Although to the theoretician there may be a temptation to essay a fit of form (1) to actual operational data, in practice it does not look promising. The data obtained by the Astronomical Observations At Sea Working Party[3] are not graduated by (1), however L_2 and L_1 are chosen; these data are certainly heterogeneous and at first sight might be thought to obey the situation described at the start of the preceding paragraph. There are many possible reasons for the failure of this graduating process, such as the presence of blunders, the failure of the probability density function $g(\sigma)$ to be uniformly distributed, and the presence of systematic errors amongst part of the basic data.

It is instructive to note the recent papers[1,4] which shed light on the approximate negative exponential behaviour of errors (of large errors in particular) observed in practice in a wide number of different fields;[2] in most examples the error data have been heterogeneous. It is, however, wrong in my opinion to go to an extreme and decry the Gaussian distribution because it does not graduate data for which it is inappropriate. There is a danger that recent evidence be used to call in doubt the validity of Gaussian methods over the whole field of navigation; this is wrong since in many—indeed, to the practical navigator, most—applications the data are *not* markedly heterogeneous. To take a simple example, when using probabilistic methods to determine position,[5] the navigator is concerned not with the errors all navigators made under a wide range of operational conditions, but with his own errors made under a specific set of circumstances. It seems to me that Gaussian methods are appropriate in this context. It is hoped to review the whole subject at greater length in a future article.

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A Radar Display for Collision Avoidance

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It is, I believe, generally agreed that if the aspect of a ship could be seen on the radar screen from a range of 4 or 5 miles down, the information provided by the radar picture would be sufficient to prevent collisions from occurring. The aspect cannot be directly observed on an ordinary 3-cm. marine radar, but I think such a set could be modified in the following way to enable the aspect to be shown.

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Requirement: A 12-in. PPI, or if larger so much the better, which could be slave driven from the ship's normal set, with a long afterglow which should last for about 30 seconds, and set to a range scale of 3 miles.

The picture is offset so that the view ahead is about 5 miles. It is ship's head-up and covers about the same area that the eye commands on a clear night, for it is important that the radar picture should correspond as closely as possible with the visible situation if a target-vessel becomes visible.

An own-speed setting (not necessarily from a log) feeds in own ship's speed to the picture. The picture would need resetting when own ship has advanced beyond the centre of the screen. This can be done automatically or manually.

An electronic bearing cursor and range rings are necessary and a reflection plotter would probably be an advantage.

Echoes would appear at ranges of about 4 or 5 miles, that is, at ranges at which lights are usually seen at night. Their track across the screen would be true relative to own ship's course and would show the target's aspect. The echo will move 2 inches for every mile steamed and, I should think, the aspect should be definitely apparent by the time half a mile has been covered; i.e. within 2 minutes if the approaching vessel was steaming at 15 knots. The faster the approaching vessel the quicker will the aspect be observed.

The electronic bearing cursor will show if risk of collision exists and the range rings (adjusted to be faintly visible) will give an estimate of the range at any time.

In areas where density of traffic and lack of sea room make long-range plotting and disengagement impracticable such a display should be of especial value.