

Gettin' Hitched in Vegas

by Geoff Archer, Region I
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When most people hear the name “Las Vegas,” their thoughts quickly shift to images of the adult entertainment landscape; casinos and gambling, championship fight nights, Broadway-style shows and the infamous quickie wedding. Well, this article is about a wedding of sorts - but this was not a shotgun ceremony. Rather, this relationship is one we believe will only grow stronger with time. This story is about a union of robots and trailers, trailers and robots, and the bond that brings these two together: the trailer hitch. This is a tale about gettin' hitched in Vegas!



Team members bringing the MK-V and miniMACE to the demo area

Back in early 2005, the Las Vegas Fire & Rescue bomb squad took delivery of the country's first miniMACE water-abrasive suspension cutting system from Applied New Technologies (ANT). The primary mission of this tool was to provide a minimally-invasive technique for access and interrogation of suspected LVBIEDs. The “water jet” machine has proven itself to be useful for access, as well as other tasks, including specific RSP work - but that will have to wait for another article.

The original design of this system called for the miniMACE to be deployed remotely via a trailer towed by a robot – specifically our Remotec Mark VA1. The complete miniMACE and trailer assembly is quite heavy, approaching 700 pounds, when ready for deployment. While the Mark V is more than capable of pulling a load of this size, we quickly discovered a number of limitations with the trailering system as delivered. The first issue to arise was the limited maneuverability afforded with the trailer attached. Problems with backing the equipment were readily identified and attributed to the two points of articulation in the towing design. This effectively minimized the potential for backing the equipment with the exception of short, straight

runs. Another issue we identified was the method of attaching the trailer to the robot.



2006 CIRT training at Nellis AFB (Las Vegas, NV) pulling a charge down range with a trailer having no true tow adaptable capability (a point noticed by both students and instructors)

The original hitch was a simple bracket bolted to the body of the Mark V that held a remote-release hitch mechanism. The entire assembly was very long – approximately 17” – and protruded beyond the rear articulators when installed. We soon found out that the bracket was subject to excessive stress and leverage when towing the trailer and it began to show imminent signs of failure after limited use. In addition to the leverage issues, we also determined that the permanent nature of the bracket created a hindrance when operating the robot without the trailer attached.



Close-up of the F6A Hitch system with ball hitch drawbar

This became readily apparent when attempting to “get small” by raising the articulators to the full up position. The original bracket and remote-release hitch protruded nearly a foot beyond the robot's factory profile, greatly reducing operability in close quarters. We decided that this had effectively dedicated the robot to pulling the trailer, thereby removing it from frontline RSP service. While our squad is fortunate to have multiple robots, we certainly can't afford to dedicate one of them to pulling a trailer. *There had to be a better way....*



Drawbar for the “Quick Release” system designed to leave the trailer behind (commonly used with LVB delivery systems)

While the genesis of the hitch system was a long time coming, the development of our current design has been even longer. Hundreds of hours have gone into R & D, as well as testing, testing, and more testing, to bring these hitch systems to where they are today. The design has morphed from an enhanced rebuild of the original bracket assembly to a specialized, modular receiver hitch system that has greatly enhanced the capabilities of our robots. The system consists of a receiver assembly that attaches to the robot and a selection of drawbars that allow for multiple options when connecting to the load to be towed. Drawbars are easily interchangeable and are held in place by a hitch pin. Function and operation mimics the receiver hitch assemblies commonly found on pickup trucks. Draw bars can be installed or removed in a matter of seconds, allowing for rapid robot deployment, with or without towing capabilities.



Receiver hitch assembly and ring style drawbar (above)

Receiver hitch assembly and drawbar delivered to HDS and installed on their REMOTEC F6A (right)

While strength and towing potential were certainly considerations for this project, we also wanted to ensure that our robots maintained a factory profile when not deployed as tow vehicles. We have been able to successfully meet these demands on both of our frontline response robots, the Remotec Mark VA1 and the Remotec F6A. Both machines are equipped and capable of towing when need dictates and can be reconfigured in seconds for deployment in the original factory profile. These hitch systems create no obstructions or protrusions that interfere with the operation of the robot as originally designed, truly providing both tow and go functions. No more dedicated towbot!

Trailers Too

Once we accomplished the task of outfitting both of our robots to tow the miniMACE, the next logical step seemed obvious – build some new trailers for the robots – so we did!

