HELICOPTER RIGGING

LIFT-IT®

“We base everything we are working on on the conversations we have with our customers. If they are looking for a more durable cover, we’ll find a way to make it.”

Mike Gelskey, President, Lift-It

Core curriculum

When it comes to long line work, be it construction or firefighting, the temptation is to think about what's at either end of the line – because a rope is just a rope, right? Wrong, as Gideon Ewers discovers.

Historically, long line operations revolutionised aerial work, giving helicopters a much greater versatility in terms of the number and type of payloads they can carry.

As with much of the helicopter industry, long line operations can be traced to Igor Sikorsky's pioneering work back in the late 1930s, but it wasn't until the advent of the Bell 47 that long line external load operations became commercially practical.

"You can't think of long line operations in terms of Vietnam-era lifting with steel cables," explains Patrick Barry, Vice President of Business Development at Barry Cordage. "Today's equipment is more sophisticated, more capable and can be used in a lot more applications."

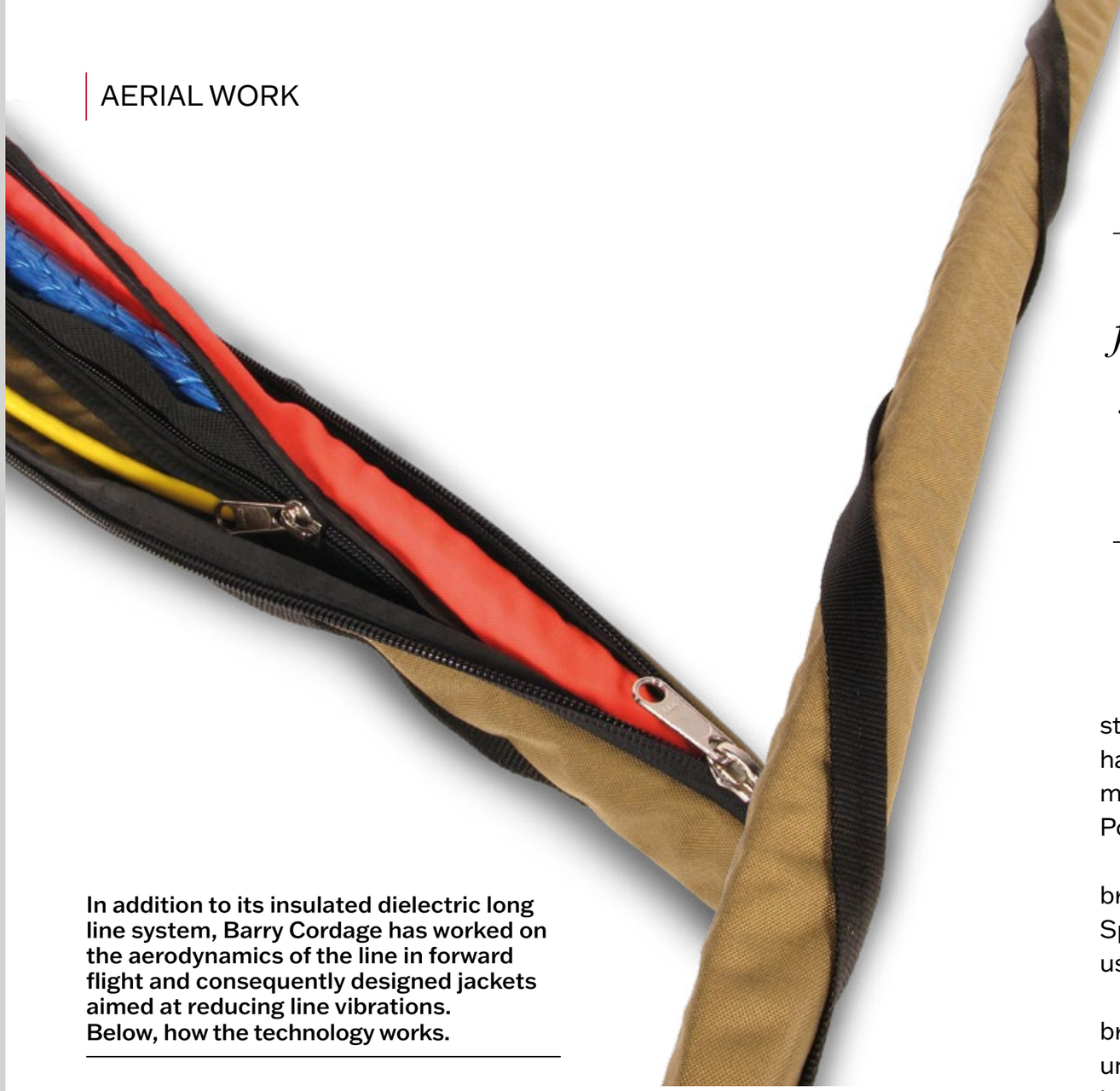
Technology upgrades

Modern-day long line operations are a crucial item in the aerial work toolbox for a broad spectrum of operations.

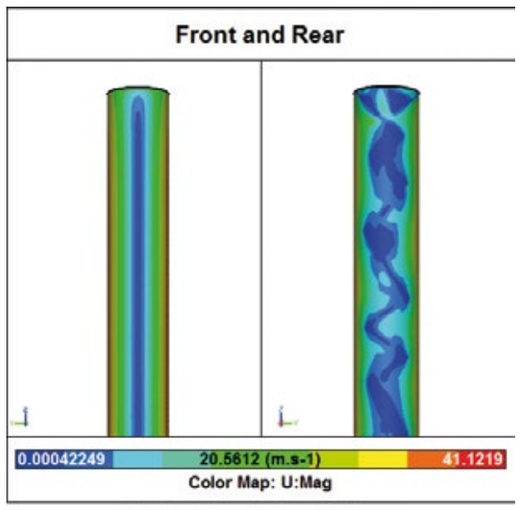
From firefighting to construction or human external cargo, long line operations are often the answer when access to remote or environmentally sensitive areas is needed.

Over the last the last two or three decades there have been a number of significant advances, primarily in materials science and technology upgrades.

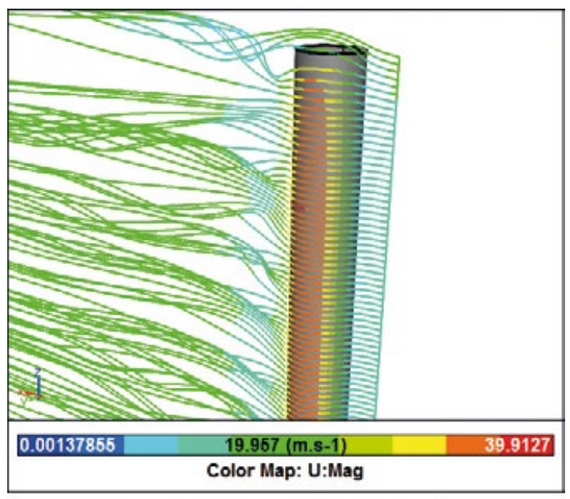
Material shift: Vietnam-era steel cables have given way to Ultra High Molecular Weight Poly Ethelene.



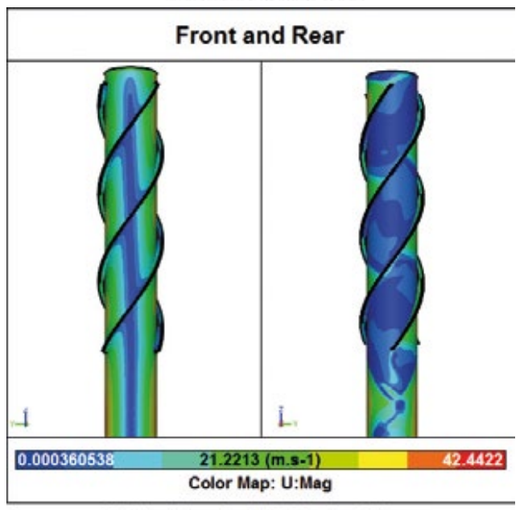
In addition to its insulated dielectric long line system, Barry Cordage has worked on the aerodynamics of the line in forward flight and consequently designed jackets aimed at reducing line vibrations. Below, how the technology works.



