



GOMS COMPARISON OF ADW TEAM PERFORMANCE WITH AND WITHOUT AN AUTOMATED TASK MANAGER CONCEPT

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The Multi-Modal Watch Station



Overview

- Design Goal – Reduce Information Overload Bottleneck for AEGIS ADW Team
 - *‘Hook and Look’ visual search for actionable air tracks*
 - *The environment consists of events not tasks*
 - *Tasks are in the eye of the observer; miss an event and the task does not exist*
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Overview

- Hypothesis – Automated Task Manager
Concept Improves Task Throughput, Latency
 - *Rule-directed, ‘Super – Google’, search engine*
 - *Continuous search of all available data bases*
 - *Discovers and ranks tasks, does not do them*
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Overview

- Retrospective models of team exercises with and without ATMC – ambiguous results
 - *Teams revert to Aegis command hierarchy and local comms ‘chatter’*
 - *Behaviors, personalities, interactions differ widely across teams*
 - *Models can not represent behaviors that can not be defined*
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Overview

- Prospective models of ‘ideal’ teams – clean results, certain advantages for ATMC
 - *Compare performance w/wo ATMC - all other things being equal*
 - *Give both model teams the ‘best’ strategies as determined from the design and observations in the exercises*
 - *Use minimal direct commands, no ‘chatter’, visual search brackets*
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The Tacsit Display



The Task Manager Display

The Task Manager Display interface is organized into several functional areas:

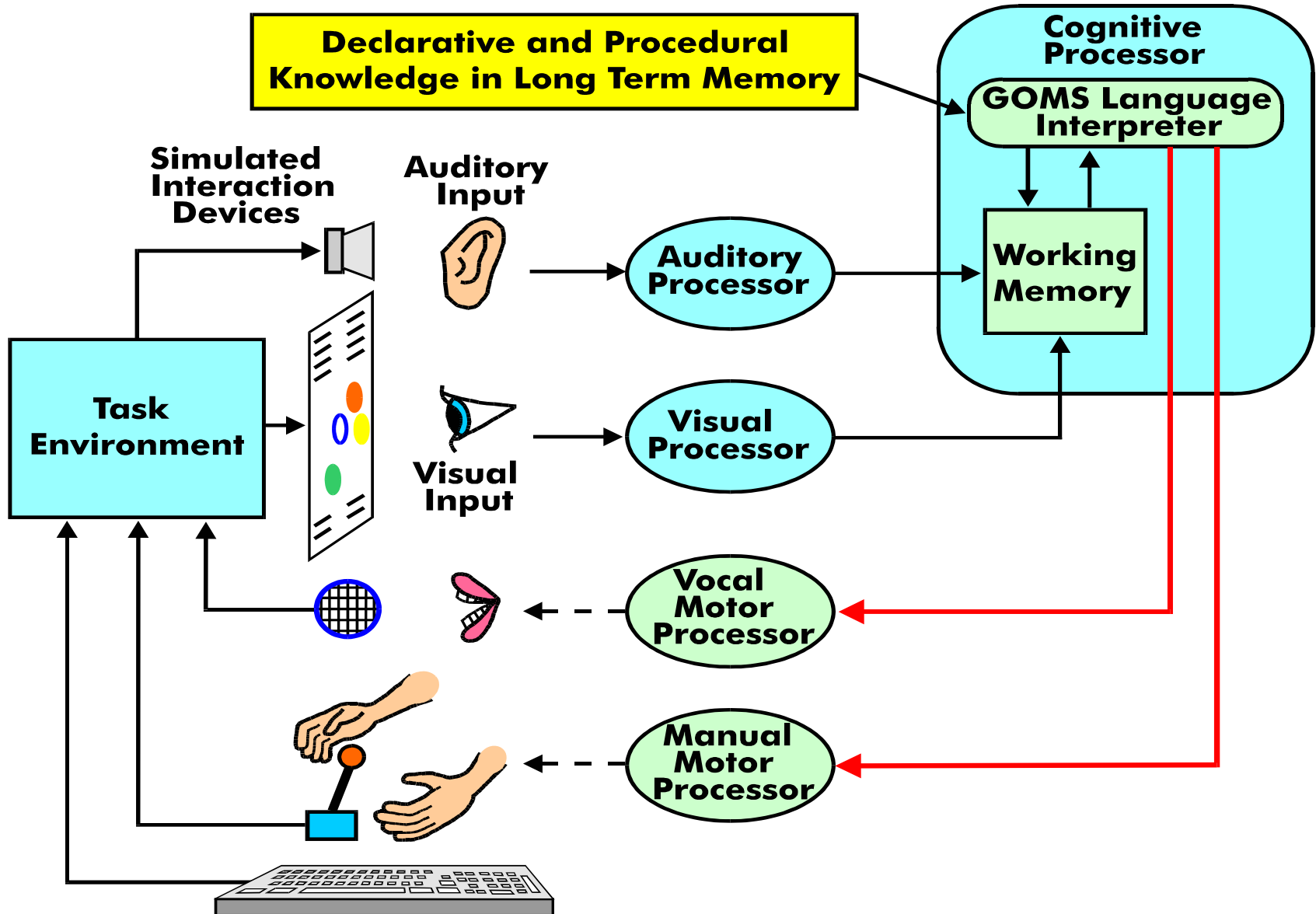
- Task Columns:**
 - Respond to ESM:** Contains tasks 1018 through 1021, each with an ESM icon and a red diamond.
 - Maintain SA:** Contains a 'Monitor Workload' task with a blue pentagon icon.
 - Conduct AIC Tasking:** Contains an 'Air Resrcs' task with a grey square icon.
 - Monitor Air Situation:** Contains a 'Monitor' task with a yellow cloud icon.
 - Review Tracks:** Contains tasks 1038 through 1043, each with a 'NEW' label and a purple cross icon.
 - Conduct Engagement:** An empty column.
 - Respond to Air Threat:** Contains a 'Level 1' task 1035 with a yellow cloud icon, highlighted with a red box.
- Task List:** A table with columns: Net 15, AAW, EW, IAD, Que, Circuit, Report Name, Track. It contains a list of tasks with their respective icons and IDs.
- Systems Status: ADW:** A grid of system health indicators.

