

# Smart Snowplow and Snowblower

Advanced technology applied to a snowblower/snowplow.

**A**laska's severe winter weather conditions and the lengthy winter nights can produce some of the most hazardous driving conditions in America. This combination can reduce visibility to the point where the efficiency of snow removal operations is greatly affected and can result in collateral damage to infrastructure (i.e., guardrails, signs, milepost markers, equipment, etc.) as well as increase the likelihood of collision with other vehicles. As the efficiency of snow clearing operations declines there is a corresponding deterioration of driving conditions, which can ultimately result in the closure of highways. Highway closures affect the public's ability to access essential services, prevent public safety agencies from responding to emergencies, and result in

substantial economic impact to the affected communities.

The smart snowblower/snowplow is snowblower and/or a snowplow outfitted with sophisticated instruments to keep the driver in the lane. The main purpose is to avoid other vehicles and obstacles such as guardrail during low visibility caused from blowing snow, fog, and darkness.

The vehicle-mounted portion of the system combines a recent advancement in Differential Global Positioning System (DGPS) called Real Time



*Information is provided to the driver by a system that employs graphic, haptic, and auditory interfaces.*

Kinematics (RTK) and collision avoidance technology. The supporting infrastructure includes a base station and additional signal repeaters to extend coverage to more than 20 miles of highway. The system relies on a highway model that is generated using GIS based survey methods that depicts the entire infrastructure, hazards, and the highway alignment within the right-of-way for this segment of the highway.

Vehicle positioning, collision avoidance, and the driver interface constitute the primary components of the smart snowblower/snowplow. Vehicle positioning is accomplished through a combination of a DGPS and a geospatial database. Collision warning and avoidance is accomplished with radar sensors and signal processing techniques, which take advantage of information returned by the vehicle positioning system. Finally, information is provided to the driver via the driver interface system,



*During low visibility from snow, fog, and darkness, obstacle avoidance when operating a snowplow this size cannot be taken for granted.*

which will employ graphical, haptic (sense of touch), and auditory interfaces (or any combination thereof as deemed appropriate) to provide an optimal information path to the driver.

The smart snowblower/snowplow is expected to:

- Reduce accidents
- Improve response time to incidents
- Allow snowblower operators to keep roads open and reopen sooner if closed
- Improve safety for the traveling public and operators
- Reduce driver stress

Thompson Pass, the test site, extends from milepost 12 to milepost 45 on the Richardson Highway in south central Alaska near Valdez. The test site includes portions of the highway on either side of Thompson Pass, a 20-mile section of highway characterized as high alpine, in the heart of the Chugach Mountains. This site was chosen because of the severe environmental conditions (over 450 in. of snowfall annually) that are common to this por-



*A GIS-generated highway model depicts the infrastructure-including hazards and alignment-on which drivers must operate large equipment.*

tion of the Richardson Highway during the winter months.

The University of Minnesota Intelligent Vehicles Laboratory Program in collaboration with the Alaska Department of Transportation & Public Facilities (ADOT&PF) outfitted one snowplow and one snowblower in the

Thompson Pass area with sophisticated instruments in January/February 2004. ADOT&PF maintenance and operation personnel are testing the system through winter 2006/07. Upon successful completion, ADOT&PF will decide to purchase additional technology to outfit other snowplows and/or snowblowers. 