AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

Reference:	CA18/2/3/9120

Aircraft Registration	**ZU-EFY**	**Date of Accident**	06 January 2013	**Time of Accident**	1035Z
Type of Aircraft	Bantam B22J		**Type of Operation**	Private	

Pilot-in-command Licence Type	National Pilot License	**Age**	53	**Licence Valid**	Yes
Pilot-in-command Flying Experience	Total Flying Hours	50.7		Hours on Type	50.7

Last point of departure	Hazyview Airfield, (Mpumalanga Province)
Next point of intended landing	Hazyview Airfield, (Mpumalanga Province)

Location of the accidentsite with reference to easily defined geographical points (GPS readings if possible)
GPS co-ordinates S25 05.539' E030 42.415' (Sabie area, Mpumalanga Province)

Meteorological Information	Temperature: 24 °C Dewpoint: 17 °C Visibility: >10k m Cloud: Sky Clear Surface wind 100°/11kts

Number of people on board	1+1	**No. of people injured**	1+1	**No. of people killed**	0

Synopsis

On 06 January 2013, the pilot departed with his wife in his Bantam aircraft from Hazyview airfield on a scenic flight to the Bridal Veil waterfall in theSabie area.

The take-off and routing to the waterfall was uneventful. The pilot's wife captured photographs of the waterfall whilst the pilot manipulated the aircraft's controls.

The pilot's wife was unsure of the clarity of her photographs and the pilot opted to commence a climbing turn to the right and route back to the waterfall to capture more photographs. Whilst climbing and routing away from the waterfall, the pilot positioned the aircraft further into the valley. The pilot then experienced a loss of altitude and the aircraft continued to descend in the valley.

The pilot attempted to land the aircraft on a service plantation road. The aircraft's right wing struck tree tops first causing the pilot to lose control of the aircraft. The aircraft impacted with vegetation short of the service road.
The occupants vacated the aircraft without assistance. The pilot's wife sustained serious injury to her back whilst the pilot was treated for minor injuries. The aircraft was substantially damaged.

Probable Cause

Unsuccessful forced landing following failure to maintain flying speed

Contributory Factors
Lack of familiarity with the aircraft, inability of pilot to identify aircraft's stall characteristics

IARC Date		Release Date	

AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator	**:**P G Eksteen
Manufacturer	**:**MicroAviation New Zealand LTD
Model	**:**Bantam B22J
Nationality	**:**South African
Registration Marks	**:**ZU-EFY
Place	**:**S25 05.539' E030 42.415' (GPS) (Sabie, Mpumalanga)
Date	**:**06 January 2013
Time	**:**1035Z

All times given in this report are Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

Purpose of the Investigation:

*In terms of Regulation 12.03.1 of the Civil Aviation Regulations (1997) this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and **not to establish legal liability**.*

Disclaimer:

This report is produced without prejudice to the rights of the CAA, which are reserved.

1. FACTUAL INFORMATION

1.1 History of Flight

1.1.1 On 06 January 2013 at approximately 0950Z, the pilot departed with his wife in his Bantam aircraft from Hazyview airfield on a scenic flight to the Bridal Veil waterfall in the Sabie area. The take-off and routing to the waterfall was uneventful and lasted forty minutes. The pilot's wife captured photographs of the waterfall whilst the pilot manipulated the aircraft's controls and maintained an altitude of 4300ft Above Mean Sea Level (AMSL).

1.1.2 The waterfall is surrounded by tall vegetation and steep terrain. The top elevation of the waterfall is 4012ft AMSL. The pilot maintained an approximate clearance of 288ft between the waterfall and the aircraft. After capturing photographs of the waterfall the pilot opted to commence a climbing turn to the right and route back to the waterfall to capture more photographs.

