“Situational Awareness”

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Presentation Overview

1. Introduction to situational awareness.
2. The three phases of situational awareness.
3. How to lose situational awareness.
5. Take-home lessons & suggestions.
How do you prevent occupational illness and injuries?
What Causes Mining Incidents?

- Equipment failure
- Mother nature
- Unsafe work procedures
- Pre-existing condition
- Unsafe work environment
- At-risk behavior
Hazard Identification & Risk Assessment

- Unsafe conditions
- Equipment
- Procedures
- Behaviors
Risk

- Risk = Probability \times \text{Consequence of occurrence} \times \text{Consequence of outcome}
Eastern Airlines
Flight 401
Wildfires
Situational Awareness (SA) Defined

Being aware of what is happening around you to understand how information, events, and your own actions will impact you and your goals, both now and in the future.

Wikipedia

The perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future.

Endsley, 1988
Situational Awareness
Situational Awareness
Situational Awareness

1. The perception of elements in the environment with a volume of time and space;
2. The comprehension of their meaning;
3. The projection of their status in the near future.

Perceive \(\rightarrow\) Understand \(\rightarrow\) Project
Gaining & Maintaining SA

Perceive

Gathering (scanning) information

Understand

Comparison w/ mental model

Project

Update model

Future: Understanding the situation triggers decision-making, action & review.

Feedback, check, monitor
The (Situational Awareness) 360° Bubble
Elements of Situational Awareness

- **Information**: production targets, SOPs, timing, rules, training, operations data, communication, etc.
- **Environment**: temperature, heat, lighting, co-workers, equipment, visibility, proximity, tools, housekeeping, complexity, etc.
- **Personal**: health, fatigue, confidence, experience, competence, vigilance, distractions, motivation, working memory, etc.
- **Organizational**: acceptable behavior, culture, change & change management, history, expectation, supervision, accountability, incentive, teamwork, etc.
The (Situational Awareness) 360° Bubble

- Proximity?
- Poor weather?
- Mechanically sound?
- Housekeeping?
- Line of fire?
- SOP?
- New workers?
- Process upset?
- Non-routine task?
- All energy isolated?
- Unusual sounds?
- Behind schedule?
Situational Awareness

- Is SA an innate skill? Are some people born with the ability to be competent at SA regardless of the environment?
- If so, how do you identify these people?
- Can workers be screened for SA ability?
- Can SA be learned and developed? If so, how?
• Level 1 SA.
• Acquiring information from the environment/situation:
  – By seeing, hearing, smelling, touching, feeling.
• Paying attention to what is most important.
• Knowing what is relevant and what is not relevant.
• Active process. Requires practice & discipline.
• Information used to build a mental model of the environment.
• Can we be ‘on’ all the time?
What Do You Perceive?
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It’s also important to know when there is no change...
Keys to Optimizing Perception

• Testing workers’ ability to ‘see’ in their environment.
• Show new workers what is acceptable & unacceptable;
• Avoid complacency (experienced workers on autopilot?);
• Build on previous shift’s perceptions:
  – Use pre-shift/tailgate meetings to describe changes;
Failing to See

- Scanning & observing require discipline & practice.
- Scan the entire environment -- may be multiple areas.
- Don’t expect to see something.

“Sometimes you see only half of the picture but need to see all of it to understand the situation.”
Visual Illusions

• Visually perceived images that differ from objective reality.
• Literal optical illusions: create images that are different from the objects that make them.
• Physiological illusions: the effects of excessive stimulation of a specific type (brightness, color, size, position, tilt, movement).
• Cognitive illusions: result of unconscious inferences.
Optical Illusions
Julian Beever, UK Artist
Julian Beever, UK Artist

Amamorphic illusions
Illusion of Attention

- Aka: inattentional blindness & selective attention.
- We think everyone sees/experiences the world as we see it.
- We share an illusion that we all see/experience the world the same. This is an incorrect assumption.
- You experience the world based on what your mind allows you to experience.
- Not paying attention to something is to be blind to it.
• Level 2 SA.
• Building the mental model.
• Comparing observations with experience & knowledge.
• Synthesizing disjointed elements through pattern recognition, interpretation & evaluation.
• With no experience it’s difficult to form an accurate mental model. This is one reason inexperienced workers get injured most often.
• Mental models must be kept up to date.
Change Blindness

- A form of inattentional blindness.
- Usually associated with an extraneous, momentary, disruption in visual continuity.
- Magicians rely on this common human error.
- Increasing shifts in attention decrease the severity of change blindness.
- Changes in the foreground are detected more readily than changes made to the background, an effect of the intentional bias for foreground elements.
• Level 3 SA
• Understanding of the situation enables us to look ahead.
• Ability to project future actions of the environmental elements.
• Achieved through knowledge of status & dynamics of elements and extrapolation of this into the future.
• Time is critical in SA – it changes with the action of individuals, task characteristics and the environment.
Endsley (1995)
Decision-making & Situational Awareness

- **Goal**
- **Action**
- **Result**

- **Review**

- **Planned Action**
- **Expected Result**
Mistakes & Performance Growth (H. Dreyfus)

- Novice: Behavior based on rules & procedures
- Advanced Beginner: Behavior based on rules & procedures
- Competent: Behavior based on rules & procedures
- Proficient: Behavior based on personal practical knowledge
- Expert: Behavior based on personal practical knowledge
Mindfulness (Habit)

If a worker’s normal work pattern includes unsafe behavior, and the work is repetitive, the unsafe behavior will become habit.
SA & Mining Incidents
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Hazard (Situational) Awareness: Errors

• Level 1: Failure to perceive information in the environment.
• Level 2: Failure to correctly assimilate or understand info.
• Level 3: Errors due to lack of mental model, i.e., think ahead.

