



# 712CD

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# A Doctrine-Based Ontology of Situational Awareness for Small Combat Unit Tactical Operations



# Novel, Broadened Concept of “SA”



**Standard concept of SA:** SA is not defined in the Ground Soldier System Capabilities Description Document, although it seems to be conceived as essentially “Geospatial Data Services” combined with “Friendly Location Tracking” with a Graphic User Interface (GUI) design implementation.

**FCS O&O concept of SA** (adapted from work by Dr. Mica Endsley):

- The state being aware of everything that is happening around oneself and the relative importance of everything observed - a constantly evolving picture of the state of the environment.
- SA is a Leader’s state of knowledge or mental model of the situation around him. SA is important for effective decision making and performance in combat- a complex and dynamic environment requiring human control.
- A general, widely applicable definition describes SA as “*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.*”

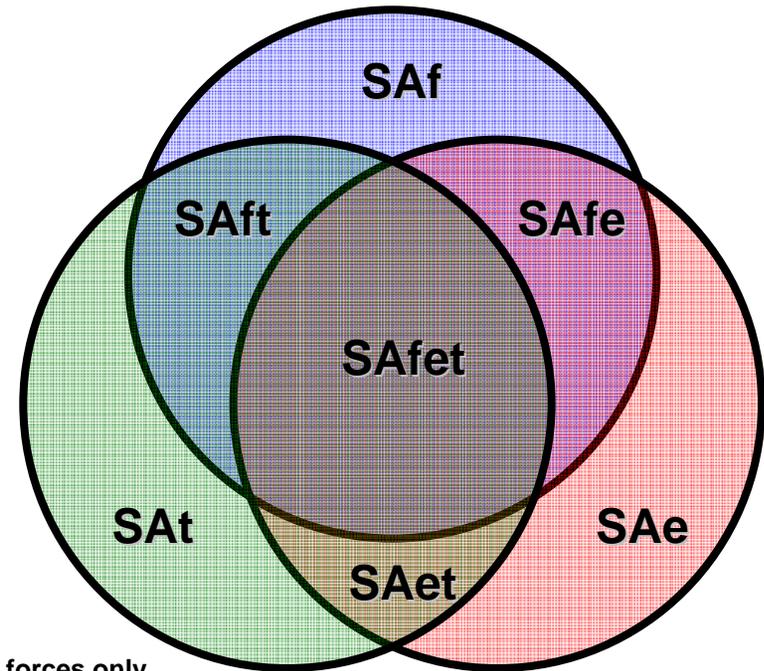
(SOURCE: Dr. Mica Endsley, pp 97-101, "Design and evaluation for situation awareness enhancement," proceedings of the Human Factors Society 32nd Annual Meeting, Human Factors Society, Santa Monica, CA, 1988).



# Seven SA Classes



- Situational Awareness is classified by variables representing Friendly, Enemy, and Terrain factors
- Classes of SA Particles are formed as expressions by single or combined variables



1. **SAf:** A *simple* class representing pieces of knowledge relevant to **Friendly forces only**.
2. **SAe:** A *simple* class representing pieces of knowledge relevant to **Enemy forces only**.
3. **SAAt:** A *simple* class representing pieces of knowledge relevant to aspects of **Terrain only**. "Terrain" includes weather & visibility factors.
4. **SAft:** A *complex* class representing pieces of knowledge relevant to the relationship between **Friendly forces** and their surrounding terrain.
5. **SAet:** A *complex* class representing pieces of knowledge relevant to the relationship between **Enemy forces** and their surrounding terrain.
6. **SAfe:** A *complex* class representing pieces of knowledge relevant to the relationship between **Friendly forces** and **Enemy forces**, independent of aspects of Terrain.
7. **SAfet:** The *most complex* class representing pieces of knowledge relevant to the relationship between **Friendly forces, Enemy forces,** and aspects of **Terrain**.



# Three SA Levels



**SA Level-1: "Situational Awareness": Perceiving** critical SA Particles in the environment; composed of disaggregate elements of information, in other words, raw input.

