ON ROPE
North American Vertical Rope Techniques
New Revised Edition

By Bruce Smith and Allen Padgett
Illustrations by Ron Buffington

For
Caving
Search and Rescue
Fire Fighting
Rope Rescue
Mountaineering
Window Cleaning
River Runners
Rock Climbing
Arborists
Event Riggers
Military Operations
Challenge Courses
Nautical Applications
Rappellers

Vertical Section
National Speleological Society
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National Speleological Society

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Chair, NSS Special Publications Committee
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On Rope Liability Disclaimer
WARNING. Serious injury or death could result from the use of techniques and equipment described in this book. It is the reader’s responsibility to seek qualified instruction on the use and precautions of vertical rope work. Experience tends to be one of the best teachers. However, a mistake or misinterpretation of the material in this book could have irreversible consequences. Every person doing vertical rope work should use good judgement and a lot of common sense. This book is sold with no liability to the authors, editors, critiquers, publisher, or the Vertical Section of the National Speleological Society, Inc., expressed or implied, in the case of injury or death to the purchaser or reader.
Contents

<table>
<thead>
<tr>
<th>Page</th>
<th>Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>1 The Challenge</td>
</tr>
</tbody>
</table>
| 17   | 2 Rope  
      | Construction, Strength, Care, Inspection, Webbing. |
| 39   | 3 Ties  
      | Knots, Hitches and Bends, Efficiency, Characteristics,  
      | Anchor Knots, Midline Knots, Bends, Friction, Belays,  
      | Climbing Knots. |
| 57   | 4 Rigging  
      | Anchors, Back-ups, Bolts, Hangers, Reelays, Pads,  
      | Hazards, Drop Distances, Pull-downs. |
| 97   | 5 Rappelling  
      | Harnesses, Rappel Devices, Technique, Style, Reelays,  
      | Home Workshops. |
| 135  | 6 Ascending  
      | Climbing Systems, Practical Use, Technique, Style,  
      | Crossing Knots, Reelays, Directionals, Tandem, Home  
      | Workshops. |
| 177  | 7 Long Drops and Deep Expeditions  
      | Special Considerations, Planning, Equipment, Rigging,  
      | Rappelling, Climbing, Derigging, Expedition and Project  
      | Caving. |
| 197  | 8 Domes and Walls  
      | Underground Rock Climbing, Ethics, Techniques, Route  
      | Selection, Movement. |
| 211  | 9 Belaying  
      | Belay devices, Descending, Ascending and Rock Climbing  
      | Belays, Body Belays. |
| 229  | 10 Vertical Potpourri  
      | Gear, Lowering and Raising Systems, Highlines, Etiquette,  
      | Communications. |
| 265  | 11 Other Rope Users  
      | Arborists, River Rescue, Window Cleaners, Circus  
      | Riggers, Theater, Steeplejacks, Military, Aerial Tram  
      | Rescue, Ropes Courses, Firefighters, Hollywood. |
| 295  | 12 Vertical Skills and Rescue Training  
      | Basic Training, Intermediate, Advanced, Rope Skills,  
      | Changeovers, Self Rescue, Partner Rescue, Pick-offs,  
      | Teaching. |
| 323  | 13 Sources of Information |
| 333  | 14 History |
| 339  | 15 Glossary |
| 373  | Index |
Photographs

Front Cover  By Ralph Earlandson. Peter Dayton in Neversink, Alabama.


