IRATA TECHNICAL REPORT ON TESTINGS DONE AT GRIDINS, LITHUANIA, MAY 2012

Summary

IRATA arranged the undertaking of a number of practical tests at the IRATA ITEC held at Gridins, Lithuania in May 2012, on various rope access equipment and systems to supplement other sources of testing and information to assist members in the selection of equipment and systems.

The tests were designed to be similar to work situations rather than e.g. EN tests which require only the use of new unused equipment, conditioned rope, measurement of forces and set parameters to give reproducible results but which may be different from rope access work.

IRATA note due to the limited number of tests and controls that conclusions drawn here should only be used to supplement other information and not be used as the sole basis for the selection and choice of rope access equipment and systems.

Many of the tests undertaken were single tests to demonstrate consequences. With hindsight combining testing with an event was not the best plan as some tests raised questions which could not be answered because of time constraints. However funding has been allocated for future research /testing and members are encouraged to be involved in suggesting what tests will produce evidence that will be of benefit to the association.

Factors which may affect comparison with other tests

1 100kg mass was chosen as the most common value for industrial tests, but loads above or below 100kg may produce different results.

2 The use of sand bags are likely to give less reproducible results than methods in EN tests but are more practical for our chosen test locations, also they may represent the action of a human body in a more realistic manner than a steel mass.

3 One of largest potential variables is between new and used rope, but there are others such as type of rope, conditioned, wet or dry etc.

4 Backup devices were tested with lanyards [cow's tails] supplied, or approved by the manufacturer. One factor in 'total fall distance' is the length of lanyard and the device position above or below the descender of the user. Greater total fall distance is likely with longer lanyards, or for those designed to hang down or 'follow' the user.

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5 Back-up devices were tested 1m below anchor point - a likely position during a descent, though total fall distance and forces will vary with length of rope above the device.

6 Variability in tying and pre-tensioning knots is more significant with a small length of rope compared to a longer rope where the 'end effect' is diluted.

The testing and investigation programme found the following significant issues:

Time and Motion

- The time and motion questionnaire indicates that much more time is spent suspended on ropes at the site of the work than doing rope manoeuvres (e.g. descending, ascending or climbing) to get to or from the work site. An average of over 90% of time was spent at the actual location of the works

Rope Protection

- Operatives testing rope protection devices (prevention and mitigation) found it difficult to ensure that the rope protection remained effective whilst they were getting over the top edge.

- Tests have shown that the single layer canvas and PVC rope protectors do not offer significant protection against a tight radius edge such as metal sheeting or cable trays, and are quickly cut through where lateral movement is present. Further tests over a rough cast concrete edge showed these types of protectors offer only limited protection against vertical loading and unloading of a rope (comparable to an operative ascending a rope).

- Rope stretch on the back up rope in the event of a working rope failure can render rope protection that attaches to the rope ineffective as the protector can be pulled below the edge that it is meant to protect against.

Back-up systems, devices performance and rope stretch

- When an operator is in a static work position, back-up devices that are positioned above the operator limiting any potential free fall will minimize impact forces and fall distance in the event of a working rope failure.

- Towed type back-up devices that require the operator to release the tow, or for a fail to safe device to engage have a greater potential for increased free fall if the device towing mechanism is being operated at the time of a main rope failure.

- The tests DID NOT address the suitability of towed devices and effectiveness of release mechanism where available

- Rope stretch in the back-up system is a significant issue regardless of the device used. The more rope that is in the system, the greater the back-up rope stretch. The more weight or impact force on the system, the greater the back-up rope stretch.

- The potential for rope damage is a serious concern with toothed lock-on type devices like the ASAP. The first of two tests with the ASAP with an L57 energy absorber combination and a 100kg load gave an unexpected result causing serious rope damage. While this isolated result cannot be disregarded, Petzl have since stated that "they have not had similar sheath damage of this type reported, nor managed to recreate this in investigative testing even with more severe configurations".

Recommendations

- Consider during a risk assessment whether one type of back-up arrangement for use at the work site, and a different arrangement for performing access manoeuvres is appropriate.
- When using rope protection devices, consider using a separate device for each rope, or use multiple edge mitigation measures.
- Traditional single thickness canvas and PVC rope protectors should not be used as the sole means of mitigation where potential for a significant edge hazard exists.
- Combined Rope Stretch and Device performance should be assessed and alternative Back-up systems should be a serious consideration.
- Clearance distances and exposure times during operational tasks should be a major factor in both Planning methodology and Equipment choices and be identified in Risk Assessments.

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IRATA Technical Report

Introduction

Rope access contracting and training as carried out by IRATA member companies has grown in the last 20 years from a niche activity carried out by a handful of companies and a few hundred technicians, to a global industry with over 200 member companies and over 50,000 registered technicians.

IRATA members working statistics are recorded at over 5,000,000 hours worked on rope in 2010 (http://www.irata.org/pdf_word/Work_and_Safety_Analysis_2010.pdf). In 2010, the following incidents were reported:

- 1 Major injury (7 in 2009)
- 6 Serious (Minor) injuries (8 in 2009)
- 29 Not Reportable or <3-Day injuries (37 in 2009)

IRATA is justifiably proud that the incident rate suffered by IRATA member companies is significantly below the all industry average, however given the potentially significant consequence of any incident when working at height, it remains IRATA's mission to continually strive to improve the effectiveness of the system.

Tragically, in 2011, an IRATA technician died from injuries sustained as a result of a fall. At the time of writing the incident is still being investigated by the UK police, and the information released into the public domain is limited to confirming that the technician was working on rope and fell as a result of a double rope failure.

Also in 2011, an analysis of IRATA rescue training incidents identified potential issues related to the use of back-up devices in particular situations and Petzl now recommends to NOT use the Petzl Shunt, while towed by a cord, as a back-up device in rope access

Whilst there is substantial literature addressing equipment performance available, particularly the HSE Contract Research Report 364/2001 (http://www.hse.gov.uk/research/crr_pdf/2001/crr01364.pdf), it was felt that further research surrounding the issues of rope protection and back-up device use and performance would be valuable. The IRATA executive approved funding for a range of testing, focusing primarily on rope protection and issues surrounding the use of back-up devices.

Some testing relating to back-up devices was carried out at IRATA member company facilities in the UK and in Australia. A programme of testing was scheduled for the Technical Conference held in Lithuania in May 2012 using the facility of IRATA member Gridins.

1.0 Aims, objectives and scope

1.1 The aim of the testing was to examine a range of rope protection measures, and the performance of a range of back-up devices in a variety of typical situations.

1.2 Objectives

The objective was to record the performance of equipment and suggest ways to improve the effectiveness of the IRATA two rope system.

1.3 Scope

The event included presentations, demonstrations and tests relating to:

- Time & Motion - presentation of data relating to time spent working on rope versus time spent conducting manoeuvres to access the workface.
- Rope Protection – measures to protect ropes, and factors affecting the rope protection
- Back-up device performance for 1 and 2 person loads

1.4 Equipment

The following types of equipment were tested:

- Ropes
- Rope protection devices
- Back-up devices and associated lanyards

1.5 Questionnaire

A questionnaire was circulated to IRATA member companies. The objective of the questionnaire was to identify the duration spent by a technician on rope carrying out the work task compared to the time spent performing rope access manoeuvres to access and exit the workface.

1.6 Testing

A variety of tests were used to assess the performance of the equipment. Tests carried out at AID Ltd and 5th Point focused on the Petzl Shunt and the Petzl ASAP, and were commissioned in response to Petzl's revised statement on the use of the Petzl Shunt as a back-up device. The tests performed at AID and 5th Point were all designed to be reproducible to allow for verification of the results.

