All Forked Up

by Geoff Archer

Last Spring, I wrote an article about our experimentation with trailers and trailer hitches behind our Remotec robots. I received a lot of feedback from folks around the world, most of it positive. However, I did notice a common theme in the questions that were posed: What in the heck do you do with a trailer behind the robot?

The original intent of the trailer and hitch concept was based solely on the necessity to deploy our water-abrasive cutting system on a manageable platform without dedicating a frontline robot to a single task.

We were successful in achieving those objectives and soon started seeing many other potential trailer-based applications. The remote delivery of disruption tools for LVBIED's was one of the next things we tackled. To date, we have been successful in delivering both constructed and commercially available LVBIED countermeasures via the robot/trailer combination in a variety of training scenarios. The trailer platform has continued to evolve and we are currently experimenting with a variety of additional applications including miniature bomb tubes, robot range extenders, tool platforms and marsupial robot relationships. Some exciting things are happening with the trailer concept, but I must leave the finer details for another time.

As we have stumbled our way through developing and enhancing our robotic arsenal, I have come to understand a very simple concept with the utmost clarity: These little machines can do some serious work! As I watched our robots tow a variety of things around town, I started to wonder just what else we could get these rigs to do. After all, the more we can accomplish with a remote platform, the fewer chances we take by putting a tech downrange over a device, right? So a few calls to Remotec were made, discussions ensued, ideas were floated and the Las Vegas Fire & Rescue Bomb Squad is now all forked up!

Vehicle-borne IED's are certainly generating a high level of concern at the national level. Large or small, car bombs present a significant threat and a major challenge with respect to render safe procedures and, specifically, the speed at which we as a community are able to perform them. Rapid and reliable deployment is critical, but are we really there yet? According to FBI Special Technicians Bulletin 2007-3, the answer is probably not. Collectively, we are making great strides in getting there, but clearly this is an area of concern that needs to be refined and made available to the community as a whole.

LVBIED exit charges readily lend themselves to deployment from a trailer-based platform. Whether you plan on deploying HEADD shots, MREL Aqua Rams, MLVD's or any other large disruption tool, not too many robotic platforms are going to pick these up and carry them downrange to your target. Towing a trailer-based tool seems like the most logical option. But what about smaller targets and the tools designed for them? I'm talking about Big Mikes, Trunk Trashers, Boot Bangers and any other small exit charges. How do we deploy these things remotely in a rapid, safe and reliable manner? I personally have never seen one deployed exclusively by a robot in a training environment, or any other environment for that matter. So far, in my limited experience, deploying these tools has been accomplished by means of a manual approach for placement. Occasionally the disruptor has been placed near the intended target and final placement was achieved by pushing, nudging or otherwise shoving it into the final position with a robot. After asking around about the preferred method of deploying these VBIED disruption tools, the only other option I learned of was not much better. Grab the disruptor in the grip and push, pull or carry it downrange to the target. Trying this during a training session proved to be less than impressive. The job got done, but it was neither pretty nor expedient. For starters, I prefer to avoid committing my gripper until I simply have no other option. Without the use of the gripper, the robot is paralyzed in the event an unforeseen obstacle is encountered. Setting down loaded disrupters to

deal with other problems and then picking them up again to proceed seems somewhat less than efficient. Likewise, pushing or pulling them along the ground with the arm did not instill a high level of confidence in this operator. Overloading the arm with a large payload causes the arm to drift and, ultimately, arm motor failures. There had to be a better way.

A closer look at the anatomy of a Remotec F6A seemed to show a viable solution to this problem. This little workhorse, along with it's big brother the Mark VA-1, are fitted with tracked articulators both front and rear. It is my understanding that these appendages were originally designed to aid in navigating uneven terrain and specifically to allow these machines to climb stairs. Not only do the articulators allow the machines to accomplish these tasks, but to also permit the robot to extend its vertical profile by getting "up on its toes" with little effort. If the articulator motors in the F6A are capable of lifting the 400+ pound robot up on its toes, then they should have an easy time carrying any of the various exit charges previously mentioned, right? Off to the shop we go...

