SPEED TRIALS

SPEED, LENGTH OF APPROACH RUN AND SPEED REDUCTION IN TURNS

EFFECT OF WIND ON SPEED

by J. Th. VERSTELLE

Article reproduced from the Hydrographic Newsletter No. 34, *July 1962, of the Hydrographic Service of the Royal Netherlands Navy*

Introduction

It is generally acknowledged that the length of straight approach runs for speed trials should be of the order of 3 to 3 1/2 nautical miles and that turns should be made at a rudder angle of 5°. As these figures will have been based on experience with ships that nowadays are considered relatively small (some 20 000 tons displacement or smaller) the question may be, and in some cases has been, raised as to whether the present-day very large tankers at their usual speed of about 17 knots might not require longer approach runs and/or smaller rudder angles for turning to the opposite course. This paper intends to give an answer to this question.

Although the required information could up to now be collected for one ship only, the trial described in this paper indicates that for this particular ship — of 62 000 tons displacement and a speed of 17 knots — the answer to the question is negative.

Trial

Ship : single screw turbine tanker of 62 000 tons displacement.

Draught : { fore 38′00″ / aft 38′00″ } fully loaded condition

Depth of water under keel : 55 fathoms

S(haft) H(orse) P(ower) : 16 140

Speed run courses : 335° and 155°

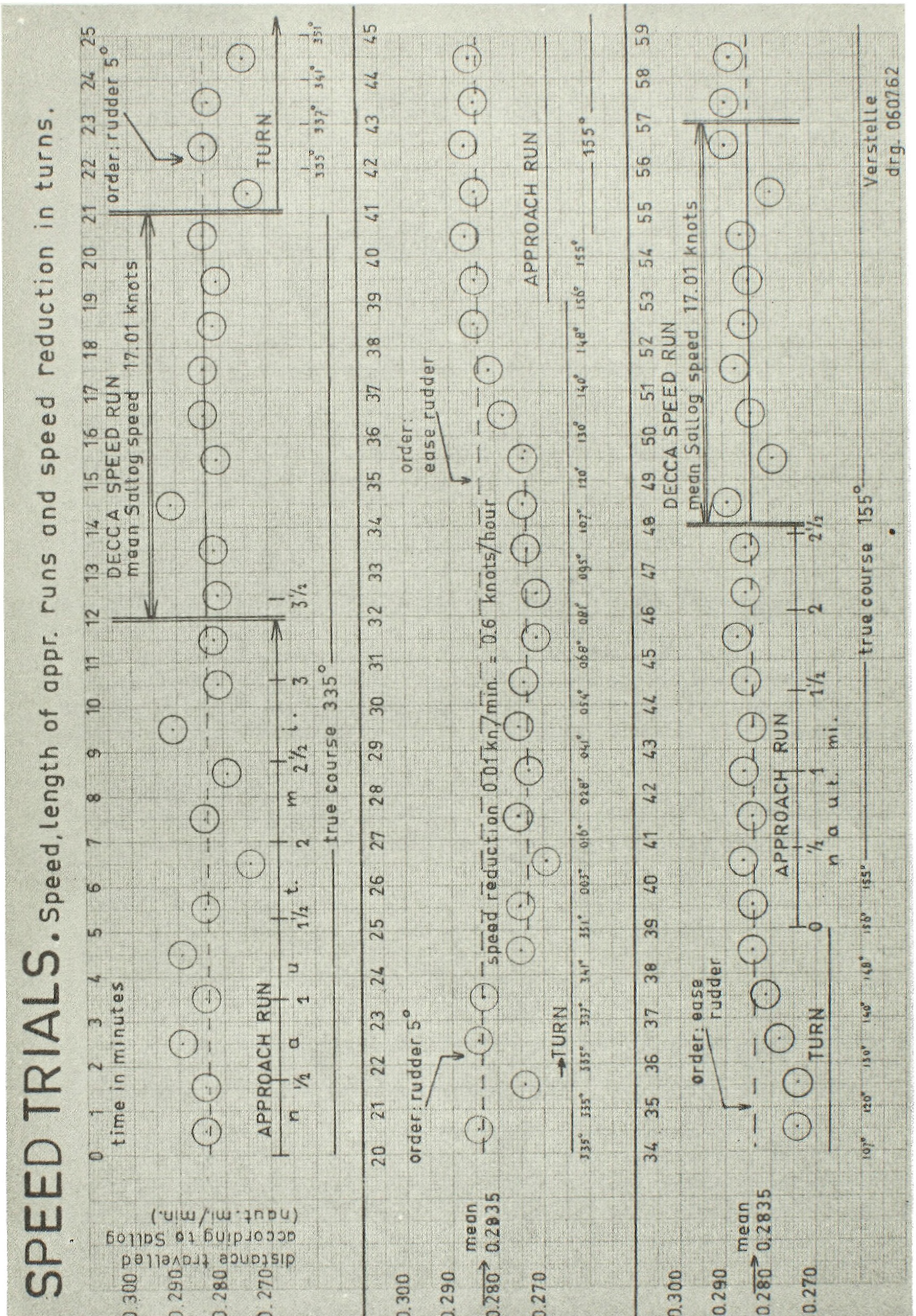
Rudder angle : 5°

Diameter of turning circle : 1.4 nautical miles

Wind and sea : NW 4.

