

R.A.W. August 25th 1924



Report on short Discussion with
Mr R.V. Southwell, M.A. and Mr R. Jones, M.A.,
at N.P.L., Teddington, on Aug. 23rd 1924.

~~Introduction.~~
~~Object of Visit.~~
~~Reason for~~

It was felt that the advice and/or criticism of Mr Southwell and Mr Jones would be of value in matters affecting

1. The shape of the proposed airship
2. The turning of the proposed airship

and in addition, the Head of Design and Research, R.A.W., desired certain information in respect of proposed full scale experimental work on rudder oscillations and turning.

1. Those



1. Shape

Those of the mathematical curves of 'streamline' shape (Work Book B.I. 14/15-?) which had been selected as the most suitable for airship hull forms were shown to Mr Southwell and Mr Jones.

These were the shapes 1, 2, 3, 4, 6, 12, 13, 15, 17, 18.

In addition, the following curves were available

- a. Curves of $\frac{dy}{dx}$ for shapes 1, 3, 4, 6, 2, 12, 15, 13
- b. " " $\frac{d^2y}{dx^2}$ " " 1, 3, 4, 6, 2, 12, 13
- c. " " $\frac{1}{y} \frac{dy}{dx}$ " " 3, 4, 2, 12, 15, 13
- d. " " Volume distribution for shapes 2, 3, 4, 12, 13, 15, 17.

The curves ~~are~~ ~~included~~

Mr Southwell



Mr Southwell had previously suggested at the R.A.W. that some criterion capable of aerodynamic discrimination would be of use in selecting one from a number of shapes of equal structural and volumetric merit: he had hoped, moreover, that such a criterion would be found as a function of the transverse curvature, $\frac{1}{y} \frac{\partial^2 z}{\partial x^2}$, and for this reason the curves z were plotted.

Unfortunately, it now appears that the ~~possibility~~ ^{successful} ~~of~~ development of a test of this nature ~~is improbable~~ ~~is remote~~.

However, Mr Southwell reiterated his belief that to be ~~an~~ efficient aerodynamically, the lengthwise curvatures of the shipshape should never



never numerically increase in traversing half the curve of shape from head to tail.

The curves of $\frac{\partial^2 y}{\partial x^2}$ may be considered as giving curvatures very closely except where $\frac{\partial y}{\partial x}$ is not small (e.g. at the nose or at the tail, if rounded), and these were examined in consequence.

It was seen that ~~for~~^{of} the ~~shapes~~^{forms} with pointed tails, the most agreeable shape for which $\frac{\partial^2 y}{\partial x^2}$ continued to rise towards zero was ~~Shape~~^{No} 3, and therefore Mr Southwell & Mr Jones considered that it probably had the best aerodynamic characteristics. Mr Jones pointed out however, that in practice the presence of the fins probably rendered the tail shape comparatively unimportant in their vicinity.

In this



In addition, Mr Southwell suggested that even over the bare hull, the flow was no longer 'streamline' aft of about .85 of ~~the~~ its length.

These considerations led to the decision that so long as the curvature was of decreasing magnitude until at least .85 of the ship's length had been traversed, the curvatures of the remainder might, provided the ship was satisfactory from points of view other than the aerodynamic, be conveniently ^(within reasonable limits) left to arrange themselves ~~within~~ ~~reasonable limits.~~

It was realized that this

This
restriction



This restriction of curvature was unlikely to produce any structural difficulty, and assuming sufficient volume available in the tail, a shape so restricted was to be commended, for it ^{would generally have} ~~would in general be suitable but~~ generally an additional aerodynamic advantage in being suitable for the mounting of the most efficient type of fin — one of high aspect ratio

Both gentlemen considered the heads of our shapes to be suitable, with the exception of shape 15, which was too fine.

They do not favour very bluff noses, and mentioned their R33 model heads

no space to be left here.



whose nose was a 4:1 ellipse as
being about as ~~thick~~^{sharp} bluff as was
advisable.