<table>
<thead>
<tr>
<th>Page</th>
<th>Chapter</th>
<th>By</th>
<th>Photograph Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>1</td>
<td>Stephen Capps.</td>
<td>Roger Wells on rope in Mystery Falls, Tennessee.</td>
</tr>
<tr>
<td>17</td>
<td>2</td>
<td>Peter Jones.</td>
<td>David Jones carrying coiled rope in the Guadalupe Mountains of New Mexico.</td>
</tr>
<tr>
<td>39</td>
<td>3</td>
<td>David Bunnell.</td>
<td>Sunbeam in Cova Negre, Mexico.</td>
</tr>
<tr>
<td>57</td>
<td>4</td>
<td>David Bunnell.</td>
<td>Rappeller on Münter Hitch in Resistol Cave, Mexico.</td>
</tr>
<tr>
<td>97</td>
<td>5</td>
<td>Ralph Earlandson.</td>
<td>Gordon Fulks in the Warm-up Pit, Ellisons Cave, Georgia.</td>
</tr>
<tr>
<td>135</td>
<td>6</td>
<td>John Van Swearingen.</td>
<td>Marion Ziemons in Off Limits, Alabama.</td>
</tr>
<tr>
<td>138</td>
<td>6</td>
<td>T.C. Barr Jr. Bill Cuddington in Haynes Cave, West Virginia. Taken during the first cave trip where Single Rope Techniques were used.</td>
<td></td>
</tr>
<tr>
<td>177</td>
<td>7</td>
<td>David Bunnell.</td>
<td>Four climbers on two ropes in Sotano de las Golondrinas, Mexico.</td>
</tr>
<tr>
<td>229</td>
<td>10</td>
<td>Peter Jones.</td>
<td>Rappeller at top of Boulder Falls, Lechuguilla Cave, New Mexico.</td>
</tr>
<tr>
<td>295</td>
<td>12</td>
<td>Scott Fee.</td>
<td>Jay Knapp practicing a heel hang recovery in an Indiana Pit.</td>
</tr>
<tr>
<td>323</td>
<td>13</td>
<td>Scott Fee.</td>
<td>Jackie Allen on rope in Jug Hole.</td>
</tr>
<tr>
<td>333</td>
<td>14</td>
<td>Buddy Lane.</td>
<td>Bill Cuddington coming over the lip of Sotano de las Golondrinas, Mexico.</td>
</tr>
<tr>
<td>339</td>
<td>15</td>
<td>Peter Jones.</td>
<td>Don “Wisdom” Kleuver climbing Boulder Falls in Lechuguilla Cave, New Mexico.</td>
</tr>
<tr>
<td>373</td>
<td>Index</td>
<td>David McClurg.</td>
<td>The 105-foot entrance pit in Tenextepec Cave, Mexico.</td>
</tr>
</tbody>
</table>
Profiles

Bruce Smith (NSS 12458F, CM).
Smith began caving in 1961 at the age of 13 with an Illinois Explorer Post. In 1968, he began vertical caving with half-inch manila rope, two Hieblers, and a book of directions. Through contacts in the vertical world, information was acquired, and Smith became a vertically knowledgeable person. Experience and a lot of research helped gain him the recognition of being the first editor of Nylon Highway, the publication of the NSS Vertical Section. He has been active with the Vertical Section since its beginnings.

Smith considers himself a generalist, able to review and analyze all different techniques and vertical designs. To further his generalist aims, Smith makes it a practice to try out new devices and techniques as they are developed. His goals focus on becoming the artistic technician focused on being precise about terminology, techniques and methods. He is then able to speak and publish reliable, usable vertical information so all can enjoy the aspects of safe vertical work.

Though originally a West Virginia caver, Smith relocated to the TAG area (Tennessee, Alabama, Georgia) to be with the caves. He teaches regularly for the National Cave Rescue Commission and is a member of the Chattanooga Hamilton County Rescue Service, Cave and Cliff Unit. Currently, Smith and his wife, Lyn, own and operate On Rope 1, Inc., a company that trains, educates, manufactures, and markets custom rope climbing equipment. Smith practices his vertical work in TAG or in his old favorite, Hellhole Cave, West Virginia.

Allen Padgett (NSS 10371F, CM, L).
Padgett first began caving as a “flash light” type with a high school biology class in 1963. He was introduced to organized caving in 1967, where he learned a great deal from the early TAG (Tennessee, Alabama, Georgia) cavers. With the TAG group he participated in many explorations and discoveries in the Southeast. An early concern for safety and an involvement with a near tragic vertical accident prompted a desire to learn, teach, and share knowledge. Padgett was Safety and Techniques chairman of the National Speleological Society from 1979 to 1983 and has been an active member of the Vertical Section of the NSS since it began.

Also active in search and rescue, Padgett is a member of the Mountain Search and Rescue Team of the Georgia Department of Natural Resources.

Another interest is working with Search and Rescue Dogs of Georgia to locate lost persons. Search and rescue teaching for the Georgia Emergency Management Agency and the National Association for Search and Rescue occupy a lot of spare time. In cave rescue, Padgett along with his wife Karen, are members of Walker County Fire-Rescue, Cave, and Cliff Team. Padgett puts aside a little time each year to act as an instructor at the annual NSS National Cave Rescue Commission training seminar. As a Game & Fish ranger since 1971, vertical rope applications are often a part of his work. As the Area Manager for the Pigeon Mountain Wildlife Management Area, Padgett is responsible for Ellison’s Cave with its 586-foot deep Fantastic Pit. Imagine being on rope in a pit and “being at the office.” Padgett can.

