

*Mobius™ is a user-friendly software solution used to command, control, and monitor multiple unmanned systems. In addition to its powerful configurable GUI, Mobius™ is supplied with algorithms for path planning, multi-vehicle traffic management, and process optimization, as well as analytics and reporting tools. Through the use of an open JAUS protocol, Mobius™ has been used to control vehicles from a variety of partners ranging from small EOD robots to the largest mining haul trucks. Mobius™ is even used to optimize operations of mixed manned/unmanned fleets.*

Through an open JAUS-based protocol, Mobius™ can be configured to run unmanned vehicles from a variety of robotic vehicle suppliers.

Mobius™ has been used to control military UGVs from robotics OEMs including:

- QinetiQ (Foster-Miller)
- iRobot
- Northrop-Grumman Remotec
- Kairos Autonomi

It has been used to autonomously drive:

- Industrial trucks, tractors, and dozers from Deere, CAT, Bobcat, Komatsu
- Utility vehicles from Bobcat, Deere, Polaris, Kubota
- Logistics vehicles from International, MAN Truck
- Consumer vehicles from Ford, GM, Chrysler, Toyota, Nissan

## Real-Time Data Feedback

## Video Window



## Map Windows

Full-featured maps are used to monitor the operating area. Views are static or set up to track designated vehicles.

## Control Panel

The control panel displays unmanned vehicles and sensors that have been checked into the system. Drop-down menus provide access to any payloads on the vehicles. Corresponding command buttons for controlling the selected vehicle or payload appear as each is selected.

## Joint Architecture for Unmanned Systems SAE-AS4 (JAUS)

JAUS is an unmanned vehicle architecture and messaging standard that allows diverse unmanned system components to interact. Mobius™ uses the JAUS architecture and messaging structure to allow a single operator to command, control, and monitor unmanned vehicle missions.

# Unmanned Vehicle Command and Control

## Waypoint Navigation

Waypoint Navigation allows the user to select specific locations on the map to direct a vehicle to. Waypoints can be either a final destination or a reference point along the way. The waypoint tool automatically calculates the least cost path and plans around known obstacles.

## Map Builder

Map Builder™ is a GIS mapping tool that allows the user to create and edit a map of the area in which the vehicle(s) will be operating. It includes tools for creating, editing, and importing GIS data. Map Builder can overlay and match aerial photography, and other forms of GIS imagery. Areas on the map can be marked as “keep ins” or “keep outs,” preventing vehicles from entering or exiting them.



Autonomous Solutions, Inc. is the leader in implementing the Joint Architecture for Unmanned Systems (JAUS) on commercial and government unmanned vehicles. Mobius™ is the standard against which robotic systems are measured for JAUS compliance.

## Path Builder

Path Builder™ sketches drivable paths for an autonomous vehicle on a satellite map. Using the constraints of the vehicle, Path Builder assists the user in creating a drivable path. The Payload Action Tool within Path Builder allows the user to place payload actions at discrete points along this path.

