

A photograph of a climber hanging vertically from a metal camming device, which is wedged into a crack in a light-colored rock face. The climber is wearing a red shirt and dark pants. Below them is a deep blue, misty valley. The title text is overlaid on the right side of the image.

the **cam**
book

wild country



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Front cover: Ray Jardine on **Separate Reality** 5.11d high above Cookie Cliffs, Yosemite, 1977. Photo: John Lakey

Left: Ray Jardine on **Crimson Cringe** 5.12a, Yosemite, 1975. Photo: Mark Vallance

introduction

> the wild country cam book

'Cams can't work, put a nut in, it's stronger', 'they won't grip in Limestone', 'you can't use rigid ones in horizontal cracks', 'these are lighter but those have more range', 'just how do they work anyway?'

There has always been a special buzz about Friends. More than any other piece of climbing gear Friends have always created and polarised opinion. Every climber has a question and a point of view and over the years their counter-intuitive nature and complicated physics has perplexed and excited climbers' in equal measure.

Guide books describe cracks by Friend size and climbers stories of life saving Friend placements are legendary. They are quite simply the most important, the most expensive and the most desired piece of gear on any climber's rack.

Yet paradoxically, when polled, climbers still don't seem to trust them absolutely. Most would prefer to set off on a lonely run-out pitch above a 'bomber nut' than trust to its complicated mechanical equivalent. So why should this beautifully

engineered machine, that revolutionised climbing world-wide over two decades ago be viewed with such ambivalence? The simple answer is that many climbers just don't get them. Why do these 21 components made from exotic aluminium alloy and carbon steel, grip tenaciously in the crack as we fall past, protecting us from certain disaster? Where did they come from, who invented them, how do they work?

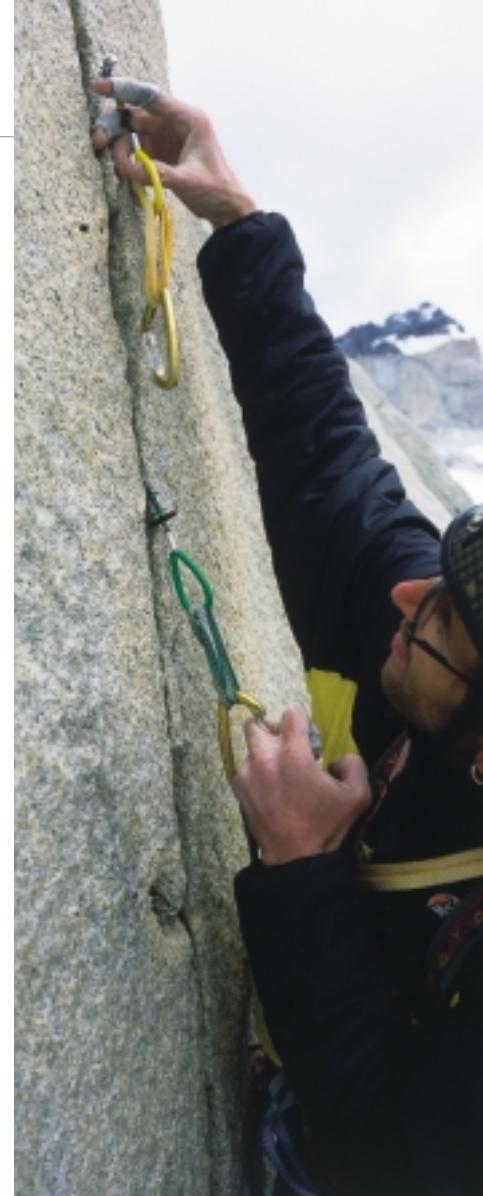
The Wild Country Cam Book will not only explain why Friends work but how they work, where they work best, as well as the circumstances where they may not work. Based on over two decades of experience in Friend manufacture, Wild Country knows more about cams than any other company and is best placed to give you the answers to the questions you most wanted to ask.

Learn about the design of Friends from prototype to production, the materials and manufacturing techniques, the quality control, the standards and the testing involved.

Learn how a cam works, what is cam angle, cam range, predictability and stability, friction and flares.

Learn about using Friends safely in parallel, flared and horizontal cracks and how to select the best Friend for the job, Forged, Technical or the new Zero cams.

The Wild Country Cam Book has been written to answer all your questions about cams, but one question you may quite rightly ask is why now? The answer is quite simply Zero Cams. This project more than any other focussed us on explaining more about what we do, as we struggled with the complexities of moving the game on in cam design. We had to re-evaluate our ideas and techniques



and most importantly, we had to reinvent how we tested and use these radical miniature cams out there on the crag.

The Zero cam was the catalyst but The Cam Book became much more for us. The desire to write down the distillation of 25 years of knowledge for climbers to learn and understand about cams became compelling. So whether you are an experienced big wall climber or fresh apprentice straight from the gym, we trust you will enjoy the Wild Country Cam Book, brought to you by The Cam Company.

Martin Atkinson, Wild Country



Above: Andy Cave testing Zeros on Cerro Mascara, Bader Valley, Paine, Patagonia. Photo: Simon Nadin



genesis

> a chance meeting

The beginning of the Wild Country story was a chance meeting between two climbers from entirely different backgrounds, Ray Jardine and Mark Vallance. Had that meeting not taken place, who is to say if camming devices would have ever graced our hardware racks. Of course most people would say that someone else would have invented them, but these things are always easy with hindsight. I would prefer to believe that if these two climbers, one a scientist and the other an entrepreneur, had not teamed up to climb together in the summer of 1972, 'Friends' might never have been.

Ray grew up in Colorado Springs, a normal upbringing which included many outdoor activities but remarkably no climbing. In 1962 he decided that aerospace engineering was the career for him and set about his studies with a will. It was while on a summer vacation

job in Yellowstone Park that Ray took climbing lessons with instructor Barry Corbet of Everest fame. The die was cast and Ray threw himself into his new passion, climbing many routes in the Tetons that year.

By 1964 he had moved on to Northrop University, Los Angeles, to study Aeronautical and Astronautical Engineering, qualifying in 1967 with a degree in his chosen speciality. Moving to Denver he began work as a systems analyst, specialising in computer simulated space flight, shaping trajectories for earth satellite and interplanetary missions.

Through the late 60's climbing took on more urgency for Ray. By 1970 he decided to give up the space race and began climbing full time, with Yosemite occupying his ambitions. It was undoubtedly during this frenzy of climbing activity that culminated with his first ascent of the Nose on El Capitan, that his need to protect those soaring crack lines developed. The next two years saw the grades escalate and by the end of 1972 he had climbed his

first 5.11 New Dimensions, which was the first all nut ascent. Clean 'pin free' climbing was introduced to America by Yvon Chouinard in the 60's, and as Ray pushed the grades ever higher, the need for a new fast method to protect his ambitious projects became obvious. The Friend was born.

Ray had begun to work on his first prototype Friend in 1971 and during the following five years both his climbing career and Friend development accelerated at an extraordinary pace. During 1976 and 1977 Ray's investment in climbing was paying off, even though his other passion, Friends, had yet to become a commercial reality. His success on Routes like Crimson Cringe 5.12, Hangdog Flyer 5.12c, Separate Reality 5.12, Owl Roof 5.12c, Rostrum 5.12c and the first 5.13 in the valley, Phoenix, were not only due to his outstanding climbing ability but undoubtedly the success of his early prototype Friends.

During the summer of 1972 Ray had met and climbed with fellow instructor and future business partner Mark Vallance at the Colorado Outward Bound School, although at this time Ray's early prototypes were still top secret. It was much later, in 1975, that Ray introduced his prototype cams to Mark, a story told later in *The Cam Book*, securing a future for what was to become the first commercial camming device, the Friend.

In 1977, after many frustrating attempts to get his Friends made in the USA, Ray teamed up with Mark Vallance to develop and produce Friends in Derbyshire, England. The story of that beginning, the risks, the commitment, the facts, the myths and the characters that made it all possible is now told by these two remarkable men.

Steve Foster, *Wild Country*

Scott Burke on 33rd pitch of **Freerider**, (left of the Salathé Headwall a 5.10 offwidth) Freerider is 37 pitches of 12d/13a. Photo: Eric Perlman

history

> a brief history of friends

Some day we climbers may wear special gloves and shoes enabling us to scale blank walls like spiders. Should we fall off, like spiders our body harnesses may instantly attach safety lines to the rock. If and when inventors develop this technology, we will no doubt consider it clever... but obvious – thanks to our 20-20 hindsight. But for now, none of us can envision the details.

And so it was with the Friends 25 years ago when I was inventing them. The need was apparent, at least to me, but the actual configuration was elusive to me and everyone else.

Seeking a device that would anchor itself in a crack, and hold with greater power the harder the pull, I began the inventive process in 1971 with a dual sliding wedge design. Taking advantage of my aerospace engineering background I analyzed this configuration and found it mathematically unsound. The internal friction between any kind of wedges reduce their holding power and in many situations such a device could pull out. I was inventing for my own use and was not about to compromise safety.

