

Lt. General William Pagonis, Gulf War logistics chief discussing the logistics of bringing back equipment from Iraq:

*"Getting it back poses a huge logistical challenge. Most helicopters and tanks are likely to be trucked out through Kuwait, though some containers may go through Jordan or Turkey. And before anything can be put on a ship home, it has to be scrubbed and inspected. That's because sand can harbor diseases that might harm poultry or livestock back in the U.S."*



Why A Deployable Closed Loop Retrograde Wash Down and Inspection Rack (DRWIR)?

- Cleaning and Sterilizing all of the vehicles coming back from Iraq will be a monumental task.
- Giving the soldiers the right tools for the job is an advantage they need with today's lean military.
- Recent history shows this process is a bottleneck in the logistics chain
- Water and People are a scarce resource in SWA
- Fast effective cleaning is essential for

Unique Features of this system:

Deployable system requires no site improvement for set-up and operation—can be shipped anywhere and set up in a few days

Ten Standard 20' containers and Flat Racks contain the entire system

Completely self contained, does not require permanent or potable water source

Completely closed loop, meets DOD Directive 6050.16 for foreign deployed wash racks

Set up in any port or base that is accessible by truck, rail, or ship.

3 Step Process:

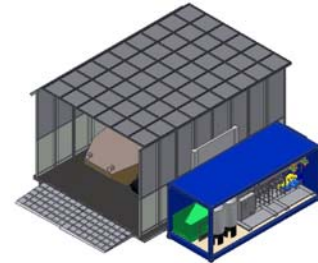
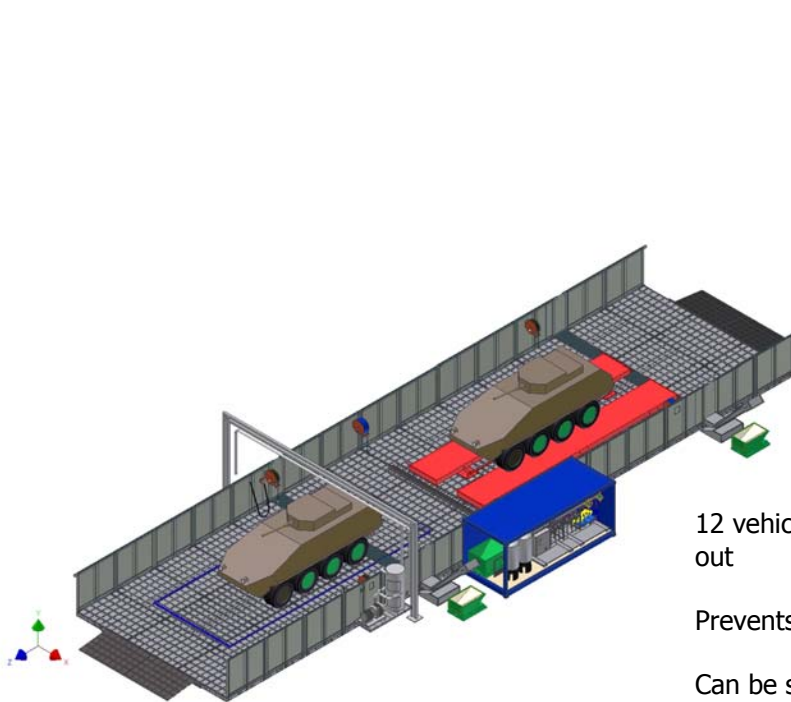
1. Completely flushes the underside of vehicles including tanks in an automated process.
2. Lifting system raises the vehicle in the air for complete undercarriage inspection and detailed cleaning of recessed areas
3. Exterior detail cleaning and interior vacuuming

**Processing speed is ensured with 3 large vehicles in system at any time, 12 vehicles per hour can be cleaned to USDA standard inside and out.**

Will process an M1 tank or an HMMWV on the same pad and same lift quickly and effectively.

**Designed, built, and shipped from Michigan.**

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12 vehicles per hour can be thoroughly sterilized inside and out

Prevents USDA rejection of shipment for invasive species

Can be set up anywhere equipment is concentrated, even on a road

Palletized system sets up quickly

The DRWIR shall be capable of washing vehicles to US Dept Agriculture Inspection Agency regulation D-95-26 (2nd Revision) Appendix 5 compliance at a rate of two 12 HMMWV's per hour.

Specification for cleanliness can be met with pressure washer capable of 5 GPM @ 3500 PSI Hot Water to 200°F and various undercarriage nozzle styles with equal pressure and heat. In addition 1-5% Hypochlorite solution can be maintained and pumped through the system continuously. Pressure washers are continuous use with automatic start stop functionality and low water protection to shut off pumps if water flow is insufficient.

