



BOEING and BowTie in Safety Risk Management

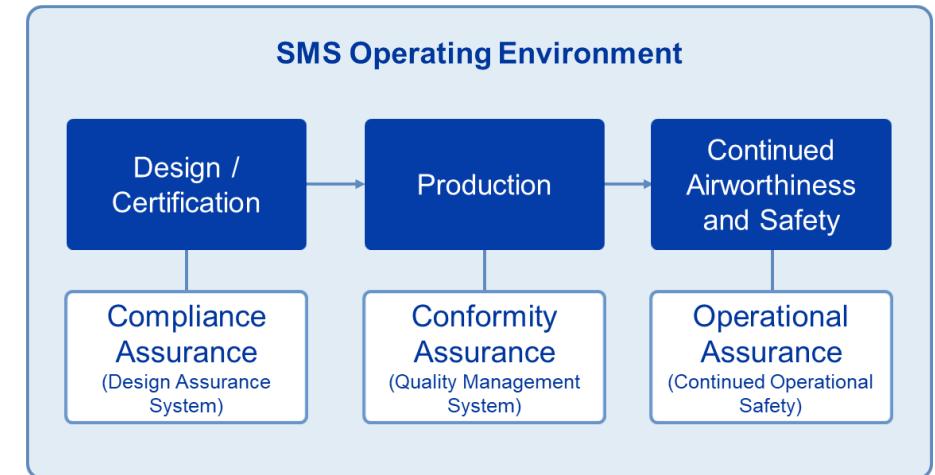
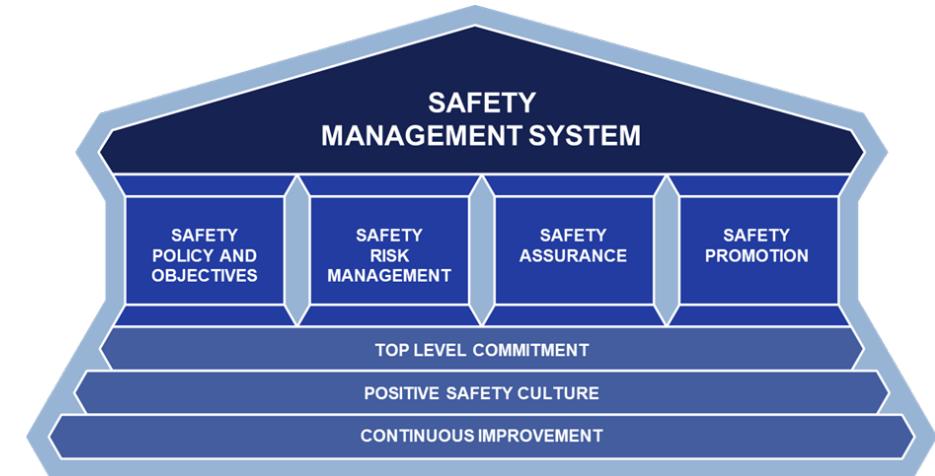
Janeece Escobar
Safety Engineer
Safety Management System

Boeing implementation of SMS

- Extensive benchmarking with Operators & OEMs
- Based on current FAR 14 CFR Part 5 and NPRM
- FAA approved voluntary program – Dec 2021
- For Design and Manufacturing (D&M) Companies:

Are the systems that **Design, Produce and Support** the product operating as intended?

- Using Bow-Tie analysis techniques to address the threats, events, controls and consequences in the operating environment.



