

UNCLASSIFIED

AVIATION/21

22nd Part of Report No. A. & A.E.E./689, G.
24 APR 1942

AEROPLANE AND ARMAMENT EXPERIMENTAL ESTABLISHMENT,
BOSCOMBE DOWN.

Hurricane IIB. B.N. 114
(Merlin XX)

Handling trials with 2 - 500 lb. bombs fitted.

A. & A.E.E. ref:-4482/51- A.S. 55/31.
M.A.P. ref:- S.E. 11579/RLE1(b)

Progress of Issue of Report.

This report deals with the aeroplanes as tested. Action to remedy defects, or decisions to accept items not in strict compliance with the specification, are matters for decision and action by the Ministry of Aircraft Production.

Report No.	Title
17th Part of A. & A.E.E./689, G.	IID. Z. 2326 - SECRET - Limited circulation.
18th do	IID. Z. 2326 - do do
19th do	IIB. B.N. 114 - Weights and loading data.
20th do	IIC. Z. 2905 - Weights and loading data.
21st do	II. Z. 3451 - Brief handling and level speed performance with 2 small bomb containers fitted.

Summary.

1. Introduction.

This report deals with handling trials on a Hurricane II aircraft fitted with a 500 lb. bomb under each wing. The tests have been divided into three parts: (a) with the two bombs in place (b) with the starboard bomb only in place, and (c) with the port bomb only in place. The handling characteristics for the three cases are discussed fully on pages 1 to 4. The tests were made on 1.4.42.

2. Condition of aeroplane relative to tests.

The all-up weight of the aeroplane with the full bomb load was 8416 lb. and the centre of gravity position was 59.1" aft of the datum point (undercarriage down). Raising the undercarriage moves the centre of gravity position 0.3" further aft. The design centre of gravity limits are 57.0" and 60.6" aft of the datum including the 1% S.M.C. extension.

The aircraft was fitted with 12 x 30" guns but the gun ports were sealed during the tests. The aeroplane was also fitted with bomb carriers designed to take either a 250 lb. or 500 lb. bomb.

A W/T mast complete with aerial was fitted. I.F.F. aeriels were installed. An automatic recognition signal pistol hole was fitted near the top of the fuselage at the foot of the main W/T mast.

An interal bullet-proof windscreen was fitted and a rear view mirror was mounted on top of the pilots' hood outside. A snowguard was fitted over the air intake. An oil slinging ring was fitted on the nose of the cowling. Triple ejector exhausts with fishtails were fitted.

3. Handling.

3.1. The aeroplane was first flown at full load (2-500 lb. bombs).

Take-off. The take-off is normal except for a slightly more pronounced swing to the left. The take-off run is not noticeably lengthened compared with a Hurricane II at full fighter load.

Climb. The initial climb is a little worse, due to the extra load. The stability on the climb is about normal for a Hurricane II except that the nose up

and down couples were rather more pronounced and this affects the climb if the rudder is not held steady. The rudder bias is not quite sufficient for a full throttle climb at 140 m.p.h. A.S.I., the minimum trimmed speed being 150 m.p.h. A.S.I.

General flying. There was no noticeable difference from a Hurricane fighter. In steep turns up to approximately 5g the aircraft showed no tendency to tighten in the turn.

Stall. The stalling speed with flaps and undercarriage UP = 94 m.p.h. A.S.I.
The stalling speed with flaps and undercarriage DOWN = 73 do.

Flaps and undercarriage UP

There is little warning of the approach to the stall, except for a slight pitch immediately preceding the stall. At the stall the right wing drops slowly but can be held up with aileron. Moving the control column right back produces a lateral rock which becomes more violent and finally results in the left wing dropping through 70° to 80° followed by the nose.

In slow turns to the left at a minimum speed of 104 m.p.h. A.S.I. the right wing drops and the aircraft comes out of the turn at 102 m.p.h. A.S.I. In a slow turn to right at a minimum speed of 100 m.p.h. A.S.I. the nose drops and aircraft comes out of turn at 98 m.p.h. A.S.I. Aircraft will recover from either turn holding the rudder fixed, though recovery is slower from the right turn.

