

08 SOLARA & SPOT FEILD REVIEWS
Rocky Mountain National Park
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****If you do not want to read through all of this, skip down to the Recommendations****

In response to an informal directive to find an effective way to track NPS personnel working in remote areas, and to have a way of being alerted during an emergency, Rocky Mountain National Park was tasked with looking at various new technologies, to see if they fit our needs. In 2007 we looked at PLBs, GPS/microphones, & some remote satellite trackers. (See 2007 report)

This past season, we reviewed the SOLARA & SPOT tracking units. We did not have the capability or expertise to conduct a controlled, scientifically sound test. We did want to see how each of these units performed in the field. We wanted to see how low-tech Rangers would interact and perform with these units, under real world conditions, instead of a controlled environment.

Other tests were conducted at ZION, & Sequoia-Kings Canyon National Parks. In addition, tests were conducted at Grand Canyon National Park.

SOLARA

The overall impression I received from ALL field testers about this unit was that it was too big & too heavy. This unit measured 36.4 cubic inches & 1 lb 7.5 ounces. (See chart for comparisons) Most felt the size was enough to keep it out of their packs, when assigned to the back country. The Solara unit will have to drop its volume by half and it's weight by 2/3 to become competitive with a Motorola Talkabout, Avalanche Transceiver, Spot Unit, & GPS unit. These are all items that can & have found their way into the packs of many hikers, climbers, & patrol rangers.

Well-liked was the small, foldable solar panel. One test was conducted where the solar panel was powering the unit while tracking at 10 minute intervals. Since the battery charge meter measured in bars-not numbers, it was difficult to determine the exact charge of the battery. However, with a sunny day, in an open forest, the solar panel appeared to keep up with the rate of discharge on the tracker. It was not, however, able to put any surplus charge on the battery. It would also be nice to have the connector (round 4 pin) be a standard USB connection, thereby making it compatible with a host of other devices.

The ability to send text messages to e-mails or cell phones also expands the flexibility of your communications network. This means, as long as your message recipient is near their cell phone or computer, they can readily receive (and transmit) text messages.

Other thoughts/comments include:

- The battery charge life was too short. One or two day patrols are possible, anything longer will discharge the battery.
- The display screen is too small. GPS units have the same or larger size screens, although taking up less than 1/3 of the size.
- Toggling through display screens or lettering is too clumsy or cumbersome. (Possibly a toggle or directional arrows, such as on GPS or cell phones would improve this)
- Toggle switches appear to be well protected (recessed & covered), but confidence would improve with beefier, shorter switches.
- All controls were manipulatable with medium-light gloves. Heavy winter gloves/mittens are questionable.

SPOT

Among the reviewers, there was a qualified greater approval for the SPOT over the SOLARA, with the prime reason being the volume & weight factor. The SPOT is significantly smaller & lighter than the SOLARA. The other factor was the significantly longer charge life of the SPOT over the SOLARA battery.

This unit is a simpler piece of equipment to use, although not as simple as most PLBs. Simplicity of use seems to directly correspond with the number and complexity of functions each unit performs, with SOLARA being the most complex, and PLBs the simplest.

Under optimal conditions, the SPOT tracked and sent messages satisfactorily. The 911 feature was not activated for this trial. It was assumed that since the message function utilized the same satellite system, a test of the message function would also serve as a test for the 911 function. However, a thorough test of the 911 function, including the entire chain of communication probably should be tested or demonstrated at some future point.

SPOT Functions:

- Transmits 911 distress signal, with location & registration info to the GEOS International Emergency Center in Houston. They in turn contact local SAR officials.
- Transmits Help signal with location to registrant's designated contact.
- Transmits Check In (OK) signal with location to registrant's designated contact.
- (Optional) Transmits tracking location to Google Earth, accessible by login & password.

NOTIFICATION PROCESS:

- SPOT acquires its GPS location.
- 911 button is depressed.
- SPOT transmits 911 distress signal to the Globalstar Satellite network.
- The 911 message is picked up by Globalstar's International Emergency Response Center.
- This message is relayed to the local SAR official (CO Sheriff's Office)

POWER MANAGEMENT

The Solara units were programmed to transmit a location every 10 minutes. At this rate, the battery charge generally lasted around 2 days. 2 days is definitely not enough charge for remote operations. Personally I feel a 2 hour (or more) interval would be adequate for most tracking needs. This should extend the period of use significantly. Other power management practices would also have to be implemented, such as turning the unit off when not in use, minimizing texting, utilizing the solar panel when feasible, etc.