Since we already had a mounting platform for our hitch system that attaches directly to the F6A's rear articulators, it seemed to be the obvious place to start. At a quick glance, it would appear that the front and rear articulators are identical and, in fact, they are. However, there is a minor configuration difference, specifically their positioning in relationship to the F6A chassis. A considerable redesign was necessary to allow the mounting base to be attached to the front articulators without interfering with normal articulator function.

Just like the design process for the rear mounting plate, we did not want the front system to interfere with the robot's normal functions when not in use. Our redesigned base bracket achieves these goals with only one minor trade off: The base bracket will obscure some of the drive camera's field of view as the articulators run through their range of motion. This is a minor inconvenience thatcan be easily overcome by using the additional cameras on the robot if necessary. Extensive testing by members of our unit has not shown this to be a problem for an experienced operator. So at this point, we have essentially relocated our trailer hitch system to the front articulators. Now what?

Looking across the shop at our HEARST (Heavy Equipment & Render Safe Technology) platform, the solution became quite obvious; make that F6A into a forklift! The HEARST is based on a 10,000 pound capacity Yale forklift that has been modified for remote operation. The intended mission of this machine is to deliver very large disruption tools against very large vehicle-borne IED's. So if we could just shrink this concept down and employ it on our other robotic platforms, we would be in business. We figured that if anybody could fork it up, well, you get the idea.

Since we had already relocated our hitch system to the front articulators, the rest came along fairly quickly. The receiver hitch concept allows for an infinite number of tools to be attached by way of the standard draw bar and hitch pin mounting concept. Our fork design is no different and can be mounted and deployed in just a matter of minutes. The main draw bar is fashioned in a tee configuration that, in turn, holds an extruded aluminum bar out just beyond the front articulators. The "forks" are then attached to the aluminum bar with adjustable connecters and, taa-daa, the F6A is now a forklift.

The "forklift" function is controlled by a quick flip of the front articulator switch and requires no additional modifications. The tool is simple, effective and brimming with potential.

The system allows for fine adjustment of fork width, as well as rapid interchangeability of different fork designs. We have experimented with a variety of different fork shapes and configurations, to include a standard flat fork, as well as both round and hexagonal profiles. The flat fork mimics the shape of forks seen on most any forklift in common use around the world. We have tested these flat forks in several lengths and have been successful in delivering Big Mikes (~45 pound payload), both with and without base platforms. This was achieved without requiring any counterbalance on the rear of the robot. However, in the event counterweight is needed, it can be placed in the rear hitch assembly as necessary. The flat forks also work very well for delivering the Cherry Engineering Trunk

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Trashers. Since these are considerably lighter than a Big Mike, deployment proved to be relatively easy.

The round and hexagonal forks are more purpose built and designed for delivering several commercially available countermeasures.

All of the Alford products that we have tested have channeled openings on one or more facets of the exterior container. These channels readily accept both round and hexagonal "forks" and provide for an extremely secure deployment method. While payload capacity is significantly reduced with these fork profiles, the disruptors are also about half the weight of a mini-HEADD. All our testing with these disruptors has been very successful. The options seem endless and limited only by payload capacity.

With the growing concern over vehicle-borne devices again reaching our shores, every bomb technician should be asking themselves; What if? What if there's a car bomb in my city? What if I have to deploy some type of VBIED disruptor? Can I do it quickly? Safely? Can I deploy it remotely? Or do I have to take the long walk down? I truly hope I never have to find out the answers to those questions when faced with the real thing. I also believe that together, we need to at least try to find the answer to those questions before we're faced with the real deal. Start remote and stay remote is how the HDS adage goes. Exploiting our robotic platforms to their full potential can only bring us one step closer to following this rule without fail, and going home at the end of the shift.

The author is a nineteen year veteran of the fire service and has been a member of Las Vegas Fire & Rescue for the last eleven 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 three years. Geoff is a certified bomb technician, Hazardous Materials Specialist, Category I Peace Officer, and is a Master Fire Instructor. He can be contacted at garcher@lasvegasnevada.gov.