The miniMACE was originally delivered on a very large and capable cart that had been mated with the original hitch bracket. Extensive use of this cart, in both training scenarios and deployed on jobs, revealed many of the maneuverability problems mentioned earlier. This setup works great for going in a generally forward direction but negotiating tight spaces and backing up are quite difficult. While this original cart was based on an existing platform that was modified to accept the miniMACE, we felt a more purpose-built design for the trailer was in order. A custom trailer for the miniMACE was the next project we decided to tackle. Smaller in profile and using a

Get Hitched!



Removable Robot Hitch Systems
Patent Pending

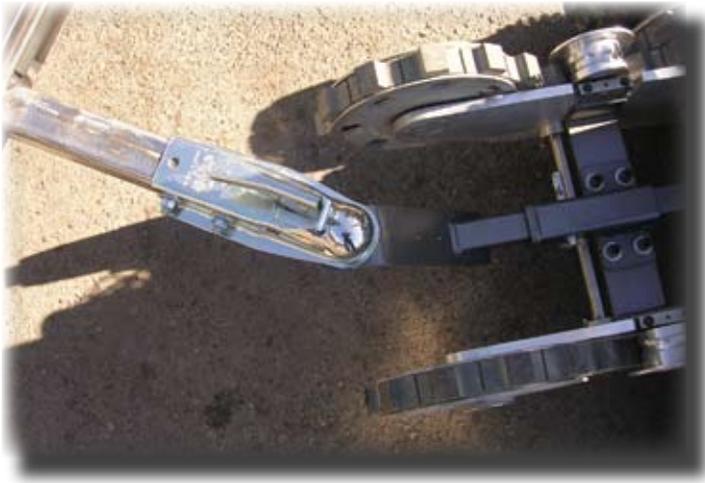


F6A System



Mark V System

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Close-up of the F6A Hitch system using a ball hitch drawbar

tandem axle design, this true trailer was built to work in conjunction with our removable hitch systems. Preliminary testing and operation has shown this design to be of significant benefit by affording greatly increased maneuverability and a lower center of gravity.

As for utility trailers, we tried our luck with the standard 4-wheel garden carts that are plentiful and inexpensive. Various testing and training scenario use left us unimpressed. These carts will work in a pinch, but have a number of limitations including the dreaded 4-wheel design, limited payload capacity and a poor hitch connection design. We believe these garden cart platforms have their place and are best suited for remote operations that require leaving a trailer downrange. Deploying VBIED disruption shots or remote atmospheric monitoring equipment are just two examples.

When it came to having a true utility trailer, we identified our top three concerns before beginning the design process: **durability**, **maneuverability** and **versatility**. The current design meets these mandates and has a number of key features including removable sides, interchangeable decks and an estimated 750 pound capacity. It is designed specifically for use with our F6A, but will also function well with a Remotec Wolverine, since both



REMOTEC F6A with stake bed trailer featuring removable sides and interchangeable top deck

robots share the same track width. Maneuverability has been greatly improved by eliminating unnecessary articulation points and adhering to a more standard trailer design. This trailer can be backed up with ease and will quickly navigate through tight spaces under the control of an experienced operator. The trailer's sides are smooth and free of protrusions that could get hung up and impede or stop downrange operations.



REMOTEC F6A with "exploded" view of the trailer

While we still consider this project to be in the developmental stages, it does show great promise for a variety of remote transport and deployment options. Future plans include a larger version of the same trailer for use with the Mark VA1 as well as additional interchangeable decks designed for specific tasks.

The evolution of remote robotic operations is part of the new world order for bomb squad and other homeland security operators. The potential mandate for robots as standard equipment is rapidly approaching and making them work for us is a reality best not avoided. The Las Vegas Fire & Rescue Bomb Squad is always looking to push the limits of our capabilities to new heights and this is no exception. Getting the most out of the tools we have available while increasing operator safety is what it's all about. We believe that by sharing our experience with the bomb squad community we all can be a little safer. Hopefully you will agree. 🍀

About the Author:

Geoff Archer is an eighteen year veteran of the fire service and has been a member of Las Vegas Fire & Rescue for the last ten years. Having previously served as a Firefighter/Paramedic and a Fire Training Officer, he has been a member of the Las Vegas Fire & Rescue Arson/Bomb Squad for the last two years. Geoff holds current certifications as an EMT-Paramedic, Hazardous Materials Specialist, Category I Peace Officer, bomb technician and is a Master Fire Instructor. garcher@lasvegasnevada.gov