The testing carried out in Lithuania included testing of the Petzl Shunt and ASAP as well as back-up devices manufactured by other manufacturers including S Tec, ISC, SAR and DMM.

In addition to the repeatable tests, there were a range of practical 'field-tests' designed to illustrate the performance of equipment in typical work situations. This included 'field-tests' illustrating the effect of rope stretch on the back-up system and the effectiveness of a range of rope protection devices.

1.7 Limitations of testing & results

IRATA Note. Due to the limited number of tests and controls that conclusions drawn here should only be used to supplement other information and not be used as the sole basis for the selection and choice of rope access equipment and systems.

In some cases the final tests may represent worst-case scenarios, thus the results from these tests represent the harshest possible regimes. Where tests indicate that equipment performance could prove dangerous then this is clearly indicated.

2.0 Time & Motion

The results of the Operator Member field study time and motion questionnaire indicate that much more time is spent hanging on ropes at work sites than accessing (descending, ascending or climbing). An average of over 91% of time was spent at work sites and no questionnaire showed less than 80%.

Recommendations

Members should consider that tool use may present different hazards to the hazards present when accessing and exiting the work site. Members should assess this factor for each job to assist in the choice of techniques and equipment selected. This may require the use of different working and back-up arrangements. For example, consider the use of more than one type of back-up device – hands free for descent, and a device that can be positioned high on the rope when in position in the work zone.

3.0 Rope Protection Measures

3.1 General principles of rope protection

Typically there are two broad categories of rope protection hazards:

- Top edge hazards, e.g. where a rope is rigged on a roof and goes over the edge of the building or structure. This will often involve a bend in the rope of 90 degrees, and involves significant point loading at the bend.
- Mid-rope hazards, e.g. when a vertical rope contacts with surfaces at or vertically above the worksite

All Rope Access users should apply a systematic approach to the requirement of ensuring the integrity of the ropes, in particular relating to contact with potentially hazardous surfaces. When assessing the potential of a surface to be hazardous to the integrity of the ropes, it is prudent to err on the side of caution. As a minimum, control measures should be applied when:

- The radius of an edge is less than 5mm
- The surface is abrasive
- The surface has the potential to be sufficiently hot to damage ropes

The hierarchy of control measures for protection of working & back-up ropes is:

- **Avoid -** Wherever possible ropes should be rigged so that contact with any surfaces is avoided.
- **Prevent –** Use equipment to prevent rope contact with the hazardous surface e.g. edge roller.
- **Mitigate –** Use equipment to minimize the potential hazardous effects of contact e.g. fabric rope protector.

Equipment and materials used to mitigate the potential contact hazard include the use of general purpose fabric such as carpet or canvas improvised to provide protection, through to purpose made ‘rope protectors’.

3.2 Rope protectors that prevent contact

Broadly speaking, devices and equipment that prevent contact with the hazardous surface are used on top-edges, but are not as suitable for mid-rope hazards. Some common measures to prevent contact with sharp radius top edges include the use of scaffold tubes, or proprietary devices such as edge rollers. A range of proprietary edge prevention devices (shown below) were demonstrated. A common feature of all of these devices is the potential for the ropes to come into contact with the edge whilst the operative maneuvers into a position ready for descent. It is therefore recommended that the when using such devices, consider using a separate device for each rope, or also using edge mitigation measures.

Lyon Edge Guard - A small stainless steel device - possible for two ropes to be fitted between retaining side plates.
Supplied by Lyon Equipment

LEG-10 Edge Guard

Heightec ***Magic Carpe****t* - Rope protector set - fixed stainless steel tubes give good radius and keep rope away from a 90 degree edge either with roller on edge or one above and one below edge.

Petzl Caterpillar x 4 Module Fixed bar and connecting Maillons - very similar to Heightec Magic carpet. Supplied by Lyon Equipment

3.3 Rope protection that mitigates the contact hazard

This type of rope protection is commonly used in both 'top-edge' and mid-rope contact situations. Tests have shown that the traditional canvas and PVC rope protectors do not offer significant protection against a tight radius edge such as metal sheeting or cable trays, and are quickly cut through where lateral movement is present (http://www.apple-sac.com/rope-pro.html and http://www.youtube.com/watch?v=bXybc03JUDk) . As a result there are a number of new products that have come to market that use more resistant materials such as Kevlar and stainless steel mesh. It is important that each rope is individually protected, which for wrap around protectors means using one device for each rope. The products shown at the ITEC are listed below:

Lyon Equipment -Classic style double thickness canvas available in 1m or 50cm length with an eyelet for connecting securing cord. The protectors have velcro on the seams and can easily be taken on and off the rope.
DMM - Classic style double thickness canvas available in 1m or 50cm length with an eyelet for connecting securing cord. The protectors have velcro on the seams and can easily be taken on and off the rope.

Petzl PVC - Narrow designed for single rope use with wire clip for positioning on the rope. The protectors have velcro on the seams and can easily be taken on and off the rope.

Apple-Sac - Double layer 12oz/340gm Rip-stop Canvas with contrasting colours inside and out. It has stainless steel wire mesh between the layers. 600mm long, the protectors have velcro on the seams and can easily be taken on and off the rope.

Apple-sac

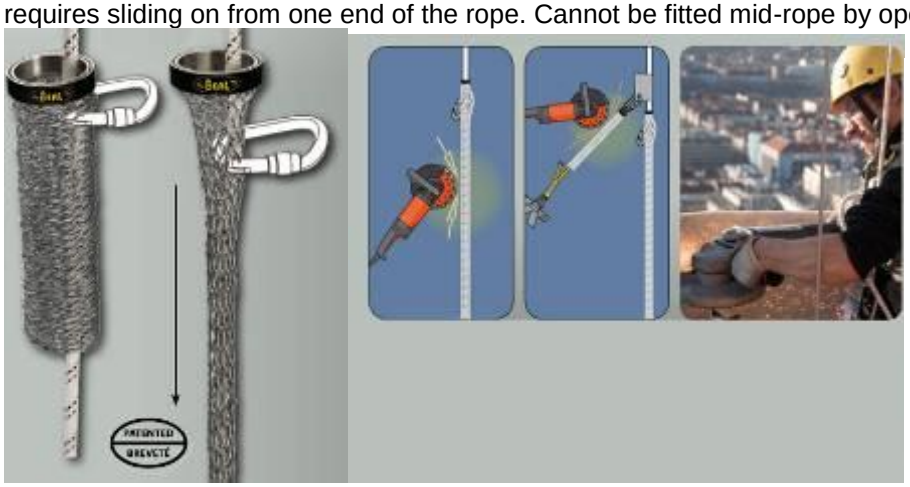
Armadillo

Altisafe Armadillo - Kevlar Outer Sheath with a Fine Stainless Steel Wire Mesh inside. 500mm long, the protectors have velcro on the seams and can easily be taken on and off the rope.

Chafe-Pro (model 6-98Y-16) - designed for protecting mooring lines (ropes) in the Yachting industry made from a single layer of heavy-grade black nylon.

Gridins Hinged Tube - a 600mm long metal tube that hinges open to allow it to be attached around ropes. Inflexible - more suited to protecting ropes immediately above operative or on very shallow angle contact or rub points.

Beal Rope Armour - a mesh tube - cannot be fitted mid-rope on a loaded system, not easily passable - requires sliding on from one end of the rope. Cannot be fitted mid-rope by operative



BPRM Magnetic Protector

3.4 INVESTIGATION – Effective Protection of Top Edges.

Velcro style rope protectors are sometimes used as the only method for rope protection at danger points including top edges. The effectiveness of this method on this type of edge has been questioned elsewhere in this report but the problematic issue of effective installation and provision of a barrier between ropes and top edges has generally not been recognised.