Padgett’s varied background in the areas of vertical work, combined with his drive for safety, together provide the beginnings for others to enjoy safely the On Rope experience.
Ron Buffington. Buffington received his Bachelor of Fine Arts degree from the University of Tennessee at Chattanooga in 1989, and his Master of Fine Arts degree from DAAP at the University of Cincinnati in 1992. He writes and lectures about contemporary art and exhibits his paintings nationally. He is currently an Assistant Professor of Art (Painting/Drawing) at the University of Tennessee at Chattanooga.

Buffington would like to express his appreciation to Karen Vann, whose support has been instrumental to the completion of this project, and Bruce Smith, a former student who served as an advisor and mentor regarding the world of ropes.

David McClurg. (NSS 4608F, OS). McClurg began caving in 1956 while on assignment in the U.S. Diplomatic Service in Curaçao (Netherlands West Indies)—a tropical island resting on a coral limestone base riddled with caves. He has remained an active caver ever since (albeit curtailed somewhat past age 60). Following a tour of duty in Germany, he settled in the San Francisco Bay Area. There he spent over 25 years exploring the caves and lava tubes of California, most other parts of the United States, Mexico, and Slovenia.

In 1985, he and his wife—Janet, constant caving companion—relocated to Carlsbad, New Mexico. From this home base, they continue to explore and photograph the beautiful and extensive caves of the Guadalupe Mountains, and to travel with their trailer to visit grandchildren—and caves.

McClurg’s instant initiation into vertical caving began in 1960 with a 110 foot brake-bar rappel into—and a 90 foot cable-ladder climb out of—Black Chasm, a challenging vertical cave in California’s Mother Lode country. In subsequent years, he has dropped pits and outdoor cliffs in California, Arizona, New Mexico, TAG country, and Mexico.

For over a decade, he has coordinated the annual Vertical Section techniques workshop, which has introduced vertical caving to over 500 neophyte cavers. He is the author of three books on beginning caving techniques, the latest entitled Adventure of Caving.

Active in the National Speleological Society since 1958, McClurg has served as an NSS vice president, a board member, and a chair of various committees. Currently, he is chair of Special Publications, the committee responsible for the Society’s publication program.

By profession, a photographer, writer, and graphic designer, he designed and supervised the production of both editions of On Rope.
Acknowledgements

Throughout its two-plus years of preparation, this new revised edition of *On Rope* has been reviewed and critiqued by dozens of people. Their efforts have brought field-proven reliability to the contents of *On Rope*. It is the input from the reviewers that has allowed the authors to push aside the myths and write and illustrate what really happens. The process has been cumbersome, but effective.

After the initial research and writing, each chapter was mailed to a number of reliable sources, many of whom were officers in the Vertical Section of the NSS, who critiqued the chapters for content, accuracy, and reliability. After retrieving the input, the authors sorted out the information, often during marathon get-togethers. The consolidation became the best-of-the-best, so to speak.

This in turn was presented again to other key critiquers. Adjustments seemed never-ending. Because so many gave so freely to this project, *On Rope* the first North American SRT book, and *On Rope—New Revised Edition* was the answer to the outcry from rope users for more.

William F. Boehle
Gary Bush
Bill Bussey
Miriam Cuddington
Bill Cuddington
Jon Dragan
Mike Fischesser
Joe Ivy
Arnör Larson
David McClurg
Tray Murphy
Ed Sira
Gary Storrick
Gary Taylor
Kent Weber
Robert Wells

The proof readers, Lyn Smith, Jayne H. Smith, and Traci Potter deserve a special applause after enduring page after page of meaningless (for them) information.

Several individuals sacrificed time and resources to bring the facts to print. These include: Don Blair, Stefan Bright, Keith Burrows, Louie Clem, Jon Dragan, Dave Dudley, Mike Fischesser, Maureen Handler, Steve Hudson, William Shrewsbury, Roswell Jones, Buddy Lane, Mike Mather, Kirk and Katie Mauthner, Alex Sproul, Catherine Tait, Jim Wall, Kent Weber, Robert Wells, Dennis Fetter, and Rock Creek Outfitters in Chattanooga, Tennessee.

Special thanks to the Hamilton County Rescue Squad who shared money and resources which afforded the opportunity for attendance at special rigging classes in British Columbia.

Other individuals who cooperated or played important roles in the book’s financing, proof reading, and printing were style editor Barbara Ritts, Tom Rea, David Luckins, Fred Wefer, and the NSS Board of Governors.