The constant angle spiral is ubiquitous in nature, from seashells and pinecones to swirling barometric pressure gradients and the great spiral nebulas. Really it is just an expression of uniform growth. Descartes described the principle mathematically in 1638, calling it the equiangular spiral. Since then constant angle cams have been used in uncountable mechanical devices.

Configuring a workable device, however, proved to be an enormous task. In retrospect it took someone with aerospace engineering skills, a questing mind coupled with extreme motivation

and a passion for climbing – something of a rare combination in those days perhaps. For months I worked, building camming prototypes, testing them at the local crags and innovating design improvements in the evenings at home. In the end I filled a couple of sizable boxes with discarded prototypes.

against each other, and they were held together with a high-tensile steel bolt. But the bolt was wrapped with a piece of ordinary strap iron as a stem, and of course the device lacked any kind of trigger.

On a 5.8 route which I called Fantasia located at Split Rocks, I climbed to a

stance where I could almost let go with both hands, I managed to squiggle the quad into a handsized crack. By the way it behaved I knew instantly that it was the answer.

The following spring, 1974, I took my first set of working prototype Friends to Yosemite and climbed dozens of difficult routes with them. These units were rough hewn and extremely limited by today's standards, and I had only a limited number of them: four size 2 1/2s and three 3 1/2s. But they certainly proved their worth, and at season's end three of us used them in an attempt to climb the Nose in a day. Three hours of late afternoon downpour immobilised us beneath

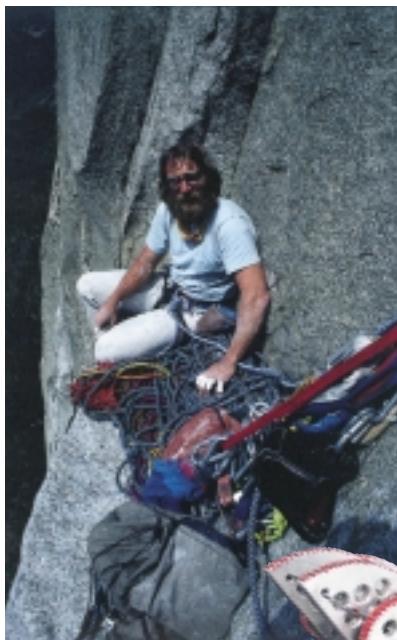
the Great Roof and forced a bivy at Camp V. But we did finish in 20 hours total climbing time, and managed to cut the previous three-day record in half.

In 1977 Mark Vallance invited me to the UK to help him start manufacturing Friends.

Mark is a highly dedicated and gifted individual, and was the first person to see the widespread appeal of Friends. Friend marketability is obvious now, but it certainly was not then, and Mark was the visionary who made it happen.

The next year, Mark founded Wild Country and started selling Friends.

Ray Jardine – 19 April, 1998.



Then one day after trying absolutely everything I could think of, and continually straining my mind for ever more ideas, the concept came to me of a double set of opposing and independently spring loaded cams. Like wheels of a car having independent suspension, each of these cams would be able to adjust to widely varying surface irregularities, within its limit of course. I put one of these 'quads' together and took it to the crags for testing. The cams were spring-loaded





development

> with a little help from my friends

Starting a new business is like having one hundred feet of rope out, no runners and 5.10 move in front of you, and it can feel like that for weeks on end.

I prepared to jump, the weather was perfect, clear sky, hard frost and a scattering of snow. The camera team was in position and waiting, the 'radio mike' was turned on and recording.

I climbed past the top Friend, got my feet above it, climbed a little higher - 'Hell I'll give them a real show' - and climbed a little higher still. Then I jumped.

As the rope tightened, my belayer was jerked upwards and I felt my breath being knocked out of me. I was lowered to the ground - no need for a 'retake'. The five minute episode on the BBC's Tomorrow's World programme was aired at the end of January 1978 and a six year secret was out of the bag.

It was 1972 when I first met Ray Jardine in Colorado, I was on my way back from Antarctica. We were both working for Outward Bound and between courses climbed together. Though I did not know it then, he was carrying the first prototype Friend around with him - four cams on a shaft with no stem or trigger. It required four hands to get it out of a crack.

My first experience of Friends was much later, in 1975. Ray was very secretive. He was carrying a blue nylon bag around which clinked and rattled. It was another hot October day. We were below Washington Column, about to make the first ascent of Power Failure. I was sworn to secrecy before the blue bag was opened and I was allowed to see its contents.

Ray's prototypes were an odd selection. Some of them were

I prepared to jump, the weather was perfect, clear sky, hard frost and a scattering of snow.

beautifully made with polished aluminium, carefully filed edges, sophisticated trigger assembly and even 'J slots' for holding the trigger in the closed position for neatness and fast action. Others were gnarled and bent from use and testing, or just slung together to try out some new idea, but retained in the armoury because they worked.

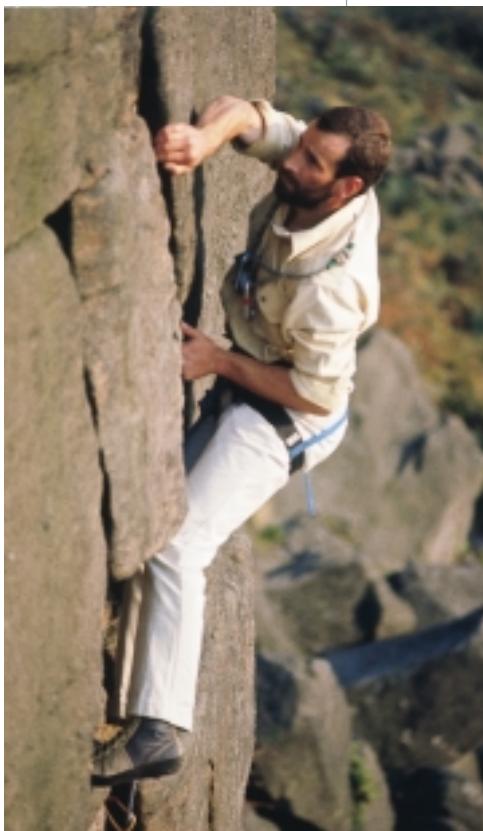
The name 'friends' was coined by Chris Walker when he and Ray were about to go climbing with several climbers who were not in on the secret. Chris wanted to know if Ray had the bag of goodies, but didn't know how to ask without giving the game away. Finally he said, "have you got the bag of Friends, Ray?". The name stuck.

After several disappointments Ray asked me to make Friends in England. Much of the work we did together over the summer of 1977 came to nothing. We could not find anyone to extrude the 7075 stem alloy. Everything was too expensive. A simple nut with one blob of aluminium, two drilled holes, a single piece of wire and a swage cost under two pounds (1977). How could I make a piece of kit with twenty seven high tolerance parts and a whole stack of holes and operations, and get it into the shops at a half way realistic price?

When Ray left for California in September he must have thought that yet another attempt to get Friends off the ground had failed, but a few weeks later everything started to fall into place. Now I had to go for it, the long unprotected lead. I borrowed all the money I could and got the bank to give me a second mortgage on my house. I had some stationery printed and started to place orders for tools and components. Finally, in November, I took a deep breath and gave up my job - no runners on this climb - either success, or a big, big fall.

Mark Vallance

Extract from an article published in the 1978 Climber's Club Journal.



Left: Ray Jardine making the first ascent in 1977 of **Phoenix** 5.13a, Yosemite USA Photo: George Meyers
Right: Mark Vallance on **Left Unconquerable**, E1 5b, Stanage, Peak District, England 1979
Photo: Pete Freeman

how cams work

> designing the perfect cam

Friction and Angles

If you place a ladder against a wall you don't need to be a rocket scientist to know that if the angle at which the ladder makes contact with the ground is too big, the foot of the ladder will skid away and you will fall. Friction is what keeps the ladder in place. You can verify this by taking a plastic ruler and leaning it against a wall. The angle between the ruler and the surface you place it on can vary but there is a point beyond which the ruler will always slip.

The material that the ladder - or ruler - is made from, and the surface it is placed on are important. A wooden ladder on a concrete path should not be much of a problem but if a metal ladder was used on a polished floor you would need to be much more careful. There is less friction between aluminium and a polished floor than between wood and concrete: a rubber tipped aluminium ladder would be safer.

To measure the degree of friction between two materials - take for instance an aluminium ladder and a granite floor, a block of aluminium is placed on a slab of granite. The granite slab is then tilted until the aluminium starts to slide. The angle of tilt is measured and found to be 18°.