A simple demonstration was undertaken where 2 IRATA rope access Level 3's descended from a horizontal platform over a right-angled edge where the ropes were anchored at platform level - passing through a 90-degree angle at the edge. They both used 2 x Velcro canvas rope protectors and installed one on each rope as they descended over the edge.

One of the L3's had two protectors, one pre-installed loosely around each rope above his descender and back-up device. He pulled them down as he passed over the edge. During the maneuvering over the edge both ropes and back-up cows-tail were not protected until he stopped just below. At this time he was able to pull the protectors into place and secure them in place using tie cords on the bottom of the protector.

The other L3 kept the protectors open and climbed over the edge attempting to keep both ropes and backup cows-tail in line [i.e. on the protector] to provide protection. This was not achieved and at times one or both of the ropes were exposed. Once he was below the edge he closed the protectors and descended.

The method used by the first L3 was quicker and only exposed the ropes for a very short period. The second was considerably slower and exposed ropes at different times but for longer periods.

The ITEC delegates were able to watch these demonstrations at close range and witnessed the ropes and cows-tails **exposure** to edge contact that would have occurred if a slip happened.

Samples of open type protection were installed, one a Lyon Equipment 6mm thick 950mm x 600mm polymer

sheet with eyelet points to attach positioning slings and a Gridins Steel triangle device with both a 90-degree edge positioning section and a 40mm radius section for rope contact angle. Both allow more controlled and efficient passage over the top edge and can easily provide a barrier for 100% of the time taken to pass from above or below.

Observations and comments
Velcro fabric tube type devices are very difficult to install even by experienced personnel and therefore would not be suitable for those with less experience especially where the edge is more difficult to pass e.g. - where the platform is under-cut; i.e. there is no vertical face so feet swing under the platform.

Recommendations
Training Members should actively promote the use of devices on top edges that allow for safe and efficient passage for operatives.

Single thickness PVC or canvas rope protection devices should not be used as the sole method of protection on top edges

3.5 Investigation - Working Rope Movement

Over the last 12 months several 3rd party investigations have looked at Velcro type rope protection performance against damage from sharp edges. These have all concentrated on the side-to-side movement of a loaded rope being rubbed on the edge.

Apple Sac - Australian Manufacture - Velcro tube type with wire mesh in canvas (http://www.apple-sac.com/rope-pro.html)

Altitech - UK Manufacture - Velcro tube type 'The Armadillo' wire mesh in PVC & Kevlar. (http://www.youtube.com/watch?v=bXybc03JUDk)

Gridins - Lithuanian Rope Access Member Company - Velcro tube type -1mm wire strands in canvas

These investigations all concentrated on the protection of a loaded working rope and used a sideways movement of loaded ropes to demonstrate the enhanced performance of the products.

The Applesac video shows both ropes in the same protector. Experiments clearly indicate the need for an individual rope protector on each rope as the consequences of the rope protector becoming damaged sufficient to cut the working rope also means that the back-up rope is exposed to the same danger without any protective barrier

Although there is a European Standard for 'Edge specifications' used in tests, there are many factors that affect any direct comparison of performance and any specification comparisons can only be seen as giving an indication of performance in similar situations in the infinite range of permutations that occur every day in rope access works.

The variables include:

- load - weight of worker.
- rope - type of rope and diameter, soft, firm, sheath weave etc.
- angles of contact - at what angle does rope get deflected by contact point.
- contact material - how aggressive the contact surface is on the rope material
- sharpness of edge at point of contact
- what rate the sharpness diminishes - with rope rubbing the edge will get worn smoother this may be quickly e.g. wood, rough cast concrete hardly any wear
- activity occurring below the edge - is the worker ascending smoothly, ascending rapidly and jerkily, descending smoothly or jerkily, moving sideways etc.

- design and material of any ‘barrier’ rope protector.
- also IS THERE GOING TO BE MOVEMENT of the rope against /over the contact point/s - belaying, lowering, hauling or a back-up rope becoming under emergency load.

3.6 Top-edge rope mitigation measures - field testing

An investigation was under taken to witness the differences in effectiveness of various mitigation rope protection measures when used over a ‘top-edge’. Ropes were passed through 90-degrees over a rough concrete edge mounted on a platform and down to a 120kg operative with the rope fitted to his chest ascender. Rope movement over the edge was produced by the operative simulating rapid and vigorous ascending.

Protector	Approximate number of movements over edge	Results
Lyon Canvas	30 -35	Rope sheath failure
DMM Canvas	15	Rope sheath failure
Lyon Proflex	15 -20	Surface compression damage to proflex No visible rope damage
Nylon Carpet	15	Rope Sheath failure
Rigmar	20 -25	Rope sheath failure
Chafe-Pro	15- 20	Damage to the protector, Rope sheath failure
Altisafe –Armadillo 1st test cycle 2nd Set same place	 20 20- 25	 Damage to inner PVC face of protector. Inner wire exposed. No visible rope damage
1st set Apple-Sac 2nd Set same place	20 12	Damage to protector – wire mesh exposed Rope sheath failure

3.7 INVESTIGATION - Back-up Rope Movement

The effectiveness of protection of the Back-up rope is difficult to assess. Will it be sufficient to provide protection during any loading movement of a ‘deployed’ Back-up rope? Will it stay in place?

A demonstration was carried out to show the movement of the Back-up rope over an edge in the event of working rope failure.

A demonstration was undertaken where both the Working rope and Back-up rope were anchored 2m higher and

12m back from a platform edge (approx. 10 degrees). The edge was very rounded with a radius of over 5mm so the demonstration concentrated on observing the movement and inspecting the wear on the Back-up rope protector. Velcro PVC protectors were installed on each rope and a 100kg weight suspended just below the edge on the Working- Rope.

- Ropes were anchored 12m back from the edge.
- The ropes passed over the edge at a shallow angle approx. 10 degrees above square.
- The load on working rope was 100kg.
- A PVC Velcro Rope protector was used.
- The edge was smooth painted steel with a radius of more than 5mm.
- The 100kg was attached to the Back-up rope using an ISC Red less than 50cm below the edge.

During the demonstration one of the conference delegates was watching within 1m of the edge and witnessed at close quarters the movement of over 0.8m of rope pass over the edge and the severe damage to the PVC protector caused by the frictional heat.

Damage to PVC protector during emergency loading of a backup rope over rounded edge.

Analysis

- The 10% minimum of rope stretch that can be expected when remotely anchored Back-up ropes become subject to emergency loading should be anticipated and the rigging and protective devices must be capable of performing during this movement.
- The less rounded any edge is the more concentrated the loading would be and thus the heat energy will be similarly concentrated.
- PVC is not a good choice for Back-up rope protection in situations where movement will occur - as stated by the UK HSE in their 2001 report.
- Are most Velcro style protectors suitable for all edges – certainly not
- Will they help reduce the edge radius to less than 5mm - unlikely
- Will operatives be able to fit them on top edges or mid-rope without exposing ropes to potential damaging contact - unlikely.

Further Investigations?

Formal test of Back-up rope protective devices and systems over a more severe edge with different amounts of stretch/movement of rope during emergency loading.

4.0 Back-up devices

4.1 General principles of rope access back-up devices

Rope access methods involving the descent or ascent of rope are a form of work positioning involving the suspension of the worker on a working rope using friction or rope-grab type devices. In addition to the working rope, the IRATA system requires the worker to have an independent back-up suspension system in case of failure of the working system. The back-up system is usually a similar type rope to that used for the working system together with a back-up device that connects from the back-up rope to the worker's harness.