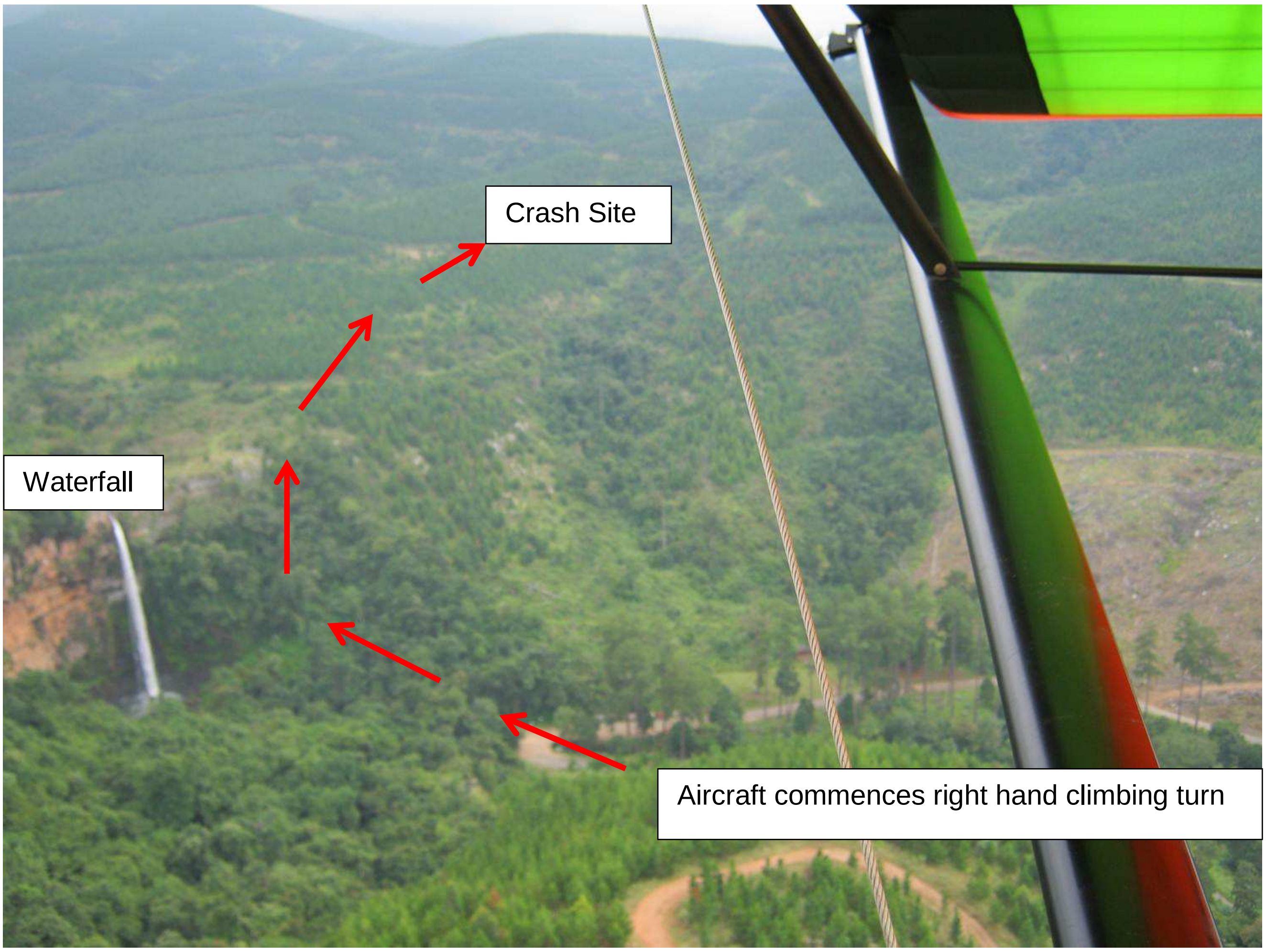

Figure1: Flight path of aircraft prior to impact.

1.1.3 Whilst completing a climbing turn to the right the air craft maintained a positive rate of climb temporarily thereafter he noticed that the aircraft started to descend. The pilot confirmed he had a full power setting but the aircraft continued to descend towards the tall vegetation in the surrounding area.

1.1.4 The pilot spotted a plantation service road and attempted to execute an emergency landing on the road, however during the emergency landing the left hand wing impacted with the tree tops first, causing the pilot to lose control of the aircraft.

1.1.5 The aircraft came to rest on an embankment (elevation 4030ft AMSL) and the pilot and his wife evacuated the aircraft without assistance.

1.2 Injuries to Persons

Injuries	Pilot	Crew	Pass.	Other
Fatal	-	-	-	-
Serious	-	-	1	-
Minor	1	-	-	-
None	-	-	-	-

1.2.1 The pilot’s wife was airlifted from the accident site to hospital where she received medical attention. She sustained a lower back fracture and was hospitalised for 72 hours.