Using this information a device can be made that will illustrate how the angle of contact is critical, to stay within the friction limit and hold in a parallel crack. Two rectangular alloy rods are bolted together so that they pivot. For convenience a handle is added to pull on. Aluminium alloy is used because it is strong, lightweight and has better frictional properties than other strong materials. This device will hold in a perfectly smooth, parallel sided crack, but only if the

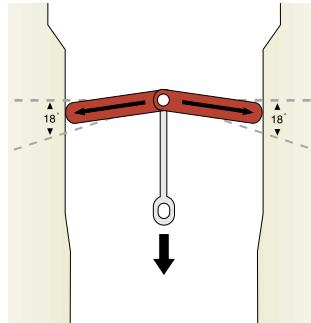


Fig 1.

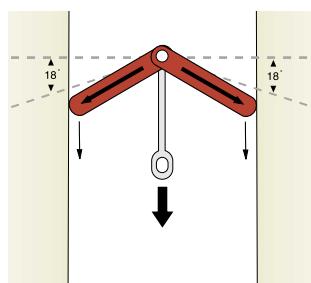


Fig 2.

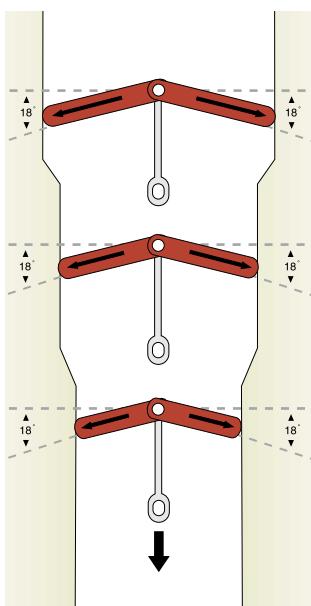


Fig 3.

rods are placed within the 18° angle we have measured. For the sake of simplicity this is shown in two dimensions. (fig. 1) Just as the ladder will slip if the angle is too great, so also will the aluminium rod slip against the side of the crack if the angle of contact is more than 18°. (fig. 2)

(We use this principle when stemming a very wide chimney. Climbers can press at a steeper angle because they have rubber soled shoes. See picture of Matador opposite).

This device would have limited use as climbing protection as it would only fit one size of crack - but the concept can be developed to fit a variety of crack widths by using several pairs of rods of different lengths (see fig.3). If these rods are fanned out, a familiar shape emerges - that of a cam (fig.4).

Designing the Perfect Cam

A cam, as used in engineering, is any roller with an asymmetrical shape. What the climber needs is a shape that will transmit the load to the side of the crack at a consistent angle within the friction limit of the rock - what we call a constant angle cam. So what is the perfect camming angle? To answer this question one needs to go back to the friction test. Aluminium slips on granite at 18°, but if this angle were used the device would be at its absolute limit of friction in a parallel granite crack and would not work in a flared placement or in say, a limestone crack. The angle needs to be reduced a little. Ray Jardine originally used 15° on his prototype Friends, which was good on granite, the rock he was familiar with, but didn't work as well in some rock types he climbed on in Britain in 1977.





how cams work

> designing the perfect cam

After much testing, Ray and Wild Country decided on 13.75° (see fig.5), an angle that worked well on most rock types and allowed for use in quite flared cracks, in such rock as granite and gritstone. Wild Country has never needed to change this angle, which has become internationally acknowledged as the definitive camming angle.

Stability

Having designed the perfect cam we need to make a workable piece of protection. A device using two constant angle cams rather than the two rods as used in the first prototype would still be very unstable. Friends have four cams, which offer much greater stability in the same way as four wheels is more stable than three wheels on a car. The width between the cams also plays a key role in this stability - compare a wide sports car with a narrow van, which is more likely to topple over. Therefore as part of the design of Friends the cam spacing increases proportionately with the cam size, ensuring maximum stability throughout the range of sizes.

Plane of rotation

As the cams rotate about the axle (known as the plane of rotation) the force that they transmit to the sides of the crack is directional. Friends should be placed - whenever possible - so that the stem is aligned in the direction of the anticipated load from the falling climber and directing the stem downwards generally works best. This is not always possible, and sometimes the fall may not load the cams in a downwards direction, but the single stem is designed to allow the unit to swivel and align itself correctly in most circumstances (see fig.6). If the load is not applied in the

plane of rotation - the cams can slip sideways. Remember the ladder. If you present the ladder other than at a right angle to the house it will be unstable and can slip sideways as you climb up it.

Walking

If you place a Friend in a smooth sided crack and move the stem, one pair of cams will grab the sides of the crack whilst the second pair will slide deeper into the crack. If the stem is moved in the opposite direction the second pair of cams will grab, and the first pair slide in deeper (fig. 7). This is called walking and can cause a cam to move into a placement that is less safe - possibly making it move to a wider part of the crack where the cams no longer work. Because rope movement and rope drag can cause the Friend to move we use strong springs to help to keep the unit in the position the leader intended. Sometimes the tiring leader may curse the design specification but the springs have been carefully developed to provide the maximum placement stability.

Flared cracks

To go back to the friction test again, the same result would be obtained if a block of alloy the size of a sugar cube or a block weighing two tons were used. The angle at which the block will start to slip is independent of the load applied. What this means in practice is that if you place a cam in a flare and pull on it, and it does not come out, (and so long as you do not disturb the placement), the cam will hold up to the limit of the unit or the rock. To fully appreciate this, think back to the ladder. If the ground where the ladder was placed sloped down hill there would still be a spot where the ladder would hold

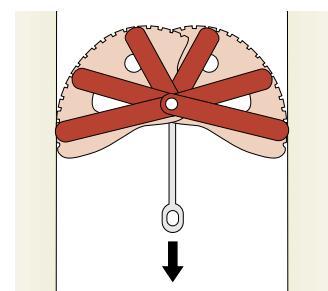
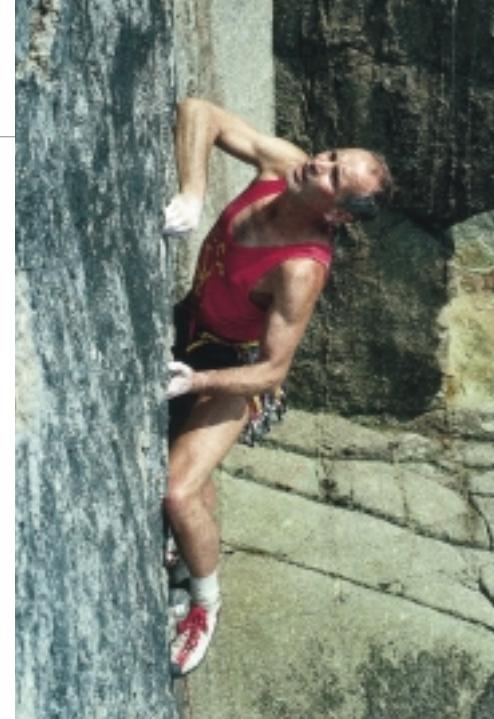


Fig. 4.

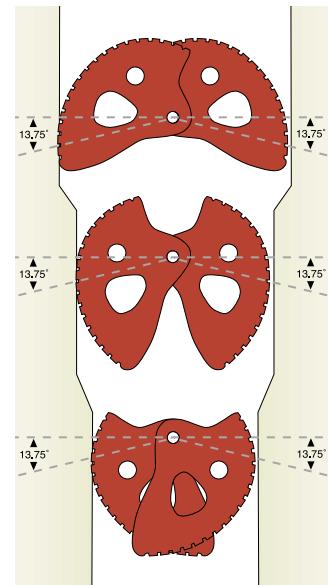


Fig. 5.

how cams work

> designing the perfect cam

and beyond which the foot of the ladder would slip. As the angle at which the ground slopes increases, there will come a point at which the ladder will never hold. The same is true of flared cracks. Depending on the type of rock there will be an angle of flair in which the Friend will never hold.

Getting them out

We've all done it; crammed in a unit in desperation knowing it will be a real nightmare for the second. When leading, try not to place them in cracks that are too tight. When seconding, assess the placement before doing anything - you might save yourself a lot of trouble. If it looks or feels as though it's stuck, squeeze the trigger as hard as you can before trying to remove the cam. If this does not work and the unit seems well and truly stuck, ask for a tight rope and/or clip into another piece so that you can use both hands, or if on a shorter climb, rappel down

later. Concentrate on one pair of cams at a time and try to feel or see if there is any movement. The floating trigger design of Friends will enable you to do this as it allows the manipulation of individual pairs of cams on either side of the axle. Try using a nut key to free the cams. Use a pair of wires looped round the trigger to pull on the trigger bar whilst pressing or tapping the end of the stem to release the cams. Try moving or tapping the cams sideways - in the direction the axle is pointing. Don't get angry and don't give up, most cams can be removed with patience.