For many years the most commonly used back-up device has been the Petzl Shunt, connected to the worker via a dynamic rope lanyard. The Shunt was not designed as a back-up device to be used in combination with a lanyard, though the use of the equipment in this manner was first recognised by Petzl in 1999. However, Petzl now recommends to NOT use the Petzl Shunt, while towed by a cord, as a back-up device in rope access (see Petzl statement www.petzl.com). As a result IRATA commissioned testing in order to determine the performance of the Shunt, and another Petzl product, the ASAP. The ASAP is specifically designed to be used as a rope access back-up device. IRATA has issued its own guidance on the continued use of the Shunt (see www.irata.org/equipment.php

This issue has generated a lot of debate within the industry as to the possible pros and cons of different devices, and of other factors that affect the effectiveness of the back-up system including rope stretch and rope protection. The IRATA executive agreed to an extended testing regime to be conducted as part of the Technical Conference held at the facility of IRATA member company Gridins in Lithuania. The aim of the testing is to collect information that can be used by members to help them select the appropriate back-up system for each task. The tests DID NOT address the suitability of towed devices and effectiveness of release mechanism where available.

4.2 Back-up devices tested

In terms of user operation the back-up devices tested can be divided into two broad categories, back up devices that are towed by the operator, and back-up devices that operate 'hands-free' and trail below the operator. As a number of the devices tested are newly developed there were practical demonstrations to illustrate how the devices are used.

Each of the devices was demonstrated in the following:

1. Installation on the Back-up rope
2. Method of connection to the Harness
3. Function Test of Back-up device
4. Position of Device during function test of descender
5. Position of device during descent
6. Position of device at work zone

Several new devices have recently being developed, often in co-operation with IRATA members, and featured at ITEC were the S Tec Duck, DMM Buddy Catch and ISC Red.
Other devices already widely used were also demonstrated and tested including the ISC Rocker, Petzl Shunt and Petzl ASAP.

ISC - RED S.Tec - Duck R DMM - 'Catch'

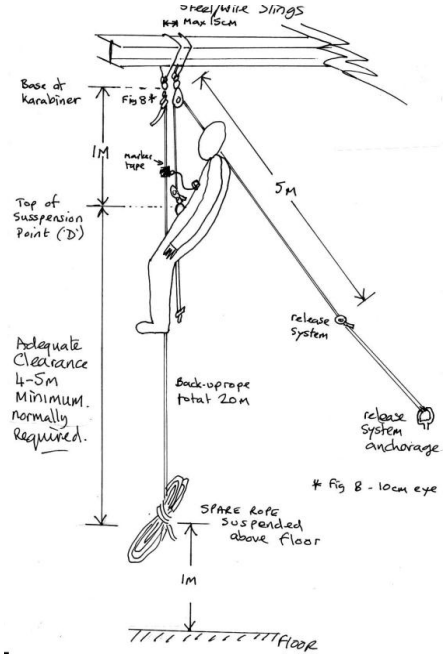
SAR Rocker Petzl Shunt Petzl ASAP

	DMM Catch	S.Tec Duck R	ISC RED	SAR Rocker	Petzl ASAP
User made Dynamic Rope Cows-tail	80cm +Inc Karabiners	80cm +2 x Karabiners	80cm +Inc Karabiners	NO	NO
Supplied Lanyard	Nylon Twin Point Steel Twin Point	45cm Webbing		10cm, 20cm & 30cm were supplied.	L57 Absorbica used as appropriate in both one or two person use
Waist Point (Ventral)	YES	YES	YES	NO	NO
Chest Point Attachment (Sternal)	YES	YES	YES	YES	YES
Rear point (Dorsal)	NO	NO	NO	Not Confirmed	YES

4.3 100kg Abseil Position Drop Test Dates: 21st & 22nd May 2012
Venue: Gridins Training Centre, Lithuania

Testers: C Parkin - Auditor/Assessor, Arturas Vengalis - L3 Training Manager Gridins) V Tomas Daugintis – L3 (Gridins), Robertas Daugintis - L3 (Gridins), Arunas Saulinskas - L1 (Gridins), Adriano Peixoto - L3 Assessor (Alpitec/S.Tec), Rogerio Matos- L3 Assessor (Alpitec).

The test was designed to investigate the effectiveness of devices when positioned in the extreme lowest acceptable position whilst descending or at the work-site. Live tests would be required to investigate the issues relating to operator handling of the devices.
All test completed on new sections of 11mm Marlow LSK Low-stretch Rope (EN 1891A).



100kg was used as the test load (2 x 50kg weight bags) that was suspended 1m below the anchor point using a Test Plate with facilities to simulate both Waist (ventral) and Chest (sternal) attachment of cows-tails or supplied lanyards.

The 100kg tests primarily showed the device and cows-tail/lanyard performance as there was only 1m of rope above the load point.

This simulates a serious scenario at the top of an anchored back-up rope where there is very little rope stretch to absorb energy in the event of system failure. The stretch and the knot tightening was measured and recorded. (Found to be around 10% - 9cm -16cm in the 1m of rope and knot).

Pictures showing the test plate with both waist and chest attachment points.

Weight Bags 50Kg each.

Left: Set-up for chest attachment.

Right: Set-up for waist attachment

The tests involved the following devices, three are known to members and three others are newly developed and in final production stages of development. Some field investigations have been under taken by UK North Sea Operator members, the ISC RED, DMM Catch and S.Tec Duck are scheduled for field trials July & August 2012.

ISC **RED** -EN tests scheduled at SATRA - June 2012

A simple to use swing plate device with a large karabiner connection eye and a short tug cord (not fitted on pic.) for manual positioning on the Backup Rope. The RED can be positioned by the user and will stay in that position. For use with up to 80cm Dynamic Rope Cows-tail (Inc. Karabiners)
Waist or Chest Attachment.
(Shorter Cows-tail required when used on chest point).
Tested with: 80cm cows-tails with Fig 8 knots

S.Tec **Duck R** – EN12841A Tests Completed by SGS - 17.05.12

Fitted with 4cm tug cord for manual positioning on the Backup Rope. The Duck R can be positioned by the user and will stay in that position.
Can be used with either the S.Tec 45cm Webbing Lanyard (chest) or Dynamic Rope Cows-tail - 80cm max (waist).

Waist or Chest Attachment options.
Tested with both 45cm Lanyard and 80cm cows-tails with Fig 8 knots

DMM **Catch** - EN12841A Tests Completed by SGS - 17.05.12

A sprung version of the DMM Buddy, allowing it to be positioned high on the back-up rope and stay in the optimum position. Fitted with a handle and panic button.
Can be used with either DMM Two Point Cows-tail or Dynamic Rope Cows-tail - 80cm max.
Waist or Chest Attachment.
Tested with the DMM Two Point Cows-tail (long x 2 short x 1).

SAR **Rocker** – EN 12841A

A well-established EN353, EN 358 and EN 12841A for use as a rope access Back-up.

Supplied with 10. 20 & 30cm SAR Twin-eye lanyards.

Tested with SAR 30cm and 10cm Twin-eye lanyard

Petzl **ASAP** - EN 12841A
A commonly used device, differs from all others tested, it has teeth that lock it on the rope. It must be used with one of three Petzl lanyards: ASAP'SORBER 20, ASAP'SORBER 40 or ABSORBICA L57.
Chest Point attachment.

Tested with L57 Absorbica

Petzl **Shunt** EN 567

Has been widely used by IRATA members. Petzl recommends to NOT use the Petzl Shunt whilst towed by a cord as a back-up device in rope access

Tested with: 80cm cows-tails with Fig 8 knots – waist attachment.

Steel version of DMM Cows-tail – Nylon version has the same mid-point connection ring.

This test was set up with the back-up device at the abseil descent position with 100kg load suspended on a descent device 1m below the anchor point.

Cows-tailed devices were at the lowest acceptable height – above the descender.