Pressure washers (4) use diesel fuel for heat, schedule 80 steel coil, have vented stacks to atmosphere with rain diverter. Pressure washers are permanently plumbed and mounted in ruggedized container.

Hoses: Pressure washer hoses are installed on spring re-wind reels with guides and stops. Hose is double wire reinforced with 4500 PSI min rating and stainless steel disconnect on output end.

DOWN AND INSPECTION RACK



Detail cleaning hot water pressure washer and water cannon mounted on recessed reels

Reels and controls mounted into overspray walls.

Rewind mechanism is easily washed with hose

Guns: Wash guns are fatigue reducing design with insulated grip and HD internal structure to operate in hostile environment. Wash guns will have QC fittings to mate with hose on reel.

The vehicles / tanks are cleaned (remove accumulation of mud and dirt without removing the surface paint on the vehicle) to allow unrestricted transportation for repatriation to NATO countries and US ports specifically.

Initial undercarriage de-mucking/cleaning is accomplished with 400 GPM at 80 PSI in a halo spray pattern. The undercarriage cleaning system consists of:

- Containment area:
  - Sized to carry the largest vehicle on the specification list, but no smaller than 18' x 24' exclusive of ramps
  - Capacity of 150,000# per vehicle
  - Complete containment for overspray and all water being used, 100% recycled
  - Water tight construction with modular construction technique can be set up with rough terrain forklift and hand tools only
  - Finish is to Mil-Std 810F or equivalent
  - Containment overspray walls are continuous for overspray collection
  - Overspray walls are made of epoxy primed, urethane coated 20 gauge sheet with 1.5" square tube frame
- Nozzles:
  - 20 nozzles with cone and flat spray patterns to cover every side of vehicle.
  - Nozzles are to be protected from damage by tracked vehicles in undercarriage blast array
  - Nozzles on risers shall be assembled on QC pipe fittings for quick tear down of system for shipment and re-deployment

Undercarriage wash systems supply large flow at low pressure to flush away sand, gravel, silt, mud, and wet entire undercarriage as quickly as possible.

A Hypochlorite solution is used to sterilize the undercarriage with ozone intensifier.



- Pumping system:
  - Total pumping HP of not less than 30 HP generating 400 GPM @ 80 PSI
  - Pumps are interlocked with run dry protection.
  - Pumps have branch circuit protection to prevent damage from power supply issues, jamming, shorts and other electrical failures
  - Pumps have wash down duty TEFC motors and wash down duty cables and connectors
  - Pumps are controlled by soft start technology to reduce load on electrical generating system
- Recovery System
  - High solids tolerant pumping system with cast iron housing and impellor
  - Pumping system are integrated with collection area, no operator needed
  - Pump switching uses sensors that have no moving parts to foul
- Drag Conveyor
  - Undercarriage washer collects dirt and debris in open channel with 24" drag conveyor
  - Drag conveyor has outlet with wedge wire screen for solids removal
  - Drag has HD 1" chain with composite construction flights and rubber scraper
  - Drag discharges into hopper mounted outside of ISO
  - Bolt down protective grating with 3" openings ensures solids do not collect on surface of undercarriage wash area



Drag conveyors are robust devices used to remove sand, silt, rocks, and anything else that falls through the grating in the undercarriage wash area

Labor savings in mud removal and time savings by ensuring zero downtime for clean-out are just a few of the advantages of a drag conveyor

- Undercarriage wash area and support filtration system fit on 1 8' x 20' ISO standard "flat rack" and one 8' x 20' enclosed ISO container
  - Flat rack is used to carry system to site and for storage
  - Container is operational with doors closed for harsh environments
  - Containerized filtration package has QC fittings for all external connections
- Filtration system for undercarriage washer
  - Primary wedge-wire filtration to 1/8" with flow rate of 400+ GPM to support continuous operations
  - Filtration system processes through OWS to remove all oils as required
  - Filtration system removes solids to 100 μ at 400 GPM to prevent nozzle plugging
  - Cyclonic separator removes large solids from wash water in side stream 50 GPM closed loop solids separator
  - Cyclonic separator is non-corroding construction
  - Cyclonic separator has dedicated 3 HP pump with cast iron impellor to remove solids larger than 100μ
  - Discharge of separator is classified and preferentially passed to self dumping hopper at discharge of drag conveyor
  - Secondary filtration for high flow water is via stainless steel screen
  - Third level filtration is via high capacity 125 PSI rated multi-media filter with auto purge and auto backflush cycle
  - No manually changed filter are employed
- Water storage
  - Sloped bottom tank with auto fill and auto purge
  - Tank, if mounted externally is protected from freezing during use
  - Tank has access for complete interior cleaning via pressure washer for storage and end of job clean-out
  - Tank is made of UV stabilized material capable of sustained outdoor storage and use

Detail Cleaning and Inspection on Scissor Lift with Lighting.