Conclusion

Climbers develop skills in seeing opportunities for placing nuts and the same is true of camming units. Whilst these skills overlap, they are distinct. Some climbers can make great nut placements but, usually because they don't fully understand them, are less successful at placing

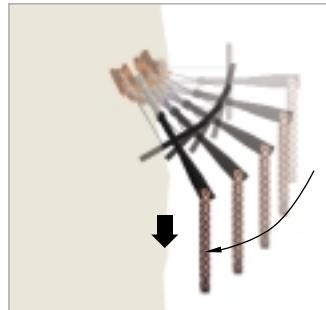


Fig 6.

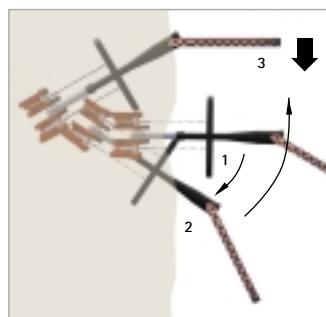
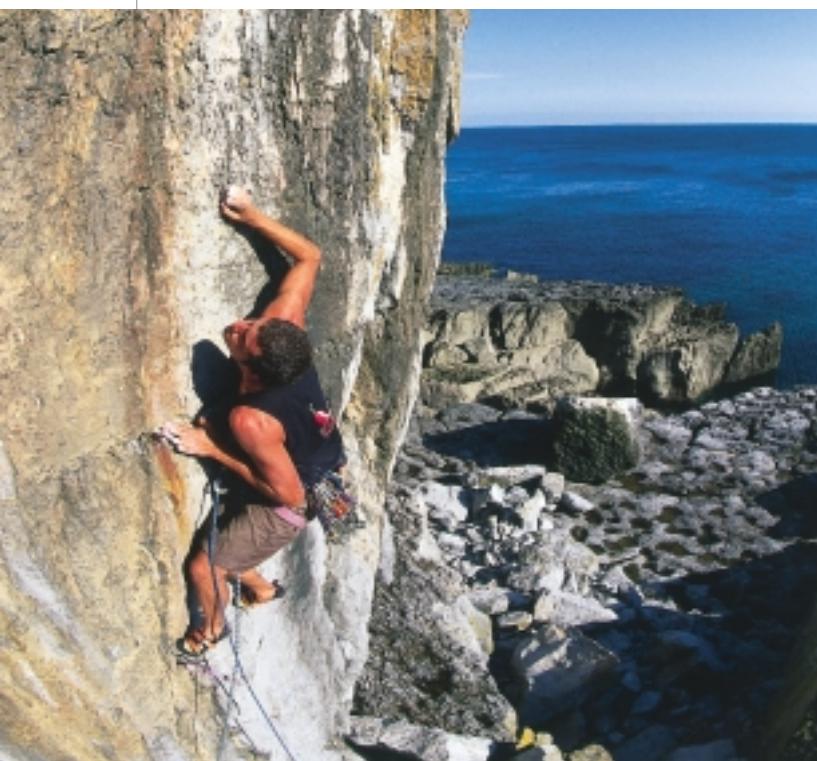


Fig 7.

camming units. Selecting the right size of unit first time requires experience and using them is a skill and as such needs to be learnt and practised. Your safety is enhanced by this skill.

Understanding how cams work, the design parameters and the limitation of friction, cam angle and rock type will help to increase your safety further. As with all climbing gear, when the chips are down, a marginal placement made with a complete understanding of the dynamics of cam design is better than no placement and informed and intelligent misuse of your equipment is better than having no gear at all.

Mark Vallance



Mike Weeks, *Man From Uncle* (E6 6b), Pembroke, Wales, UK. Photo: Simon Carter, Onsight Photography. Airlie Anderson on a one day ascent of *Zodiac* 5.10 A3, El Capitan, Yosemite. Photo: Ian Parnell



zero cam development

> achieving engineering excellence

Wild Country has always made products that are relevant to the climbing standards of the day and what grabbed our attention was the rapid development of 'clean aid', 'speed' and the 'big free' ascents by the Huber brothers, Leo Houlding and others.



Smaller cams had proved invaluable for these routes, but as we experimented with our own small cam designs we saw there was a problem to be solved. Axle/termination design basically hadn't changed for 20 years and remained a barrier to the miniaturisation necessary to take cams on to the next level - real micro sizes.

Traditional cam design had been restricted by the need to achieve the maximum strength possible to meet international standards. We needed to go back to basics, so we asked climbers to build a wish list from their perspective of cutting edge performance. During these conversations it was size, weight, and flexibility that were the key elements, while interestingly, strength seemed to matter less as long as they were, in climber parlance, 'strong enough'.

Our engineers provided a solution. Their 'Direct Loading Axle' removed the weight and especially bulk of the old axle/termination design, allowing a much smaller cam-head to be used. A 'Flexistem' protected the very light wire rope needed for such

tiny units whilst a 'Guided Trigger System' allowed confident triggering with minimal flex, essential for placement and removal.

Strength

While every effort was made to make Zeros as strong as possible, the radical design limited the amount of strength that we could build into them, especially in the smaller sizes. Zeros 1 and 2 which are rated as 'Progression Equipment' and cannot therefore be recommended for free climbing'. However similar criteria are applied to test small nuts for example RPs. Yet these are used extensively for free climbing and are essential components of any rack.

Zeros 1 and 2 were designed primarily to extend an aid climbers rack but with a distinct nod to the free climber and it is quite clear that they will perform the same role as the RPs described above.

Function

We soon came to understand that these units were a step forward in our understanding of cam performance.

As with any new device there was a period of adjustment, getting used to the new techniques necessary to achieve the best results. From our testing it became obvious that Zeros unlike larger cams, needed a different approach.

We found it easier to place Zeros from a static position for example in 'aiders', than in the middle of a dynamic free climbing move, and the more gently the cams are pulled back the easier they were to place, more like precisely placing a micro nut than a cam.

Depth of Placement

Due to the small expansion range, we found it advisable to place Zeros so that we could view all the cams to make sure they were seated well. Even relatively smooth rock, has an irregular surface which can allow the cams to expand out of range. Obviously the deeper the placement the less visible the unit and the greater the possibility the cams over-expanding.

Camstops

Zero cams are the first micro cams to have cam stops rated to the strength of the unit. During testing we found that they performed an important role in anchoring the unit in extreme direct aid placements. We do not recommend that this is the first choice of placement and should only be undertaken by experienced aid climbers.

Conclusion

We are now sure, Zeros are 'clever' enough and strong enough to satisfy what cutting edge climbers demanded, the ultimate tool in their quest for more and more extreme adventures.

Richie Patterson, Wild Country



Right: Andy Cave on Janus, E6 6b, Curbar Edge, Derbyshire.

Photo: J Houlihan, Witness





"New products appear from time to time that make routes easier and sometimes people claim these advances warrant grade revisions. After testing Zeros I know these claims are for real, Zeros will do much more than we can yet imagine. Speed times will shrink and grades really will need adjustment. These are the indispensable granite tools for the 21st century."

Kevin Thaw

zeros

> the smallest cams in the world

Size

New Zeros take cam sizes smaller than has ever been possible. Six sizes start at a minuscule 0.22" (5.5mm). This ultra-small cam dimension is achieved by using a new, compact, patent pending Direct Loading Axle™ which amalgamates termination and axle into one unit, allowing the cams to operate without the hindrance of bulky conventional assembly.

Flexibility

New technology was developed to provide climbers with total stem

flexibility and complete control. This was achieved with a new, patent pending Flexistem™ system which overlays the wire rope stem. This allows flexibility up to the base of the cam-head, minimising the possibility of levering the cams out of shallow seams.

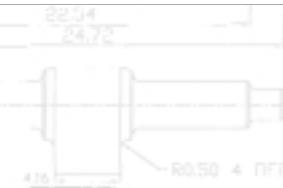
Control

Flexibility is of limited use without control, and the patent pending Guided Trigger™ system achieves

positive directional control of the cams through an innovative combination of flexible springs and guides which overlay the stainless steel wire rope stem. These prevent 'bowing' as the trigger is retracted yet allow individual manipulation of the cams in restricted placements.



Russel S. Mitrovitch climbing **The Joshua Tower**, Baffin Island, Canada. The big walls of Baffin Island offer serious and remote challenges to modern activists. Photo: Russel S. Mitrovitch collection



Versatility

To complete the design of these exceptional micro-cams, They were subjected to a rigorous test regime. Zeros are small, but not too small for the beefy, taped hands of a crack-climber. Zeros are colour coded for fumble-free racking. Finally, Zeros are fitted with an ultra-light colour-coded 10mm Dyneema™ sling which is bar-tacked in a double loop for fast extending when required.

Lightness

These new technologies, reducing components, re-evaluating and going beyond the boundaries of current camming technology, have created a range of cams which are lighter and more compact than anything previously imagined. Sizes Z1 through Z3 are all lighter than most standard 'biners'.

The complete set (6 pieces) weighs 9.5oz (268gm) – little more than a single

Technical Friend 4.



