

# Vertical

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**BAMBI BUCKET  
MORE...WITH LESS**



# More... With Less

WITH WILDLAND FIRES GETTING BIGGER AND MORE FREQUENT, AND LESS MONEY AVAILABLE IN AGENCY BUDGETS TO FIGHT THEM, OPERATORS NEED A TOOL TO HELP THEM DO MORE.

Story and photos by Jon Mayer

With United States Forest Service (USFS) budgets being cut by nearly 10 percent, and unprecedented fire seasons becoming commonplace, fire managers are going to have to find more efficient ways of fighting fires with fewer resources at their disposal.

Everyone in the industry, whether directly fighting fires or not, can already tell you what is needed to fight fire with a helicopter — a Bambi Bucket. For 25 years, the Bambi Bucket has remained an essential tool in the aerial fire fighting effort. Day after day, season after season, each bucket drops thousands of gallons of water, without fail and with relatively little maintenance required. But, can this stellar device be improved upon?

## ADDRESSING THE LIMITATIONS

The Bambi Bucket was designed by Don Arney to increase the accuracy of water drops and reduce turnaround times for the helicopter to reload at the nearest water source. Its one limitation has always been that if the pilot wants to maximize efficiency, he or she must choose a water source of sufficient depth (generally at least four feet) to fully submerge the bucket. Otherwise, they will leave the dip site with a partial load. Searching for water sources of this depth can dramatically reduce the number of potential dip sites available, especially when operating in the dry western areas of the U.S.

Now, what if there was a way to make use of those shallower water sources significantly closer to the fire line? Ironically, fixed, belly-mounted tanks hold the answer. These tanks make use of an ingenious snorkel pump that is lowered into any water source, shallow or deep, and “powerfills” the belly tanks.

In 2001, SEI Industries of Delta, B.C., manufacturer of the Bambi Bucket, adapted this powerfill technology for its buckets. Not only is the option now available on all new buckets, model 2024 (240 US gallons) and larger, but existing buckets can be retrofitted to accept this snorkel-filling capability.

SEI offers two versions of its PowerFill pump technology. The widely publicized Torrentula Valve Bambi Bucket has the PowerFill pump incorporated into the design of its variable-dump valve, and is ideal for larger buckets. The smaller, and far-less-known version is the Bambi PowerFill snorkel. It utilizes a one-way flapper valve built into fabric shell of the bucket, approximately 12 inches below the top rim. From this fitting, SEI bolted an external snorkel pump, which draws in water from the bottom 12 inches of the bucket, and requires as little as 12 to 18 inches of water depth to achieve a completely full bucket.

## REAL-WORLD PROOF

The Bambi PowerFill is the snorkel my company, Heli-1 Corp of Reno, Nev., has been using for the last three fire seasons on our Bell 212HP with a 240-gallon Bambi Bucket. Our experience has been very positive, and in more ways than we could have foreseen.

Everyone’s first reaction, upon seeing the pump for the first time, is to ask, “What’s that?” This is followed by, “We’re *not* going to need that around here.” Close on the heels are statements that the snorkel looks heavier and bulkier than what they are used to. Granted, the sturdy pump makes the standard bucket 45 pounds heavier, but you can remove the bucket’s 20 pounds of lead ballast. (Lead is no longer needed to keep the bucket from spinning in forward flight as the offset mounting of the pump now performs this function.) Twenty-five pounds extra weight is a small price to pay for the efficiency gained.

Once the snorkel pump is put to work, though, all skepticism is quickly put to rest. Even I, who believed in the snorkel idea, had no idea just how useful it would be on practically every fire we worked. It has gotten to the point that our pilots feel like they have one arm tied behind their back if they have to use a bucket without the pump.

Our first experience putting the pump to good use came on its first assignment in the Kaibab National Forest on the north rim of the Grand Canyon in 2005. This particular area of the “Arizona Strip” is arid high-desert Pinion and Juniper trees with little water available. Due to the lack of available water, we were directed to a remote Pumpkin (SEI portable water tank), only to find it was only a third full, or about 2.5 feet deep. As we now do every time this happens, we laid the bucket on its side in the water and then stood it up. This got it about half full. We then moved the thumb-activated cyclic switch to turn on the 425-gallon-a-minute pump, and it topped off the bucket in about 15 seconds. This effectively doubled the amount of water delivered to that fire without adding extra flight time or expense.

Imagine if *each* time, *every* helicopter left a pumpkin carrying 10 to 50 percent additional water, on a fleet-wide basis. That would conservatively translate to millions of gallons of additional water delivered per season. With the extensive use of pumpkins as dip sites for water buckets,

**OPPOSITE** For 25 years, the orange-colored Bambi Bucket has been an essential tool in fighting forest fires from the air.

