The "Great Race" to the South Pole

By Mark Breach

In 1911/12 Scott and Amundsen famously raced to be the first to the South Pole and although Scott "lost" the race the exploit has been reflected in literature, films and television as a major British achievement. This summer Keo Films has been commissioned to make a six hour series of documentary films for the BBC and other channels about these historic expeditions.

Although it is intended that the finished programme will include archive material and interviews with historians, scientists, medical experts, explorers and others, part of the programme will follow two modern teams who have been set the challenge of travelling a route similar in length and terrain to that covered by Scott and Amundsen. They plan to use only equipment, clothing and food that were available to the original teams.

The journey will be about 2,500km and will take them through eastern parts of Greenland. It is not possible to film the expedition in Antarctica as dogs are prohibited from Antarctica. They started in April and plan to finish in July, taking a maximum of 99 days.

Navigation is an essential part of the expedition. The navigation problem is twofold. Position needs to be found and then carried forward by "dead reckoning". Position, in 1911 could only be found by astronomy and near the Poles during summer only the sun is useful. Dead reckoning needs knowledge of distance and direction of movement since the last position determination. Distance can be determined using a sledge wheel which works well provided that it does not get too much snow stuck to it. Direction can be found by sun compass when the sun shines, or by magnetic compass, which becomes unstable and therefore inaccurate near the magnetic poles. Direction can be maintained by sighting forward to geographical features and back to flags on poles. It takes a lot of flags, which all have to be carried on the sledge to cover an outward journey of 1250km!

Scott and Amundsen approached the position problem quite differently and selected different technologies and observing strategies. Amundsen found his location by using a sextant with an artificial horizon and observed position using the "position lines" method. Scott used a theodolite and observed separately for latitude at midday and longitude in the evening. Scott was aware of the position lines method but decided against it, presumably on the grounds of greater computational complexity. Since only the sun was used by both explorers as a celestial body then it would be necessary to wait at the same point for the sun to move around the sky to get a second position line. However methods to find longitude need knowledge of latitude and even finding latitude by the elevation of the midday sun need knowledge of longitude and time to determine local midday. Separate determinations of latitude and longitude run into other problems very close to the Pole.

One of the challenges the organisers faced was finding suitable instruments of the period. This author became involved with the project following publication of his book *"Celestial Navigation when your GPS fails"* via contacts through the RICS and was able to locate a pair of vernier Cooke Troughton and Simms theodolites in a back cupboard at

Nottingham Trent University. Although the theodolites were of a slightly later period than the time of the original expedition they were considered close enough in form and function to be acceptable. Neither had been used for many years and both had a number of faults, but by taking the best parts of both, including the frame of one and the telescope of the other, it was possible to create a suitable working instrument. On this instrument it is possible to reverse the trunnion, a process that Scott used, but which leaves it vulnerable to icing from the observer's breath. Reversing the trunnion is also a potentially difficult operation in sub-zero temperatures when wearing gloves. Without gloves the observer could freeze to the instrument. Special low temperature lubricant was used on the trunnion and other moving parts.

In 1911 there were no calculators or computers and all computations had to be carried out by hand with pencil and paper. This would probably not have been as daunting then as it is now. This author is a lecturer who teaches maths to undergraduates and has noticed that the level of numerate ability of students has dropped over the years. In the pre-calculator era, the only computing aids were log tables and slide rules, the latter insufficiently precise for astronomical calculations. Therefore Scott is likely to have been much more comfortable doing the necessary mental arithmetic than today's explorers.

With the Scott team selected, training in the many aspects of polar exploration began. This author was responsible for the celestial navigation aspects and had two days to turn novices into competent surveyors well versed in theodolite use and capable of completing the calculations without a calculator. Bespoke observing and computing sheets and astronomical tables designed to minimise the workload were prepared. Potentially the most problematic part was the calculation of the computed altitude of the sun using the spherical cosine formula associated with the "astronomical triangle". Using tables in *"Celestial Navigation when your GPS fails"* this calculation was reduced to a series of additions to avoid the use of trigonometry and log tables to effect the necessary multiplications.

Although the team were able to master the theodolite and sun observations and follow through the process of extracting celestial data from tables, the greatest challenge turned out to be performing the additions, especially where negative numbers were involved, which highlights a point made earlier in this piece.

The presence of a camera crew during the training created some additional challenges. Interviews of trainer and team during lectures and practical work did little to aid the flow of knowledge and understanding. "We need another take - can you explain that bit again …"

How did the teams get on in Greenland? For an answer to that question you will have to see the programme which is understood to be scheduled for transmission early in 2006.

About the author
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