Above: Computer Aided Design (CAD) enabled Wild Country to create our unique **direct loading axle™** (Patent pending) made from 4340 Nicromo steel and using Nickel plating to protect against corrosion.



- >1. Patent pending **direct loading axle™** allows cams down to a crack width of 5.5mm (0.22 inches)
- >2. Patent pending Flexi-stem™ system permits the most extreme cam placements
- >3. Patent pending **Guided Trigger™** system allows total control of the cam head.
- >4. Six Sizes Z1 through Z6 are colour coded and include new exclusive 10mm Dyneema™ double loop fast extending slings
- >5. Incredibly light weight, the **Zero One** weighs a mere 1oz including sling, lighter than a wire-gate karabiner

Left: Zero One Actual Size





Above: Z1 and Z2 are shown at actual size

zeros are different

Because Zero cams are different, it is vitally important that you read and understand the instructions supplied with each cam.

Not all sizes of Zero cams comply with EN12276 and are therefore classed as progression equipment. Progression equipment must only be used for direct aid, this means it must only be subjected to static

loads not exceeding the strength as marked on the device. See specification chart for complete details.

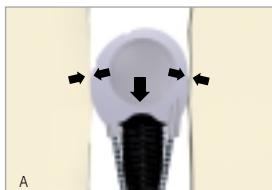
Zero cams may be damaged in a fall or, in the case of progression equipment, the axle may bend when weighted with a static load approaching the rated strength, and consequently should always

be examined before re-use. If your Zero Cam exhibits signs of wear, defect, or bending, or if there is any doubt about its serviceability, replace it. It is recommended that any equipment involved in a serious fall or weighted sufficiently to cause bending of the axle in the case of progression equipment, should be replaced.

Above: Dave Hesleden on Duncans Dyhedral attempting the first free ascent at E4 6a an 800m route on Cerro Mascara, Bader Valley, Paine, Patagonia. Photo: Simon Nadin



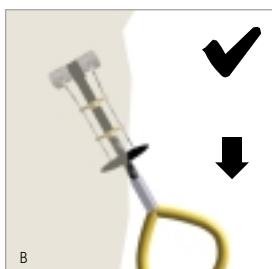
dynamics



A General Placement: It is vitally important that all the cams make contact with the sides of the crack, preferably in the middle 1/2 of their expansion range (i.e. the cams should be between 1/4 to 3/4 open) as the minimum breaking strengths in kilonewtons (kN) is tested at 1/2 expansion (refer to specification chart on page 30).

You should note particularly that when using Zeros rated as progression equipment, their expansion range is very small and therefore the margin of error is equally small. When placing progression equipment inspect the placement carefully to ensure that all four cams are in contact with the crack as stated above, paying particular attention to the two rear cams which will be difficult to see. Avoid deep placements (particularly Zero cams rated as progression equipment) where setting and retraction will be problematical.

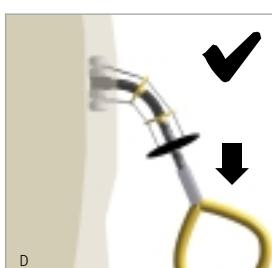
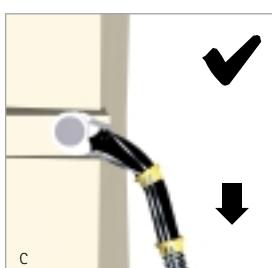
B Maximum Strength: As a general principle in order to obtain the maximum strength from Zeros, they should always be placed with the stem in line with the anticipated direction of loading. This will ensure that the force of the fall will be transmitted directly to the cams in their plane of rotation and will avoid adverse torsional forces on the stem (see fig. B).



C Horizontal Placement: and

D Vertical Placement: Zero cams are designed specifically to work in extreme horizontal placements and shallow vertical cracks. Flexibility to the base of the cams means no termination to lever out the placement. But be aware these extreme direct aid placements require expert training and may only support body weight.

Caution: When removing Zero cams take care to avoid exerting excessive force on the trigger mechanism, due to the miniaturisation of the components (particularly with Zeros rated as progression equipment). The trigger mechanisms are rated at only 45kgs. You will find a gentle approach when placing or retracting Zeros reaps rewards in speed and safety.



Above: Dave Hesleden on Cuernos Est, Bader Valley, Paine, Patagonia. Photo: Simon Nadin
Bottom Right: Z2 in extreme vertical placement



"The most impressive feature (Technical Friends 5 & 6) is the cam's broad axle. Combined with its stout cam springs and unique tensioned trigger stop, this cam has unequalled stability - once placed, they stayed put. I liked to place these solid beauties more than any other unit I tested."

Johnathan Thesenga, Climbing 183

technical friends

> the definitive range of cams

Technical Friends are the culmination of 25 years of continuous refinement of the Friend that emerged from Ray Jardine's Californian workshop in the mid '70s. Every component has undergone re-evaluation and improvement many times over the intervening years - Technical Friends are lighter, stronger, easier to use and identify than ever before.

An amalgamation of features, a single Nickel Chrome Molybdenum steel axle, a single flexible stainless steel stem, CNC machined cams (including cam stops) and Dyneema™ sling ensure Technical Friends size for size are lighter than a double axle design. This means you can carry more Wild Country Friends on your rack for the same weight as fewer double axle cams, a real benefit on long crack pitches and big wall projects.

Technical Friends cover the largest crack range of any

manufacturer, from a diminutive 0.4 inch to a truly awesome 7.64 inches. What this means in practice is no matter what project you are racking up for whether it be a fearsome off-width or tips crack, Technical Friends offer a range of sizes which will comprehensively cover any crack protection situation.

Stability and therefore safety is achieved by a combination of strong springs and incremental increases in cam head width - resisting rotation as you climb past each placement. These features combined with a single axle and flexible stem supported by a unique stem frame ensure the cams are always loaded in their optimum plane of rotation - maximising predictability and

safety with every placement. Complementing the mechanical attributes of Technical Friends are well thought out ergonomics - directional control coming from the use of a floating trigger and unique stem frame, allowing accurate directional control plus reliable extraction however difficult the placement - whilst fast identification and selection of the correct size is ensured by colour coded cams and Dyneema™ slings together with printed stem frames.

Put simply Technical Friends provide a combination of lightness, range and safety unequalled by other designs.