We would also like to thank all those who pushed so hard to make the original *On Rope* a reality. Without these friends none of this would have happened. We also want to thank those (local and international) who wrote in and called to share their discoveries of errors or omissions in the original book. This is how *On Rope* matured into the higher technical approach that we feel it is today.

The authors and illustrator want to extend a special public thank-you to their spouses, Karen and Lyn who endured the grossly underestimated amount of time necessary to do it all again.

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The NSS Special Publications committee would also like to thank Janet McClurg and several other committee volunteers who helped produce the camera ready materials for the printer.

Trademarks

Trademarked items referenced in this edition of *On Rope* include:

- **Goldline**: Columbian Rope Co.
- **Samson 2-in-1**, **Banana Line**, **Monkey Line**: The American Group
- **BlueWater**, **Bluewater II**, **Bendz**: Bluewater Ltd. Inc.
- **PMI**, **Max-Wear**, **E-Z Bend**: Pigeon Mountain Industries, Inc.
- **Rhino Ropes**, **Rhinocoat**: Wellington-Puritan
- **CMC**: CMC Rescue, Inc.
- **FUENON**: Caimgorm Climbing Rope Co. Ltd.
- **KMII**, **KMIII**, **Maxim**: New England Ropes, Inc.
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- **Super Braid**, **Wallthane**, **E-Z-V**, **Arbor Plus**, **Tree Pro**: Wall Rope Velcro: Velcro USA, Inc.
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Dedication

To Lyn and Karen

For their patience and acceptance
of our second greatest love.
1 The Challenge
1 The Challenge

A BASE JUMPER, hanging thirty feet off the ground from parachute shrouds—tangled in branches of what seemed the only tree on the beach—swayed back and forth as a green uniformed park ranger approached the challenge. The West Virginia Bridge Day crowd looked on as the ranger proceeded to attempt to climb the tree to rescue the unfortunate base jumper.

Clad in a seat harness and two attached 15-foot etriers, the ranger began to systematically girth hitch up the tree, jockeying his weight back and forth between the two etriers. He could only place the etriers as high as he could reach so his progress was slow. He retied each etrier with each step.

For an arborist, it must have been painful to watch. Progress was measured in short 8 to 12 inch bites. Frequently, the ranger got tangled in his long etriers, and they in turn got tangled in branches.

Hours passed as this dedicated ranger worked to rescue the drifter. Rangers on the ground placed rubber river rafts in a pile below the parachutist to cushion a fall. The climbing ranger finally reached the branch that had hooked the base jumper. He threw a safety line over a crotch in the shin-bone sized limb and at this point ran out of tricks.

What could the ranger do? Turn from his perch and yell for an arborist in the crowd to coach him on his next move? Would it have been appropriate for a rope rescue dude to strut forward and announce to the ranger:

“I know how to perform aerial rescues.”

Would the ranger’s liability have allowed him to welcome the help? Would his ego?

No, the ranger was on his own with an empty bag of tricks. In the painful end, the ranger used a handsaw to cut the limb. The jumper fell onto the rafts, unharmed. The ranger as well as the jumper were lucky. The parachutist could have died from compartmental syndrome or bounced off the rafts onto a rock, and the ranger easily could have died of frustration or embarrassment.

They both had harnesses. They both had vertical skills. They both were apparently not afraid of heights.

More Skills Needed

But, they both lacked the skills they needed to cross the line to another discipline and use their bag of tricks to serve selfish purposes. This is what On Rope is all about—filling that bag with techniques and methods, crossing the lines into other disciplines, and providing casual rope users with the knowledge they need to become accomplished rope and rigging technicians.

A second edition of On Rope has been needed almost since its first publication in October 1987. Since the technology has been refined—and in some cases redefined—a new rope user’s manual has been sorely needed.

An exciting outcome of On Rope has been the initiation of a cross pollination among the rope-using cultures of the world. There are millions of people in the world who own some form of a seat harness and use ropes, lanyards, and wire rope. They expose themselves routinely to the pull of gravity, defy heights, and challenge the elements. These millions of people are now discovering other exciting high angle activi-
ties. Many of these efforts actually provide a paycheck.

*On Rope* contains descriptions of practical equipment and safe rope-work techniques commonly used in North America. It is the instruction manual for single rope techniques. This book will never claim to contain everything a rope-meister should ever know. However, it is a great springboard to many of the philosophies and techniques needed by rope users.

