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A Presentation For The Chesapeake Chapter of INCOSE

Systems Engineering In Forensic Investigations

Introduction

- What is a forensic investigation?
- The role of systems engineering?
 - In conducting the investigation
 - In the analysis
 - In identifying evidence

Forensic Investigations

- Forensic Engineering Investigations can be used as part of:
 - Accident Investigations
 - Incident Response Investigations
 - Fire Origin & Cause Investigations
 - Criminal Investigations
 - Civil Litigation Investigations
 - Commercial / Disciplinary Investigations
 - Patent Infringement / Intellectual Property Theft Investigations

Incident Causation Theories

- Single Event Theory
 - The incident is the result of a single event

Incident Causation Theories, contd.

- The Domino Theory
 - W. H. Heinrich
 - Ancestry and social environment
 - Worker fault
 - Unsafe act together with mechanical and physical hazard
 - Accident
 - Damage or injury

Incident Causation Theories, contd.

- Multiple Causation Theory
 - For a single incident there may be many contributory factors
 - Only a particular combination will lead to an incident
- Contributory factors grouped according to:
 - Behavioral
 - Environmental

Incident Causation Theories, contd.

- In general the theories view the incident from a wide prospective
 - With contributing factors from three primary sources
 - The human participant
 - The apparatus involved
 - The environment in which the incident occurs

Human-Machine-Environment Matrix

- A. Chapanis
- P. Fitts
 - Army's Aero Medical Laboratory
- Alternatively known as the 9-Box Matrix

Human-Machine-Environment Matrix

	Before	During	After
Person			
Machine			
Environment			

Defining the Matrix

- Time dimensions - Before

	Before	During	After
Person			
Machine			
Environment			

Defining the Matrix, contd

- Time dimensions - During

	Before	During	After
Person			
Machine			
Environment			

Defining the Matrix

- Time dimensions - After

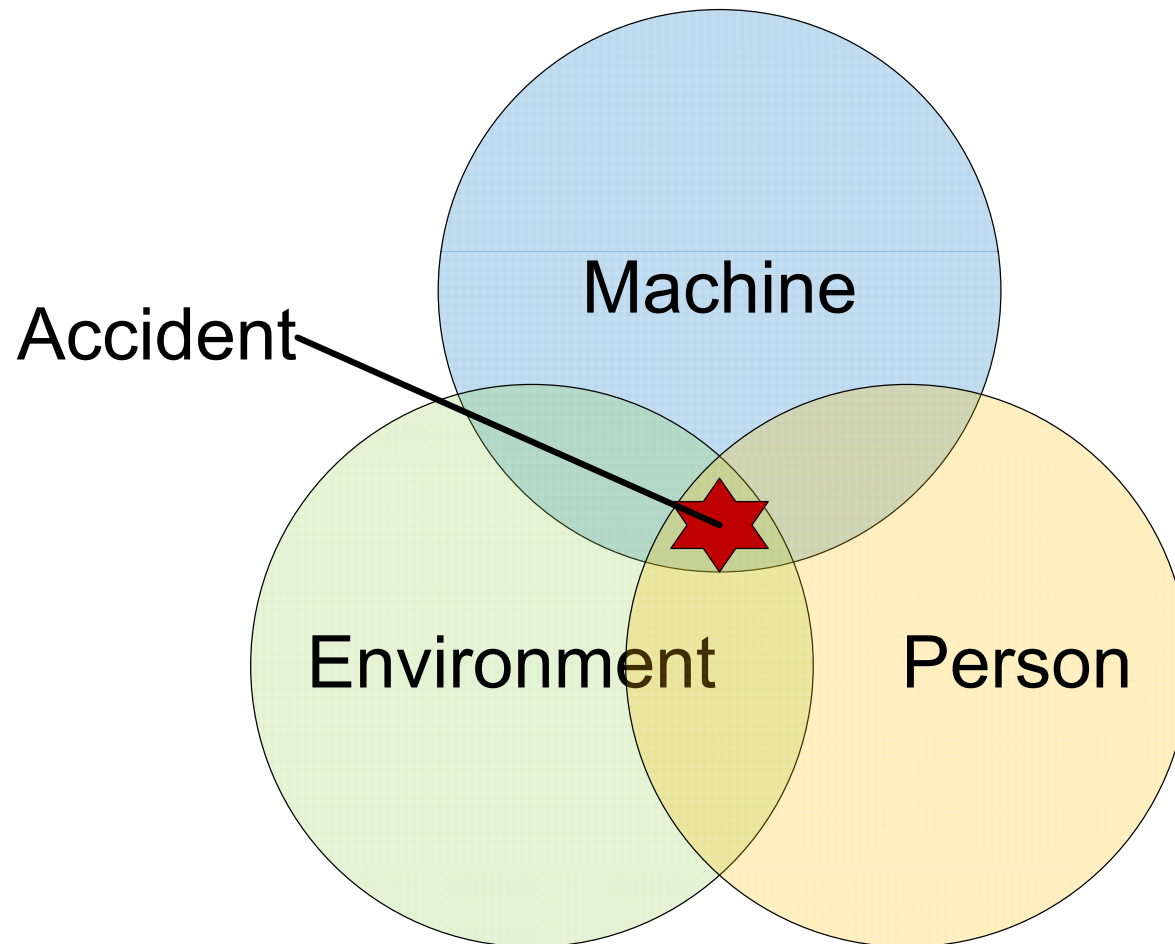
	Before	During	After
Person			
Machine			
Environment			

