A Review of the ForceK9 MOLLE Combat Vest

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I. Introduction

Rudy is one of my best friends. He's gentle, affectionate, loyal, patient, and forgiving. His greatest joy is hanging out with me, his greatest concern, that I get sufficient exercise. He's willing to go anywhere I ask, come rain or shine, heat, wind, or cold. Did I mention that Rudy is my German Shepherd?

Rudy and I do a fair amount of walking. This may consist of urban exploration on neighborhood sidewalks and streets. Sometimes we explore mountain paths or desert trails in area parks and recreational areas. Occasionally, he travels with me. Over time, he has acquired certain equipment associated with this activity like his goggles, his footwear, and his collapsible water bowl, not to mention water, treats, and other accessories. I decided long ago that he should be responsible for carrying his own gear.


Figure 1: Rudy, ready for action

Initially, I fitted him with a pet store-grade canine backpack. It was was not terribly expensive and admittedly served the basic purpose for which it was intended. Yet it did not fit him very well and exhibited the annoying tendency to roll sideways. I was constantly fussing with it to keep it centered on his back. It also did not hold up very well. I soon found myself spending time repairing straps and buckles with my sewing awl.

I happen to be a licensed radio amateur, (station AC7ZL) and one of my interests is QRP. QRP is a ham radio term used to describe communications made with very low power transmitters—typically 5 watts or less. QRP operators often employ small, lightweight, battery-powered transceivers, coupled with portable antenna systems for use in the field. Under ideal conditions, it is possible to use such meager equipment to communicate many thousands of miles. This interest got me thinking about how I might equip Rudy to help me carry my radio gear as well.

Whether simply walking, hiking, or toting radio equipment, it was clear to me that another pet store K9 vest was not going to cut it. I needed something more robust and more flexible.

II. Why MOLLE?

Warfare is a notoriously complex activity requiring a soldier to carry a staggering load of equipment. While a 2001 Army Science Board study recommended a maximum carry load for individual soldiers of 50 pounds, a subsequent study in 2003 showed that soldiers on extended foot patrols routinely carried between 87 and 127 pounds of weapons, armor, ammunition, electronics, and supplies.

Over the years, the U.S. Military has invested a great deal of effort to develop systems by which these payloads can be carried. These include the LCE (Load Carrying Equipment), MLCE (Modernized Load Carrying Equipment), and ALICE (All-purpose Load Individual Carrying Equipment) systems. ALICE, probably the most familiar of the legacy systems, makes use of removable metal clips to attach equipment pouches to belts or packs.

The most recent system, adopted in 1997, is the MOLLE (MOdular Light-weight Load-carrying Equipment) system. MOLLE, pronounced like the female name "Molly," dispenses with the need for ALICE's metal clips. See Table 3 for Wikipedia references to ALICE and MOLLE.

A typical MOLLE attachment point consists of a parallel array of horizontal webs which are stitched onto a fabric panel so as to produce a series of evenly-spaced loops. The MOLLE pouch to be attached features two or more vertical webs, stitched to the pouch at their top end and fitted with a snap on the bottom. To join the pouch to the attachment point, the pouch's vertical webs are inserted into the loops on the attachment point's horizontal webs, back through a "keeper" web on the pouch, and then snapped.

Just how this works is considerably more difficult to describe than to understand. In effect, attachment relies on a "weave" between pouch and attachment point. Army technical manuals describing the MOLLE system and its use are readily available on the Internet. See Table 1 for a list of desirable volumes to download, and Table 3 for URLs.

Table 1: Useful MOLLE Literature

Identification Number	Title
N/A	Modular Lightweight Load Carrying Equipment Care and Use Manual
TM 10-8465-236-10	Operator's Manual For Modular Lightweight Load Carrying Equipment
TM 10-8465-236-24&P	Field and Sustainment Maintenance Manual For Modular Lightweight Load Carrying Equipment

A side effect of the Government's investment in MOLLE is a seemingly endless supply of MOLLE-compliant pouches, containers, and accessories—available to the general public at reasonable prices through surplus channels. Additionally, numerous companies produce brand-new MOLLE-compliant equipment for use by hunters, campers, law-enforcement, and security personnel.

The flexibility of the MOLLE system and the ready availability of affordable pouches and containers

prompted me to conclude that the best kind of dog vest for Rudy would be one engineered with MOLLE attachment panels. This would allow me to configure the vest for any anticipated mission.

I must admit that I had expected to find MOLLE-compliant dog vests as ubiquitous as any other MOLLE component. I was wrong. At present, there are few players in this field. That's why I was happy to stumble upon ForceK9 and owner-craftsman Paul Teixeira.

III. The ForceK9 Customer Experience

A series of Internet searches eventually led me to ForceK9's website (see Table 3).

I made several email inquiries with ForceK9, explaining my interests and objectives to Paul. He sent me his phone number and we spoke further. This dialog resulted in a short road trip to Phoenix, Arizona so that Rudy and I could meet Paul in person. In the interest of saving me some mileage, Paul suggested that he drive part of the way and that we meet in the parking lot of a department store at the north end of town.