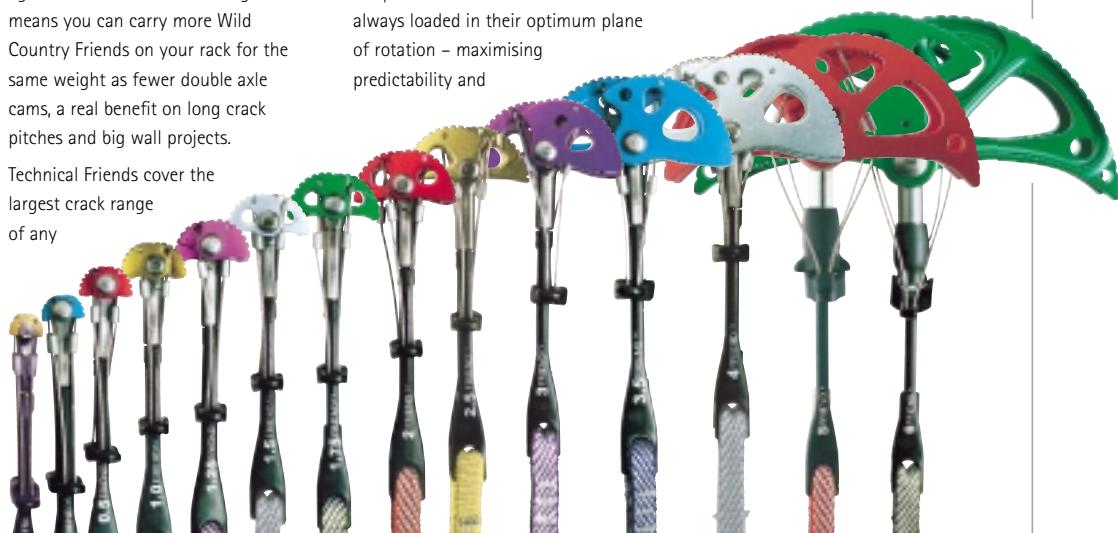
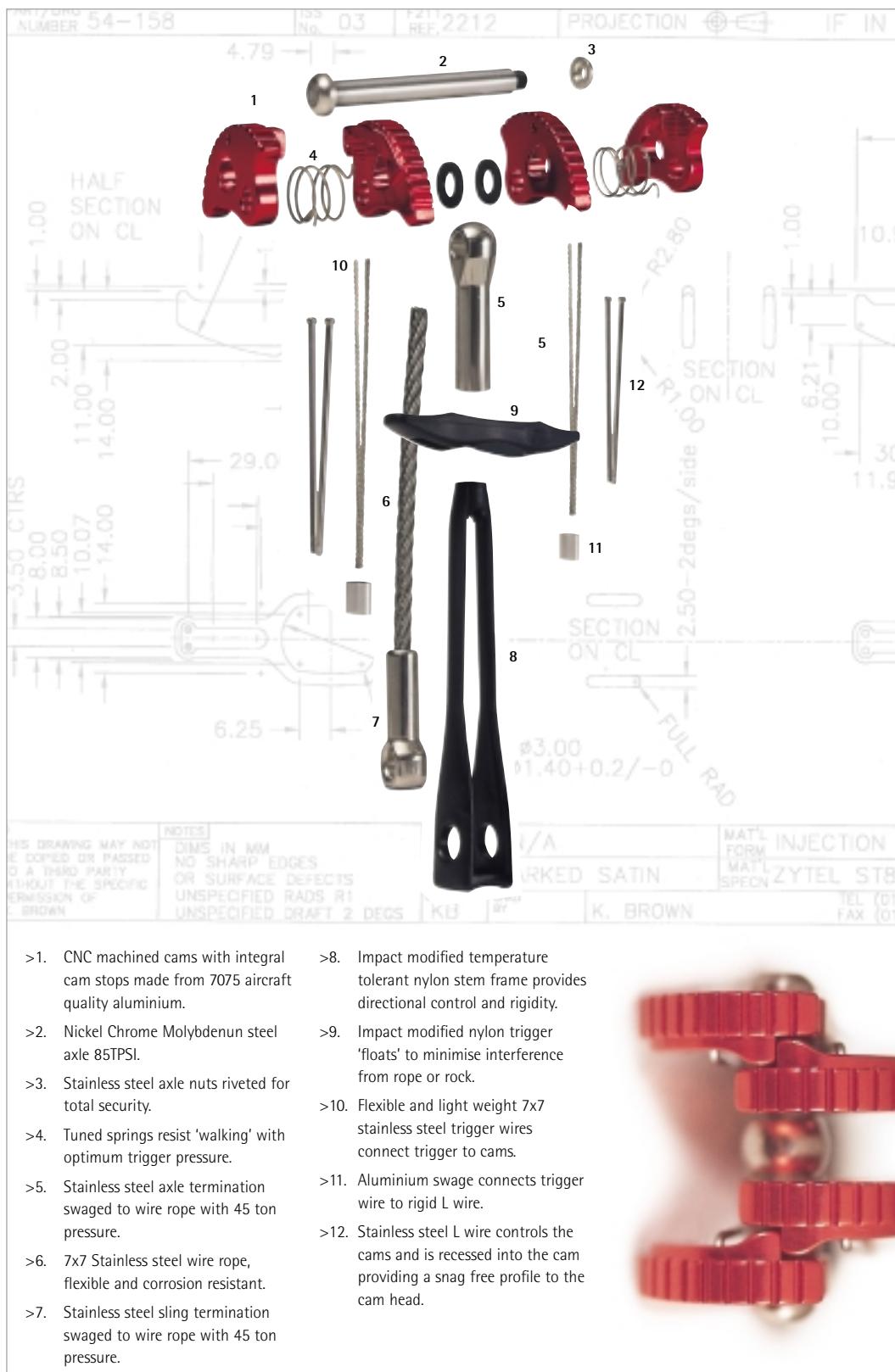


Photo: Airlie Anderson on Separate Reality 5.11d, Yosemite, USA

Photo: Ian Parnell



Bottom Right: Detail of Technical Friends CNC machined cam stops which give passive strength should the cams run out of expansion range in an inward flaring crack.





dynamics

A General Placement:

Always ensure that all the cams make contact with the sides of the crack, preferably in the middle 1/2 of their expansion range (i.e. the cams should be between 1/4 to 3/4 open). Always ensure the direction of loading is in the plane of rotation of the camming mechanism (see fig. A).

B Vertical Cracks:

As a general principle, in order to obtain the maximum strength from Friends they should always be placed with the stem in line with the anticipated direction of loading. This will ensure that the force of the fall will be transmitted directly to the cams in their plane of rotation and will avoid adverse torsional forces on the stem (see fig. B).



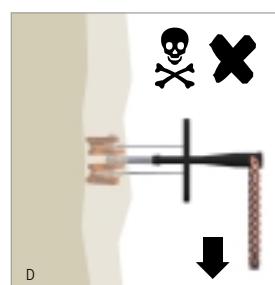
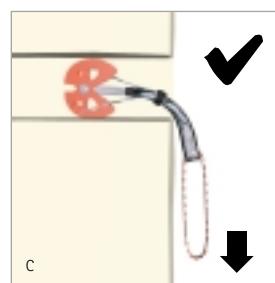
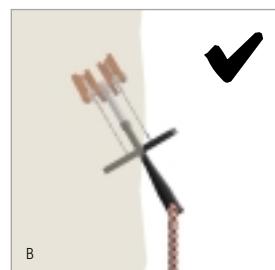
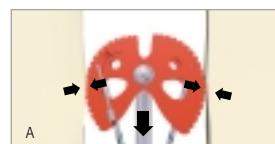
Technical Friend 00,
(Shown right at
actual size)
Minimum
strength 10kN

C Horizontal Placement:

Technical Friends may be loaded over an edge as long as the stem makes contact with the edge in its flexible section, however, this may cause damage to the cable (see fig. C).

D WARNING:

The strength of Friends placed in vertical ('bottoming') cracks where it is impossible to align the stem in the direction of the anticipated load will be seriously compromised (see fig. D).





forged friends

> the original cam

Forged Friends have evolved directly from Ray Jardine's visionary design which revolutionised the climbing world back in 1978. Despite their new colour coded cams, Dyneema™ slings, cam stops and forged stems you might wonder why rigid stems continue to be made alongside flexible stem units. The answer is fourfold - price, weight, precision and durability.

Undoubtedly a flexible stem can be placed in horizontal cracks without worry but with a little preparation (see Gunk's Tie-off fig E page 27) Forged Friends provide safe horizontal crack protection even in the smaller sizes.

Experienced users of rigid stem Friends have also realised that the bigger sizes don't need a tie off at all, as burying the stem in a horizontal deep placement puts little strain on a Forged stem, only

exposing the very end to the force of the fall see figure A, page 27.

Another endearing feature of Forged Friends is the control provided by a rigid stem, ensuring precise placement and easier retrieval due to the direct transfer of the triggering action through to the cams. The independent control of each pair of cams can be used to the full on rigid units, allowing precise movements of the trigger to tease out even the most stubborn placement.

Don't dismiss Forged stem Friends as outdated - the benefits of this original design will impress you with their honest performance and predictability.



Above: Chester Dreiman on Super Crack 5.10, Canyonlands Utah, circa 1986. Photo: Ed Webster

"I remember when Friends appeared in the late 1970s. Back then I climbed in EB rock shoes, flared jeans and a tie dyed shirt, and I drove a VW van. The shoes and clothes wore out long ago and the van broke down too. But I've still got most of my original Friends on my rack, 23 years later."

Greg Child



- >1. The stems are forged into an 'I' beam section increasing strength whilst reducing weight.
- >2. Forged Friends feature colour coded cams with CNC machine integral cam stops which give passive strength should the Friend 'walk' and the cams become fully opened in flaring cracks.
- >3. The dedicated slings are made from 12mm Dyneema™ and are colour matched with the cams to aid fast identification.
- >4. Redesigned Cam profiles ensure tangle free racking on the biggest of big wall racks.

Below: Ray Jardine's first working prototype used in 1974 on a record one and a half day ascent of the Nose with Lou Dawson and Kris Walker. This early Friend bears a remarkable resemblance to the current design of Forged Friend with the exception of the trigger lock (later dropped from the design) and is testimony to the integrity of his original concept.

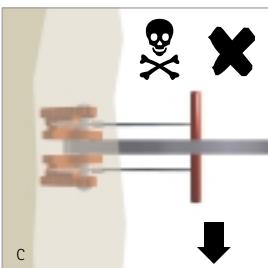
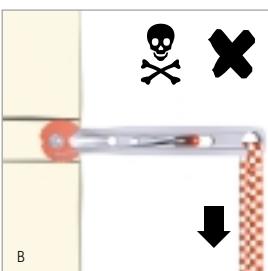
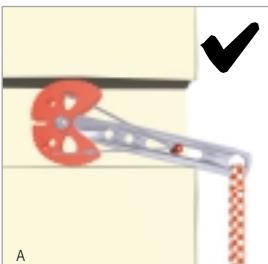


Above: Stefan Glowacz training on VW Bus, Smith Rocks, Oregon, USA. Photo: Uli Wiesmeier





dynamics



A Horizontal Placement:

As a general principle you should avoid horizontal placements where the stem is loaded over an edge. However the deeper the Forged Friend is placed (see fig A) the safer the placement will be if you have no alternative. No absolutes on safety can be given when placing Forged Friends in horizontal placements and the safest practice is to always use a "Gunk's tie off" see fig. D but with experience you will be able to judge how vulnerable a horizontal placement is, should you have to use one in extremis.