1.2.2 The pilot sustained minor injuries to his neck and right leg.

1.3 Damage to Aircraft

1.3.1 The aircraft sustained substantial damage to the cabin area, wings, undercarriage, nose and propeller.

Figure 2: A view of the aircraft as it came to rest

1.4 Other Damage

1.4.1 The aircraft struck several pine trees prior to coming to rest.

1.5 Personnel Information

Nationality	South African	Gender	Male	Age	53
Licence Number	0279016489	Licence Type	NPL		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	None				
Medical Expiry Date	30 June 2014				
Restrictions	Corrective Lenses and Hypertension protocol				
Previous Accidents	No				

Flying Experience:

Total Hours	50.7
Total Past 90 Days	16.1
Total on Type Past 90 Days	16.1
Total on Type	50.7

1.5.1 The pilot had completed his National Pilot Licence three months prior to the accident flight and was current at the time of the accident.

1.5.2 According to the pilot's training file he displayed satisfactory flying skill and was confident with his flying ability. He was signed out for the stalling exercise after completing 5.1 hours of dual training.

1.5.3 During the post-accident interview with the pilot the investigating team found the pilot's technical knowledge on the aircraft to be very limited.

1.6 Aircraft Information

Airframe:

Type	Bantam B22J	
Serial Number	806-0296	
Manufacturer	Micro Aviation New Zealand LTD	
Year of Manufacture	2006	
Total Airframe Hours (At time of Accident)	445.8	
Last Annual Inspection (Date & Hours)	6 November 2012	431.3
Hours since Last Annual	14.5	
Authority to Fly (Issue Date)	18 June 2012	
C of R (Issue Date) (Present owner)	13 June 2012	
Operating Categories	Private	

Engine:

Type	Jabiru 3300A
Serial Number	33A 1100
Hours since New	52.8
Hours since Overhaul	TBO not yet reached

Propeller:

Type	Brent Thompson
Serial Number	390 64 x 41
Hours since New	52.8
Hours since Overhaul	TBO not yet reached

Weight and Balance

Basic Empty Weight	255kg
Pilot and Passenger	150kg
Fuel on board	36kg
Take-off weight	441kg

1.6.1 The aircraft's Maximum Take-off Weight (MTOW) is 450kg. The aircraft's weight for this flight was within the prescribed limits.

1.6.2 The Bantam B22J aircraft was designed and built in New Zealand. The aircraft was initially equipped with a four cylinder Jabiru 2200A engine. Once the aircraft was marketed in South Africa it became apparent that it was lacking power due to high density altitude operations.

1.6.3 The installation of a six cylinder engine to Bantam B22J aircraft was an approved modification by the South African Civil Aviation Authority (SACAA). This modification was approved by the SACAA for this aircraft on 31 June 2006 under modification number M/06/349E.

1.7 Meteorological Information

1.7.1 An official report from the South African Weather service was obtained.

Wind direction	101°	Wind speed	11kts	Visibility	3000m
Temperature	24°C	Cloud cover	Broken	Cloud base	6500ft
Dew point	17 °C				

1.7.2 The official weather report stated that conditions prior to the departure of the accident flight were Instrument Meteorological Conditions (IMC). The surrounding weather stations in the area indicated that the weather conditions were improving.

1.7.3 During the day and in mountainous areas an anabatic wind (weak upslope wind) was present. The anabatic wind reaches speeds up to 20kts however wind charts indicated an average wind speed of 11kts on the day of the accident.

1.7.4 The weather report indicated the temperature at the time of the accident to be 24°C and the dew point 17°C. This indicates a condition associated with moderate carburettor icing however the pilot and passenger did not note any of the symptoms (loss of RPM, vibration of the engine etc.) associated with carburettor icing during the accident flight sequence.

1.8 Aids to Navigation

1.8.1 The aircraft was equipped with the minimum Visual Flight Rules (VFR) navigation equipment required by the regulations. There were no recorded defects on the navigational equipment prior to the flight.

1.9 Communications

1.9.1 The aircraft was equipped with standard communication equipment as required by the regulator. There were no recorded defects on communication equipment prior to the flight.

1.9.2 The pilot reported his position at the Bridal Veil waterfall on the Very High Frequency (VHF) 124.8 MHZ.

1.10 Aerodrome Information

1.10.1 The accident occurred outside the boundaries of an aerodrome.

1.11 Flight Recorders

1.11.1 The aircraft was not fitted with a cockpit voice recorder (CVR) or a flight data recorder (FDR), and neither was required by regulations to be fitted to this type of aircraft.