Hands free devices designed to be used with a lanyard were in the ‘hang down’ free running position.

NB1. During descent the fall distance for all devices would be shorter if the devices were managed in higher positions and/or shorter cows-tails /lanyards.

NB2. At the work site **all** devices can and should be positioned high, the Rocker and ASAP* require locking to maintain this high position. High positioning and minimal slack in cows-tails or lanyards will ensure that device deployment and slippage is minimal and fall distances mainly due to rope stretch.

* *Repeated deliberate locking can accelerate wear on the ASAP* - http://www.petzl.com/files/all/product-experience/PRO/B71-PE-ASAP-EN.pdf

NB3. Many operatives are more than 100kg.

Device	S.Tec ***Duck R***			S.Tec ***Duck R***			ISC **RED**			Petzl **ASAP**			SAR **Rocker**				DMM **Buddy Catch**			Petzl **SHUNT**		
Connecting Lanyard	S.Tec, Chest point 65cm, inc karabiners			Cows-tail - Waist 1m inc. karabiners			Cows-tail - Waist 1m inc. karabiners			L57 - Chest			Drops 1, 2 & 3 used 30 cm SAR Twin-Eye: 50cm inc karabiners Drop 4 – 10cm SAR twin-eye: 30cm inc Karabiners				DMM Waist: 1m inc. karabiner		DMM Chest45 cm inc. K	Cows-tail - Waist 1m inc. karabiners		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	4	1	2	3	1	2	3
Device movement/slippage.	22 cm	25 cm	25 cm	30 cm	32 Cm	34 cm	3 cm	3 cm	5 cm	33 cm	6 cm	-	49 cm	89 cm	65 cm	60 cm	16.5 cm	27 cm	7 cm	23 cm	30 cm	36 cm
Device Stopping distance (slippage + back-up rope stretch)	38 cm	37 cm	40 cm	42 cm	43 cm	43 cm	13 cm	14 cm	16 cm	33 cm	24 cm	-	75 cm	106 cm	80 cm	72 cm	28 cm	32 cm	21 cm	34 cm	44 cm	49 cm
Lanyard extension *measured whilst still loaded.	1cm	1cm	1cm	22 cm	24 cm	21 cm	27 cm	26 cm	29 cm	11 cm	24 cm	-	0	0	0	0	0	0	0	26 cm	33cm	34cm
Fall Distance - the most important issue.	0.86 m	0.88 m	0.93 m	1.42 m	1.38 m	1.40 m	1.08 m	1.09 m	1.08 m	1.16 m	1.2 m	-	1.66 m	1.98 m	1.75 m	1.3 m	0.97 m	1.06 m	0.61 m	1.44 m	1.49 m	1.56 m

S.Tec - Duck R Rope: slight bulge and light glazing. S.Tec have confirmed no damage to Device Lanyard has stitching failure to protective cover only, Lanyard OK With Cows-tail: Some variation due to cows-tail tying. Additional fall distance due to cows-tail tightening and more slack to device. S.Tec have confirmed no damage to Device Knot tightening and stretch in cows-tail	**ISC – RED** Some variation due to cows-tail tying. No apparent damage to Device – inspected on site by ISC Knot tightening and stretch in cows-tail	**DMM – Catch** DMM have confirmed no damage to the Devices other than some acceptable marking by karabiner. DMM confirmed that this device can be used with a 1m cows-tail (inc. karabiners) Has completed EN 128341A with three lanyards DMM two point Nylon. DMM Two point Steel and Cows-tail.
SAR – Rocker **NB.** Drop 4 used 10cm SAR Twin-Eye: 30cm inc Karabiners Wide variation in slippage affected fall distance. The Single drop on the 10cm SAR Twin-Eye shortened the fall considerably. No apparent damage to Device. Slight marking by karabiner Wide variations on distance.	**Petzl – ASAP** **1st Drop resulted in sheath stripping and two inner cores failing, where the ASAP 'locked on' the rope was squeezed and damaged by heat (see below for picture).** 2nd Drop: Slight damage to rope but at the same position of where 1st had sheath failure. Deformation to body of both devices. Deployment of L57. Note: Petzl state "equipment must be retired when it has been subjected to a major fall (or load)"	**Petzl – Shunt** Some variation due to cows-tail tying. Wider range in slippage distance. No apparent damage to Device. Knot tightening and stretch in cows-tail.

Damage – 1st ASAP 100kg Drop Test

General Observations:

1. The 1st ASAP result was very unexpected and the Petzl representative, C. Blakeley, has taken a sample of the rope for investigations and Petzl will also examine the ASAP and the L57 Absorbica to try to determine the cause of this damage. Petzl say that they *"have not had any sheath damage of this type reported and have not managed to recreate similar damage in investigative testing of the same, similar and often more severe configurations."*

2. The higher the Back-up device is positioned and the less slack in the connecting cows-tail or lanyard the shorter any fall.

3. Devices that can be 'parked high' during work periods provide better levels of personal protection.

4. The Devices that slip to help absorb the shock loading were all useable after the drop test and useable as part of an escape evacuation system. The ASAP relies on the energy absorbing lanyard (shock-pack) to absorb the shock load, thus will have limited use in an eventual escape, as both the device body and the lanyard are damaged.

5. All devices require inspection following drop loading and where this is serious they should be removed from service.

Recommended actions:

Procedures, Supervision, Training and Assessment should reinforce the management of back-up devices and should **not condone** operatives to allow devices to hang low, or be left in low position when not moving. It is simple and efficient to manage 'hang-down' devices with its lanyard over the arm during ascent and descent or over the shoulder at work sites.

Considerations for further investigations:

The set-up of this test simulates a situation where there is only approx 1m of rope above the device and therefore very little energy absorption in the system.

Discussion regarding other situations/set-ups were discussed. Where more rope is above the device it is clear that rope stretch is a major factor in fall distance and often the most contributory factor. But also the elastic nature of the rope may affect the locking on of devices as was seen on later 200kg long rope investigations.

The more serious situation of when the Back-up device is just below or just above a knot and its cows-tail/lanyard is in a FF1* was not investigated. This occurs when operatives are required to pass re-belays, knots or when initially getting on ropes anchored just above but they then need to climb over handrails so the cows-tail or lanyards do have FF1 slackness.

* Where the device is level with its connection to the harness

.Q. Would devices above knots be damaged with no rope to allow slippage or absorb any shock?

Following pages show pictures of damage to rope and ASAP following 100kg Drop tests.

2nd 100kg Drop Test. Minor damage to rope caused by teeth. Red mark indicates stopping position of the top edge of the ASAP. The damage is where the teeth locked on.

1st 100kg Drop Test - Top end - Sheath failure and two of core strands, this is at the same position as on 2nd test.

1st 100kg Drop Test - Lower end - of failed sheath showing crushing at the point that the ASAP 'locked on'. The taper is where the wheel stopped and the shape is permanent due to heat distortion.

New ASAP – only teeth profile visible

Damage after 100gk Drop test – section of ‘wheel’ visible

Marking on inner face at the Anti-return stop – the small bump behind the wheel

New – No damage to body at clip point.

Deformation caused by Karabiner during 100kg drop test.

Deformation of device – small hole at top of device exposed.

More details of inspection - http://www.petzl.com/EPI/v2/epi-en/Asa/AsaGB.htm

Left New Right- Non Return of spring action

4.4 Back-Up device Attachment Point

In order to explore the consequences of a person falling on to a back-up device attached to waist, chest and back points of the harness live investigations were undertaken. Two sessions were completed one prior to the main ITEC conference and one during the conference. Volunteers: Arturas Vengalis - L3 Training Manager Gridins) & Rogerio Matos- L3 Assessor (Alpitec).

