
Autonomous Vehicle Operator Span of Control Evaluation Tool

MICRO ANALYSIS & DESIGN

# AVOSCET

AUTONOMOUS VEHICLE OPERATOR SPAN OF CONTROL EVALUATION TOOL

## Overview

As technology motivates and allows for the implementation of automation, more and more vehicles and systems that were originally manned are now unmanned. The human, who was once directly controlling these systems, is now remotely involved as an operator, or a supervisor. However, almost every autonomous system still requires the involvement,to some degree, of a human operator. As autonomy permeates current technology, one concern is that sweeping assumptions will be made with respect to how many autonomous systems an operator or a crew of operators can control at one time. Many assume that because a system is labeled with the term '*autonomous*' then it must not require any human intervention or will only demand very minimal operator involvement. However, almost all autonomous systems being acquired and distributed are merely *semi-autonomous*. In essence, the involvement of an autonomous system operator is heavily dependent on the systems's level of autonomy (LOA).

HOW DO WE DETERMINE SPAN OF CONTROL OVER SYSTEMS UNDER VARYING

Although current autonomous systems exhibit low or mid-range levels of autonomy, future systems are being proposed with extremely high levels of autonomy. One worry is that the decrease in operator responsibility and the remote nature of an operator's control with respect to autonomous systems may actually hinder the operator's abilities to maintain proper situational awareness and therefore will complicate his ability to intervene quickly and efficiently. There are also the numerous mission, vehicle, and operator parameters that will affect the performance of an autonomous vehicle operator. All of these things combine to affect the appropriate operator-to-autonomous system ratio and should be taken into account before strict ratios are assigned.

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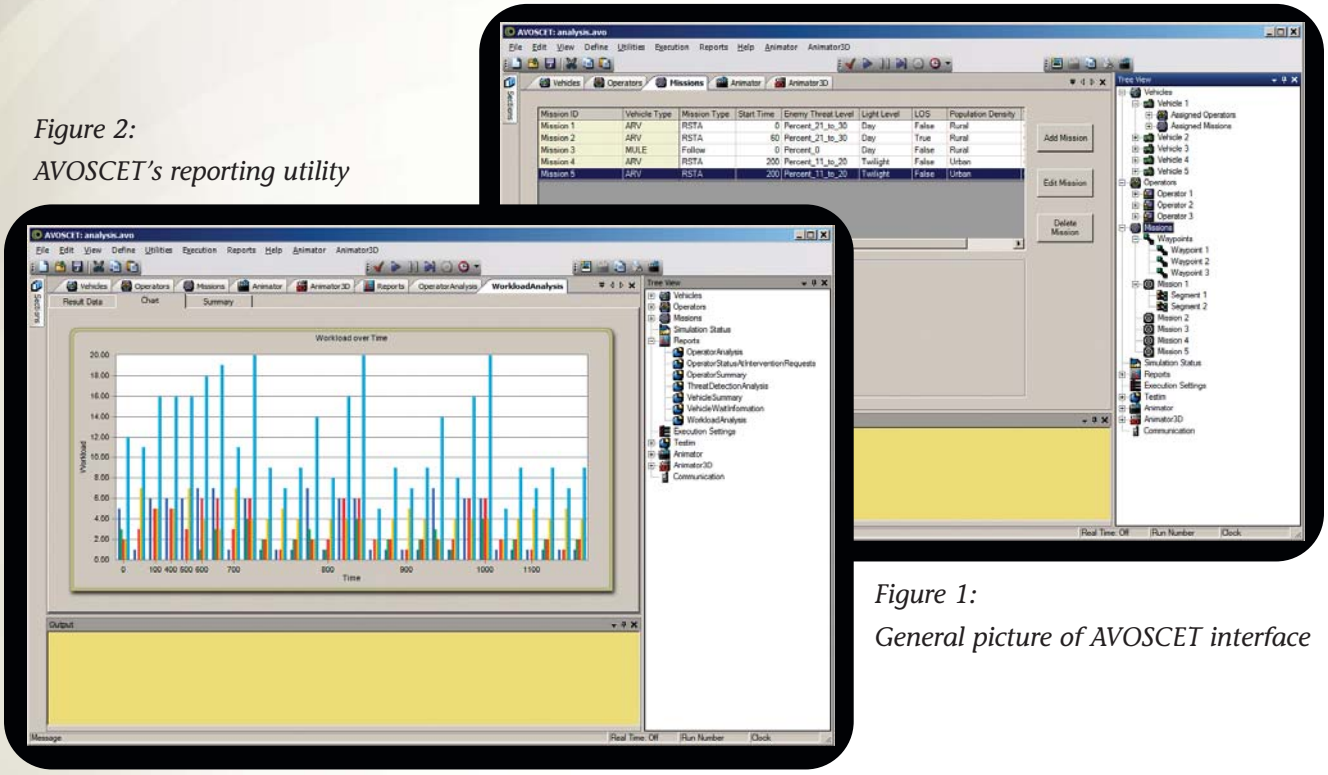


*Figure 2:*
*AVOSCET's reporting utility*

*Figure 1:*
*General picture of AVOSCET interface*

# The Solution: AVOSCET

AN OPERATOR'S AUTONOMOUS CONDITIONS?

MICRO ANALYSIS & DESIGN'S (MA&D) *Autonomous Vehicle Operator Span of Control Evaluation Tool* (AVOSCET).

MA&D and their collaborators at PercepTek originally created AVOSCET for the Army Research Laboratory under a Small Business Innovative Research contract. AVOSCET is a tradeoff analysis tool specifically designed to help analysts determine how many autonomous systems an operator or a crew can control under a variety of conditions. AVOSCET provides a user-friendly interface (*like that seen in Figure 1*) through which an analyst can define specific parameter values envisioned for a particular mission involving autonomous systems. Among these parameters are: vehicle characteristics (what type of vehicles, how many, what is their underlying LOA), operator characteristics (how much training have they had, what is their aptitude and innate proficiency, what environmental stressors are they experiencing), and mission characteristics (how many waypoints, what type of terrain, vegetation, and soil resides between each waypoint, enemy threat level, population density). Once a user has defined an analysis, AVOSCET is ready to launch its task network simulation where the mission of the autonomous systems and their operators will be simulated. After model execution, results will be fed back to the AVOSCET interface where the user can view and evaluate the performance metrics of the autonomous systems and their operators through AVOSCET's reporting utility *(shown in Figure 2)*.

# AVOSCET Background:

AVOSCET was developed under the guidance of extensive research, data collection, and discussion with subject matter experts (SMEs). Research in the domain has ensured that AVOSCET is realistically modeling the capabilities of autonomous systems. In addition, live unmanned ground vehicle experiments were conducted by PercepTek in order to quantify relationships between vehicle performance and various environmental parameters. PercepTek used the Defense Advanced Research Projects Agency's (DARPA) Perception for Off-Road Robotics (PerceptOR) vehicle for these data collection experiments (see Figure 3). This data, along with discussions with SMEs informed the development and the validation of the underlying AVOSCET simulation.

*Figure 3:*
*The unmanned vehicle used for AVOSCET validation: DARPA's PerceptOR vehicle*

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