He was already waiting when I arrived. We exchanged pleasantries and then he opened the rear of his SUV, which seemed to be filled with samples of his product, fabrics, webbing, and buckles. On handling one of his sample vests, I was immediately struck by its quality and the obvious attention to detail. Stitching was precise, ends were neatly finished, seams were perfect. Nowhere was a loose thread to be found.

Earlier I referred to Paul as a "craftsman." I intentionally used that word because the dog vests he produces have all the hallmarks of an exquisite musical instrument, a handmade piece of fine furniture,

Figure 2: Rudy's vest arrives in the mail

or a hand-tailored suit. These are not the products of a soulless robot or disinterested semi-slave laborer in some third-world sweatshop.

Speaking of hand-tailoring, all of the vests ForceK9 produces are custom-fit and made to order. This business model assures a no-compromise fit and maximum comfort for your dog. Six measurements define the vest that is ultimately made, including measurements of the dog's chest, back, and girth. The required measurements and how to make them can be found in ForceK9's Measuring Guide. See Table 3 for the associated URL.

As we were fortunate enough to meet Paul in person, he made these measurements himself. An interesting benefit of this was watching him interact with my dog. This is not a person who grudgingly practices a trade simply to make a living. It was satisfying to see that dogs and the equipment he makes for them are both obvious passions.

ForceK9 offers a whole family of different vest designs including their SARVest (Search Sport Vest), URBVest (Urban Sport Vest), and TACVest (Tactical Sport Vest). After considering my objectives and interacting with Rudy, Paul showed me his COMVest (Combat Vest). At the time, the COMVest was a relatively new addition to the ForceK9 product line. Two had been deployed to Afghanistan for field testing. Paul offered to create one for Rudy, that we might be able to assist in testing and evaluating its performance. This is what prompted the creation of the report you are now reading.

Paul offered me a choice of color and showed me samples of olive drab, coyote tan, and different camouflage patterns including Crye Precision Multicam. I selected the coyote tan, or more precisely, Tan 499.

It is worth noting that ForceK9 will happily entertain requests for additional customization. This means that no matter how esoteric the end-application, they can produce some configuration of vest to meet the need.

Since these vests are not stocked but are made to order, there is a certain lead time associated with their fabrication. The ForceK9 website indicates that typical lead times range from 3 to 4 weeks. If memory serves me, Rudy's vest was fabricated and delivered within that span of time.

Figure 2 shows the container in which Rudy's vest was shipped. The vest was folded neatly inside the box, wrapped in a sheet of tissue paper.

When Rudy's combat vest arrived, I was not disappointed. It exhibited every bit of the quality and craftsmanship that I had observed in the sample vests.

IV. Technical Details

Rudy's actual vest can be seen as received in Figure 3. His vest measures approximately 15.5 inches in length by 22.5 inches in width. It is a beefy garment, weighing in at approximately 31.3 ounces.

ForceK9 vests are fabricated with highest-quality American-made materials. Their website describes these materials in some detail, citing a veritable alphabet soup of military specifications. Rather than attempt to restate this information in my own words, I've opted to quote the website text verbatim here:

> ***Fabric*** *- The standard fabrics are 1000 (vests) or 500 (gear) denier Cordura®, which are very durable and abrasion resistant. Some of the fabrics feature a urethane coating on the back and a durable water-repellent (DWR) finish on the front for enhanced water resistance. Mil-Spec code: Mil-C-43734. Class 3: 1000D Cordura®; Class 4: 500D Cordura®*
>
> ***Webbing*** *- All of our vest and gear use some kind of tactical webbing. We use two main types of mil-Spec webbing. The Mil-Spec A-A-55301 is the common webbing used for PALS/MOLLE webbing (former Mil-Spec code was Mil-W-43668). It has five different types referred to the width of webbing strap (we typically use 1", 1.5" and 2"). The 1" width is Type III. It comes in 0.046" thickness and its tension strength is 1000lbs. The other is a very popular webbing Mil--*