• What type of error is most common?
Hazard (Situational) Awareness: Errors

- Level 1: Failure to perceive information in the environment.
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- Level 3: Errors due to lack of mental model, i.e., think ahead.

What type of error is most common?
Losing Situational Awareness

- Perception based on faulty information;
- Inadequate pattern recognition (don’t see the cues);
- Inadequate/inflexible mental model;
- Excessive motivation (distraction);
- Inadequate working memory (fail to ‘chunk’ information);
- Workload (overload);
- Stress;
- Fatigue;
- Poor communication (especially for team SA).
Alertness (Fatigue) & Human Error

**Day-Night Cycles**

Number of Errors

A.M.

- 5,000
- 3,000
- 1,000

Time (hours)
Job & Personal Factors that Weaken SA

- **Task saturation**: Lack of planning or preparation.
- **Physical stress**: Hunger, temperature, noise, endurance, etc.
- **Mental stress**: Pre-existing condition, divorce, demotion, $.
- **Impulsiveness**: Ready, act, think.
- **Invulnerability & complacency**: “It won’t happen to me…”
- **Resignation**: Fate, out of my hands, I don’t care.
- **Time**: Bias is always on not having enough time.
The Impact of Stress on SA

- **Omission**: Letting things drop by failing to respond to important signals (L1).
- **Error**: Make mistakes (L3).
- **Procrastinating**: Delay things you can’t handle (L3).
- **Approximation**: Accept lower standards of performance.
- **Fixation**: Concentrate on one item while ignoring others (L3), e.g., Eastern Air 401.
- **Regression**: Revert to an earlier procedure or action (L2&L3).
Warning Signs for Decreasing SA

- Fixation on one thing to the exclusion of others.
- Failure to look around.
- Failure to adhere to standard operating procedures (SOP).
- Two or more source of information disagree.
- Unresolved personal conflicts.
- Confusion/bafflement regarding the situation.
- Failure to meet checkpoints or milestones in the plan.
Measuring SA

- Mental Models
- Working Memory
- Performance
- Workload
- Attention
- Pattern Recognition
- SA
Sample SSA Survey Question

“You have been asked to do an important task by your manager. A colleague then asks you to give an important but non-urgent message to another colleague. What do you do?”

- Tell my colleague that I will pass the message on as soon as I have finished the task for my manager.
- Stop what I am doing, give the message to the other colleague and then finish the task for my manager.
- Tell my colleague that I am very busy and that I cannot pass the message on.
- Tell my colleague that I am very busy and that they should do it themselves.
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‘Situational Safety Awareness’ Survey (SSA)

- Reports the results of a study of 808 heavy industry & mining employees.
- Claims that new recruits scoring >60 on the SSA were seven times less likely to be injured than employees who had not been screened.
Ways to Improve Situational Awareness

• Actively scan the environment: no ‘one & done.’
• Expand your area of attention.
• Minimize internal & external distractions:
  – If distracted, return to the start.
• Be aware of & anticipate visual illusions & miscues.
• Never trust your expectations exclusively.
• Check for contradictory elements.
• Check the reliability of your information.
• Don’t rush assessments.
• Regularly update your mental model.
New/Reassigned Employees

- Ensure they have a basic mental model before being released to the work environment alone:
  - Use 2D & 3D images & video.
  - Use virtual reality.
  - Make it as real as possible.
- Ensure they understand the mechanisms of communication if they are alone or working in a team/crew.
- Check for understanding during the shift: supervisor, mentor.
- Debrief as heavily as possible in the early days.
- Emphasize the importance of near miss reporting.
Thinking Ahead – In Practice

• Set a time or place to recheck the situation.
• Confirm that the situation agrees with the initial plan.
• Set priorities for the current situation:
  – Rules
  – Standard operating procedure (SOP).
  – ‘Change triggers’.
• Set priorities for thinking:
  – Workload
  – Attention
  – Task
Bourne
Conclusions & Recommendations

- Individual & team SA is a life & death issue in most industries.
- Effective SA can greatly enhance your personal safety.
- Some people are naturally good at SA (Select them).
- SA is a cognitive skill that can be taught (Do it);
  - Use site-specific examples, be visual, auditory, etc.
  - Use video, slides, simulators, etc.
  - Integrate into personal risk assessment (Take 5).
- Integrate into pre-shift crew/team meetings.
- Integrate SA into your BBS processes (Do they SA?).
- Integrate SA into your incident investigation process;
  - Did the injured party or co-workers neglect SA?
- Track indicators of systemic SA weakness as a metric.
Situational Awareness

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Thank You for Your Attention

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