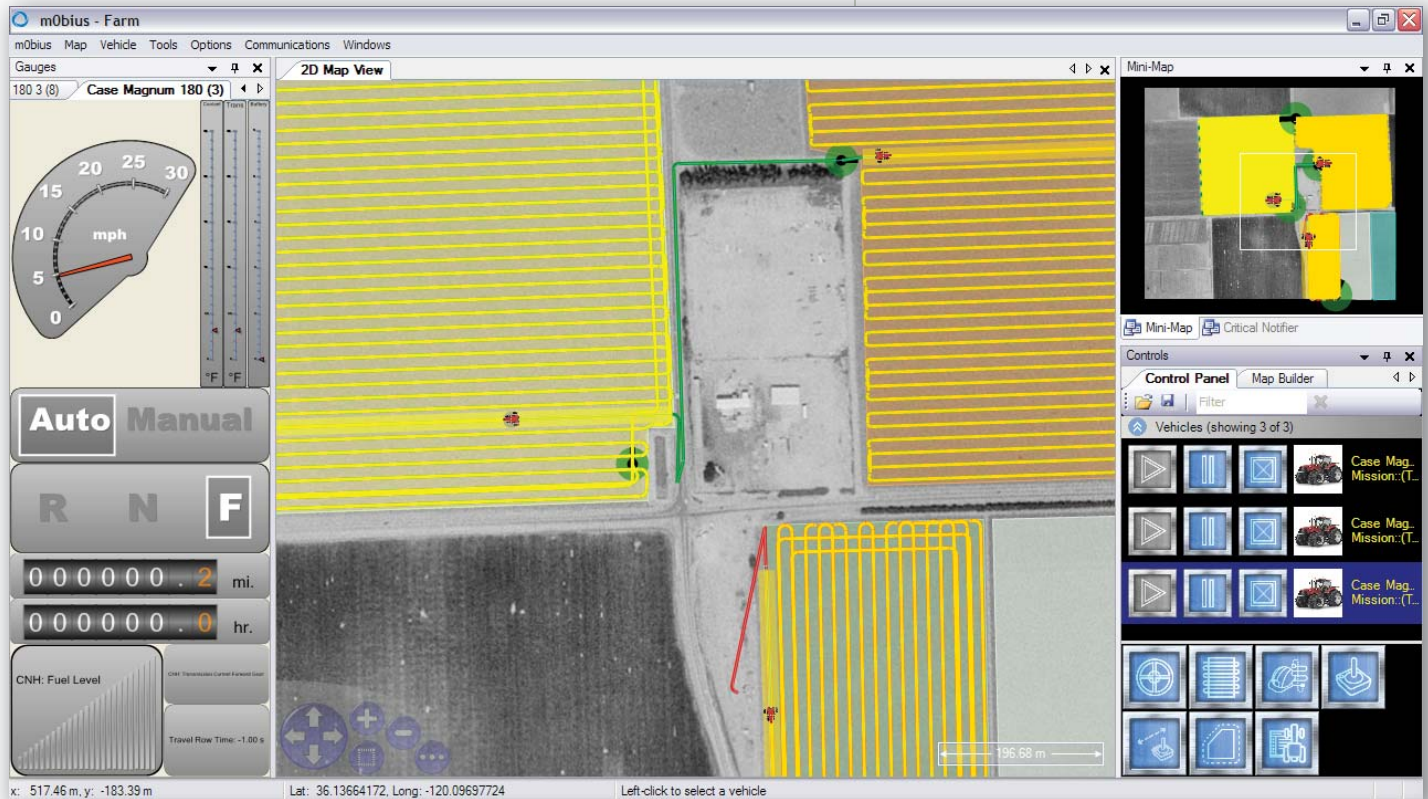
## Features and Highlights

## Area Coverage

Given a user-designated area of interest, patented Mobius™ planning algorithms generate optimal paths for one or more vehicles to cover the area with sensors or implements for applications such as range clearance, UXO detection & mapping, agricultural, and earth-moving operations. Mobius™ automatically creates routes to avoid obstacles and accounts for widths of implements and driving properties using turn and sweep patterns.

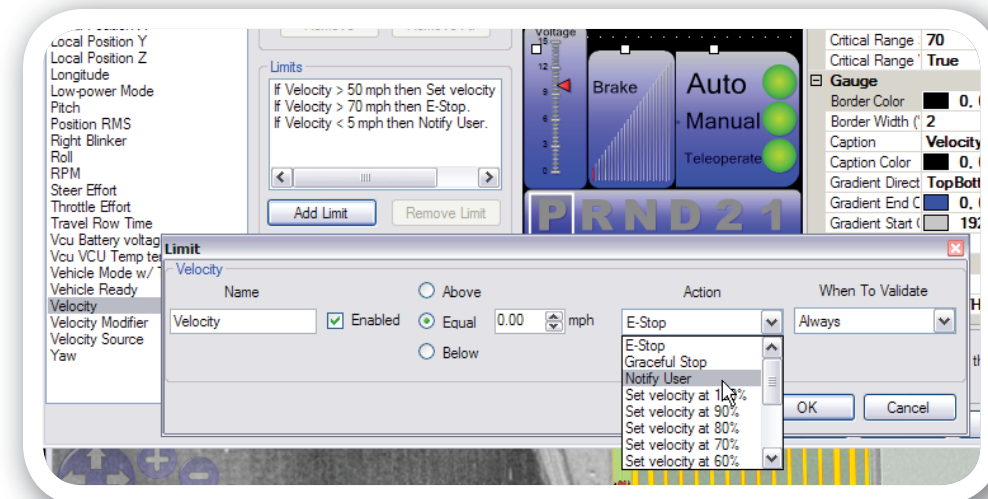
"Mobius™ gives us the ability to easily plan paths for our remote-controlled target vehicles. It also provides a real-time graphical display for monitoring mission progress."