**SA Level-2: "Situational Understanding": Comprehending** what those critical SA Particles mean, particularly when integrated together in relation to the decision maker's goals; the earliest level of gaining situational understanding; achieved when the individual combines, interprets, stores, and retains the information; includes integrating information received and then determining the relationship between those pieces of information and the relevance of the individual pieces to the desired end state.

**SA Level-3: "Situational Forecasting": Projecting** what will happen with those critical SA Particles in the near future; reached by using **Comprehension** to project possible future events and to anticipate their outcomes.

*(SOURCE: Adapted from FCS O&O paragraph 4.6.2.4 and work by Dr. Mica Endsley).*



# SA Particles



- A basic unit of "Situational Awareness"
- The particle is the smallest discrete amount of SA useful to Rifle Platoon, Squad, and/or Fire Team Leaders during close combat operations
- Each particle is of 1 of the 7 classes and 1 of the 3 levels
- All particles are traceable to FM & ARTEP 7-8 and STP 11B Skill Levels 2-4
- For a recent MAPEX a "Fire & Maneuver" SA Particle List contained 119 discrete particles



# Example SA Particles



Ammunition Casualty & Equipment (ACE) Status  
Assault Element Status (Assault Position established/pending/other)  
Assault Position (last covered & concealed Position before assault objective(s))  
Camouflage Status  
Casualty Treatment Requirement  
Collect Enemy Combat Information Feasibility  
Element Interval Requirement (pre-contact)  
Enemy Contact Probability  
Enemy Cover & Concealment  
Enemy Fixed Status  
Enemy Flanks  
Enemy Observation & Fields of Fire  
Enemy Position  
Enemy Strength  
Enemy Suppressed Status  
Enemy Vulnerability to Assault (Assault Element is/is not able to continue to advance without undue risks)  
Enemy Vulnerability to Suppression  
Friendly Fire Accuracy  
Friendly Fire Volume  
Friendly Morale Loss  
Friendly Observation & Fields of Fire  
Friendly Position  
Friendly Strength  
Friendly Strength Loss - KIA  
Friendly Strength Loss - MIA  
Friendly Strength Loss - WIA



# Example Use of SA Particles



PURPOSE: Investigate and assess **Situational Awareness needs** of small-unit Infantry leaders in the context of infantry **fire & maneuver** tactics and **capabilities of the FFW system** to meet those needs.

CONCEPT: Military subject-matter experts **assume roles** within a rifle platoon in a MOUT operation, wargame it collaboratively, and provide feedback about **information needs** and the potential for FFW equipment to meet those needs. Online survey is used to collect responses.

APPROACH: Pay particular attention to what tasks are **Most Important** and what are **Most Difficult** in terms of Situational Awareness of the Enemy ( $SA_E$ ), Terrain ( $SA_T$ ), and Friendly forces ( $SA_F$ ). Use a “Brief, Wargame, Discuss, Survey” cycle of events.