Removal of mud, dirt, clay, baked on silty soil, oily residue, baked on grease, and other contaminants is effectively accomplished with hot water at 3500 PSI and a pair of water cannon of 20 GPM @ 500 PSI to remove large particulate quickly.

Undercarriage detail cleaning is simplified with a drive-over scissor lift that allows the operator to reach all undercarriage spaces that were cleaned with the high flow pre-wash. This undercarriage inspection is critical to the mission and quick with only 2 minutes needed to position, raise, and begin inspection of vehicles from the smallest to the M1.



A complete system arrives via flatbed truck with 2250 gallon overflow tank for rain water: This becomes a 24' x 48' wash pad with water cannon, pressure washer, filtration, and HVAC controlled enclosure.

- All components are palletized on ISO standard shipping pallets and secured with corner braces and structures to make them intermodal compliant to ISO shipping configurations
- Lifting and tie down provisions are provided for sea and land transportation
- No site improvement beyond level ground with compacted surface is necessary for use of DRWIR
- Set up is accomplished by trained installers in less than 2 days with 6 trained installers and 2 rough terrain forklifts
- Set up does not require welding or other permanent attachment means that would prevent de-installation in 2 days or less
- System is able to be shipped as a complete DRWIR in 8 each 20' containers and flat racks
- Wash pads support wheeled vehicles to 75,000# and tracked vehicles to 150,000# across entire surface
- Containment area measures 32'W x 90'L and fits on in 3 stacks of 8' x 20' plus 1 standard 20' x 8' ISO container with side openings

DOWN AND INSPECTION RACK

- Containment area is painted with durable epoxy base primer, urethane top coat, and highly durable anti-skid material
- Custom containment area includes 6' overspray walls on both long sides

Lifting provision for undercarriage cleaning and inspection:

- Parallelogram lift 150,000# capacity
- Wash water duty lift with stainless bearings, dirt scraping slides, UHMW protective barriers

Riveer Environmental specializes in 100% closed loop wash racks that are completely above ground and require no site improvement. Our wash racks can be installed in hours and removed in hours to make it a truly portable solution. Our wash pads are joined together with re-usable gasket material and grade 8 bolts to create a durable water tight seal. The steel containment racks are easily assembled with a forklift and hand tools.



Drive on/back off wash rack.

***US Air Force Holloman AFB***

Through an exhaustive market analysis Riveer Environmental prevailed when S&K Technologies, Inc.; Air Force Corrosion Prevention & Control Office selected Riveer Environmental to build a corrosion prevention wash rack for a 1 year program to demonstrate the benefit of clear water rinse of Aircraft Ground Support Equipment.



This completely self contained system has been as thoroughly analyzed as any system tracking every gallon of use both on site and remotely. Some highlights of the system.

- HVAC controlled 20' container with side opening doors for easy equipment access.
- Remote monitoring with cellular modem to integrated password protected web site
- Remote programming and diagnostics including TDS monitoring
- High pressure water cannon 13 GPM @ 1500 PSI
- High temperature pressure washer 4 GPM @ 4000 PSI 200°F max temp
- All automatic operation with auto on/off of pressure washer and water cannon
- HEPA air intake filter with dedicated circulation fan for desert dust storm survivability
- Overflow protection with floor level water sensor
- 1500 Gallon RO feed water tank to process all water prior to use to 30 mg/l TDS or less

The Holloman AFB system has massively improved productivity and kept hundreds of thousands of gallons of water out of the base treatment works. Water quality is excellent month after month and has reduced corrosion with demonstrable results<sup>1</sup>.

<sup>1</sup> Report available from third party



Riveer Environmental 100 PGM @100 PSI water cannon

Heavy equipment washing in all environmental conditions were the design criteria for this large scale wash pad and closed loop filtration system. Two heated and insulated containers with solar vents and a 100' x 125' concrete pad with loader clean out and automatic sludge conveyor are just some of the features of this system.

- 60-80 GPM filtration flow rate
- 100 GPM @ 125 PSI water cannon
- Electrically retracting reels for hose storage
- 100 GPM Sump Pump system with smart water management features
- Single pass filtration with continous recycle and ozone injection
- 3000 gallon capacity and 800 gallon oil water separator
- High pressure hot water pressure washer
- System can be operated in sub-freezing conditions without damage
- Simple remote operator station with lockable NEMA 4X control box
- MicroLogix 1200 Controller with I/O indicators make maintenance a snap
- Solids handling capabilities to support open pit mining operation have proven to be very robust.