A vinyl banner was used to simulate a work surface it was weighted at its base to aid stability. The volunteers descended to a position with their heads near its top and their feet on the banner. With an additional safety system in place the working rope was failed and the volunteer came on to the back-up system. The trial was repeated with the back-up device lanyard attached to front waist (ventral), front chest (sternal) and back (dorsal) points of the harness.

The results from both sessions supported the following:

- At the work zone front attachment allows for easy positioning of the Back-up device high on its rope.
- Rear attachment makes it difficult for the user to position the Back-up device and may encourage users to neglect it.
- The video evidence showed:
- A fall on to one of the front attachment points kept users in the same orientation and the head moving away from the surface.
- If Chest attachment is used the body is pulled forward but not as dramatically as Back attachment demonstrations.
- A fall on to a 'Back' attachment results in the user being thrown into the surface and potential for head injury would have been considerable if the surface had been solid.
- Front attachment leaves the user in a good position for self-recovery.
- Rear attachment puts the user in an awkward position for self-recovery.

Both experienced volunteers expressed concern as to the disorientation and difficulty they had installing a descender onto a recovery rope after the 'Back' attachment falls.

Recommendations
IRATA Members should not use rear attachment point for the attachment of Back-Up Device.
(If risk assessment raises concerns regarding risk of damage to a back-up rope e.g. welding, cutting etc – a back attachment is not a suitable control measure).

IRATA Members should use safety systems that can protect operatives with minimal fall potential and without relying on operatives hanging off the back attachment point of the harness.

Questions for further consideration:
The body movements for different sized operatives will vary and the choice between waist and chest attachment may be more critical for some. Further investigations would provide a better understanding (with particular concern for the larger users).
Question:- Are back points suitable to suspended operatives from either as work system or as a back-up system or is it best to limit their use to attach restraint equipment?

4.5 ***INVESTIGATION - Rope Stretch - Back-up Rope Elongation (NO device used)***
Note: further detail regarding rope stretch is at section 5.0

This investigation shows that on long ropes the stretch that occurs when loaded following main rope failure is the most significant factor in the uncontrolled fall that occurs. The use of 'static' rope can reduce this distance.

At ITEC 2012 a demonstration to show how much stretch could be expected in the Back-up Rope in the

event of a Working Rope Failure was undertaken. This used a 200kg load to show a potentially bad situation that may occur in rescue situations.

To limit the findings to just rope stretch no devices were used and each drop was on to a pre-tied 'back-up knot'.

Three 50m different ropes were rigged via a series of adjacent pulleys to 18m above the demonstration area. The ropes were all anchored to the same point, 32m to one side.

Each rope was knotted 8m above the ground, thus 42m of rope from the back-up knots to the rope anchor and providing 8m of clearance to the ground.

The 200kg load was then raised on an electric winch and using an 80cm cows-tail attached to the 'back-up knot' repeated on each of the three ropes.

The 200kg was then allowed to fall on to the back-up knot.

The stretch/elongation was recorded once the load had come to a halt. It does not show the peak elongation which is evident from the video footage and there was over 1m of additional stretch in the 'bounce' before coming to rest.

Rope type	Rope Length	Stretch Elongation	Percentage
10.5mm Lanex (lightly used) – EN 1891 Low-stretch	42m	4.7m	11.2%
11mm Marlow 11mm LSK – EN 1891 Low-stretch	42m	4.4m	10.5%
11mm Sterling HTC Static - NAFP 1983 + CE0120	42m	2.7m	6.4%

Low-Stretch Rope was in excess of 10%

Static Rope was under 6.5%

General observations:

- *Rope stretch is a serious issue in all activities and is especially significant for the Back-up rope.*
- *Do not under estimate the amount of rope stretch during operational planning, especially when working close to obstructions or the ground and particularly where long ropes are being used.*
- *Allow for stretch in the planning of Rescue provisions*
- *Consider the use of Static Rope for operations though this should also assess potential impact loads*

Further investigations?

Undertake formal tests using free hanging ropes and measure the maximum elongation of ropes using 100, 125, 150kg loads.

Rescue load – more than 200kg?

4.6 ***Demonstration - Rope Stretch - Back-up Rope with Back-Up Devices***

This demonstration shows that the use of any back-up device on long ropes for rescue could result in an excessive fall distance which would be unacceptable as a safe system of work, therefore the effects of rope stretch must be prevented or mitigated.

In order to view the implications of the combination of Rope Stretch and Back-up device performance, demonstrations were undertaken. A 200kg rescue load was used and time constraints limited investigations to three demonstrations, one of each of the following devices: S.Tec Duck R, DMM Catch, and Petzl ASAP.

For each demonstration the device was installed immediately below a knot with 42m of 11mm Low-stretch rope to its anchorage.

The 200kg *test weight* was raised using an electric winch to a position where the base of the weight bags was 7m above the ground and the back-up attachment point 8m

Each of the three devices was attached to the test weight which was then released and the resulting fall and stretch was clear evidence that the length of rope above the Back-Up device is a far greater factor than the device performance.

The 'Catch' and Duck R both demonstrated their functional reliance on some slippage to absorb the excessive load, both slipping over 2m, the ASAP locked on the back-up rope and its L57 Lanyard deployed 53cm. **For all devices the stretch was the greatest factor in the fall distance**.

Both 'Catch' and Duck R produced glazing to the rope sheath whilst the ASAP concentrated its damage to one 7cm section at the 'lock-on' point, the rope was clearly bunched and thicker and the sheath had severe damage to fibers and a small amount of core was exposed. The thickness was measured to be 12.7mm wide, an increase of 1.5mm on the average measurement of 11.2mm.

Video evidence clearly shows that although slippage on the Catch and Duck R occurred and due to limited clearance in the demonstration set up, the weight bags touched the ground before bouncing back. The devices were seen to slowdown the speed of travel considerably. Inspection, and subsequent manufacturer's confirmation, showed that both devices were in still in good working order and suitable to continue an effective evacuation. The ASAP mechanism ensured a faster time before locking on the rope and the lanyard did not deploy to its full extension capacity. The ASAP Body showed clear signs of deformation and there was damage to the rope.

Observations:

- Rope stretch increases the uncontrolled descent distance. Free fall is limited to the distance travelled before the connecting lanyard /cows-tail becomes under tension.
- The position of the back-up device in relation to the load at time of impact will affect fall distance
- Combined Rope Stretch and Device performance should be considered and alternative back-up systems should be a serious consideration.
- Clearance distances and exposure times during operational tasks should be a major consideration in both planning methodology and equipment choices and be identified on Risk Assessments.
- The potential for rope damage is a serious concern with toothed lock-on type devices like the ASAP as seen in this IRATA test.
- The permutations of rope types, rope condition, rope lengths, operative weight and other variables suggest that more severe damage could occur with these types of devices with high loads, though they are intended to be used with an energy absorber.
- Other investigations have shown that device performance would have been less severe for all types of Back-up device if the Back-up was positioned higher on the rope in relation to the load suspension point – keep Back-up devices as high as possible at all times especially with large loads e.g. 2-person, or when using long ropes and especially when close to obstructions or the ground.

5.0 Ropes and Rope Stretch

5.1 Introduction

In Low-Stretch ropes; 5% stretch is frequently quoted, but where does this figure come from? The 5% is taken from the *EN 1891A Elongation test,* where a 3m length of rope is loaded to 50kg for 5 minutes then additionally loaded with a further 100kg for 5 minutes totaling 150kg. A formula from these measurements gives a result which must not exceed 5%

Whether this is the most appropriate measure of rope stretch for users in the Rope Access Industry is debatable.

