

NOMINAL RANGE

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As was agreed upon during the 9th International Hydrographic Conference, IHB Member States have been requested by the Bureau to give an opinion on the inclusion in nautical documents of the "nominal range" of lights, as defined by the International Association of Lighthouse Authorities (IALA).

In its reply the Italian Hydrographic Office expressed an unfavourable opinion, and the object of the present article is to explain its reasons for voting against this proposal. We hope that if we have misunderstood any point we shall be given further explanations.

In their very detailed article, published in the *International Hydrographic Review* of July 1968, Monsieur Pierre BLAISE and Monsieur Paul PETRY explained that the concept of nominal range had been proposed by IALA for the following reasons :

- This was the opportunity to replace the concept of luminous intensity by "some other concept" since its values appearing in the Light Lists of the different countries are not comparable one with the other, as well as because the candela is too complex in definition and its accuracy is illusory.
- Confusion arises from the fact that the luminous ranges published in Light Lists are sometimes computed from the Allard formula (where the factors I, E and T are never entirely known), and sometimes established from statistics of uncertain worth.

Nominal range on the other hand would be an absolute concept, being based on the meteorological visibility equal to 10 miles, as it has been defined by the World Meteorological Organization (WMO).

We can quite understand an engineer's need to have a system of measurement that is universally accepted, and one which would permit a comparison between the lights of the various countries. Up to the present time we have always thought that this system was the luminous intensity system, but we now learn that the methods used in the various countries are very diverse, and that the task of standardizing them has been entrusted to an IALA Sub-Committee.

What we are not able to understand is how nominal range could fill a role of universalness, a role that — for the present at least — luminous intensity does not possess.

Nominal range (P_n) is in point of fact linked to luminous range (I) by the Allard formula (*) in which values of $E_s = 0.686$ and $T = 0.74113$ (corresponding to a visibility of 10 miles) have been chosen. In consequence — or so it seems to us — all the drawbacks to luminous intensity are thus transferred to nominal range.

In actual fact the only progress made is that a reference value for the coefficient T has been chosen.

Let us now examine this decision from the navigational angle, as this is the one most familiar to us.

The mariner looking for a particular light at night-time will normally content himself with a quick search in the Light Lists and on his charts for an approximate indication of the distance at which he is likely to perceive this light. He does not ask for more since he is perfectly well aware that the factors involved for altering any forecast of luminous range are so numerous that it is useless for him to pursue the dream of a deceiving theoretical accuracy.

He would naturally be very satisfied with knowing the "actual" distance at which he might expect to see the light because this element when known with exactitude could add to the knowledge of the ship's position, but unfortunately the system suggested by the IALA does not help him in this way.

He enters a graph, in fact, with two imperfectly known elements in order to arrive at a result which in its turn will be just as imperfect.

The first of these elements is luminous intensity (or nominal range) whose "approximation may in many instances amount to over 50 %". As to the second element, visibility, this has to be established from weather forecast bulletins, and this suggests the need for several observations.

In these bulletins the visibility is given by a code number that indicates the upper and lower limits of visibility : for example,

Number 6 indicates visibility of from 4 — 10 km

Number 7 indicates visibility of from 10 — 20 km

Number 8 indicates visibility of from 20 — 50 km

According to the system proposed to us — and using the IALA graph — we shall find that for a code number 8 visibility a nominal range of 15 miles corresponds to a luminous range varying between 15.5 and 28 miles. Furthermore it has to be borne in mind that these are but forecasts, that the visibility value given is for a zone twice the size of Sardinia, and that the mariner is supposed to correct this value by taking into account the trend of its development; and that contingent factors such as the presence of the moon and its azimuth are not taken into consideration.

It would appear to us that the result obtained will be of very small practical value.

The mariner — to return to the true utilizer of the Light Lists — will be satisfied if he is supplied an approximate value for the range of lights in fair weather. Basing himself on his own experience he will be

$$(*) P_n^2 = I \frac{T P_n}{E_s}$$

able to estimate the reduction in visibility on the spot itself. This, moreover, is what he has always done without complaining.