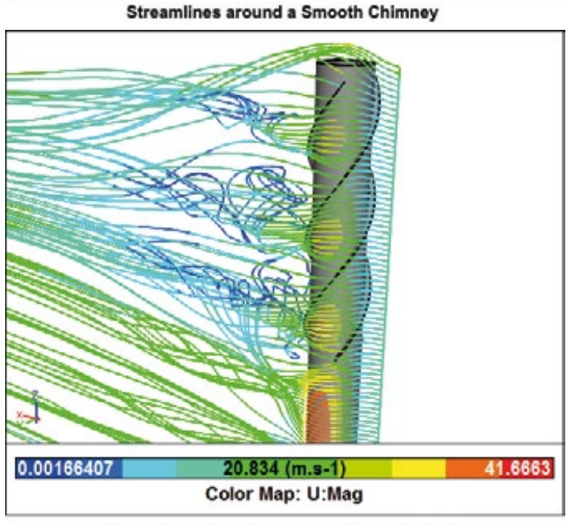
CFD Simulation of a Smooth Chimney
Velocity magnitude contours



Streamlines around a Smooth Chimney



CFD Simulation of a Helical Strakes Chimney
Velocity magnitude contours



Streamlines around a Helical Strakes Chimney

"Today's equipment is far more sophisticated, far more capable and can be used in a lot more applications."

Patrick Barry, Vice President of Business Development, Barry Cordage

First of all, in terms of materials, the steel cores of yesteryear are long gone, having been replaced with cores primarily made from Ultra High Molecular Weight Poly Ethelene (UHMWPE).

With a name like that, you can see why brand names such as Dyneema or Spectra have found favour in general usage.

The UHMWPE strands are generally braided into a 12-strand plait that when unloaded is soft and pliable but under load takes on the characteristics of a steel rod – though much stronger in torsion than the equivalent in steel.

As Lift-It President Mike Gelskey says: "I don't think anyone outside of the cordage industry calls it that – UHMWPE 12 rope. I'll tell them there's just one brand name, it's UHMWPE, and they'll reply 'Whatever, Mike, gimme another Dyneema line.'"

Material difference

Besides its higher strength to weight ration compared with other materials, the other area where UHMWPE scores is in its lack of stretch.

While that has obvious advantages when it comes to precision work in construction applications, the additional benefit is that less stretch means less "snap back" – the amount a line recoils when it or an attachment fitting fails.

By and large, when compared with other materials UHMWPE will snap back only about 25% that of a polyester or nylon line.

Even low-stretch aramid lines – for example Technora – while significantly better, will still snap back around 85% as

far as the baseline polyesters.

Why is this important? Well, if a line or fitting fails you are going to have enough problems without the recoiling line flailing up into the rotor system – that would make for a very bad day indeed.

Summing up, in UHMWPE lines you have an exceptionally strong, pliable material, except when it's rigid and thus more stable in flight. But there must be a downside, right?

Right, and it comes in the form of cost – UHMWPE is very expensive. Also, the material's relative lack of resistance to abrasion means that to have any kind of working life it will need a cover.

"Covers are our main area of focus," says Gelskey. "We have found that 50 to 75 per cent of damage and wear comes from ground operations. This might be because of picking up grit and other foreign objects from the pavement or ground when a line is laid out for pick-up or laid out before a job. So we've been thinking a lot about covers."

A key benefit of UHMWPE is that there is less stretch, resulting in less 'snap back' recoil.

Lift-It started covering cores with a fabric made from bulked nylon fibres, known as Cordura to you and I.

They began with a 1,000 denier fabric –

> *"Covers are our main area of focus. We have found that 50 to 75% of damage and wear comes from ground operations."*
>
> Mike Gelskey, President, Lift-It

denier being a value that describes the density of a woven material, typically fabrics – increased it to a 1,680 fabric and now to a 2,100 as they search for the perfect balance between weight and durability.

"It's the Achilles heel of a long line," says Gelskey. "Optimising the covers is part of it. Training ground crews on how best to handle and store the lines is the other important part of the equation.

"It comes down to three things – proper use, care and maintenance. Understanding how to care for it, how to inspect it for damage and then how to repair it. We have an eight-hour training curriculum just around those three topics."

Patrick Barry agrees, noting that training is paramount not only as far as safe operations are concerned but also to protect the investment in the equipment.

"We were the first company to offer a comprehensive user manual, the first to offer long line inspection training," he says. "Our teams, including me, have been in the field training commercial and military users of our equipment from all over the world for more than 10 years."