– Bob Schuchmann  
Lead Hardware Engineer, JT3  
Nevada Test and Training Range



## Event Monitoring & Alerts

A configurable, rules-based framework allows users to define events of interest, generate alerts/alarms, and alter vehicle behaviors based on detection of those events. For example, a vehicle running perimeter security may change modes and alert an operator based on an intruder detection.



# Unmanned Vehicle Command and Control

## Teleoperation

Configurable video windows and joystick-mapping tools allow operators to configure a run screen for teleoperation and to use any ordinary COTS controller hardware for vehicle teleoperation. Mobius™ allows for easy mode switching between teleoperation and autonomous operations.



## Multi-Vehicle Coordination & Control

Users can monitor and coordinate multiple vehicles simultaneously. The Proximity Monitor and Mission Choreographer prevent collisions and bottlenecks, timing vehicles to keep traffic flowing smoothly. Convoy queuing lets you route multiple vehicles as a group, dynamically maintaining safe distances between vehicles.



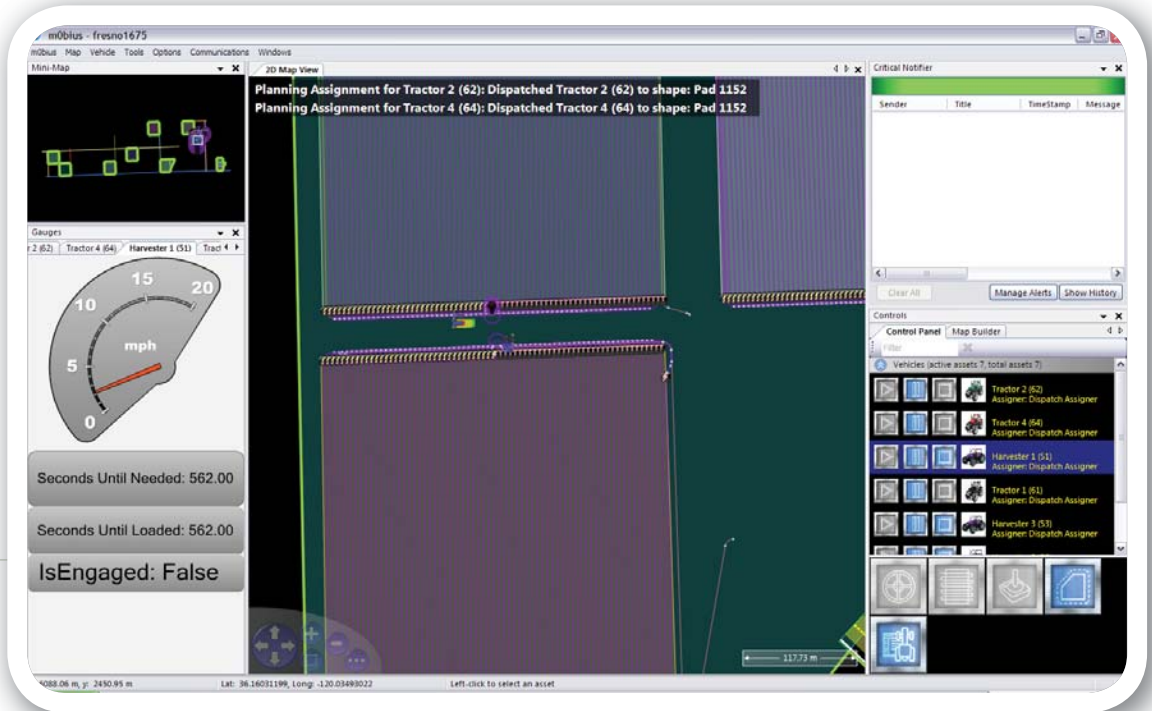
## Features and Highlights

# Advanced Features

ASI continues to develop advanced capabilities through work with partners in the mining, agricultural, government, and automotive testing industries.