The photos below show the effect of rope stretch when weighting the working rope

These pictures are from an Off-shore Turbine site and demonstarate the stretch during normal loading on a Working Rope – any dynamic loading of a Back-up Rope would be considerabily more even before considering device performance. Over 6m of rope stretch was measured on 72 m of Edelrid SUPER SAFETY 11mm Rope when loaded with an 80kg person

5.2 In order to illustrate the effects of rope stretch in practice, a range of ropes were weighted and the stretch measured.

Working Rope Elongation - stretch measurements

Load 100kg +/- 0.5%

Loading method – Grigri 2:1 hoist

LOW STRETCH ROPE

Marlow	11mm	Static Rope L.S.K. (low stretch kernmantle)	Nylon	10.08%	EN1891 A
Marlow	10.5mm	LSK	Nylon	10.02%	EN1891 A
Beal	10.5mm	Industrie	Nylon	10.4%	EN1891 A

STATIC ROPE

Marlow	11mm	Abseil Rope (Static)	Polyester	4.6%	NATO certified
Sterling	1/16” (11mm)	HTP Static	Polyester	4.5%	NAFP 1983 + CE0120

DYNAMIC ROPE

Lanex	11mm	Dynamic	Nylon	15.1%	EN892
Edelrid	11mm	Dynamic	Nylon	15.2%	EN892
Edelweiss	11mm	Dynamic	Nylon	15.9%	EN892
Beal	10.5mm	Dynamic (topgun)	Nylon	23.1%%	EN892
Mammut	10mm	Dynamic (galaxy)	Nylon	20.5%	EN892

General observations:

- *100kg static loading - More than 5 % elongation with Low-stretch rope.*
- *Static Ropes have considerably less stretch but also have less capacity to absorb any impact.*
- *10mm/10.5mm Dynamic ropes stretch more than 11mm.*

5.3 Rope Types

Presentation by Steve Pearman (Marlow) and Chris Edmondson (Lyon Equipment) on the different types of rope available.

- *Ropes do we know what we are using?*
- *Stretch – Low-Stretch vs Static - Standards may restrict some operator's choices*
- *Heat resistant – not heat proof*
- *Chemical resistant – not chemical proof*
- *Harder wearing - not cut proof*

Short distance longitudinal cut/wear along one side of a short section of rope sheath can be serious. Chris Edmondson explained that sheath wear on one side of a short section of rope can have serious consequences. Rope construction usually has all fibers spiraling around the rope core and it is possible that wear restricted to one side of the rope can actually result in the damage of every sheath fiber.

Rope condition

A general discussion relating to the condition of used ropes was supported by a display of used ropes.

These included:

- Wet rope – soaked for 24hrs +
- Oil soaked rope – light oil undertaken on previous day by Gridins
- Grease and oil contaminated – provided by an Operator Member
- Paint - both splattered and large areas covered – provided by an Operator Member
- General clean heavy and light abrasion wear - – provided by an Operator Member

Used Ropes were supplied by Oceaneering, Stork , Vertical Access & Gridins

General discussion highlighted:

- Ropes normally become thicker with increasing wear or contamination which affect the 'normal' operation (day to day up and down use rather than emergency deployment) making the device movement harder or impossible without excessive operator handling. This may encourage operatives to pull on devices in ways that would affect their emergency performance – wrapping 'shunt cord / towing cord' around fingers or squeezing any cam loaded Back-up device.

- Devices that normally run unassisted (Rocker & ASAP) may not run, resulting in slack rope occurring above an ascending operative, or locking on (becoming partially loaded) during descent and requiring de-weighting involving short use of ascending technique.

- Devices with teeth function better than cam loaded devices on greasy or oily ropes

- Contaminant materials may make rope damage less apparent.

- Cleaning problems - will cleaning products affect rope properties.

- Contaminants may affect the functioning of devices – may block them in open position, or render them ineffective or inoperable.

- Wear on devices – longevity of devices will be considerably shorter for those used on dirty, grit-contaminated ropes than those used on clean ropes.

- Long ropes where the combined weight of the rope below the device and the presence of contamination affects descender performance considerably.

- Contamination can pass on to rope protectors and other equipment and then to other ropes.

The overall the view was that however ropes perform when new it is up to Operators to evaluate any wear or contamination as to how they affect both the rope integrity but also the performance and selection of devices used for ascent and descent etc. Toothed devices may perform better than smooth cam faced ones on oil or grease contaminated ropes.

5.4 Managing back-up rope stretch during rescue: Shared Loading - Rescue with 2 x Descenders

A demonstration was carried out to show the rope stretch and other consequences of one rope failing during a rescue, where a technique to share the 2 person-load on both ropes is being used.

Two Gridins Level 3 trainers volunteered, one as rescuer and the other as casualty whilst a third L3 'failed' one rope.

Setup

2 x Low-stretch Ropes
2 x Descenders
Demonstration team weight 220kg
10m of rope above
8m of clearance below

The demonstration team were attached via the descenders 8m above the ground and 10m below the rope anchors.

An additional safety back-up was provided using a 3rd rope (dynamic) attached direct to the rescuer. It was independently anchored but had 2m of slack.

One of the Low-stretch ropes was 'failed'.

Observation

Very little change occurred and the demonstration team dropped between 20cm and 30cm with no violent movement. The rescuer was able to immediately continue descent on one rope if required (two ropes were used to complete the actual ITEC descent).

This technique has clear benefits in comparison to considerably longer falls that would occur on to an un-weighted back-up device taking into consideration the device slippage, elongation of cows-tails/lanyards, and the back-up rope.

Recommendations

- Planning of rescue provisions should consider this technique as an option.

This technique could be undertaken by competent rescuers once they have completed independent operational checks of both descent devices.

5.5 **Investigation: back-up stretch in event of 'Rig for Rescue' rope failure -120kg drop on Petzl ASAP with ASAP'Sorber 40cm**

An unscheduled investigation was agreed to highlight two issues that the conference raised.

Firstly the conference discussed the methods used to rig ‘releaseable’ ropes. Many used Petzl Stops because they still had them in the system, yet used Petzl ID’s for most descent work. Others purchased ‘Stops’ because they were more cost effective than ID’s if only used for releaseable systems. Others mentioned the use of locked off friction hitches with option to back these up with devices if needed – especially favourable if exposed for any period of time to marine environments.

The other issue was in relation to the fact that many operatives are heavier than the 100kg required by EN 12841 2006 Type A. Gridins personnel were very interested in the performance of the ASAP with the 40cm ASAP’Sorber with 120kg weight.

- An anchorage for the Back-up rope was established using an inverted Petzl Stop attached direct to an anchor on the structural steelwork. The rope was threaded and locked off.
- The 120kg load was raised and suspended by the rigging plate with the ASAP’Sorber hanging from the rigging plate’s higher point. The ASAP was fitted to the Back-up rope.
- The ‘working’ rope was failed.
- The ASAP held the fall with no noticeable damage to the rope.
- The 40cm ASAP’Sorber fully deployed to 80cm, though no measurement of forces was made
- The fall distance was 2.2m.
- The Petzl Stop was inspected and no damage was seen. The rope was compressed by the device but showed no signs of sheath or core damage.

Appendix 1

Planning **ITEC 2012**

April & May 2012

Once the aims had been agreed at the January 2012 Geneva General Meeting contacts were made with various equipment manufacturers to discuss any products that may be of interest and benefit to the Operator members.

The following were all positive in expressing interest and support for the event and provided much assistance in the supply of samples, equipment, advice and help in the practical running of the event.