Fresh thinking

Even more than the cores and the covers, today's long lines are far more than an object with which to connect an aircraft.

I say aircraft, because these days in addition to helicopters UAVs are being used in long-line operations. They have become smarter, much smarter than earlier equipment.

Correct use, care and maintenance are vital elements of long line work. Photo: Blackcomb Helicopters

Electronic load monitoring, which allows pilots to precisely monitor weight measurement and stability during flight, has become ever more sophisticated.

Likewise, the remote control of cargo hooks has delivered the option to pick up or release multiple loads with greater efficiency than ever before.

Not to mention the latest in firefighting bucket systems with their multitude of pumps, controls and release mechanisms.

These in turn have power or communications leads running the length of the line which also have to "play nicely" with the core and the cover.

"You can see four, six or even seven separate leads on a line used for a firefighting bucket system," says Gelskey.

"So there's plenty of opportunity for internal wear, chafe and abrasion damage.

"You might have a core line that weighs say 200 lbs but it will be mated with power, control leads and covers that weighing another 400 lbs all of that has to work together."

Another innovation created by Barry Cordage came from thinking about how the safety of operations in proximity to energised high tension power lines could be improved.

Accordingly, the company developed another first of its kind – an insulated dielectric long line system for working in that, forgive the pun, highly charged environment.

> *"Our teams, including me, have been in the field training commercial and military users of our equipment from all over the world for more than 10 years."*
>
> Patrick Barry, Vice President of Business Development, Barry Cordage

War stories

Load stability is another area where enormous strides have been made.

I remember my late father, a fixed wing pilot and Vietnam-era US Army veteran, warning me against taking up helicopter flying by telling me a cautionary tale of a CH-47 crash he had observed because of a long line lift going very badly wrong.

It seems the CH-47 had been tasked with transporting an unflyable UH-1 to a maintenance base for repair.

As I recall the story, the CH-47 crew were surprised by the payload lag – which was made worse by a too aggressive transition from the hover.

There then followed an ever-increasing pilot-induced oscillation initiated by an equally over aggressive attempt at correction as the load swung ever more violently – until inevitably control was lost, along with both aircraft.

Since that time, many solutions have been found – some of them as the result of lessons learned, some of them the hard and tragic way, but also as a consequence of work carried out in the materials and design arenas, as Patrick Barry explains.

He says: "We've done a lot of work which thinks about the way the line behaves when it is unloaded and came up with a ballasting system, actually the first of its kind, which stabilises unladen lines."

Barry Cordage has also worked on the aerodynamics of the line in forward flight and come up with jacket designs aimed at reducing line vibrations by including an external ridge wound around the cover in a helix pattern.

This works in the same manner as helical strakes around chimneys and other structures, by inducing vortex shedding in the airflow around the line and thereby reducing harmonic vibration.

The vibration reduction has the additional benefit of reducing parasitic drag on the line at certain airspeeds.

It is tempting to think of long line applications as limited to aerial construction, firefighting and HEC applications. They certainly always spring to mind. But as with the rest of the vertical lift industry, additional

Barry Cordage has designed a range of textile products to work with UAVs. Photo: Hybrid Drones Ltd

> *"We base everything we are working on on the conversations we have with our customers. If they are looking for a more durable cover, we'll find a way to make it."*
>
> Mike Gelskey, President, Lift-It

inert as far as interference with delicate sensors is concerned.

Similarly, as operators consider alternative forms of vertical lift technology, so too have long line systems been developed for UAVs, which can perform tasks like cargo delivery, aerial surveys and infrastructure inspections.

This innovation has opened new possibilities for industries ranging from logistics to agriculture.

Talking points

Cumulatively, the equipment has travelled a long way from its early beginnings and equipment manufacturers are not resting on their laurels, continuing their efforts to refine their products.

"We base everything we are working on on the conversations we have with our customers," says Gelskey. "If they are looking for a more durable cover, we'll find a way to make it."

Berry is equally focused on innovation. He says: "We've come a long way and are nowadays indispensable tools for a multitude of applications.

"Helicopter long lines have truly elevated the possibilities of aerial transportation and external load operations, shaping the way we approach complex tasks in diverse industries.

"As technology continues to advance, the future of long line operations has equal promise, with expanded capabilities and applications." ■