1.12 Wreckage and Impact Information

1.12.1 The aircraft's left wing struck several tree tops before the propeller struck a tree, slid down an embankment and came to rest.

1.12.2 The aircraft was found in an upright position nestled between the vegetation facing in a northerly direction.

1.12.3 Witness marks on the propeller indicated that the engine was producing power during the impact sequence.

Figure 3 and 4: ZU-EFY's wreckage between the vegetation

1.13 Medical and Pathological Information

1.13.1 None.

1.14 Fire

1.14.1 There was no evidence of pre- or post-impact fire.

1.15 Survival Aspects

1.15.1 The accident was considered survivable due to the low kinetic energy associated with the impact.

1.15.2 The occupants were properly restrained by making use of the aircraft equipped safety harnesses.

1.16 Tests and Research

1.16.1 The aircraft's engine was inspected by an Approved Maintenance Organisation (AMO) and no faults were found that could have contributed or have caused a loss in engine power.

1.16.2 A flight test was completed by a SACAA appointed test pilot in a Bantam B22J aircraft to identify the stall characteristics of the aircraft. The pilot recommended the addition of a stall warning device due to the lack of stall warning devices in the aircraft. A copy of the report is attached to this report as annexure A.

1.17 Organizational and Management Information

1.17.1 This was a private flight, with the pilot also the owner of the aircraft.

1.18 Additional Information

1.18.1 Stalling

The following information below was taken from:

Volume 1: Air Pilot's Manual, Flight Training

Stalling occurs when the critical angle of attack in an aircraft is exceeded. A speed is used as a reference because light aircraft do not have critical angle of attack indicators.

Warnings of an impending stall include:

- A reducing airspeed
- Operation of a pre stall warning (warning horn, buzzer, light)
- The onset of buffet (a vibration felt on the control stick)
- High nose attitude

Recovery from the stall

- Reduce back pressure by applying forward pressure on control stick
- Once aircraft is un-stalled ease out of the dive and resume normal flight.

1.18.2 A flight was conducted by the investigator in charge and a rated pilot on the Bantam B22J aircraft. The pilot demonstrated various manoeuvres at low speeds and a buffet prior to the stall was evident. The buffet was not significant enough for an inexperienced pilot to identify the warning of the impending stall.

1.18.3 The Bantam B22J stall speed in the clean configuration is 35kts whilst in the landing configuration the stall speed is 34kts.

1.18.4 During the onsite investigation it was established that the aircraft had sufficient fuel on board and on visual inspection the fuel filter was clean.

1.18.5 The density altitude with a pressure altitude of 4030ft and temperature of 24℃ was calculated at 6222ft, this placed the aircraft within its performance range.

1.19 Useful or Effective Investigation Techniques

1.19.1 None

2. ANALYSIS

2.1 Man:

2.1.1. The pilot obtained his license three months prior to the accident flight. According to the pilot's training file he displayed satisfactory flying skills however the pilot had only received 5.1 hours of dual instruction when he was signed out for stalling proficiency.

2.1.2 The pilot's knowledge of the technical aspects of the aircraft was very limited.

2.1.3 The pilot commenced a climbing right hand turn in an area that had tall vegetation and rising terrain. The pilot fixated on clearing the terrain whereby it would appear that he neglected to scan his airspeed indicator. He failed to recognise the aircraft had entered into a stall and was unable to recover from the situation due to inadequate height available and collided with vegetation short of a plantation service road.

2.2 Machine:

2.2.1 The pilot was fixated on the rising terrain and cockpit distractions that he did not recognise the other symptoms associated with a stall. He only noticed the aircraft started to descend once the aircraft had stalled.

2.2.2 The aircraft sustained substantial damage to the propeller, this was indicative that the propeller was still producing power on impact.

2.2.3 The pilot indicated refuelling the aircraft to full capacity before departing for the flight.

2.2.4 The aircraft was loaded within limits and could not have resulted in a reduction of engine performance prior to the accident.

2.3 Environment:

2.3.1 The weather report indicated the temperature at the time to be 24°C and a dew point of 17°C. This indicates a condition associated with moderate carburettor icing however the pilot and passenger did not note any of the associated symptoms and therefore this phenomenon was not considered to have any bearing on this accident.

2.3.2 The wind at the time of the accident was 11kts. This would not have adversely affected the performance of the aircraft.

2.3.3 The aircraft was within its performance limitations at the calculated density altitude of 6222ft on the day of the accident.

