Surface Mining Association for Research and Technology
“SMART Shovel”
Project Overview

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Marietta, GA USA
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Overview

• Introduction
  – About SA Technologies
  – Situation Awareness

• Project
  – Tasks 1, 2, 3 and Our Approach
  – GDTA Interviews (Kamloops / HVC visit)
  – Project Schedule and Deliverables

• Questions & Next Steps
SA Technologies, Inc.
Our Areas of Expertise

Design
- Principled Methods For Designing to Enhance SA
  - SA Requirements Analysis
  - SA-Oriented Design
  - SA Measurement

Measurement
- Validated metrics for SA and Team SA

TRAINING
- Revolutionary Training Programs for SA

Research
- World leaders in SA Research
  - Shared SA
  - Human/Automation Integration
  - Model of SA
  - UAV/UGV Operations
  - Collaborative Tools

NASA 2001 Woman Owned Business of the Year

20 years in Situation Awareness

Know the Situation. Know the Solution.
What is Situation Awareness?

Situation Awareness is the **Perception** of 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
Situation Awareness is Critical in a Wide Variety of Domains.

- Aviation
- Air Traffic Control
- Maintenance
- Medicine
- Military Command & Control
- Intelligence
- Space Flight
- Power Systems
- Oil & Gas
- Transportation
Significant Challenges for SA in Mining Operations

- Noise
- Dust, lighting
- Poor visibility from vehicles
- Distributed operations
- Piecemeal addition of technologies
- Increasing use of automation
- Shiftwork, fatigue
Our Services

- **Requirements Development**
  - Goal-directed task analysis
  - Increase software quality
  - Improve communication

- **Visual Design**
  - Stand out from competition
  - Stay cutting-edge

- **Branding**
  - Extend corporate identity
  - Facilitate brand recognition

- **SA-Oriented Design**
  - Improve operator performance
  - Reduce workload and errors

- **Design Principles**
  - Automation
  - Error Management
  - Alerts and Statuses
  - Information Visualization

- **Style Guide**
  - Commonality
  - Consistency
  - Reuse

- **Measurement & Evaluation**
  - Measure progress
  - Focus design and development efforts
  - Hard proof for customers
Task 1 – Conduct SA Requirements Analysis
Contractor will determine the **SA requirements for Shovel Operators using a Goal-Directed Task Analysis process** in order to clearly delineate the specific information needed for situation awareness in their respective tasks, and the ways in which that information needs to be processed to provide comprehension (level 2 SA) and projections of future events and states (level 3 SA) to meet each critical decision and operational goal.

Task 2 – Design User Interfaces for Shovel Operators
Based on the GDTAs developed in Task 1, SA Technologies will **design prototype display designs shovel operations to convey the needed information**.

Task 3 - Conduct Initial User Review and Testing of the Prototype Displays
SA Technologies will **conduct an initial user review of the draft Shovel Operator displays** with subject matter experts to ensure the success and validity of the prototypes.
Solution Overview

- We will utilize the Situation Awareness Oriented Design (SAOD) process to assist in the design and evaluation of this project.
- Our user-centric SAOD approach helps ensure supporting the end-user: increasing their SA and performance, reducing their cognitive workload and errors.
- 5-month project timeline: August, September, October, November, December
Task 1

- Utilize a form of cognitive task analysis called a Goal Directed Task Analysis (GDTA)
  - Used extensively in a variety of domains
  - Identifies the user’s goals, the decisions that must be made to achieve those goals, and the specific information requirements that are needed to effectively make the decisions
  - Provides specific direction as to what information the users need, which information needs to be presented together (e.g., to support a decision and a goal), and how this information needs to be presented in order to facilitate understanding and task performance.

Drives Design
Drives Evaluation
## Task 1: GDTA Interviews

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<th>Day 2</th>
<th>Day 3</th>
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<td>SME#2</td>
<td>SME#4</td>
<td>SME#6</td>
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- **Observations**
  - Observe the operational environment (e.g., lighting, visibility, space, etc.)
  - Ideally operators on-the-job / hands-on
- **Interviews**
  - 4-6 SMEs, potential operators for the envisioned system
  - ~2 hour interview sessions are conducted with individual SMEs 1-on-1
Task 2

SA-Oriented Design Principles
• Automation Guidelines
• Collaboration Guidelines

Human Factors Standards & Guidelines

Wireframe UI concepts

“Design User Interfaces for Shovel Operators”
Task 3

- Conduct an initial user review of the draft shovel operator displays with subject matter experts
- Ideally with ~6 subject matter experts provided by company representatives
- Cognitive walkthroughs to determine initial usability, understandability, information completeness and functionality
- Update shovel operator displays based on feedback
Deliverables
1. Goal-Directed Task Analysis for Shovel Operators
2. Shovel Operator User Interface Display Description Document for each Screen – Initial & Revision
3. User Testing Results & Recommended Improvements for each Screen
4. Final Report to SMART on Results and Recommendations

Assumptions / Needs
- Visit to the Nevada Barrick site for operator / SME interviews early September
- Access to operators / SMEs for design reviews early November
Next Steps

• Upcoming Trip
  – Confirmed SMEs and their roles
  – Directions to the interview location
  – Interview POC

• Going Forward
  – 2nd GDTA trip
  – GDTA validation review
  – Questions / interaction during the design phase
  – Draft designs and potential for an early-November user test
Questions?

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