The Solara is currently powered by a NiMH battery. An optional Li battery kit can be obtained as an add-on for cold weather operation. Possibly a rechargeable Li-Ion battery as the primary power source can be developed for this unit. This might extend the charge and mitigate some of the weight problem.

Spot is powered by 2 AA Lithium Batteries. SPOT advertises 1 year of usage without the tracking function, per 1 set of Lithium Batteries. They state the batteries will withstand 14 days in the optional tracking mode. We utilized these units with the tracking mode. In addition, we tested the units by activating the Help & Check In functions several times each trial. We did not have any battery issues and feel confident in SPOT's claims on power usage.

Aside from PLBs, which are never activated until there is an emergency, SPOT utilized the least power of all of the various units we have tested. (BUT, please note in the Communications section, this was not necessarily a good thing!)

GPS

GPS receivers are integrated into both the SOLARA & SPOT. They are not full featured GPS units. Functions common to most GPS units are not available to the user. It basically fixes a location to be transmitted over the satellite communication system. SOLARA does display its location on a small screen.

COMMUNICATIONS

Communications with this SOLARA is relatively weak. Field testers found the unit's antennae should be oriented towards the sky, and located in the upper portion of the pack in order to obtain a consistent link with the Iridium Satellite system. This link was, however, significantly stronger than the SPOT unit.

Everyone liked the two-way communication capability of SOLARA, even if limited to short, text messages. This capability would greatly eliminate a lot of uncertainty and could potentially provide much needed information, especially when compared to devices which provide only one-way communications. When requesting help, this device has the capability to specify what the situation is and what kind of help is needed. (I.e. helicopter, wheeled litter, horse, or bring the beer!) This communication ability gives the sender the ability to alter or cancel a "911" call.

Responders have the ability to query the sender about any information needs they have, such as weather, terrain, & patient conditions.

The texting feature proved to be doable, but cumbersome. Having the capability for 2-way communication is highly preferable over the limited 1-way communication of the SPOT unit. This ability allows greater exchange of information, and would go far in having one side or the other not fill in information gaps by guessing. The ability to remotely reprogram the unit, via computer, could also prove to be extremely helpful. 2-way communication with any tracking device would be a highly desirable feature.

SPOT features 3(or 4) different functions: 911, Help, Check In, and the optional tracking, which gives the SPOT more options and greater flexibility over PLBs. This might mean the SPOT could be a device that will be used more often by field personnel, as opposed to being another unused piece of equipment, only to be opened during emergencies, or sitting on a shelf somewhere.

The Help and Check In messages can be set up to be sent to an e-mail or cell phone. Tracking data is sent to a Google Map program with access secured by login & password.

There are also some potential weak points here:

- The SPOT sends out a very low wattage signal. This means the signal can be easily interrupted. It must have access to a clear sky. Narrow canyons, overhead vegetation, overcast weather can all interfere with this signal. Indeed, this signal is so weak; we found that if it was positioned incorrectly, i.e. upside down, it could not complete any transmission. We also found it could not be buried in the pack. Even if you hang the unit by its belt clip to a belt, it compromised its ability to transmit. To operate correctly, the unit must be facing front-side up, with access to an open sky.
- SPOT utilizes the Globalstar Satellite Network. This particular system has proven to be less reliable than Iridium. The system is notorious for dropped calls, coverage gaps, and short connect times. Only with constant, consistent, short burst transmissions may it eventually connect.
- As opposed to the SOLARA unit which does have 2-way communication through its texting feature, the SPOT does not have 2-way communication. There is no way to clarify what the 911 emergency is, or what kind of response is needed. There is also a question of what kind of response is needed with the Help message:
 - A PCT hiker accidentally activated the Help function. His wife & friends had no easy means of responding, so they initiated a search from local authorities. The Duty Officer had difficulty with the International Emergency Response Center, - they refused to give out any information on the SPOT message (I believe, because it was NOT a 911 distress signal) Meanwhile, the hiker tried to correct his accidental activation by sending his OK (Check In) function, which his wife ignored, because she was too worried.

FORM FACTOR

The most complaints I received from Field testers were about the size and weight of SOLARA. It was made clear to me, that if unchanged, this unit would be left behind on any backcountry trip. In order for a piece of equipment to work, it must be used. This unit has to drop weight & volume, period.

Other things to consider about SOLARA:

- Battery charged life is inadequate.
- Transmissions are weak.
- 2-way communication was well liked.
- Arrowing through the different screens & menus was awkward and cumbersome.
- The screen was too small.
- The power cord for the solar panel should be USB.

