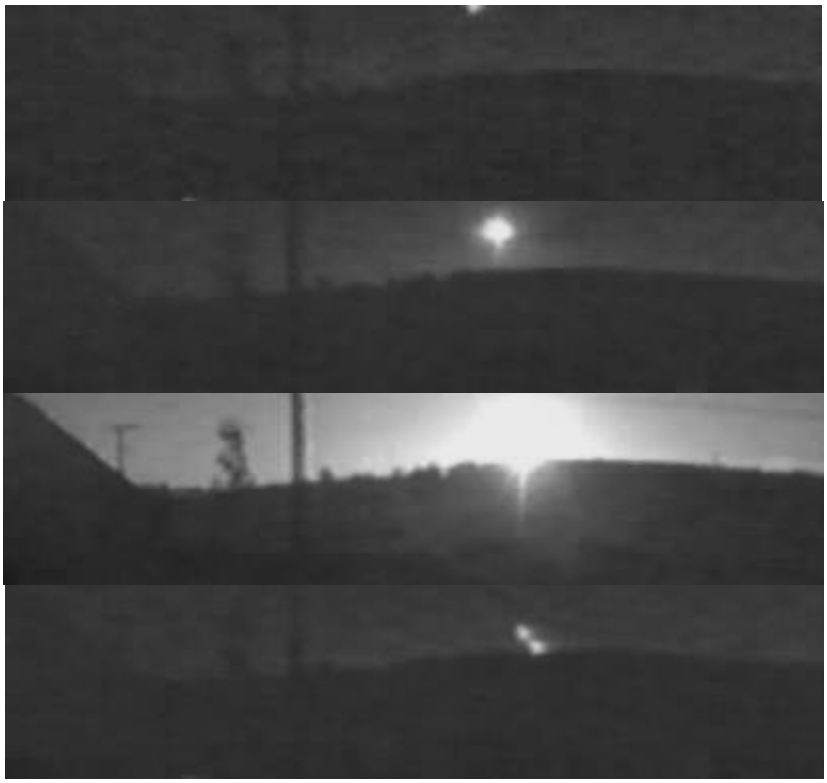
Meteor Section

The North Sea Fireball of October 27-28, 2001

A superb, very brilliant, green fireball occurred around 19:20-19:21 UT on 2001 October 27-28. Early UK media reports indicated it had been seen over a wide area of southern England, and that coastguards had been alerted to a possible incident offshore of East Anglia or Kent after the sound of "an explosion" was heard from Essex. Unfortunately, this item could not be traced to source, and no details of acoustic effects associated with the meteor were secured in the end. The widely-seen nature of the event was confirmed however, and 30 useful observations of the fireball were collected from England, Scotland, northern Germany, the Netherlands, and the Norwegian-sector Ekofisk and Valhalla oilfields in the North Sea, plus several more witnesses who mentioned having seen the event, but were unable to give any further information. Other sightings from Belgium, Denmark, northern France, and various vessels in the North Sea are known, some of which can be found in the preliminary analysis on the *Dutch Meteor Society's* (DMS's) website at: http://www.dmsweb.org (the analysis is in English, as are some of the sightings). The SPAMS report has been prepared drawing on information from the DMS analysis (using the 2001 November 2 updated details) for the early parts of the fireball's flight especially, which was not well-observed from the UK. Two DMS observers were able to give an accurate timing of 19:20:20 UT for the meteor, which is also adopted here.

The sketch-map shows the approximate surface track of the fireball across the southern North Sea. National capitals are labelled, along with the towns of Haarlem (H) in the Netherlands and Mablethorpe (M) in England, probably the

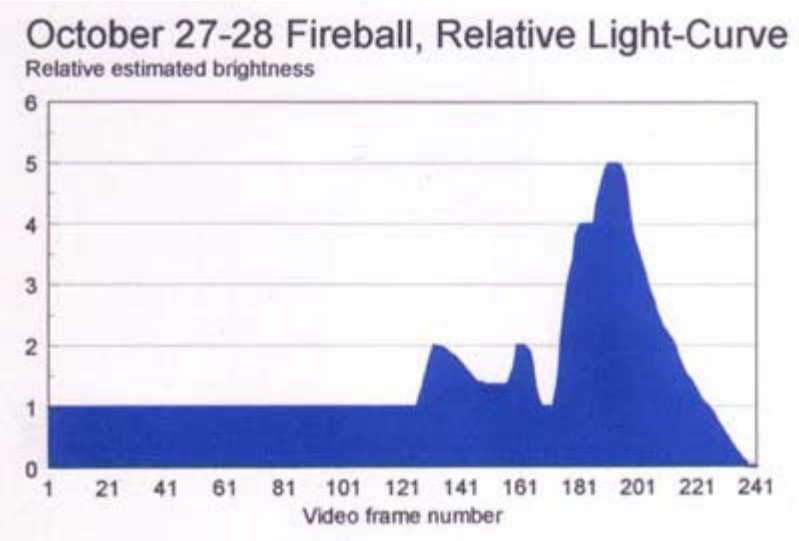
nearest places to the start and end of the track respectively. The target symbols show the approximate outer limits of the area of reports received by the SPA Meteor Section. Clockwise from the pair in the North Sea, these are rigs and ships in the Ekofisk and Valhalla oilfields, Meppen in Germany, Enschede in the Netherlands, Canterbury and Warwick in England, and Dollar in Scotland, from where Dave Taylor was very fortunate in catching part of the meteor's flight on a security video, particularly important data.