**Who needs *On Rope***?

Anyone who needs to know about the equipment and skills necessary to go up and down a fixed rope should study this book carefully. Included are:

- Cave explorers
- Mountaineers
- Firefighters
- S.W.A.T. personnel
- Arborists
- Circus riggers
- Theater crews
- Military people
- Sailors
- Rock climbers
- Roofers
- High angle rescuers
- Hollywood
- Ropes courses users
- Steeplejacks
- River runners
- Window cleaners
- Bridge inspectors
- Blimp operators
- Rescue helicopter pilots
- Ski lift rescuers
- Tramway operators
- Rain forest canopy workers
- Forest rangers.

*On Rope* will help these people, from beginners to old-timers, approach the topic correctly. The sequence of chapters and many illustrations make the book a “natural” for use as a classroom text or as a reference book to be consulted again and again.

**Abundance of Gear**

There is an abundance of rope-oriented equipment for sale out there. However there is a lack of information on its proper use. In addition, the woods are full of semi-trained, word-of-mouth trained, and I-think-it-works-this-way “experts.”

People looking for information on ropework are often without resources. There really is no set standard for competence in an instructor. Instructors are often judged by the drops or caves they have done.

“Experienced” old-timers are often not up to date on current trends, methods, and systems, and are too prideful or embarrassed to ask. These old-timers are encouraged to update themselves and remain current. *On Rope*, along with quality instruction and hands-on practice, will produce competent vertical people.

**North Americans**

The basic North American is caver an individual working alone or as part of a team working toward common objectives. If two climbers have an identical rig, it happened by mistake. The wonderful thing about this individuality is that it encourages innovation, experimentation, and discovery.

North Americans—primarily cavers—began to define the technology in the 1940’s and developed the three-knot climbing system in the 1950’s, which is still in use. The 1960’s brought advances in technology combined with increasing numbers of people taking to the out-of-doors. Then, during the 1970’s, 1980’s, and 1990’s, the type of gear and its availability expanded exponentially.

The number of rope users increases dramatically each year. The fire/rescue market, realizing the importance of the technology, has emerged as America’s largest user of rope and related equipment. With that growth comes the increased challenge to educate and train these people in the proper use of single ropes and their associated equipment.
Who Made *On Rope* the Authority?

You did. The two authors do not claim to have all the answers. Fortunately, there is a vast amount of research now available on various topics. Each chapter concludes with a list of references used to prepare that chapter. These reference lists are not to be considered an exhaustive bibliography but, rather, an available reference for further study of topics discussed in each chapter.

After the initial research and writing, each chapter, along with the rough proposed drawings, was sent to knowledgeable individuals, the Vertical Section Board members, volunteers, and specialists. Their comments were then collected and incorporated into each section. Proofreaders repeatedly provided review at each step of the process.

The Glossary

The Glossary is a list of technical terms that usually are defined in the text when first introduced. However, if the reader happens upon an unfamiliar word, consult Chapter 15, the Glossary. This compilation not only defines words used in the text, but also terms likely to be encountered in training classes or contacts with other rope users.

New Ideas Welcomed

In the end the authors were the final jury. Subjects such as mountaineering, nautical, rock climbing, and rescue have been left to the specialists. There already exist vast libraries written by seasoned experts on these subjects to which *On Rope* could not do justice.

With regard to SRT (Single Rope Techniques), there always will exist differing opinions. The authors have attempted to remain objective. There is no doubt the future will reveal that some of the practices detailed in *On Rope* can be improved by some technique or piece of equipment yet to be developed.

Suggestions, criticism, new ideas, techniques, and equipment are always welcome. Contact the authors through the National Speleological Society office. The address is in Chapter 13.

A Practical Approach

*On Rope* is a practical approach to North American ropework skills. Whether you call it ropework, vertical work, or SRT, the technology of all the different users of rope has one common goal, getting *On Rope*.

As this organization has grown, it is obvious that it has become the epicenter of the rope using world. It is important for rope users to recognize that using rope can be dangerous and should never be approached in a cavalier fashion.

Users are encouraged to rise to a new plateau of self expectation. Experienced, competent users will be called upon by the courts, armed forces, industry, rescue, adventure seekers, and a long list of those seeking the correct and safe way to use ropes.

Sound, thorough knowledge based on current tested facts should determine the approach to this topic and not the “feel good” approaches that too many of the old guard rely upon.

Be progressive. Be precise. Be the technician that is necessary to remain on the safe leading edge of this craft. Never lose the passion for that which you love.

It is important for rope users to recognize that using rope can be dangerous and should never be approached in a cavalier fashion.