**TOP RIGHT** Heli-1 of Reno, Nev., has been using the PowerFill snorkel with a 240-gallon Bambi Bucket on its B412HP for the last three fire seasons. It has had great success in fighting fires with it, even outdelivering a Skycrane on one day.

**BELOW** The Bambi PowerFill snorkel can fill almost any size bucket from shallow water sources. **Dan Sweet Photo**



this is an area the snorkel pump can consistently pay off. If 10 percent more water delivered is the equivalent of 10 percent more helicopters in the air (at no additional expense), then the Bambi PowerFill is truly a force multiplier that cannot be ignored.

On another fire, in Sedona, Ariz., in 2006, with a full pumpkin available, our Bell 212HP was out-delivering a Bell 205++ because its 324-gallon bucket was too large to fully submerge. It had to leave with a partially full bucket.

An interesting thought to ponder is that all the assumptions made by interagency decision-makers for their best-value performance calculations (based on pennies per gallon of water delivered), are figured on full buckets. In fact, these numbers are valid only if everyone flies with their buckets full all the time. The government assumes this to be true, but, as we’ve seen, it’s frequently not the case.

One of my favorite stories about SEI’s snorkel happened in 2006 in Grants, N.M. Over the radio, a local engine captain, enroute to the fire, radioed our helitack personnel with the message, “Don’t bother hooking up the bucket, because there is no water around here.” But, he was too late, and we didn’t know any better. Shortly after his radio call, our pilot on the job, Eddie Thoroughgood, emerged over the fire, dumping his first full bucket of water on the flames — in full view of the flabbergasted engine captain. The fire was out shortly thereafter... but maybe we should have just let his crew dig line and throw dirt at it?

## JUST ADD A LONG LINE

When the efficiency of the snorkel is combined with a 100-foot (or more) long line to access streams, forest ponds confined by trees or any other normally inaccessible water source, anything “wet” becomes fair game and maximum efficiency is sure to follow.

This was taken to the extreme in Yosemite National Park in California in 2006 when working a fire at the top of El Capitan. We were able to utilize a creek running on top of El Cap that was 200 feet from the edge of the fire line. With designated dip site for Skycranes a 20-minute turn away, our Bell 212HP out-delivered a Skycrane that day!

Regarding the assignments worked in and around the Sierra National Forest in California, Patrick Basch, a USFS forest aviation officer said this about the Bambi PowerFill

**Day after day, season after season, each bucket drops thousands of gallons of water, without fail and with relatively little maintenance required. But, can this stellar device be improved upon?**



# Out in the Wilderness

FROM FIRE FIGHTING BUCKETS TO ENVIRONMENTAL PROTECTION, SEI HAS MADE A NAME FOR ITSELF CREATING PRODUCTS THAT ALLOW COMPANIES TO WORK IN AND PROTECT OUR WILDLANDS.

Story by Mike Reyno  
Photos by Graham Lavery



snorkel: "This added efficiency enabled the flight crew to fill complete buckets of water from ponds, streams and depressions with six inches or more water depth. Often, this capability enabled this aircraft to produce more gallons delivered per hour flight time by a factor of four compared to like model aircraft with standard Bambi Bucket configuration. . . . Other benefits were reduced exposure to [the] public when water-point options were in close proximity to the incident, in case of national parks or wilderness areas where aircraft noise and visual effects play on public concern . . . ."

Because the snorkel is always attached to the bucket, it is always ready when needed (which, in my experience, is conservatively 80 percent of the time). The bucket still operates like other Bambi Buckets when the pump is not needed. And, if the pump ever became inoperative, the bucket will still work normally (unlike a fixed tank).

At Heli-1, we have had no experience with failures to this point, and have not required any unscheduled maintenance in three full fire seasons of use.

## TANKS BUT NO TANKS

Okay, some of you are probably wondering how the Bambi PowerFill snorkel stacks up to a typical fixed belly tank.

Fixed tanks excel in both the wildland urban interface and grass and brush fire environments. They are used primarily for connecting "trail drops" and cooling the fire line down for the ground crews. Buckets, on the other hand, excel in forest/heavy timber and mountainous terrain environments, concentrating on precision drops to hot spots, as well as making trail drops.

Heli-1 has a fixed belly tank as vendor-offered additional equipment to our exclusive-use fire contract H-510 in Chester, Calif. During the outbreak of the October 2007 Southern California fires, our belly tank was requested and supplied.

We found, though, that once our tank arrived, most aircraft on scene were already "tanked." This made our longline- and snorkel-equipped Bambi Bucket somewhat of a novelty. That novelty soon turned into name-requests for H-510, due to its versatility and ability to remain well above the fire and not fan the flames. Even though most of the tanked helicopters were hydrant filling, our turn times were still quicker, as we were able to



access numerous neighborhood swimming pools.