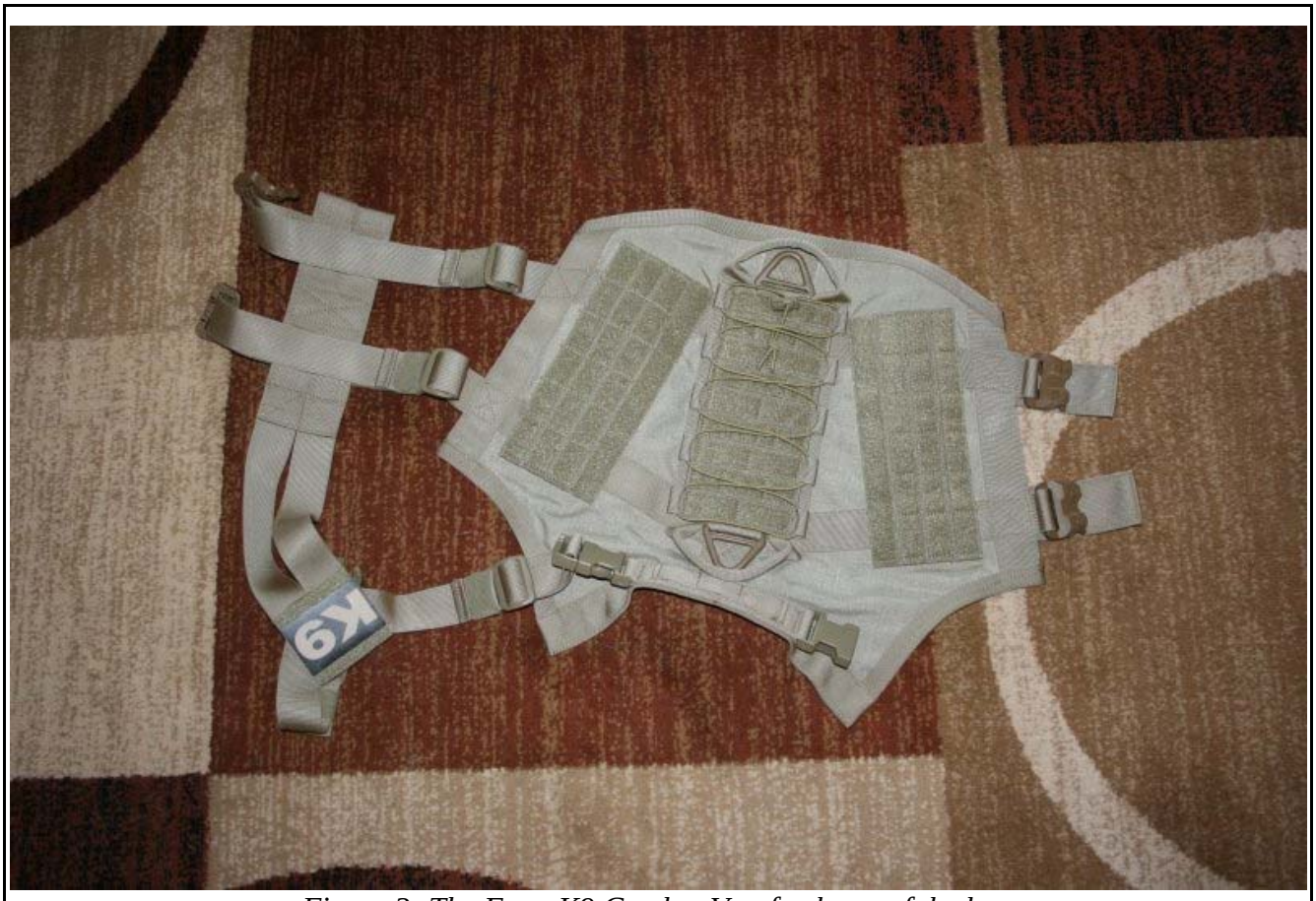

Figure 3: The ForceK9 Combat Vest fresh out of the box

W-17337. It's a good thin and flexible webbing for making and trimming gear. The 1" width is 0.038-0.050" thick and its breaking strength is 1200lbs, while the same webbing in 2" thickness has 2200lbs breaking strength. Mil-Spec code: A-A-55301 Type III; Mil-Spec code: Mil-W-17337

Hardware *- We mainly use ITW Nexus or ITW Military products. These plastic buckles/hardware are very durable, yet light-weight and made of a very durable acetal resin. The dye is mixed with the plastic resin so the color is present throughout the material, not just on the outside. In some custom builds, we use the all metal Cobra buckle which is available on request. When it comes to lead attachment points we use very strong, welded-steel D-rings or drop forged steel V-rings.*

Thread *- We only use Mil-Spec bonded threads size V69 (Tex size: T-70, US Govt: E), either nylon or polyester (brands like A&E, Coats, and Eddington). Both have a good water resistant features with polyester threads handling UV rays slightly better long term.*

All edges of Rudy's vest are carefully trimmed. Note that the webs which make up the attachment harness are not merely terminated at the edges of the vest, but pass completely through it. Thus it is the webbing, not the vest, that bears any tensile forces.

Figure 5: The top of the ForceK9 Combat Vest

The vest is fitted to the dog through the joining of four snap buckles. Two straps and their buckles, seen at the 10 o'clock position in Figure 3, wrap around the dog's chest and mate with the buckles which can be seen at the 3 o'clock position. The webs on Rudy's vest are approximately 1.5 inches in width.

Perpendicular to these is a double-width breast web. This is intended to run along the dog's chest, and up the breast to the base of the neck. The web extends to the "K9" logo where it then splits. Each half goes to one side of the dog's neck and mates with snap buckles at the front of the vest, seen in Figure 3 at the 5 and 7 o'clock positions. The buckle at the 7 o'clock position is already fastened.

One of the outstanding features of the breast web is its split construction. The breast bone of German Shepherd dogs (and I suspect other dogs as well) is not flat as in humans. Rather, it presents an acute angle or apex. Because of the split nature of the web, it is able to conform to and cradle the breastbone's ridge, resulting in a more secure and more comfortable fit.

As previously indicated, ForceK9 vests are custom-fit to each dog, though four adjustment buckles are provided to allow for fine-tuning. Any extra web is secured with Velcro® keepers, supplied with the vest.

