2019_Feb_Newsletter

Off-Road Safety Academy

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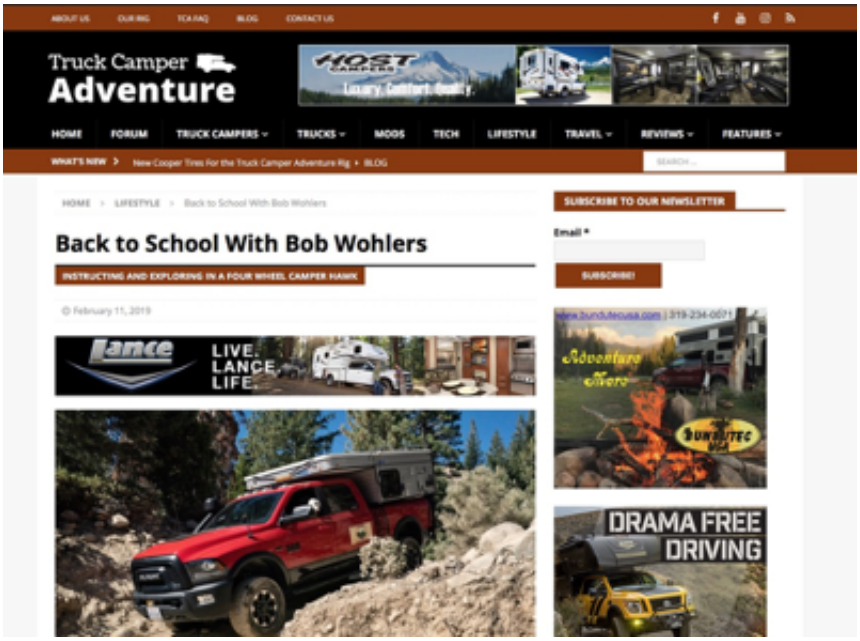
Hello Newsletter Subscribers,

Thank you for signing up to receive my training-centric newsletters. I hope you've found the previous editions informative and helpful for your vehicle-supported adventures. I trust you will enjoy this months newsletter. If you have comments, please email me: Bob.Wohlers@discoveroffroading.com.



Truck Camper Adventure Online Magazine recently interviewed me. This was an honor to be interviewed by this wonderful magazine! Read the interview by clicking HERE.

Determining Mechanical Advantage When Using Winch Pulleys

My newest book, due out in April – *The Total Approach to Getting Unstuck Off Road – 4WD Self Recovery & Vehicle-Assisted Recovery* – has an entire chapter titled:

Don't Make Your

Prior to winching, reduce the resistance of the terrain keeping your vehicle from moving. This is the easiest way to keep your winch from working so hard!

Winch Work so Hard

In this chapter I talk about four primary methods you can use to keep your winch from working so hard:

- Reducing Pulling Resistance at Your Vehicle
- Setting Up Straight Line Pulls
- Removing Winch Line Layers from Your Drum, and
- Using Pulley Blocks

If you don't use these techniques to keep your winch from working so hard, it's quite easy to damage your winch by burning up it's motor. It will also be much harder to extract a stuck vehicle. This newsletter edition's content is a bit complicated, but you can figure it out if you read carefully.

If you have a winch or are planning to get one, you need to get my book. Of the fourteen chapters in the book, seven chapters discuss the safe art of winching. Why so many chapters on winching? Simply put, powered winching (with an electric or hydraulic winch) is the only recovery technique that can be used for both Self-

Recovery and Vehicle-Assisted Recovery. With a winch, you can help yourself get unstuck and help others. If you plan on going Remote, Solo, and perhaps International (or RSI as my 4WD students know it), then a winch is practically a necessity in the backcountry. I have a winch on each of my three off-road vehicles.

Of the four techniques listed above to help your winch pull a heavy resistance load with less effort, the use of pulley blocks is one of the most misunderstood. Pulley blocks can be used in winch-rigging to solve two important problems: 1) To angle or change direction of a pull, and 2) To add mechanical advantage to the rigging set-up.

