MAGNETIC DEFLECTION

Testing the effects of popular headlamps on a Suunto compass

Photos & text by Jeff Bartlett
Testing by Jeff Bartlett & Bryan Signorelli

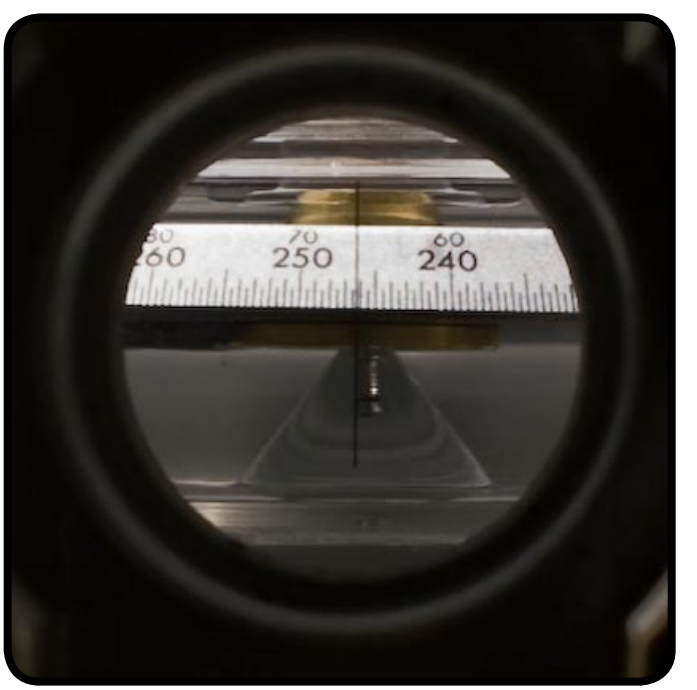
At the end of 2007 (that's right, 2007), after having several discussions on the subject and realizing neither of us had seen any actual data addressing the issue, Bryan Signorelli and I decided to spend an evening testing the magnetic deflection effect caused by different headlamps at close proximity with a Suunto Tandem. These are the results of our not-entirely-unscientific study.

First, the test rig. In order to minimize the ambient influence of ferrous metals, we set up an 8 foot long, 2" x 4" board on plastic sawhorses and secured a Suunto Tandem to the board with hair elastics. We then set up a length of string directly above the Tandem's compass unit, upon which to raise and lower the various subject headlamps. A fiberglass tape was set up behind the instrument in order to regulate the heights for each test sample. At one end of the board, a camera with a zoom lens was located, wired to an external flash illuminating the compass card; this camera, then, recorded azimuths from the instrument. Perpendicular to this setup, a second camera and flash were positioned, from which the position and type of headlamp could be documented and paired with the compass readings.

Using the tape as a guide, each headlamp was positioned sequentially at distances of 1.0 feet, 0.5 feet, 0.25 feet and 0.1 feet directly above the compass, with a photograph taken at each position by each camera. These photographs were then examined to determine the azimuth, with the readings then compared to a control reading of 246.0 degrees in order to determine the deflection. The control reading was repeated and confirmed between each series of photos.

After pooling our resources and making a few phone calls, these were the headlamps included in the test:

- Princeton Tec Apex
- Stenlight
- Petzl Tikka XP



- Petzl Myo XP
- Petzl Zoom
- Petzl Mega (with LED upgrade)
- Autolite cap lamp (hey, we were curious)

The actual results of this test are shown in the graph on the following page.

Unsurprisingly, the Stenlight had an effect on compass readings that qualifies as "devastating" at close ranges. The Sten was retested at different output settings, including completely off, with no effect on deflection, which quite squarely fingers the magnetic switch as the culprit in this case. If you use a Stenlight, and you hold your helmet in one hand to illuminate your Suunto underground, hold it FAR away, preferably at least 12 inches. After performing these tests, I no longer use mine in this manner, instead removing the helmet and using a small target light.

The Princeton Tec Apex (with its regulated circuitry in the head unit) and the Tikka XP (which houses the battery and LED in the same forward compartment) both showed a noticeable effect (0.25-0.5 degree) on compass readings from a distance of 0.1 feet, too close for comfort when the helmet remains on the reader's head. In the case of the Apex, this effect was prevented by turning the unit off, but even with the light off, moving the unit to the point where it contacted the compass (see next paragraph) caused a 4.5 degree error. If you use an Apex or similar modern, regulated headlamp, it's really advisable to remove your helmet when reading instruments.