The interior of the vest is lined with a soft, coarse, nylon mesh or net. It is thought that this mesh helps the vest to "breathe" and shed excess heat, as well as protect the dog's coat from damage.

The MOLLE panels, seen in Figure 4, form the heart of this vest. Two MOLLE panels appear on the

vest, one on each side of the dog.

Each MOLLE panel is comprised of three strips of webbing, each stitched to provide 6 loops (attachment points). The MOLLE webbing is faced with Velcro® to allow for the convenient attachment of emblems, identification patches or name tapes.

Above the MOLLE webs is an additional strip of Velcro®-faced webbing. This is not part of the MOLLE attachment system, but it does provide additional surface area to engage Velcro® sign-age or accessories.

The MOLLE panel exhibits a forward/downward cant. Initially this struck me as peculiar, if just for aesthetic reasons. However, as time has passed, I have come to regard this feature as having engineering merit.

My empirical observations suggest that the orientation of the panel tends to lower the center of gravity of the MOLLE payloads, moving it forward as well. A lower center of gravity can be expected to improve the stability of the harness (less inclination for a loaded vest to roll from side-to-side), not to mention improving the dog's balance. Moving the center of gravity forward helps to shift the loading from the dog's back onto the shoulders (which is the preferred load-bearing part of the animal).

Speaking of the dog's back, the ForceK9 Combat Vest provides a feature-rich mounting surface at the top of the vest. In addition to a very large panel of Velcro®-faced MOLLE webbing, the top of the vest features 10 anchor loops laced with elastic cord. The lacing can be tightened with a plastic pushbutton-type cord lock. See Figure 5.

The Velcro® and multiple MOLLE loops on this surface offers endless possibilities for the attachment of sign-age, small pouches, or electronic devices. There are some pretty elaborate (and expensive) wireless K9 camera systems available to law enforcement and military handlers. Conversely, an Internet search revealed several examples of comparatively inexpensive MOLLE camera mounts for the famous GoPro camera. Other options might include radio receivers (through which verbal commands can be issued) and GPS transponders.

In Rudy's case, this is where I secured his name tape and a Velcro®-backed American flag. When we walk at night, I use the elastic lace to secure a blinking red LED lamp to ensure that drivers can see us when we cross the road. I have also used the lacing to secure thermocouple instrumentation when I conducted thermal studies of the vest. I'll comment more on that a little later.

The back of the vest features two V-rings, not unlike those found on parachute harnesses or rigger's belts. Though I've not yet had cause to use them, the V-rings offer convenient points for the attachment of leashes or lines.

Coincident with the V-rings is a pair of control handles comprised of stitched webbing. I've not had occasion to use these either, though my infant granddaughters like to hold on to them when we take Rudy walking. In a working/tactical situation, they would provide an ideal means by which to lift a dog up and over a block wall, a pile of rubble, or similar barrier.

V. Useful Pouch Configurations

As part of my evaluation of Rudy's new vest, I gathered together an assortment of MOLLE and ALICE assets to experiment with. This equipment was purchased on-line, from local military surplus stores, and from garage sales. Some I already owned and used myself for hiking purposes.

Table 2 lists some of the equipment I applied to the ForceK9 Combat vest. Where possible, I included information that might be helpful in finding and purchasing them, as well as data useful in determining suitability for use.

Table 2: MOLLE Equipment Tested with the ForceK9 Combat Vest

Description	NSN Number	MOLLE Loop Spacing	Approx Weight (Oz)	Approx Size (H-W-D in In)
100 Rd Utility Pouch	NSN 8465-01-524-7365	2	5	6.5 x 5 x 3
200 Round Saw Gunner Pouch	NSN 8465-01-524-7620	4	6.3 oz	8.5 x 7 x 3.5
Canteen Carrier with empty canteen	NA	2	10.4	7 x 5.5 x 4
Canteen Carrier with full canteen	NA	2	43.9	7 x 5.5 x 4
IFAK (Individual First Aid Kit) Pouch	NSN 8465-01-531-3647	2	5 oz	6 x 5.25 x 2.75
Magazine Carrier (2 30-rnd 5.56x45 NATO) empty	NA	4	4.9	7 x 6.5 x 1.5
Magazine Pouch (2 30-rnd 5.56x45 NATO) loaded	NA	4	37.3	7 x 6.5 x 1.5
MOLLE Adapter	NSN 8465-01-465-2062	2	1.3	NA
Waist Pack	NSN 8465-01-491-7445	7	12.6	6 x 15 x 5

The first two columns describe each item and report its respective NATO Stock Number (NSN).

The third column indicates how many MOLLE loops are occupied by the item when installed on a MOLLE panel.

Figure 6: Configuration (A), 4 X IFAK pouch

The fourth column indicates the approximate weight (in ounces) of each item. Weights were measured with an uncalibrated hook-type digital scale. The instrument was a cheap consumer-grade instrument of overseas origin, so the reported values are offered for reference only. Any payload not specifically mentioned (ex:: water, ammunition) must of course be added to the overall weight of the item.

The last field describes the physical dimensions of each item as measured in inches. Since the equipment in question is made from fabric, and fabric is compliant, exact measurements are nearly impossible to make. Again, the reported values are offered for reference only.