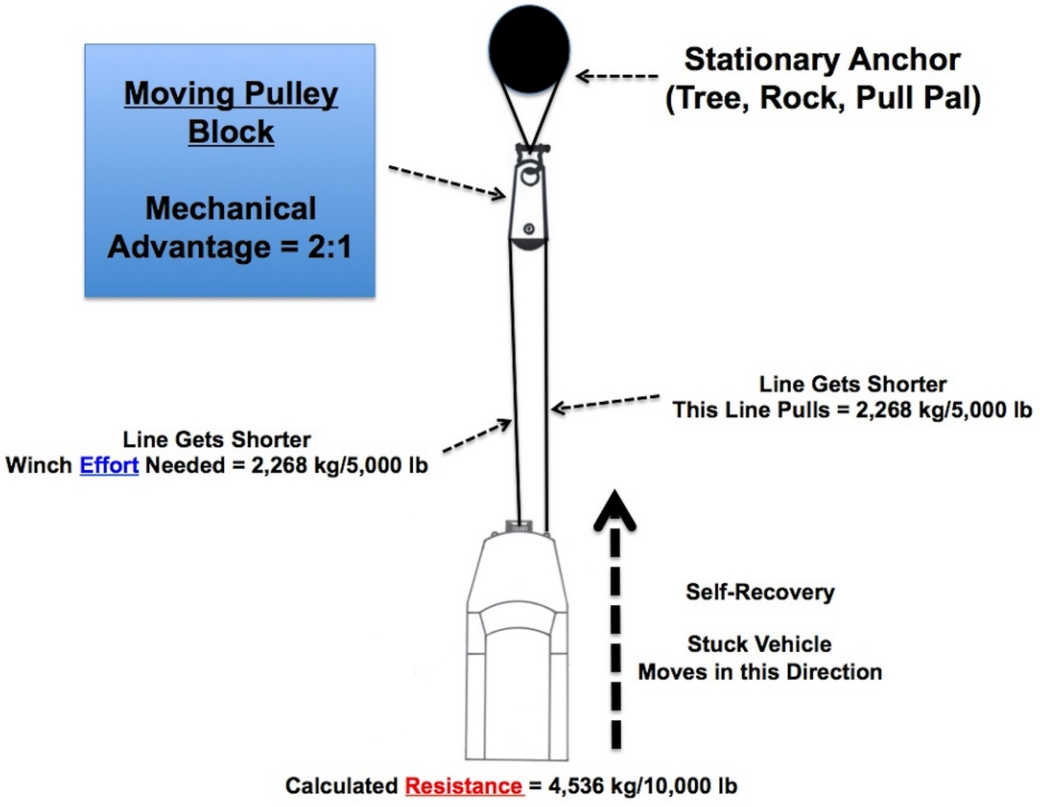


FIGURE 1

When used to achieve mechanical advantage, pulley blocks allow your winch to pull a greater resistance load with less force. In this respect, pulleys are “force multipliers.” When using pulleys in winch rigging to achieve mechanical advantage you can get a severely bogged vehicle unstuck, climb over a difficult obstacle, or move a heavy object off a trail all without your winch even breaking a sweat.

So, how do you determine whether a winch-rigging set-up with pulleys has mechanical advantage and acts as “force multipliers?" There are two methods – one for *simple* winch-rigging set-ups (only one line in the rigging) , and other for more *complex* winch-rigging set-ups (more than one line in the rigging). Let’s look at each method by examples of differing winch-rigging set-ups.

Figure 1 shows a typical double line winch pull. This simple rigging set-up is often used by recreational off-roaders to get unstuck and self-recover. To determine the mechanical advantage of a simple, single-line winch-rigging set-up, you only have to:

Count the number of winch lines that get shorter within rigging set-ups.

OR:

Count how many winch lines actually pull a vehicle or object.

In **Figure 1** the vehicle’s winch pulls the vehicle toward the stationary anchor, causing two lines to get shorter in the same direction. Another way of thinking is that two winch lines actually pull the stuck vehicle. This means that this rigging set-up has a 2:1 mechanical advantage. If the vehicle’s winch has a

manufacturer's rated pulling capacity of 8,000 pounds for a single line pull (and all but one layer of line off the winch drum), then a 2:1 mechanical advantage gives this winch a total pulling capacity of 16,000 pounds. At 16,000 pounds, this stuck vehicle will be easily extracted.