A **video clip** prepared by SPA Vice-President Robin Scagell from Dave's tape shows how the event appeared, lighting up the sky despite being nearly on the local horizon, and ~410 km from the probable end-point! A few frames of the same scene in daylight give an indication of how lucky this video capture was, in the small sliver of visible sky. Note that the time-stamp on the video is incorrect compared to UT however. Four still images have also been extracted from the tape by Robin Scagell and Peter McBeath, illustrating the four main stages of the fireball's flight, and show the sky-horizon region only.

In addition, a crude estimate of the fireball's relative brilliance during the part of the trail on Dave Taylor's video is illustrated by the graph. The first clear appearance of the fireball on the top edge is frame number 1, and the end assumed is at frame 238. These relative brightness estimates have been made by-eye only, and do not represent a serious attempt to give accurate bolometric magnitudes. The graph does help clarify the various flare events towards the end of the fireball's flight, although it covers the main fireball only. It is unclear if the two distinct pieces visible after the main flare had faded away were fragments following along the same path as the original meteor (a few of the visual reports mention late fragmentation was seen) or were parts of a persistent ionization train visible after the meteor itself had faded away completely (again, a persistent train featured in only a few visual sightings, though given the brilliance

of the main flare dazzling the observers, this is not very surprising). Magnitude estimates by visual observers and from the video (though the relatively high infrared sensitivity of many video systems tends to mean meteors appear brighter than a visual watcher would perceive them) suggest the main flare was probably in the magnitude range -14 to -20. Several reports were made from lit rooms indoors through closed windows, and in three cases even through closed curtains!



Positional data from the SPAMS results support the general track's position and roughly south-east to north-west direction established by the DMS for this fireball, though SPAMS details on the early part of the flight were very scarce. Best-estimates suggest the first 60 km of the atmospheric trajectory was missed by the video observation for instance, while the true end may have been on or just below the local horizon from Dollar too. The atmospheric path probably began at about 120 km altitude above the North Sea ~35 km off the Dutch coast near Haarlem at approximately 52 degrees 45' N, 4 degrees E (specific positional data from Chris Steyaert of the Belgian VVS meteor observing group), and the end was most likely around 25 km altitude over the North Sea ~15 km off Mablethorpe in Lincolnshire, England, near 53 degrees 23' N, 0 degrees 30' E. The atmospheric path length implied by this is ~250 km, at an angle of descent from the horizontal of some 22-23 degrees. The surface track was thus not dissimilar to the atmospheric trajectory, at ~230 km. The projected impact area for any surviving meteorites from this proposed trajectory would have been ~60 km north-west of the visible end-point, perhaps near Brigg in Humberside, England (~53 degrees 34' N, 0 degrees 28' W). No reports of any meteorite falls in this region were uncovered, despite various enquiries however.

Drawing chiefly on the video data, as very few flight-time estimates were made by other observers, a mean atmospheric velocity (not allowing for deceleration) for the section of the trail caught on video of ~34 +/- 3 km/sec seems possible. Although it is unclear exactly how much of the trail was caught on the video, this figure is a useful guide to the object's likely speed. The lower limit of ~31 km/sec is slightly higher than the DMS estimate of ~30 km/sec based on visual reports, while the upper limit would make it definitely too swift to have been a Taurid, as suggested by some observers and also by the DMS preliminary analysis. The lower limit is not dissimilar to the Taurid velocity range of ~27-29 km/sec, which

with the low entry-angle would fit with a possible Taurid origin, as the complex Taurid radiant area was still low in the east-south-east at the time. However, one British visual observer reported seeing almost the entire trail, and noted the start as being too close to the Taurid radiant and the path far too long for the meteor to have been a Taurid. Although a Taurid origin is not absolutely ruled out, it seems unlikely to have been the source of this fireball based on the available evidence.

My grateful thanks go to all the observers for their reports, and also to Mike Dale of Royal Observatory Edinburgh, John Lambert, Marco Langbroek of the DMS, Robin Scagell, and Juergen Rendtel of the German *Arbeitskreis Meteore* group for rounding-up and forwarding reports from other observers; to Chris Steyaert for useful information and for alerting me to the DMS results; and most especially to Dave Taylor for his ready cooperation, rapid provision of his video data, and for his willingness to allow the re-use of his results on this website.

Postscript: Some time after this report was completed, news was received that infrasound signals (very low frequency sounds, far below what most humans can hear) had been detected from Deelen in Holland and Flers in France, allowing a cross-bearing to be made, which gave a near-perfect match to part of this fireball's trail. The sounds had almost certainly originated in part of the fireball's late-stage flaring. For details on the infrasound analysis, see: Infrasound from a bright bolide over the North Sea.

Report prepared by Alastair McBeath, SPA Meteor Section Director.

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