Field testers appreciated SPOTs size and weight. It does appear to fit into the profile acceptable to most backcountry users. I think it would be acceptable to all but the most fanatic of minimalists. I measured several electronic devices which might find its way on a backcountry patrol, which included from smallest to largest: cell phone, Garmin GPS, Motorola Talk-A-Bout, SPOT, Avalanche Transceiver, Sat Phone, and BK Radio. SPOT was in the middle of the pack.

What was not liked was SPOTs attachment system. The clip, which also covers access to the batteries, was too flimsy, prone to loosening & slippage. In addition, if you hang the SPOT onto a belt using the clip, it orients the unit vertically, instead of horizontally, which directly influences its ability to transmit its weak signal.

There needs to be a better attachment system whereby it can be attached in the proper orientation, securely to the person.

Interface with NPS Hardware & Software

Programming was assigned to someone who had above-average computer skills. She was able to take the Solara guide, get the unit registered, and the program running within a few short hours. She in turn showed a person with below-average computer skills (me!) how to access the program and conduct some basic stuff with it. I figure a person with some computer skill would be able to get the basics of this program up and running after a morning or afternoon of work, without IT support. To get proficient with the program would take longer.

She stated that the SOLARA unit & website is not as intuitive or user friendly as the SPOT unit & website. She did have to sit down with the manual and fumble through the website. She thought it to be a little “techy” and not as simple as it could be.

The SOLARA program can do several things:

- Track & document the field unit movements.
- Communicate with the field unit via text messaging.

- Reprogram the field unit remotely (change the tracking interval for instance)
- Program the recipient list for any messages.

As with the SOLARA unit, the same above-average, computer-skilled person set up the SPOTs for us. She registered the units, and programmed the recipients for all messages, and set up Google Map for us to use. Once that was done, I (computer-challenged) was able to receive messages and track users on Google Map.

According to our “tech savvy” tester, the SPOT website is much more intuitive, easier to get around, and a much shorter learning curve.

Both programs can:

- Track each user.
- Receive emergency alerts.
- Receive non-emergency alerts.

In addition, the SOLARA program can also:

- “Poll” remote users.
- Re-program (change or start tracking functions) remote users.
- Exchange information (2-way texting)

TRACKING

Tracking interval for the SOLARA was set at 10 minute intervals. Not because this was an optimal or a desired interval, but because the SPOTs interval is set at 10 minutes. It is not adjustable. We wanted similar intervals so that the two units could be compared.

SOLARA had more interval transmissions completed than the SPOT, although not by a whole lot. On three separate, side by side, backcountry tests of 4.5 hours, 5.5 hours, & 12 hours; SOLARA located, transmitted, & plotted locations 23, 19, & 29 times. SPOT completed 20, 11, & 26 plots respectively. On average, SOLARA completed 3.23 plots per hour. SPOT plotted 2.59 times per hour. At 10 min intervals, each unit potentially could have plotted 6 times per hour. SOLARA successfully completed tracking a little over 50% of the time; SPOT completed tracking slightly less than 50%.

Both transmitters are underpowered in my opinion. SPOT a little more so than SOLARA. However, because of the high frequency of transmissions, enough tracking data was collected to be able to keep track of our user. Even though we are high in the Rocky Mountains, we generally have a fair view of the sky. Narrow canyons would prove to be a much more robust test.

COMPARISON TABLE

	SOLARA	SPOT
COST	\$979.99; \$30/month	\$169; \$99.99 annual subscription.
SIZE	1 7/8"x 3 3/8"x 5 3/4"	1 3/8"x 2 5/8"x 4 1/4"
Weight	1lb 5.2 oz.	7.5 oz.
Messages	GPS tracking; 2-way text messages; Remote programming; Verifies message successfully completed	GPS tracking; 911 distress; Help message; Check In (OK); No 2-way
Power	Rechargeable NiMh battery. May be recharged via solar panel, wall, and vehicle accessory. Optional Lithium-Ion add-on pack.	2 Non-rechargeable AA Lithium batteries
GPS	Transmits GPS Location; displays location; & compass heading; does not store waypoints or tracks. Has Doppler position as backup	Transmits GPS location only.
Communications Network	Designated Communications Center &/or Solara 24/7 Alert Center; Iridium Satellite Network	GEOS International Emergency Response Center; Globalstar Satellite Network
Strong Points	<ul style="list-style-type: none"> • 2-Way communications. • Remote programming. • Google Mapping 	<ul style="list-style-type: none"> • Light & small. • Fairly easy to use & understand in field. • Google Mapping. • Intuitive Website.
Weak Points	<ul style="list-style-type: none"> • Too large & heavy. • Weak signal. Must have open sky. • Short-lived battery charge. • Cost 	<ul style="list-style-type: none"> • Very weak signal. Must have open sky and proper orientation. • No 2-way communications.