B WARNING:

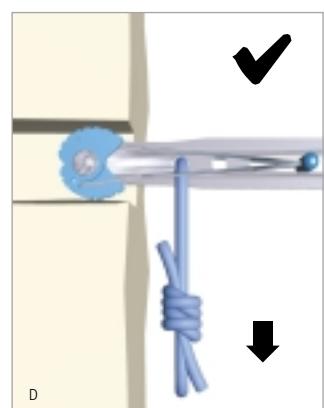
To avoid deformation or possible failure, forged stem Friends should be never loaded as in figure B. However it is possible to tie Dyneema™ cord (minimum 5.5mm diameter) into the hole near the cam head and use this to attach the rope (see fig. D).

C WARNING: The strength of Friends placed in the vertical shallow ('bottoming') cracks where it is impossible to align the stem in the direction of the anticipated load will be seriously compromised (see fig. C).

Rigid stem Friends, the original design, have a reputation for predictability and durability. They are also lighter than most other cams of comparable size. Once fitted with the "Gunks tie-off" (stem tied off with a sling through the hole near the head), rigid stems are more durable than any flexible stem if you are logging a lot of airtime with horizontal placements.

Clyde Soles, Rock & Ice 109.

'Gunks tie-off'



Left: Lucy Creamer on Flying Buttress Direct. (HVS 5b), Stanage Edge, Peak District, UK.

Photo: Simon Carter, Onsight Photography.

Top: Big Wall Rack. Photo: Topher Donahue

standards and testing

> wild country cams are tested to the most stringent international standards



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PROJECTION



3σ – Three Sigma

The Three Sigma Rating system is a method of Statistical Quality Control (SQC) which we use to describe, analyse, and control the rated strengths of our products. For each batch produced, a statistically representative sample is taken and tested to destruction in accordance with the relevant European Standard for that product and/or our own approved internal Quality Assurance Procedures.

These procedures are an integral part of our Quality Assurance System. From the data obtained from destruction testing, the average (or mean) and sample standard deviation (which is a measure of variance based upon the results obtained) is calculated. 3σ is three times the sample standard deviation. When 3σ is deducted from the mean result obtained, we can predict the spread of results which would be obtained if we were to destroy the entire batch (which is why we sample only!). We monitor this data closely from batch to batch to ensure that the rated strength (as marked on the product) is always less than the mean minus three times the sample standard deviation. This ensures that the minimum breaking strength for all products is consistently higher than the rated strength as marked on the product.



BS EN ISO9002 Quality Assured Firm

Wild Country is registered to International Standard ISO 9002: 1994 (Certificate No. C/7545.Q/2678). This is the internationally accepted model for Quality Assurance Management Systems, which has been adopted in over 150 countries worldwide.

UIAA Standards

The UIAA (International Union of Alpine Associations) began the process of formulating standards for climbing and mountaineering equipment over 3 decades ago. With the advent of the PPE (Personal Protective Equipment) Directive 89/686/EEC in 1989 it appeared that UIAA standards no longer had any relevance. However the UIAA has continued to monitor and shadow EN standards and is currently formulating a standard for belay devices which will in due course be adopted as an EN standard.



CE Certification

Where required by law (European Union Directive 89/686/EEC - for Personal Protective Equipment). Wild Country products are type examined, tested and certified (see EN 12276 below). The organisation responsible for our ISO 9002 Quality System and CE marking is Notified Body No. 0120 (SGS UK Ltd. Ellesmere Port, Cheshire, CH65 3EN).

European Standard EN 12276

5.1 Test methods

At least two frictional anchors shall be provided for each test. If a frictional anchor is manufactured in different sizes, each size shall be tested.

5.2 Apparatus for strength test

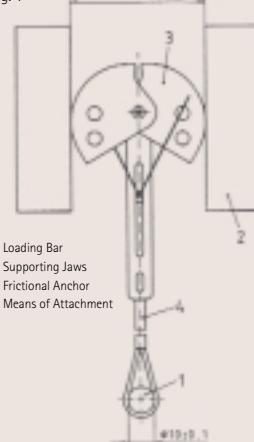
5.2.1 Layout

The apparatus consists of two parallel, rigid steel supporting jaws for the adjustable parts of the frictional anchor and of a loading bar with a diameter of (10 ± 0.1) mm for the means of attachment, see figure 1.

The static friction between the supporting jaws and the frictional anchor shall be

great enough to prevent the frictional anchor from slipping through at the test load, but the maximal surface roughness

Fig. 1



of R_{max} shall not exceed $500\mu m$. The surface of the loading bar shall have an arithmetical mean deviation of the profile of $R_{max} = 6.3 \mu m$.

There are no surface roughness requirements for the loading bar when the means of attachment is other than textile material.

5.2.2 Adjustment

The distances between the supporting jaws shall be according to the following formula:

$$\text{Position 1: } s = b_{min} + [(b_{max} - b_{min})/4]$$

$$\text{Position 2: } s = b_{min} + [(b_{max} - b_{min})^{3/4}]$$

Where

b_{min} is the minimum adjustable width

b_{max} is the maximum adjustable width

If the range between b_{max} and b_{min} is less than 5mm only one position according to the following formula shall be adjusted:

$$s = b_{min} + [(b_{max} - b_{min})/2]$$

safety and maintenance

> always read and understand the instructions supplied with each product

Safety

The safe working life of Wild Country Friends may be as little as one use in extreme circumstances, therefore it is vitally important that you check your Friends before each use. If any of the following are detected you should retire the Friend from use immediately and seek expert advice.

- a) Metal components: corrosion, burrs, cracks, distortion, broken or frayed cables, excessive wear, deformed stem.
- b) Flexible stems: particularly check that the stem is straight and not suffering from deformation, abrasion or broken strands of wire.
- c) Textile slings: check for broken stitches, cut or worn threads.

Temperature

Always keep products made wholly or partially from textile elements below 50°C as the performance of the Dyneema™ from which they are made may be affected at temperatures above this. Tests down to -40°C show no permanent change in the performance of this material although it may stiffen while at temperatures below 0°C.

Sea Water

It is essential that all Wild Country Friends are cleaned as soon as it is practical after exposure to sea water or any saline environment (e.g. when used on sea cliffs).

Chemicals and Corrosive Reagents

Avoid all contacts with chemical reagents as they will affect the performance of this product (e.g. vehicle battery acid, bleach, etc). Discard any product immediately if contact has or is suspected to have occurred (the product may permanently weaken without showing any signs).

Maintenance

Wild Country Friends are not user maintainable with the exception of cleaning and lubrication (where relevant).

Inspect your Friends for the following - they may require cleaning and lubrication as detailed below:

- a) Ensure that the unit operates smoothly throughout its complete range of movement.
- b) Ensure that when the trigger is released from any position the cams instantly return to their fully expanded position.

Cleaning

First rinse the Friend in clean cold water of domestic supply quality. If still soiled rinse in warm water (maximum temperature 40°C) with pure soap. Thoroughly rinse and dry naturally in a warm ventilated room away from direct heat.

Lubrication

The camming mechanism must be lubricated periodically and after any cleaning and drying process. This will ensure smooth operation and resistance to corrosion. A kerosene based lubricant should be sprayed between the cams and directed at the axle and springs.

Operate the Friend several times to ensure even penetration of the lubricant. Allow to drain and then wipe off any surplus lubricant. Avoid contamination of the Dyneema™ sling with the lubricant. If this occurs refer to cleaning.

Storage

After any necessary cleaning and lubrication, store unpacked in a cool, dark, dry, ventilated place away from sharp edges, pressure, corrosives or any possible causes of damage. Wet equipment should first be allowed to dry as detailed above.

Obsolescence

Wild Country Friends will deteriorate over time in the course of normal use and because of this we are required by directive 89/686/EEC to give a obsolescence date. It is difficult to be precise but a conservative estimate for this product is that it has a life span of ten years from the date of first use for metal components or five

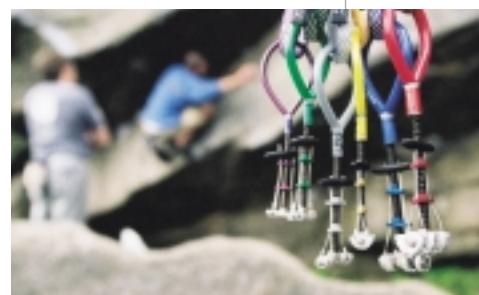
years from date of first use or ten years from date of first storage for textile components. However, please note that the following factors will further reduce the safe working life:

Metal Components: normal use, exposure to chemical reagents, heat contamination, high impact load or failure to maintain (clean/lubricate) as recommended. See above.

Textile Components: most textile materials used in safety equipment are known to degrade gradually with time, even when stored in ideal conditions. Additionally normal use, rope burn, exposure to chemical reagents, exposure to elevated temperatures, high impact load, prolonged exposure to UV light including sunlight, abrasion, cuts or failure to maintain (clean) as recommended will cause further reductions in strength. See above.