Calculating Mechanical Advantage for Complex Winch Rigging

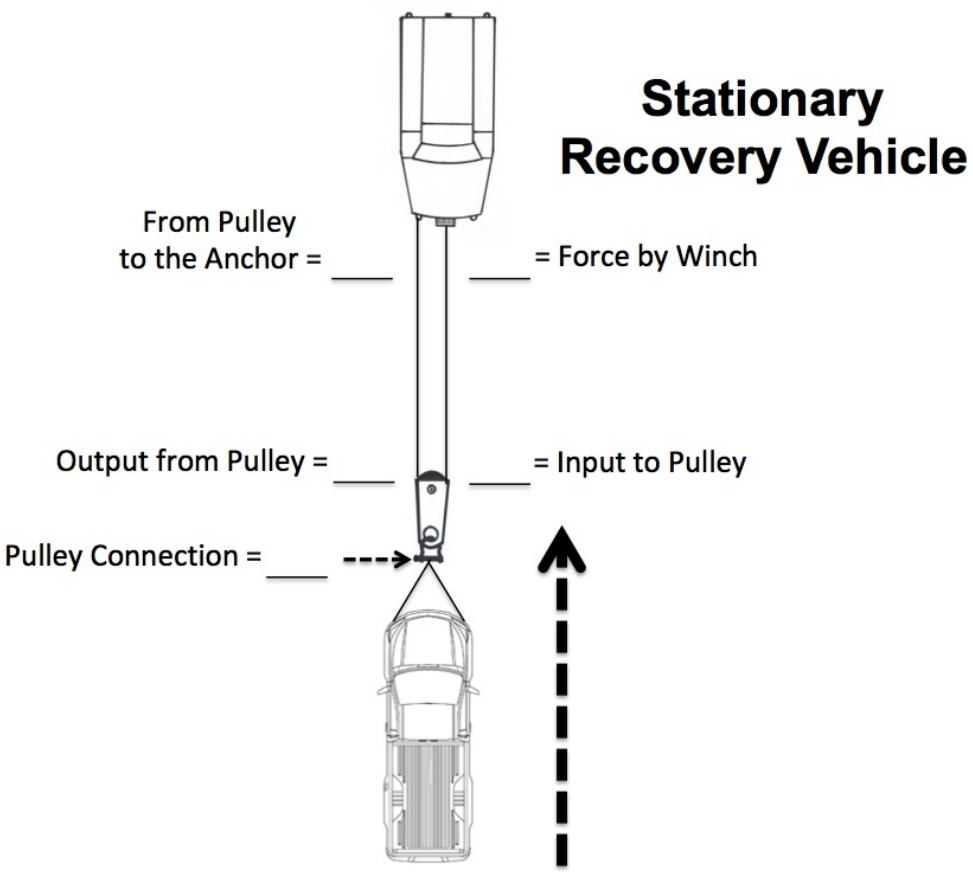


FIGURE 2

In complex winch rigging set-ups (set-ups using more than one rope) you need to do more than simply count the number of winch lines that get shorter when pulling a resistance load to determine "mechanical advantage." To accurately determine mechanical advantage **in any rigging set-up** you can use what is commonly called the T-Method (T = Tension). Go ahead, Google this method. You'll find that mountain climbers use this method all the time to determine mechanical advantage in complex rope set-ups using pulleys. This method's been around a long time. There are also several YouTube videos you can watch. Rather than using the word "Tension," we'll use the word "FORCE" since winching involves horizontal movement.

Let's walk through this method of determining mechanical advantage in two winch-rigging set-ups step-by-step – first with a simple rigging set-up (using one line), then a complex set-up (using two lines). For example, a winch-rigging set-up where one line comes from the winch itself, and a second line is from the use of a winch line extension.

NOTE: In complex winch rigging set-ups using two lines, you CAN'T simply count the number of winch lines that get shorter when pulling a resistance load to determine "mechanical advantage." This method of determining mechanical advantage DOES NOT work.