Configuration A: 4 X IFAK Pouches

One of my favorite configurations involves the use of surplus empty IFAK (Individual First Aid Kit) pouches. See Figure 6. Four pouches fit the vest, resulting in roughly 350 cubic inches of payload space. The calculated combined weight of vest and empty pouches comes in around 51 ounces.

This configuration provides ample space for Rudy's personal gear. One pouch stores his goggles (with plenty of room to spare.) A second contains a fabric collapsible water bowl and treats (again, with room to spare). A third carries his shoes and a roll of self-adhesive bandage to take care of any paw problems

Figure 7: Configuration (A), 4 X IFAK pouch, top view

that might arise in the field. The fourth pouch is best used by serving its original purpose—to carry hiking-first-aid items.

As can be seen in Figure 7, this configuration results in a pack that compact, balanced, and doesn't add significantly to Rudy's width. This preserves his ability to maneuver easily in right spaces.

Configuration B: 2 X Canteens

A person can never have too much water with them, especially here in the desert. Thus, one of the configurations I experimented with was the two-canteen-carry setup that appears in Figure 8. A standard U.S. Military canteen of this size holds 32 ounces. A pair, then, can carry a half-gallon.

As can been seen in Table 2, water is very heavy. The calculated weight of two full canteens plus the vest itself adds up to 119 onces—nearly 7-1/2 pounds. On the other hand, there is no reason why the canteens must be filled to the top, and could instead be filled to the three-quarter or one-half mark. In any event, the important point is to add or remove water from the canteens equally, so as to maintain balance between the two.

Figure 8: Configuration (B), 2 X ALICE canteen carrier

The particular canteen carriers I had on hand were of the older ALICE variety. To attach them to Rudy's vest, I inserted the carrier's ALICE clips through the MOLLE loops and secured the clips. The attachment was robust and showed no sign of failure. However, my engineering sense told me that this was probably stressing the MOLLE stitching in ways not originally intended, and that the best course of action was to use the proper MOLLE canteen carriers.

The military obviously anticipated the desire to attach older ALICE equipment to MOLLE panels, and for that reason created an adapter (NSN 8465-01-465-2062). The adapter has reinforced attachment points to accept ALICE clips, and vertical webs with which to engage the MOLLE panels. The adapters are inexpensive and add just a little more than an ounce of weight for each.

Configuration C: 2 X Canteens, 2 X 100 Round SAW Pouch

Figure 9 and 10 shows a variation on the canteen carrier theme. Starting with two canteens, the C configuration adds two 100-round SAW (Squad Automatic Weapon) pouches at the rear. The 100-round pouches are a trifle larger than the IFAK pouches. They offer a calculated payload space of 195 cubic inches at the cost of an additional 10 ounces of weight.

Figure 9: Configuration (C), 2 X ALICE canteen carrier, 2 X 100-round SAW pouch

A dog carrying two full canteens is already loaded pretty heavily, so it's a good idea to exercise restraint in loading the SAW pouches with additional burden.

Configuration D: 2 X Magazine Pouch

As a test of utility outside of my immediate interests, I experimented with the ForceK9 Combat Vest as a vehicle for carrying spare ammunition. See figure 11.

AR-style magazine pouches can be inexpensive and are readily available both as military surplus and as newly-manufactured items. The specific pouches I obtained were of commercial origin, occupy 4 MOLLE loops, and were designed to hold two 30-round magazines. A pair results in a balanced vest configuration with four magazines or 120 rounds of 5.56 x 45, total.

Like canteens and water, ammunition is heavy. The calculated weight

Figure 11: Configuration (D), 2 X magazine pouch

of the vest, pouches, and four loaded magazines totals around 106 ounces. This is a bit more than 6-1/2 pounds. On the plus side, magazine pouches hug the vest and aren't likely to cause problems when a dog tries to navigate through narrow or confined spaces.

It struck me that a good way to make use of the unoccupied MOLLE loops would be to add a pair of IFAK trauma packs. Based upon information that I could find, this would add about two pounds to the overall burden. Rudy can be seen modeling this while doing “guard duty” in Figure 17 (toward the end of this report).

Configuration E: 2 X 200 Round SAW Pouch

Figure 12 depicts Configuration E, the ForceK9 Combat Vest fitted with a pair of 200-round SAW pouches.

In terms of storage size and weight, the 200-round SAW pouches in this setup are more efficient than the 4 X IFAK pouches of Configuration A. Two 200-round SAW pouches provide a calculated carry volume of 416 cubic inches—66 more than the IFAK pouches. At the same time, the system weight (vest plus the two pouches) comes in at only 44 ounces, or 9 ounces less.

Figure 12: Configuration (E), 2 X 200-round SAW pouch

A significant downside of Configuration E is the depth of the pouches, which increase the effective width of the dog. This can create problems when navigating through brush or narrow places. See Figure 13. Initially, Rudy didn't like this setup very much, even with empty pouches. It took some getting used to.

That said, the 200-round SAW pouches hold great promise for carrying QRP ham radio gear. To protect my transceiver, I cut a block out of a chunk of closed-cell foam, sized to fit perfectly inside one of the pouches. Next, I hollowed out the block with a knife. The void was shaped to fit the transceiver. The transceiver is loaded into the foam, and the foam is slid into one of the pouches.