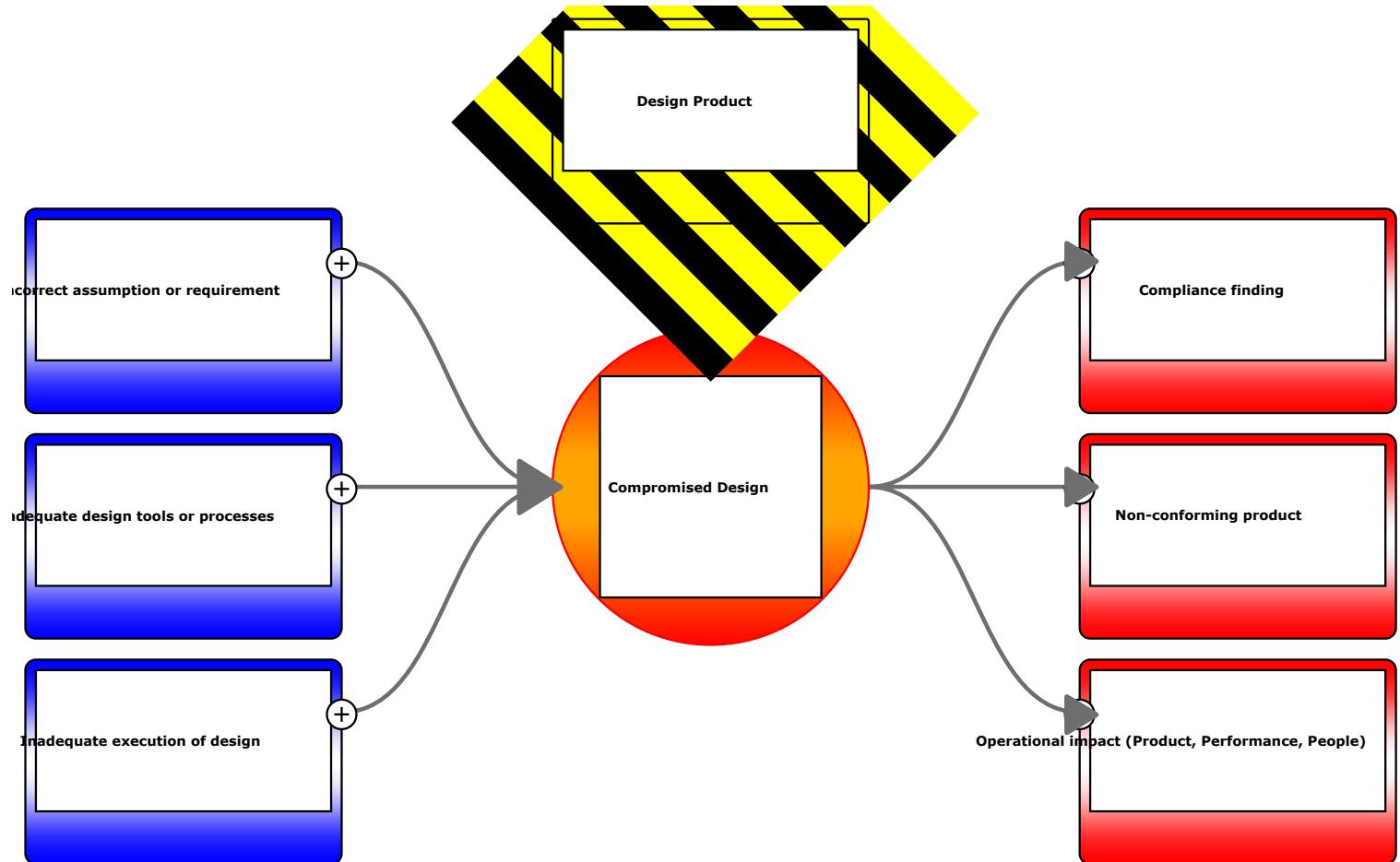
Ref: NAS 9927 (Figure 1)

SMS ensures Compliance, Conformance, Continued Airworthiness

Bowtie as an SMS Tool



- Collaborative
- Connects organizations
- Visualizes complex risk
- Forms common mental model
- Enables ongoing monitoring