Gridins	All Access Equipment for ITEC together	Weight bags & Ropes etc.
DMM	Back-up Devices	DMM 'Catch'& DMM Lanyards
ISC	Back-up Devices	ISC RED
Safetec (S.Tec)	Back-up Devices	Duck R & lanyards
SAR	Back-up Device	Rocker and Twin Eye Slings
Marlow	Ropes	10.5mm & 11mm Low-Stretch, Aramid, Dynamic & Diablo
Safetec (S.Tec)	Rope	Low-stretch Rope to Brazilian CA Standard
Web Rigging Services	Static Ropes	Both Blue Water and Marlow Static Ropes
RAT USA	Rope	Blue Water Armour-tech etc.
Gridins	Edge Protection	Edge Plates with rollers
Oceaneering	Rope Protection	Apple sac - Mark Stephen
High Q	Rope Protection	Altitech - Armadillo Rope Protector
Gridins	Rope Pro	Various including steel hinged tube design to fit on ropes.
DMM	Slings	Nylon & Dynema
DMM	Rope Protection	Canvas Rope Protection
Lyon Equipment	Rope Protection	Proflex, Rollers and Small Steel edge plate
Heightec	Rope Protection	Edge Rollers and other Edge Pro devices

Used Ropes were supplied by Oceaneering, Stork & Vertical Access

20th - 22nd March 2012 - Pre-ITEC IRATA visit to Gridins – Lithuania

IRATA representative C Parkin travelled to Gridins Training Facility in Lithuania to investigate facilities for the running of the proposed ITEC in May 2012. The visit allowed for liaison with Gridins technical staff as to what would be both practical and what the structures would allow.

- Measuring and evaluating both the indoor and outdoor technical venues as to suitability for completing investigations and the observation by attendees.
- Arranging what Rope Access and other Technical facilities would be available together with Gridins staff availability and language issues.
- Planning IT requirements
- Room requirements for estimated attendance of between 30 and 80 attendees.
- Delegate Accommodation at both training facility and Hotels in Town.
- Lithuanian ground transport arrangements.

April 2012

Telephone discussions with Marlow resulted in the committing to supply a considerable amount of various types of rope for use during the event and other investigations. Steve Pearman, Marlow Business Development also attended the ITEC.

1st May 2012 - IRATA visit to ISC (international Safety Components) Wales UK

A visit was arranged with ISC and C Parkin attended their factory Head Quarters in North Wales (UK) and held a meeting with the ISC Wayne Ellis, Commercial Director, Dave Rawlins Technical Sales and George Ullrich Technical Development. The primary area of discussion and demonstrations was in relation to the *ISC RED* a Back-up device primarily aimed at the Rope Access Industry.

ISC had meetings with Operator Members based in Aberdeen (UK) and several prototypes have been provided and tried by them. They also demonstrated a new industrial Descender that is very well advanced in design with auto locking and panic features. A prototype was made available for general viewing at the 2012 ITEC event.
ISC committed to sending a representative to ITEC.

2nd May 2012 - IRATA visit to DMM Wales UK

A visit was arranged with DMM and C Parkin attended their factory Head Quarters in North Wales (UK) and held a meeting with the Fred Hall, Technical Director and his design team. Again the focus was on Industrial Rope Access back-up device and the *DMM Catch* was demonstrated. C Parkin, Tony Loxton, Paul Shea, Mike Lamb (all Assessors) and Paul Beatie-Edwards (trainer) had previously been involved in various trials of other '*Catch*' prototypes including live drop tests. The device offers a change in focus and has a panic button fitted to the descent control handle. DMM also showed the *DMM Cows-tail* a two part lanyard that provides several choices in length; 80cm 60cm and 20 cm and can be attached at a harness waist point and without disconnection can be attached to a chest point.

DMM committed to sending a representative to the ITEC event and offered to supply samples of the new *Catch* and *DMM Cows-tail* together with slings and rope.

17th May 2012 – SGS Testing to EN 12841A

C Parkin and R Matos (Alpitec) were invited to oversee EN testing by SGS UK at the DMM test facility in North Wales of the DMM Catch and the S.Tec Duck R. Both devices successfully completed the tests. The tests were carried out under the direction of Phil Tate, SGS Senior Consultant PPE. Phil made it clear that he did not consider the EN 12841A to be fully suitable for Industrial Rope Back-up devices, as it does not allow for a device to be tested within the constraints of supplied or recommended connection devices (cows-tails or dedicated lanyards and the requirement for a 2m FF2 is artificial and suggest that this is a critical requirement. It focuses on the device stopping distance and not the load fall distance – the length of deployment of any shock-pack (energy absorber) or cows-tail extension is not considered in this certification. Neither of the DMM *Catch* or S.Tec *Duck R* are designed to be used with *shock-packs* and both rely on the device to absorb excessive energy, both met the stopping distance requirement.

Tests undertaken:
DMM Catch and the S.Tec Duck R both to EN 12841
S.Tec Lanyard EN354
S.Tec Slings EN795
S.Tec Harness (full body) EN361

Appendix 2

ITEC 2012 Program

Pre-event Conference Gridins Investigations

20th May 2012

- Test team arrive at Gridins and facilities reviewed by Alpitec Testers with Arturas Vengalis (Gridins)
- Adjustments to Scaffold platforms
- Planning and final design of rigging and lifting requirements
- *100kg Abseil Position* - Rigging drop test system for back-up devices new and existing
- *100kg Abseil Position* - Drop tests; ISC RED, S.Tec Duck R, Petzl ASAP, SAR Rocker
- Collating Results

21st May 2012

- *100kg Abseil Position* - Drop tests; DMM Buddy Catch & Petzl Shunt
- Installation of measuring banner
- Installation of 50m ropes 10.5,11mm & Static
- Stretch *'Stretch on Working Rope trial'* measurement – working rope
- Stretch tests using 200kg *No device used*- on knots at 42m
- Installation of 'vinyl-wall' (for *Body Position Investigations* Video available)
- 'Hitting the wall' - *Body Position Investigations* – Live: Rogerio Matos - Alpitec

Tuesday 22nd May 2012

- Introduction including presentation of Time & Motion Study
- Demonstrations of new Back-up devices
- 100kg Abseil Position Drop Tests - Review of results and a display of test devices and sections of rope used.
- Rope Movement – Demonstration of how much Back-up rope runs over an edge during emergency deployment.
- Back-up attachment point – '*Hitting the wall' - Body Position Investigations'* demonstrations of working rope failure with back-up attached to waist, chest or back attachment points.
- Lunch
- Rope Stretch – introduction including detail of the results of investigations on the Back-up rope stretch – excluding Back-up device performance.
- Back-up rope stretch - Demonstration of Back-up rope stretch combined with device performance.
- Rope Protection – presentation by Dave Towse (Remote Access Technology) of their process for dealing with edges during planning and daily hazard analysis.
- Rope protection – demonstration 'Getting over a top edge'
- Rope protection – display of various devices.
- Providing safe rope systems – presentation by Karl Raby (High Q) on his work with UK HSE to highlight the ways that rigging and devices can provide safe rope access systems.
- Shared Loading – demonstration of rope failure during rescue with two loaded descenders.
- Barbeque.

Wednesday 23rd

- Rope Types – presentation by Steve Pearman (Marlow) and Chris Edmondson (Lyon Equip) on the different types of rope available.
- Heat Mitigation Process - presentation by Dave Towse (Remote Access Technology) of their process for dealing with hot pipes and surfaces during planning and daily hazard analysis.
- Anchor Slings – discussion and display of various types of Slings used to anchor ropes.
- Rope to Rope – Demonstration of back-up device performance

- Presentation by Dave Towse – summary of the investigations under taken in the USA April 2012
- Rope condition – Discussion on working and back-up device performance on ropes that are heavily used, wet or soiled including a display of ropes in different condition.
- Lunch
- Questions from attendees.
- Close of technical session
- Conference dinner.