The opposite pouch is loaded with accessories—headphones, Morse key, cabling, batteries, etc—to balance the weight of the transceiver. I am still evaluating options for lightweight antenna systems.

It should be noted that this application is a work in progress. As I continue to ponder what what components should be in Rudy's pack, what should be in mine, and what is best left behind, the vest configuration details are likely to change.

Figure 13: Configuration (E), 2 X 200-round SAW pouch

Configuration F: 2 X MOLLE Waist Pack

A common piece of standard-issue MOLLE gear is the so-called Waist Pack (NSN 8465-01-491-7445). The MOLLE waist pack is an oblong zippered pouch, approximately 5 inches in diameter and 15 inches long. It is used for general purpose storage. See Figure 14.

Stitched to the pouch is a length of 2-inch-wide webbing, fitted with snaps and buckles. If the length of the web is reduced, the pack can be worn like a belt. Extended, the web becomes a shoulder strap. I've used one of these packs for more than year as a casual lunch-box/carry-all for work.

In addition to the belt, the waist pack also features two webs that allow the pack to be attached to a MOLLE panel. I wondered if a pair of these packs might make useful accessories for the ForceK9 Combat Vest and the results were promising.

The calculated volume of a pair of MOLLE waist packs is a staggering 900 cubic inches. This is two-and-a-half times the volume offered by the IFAK pouches in Configuration A. Yet, the system weight (vest plus pouches) is 57 ounces, only 6 more than the IFAK setup.

Figure 14: MOLLE Waist Pack, front

Waist packs are not perfect, however. To begin with, the pack's MOLLE webs are spaced the equivalent of 7 loops apart. Since Rudy's vest will only accommodate MOLLE equipment up to 6 loops in width, it becomes necessary to scrunch the bag laterally to get the webs to align. As a result, the bag hangs a little funny. It doesn't integrate as seamlessly as the other accessories reviewed.

In general, the bag is soft, compliant, and doesn't really hold its shape. It's most useful for transporting equally-compliant objects like clothing, MREs, or other items unlikely to be damaged through rough handling.

For permanent use with the ForceK9 Combat Vest, it would be advantageous to sever the stitching that secures the belt to the bag, and remove the belt completely.

VI. Wear and Tear

Rendering predictions about any product's probable lifespan is speculative by its very nature. However, Rudy and I have been running ForceK9's Combat Vest in the field for approximately 9 months. Given that, it's reasonable to comment on any observed wear-and-tear during that interval. I don't feel uncomfortable about drawing preliminary conclusions based upon that experience.

I have attached a wide variety of experimental loads on his vest. Some of these experiments involved the direct application of ALICE clips to the MOLLE attachment points without the benefit of a MOLLE adapter. This is rough on the MOLLE stitching and could be regarded as abusive in nature.

Our daylight walks occur under an Arizona sun—a source of ultraviolet radiation so intense that it bleaches paint and decomposes plastic. (A plastic milk jug, left in the sun here for a few weeks, will decompose to the point that will literally crumble between your fingers like a stale potato chip.)

And let's face it, the last thing a dog worries about is whether or not he'll ruin the fine vest you just gave him. If it suits him, Rudy lies in the dirt or rolls around on the ground. If we traverse a narrow trail, he doesn't trouble himself about the Mesquite needles or the jagged rock face that has raked down the sides of his pack. For him, this is all about having fun.

So what have I observed in terms of wear-and-tear on Rudy's vest? The short answer is "Nothing."

I see no evidence of damage due to abrasion. There are no holes, frayed ends, or loose threads. The MOLLE is intact with no evidence of damage. The Velcro® surfaces still exhibit aggressive adhesion. Despite hours of exposure to Arizona sun, I can detect no evidence of sun-bleaching and no evidence of ultraviolet degradation, either of fabric, webbing, or buckles. The vest has all the functionality and structural integrity it did when I first received it.

Overall, I am pleasantly surprised at how new it still looks, particularly given that I have not laundered it. Besides being a physically tough material, I've read that Cordura has an innate ability to shed dirt.

Given what I've observed over the last 9 months and extrapolating that rate of wear and tear into the future, I can't see why this vest wouldn't last for many, many years. Unless used under exceedingly hostile circumstances, it would likely outlive any dog that it was it was issued to.

VII. Thermal Considerations

Rudy and I operate in the Arizona desert where heat is always a potential concern. In outfitting Rudy with a vest, I was curious as to what effect the presence of the vest on his back would have on his ability to deal with heat.

To investigate this, I obtained two pieces of measurement equipment, an Omega HH32 thermocouple meter and a cheap consumer-grade infrared medical thermometer. The HH32 was used to measure the temperature inside the vest. One probe monitored the temperature at the chest, the other monitored temperature along the spine. The HH32 can be seen attached to the back of the vest in Figure 16. I intended to use the infrared thermometer to gauge Rudy's body temperature by looking into his ear.