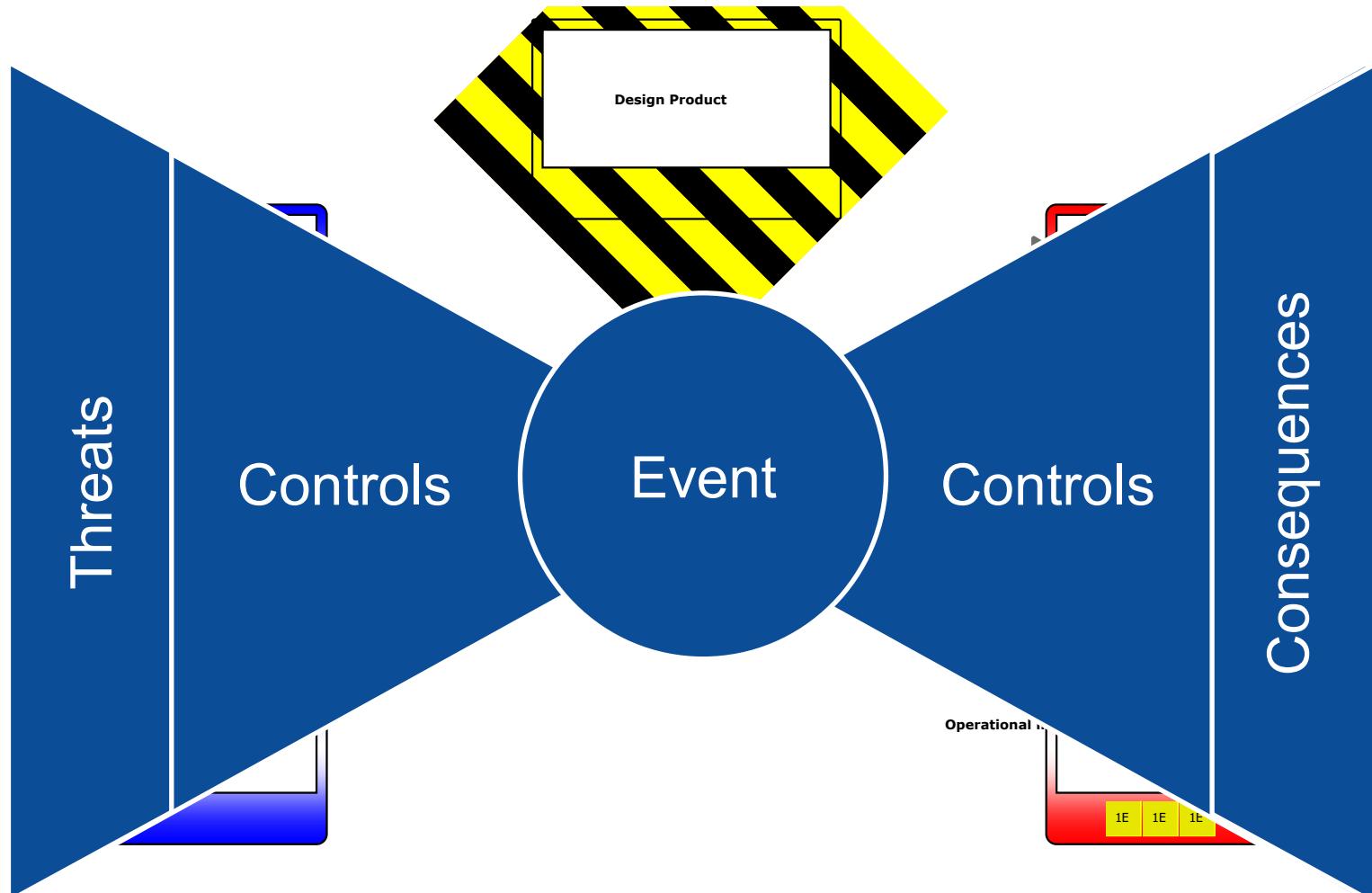


Threat could lead to **Event** could lead to **Consequence**

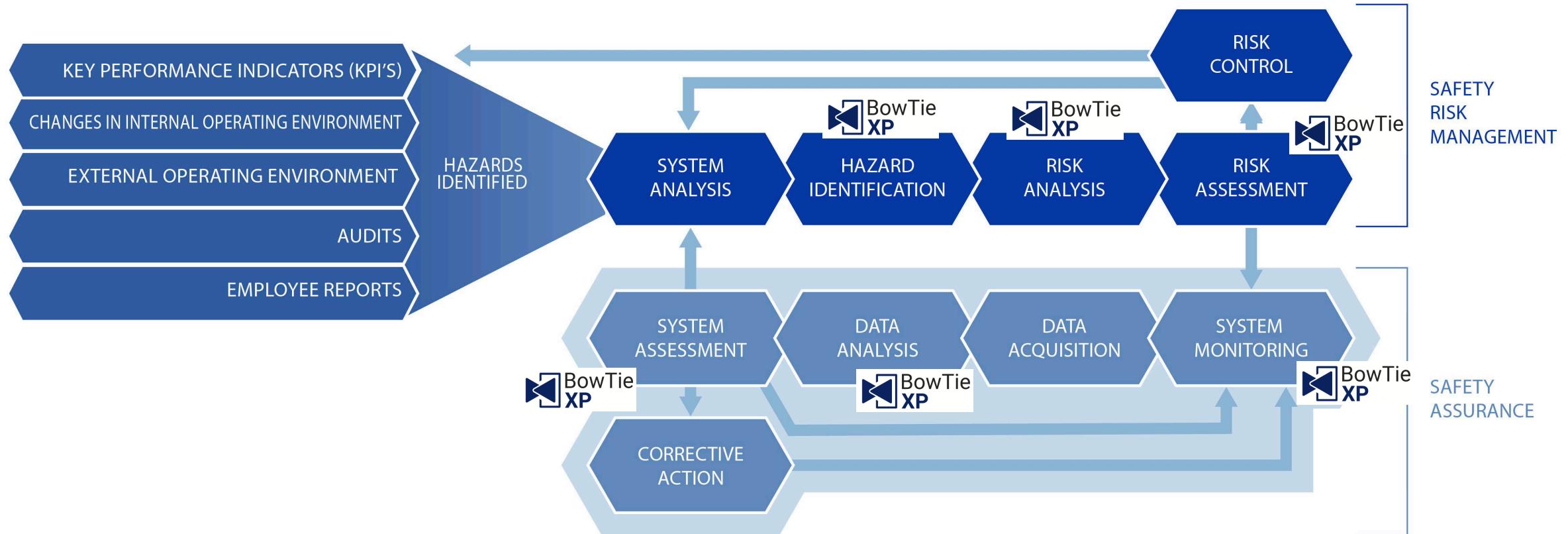
Bowtie as an SMS Tool



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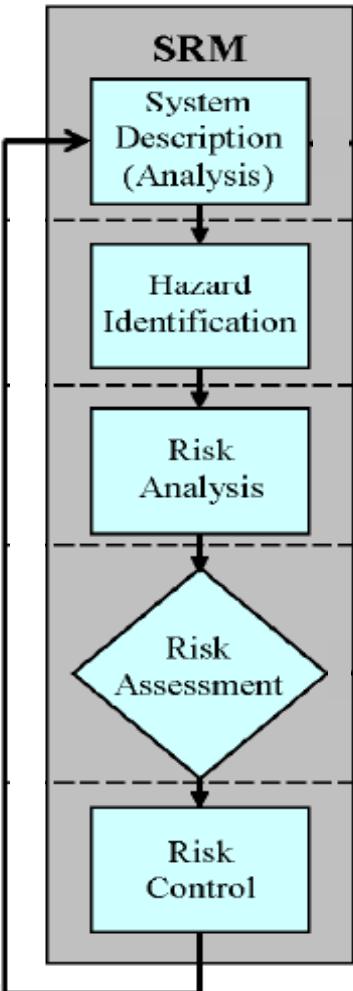


Safety Risk Management and Safety Assurance Integration



Where Bowtie fits into SRM

Safety Risk Management (SRM) Process



Step 1 - System Description

- Analyze the system to understand its functions, operating environment, procedures and processes, personnel/equipment/facilities required, organizational factors, etc.

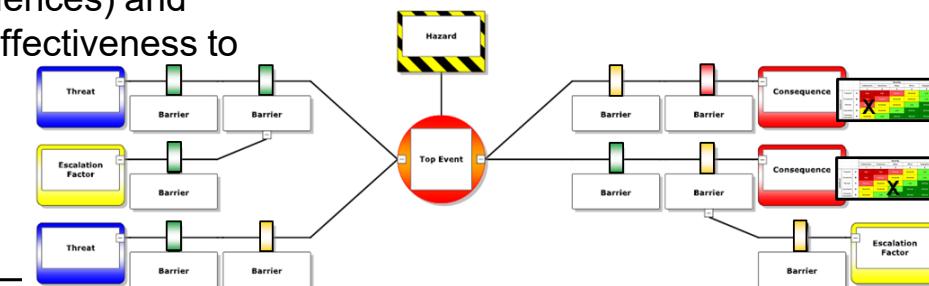


Step 2 - Hazard Identification

- Use the system description to identify the Hazard and Top Event..