Gliding at 1.1 times stalling speed the aircraft is unstable with the stick free but is steady if the stick is held.

Flaps and undercarriage DOWN

As the speed is reduced the aircraft becomes more tail heavy and at 78 m.p.h. A.S.I. a slight pitching commences. At the stall the right wing drops sharply through about 60°. With the control column right back this wing can be held up partially by use of aileron but after a short while the aircraft flicks sharply over to the left.

In slow turns to the left at a minimum speed of 81 m.p.h. A.S.I. the aircraft comes sharply out of the turn at 80 m.p.h. A.S.I.

In slow turns to the right at a minimum speed of 80 m.p.h. A.S.I., the right wing and nose drop at 79 m.p.h. A.S.I.

Dives. The limitations for diving are 3000 R.P.M. and +9 lb/sq.in. boost and the maximum A.S.I. is 390 m.p.h.

The aeroplane was trimmed for full throttle level flight in each case.

Dive No.	Throttle position	Height IN (ft)	Max. ASI (mph)	Ht. Max. ASI (ft.)	R.P.M.	Height OUT (ft)
1	FULL	13,000	360	8,500	2800	8,200
2	FULL	12,500	370	6,000	3000	5,800
3	1/2	12,500	380	6,200	3000	6,000
4	FULL	13,500	390	5,500	2800	5,200
5	FULL	15,000	397	6,900	2800	6,500

The controls are normal in the dive and there is no tendency to drop a wing. In the first dive slight aileron snatch was noticed at a speed above 320 m.p.h. A.S.I. This is believed to be due to the flaps having dropped slightly. The flap indicator was reading zero but the flaps were selected up again and for the remaining dives the aileron control was normal.

There was some vibration during dives at 3000 R.P.M. but in general the aircraft was remarkably smooth for a Hurricane II.

The aircraft reaches 360 m.p.h. A.S.I. fairly easily but requires some pushing to reach maximum A.S.I.

The limiting A.S.I. of the last dive was held for some seconds during

/which

...which 100 yds in each direction was carried being noticed.
On inspection after the dive fuse on each bomb had sheared, leaving board bomb had become loose and ...
3.2. Test 2. Carrying ...
right wing. Take-off. ...
A slight ...
noticeable ...

which 10° yaw in each direction was carried out without any detrimental effect being noticed.

On inspection after the dives it was found that the vanes of the tail fuse on each bomb had sheared, leaving the bomb unsafe. The tail fins on the starboard bomb had become loose and cracked in places.

3.2. Test 2. Carrying starboard Bomb only.

Take-off. This is normal except for a very slight tendency to drop the right wing.

Climb. This is normal and the tendency to swing is rather less marked. A slight amount of aileron is required to hold up the right wing but this is hardly noticeable as the aileron control is very light.

General flying. This is also normal. The weight of the bomb is almost unnoticeable except with full flap when almost half the aileron control is required to hold the right wing up.

Stall. The stalling speed, with flaps and undercarriage UP = 92 m.p.h.
" " " " " " " " DOWN = 76 m.p.h.

Flaps and undercarriage UP

Flaps and undercarriage DOWN

The stalling characteristics are the same as for those in Test I.

Slow turns to the left were done at a minimum speed of 102 m.p.h. A.S.I. Below this speed the A.S.I. cannot be held steady. At 99 m.p.h. A.S.I. the aircraft stalls then comes out of turn. Slow turns to the right were done at a minimum speed of 102 m.p.h. A.S.I. Below this speed the aircraft is very unsteady and at 95 m.p.h. A.S.I. stalls and then comes out of turn. The aircraft will recover from either turn with the rudder fixed.

Slight pitching commences at 82 m.p.h. A.S.I. and at 76 m.p.h. A.S.I. the right wing drops slowly and there is insufficient aileron control to hold it up. The stall is less marked than in Test 1.