## Dispatch

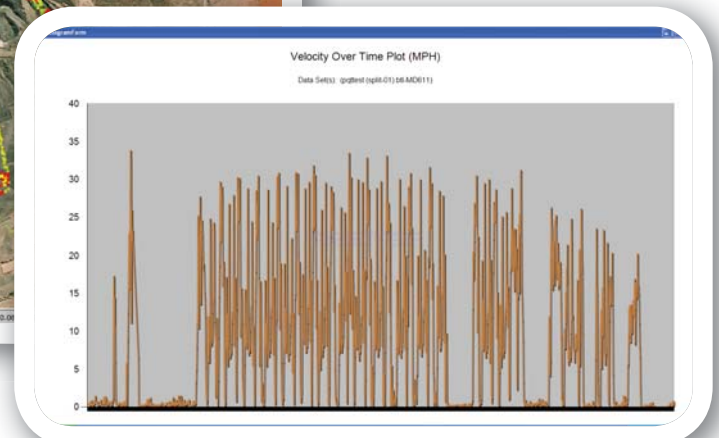
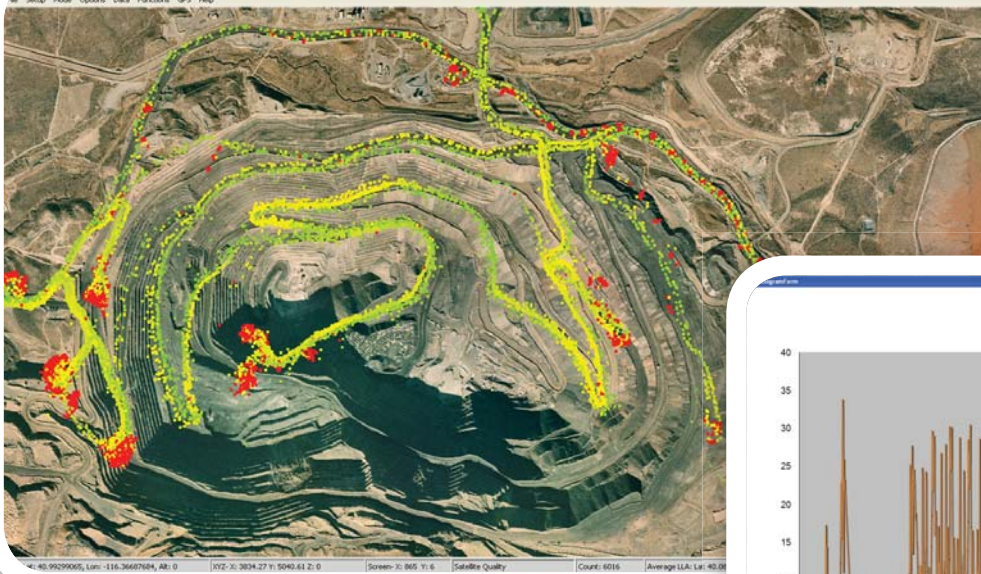
Dispatch algorithms optimize how multiple vehicles can be deployed to achieve a high-level goal. From maximizing the production of copper or tomatoes, to maximizing the coverage of a perimeter or UXO survey, ASI's dispatch framework allows for intelligent use of multiple unmanned assets.



## Analytics

Mobius™ event and reporting framework allows users to monitor and report on the activities of multiple vehicles, including both manned and unmanned assets. In mining, Mobius™ reports are used to analyze vehicle utilization and troubleshoot bottlenecks affecting productivity. In automotive testing, Mobius™ tracks human drivers to ensure tests

are performed properly and repeatably. For any application, these analytical tools give users insight into their operations for increasing performance.



## Vehicle Automation Kit

ASI uses a suite of hardware, electronics, and software to equip vehicles for complete automation. Our specialized control unit can interface with CAN bus communications on modern vehicles to monitor vehicle systems, and in some cases control vehicles using OEM hardware. For other vehicles, our actuator kit can be installed to control vehicle functions without disrupting normal vehicle operation.



## Perception

Using an application-specific suite of ASI's custom hardware and other sensors, ASI's perception systems allow for safe driving at high speeds while avoiding obstacles. Other algorithms allow unmanned vehicles to follow roads for continued operations under GPS-denied conditions. ASI also continues to advance the state-of-the-art in vision-based navigation and control.



## Guideline Robotic Leader/Follower

Guideline is a self-contained robotic leader-follower kit which can be easily integrated with any existing robotic vehicle or appliqué kit. Through a simple tether connection, the Guideline-equipped follower mimics any leader's path with sufficient accuracy for lane-keeping at highway speeds.



*Autonomous Solutions, Inc. (ASI) is a world leader in unmanned ground vehicle deployment, with experience in small robots, live-fire targets, crop spraying, military convoys, soil sampling, site security, automotive proving ground, and dozens of other applications. We can automate any vehicle-based task too dirty, dull, or dangerous for humans, and save our customers money by doing it. We specialize in making robotic vehicles easy to use, with the most sophisticated and refined command software in the business, twelve years in the making. Contact us and see what's possible today.*



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