With instrumentation in place, Rudy and I set out on a number walks. In each case he was loaded with approximately 5 pounds of payload. Ambient temperatures ranged from 85 to 98 degrees F. Pavement temperatures were 100 F in some cases. Every ten minutes, I stopped to check the HH32 and record temperature values in a notebook. I also took measurements of Rudy's core temperature.

Rudy did not like the infrared thermometer in his ear and fussed when I tried to make measurements. This and the idiosyncratic behavior of the thermometer itself casts some doubt on its readings. The

HH32 functioned properly, but without automatic logging capabilities, ten-minute intervals was the best sample resolution that I could reasonably achieve.

Because of these difficulties, I felt my data was inconclusive and I therefore chose not to reproduce it here. Yes, there is some accumulation of heat under the vest, and the temperature rises as ambient temperatures rise. But I consider this less a specific attribute of the Combat Vest than a general effect of any article of K9 clothing that interferes with the radiation of heat.

For what it's worth, I never saw any body temperature readings that alarmed me.

VIII. The Competition

It is only fair to note that there are other manufacturers in the business of producing K9 MOLLE vests. In fact, prior to discovering the existence of ForceK9, I made phone inquiries into the purchase of a MOLLE vest from a competitor.

Having never held the competitor's vest in my hands, let alone fit it to Rudy's back, it would be disingenuous to make comparative comments about its quality or construction. None the less, I do have some observations that I feel are legitimate and worth sharing.

For example, when I phoned the other manufacturer, I posed specific questions with regard to the features of their product. I was greatly disappointed that the person I spoke with did not demonstrate a working knowledge of his own merchandise. Answers to my questions were vague or incomplete—a problem for me when I am contemplating spending a sizable amount of money.

My experience with ForceK9 was entirely opposite. Every concern I had was addressed up front, and questions posed after the vest was delivered were answered both quickly and cheerfully.

While the competitor's product was adaptable for proper fit through the adjustment of its straps, the vest itself was a one-size-fits-all design. This means that, by definition, it is optimal for only one size of dog. In every other instance, it represents a compromise in terms of fit and comfort. In the case of a dog Rudy's size, the vendor's catalog implied that that vest might not even fit at all. The sales people I spoke with couldn't offer me any assurances to the contrary.

In contrast, ForceK9's vests are custom-made and tailored to the individual dog. The adjustable straps in ForceK9's vest augment this custom fit, they aren't relied upon to provide it.

Finally, the competition's product required the purchase of panels, adapters, and other accessories to provide the same functionality that the ForceK9 Combat vest delivers right out of the box.

Needless to say, I ultimately declined the purchase of the competition's product and opted for the ForceK9 vest. I am glad that I did.

IX. Some Comments Pertaining To Dog Safety

As every dog owner knows, dogs are exceedingly loyal and stoic servants. As such, they are predisposed to accept excessive burdens without complaint, even if such loads are capable of inducing injury. It is the responsibility of the owner or handler to exercise restraint and good judgment when outfitting a dog to carry anything with a load-bearing vest. I am therefore compelled to state what should already be obvious—dogs are not pack mules.

What constitutes a “reasonable” load for a dog? The answer is not a simple one. At least three sources I found claimed that loads as great as 25% of the dog’s body weight are acceptable, provided the animal is in good health and is trained through gradual addition of weight to achieve that capacity.

Other sources suggested a 10% to 15% limit. At least one veterinarian recommended no more than 5%. Ultimately, the maximum safe carry load for a dog is a quantity unique to the individual. It flows from such factors as the animal’s breed, age, health, constitution, and temperament. These factors are best assessed with the help of a competent veterinarian.

Absolute payload weight is not the only concern. The placement/distribution of pack loads is as important as the magnitude of that load. Anatomically speaking, dog's backs are not well suited for carrying weight. A dog's greatest strength lies in its shoulders, so this is where the bulk of any loading should be concentrated.

Walking, whether on two legs or four, is a remarkable balancing act. The payloads we carry necessarily impact the systemic balance of our entire bodies. Unbalanced loads cause strain and unusual movement as the body attempts to compensate. This can lead to injury.

On the other hand, when loads are balanced, it is much easier for the body to maintain its own balance. (Consider how much easier it is, for example, to carry two five-gallon pails of paint, one in each hand, than it is to carry just one one.) This issue becomes all the more critical when one attempts to traverse broken, inclined, or uneven ground. It is important then to make sure that payloads applied to a dog's vest are properly distributed and are symmetrical in nature.

Don't forget to consider a dog's feet. Sun-baked pavement can be hot enough to burn, icy ground can freeze or cut foot pads. Broken rock, like the kind often found on mountain trails here in the southwest, can abrade pads and lead to painful blisters. Broken glass is not uncommon in urban settings. When payloads are applied to a dog through a load-bearing vest, the additional weight is ultimately borne by the dog's feet. Thus, loading exacerbates these hazards. Careful training can lead to the development of robust foot pads, but anyone planning to make serious use of a load-bearing dog vest should at least consider the acquisition of appropriate footwear for their dog.

Humans have an innate sense of body space, that is to say, a feeling for the volume of space that our bodies occupy. This feeling allows us, for example, to navigate down a narrow aisle in a theater without banging into every seated person we pass. The same holds true for dogs.