Defining the Matrix

- The elements

	Before	During	After
Person			
Machine			
Environment			

Interactions Within The Matrix

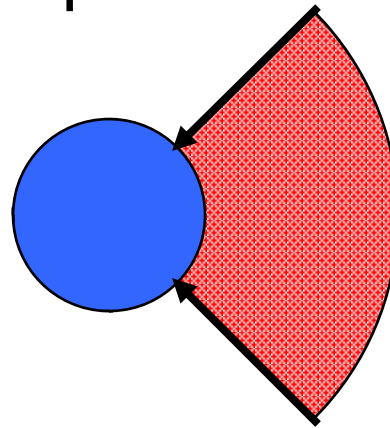


Analysis

- Scientific Method
 - Collect data
 - Establish potential causes and hypothesis
 - Test for validity

Analysis, contd.

- However
 - Hypothesis
 - Collect data
 - Test
- Constrains the exploration of an answer



Computer Investigations

- Where is evidence likely to be?
 - Follow the business process.
- Preservation of evidence
 - Volume of evidence
 - Extraction of evidence

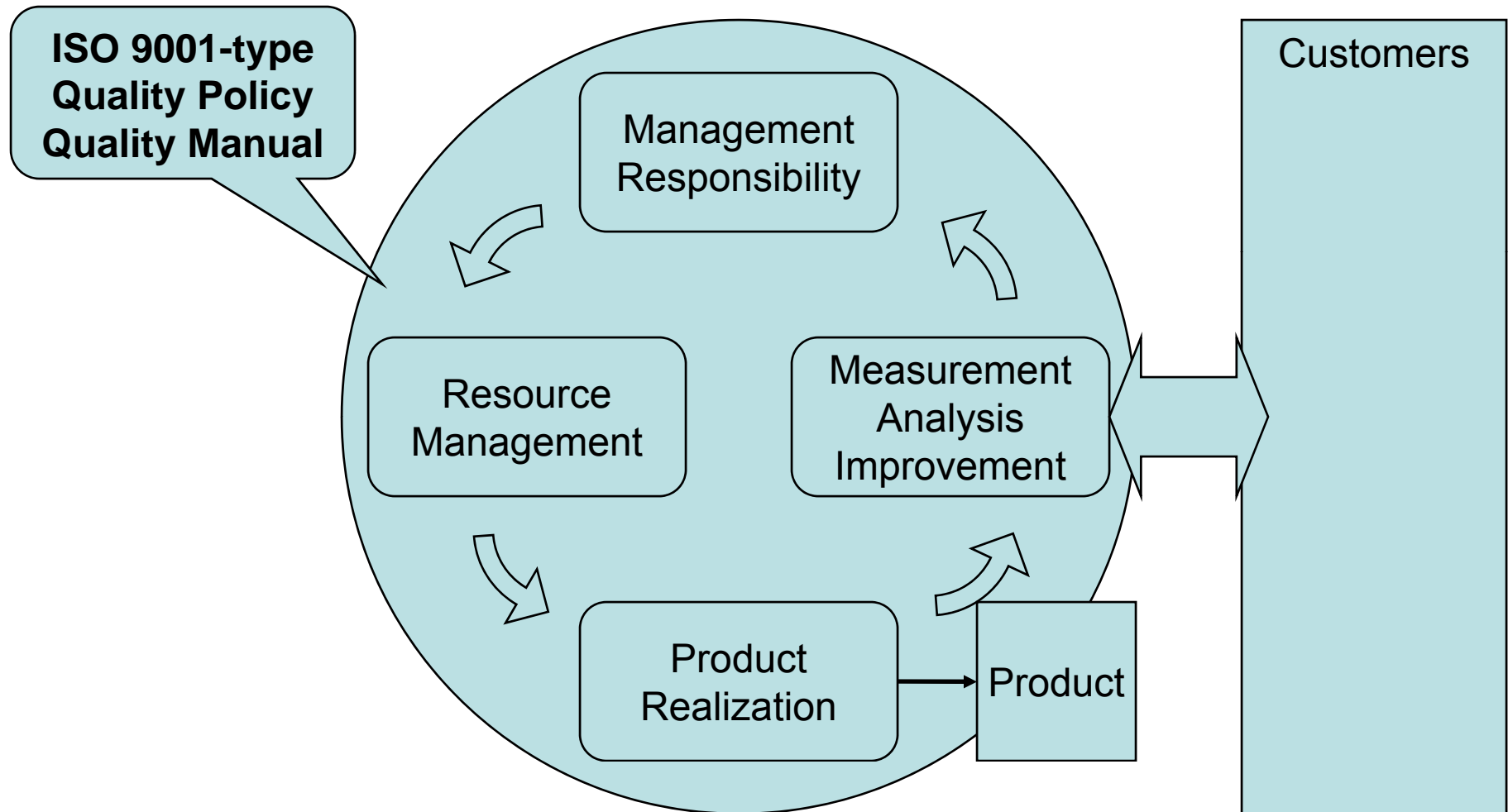
Standards For Conducting An Investigation

- Many standards exist for conducting an investigation
 - Association of Chief Police Officers
 - “Good Practice Guide for Computer-based Electronic Evidence”
 - Evidence Photographer’s International Council
 - Standards for Evidence Photography Criminal & Civil

Standards As Part Of The Analysis

- Identify standards that applied to the “machine”, the person and the environment
 - For example
 - NFPA 70 National Electrical Code
 - NFPA 70B Recommended Practice for Electrical Equipment Maintenance
 - NFPA 70E Standard for Electrical Safety Requirements for Employee Workspaces
- Compare the evidence with the requirements of standards

Standards and Evidence



Why Are Standards Important?

- Standards are formed through consensus
- Standards are used by many people
 - Adopting a standard means your practices are following generally accepted methods

Summary/Conclusions

- The role of systems engineering in engineering investigations:
 - Holistic, multi-faceted view
 - Consider not just the elements but also the interfaces
 - Standards apply to the conduct of investigations
 - Evidence is compared with the requirements given in standards
 - Standards can be used to identify possible sources of evidence