Once the Santa Ana event subsided and fires were under control, mop-up operations began, with precision drops on hot spots the order of the day. And, even here, tanked helicopters could not keep up with the snorkel/long line combination.

The Bambi PowerFill snorkel also has no downtime to reconfigure the aircraft for long-line/cargo missions. We have found the snorkel will do almost everything the fixed tank can, with the ease of deployment of a bucket. The fixed tank has in fact become a monkey on our back due to the difficulty in transporting, mounting, dismounting and handling of such a bulky and heavy piece of equipment.

After having used the Bambi PowerFill snorkel extensively for three fire seasons throughout the western U.S., it is my opinion this additional capability, now available to enhance the performance of the battle-tested Bambi Bucket, is a winning combination that cannot be beat. It is the most important (and overlooked) product available to the aerial fire fighting industry since the Bambi Bucket itself first arrived. My only complaint is it's not available on buckets smaller than the 240-gallon model. It would be great if high-performance light helicopters, such as our Bell 206L-4, using buckets ranging in size from 120 to 210 gallons, could also benefit from the Bambi PowerFill snorkel.

*A helicopter pilot for 22 years, Heli-1 president Jon Mayer has logged over 5,800 accident-free flight hours and holds an FAA airline transport pilot license for both helicopters and airplanes. Jon is also an FAA airframe & powerplant mechanic, and can be reached at [jon@heli-1.com](mailto:jon@heli-1.com).*



**TOP RIGHT** The right tool for the job. It's in areas like this where the Bambi Bucket attached to the end of a 100-foot (plus) long line proves its worth over tank-equipped helicopters.

Dan Sweet Photo

**BELOW** The PowerFill snorkel allows the Bambi Bucket to be fully filled, even when using partially filled Pumpkins.



When the Bambi Bucket went into production 25 years ago, its inventor, SEI Industries founder Don Arney, couldn't have foreseen the big orange bucket would become synonymous with helicopter fire fighting worldwide.

In fact, it was the Bambi Bucket that kick-started SEI, based in Delta, B.C., into the design, manufacturing, marketing and commissioning of structural-engineered fabric products. These product lines are not only popular in the aviation industry, but cover the remote site logistics supply, environmental and fire fighting industries.

A tour through the company's 60,000-square-foot manufacturing facility gives you a better indication of just how SEI is utilizing its engineered fabrics, and a lot of technology, to develop a variety of unique products. Currently, the company has in place new computerized laser cutters (each bucket used to be cut by hand); electronic radio-frequency welding equipment for industrial coated fabrics; metal welding, sewing and machining equipment; an in-house fabrics testing laboratory; an 11,000 Cdn gallon (13,200 US gallon) test tank with crane; and in-house computer systems. But, it all began with just one idea.

## THE ORIGINAL BUCKET

Folklore will have you believe the bucket got its name from a sultry waitress named Bambie, who worked at a famous firefighter bar in Boise, Idaho. In fact, Arney originally planned to call it the SEI-Flex, and the real, though less exciting, story

**OPPOSITE** It was the Bambi Bucket that kick-started SEI into structural-engineered fabric products.

came out in an interview with a B.C. university magazine in 2003: "He [CBC's Bob Fortune] interviewed me on a show about inventors and we became friends. One night over dinner, he asked me what I was going to call it. I didn't want to talk business, so I said, 'The Bambi Bucket' — I was just being goofy. But he said it was a great name and he was relentless in pushing me to keep it."

Back then, fire fighting buckets were nothing new, but what Arney was able to perfect that others couldn't was a valve to deliver a concentrated column of water. Today, despite the onslaught of new competition, SEI still controls over 90 percent of the fire fighting bucket market.

Since the Bambi Bucket was first introduced in 1983, not much has changed to the water-carrying vessel itself. "We still have customers sending us in their 20 year-old burgundy-colored fabric buckets for repairs," said Shawn Bethel, manager of SEI's fire fighting division. "All we typically have to do is change a few components and these old Bambies are fire ready!"

Bethel joined SEI in December 2007, after 22 years with B.C. Ministry of Forests and Range Fire Protection Program, including 12 years in its rappel program. He was also a provincial fire control officer, and worked on incident management teams. "I guess you can say that I know the Bambi Bucket well," he quipped. "The bucket has been around for so long — people know it, and they know what they are getting when they order a Bambi Bucket. It's a well-proven product."

**AN EXPANDING LINE**

Available in over 20 different sizes ranging from its smallest BB6072 72 US gallon (270 liter) bucket, to the HL9800 2,600 gallon (9,840 liter) version, SEI sells about 400 buckets a year. The company has also added 12 options that can be added to its bucket line, which, said Bethel, ranges from "the variable-drop Aqualanche valve, PowerFill snorkel and PowerFill Torrentula, to Sacksafoam foam injection, FireSock, Mission Tracker and Remote Load Control."