Swell : none

Engine revolutions : 107; constant within ± 0.9


SPEED TRIALS. Speed, length of appr. runs and speed reduction in turns.
distance travelled according to Sallog (naut.mi./min.)
time in minutes
APPROACH RUN
DECCA SPEED RUN
mean Sallog speed 17.01 knots
TURN
order: rudder 5°
n a u t. mi.
true course 335°
mean 0.2835
order: ease rudder
speed reduction 0.01 kn/min. = 0.6 knots/hour
APPROACH RUN
true course 155°
Verstelle
drg. 060762

Observations. Distances travelled according to Sallog were observed (visually) every 60 seconds. Scale accuracy 0.001 nautical mile; actual visual reading accuracy of (fast moving) fraction meter estimated at ± 0.003 nautical mile. Systematic error of Sallog is not applied to the readings (calibration against definite speed showed that the Sallog speed needed a correction of + 1.0 %).

Wind effect. Assuming (for simplicity) that the deceleration due to the NW wind on course 335° is equal to the acceleration on the opposite course 155°, the wind effect has been computed to be 0.0104 nautical mile/minute times cosine of angle of incidence. A correction thus computed has been applied to each of the individual Sallog speeds, thereby reducing them to so-called " no wind speeds ".

Results. Sallog speeds (corrected as indicated above) have been plotted against time in the annexed graph; circles of 0.003 nautical mile/minute radius indicate the estimated uncertainty of the observations.

The spread respective to the overall mean speed of 0.2835 nautical mile/minute (17.01 knots) is most likely caused by the combination of :

a. Short time variations in engine revolutions/min. (up to 0.9) respective to mean; 0.9 rev. would explain a speed variation of 0.046 nautical mile/minute.

b. Instrumental irregularities of the Sallog.

It will be seen from the graph, that the speed in the approach, as well as in the actual speed runs, has — within the limits of the above-mentioned uncertainties — been constant, whereas there is a systematic speed reduction of about 0.6 knots during a large part of the 5° turn (steam-pressure at inlet of turbine constant during the whole period of the trial).

The two approach runs were of 3 1/2 and 2 1/2 miles (12 and 9 minutes).

Conclusion

For a ship of 62 000 tons displacement, at a speed of 17 knots and given reasonable conditions of wind and sea, very short approach runs would seem to be permissible and the speed reduction during the turn does not affect the speed in the approach run, whereas the rudder angle need not be smaller than 5°.

Because of practical and operational considerations (such as sufficient time to stabilize engine revolutions, turbine inlet pressure, etc., and also to allow sufficient time to measure fuel consumption and S.H.P.), the *general rule* of about *3 miles long approach runs* and *5° rudder angle* should however be kept for this type of ship (provided depth of water *under the keel* is not less than 55 m (30 fathoms) at a speed of 17 knots).

Remarks

1. During a trial with a 82 000 tons tanker at a speed of 17 knots, it was felt that a 5° rudder angle resulted in appreciable speed loss during

the turn; no Sallog readings were taken to *measure* the effect. For further turns, the rudder angle was reduced to 2°.

Following the standard procedure with Decca speed trials, approach runs were 10 minutes or approximately 3 miles; from the 19 Decca fixes in each of the actual speed runs, it could be shown that this ship — for both 5° and 2° turns — was at full speed at the start of each run.

2. Large and very fast ships will require approach runs in excess of 3 miles and/or rudder angles smaller than 5°.

No exact information, based on measurements, is at my disposal (experience — as regards these aspects — with the superliner *France* has not yet been published). It should however be borne in mind that a standard Decca approach run takes 10 minutes and therefore is 5 miles at a speed of 30 knots, which is likely to be enough, even with 5° turns.

For a destroyer at 30 knots it could be shown that the ship was at full speed at the start of the speed runs after a 10 minute approach run and 5° turning angle, as was the case also with a 25 knots liner of 38 000 tons.

General conclusions

1. *Approach run and turning angle*

a. Up to 80 000 tons displacement at about 17 knots.
Length of approach runs *10 minutes.* Rudder *angle 5°.*

b. Between 80 000 and 130 000 tons at 17 knots.
Very likely similar to *a.*; confirmation from actual measurements is desirable (preferably with photographic registration of Sallog).

c. Large ships at speeds in excess of 17 knots.
Similar to *b.*; (because the Sallog fraction meter is then moving very fast, photographic registration is required).

2. *Wind effect*

Speed acceleration and deceleration due to even a moderate wind is considerable even on a tanker with very little superstructure as compared with a liner (0.6 knots at wind force 4 in the example described in this paper).

Except at very strong winds (wind gusts), the effect is however — within very narrow limits — eliminated in the final speed computed by the usual means of means method.