Warning

In accordance with EU Directive 89/686/EEC Wild Country Ltd. supplies detailed instructions with all its products and recommends that the user reads and understands these instructions before use. If you are in doubt, require further advice or would like a copy of the instructions for any Wild Country product, you should contact us at the address printed in this Cam Book. It is the user's responsibility at all times to ensure that he or she understands the correct and safe use of any equipment supplied by Wild Country Ltd., uses it only for the purposes for which it is designed and practises all proper safety procedures. The manufacturer or supplier will not accept any responsibility for damage, injury or death resulting from misuse.



specification

> strengths, weights and dimensions

zeros	Nominal Size	Colour Code	Expansion mm / inch	Weight gm / oz	Strength kN	Cam Stop Strength kN
CE approved to EN12276	Z1*	purple	5.5-7.8 / 0.22-0.31	23 / 0.81	3	3
UIAA approved to 125	Z2*	green	7.0-9.8 / 0.28-0.39	29 / 1.02	4	4
3σ rated	Z3	silver	8.5-12.2 / 0.33-0.48	43 / 1.51	6	6
* Progression Equipment	Z4	gold	10.3-16.0 / 0.41-0.63	50 / 1.94	6	6
	Z5	blue	13.0-19.0 / 0.51-0.75	57 / 2.01	9	9
	Z6	red	17.0-24.0 / 0.67-0.94	61 / 2.15	9	9

Patent pending. All sizes feature passive strength cam stops. All weights include dedicated colour coded Dyneema™ sling.

technical friends	Nominal Size	Colour Code	Expansion mm / inch	Weight gm / oz	Strength kN	Cam Stop Strength kN
CE approved to EN12276	00	Gold	10-16 / 0.40-0.63	60 / 2	10	6
UIAA approved to 125	0	Blue	13-19 / 0.51-0.75	79 / 2.77	14	11
3σ rated	0.5	Red	17-24 / 0.67-0.94	85 / 2.98	14	11
	1.0	Gold	19-29 / 0.75-1.14	95 / 3.33	14	11
	1.25	Purple	21-33 / 0.83-1.30	98 / 3.43	14	11
	1.5	Silver	23-35 / 0.90-1.40	98 / 3.43	14	12
	1.75	Green	25-41 / 0.98-1.61	107 / 3.75	14	12
	2.0	Red	29-44 / 1.14-1.73	111 / 3.89	14	12
	2.5	Gold	33-55 / 1.30-2.16	122 / 4.27	14	12
	3.0	Purple	43-66 / 1.70-2.60	155 / 5.43	14	13
	3.5	Blue	51-82 / 2.00-3.23	178 / 6.23	14	13
	4.0	Silver	64-100 / 2.52-3.94	217 / 7.6	14	14
	5.0	Red	84-138 / 3.31-5.43	348 / 12.18	14	14
	6.0	Green	118-194 / 4.64-7.64	533 / 18.66	14	14

forged friends	Nominal Size	Colour Code	Expansion mm / inch	Weight gm / oz	Strength kN	Cam Stop Strength kN
CE approved to EN12276	1.0	Gold	19-29 / 0.75-1.14	89 / 3.1	14	11
UIAA approved to 125	1.25	Purple	21-33 / 0.83-1.30	94 / 3.3	14	11
3σ rated	1.5	Silver	23-35 / 0.90-1.40	94 / 3.3	14	12
	1.75	Green	25-41 / 0.98-1.61	100 / 3.5	14	12
	2.0	Red	29-44 / 1.14-1.73	106 / 3.71	14	12
	2.5	Gold	33-55 / 1.30-2.16	120 / 4.2	14	12
	3.0	Purple	43-66 / 1.70-2.60	143 / 5.01	14	13
	3.5	Blue	51-82 / 2.00-3.23	168 / 5.88	14	13
	4.0	Silver	64-100 / 2.52-3.94	216 / 7.56	14	13

Guarantees

Wild Country guarantees all of its products from new against defects in workmanship or materials, unless the product has been worn out, misused, or abused, as determined by our examination. Wild Country will repair or replace any product as appropriate.

This guarantee is in addition to your statutory rights which remain unaffected. Wild Country Ltd. reserves the right to modify without notice the design and specifications of products described in this Cam Book. All weights volumes and sizing specifications, where quoted, are nominal.



Left: Alan Mullen on Auricle, Grade VI, Cairngorms, Scotland. Photo: Alan Mullen collection

glossary

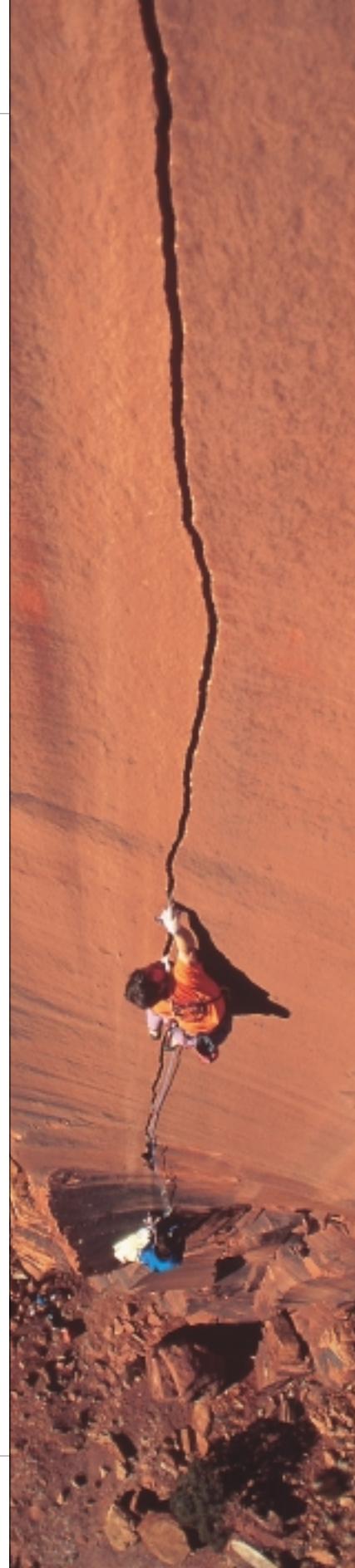
> technical terms explained

- Axle:** The steel rod about which the cams rotate. See page 21 component 2.
- Bar tack:** High strength stitch pattern used to sew climbing tape together.
- Cam Stop:** The load bearing stop which prevents the cams from over rotating when a camming device runs out of expansion range. See page 21.
- Camming angle:** The angle at which the load is transmitted to the side of a parallel crack. See page 11 Fig 5.
- CNC:** Computer Numeric Control used to programme automatic milling machines.
- Coefficient of friction:** The mathematical constant that defines the degree of friction between any two surfaces.
- Constant angle cam:** A cam which maintains the same angle of contact with the crack face throughout its expansion range. See page 11 Fig 5.
- Dyneema™:** A high strength polyaramid fibre which is weight for weight stronger than steel.
- Direction of loading:** The way in which the force of a fall loads a camming device. See page 11.
- Expansion range:** The distance between the opened and closed position of a camming device.
- Flared crack:** A rock crack which increases in size either inwards or outwards.
- Forging:** The process of heating metal before shaping it by pressure or impact. See page 25 fig.1.
- Friend:** The name given to the original camming device designed by Ray Jardine and produced by Wild Country in 1977.
- L wire:** The L shaped rigid wire used to connect the cam to the trigger assembly. See page 21 component 12.
- Patent:** An official licence from a government granting a business the sole right, for a limited period, to make and sell a piece of equipment.
- Plane of rotation:** The area within which the cams rotate at right angles to the axle.
- Swage:** The method of construction used to join the wire rope stem to the axle and sling terminations.
- Stem:** The component that connects the cam/axle assembly to the sling. See flexible stems page 21 and forged stems. See page 25 fig 1.
- Springs:** The components which push the cams into their fully expanded position thereby holding the cams against the crack wall. See page 21 component 4.
- Stem frame:** The component which supports the flexible stem providing directional control. See page 21 component 8.
- SLCD:** Acronym for 'spring loaded camming device' often used to describe 'Friends'. See above.
- Termination:** The component swaged (see above) to either end of a the flexible stem. See page 21 components 5&7.
- Trigger:** The bar which pulls the trigger wires which retract the cams. See page 21 component 9.
- Trigger wire:** Flexible wire which connects the L wire to the Trigger. See above and page 21 component 10.
- Walking:** Process whereby the camming device climbs deeper into a crack by reacting to rope movement. See page 12 figure 7.

Editor: Steve Foster

Design:  vivid creative ltd. www.vividcreative.com

Thanks: Ray Jardine, Mark and Jan Vallance and Richie Patterson.





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