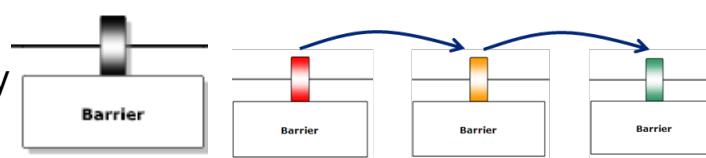
Step 3 - Risk Analysis

- Identify potential causes (threats), outcomes (consequences) and existing or proposed risk controls (barriers) and their effectiveness to determine risk levels.



Step 4 - Risk Assessment

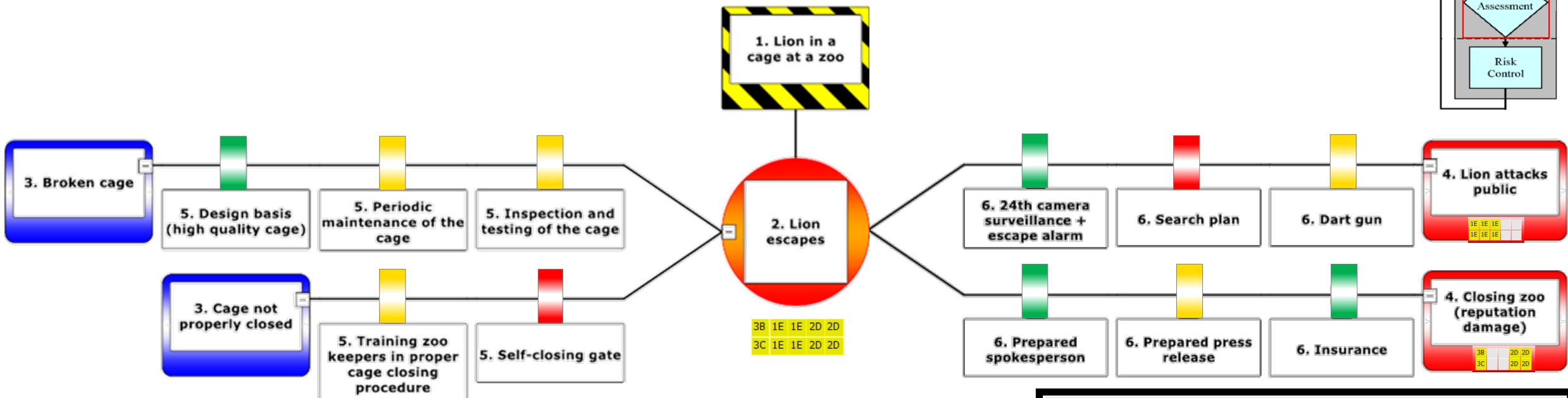
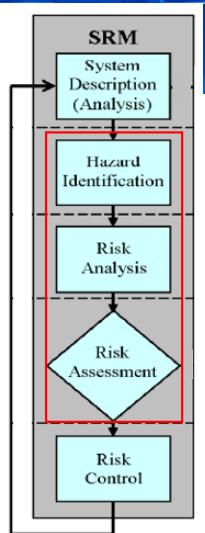
- Determine the acceptability of any risks



