&MA equity
 - S&MA viewed as an oversight organization

■ Quality of Resources

- A career in S&MA is not usually the first choice of NASA's best and brightest engineers.
- S&MA grade structure not on par with engineering counterparts.



Root Cause

Lack of Independence

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- **S&MA staffing negotiated with and directly funded by the Programs and Projects.**
 - Resulted in S&MA being beholden to programs and projects for people, tools, and travel.
 - Severely limited S&MAs ability to levy requirements on programs and projects.
 - Further clouded S&MA lines of authority.





Root Cause

Lack of Discipline Expertise

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- **S&MA downsizing in the 1990's required Civil Servant engineering workforce to become S&MA generalist at the expense of discipline expertise.**
- **The S&MA disciplines of systems safety, reliability and maintainability and quality engineering not normally offered as College degree majors.**
 - S&MA discipline expertise must be developed/ grown by employer.
- **NASA training and development programs inadequate to address S&MA development needs.**
 - No formal programs for S&MA development and qualification.
- **Minimally staffed S&MA organizations had to choose between getting the job done and providing time for engineers to obtain training.**
- **Inadequate training and travel dollars limited S&MA ability to accomplish discipline training and development.**



Changing the S&MA Paradigm Resources

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- **S&MA organization elevated from “Office” to “Directorate” level.**
- **Added 2 additional SES positions to MSFC S&MA Directorate.**
- **Civil Servant staffing increased from 102 in FY02 to 156 in 2006.**
- **Service pools created for S&MA.**
 - Included travel and procurement funds managed by S&MA.
- **Resources still negotiated with the programs and projects - but S&MA given real appeal authority to address shortfalls.**
- **S&MA grade structure brought closer to parity with engineering.**
- **New S&MA Vision created and communicated.**
 - S&MA unique discipline expertise.
 - S&MAs role of being part of the effort to find solutions.
 - Early S&MA involvement leads to improved quality, safety, and reliability of the design.
- **Center Director actively championed the rotation of some of the Center’s best engineers into S&MA.**



Changing the S&MA Paradigm Independence

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- **Service pools created in 2005 to provide more independence for S&MA.**
- **Agency further transitioning to HQ direct funding for S&MA managers designated as part of the technical authority.**
- **S&MA Technical Authority (TA) currently being defined and institutionalized.**
 - Will create a healthy balance between S&MA TA, Engineer TA, and Program/Project Management authority.
 - S&MA TA will have a seat at every level of management - Level 4 through Level 1.
 - Will provide S&MA with the authority to assure S&MA requirements are properly implemented in all programs and projects.

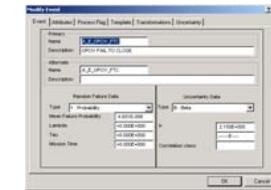


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Discipline Expertise

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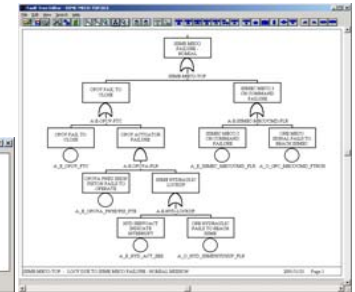
- All S&MA personnel required to select an S&MA discipline as the primary area of expertise.
- Professional Development Roadmaps (PDRMs) created to identify and list courses, knowledge and the experience necessary to be qualified at the various levels of S&MA discipline development.
- Discipline Champions established to train and mentor S&MA personnel in their efforts to develop.
- Mandatory Discipline working groups established to provide a forum for discipline development and knowledge sharing - run by Discipline Champions.