When a dog is fitted with payloads that project from the sides of his vest, the effective width of the dog is increased. Reality is then at odds with the dog’s innate sense of his own width. The tendency to bang

into things can be annoying, if not comedic. The solution is to allow the dog time to adapt. This is best accomplished by outfitting the dog with the desired pouches/containers, but leaving them empty and unloaded until the dog acclimates.

Finally, when operating in warm climates, it is important to consider the thermal burdens that a vest and its payload may place upon a dog. Dogs rid themselves of waste heat by panting, so a vest or backpack does not impede sweating the way it would in a human. However, it can act as blanket trapping body heat, preventing direct radiation, and interfering with the cooling effects moving air.

Keep careful watch of your dog’s behavior. Excessive panting, a bright red tongue, sticky saliva, weakness, dizziness, or vomiting signify that the dog is already in the midst of a serious medical emergency.

X. Conclusion

One of the great benefits of communication via the Internet is the ability to share one's experience with the use of various products. I have relied in part on the reviews of others to make purchasing decisions about items as diverse as clothing to computers, books to consumer electronics, tools, automobiles—even doctors.

Customer reviews of products tend toward a bell curve. The mass of the bell represents the general consensus, with strong yea or nay perspectives lying at the fringes. While I will still consider an extreme view (either pro or con), it's been always been my personal policy to take such views with a grain of salt.

To my way of thinking, a uniformly negative review may be the work of a crank, someone with a personal ax to grind, or someone who simply cannot be satisfied. Conversely, a uniformly positive review prompts me to wonder if the author is capable of exercising the scrutiny necessary to provide for a meaningful review.

The latter now leaves me in the uncomfortable position of hypocrite because, frankly, I just can't find anything bad to say about ForceK9 or its Combat Vest.

To summarize: The vest is made of top-shelf materials and assembled with a craftsman's hands to custom fit your dog. The design of the vest itself is sound. It appears to be comfortable, it integrates seamlessly with a variety of MOLLE components, and it's durable. (Side note: During my evaluation of the vest, seams and stitching on some of the military surplus components I tested came apart and had to be repaired. The ForceK9 vest, on the other hand, performed without any sign of degradation, let alone failure.)

“Surely,” you insist, “there must be *something* bad to say about this product.” OK, have it your way. As of the time of this review, the least expensive vest in the same product family is the SARVest. It retails at $70. The Combat Vest, the subject of this review, retails at $365. Granted, these are not cheap products. On the other hand, when I consider the cost of a product, I consider it in terms of three dimensions: absolute cost, relative cost, and the cost-to-benefit ratio.

Prices are what they are, and in this case of the Combat Vest, the absolute cost is admittedly non-trivial. However, compared to the cost of comparable products produced by other manufacturers, the price is actually reasonable, especially given that the vest is made to order and is a custom fit.

Vest or not, there are substantial costs associated with owning a dog, particularly large breeds and working dogs. These include the costs of acquisition, training, food, toys, licensing and medical care. Add those up over the life of a dog and the comparative cost of good MOLLE vest pales in comparison. Relatively speaking, the Combat Vest (and other vests in the ForceK9 product line) are good deals.

Finally, the cost-to-benefit ratio is very low. This vest offers great value, far greater flexibility than your run-of-the-mill pet store vest, and is likely to outlast the dog to which it is issued.

On a scale of one-to-five, I have to give the ForceK9 Combat Vest five stars.

XI. Addendum

At the time this review was originally prepared, I had identified MOLLE waist packs as possible accessories to the Rudy harness, but judged them to be less-than-ideal because the span between their attachment webs was wider than the span of the attachment area on the dog vest. These packs were identified as NSN 8465-01-491-7445.

I have subsequently come across another version of the MOLLE waist pack with a narrower web spacing that works perfectly with Rudy's vest. The identifying number on this article is NSN 8465-01-524-7263

Table 3: Web References	
ALICE (Wikipedia Entry)	https://en.wikipedia.org/wiki/All-purpose_Lightweight_Individual_Carrying_Equipment
Army Times (Soldiers Carrying Too Much Weight)	http://www.armytimes.com/article/20110214/NEWS/102140308/Report-Combat-soldiers-carry-too-much-weight
ForceK9 Website	www.forcek9.com
ForceK9 Measuring Guide	http://forcek9.com/forcek9_measuring_guide.html
Modular Lightweight Load Carrying Equipment Care and Use Manual	http://ciehub.info/gview.html?loc=%2Fref%2FMOLLE2CareUse.pdf
TM 10-8465-236-10	http://ciehub.info/gview.html?loc=%2Fref%2FTM%2F10-8465-236-10_2013-06-20.pdf
TM 10-8465-236-24&P	http://ciehub.info/gview.html?loc=%2Fref%2FTM%2F10-8465-236-24P.pdf
MOLLE (Wikipedia Entry)	https://en.wikipedia.org/wiki/MOLLE
Raven Tactical Gear	http://www.raventacticalgear.com/

Note: URLs provided here as a courtesy. The author is not responsible for content on these sites and inclusion in this table should not necessarily be construed as endorsement.