SEI continues to look at new accessories, options and



capabilities, including its latest offering, the Mission Tracker. (A beta version of the product was launched at Heli-Expo 2008 in Houston, Texas, with a hard launch scheduled for this fall.) The Mission Tracker has features like GPS, data recording, electronic load control and preset split drops. Said Bethel, "Our new Mission Tracker goes beyond knowing where you've been dropping loads. It will track all types of missions from aerial ignition runs, infrared scanning, and locations of helipads, fuel caches... everything you've done and where you have been. At the end of the day, your missions can be simply downloaded to a memory stick and you can see what you've done, all toward maximizing operational efficiencies."

Other new capabilities SEI is examining include innovations that improve upon delivery of foam and gel products in the Bambi Bucket systems for interface fire and community protection. "We are always working with our customers and fire control agencies to incorporate their feedback toward improving what we are doing and developing new products to meet the demand of the industry" said Bethel.

The gel bucket, though, might actually have the biggest success in North America. "We really do see gel as the new way of fighting fires, because it has much more capability over foam," said Bethel, explaining that gel acts as a water enhancer. "When gel dries, it can be re-hydrated,

**ABOVE** SEI recently installed a new laser cutter for cutting Bambi Buckets in a mere few minutes, versus the few hours it used to take to cut the material by hand.

**BELOW** SEI manufactures the bucket in 20 different sizes, from 72 US gallons to 2,600 gallons. It sells about 400 buckets a year. **Mike Reyno Photo**



**"Within helicopter circles, SEI, which employs about 100 people, is best known for the Bambi Bucket, but it represents only about half the company's revenues."**

**TOP LEFT** With new regulations coming in the U.S. and Canada, SEI's remote site division expects to see growth in its secondary containment products.

**TOP RIGHT** SEI is marketing its Red Dragon aerial ignition device, and Dragon Eggs, as having an almost zero failure rate.

**ABOVE** SEI sells approximately 400 buckets a year in all sizes.

making your water go further. It's far superior to foam in many ways and with new technologies meeting or in some cases exceeding environmental regulations, it has good potential to be embraced by more agencies in the industry."

Bethel acknowledged that SEI is exploring other options, too, including the possibility of a lightweight fixed Bambi Tank. Unfortunately, he won't divulge any more information than to say the company has a close eye on the tank market. In the meantime, SEI, through its Bambi Bucket product line, continues to provide its customers with their

choice of single- or multi-dump buckets and the many innovative options that go with them.

Bethel said that one of the most sought after add-ons is the PowerFill product. Available both internally in the multi-dump valve or as an externally mounted snorkel on the standard valve buckets, PowerFill is retrofittable and provides bottom-filling capability in shallow water sources at a rate of 450 gallons US a minute. The technology is getting gleaming reviews. Said Wayne Coulson, president and CEO of Coulson Airplane, "For the past three seasons in Australia, the Bambi Torrentula Bucket with Powerfill accessory has done an excellent job for us with 100 percent availability over several hundred hours of operation."

Other new non-bucket related fire fighting products include the Red Dragon aerial ignition device. Controlled using a remote, the Red Dragon uses a variable seven-speed tether, which allows it to adjust to the dispensing speed, rather than having the helicopter changing flight to adjust to the machine's drop rate. This enables dispersal of SEI's Dragon Eggs in perfect concentration levels according to the terrain.

**OTHER SECTORS**

Within helicopter circles, SEI, which employs about 100 people, is best known for the Bambi Bucket, but it represents only about half the company's revenues. The remainder comes from its remote site division. Headed up by Paul Reichard, this division encompasses four key brands: Remote Site (liquid logistics); Environmental (primary and secondary containment of hazardous liquids); FireFlex (ground fire fighting and water storage equipment); and Emergency Response (chemical, biological, radiological, nuclear decontamination).

"Only about 15 percent of our remote site division is related to helicopters," said Reichard. However, with new regulations in the United States and Canada, this is expected to increase. He added, "There are new environmental regulations that include a requirement for fuel transfer areas to have secondary containment, which will be a big issue for fuel handling in remote locations." The new regulation has existed in the U.S., but has not as of yet been enforced by the Environmental Protection Agency.

Reichard said SEI has also recently revamped its heli-pumps, which are now small enough to fit into a briefcase, and has made its sphere-shaped Fuel Easy more durable. "We've also launched our three series of fuel tanks on the ground." Instead of a standard fuel tank for all environments, SEI is offering a version for each type of climate: the Arctic King, Jungle King and Desert King. Said Reichard, "We will become the leader in extreme climate fuel storage."

Having both a fire fighting and remote site/environmental division with approximately 40 different product lines combined is a big part of SEI Industries' success. The company reached record sales in 2007, and has continued to hold its place in the market as the industry leader for the past 25 years.



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