Slow turns to the left at a minimum A.S.I. of 78 m.p.h. were done. At 76 m.p.h. the nose drops and the aircraft then comes out of turn. To the right the turns were done at a minimum A.S.I. of 82 m.p.h. At 80 m.p.h. A.S.I. the right wing drops and then the aircraft comes out of turn. In the turn to the right half to three-quarters aileron control is required to hold up the right wing.

Gliding at 1.1. times stalling speed the aircraft was unstable. Approximately half the aileron control was required to hold up the right wing.

Dives. A dive to 360 m.p.h. A.S.I. was carried out and there was no tendency in this case for the aircraft to drop a wing.

Approach and Landing. The approach is straight-forward though approximately half aileron is required. The landing is normal.

3.3. Test 3. Carrying port bomb only.

Take-off. This is the worst case and if the aircraft leaves the ground early due to rough ground the left wing drops and cannot be held up even with full aileron. The swing on take-off is also much more pronounced and considerable pressure is required to the right on the rudder during the take-off and initial climb.

Climb. At 140 m.p.h. A.S.I. climbing speed the pressure required to the right on the rudder is fairly considerable. A small amount of aileron is required to hold up the left wing.

General flying. Rather more aileron control is required to hold up the left wing on this load than was required to hold up the right wing in Case 2.

Stall. The stalling speed, with flaps and undercarriage UP = 91
" " " " " " " " DOWN = 68

Flaps and undercarriage UP

At the stall the right wing drops slowly. Moving the control column right back produces the same characteristics as for Test 1.

Slow turns can be made to the left at a minimum speed of 102 m.p.h. A.S.I. The right wing drops as the speed is reduced.

In slow turns to the right at a minimum speed of 98 m.p.h. A.S.I., a lateral rock develops at 97 m.p.h. A.S.I.

The aircraft will recover from the turns with the rudder fixed.

Flaps and undercarriage DOWN

Slight pitching commences at 75 m.p.h. A.S.I., and, at the stall, the nose drops, accompanied by a sharp drop of the right wing through about 60°.

In slow turns to the left at a minimum speed of 76 m.p.h. A.S.I., the aircraft is quite steady.

At 74 m.p.h. A.S.I. the aircraft stalls and comes out of turn.

In slow turns to the right at a minimum speed of 78 m.p.h. A.S.I. the aircraft is slightly less steady. At 74 m.p.h.

A.S.I., the aircraft stalls and the nose drops, aircraft going into a dive.

Gliding at 1.1 times stalling speed the aircraft is unstable.

Approximately half aileron is required to hold up the left wing.

Dive. There was no marked tendency to drop a wing in a dive to 370 m.p.h. A.S.I.

Approach and landing. The aircraft is more unwieldy during the approach at this load. Response to aileron control during recovery from a left turn is slow. At the touch down speed almost full aileron is required.

4.0 Baulked Landings.

These were not attempted for the other two cases, being considered worse at case 3 as shown below.

Opening up after a baulked landing requires considerable care. The throttle should be opened slowly as the change in trim is very marked. At 100 m.p.h. A.S.I. almost full aileron and rudder, together with a considerable backward pressure on the control column, are necessary to prevent a diving turn to the left. The climb away with full flaps should not be attempted below 110 m.p.h. A.S.I.

5. Discussion of results.

The handling characteristics generally are remarkably well maintained in spite of the large increase in weight, and the aeroplane behaves, with asymmetrical load, like a Hurricane without bombs.

With an asymmetrical load, the handling characteristics are satisfactory, but the take-off and landing are not so straightforward. This is particularly so in the case of the one bomb on the port side only.

6. Conclusions.

The aeroplane is satisfactory for use by Service pilots at any of the loads described in this report, but, owing to the increased difficulty of effecting a landing with an asymmetrical load, and particularly because of the difficulty of carrying out a baulked landing in this case, we recommend that pilots be advised to jettison the one bomb before attempting to land. Landing with two bombs fitted is satisfactory.

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