Rather surprising, to me, was the performance of the unregulated Petzl units: the Myo XP, Zoom, and Mega. All 3 exhibited the same effect on compass reading throughout the range of our testing as the Autolite did; that is, none at all. In the case of each lamp, the head unit circuitry is quite simple and the battery packs are housed at the rear of the helmet in a separate compartment. After seeing no deflection within our test range, we progressed one step further and took a series of readings with these units actually touching the Suunto, and in the case of the Zoom and Mega, still recorded no deflection. Moving the battery unit toward the compass caused a significant error, but this isn't possible to do while wearing the helmet and reading instruments. The Myo XP did impart a small error when touching the compass; we took 5 readings, with results ranging between 0.0 degrees and 0.5 degrees.

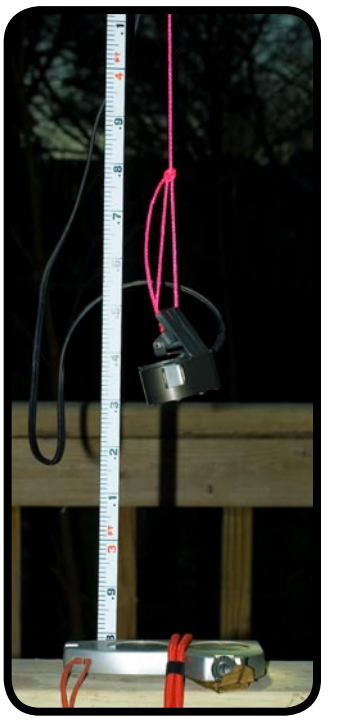
While I don't know that I can actually recommend leaving one's helmet & headlamp in place while tak-

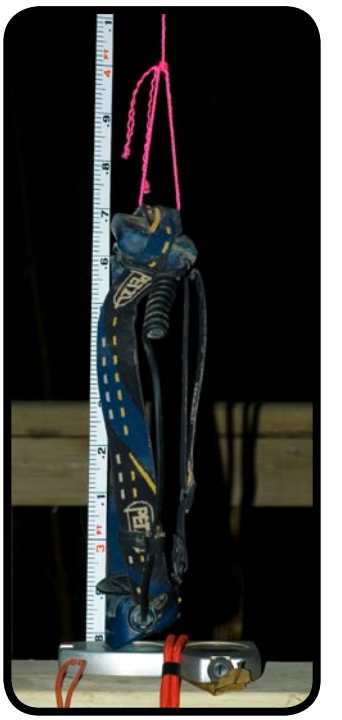
ing a compass reading, as a number of other factors can cause problems (second headlamp on the helmet, metal parts on older helmets, changes in headlamp designs that we cannot account for here, etc), our test data doesn't suggest that doing so with one of the lamps from this latter group will create a problem.