Step 1: Always start counting FORCE ("F") from the winch, then work your way through the rigging set-up, rope-by-rope, back to the RESISTANCE LOAD (in this case a stuck vehicle). Put F-1 at the winch (one unit of FORCE). A winch will always have a FORCE of one.
Step 2: Next, place three blank lines next to EACH pulley – one where the line enters the pulley, one where the line exits the pulley, and a blank line at the pulley connection point (in this example to the stuck vehicle).
Step 3: Also, place a blank line everywhere a line returns to an anchor (in this example from the pulley to the recovery vehicle). **See Figure 2.**

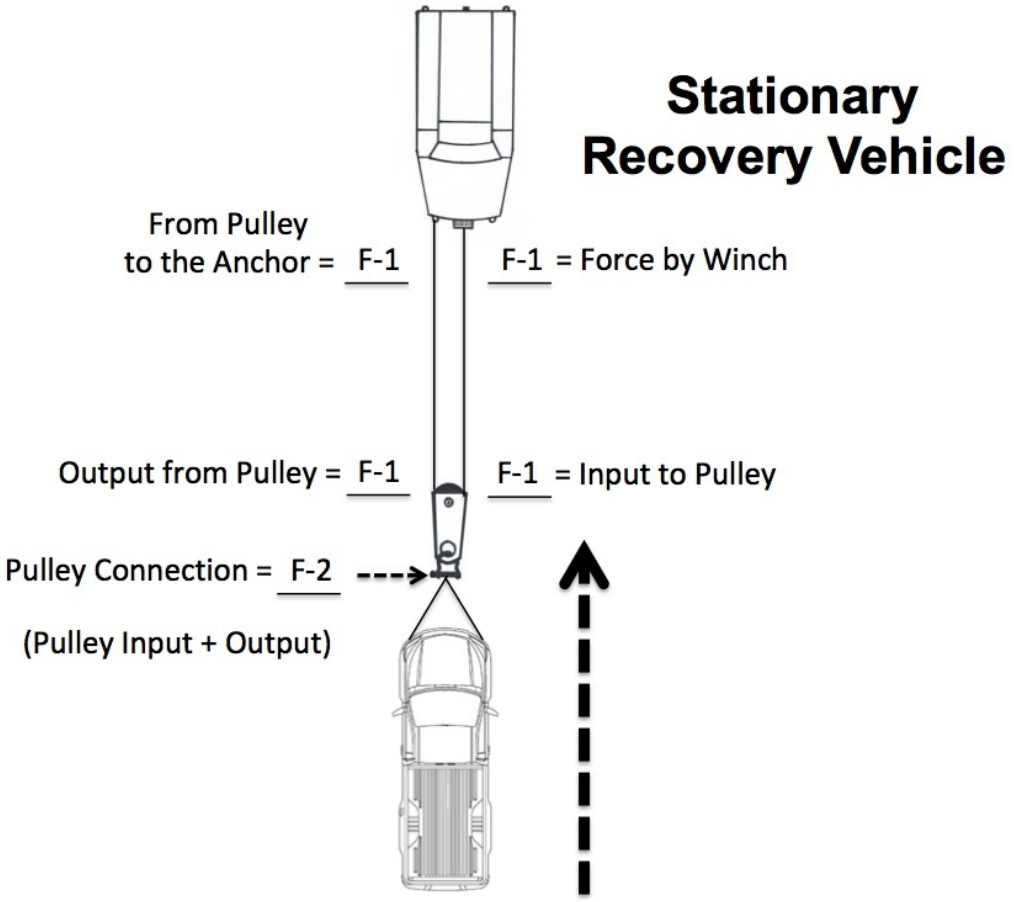


FIGURE 3

Step 4: Now, fill in the blanks as shown in **Figure 3**. You have the winch producing "1 FORCE." That same FORCE travels through the line to the input side

of the pulley. Whatever FORCE enters the pulley, that same FORCE will exit the pulley. To determine the FORCE at the Pulley Connection, you simply ADD the Input and Output FORCES of the Pulley: F-1 + F-1 = F-2. Pulleys are force multipliers, so the pulley connection has a F-Value of 2. The mechanical advantage is the total FORCE connected to the stuck vehicle (a force of 2 in this example) compared to the FORCE generated by the winch (it's always a force of 1). Therefore, the simple winch-rigging set-up in **Figure 3** generates a 2:1 Mechanical Advantage.

Let's now try this method of determining mechanical advantage on a COMPLEX winch-rigging set-up (rigging set-ups with more than one line). With complex rigging set-ups you CAN'T simply "count" how many lines get shorter to determine mechanical advantage.