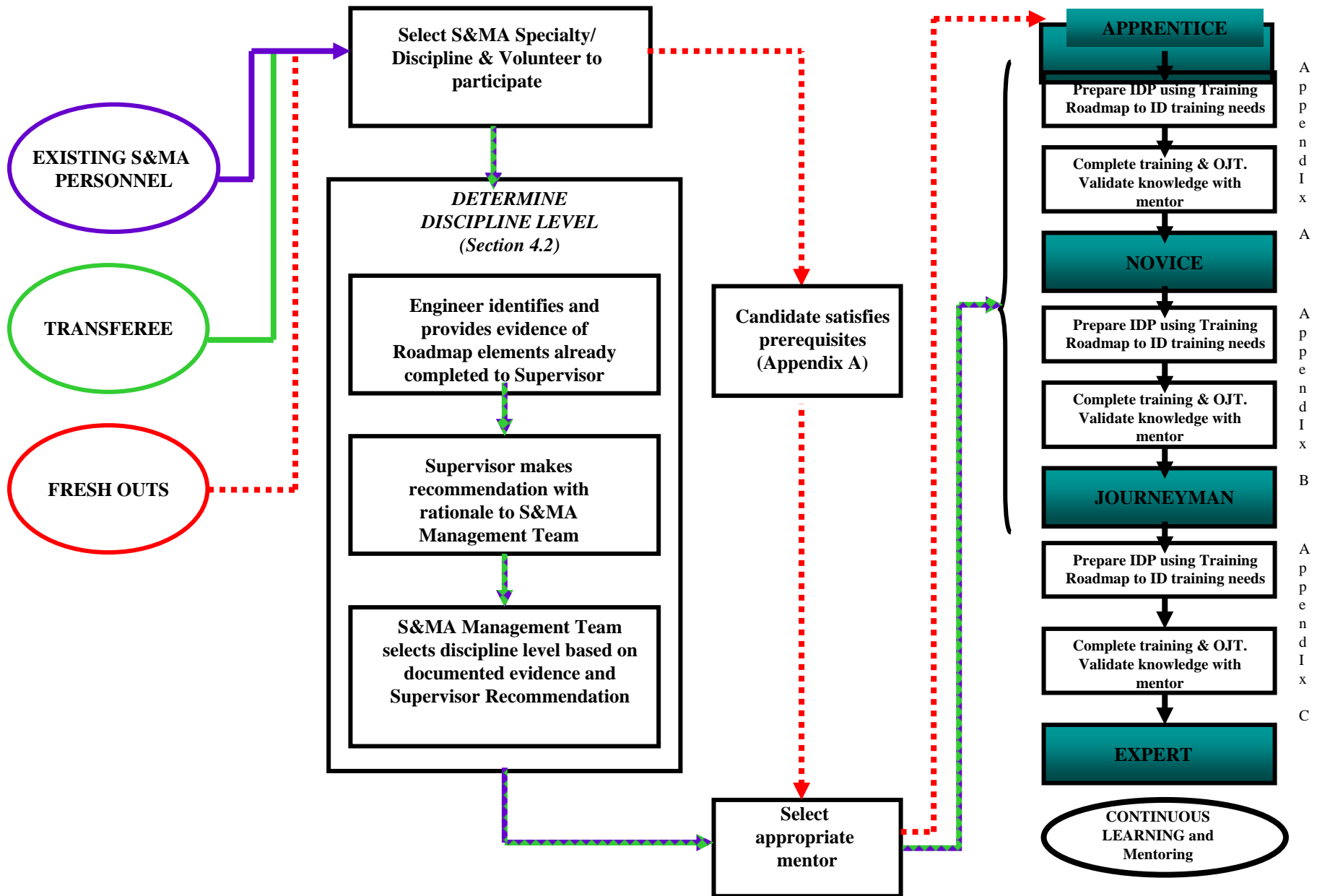
Construct fault tree using graphic (right) or logic (below) editor



- From SSME Fail to MECO PRA model.
- Modify Event: Input event probability and associated information.
- Name is limit to 24 characters for Events and 23 for Gates



S&MA Professional Development Flow





PDRM Content

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Body:

- Definitions
- Process
- Flow

Almost identical for the
three disciplines:
R&M, SS, QE



PDRM Content

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Body:

- Definitions
- Process
- Flow

Almost identical for the three disciplines:
R&M, SS, QE

Appendix C: Expert

Appendix B: Journeyman

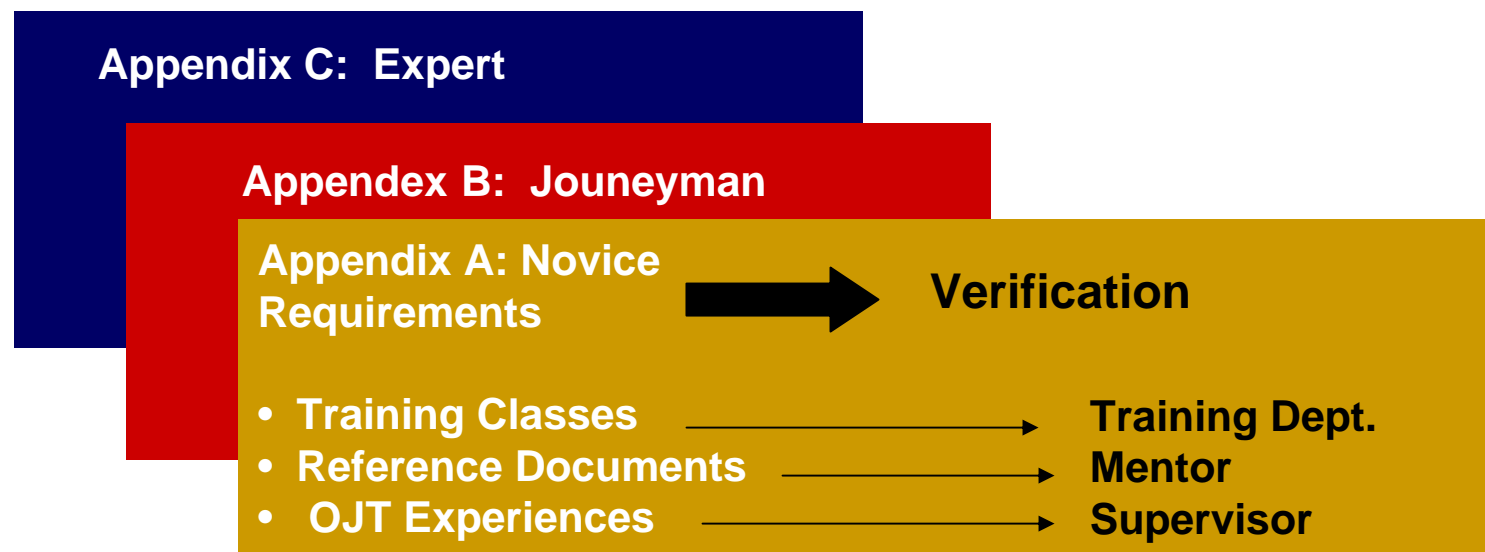
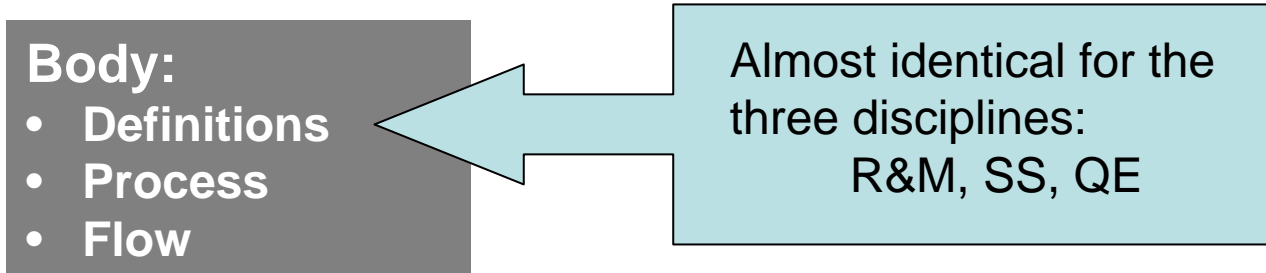
Appendix A: Novice Requirements

- Training Classes
- Reference Documents
- OJT Experiences



PDRM Content

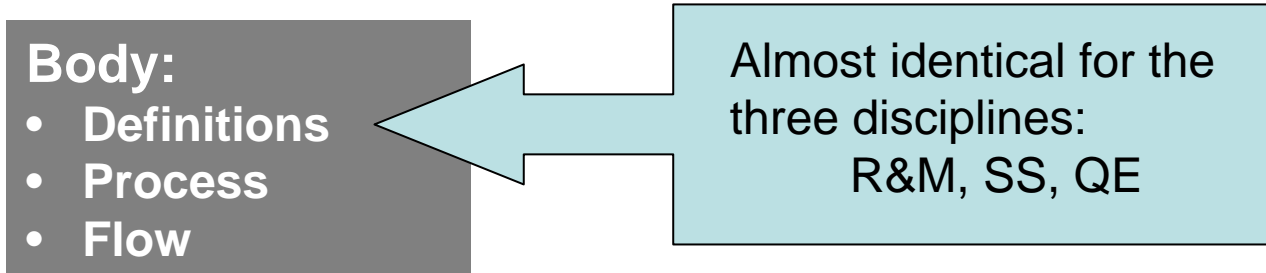
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PDRM Content

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Appendix C: Expert

Appendix B: Journeyman

Appendix A: Novice Requirements → **Verification**

- Training Clases → Training Dept.
- Reference Documents → Mentor
- OJT Experiences → Supervisor

Appendix D: Application for Certification

- Validation
- Champion
- Supervisor
- Certification Review Board





The New Vision

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- **S&MA is respected for its technical expertise.**
- **S&MA is an organization where NASA's best and brightest want to work.**
- **S&MA brings unique engineering expertise to the table in support of programs and projects.**
 - Programs see us as a must have - not a forced to have – and programs request S&MA support beginning with program formulation.
 - S&MA can help make systems safer and more reliable; early recognition of vulnerabilities results in fewer re-design efforts.
- **S&MA actively trains and develops its people.**
- **S&MA is an organization that not only identifies issues, but also helps identify solutions.**
- **S&MA is an organization that rewards and acknowledges superior performance.**



Finally

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- **Treat others with dignity and respect.**
- **Make sure your people have the tools they need to be successful.**
- **At the end of the day, make sure that everyone's hard work is acknowledged.**

Backup

Safety & Mission Assurance Directorate