We are told that the nominal range can be considered as being the luminous range in clear weather. However, this is not always true. In the Mediterranean, for instance, the clear weather visibility differs considerably from this value, and the luminous range can, in these circumstances, be much different from the nominal range as is shown by the examples in the following table in which we have indicated nominal range, luminous range for a visibility of 15 miles, and luminous range in average weather ($P_{0.5}$) deduced from almost a hundred years of statistics.

| Light | I (in candelas) | Nominal Range V = 10 n.m. | Luminous Range V = 15 n.m. | Luminous Range in average weather |
|--------------------------|--------------------|---------------------------------|----------------------------------|---|
| Cozzo Spadaro E. 1882 | 474.10^3 | 23.6 | 31 | 32.3 |
| Porto Corsini E. 2418 | 70.10^3 | 18.8 | 25 | 27 |
| Punta Maestra E. 2440 | 523.10^3 | 24.0 | 32 | 32.6 |

From this it follows that the only nominal range given in the Light Lists — and worse still on nautical charts — would have no practical significance whatever, and in very many cases would give rise to mistakes on the part of certain mariners, such as fishermen for example who are little inclined to consult graphs and tables.

We are fully prepared to understand the necessities of engineers, provided, naturally, that this does not complicate matters too much for mariners. However, it seems to us that the mariner as well as the engineer has need of universal notions. A mariner voyaging from the North Sea to the Mediterranean must be able to interpret in the same fashion the ranges of lights shown on nautical documents without being obliged to have recourse to tables or graphs. To the mariner it is quite normal (at least in our opinion) that two lights of the same luminous intensity but in different coastal zones should have a different luminous range, one which takes into account, in some measure, the different weather conditions.

This is an assertion which may seem strange to those not used to the sea, but fundamentally it is the reason why the luminous ranges of Italian lights have up to now been shown without change in the British List of Lights and without any indication in the Preface that ranges in average weather are concerned. In order to bring these ranges to a visibility of 10 miles it would, as we have seen, be necessary to reduce considerably the values indicated, and this would make the lights comparable from the engineer's viewpoint, but not from the mariner's point of view.

In our opinion the comparison with geographical range is not valid

because there are the following two basic differences between it and the luminous range.

— *Geographical range can be known to a good degree of accuracy because it is computed (ignoring some inaccuracies due to some reasons pertaining to optics or due to vertical movements of the sea) from thoroughly known measurements such as the height of the light and the height of the mariners's eye-level above the sea level.*

— *Geographical range, thus computed, can very well be used in navigation for practical ends in order to establish the light's distance at the moment it appears on the horizon line.*

This justifies the use of a table to convert a geographical range for an eye-level of 5 metres to the mariner's actual eye-level.

Finally, we come to a consideration of a practical order. Is the game worth the candle ? (The expression is most apposite). It would mean upsetting a system which has existed from time immemorial without — to the best of our knowledge — any drawbacks, in order to arrive at a result of very debatable worth.

In order to meet the wishes of engineers, would it not be easier to recommend that in Light Lists luminous intensity be always shown in candelas (or in kilocandelas) as this concept is becoming universal as a result of the conclusions reached by the IALA Sub-Committee.

The IALA graph could be included in the Light Lists (without showing nominal range), so that those so wishing may have an approximate idea of luminous range in terms of both intensity and estimated visibility, or else — and this is still more useful — so that they may obtain an idea of visibility in terms of the distance at which a light of known intensity is perceived.

In the conclusion to their article Monsieur BLAISE and Monsieur PETRY point out the need for engineers to make observations of visibility and to gather statistical data so that the Allard formula may be checked. To some extent this re-opens the whole question — but here we are entirely in agreement because on the basis of such statistics it will be possible to determine the luminous range for each light with a much greater probability of accuracy, and this would perhaps lead to a final answer to our problem.

Observations of such a type would be fairly easy to organize, for this could be done by distributing simple questionnaires to the merchant vessels of the principal fleets of the world and these could be gathered in by national Hydrographic Offices, or else by the IHB itself.

Finally we must acknowledge that the problem is most likely simpler to resolve in the Mediterranean than in the North Sea, where quick changes in visibility are bigger and more frequent. However, it seems to us that it is always useless to try to seek a scientific exactness where this will be quite impossible to find.