| Weapons | Ops Conditions | Combat Sys | Engineering |
|-----------|----------------|------------|-------------|
| VLS | White/Safe | SPY 2X | Pumps |
| CIWS | Launch | Illumin. | Generators |
| DCA | Fire Inhibit | ESM | Compres. |
| Gun Sys | Mag Auth: At | IFF | M. Engines |
| Torpedoes | Engage. | Link 21 | Damage C. |
| | EMCON: D | GFCs | Water |
| | DLI: Alert 15 | | E-Drives |
- Log/Action Buttons:** Queue, Sent, New, In, Audio Setup, Chat, Delete, Break.
- Logos:** SSC SAN DIEGO, SPAWAR Systems Center San Diego, and the US Navy logo.

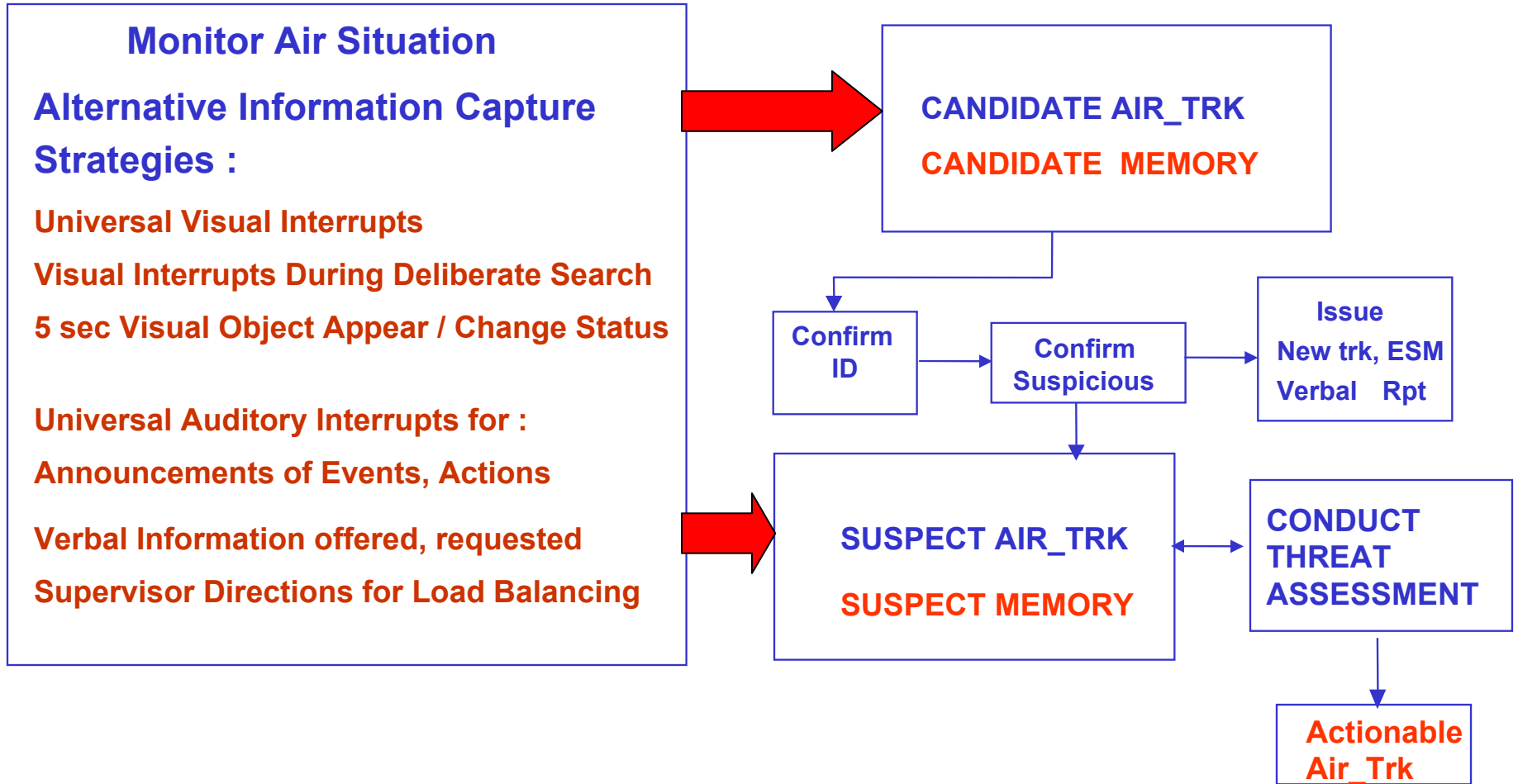
The Tacsit Display



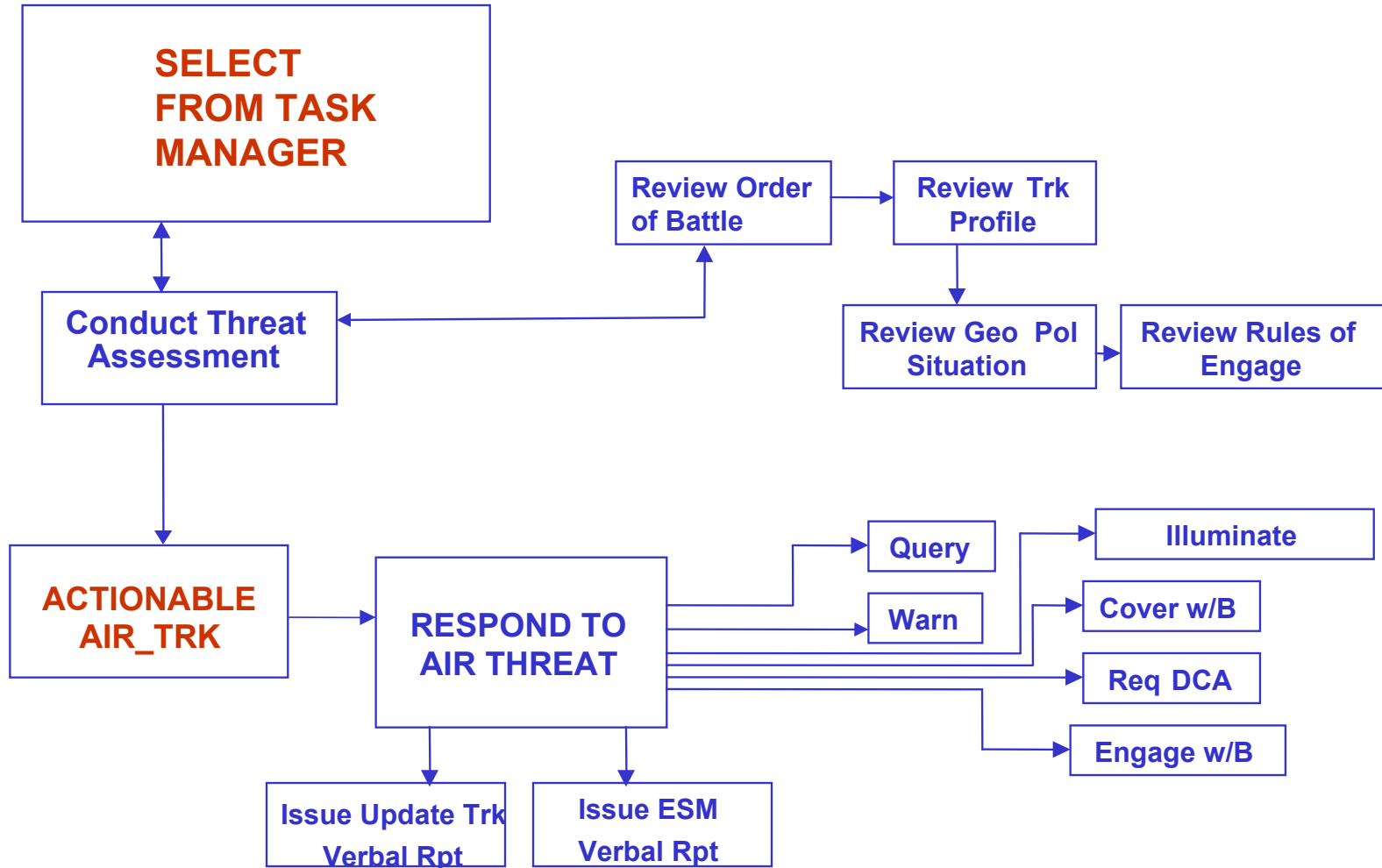
GLEAN : GOMS Language Evaluation and Analysis Tool



ADW Team Model: without ATMC



ADW Team Model: with ATMC



Conditions Tested:

1. ATMC vs Hook/Look
 2. Universal Event Capture vs Deliberate Search
 3. Three vs Four Member Team