Step 1: Again, always start counting FORCE from the winch, then work your way through the rigging set-up, rope-by-rope, back to the RESISTANCE LOAD (in this case a stuck vehicle). Put F-1 at the winch (one unit of FORCE).
Step 2: Now place three blank lines next to EACH pulley – one where the line enters the pulley, one where the line exits the pulley, and one at the pulley connection point. Also place a blank line at each anchor point. **See Figure 4.**

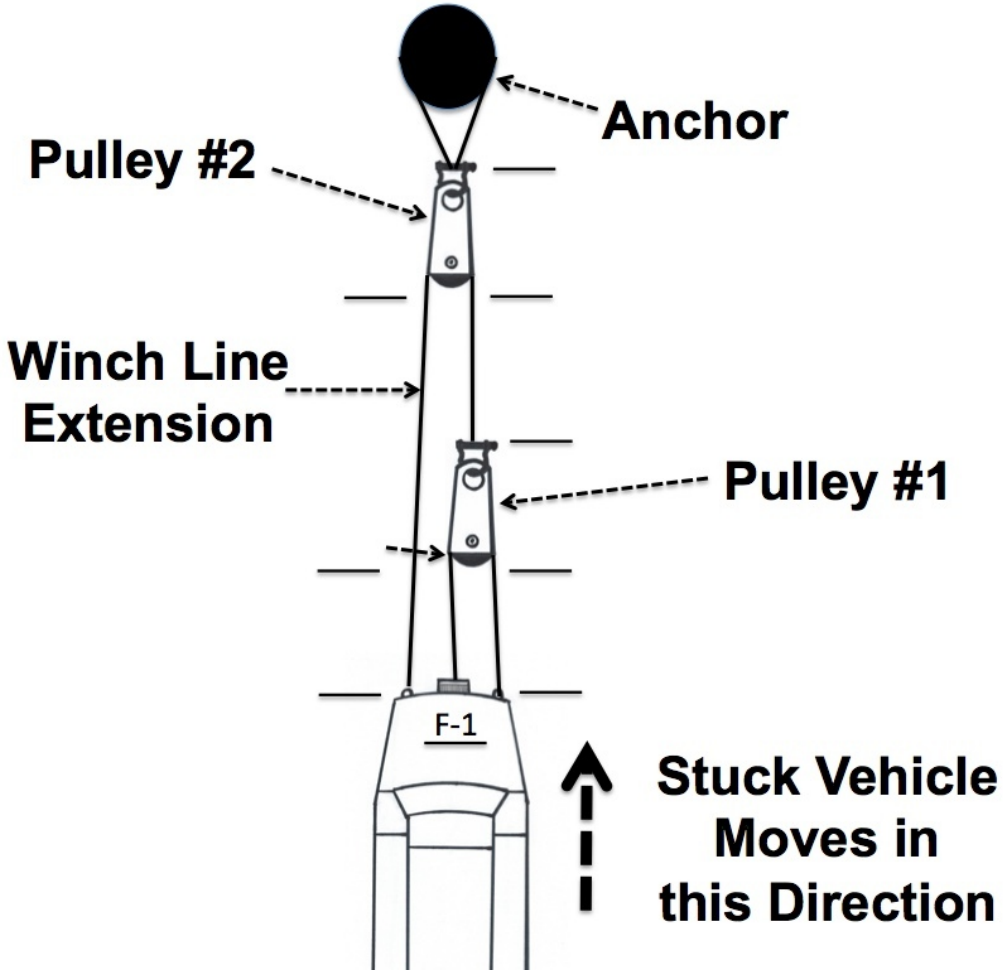


FIGURE 4

Step 3: Much like the first example fill in the blanks as shown in **Figure 5**. You will always have the winch producing "1 FORCE." That same FORCE travels through the line to the input side of pulley #1. Whatever FORCE enters a pulley, that same FORCE will always exit the pulley. To determine the FORCE at Pulley #1's Connection, you simply ADD the Input and Output FORCES of the Pulley. You ADD the input and output FORCES of the line because pulleys are force multipliers. Following this rule, the connection point at Pulley #1 will be FORCE 2 (1+1=2). That FORCE 2 travels up the winch line extension to the output side of Pulley #2. Since a pulley always has the same force on the input and output side, you also have F-2 at the input side of Pulley #2. To arrive at the total FORCE at Pulley #2's connection point to the Anchor, you add Pulley #2's input and output forces (2+2). This gives you a FORCE 4 at the anchor's connection point.
Step 4: The mechanical advantage is the total FORCE connected to the stuck vehicle. In this example you add up ALL the F-Values at the stuck vehicle, including the F-value of the pulling winch. From left to right you have F-2 + F-1 + F-1 = F-4. The FORCE generated by the winch is always 1. Therefore, this

complex winch-rigging set-up generates a 4:1 Mechanical Advantage. This balances with the total F-Value at the anchor point that is also F-4. **See Figure 5.**