They considered the 5.5:1 fineness
ratio of the shapes as drawn out,
to be very suitable, and likely to
give good results

————— " —————

2. Fins.

The writer learnt that no R.33 model data other than that of R+M 361 is available. R+M 361 is of no use for the calculation of fin criteria as forces and moments on the fins cannot be isolated by means of it.

Mr Jones considered that the shape of the ship ~~was~~ too largely ~~predominant~~ ^{by} ~~a function~~ affected the fin efficiency for comparison of this function for different ships to be fair or reliable; attempts at correlation of existing fin efficiencies, fin areas, ship shapes etc as a means of determining the fin areas proper to a proposed ship ^{were} ~~were~~ ~~and~~ therefore



Less likely to yield satisfactory results than an estimate based on a reliable experiment on a ship to which the proposed ship is likely to approximate in shape.
(cf. T1917)

3. The required information with regard to turning experiments and model oscillation, was received ~~unworking~~ and delivered.

J. K. Cox

26th Aug. 1924

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R.A.W.

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at N.P.L., Teddington, on Aug. 23rd 1924

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1. The shape of the proposed airship
2. The finning of the proposed airship

and in addition, the Head of Design and Research, R.A.W., desired certain information in respect of proposed full scale experimental work on rudder oscillations and turning.

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a. Curves of $\frac{\partial y}{\partial x}$ for shapes 1, 3, 4, 6, 2, 12, 15, 13

b. Curves of $\frac{\partial y}{\partial x^2}$ for shapes 1, 3, 4, 6, 2, 12

c. Curves of $\frac{1}{y \frac{\partial s}{\partial x}}$ for shapes 3, 4, 2, 12, 15, 13

∞ Curves of Volume distribution for shapes 2, 3, 4, 12, 13, 15, 17

Mr Southwell

Mr Southwell had previously suggested at R.A.W. that some criterion capable of aerodynamic discrimination would be of use in selecting one from a number of shapes of equal structural and/or volumetric merit: he had hoped, moreover, that such a criterion would be found as a function of the transverse curvature,

—1—

$y \frac{\partial^2}{\partial x^2}$

and for this reason the curves c were plotted. Unfortunately, it now appears that the successful development of a test of this nature is improbable.

However, Mr Southwell reiterated his belief that to be efficient aerodynamically, the lengthwise curvatures of the ship shape should never numerically increase in traversing half the curve of shape from head to tail.

The curves of (formula) may be considered as giving curvatures very closely except where (formula) is not small (e.g. at the nose or at the tail, if rounded), and in consequence these were examined.

It was seen that of the forms with pointed tails, the most agreeable shape for which (formula) continued to rise towards zero was No. 3, and therefore Mr Southwell & Mr Jones considered that it probably had the best aerodynamic characteristics. Mr Jones pointed out however, that in practice the presence of the fins probably rendered the tail shape in their vicinity comparatively unimportant.

In addition, Mr Southwell suggested that even over the base hull, the flow was no longer 'streamline' aft of about .85 of its length.

These considerations led to the decision that so long as the curvature was of decreasing magnitude until at least .85 of the ship's length had been traversed, the curvatures of the remainder might, provided the ship was satisfactory from points of view other than the aerodynamic, be conveniently left (within reasonable limits) to arrange themselves.

This restriction of curvature was unlikely to produce any structural difficulty, and assuming sufficient volume available in the tail, a shape so restricted was to be commended, for it would generally have an additional aerodynamic advantage in being suitable for the mounting of the most efficient type of fin – one of high aspect ratio.

Both gentlemen considered the heads of our shapes to be suitable, with the exception of shape 15, which was too fine. They do not favour very bluff noses, and mentioned their R33 model head whose nose was a 4:1 ellipse as being about as bluff as was advisable.

They considered the 5.5:1 fineness ratio of the shapes as drawn out, to be very suitable, and likely to give good results.

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less likely to yield satisfactory results than an estimate based on a reliable experiment on a ship to which the proposed ship is likely to approximate in shape. (eg. T1917)

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H. Roxbee Cox

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