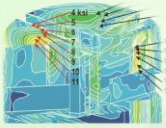
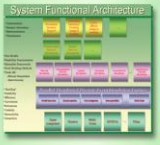


Modeling and Simulation Group



Portable Weigh-In-Motion (WIM)

Source Data System for Weighing and Measuring Cargo

Background: The Department of Defense's (DoD) Armed Forces must maintain the capability to rapidly project massive combat power anywhere in the world with minimum preparation time. Currently, DoD units use portable individual wheel weight or fixed in-ground static scales, tape measures, and calculators to determine vehicle axle weights, total vehicle and cargo weight and center of balance for vehicles and cargo to be transshipped via railcar, ship, or airlifted in support of military and humanitarian operations. The process of manually weighing and measuring all vehicles and cargo subject to these transshipment operations is time-consuming, labor-intensive, and most importantly is prone to human errors that can result in safety hazards and inaccurate data. The identification, weight and center of balance information on each piece of cargo and vehicle must be manually entered into logistics load planning systems introducing the high likelihood of human key-stroke error into the deployment preparation process. Incorrect information introduced into the Defense Transportation System (DTS) can negatively impact onward movement of cargo and vehicles in theater, needlessly delaying essential supplies and equipment to the soldier and more importantly creates a safety hazard. The importance of having correct, timely information in the DTS for use by all services cannot be overstated. In austere areas of operations, scales may not be available at all, and the vehicle and cargo weight and center of balance must be estimated. This process is even more susceptible to human error. The lack of a standardized airlift-weighing system for joint service use also creates redundant weighing and manual data entry requirements at the cost of scarce resources and time.

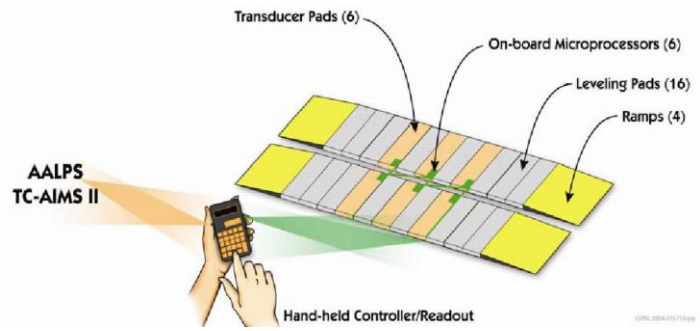
Program Initiative Basis and Objective: The WIM program leverages several complementary technology demonstration and development efforts underway in the U.S. Army, U.S. Air Force, and ORNL. WIM is automating the above mentioned manual processes and is mitigating safety and operational concerns. This program is firmly rooted in guidance provided in the DoD Transformation Planning Guidance. The WIM program links together projects under an umbrella concept for coordinated development of hardware as well as interfaces with appropriate command and control, and logistic systems and databases. The synchronized, rapid, spiral development of these technologies are significantly improving the end-to-end flow of military unit equipment and cargo across transportation nodes; processing and loading times of combat units; and the effectiveness and efficiency of existing automated tools and databases. The WIM system is considered to be physical source data-gathering device for the Transportation Coordinators' Automated Information for Movement System II (TC-AIMS II). The objective of the WIM program accomplished:

- *Objective 1:* Develop a man-portable WIM scale that satisfies the requirement for obtaining accurate vehicular data for air transport at austerely equipped theater facilities. This portable WIM scale can also be used in unit staging areas to complement or replace the fixed scales at power projection platforms. It is capable of obtaining data in static as well as a dynamic weighing mode. A concomitant effort includes upgrading the fixed-site scales at power projection platforms with this WIM technology to conduct dynamic as well as static weighing.

- *Objective 2:* Develop automatic linkages of vehicle/cargo identification data and weight/balance data with military logistics planning systems so that the process is fully automated as well as dynamic.
- *Objective 3:* Expand WIM capabilities to include determining vehicle/cargo dimensional data for input into TC-AIMS II, Automated Air Load Planning System (AALPS), and/or Integrated Computerized Deployment System (ICODES).
- *Objective 4:* Extend WIM with capabilities identified for specific homeland and commercial applications (e.g., virtual weigh and inspection station).

The current WIM Generation II system:

- Captures vehicle/cargo identification automatically.
- Determines (calculate and record) cargo weight, dimensions, and center of balance.
- Accepts Cargo Lists from TC-AIMS II, AALPS, and/or ICODES
- Updates the real-world "actual" data electronically into AALPS for load planning and manifesting purposes; into TC-AIMS II; and into ICODES for operational planning, deployment, execution purposes and in-transit visibility.
- Field tested, evaluated and previously sited at Ft. Lewis, WA, 842nd Trans BN, SDDC at Port of Beaumont, TX, Ft. Eustis, VA, Ft. Bragg, NC, Ft. Drum, WA, Ft. Sill, OK, Wheeler Army Air Field, HI, 20th Seabees Readiness Group (SRG), Gulfport, MS, 31st SRG, Port Hueneme, CA, and ORNL.



WIM Generation II Specifications:

- Usage: Stand-alone unit with interfaces to TC-AIMS II, AALPS, ICODES and ORNL Reachback server©.
- Functionality: Measures Total/Axle Weight (Production Version: ±1% at 1σ; Current R&D Version: ±0.2% at 1σ), Axle Spacing, Center of Balance and Length, Width, Height Dimensions (±1.0″ plus 1%).
- Mobility: Modular Components (Individual Pad Weight: 128 lbs.); Total system: 4′x4′x3′
- Conforms to Ethernet and 802.11x wireless standard with WPA security. Encryption available.

Point of Contact:

Robert K. Abercrombie, Ph.D.
Co-Director, Computational Intelligence Behavior Modeling Laboratory
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 37831-6085
Phone: 865-241-6537 FAX: 865-576-0003
E-mail: abercrombier@ornl.gov, Website: http://www.ornl.gov/~abe