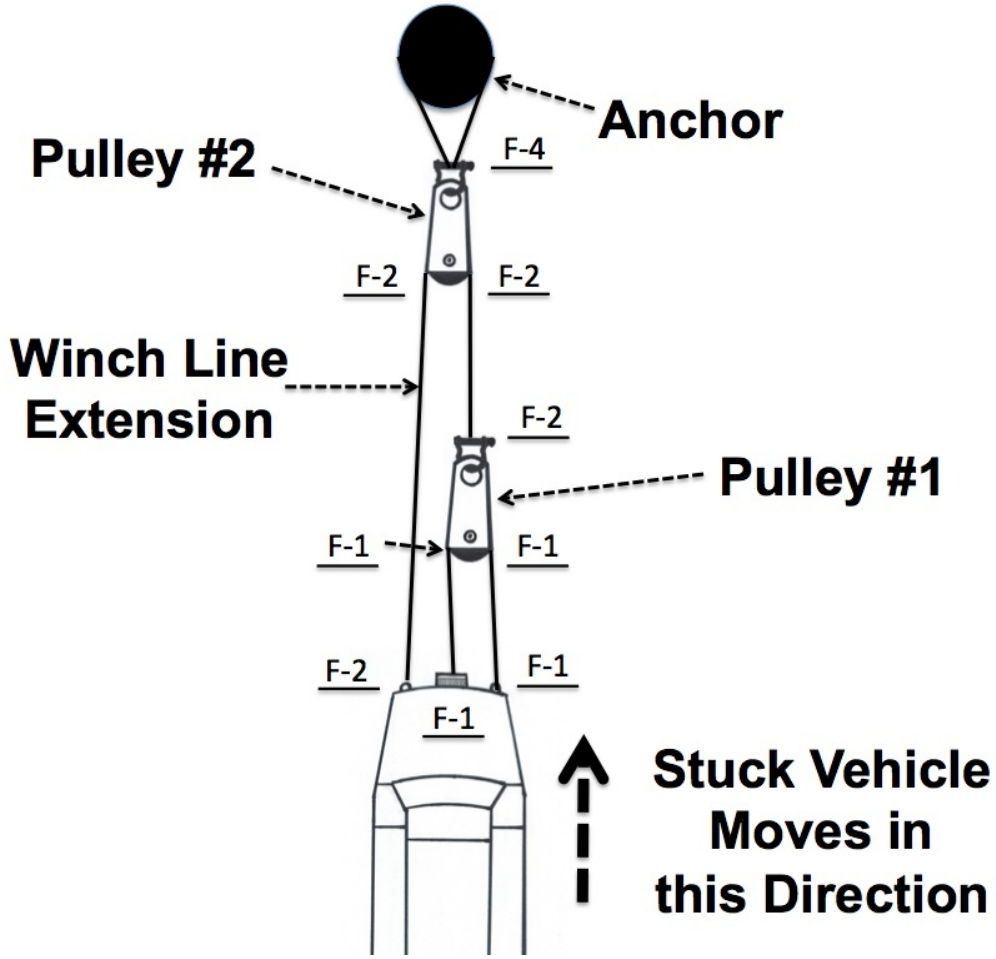


FIGURE 5

The benefit of this particular rigging set-up (called a *Spanish Burton*) is that you get a 4:1 mechanical advantage using only two pulley blocks. Compare a Spanish Burton to a simple triple line pull using two pulley blocks where you only obtain a 3:1 mechanical advantage.