 4. Autonomous Actions vs Command-Directed
 5. Verbal Announcements of Event Capture, Actions vs No Verbal Information Sharing
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PREDICTIONS: NO ATMC VS ATMC

| NO ATMC | % Total | % Within time | Latency |
|--|---------|---------------|---------|
| Query Task | | | |
| Autonomous 3m team, universal capture | 75% | 58% | 423 |
| Cooperating 4m team, deliberate search | 67% | 58% | 367 |
| Warning Task | | | |
| Autonomous 3m team, universal capture | 100% | 100% | 164 |
| Cooperating 4m team, deliberate search | 90% | 100% | 189 |
| ATMC | | | |
| Query Task | | | |
| Autonomous 3m team | 100% | 75% | 237 |
| Commanded IQC1 3m | 100% | 75% | 284 |
| Warning Task | | | |
| Autonomous 3m team | 100% | 90% | 117 |
| Commanded IQC1 3m | 100% | 50% | 185 |

Conclusions So Far:

1. Three-member team with ATMC can perform all required Query and Warning tasks.

2. Three- or four-member teams without ATMC can not do all required Query and Warning tasks:

Even with Universal Capture

Even with Verbal Information Sharing

Conjectures So Far:

1. ATMC is a 'universal visual capture' capability with very fast rule-based decision-making.
 2. ATMC can replace most local commands and inter-team 'chatter', maybe even one whole team member.
 3. Near-autonomous operations may be better than highly directed operations for all teams.
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Modeling Lessons Learned :

1. Empirical testing with real teams is difficult, expensive, and limited in coverage
 2. Retrospective GOMS modeling with real teams is difficult given all (1) above
 3. Prospective GOMS modeling is easy and cheap
 4. Do it early and often in system design, before testing prototypes with real teams
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