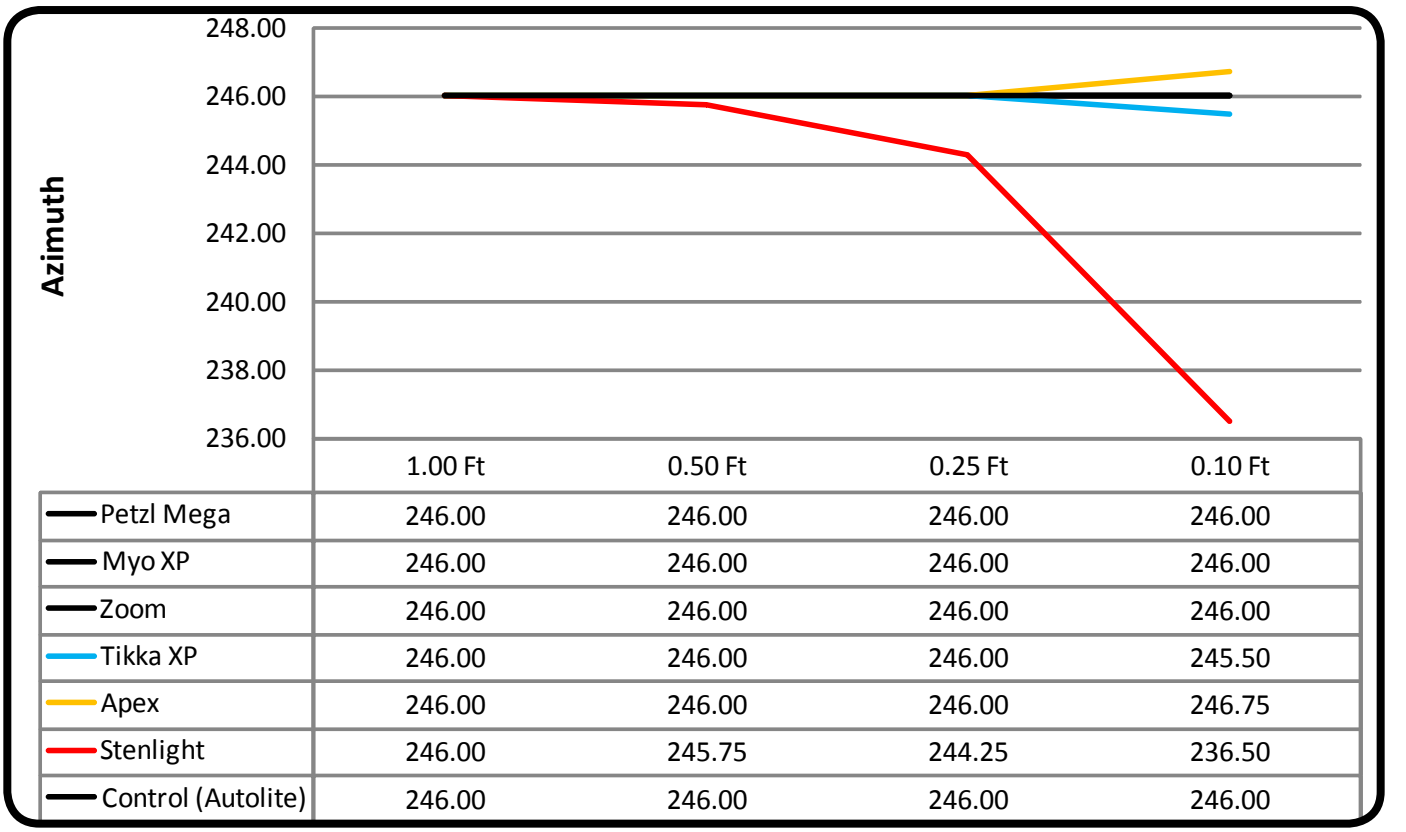
Indeed, our conclusions are not irrefutable, and our methods were not bulletproof. Maybe the orientation of the compass is a major factor a reading's susceptibility to magnetic deflection, and independent readings with the compass oriented at 0, 90, 180 and 270 degrees would tell us more. Maybe holding the headlamp directly over the center of the compass card mitigates the deflection, and we would see a more compromised reading if we offset the headlamp in one direction or another. Maybe variations in the headlamp position, dangling on a thin string, colored the results unfairly. All are valid queries and a more thorough, scientific study would do well to address them.

If nothing else, these tests provide a fundamental proof that commonly used headlamps such as the Apex do, in fact, degrade compass readings at negligible distances. I have hardly seen a consensus among cavers on this matter, and hope our study is a step in this direction. Here we can say, for certain, that there is an observable and repeatable effect on the azimuth provided by the instrument, something each surveyor needs to be aware of in order to exercise their own judgment.

This page, left to right: the Stenlight S7 is already deflecting the compass at this distance; the Petzl Myo XP didn't cause a noticeable deflection even when touching the bezel!







	1.00 Ft	0.50 Ft	0.25 Ft	0.10 Ft
Petzl Mega	246.00	246.00	246.00	246.00
Myo XP	246.00	246.00	246.00	246.00
Zoom	246.00	246.00	246.00	246.00
Tikka XP	246.00	246.00	246.00	245.50
Apex	246.00	246.00	246.00	246.75
Stenlight	246.00	245.75	244.25	236.50
Control (Autolite)	246.00	246.00	246.00	246.00