Step 5 - Risk Control

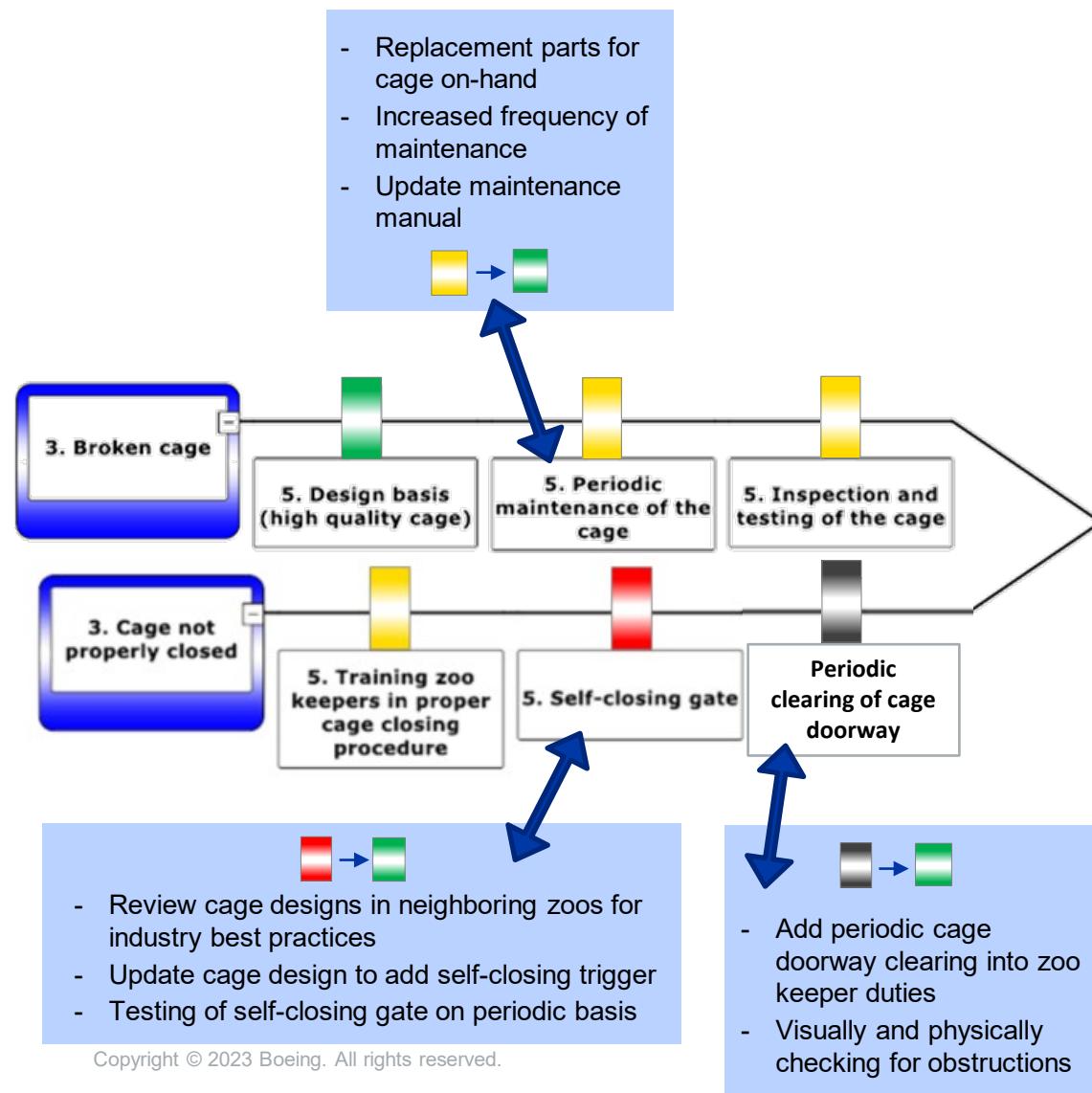
- Develop a risk control plan to mitigate the risk and plan how to verify effectiveness of barriers through targeted monitoring.

SRM Process Using BowTie (1/2)

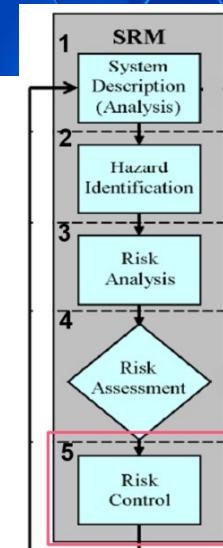


- | | |
|--|-----------------------|
| | Inadequate Now |
| <ul style="list-style-type: none"> • Barrier is not effective as currently implemented, to the team's knowledge. | |
| | Weak Now |
| <ul style="list-style-type: none"> • Barrier is somewhat effective, but could be improved as currently implemented. | |
| | Adequate Now |
| <ul style="list-style-type: none"> • Barrier is adequate and accomplishing its intent for mitigating/eliminating the risk as currently implemented. | |

SRM Process Using BowTie (2/2)



- Provide easy access for a zoo keeper to report escape
- Update search plan based on new Zoo layout and nearby road updates
- Assign Key duties to all parties involved in search
- Lethal / Non-lethal search method development



4. Lion attacks public

4. Closing zoo (reputation damage)

Not Present Now

- Barrier is not currently implemented. (i.e. planned or proposed)

Inadequate Now

- Barrier is not effective as currently implemented, to the team's knowledge.

Weak Now

- Barrier is somewhat effective, but could be improved as currently implemented.

Adequate Now

- Barrier is adequate and accomplishing its intent for mitigating/eliminating the risk as currently implemented.

Risk Integration