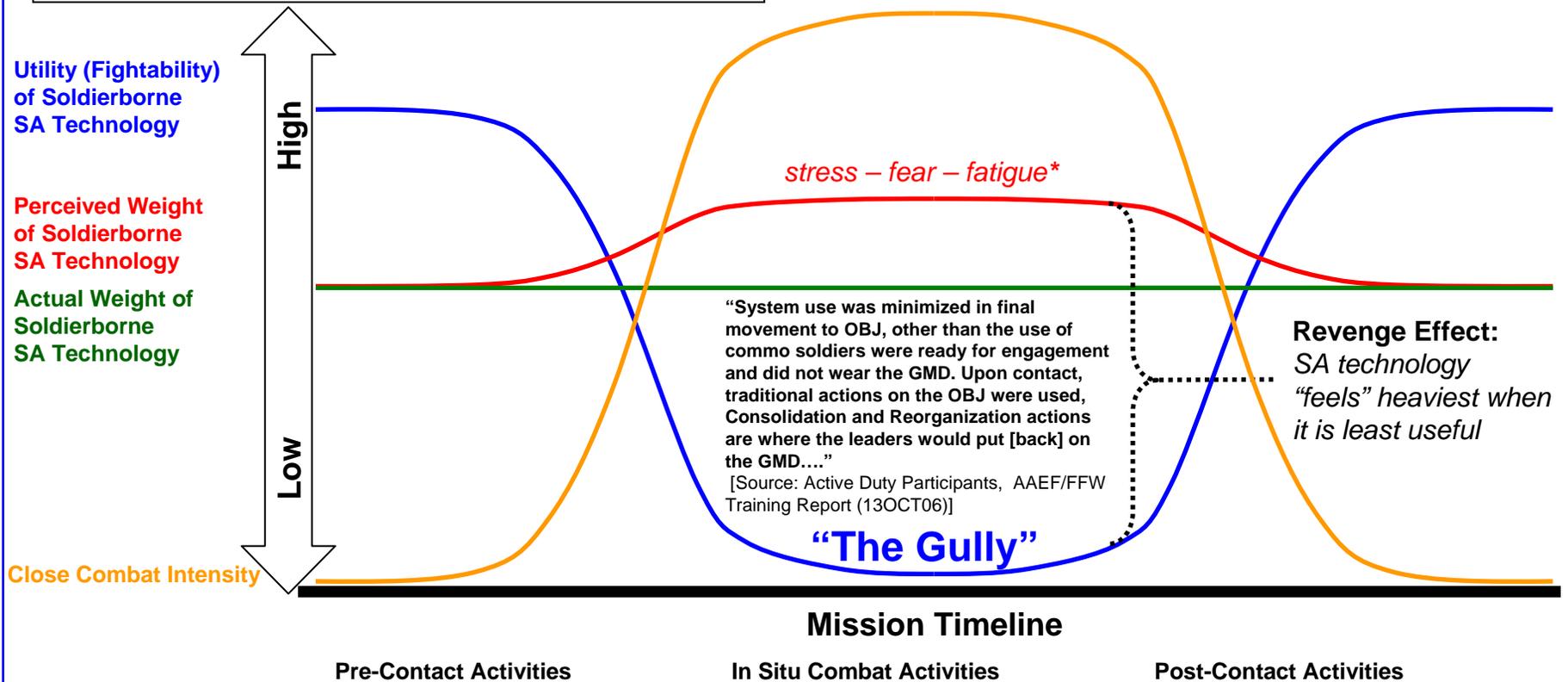
# Working Hypothesis – “SA Gullying”



**Indication:** Disuse of Soldierborne SA Technology

**Causation:**

- *Unfightable* interfaces (GUIs): users ignore SA Particles
- *Lack of time* to process some SA Particles



\* Source: S.L.A. Marshall, "The Soldier Load and the Mobility of a Nation," 1950



# Context & Modality Assessment



If an SA Particle is rated as **highly important** and **difficult to operate with** during a particular segment of the vignette, survey respondents will be asked for their opinions on ***Context & Modality***

- **Context Awareness** - Respondents will be asked to assume SA Particles could be delivered by computer devices that have information about the circumstances under which they operate, can react accordingly, and may try to make assumptions about the user's current situation.
- **Interface Modalities** – Respondents will be asked to assume a Soldier (User) Interface *could* communicate useful SA to the human senses in multiple modes.

**HAPTIC** modes which interface with the user by the sense of **touch** by applying forces, vibrations and/or motions to the user. The Infantryman's eyes continue to scan his sector.

**VISUAL** modes which interfaces with the user by the sense of **sight**, usually through a Graphic User Interface (GUI).

**AURAL** modes which interfaces with the user by the sense of **hearing**, usually through voice or tone signals. The Infantryman's eyes continue to scan his sector.



# Methodology



## “Brief, Wargame, Discuss, Survey” Process

- Day One: 14 Gamesteps of Squad/Fire Team focused Hasty Attack
- Day Two: 14 Gamesteps of Platoon focused Deliberate Attack
- Day Three: System Evaluations

## Data Objective

- Each Gamestep Survey = 5 x representative SA Particles (by SA class, SA level & Skill Level)
- 14 Gamesteps x 5 SA Particles = 70 investigated SA Particles
- Repeat for two different tactical contexts: hasty vs. deliberate attack

## MAPEX IV 1-hour Block:

1. Gamestep (15 minutes of wargaming)
2. Survey Session (10 minutes)
3. Repeat (25 minutes total)
4. Break (10 minutes)