Other Points	<ul style="list-style-type: none"> • Adequate communications connect rate. 	<ul style="list-style-type: none"> • Adequate communications connect rate. Less than Solara.
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RECOMMENDATIONS

Unfortunately, after 2 seasons of testing, there still is not a product that will do everything that is needed. A common shortcoming seems to be the power issue. It seems there will have to be another advance in battery technology to give us a battery with enough power and charge life, to power all the functions we want, but still be small and light enough to give us a palm sized piece of equipment.

There are other products out there, either of which has not been tested, or we are unaware of. With these limitations with these current products, these are my recommendations:

- IF, all you want is the ability to send an emergency distress signal, with location. I would recommend one of the PLBs. These units send out a signal which I believe is up to 10 times stronger than most of the tracking units we have tested. In fact, PLB activations within steel & concrete buildings have been detected. (With obviously, lowered location accuracy) The COSPAS-SARSAT, AFRCC, network is a proven, reliable network, with thousands of saves to its credit. The only thing these PLBs are designed to do is to send out a distress signal with location. Therefore, the charged life of the battery is not as large an issue, compared to a tracking device, which must constantly transmit at intervals.
- IF, you require the ability to remotely track in real time, backcountry personnel, I would recommend the SPOT. Although I really like the concept of 2-way communication and the strength of the Iridium system over Global Star, the size & weight of the SOLARA would be a rule-out. No one appeared to want to carry it. In addition, the compromise with more features & functions appears to be a shorter charge on the battery. Until this compromise is resolved, SPOT seems to be the choice. SPOT is small & light. Tracking is adequate, and the battery charge appears adequate as well. With a single spare set of lithium batteries (lightweight), this unit can go a month, with tracking. Tracking can be useful, not only for tracking backcountry personnel, but tracking search coverage, fire lines, and anything else that needs to be plotted & documented.

08 FIELD TESTS OF SOLARA & SPOT APPENDIX



Photo showing from left to right: Cell Phone, Garmin E-trex GPS, Solar panel for SOLARA, Motorola Talkabout, SPOT, SOS Avalanche Transceiver, Qualcomm Satellite Phone, BK Radio, SOLARA.

Comparison Table

Equipment	Size		Weight Oz.
	Cubic inches	inches	
Motorola Cell Phone	2.4	$\frac{3}{8} \times 2 \times 3 \frac{1}{4}$	2.4
Garmin E-trex GPS	9.8	$1 \frac{1}{8} \times 2 \times 4 \frac{3}{8}$	5.5
Motorola Talkabout	$13.0 \frac{5}{8}$	$1 \frac{1}{8} \times 2 \frac{1}{2} \times 4$	7.0
SPOT	$15.3 \frac{1}{4}$	$1 \frac{3}{8} \times 2 \frac{5}{8} \times 4$	7.5
SOS Avalanche Transciever	14.6	$1 \times 3 \times 4 \frac{7}{8}$	8.5
Qualcomm Satellite Phone	$25.6 \frac{7}{8}$	$1 \frac{3}{4} \times 2 \frac{1}{8} \times 6$	13.0
BK Radio	$32.5 \frac{1}{4}$	$1 \frac{1}{2} \times 2 \frac{5}{8} \times 8$	29.0
SOLARA	$36.4 \frac{3}{4}$	$1 \frac{7}{8} \times 3 \frac{3}{8} \times 5$	21.2
SOLARA Solar Panel	$95.6''^2$	$17 \frac{3}{8} \times 5 \frac{1}{2}$	4.0



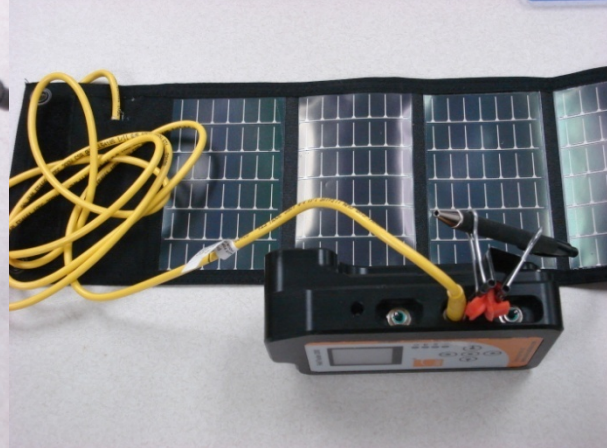
SPOT & SOLARA side by side.



SOLARA.



SOLARA showing recessed-covered toggle switch & charging connection.



Connection with solar panel.



SPOT.



SPOT with clip on back.