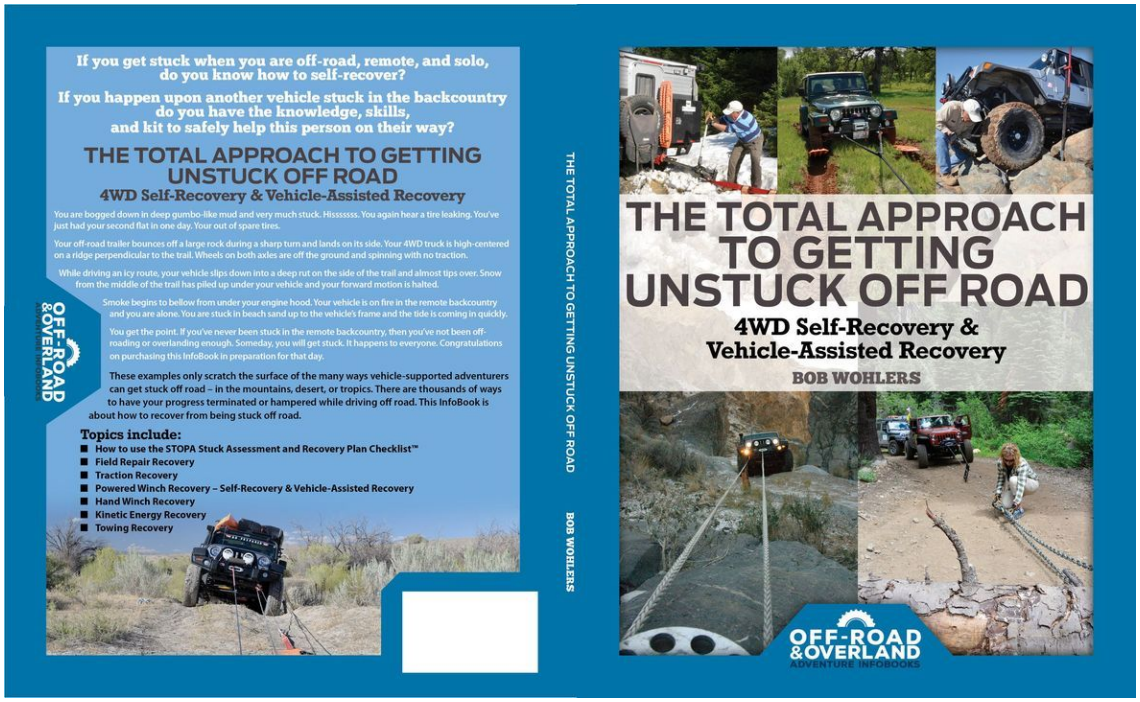
A *Spanish Burton* winch-rigging set-up can't always be used in every instance of powered winch recovery, but if you can use this type of rigging, you'll get a powerful 4:1 mechanical advantage. If this vehicle has an 8,000-pound manufacturer rated winch mounted to its front bumper, a Spanish Burton will provide the winch with a powerful total pulling capacity of 32,000-pounds (4 x 8,000 = 32,000). If this stuck vehicle had a calculated resistance of 10,000-pounds to get it unbogged, the winch won't even break a sweat to extract the vehicle.

So, you've learned three things here (if you've read through this newsletter carefully):
1. How to easily determine mechanical advantage in simple winch-rigging set-ups using ONE line.
2. How to determine mechanical advantage in complex winch-rigging set-ups using MORE than one line.
3. What a *Spanish Burton* winch-rigging set-up looks like.

Off-Road Safety Academy to Partner With Four Wheel Campers to Lead Three Backcountry Tours in 2019

Off-Road Safety Academy and Four Wheel Campers have teamed up together to produce three backcountry tours specifically for Four Wheel Camper owners. The 2019 tour destinations are Mojave Road (this tour sold out in one day and now has a waiting list), Parashant National Monument (North Rim of the Grand Canyon), and Death Valley. These tours are for anyone with a Four Wheel Pop-Up Camper on their 4WD truck. All trucks must have 4-Lo gearing capability, reasonable ground clearance, plus front and rear frame-mounted recovery points. For more information, dates, tour payment, details, and terms and conditions, go to discoveroffroading.com.

My Third Book Is On Its Way!



My third book in the series is coming! I'm shooting all the photos now for this work. There is NO other book like this on the market, anywhere on the planet. *The Total Approach to Getting Unstuck Off Road* will be the MOST complete treatise on the subject ever.

Topics will include:
* How to use the STOPA Stuck Assessment and Recovery Plan Checklist
* Field Repair Recovery
* Traction Recovery
* Powered Winch Recovery - Self-Recovery & Vehicle-Assisted Recovery
* Hand Winch Recovery
* Kinetic Energy Recovery
* Towing Recovery

You NEED this book!