2.4 Mission:

2.4.1 The pilot was unable to fly on the weekend prior to the accident due to bad weather and was meticulous about maintaining his currency after his NPL test. The intended scenic flight was in a mountainous terrain at a density altitude of 6222ft. The limited flying experience the pilot displayed could have placed him in a position where he failed to monitor his airspeed a stall followed.

3. CONCLUSION

3.1 Findings

3.1.1 The pilot's license was valid.

3.1.2 The aircraft had a valid Authority to Fly.

3.1.3 The pilot did not display sufficient technical knowledge of the aircraft.

3.1.4 The pilot operated low level in an enclosed area (270ft AMSL).

3.1.5 The density altitude was 6222ft.

3.1.6 The aircraft did not have a stall warning device installed.

3.2 Probable cause

3.2.1 Unsuccessful forced landing following failure to maintain flying speed.

3.3 Contributing factors

3.3.1 Lack of familiarity with the aircraft, inability of pilot to identify aircraft's stall characteristics.

4. SAFETY RECOMMENDATIONS

4.1 None

5. APPENDICES

5.1 Annexure A (Test pilot report)

Bantam B22J – 120 HP Jabiru Performance and Handling Quality Investigation

TEST FLIGHT REPORT

Doc No: Bantam FTR 01/08

DISTRIBUTION SHEET

CLASSIFICATION: CONFIDENTIAL

TITLE: Flight Test Report

SYNOPSIS: Flight Test Report to evaluate Bantam B22J with 120Hp Jabiru engine Performance and Handling Qualities

SOURCE FILES: Test Flight Report Bantam.doc

AUTHOR: Petri van Zyl

DATE: 17/3/2008 1:42 PM

DISTRIBUTION:

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MASTER	Claus	CAA
01		CAA
02	Andrew Pappas	Micro Aviation
03	P van Zyl	Avisol CC

EXECUTIVE SUMMARY

The philosophy of the test was to determine the characteristics of the Bantam aircraft fitted with the 120 Hp Jabiru engine. The federal air regulations were introduced to ensure that the performance and handling qualities of aircraft under the specific section conforms to a norm and all aircraft should perform and handle in a certain manner.

The test aircraft was generally stable and the performance of the aircraft was satisfactory. The aircraft did not possess any kind of stall warning and did have an airspeed error of 10 knots. This was no worse than some other NTCA aircraft flying and should definitely be addressed during training.

The airspeed errors and the lack of a stall warning should be addressed.

Table of CONTENTS

APPENDICES

Appendix A: Cooper Harper Rating Scale
Appendix B: Mass and Balance Report

Reference A: Federal Aviation Regulations Part 23 Amendment 28
B: National Test Pilot School Handling Qualities Testing
C: National Test Pilot School Performance Testing

ABBREVIATIONS

Abbreviation	Meaning	Units
CAA	Civil Aviation Authority	
CG	Centre of Gravity	meters
FAR	Federal Aviation Regulations	
FTI	Flight Test Instrumentation	
FTE	Flight Test Engineer	
GPS	global Positioning System	
Hp	Pressure Altitude	Pa
HQR	Handling Quality Rating	
KCAS	Knots Calibrated Air Speed	knots
KIAS	Knots Indicated Air Speed	knots
NTPS	National Test Pilot School	
OAT	Outside Air Temperature	° Celsius
RPM	Revolutions Per Minute	
SA	South Africa	
TFASA	Test Flight Academy of South Africa	
V_h	Maximum Possible Airspeed	knots
V_{mo}	Maximum Operating Airspeed	knots
V_{ne}	Never Exceed Airspeed	knots
V_s	Stall Airspeed	knots
V_y	Best Rate of Climb Airspeed	knots
Vx	Best Angle of Climb Airspeed	knots
Va	Manoeuvring Speed	knots

1 Introduction

1.1 Background.

A modification to the Bantam B22J has been done by fitting the aircraft with a 120Hp Jabiru engine.

1.2 Test Objectives

The primary objective of the test was to determine the basic performance and handling qualities of the aircraft. No other testing in terms of structural, systems or envelope expansion has been conducted.

1.3 Description of the Test Item.

The Bantam provided for the test was ZU-DII. The aircraft was a high wing, and aluminium tube monoplane with fixed undercarriage and a conventional horizontal and vertical stabilizer. It had two side-by-side seats with a single control stick mounted between the two seats. It had conventional rudder controls. A flap lever was situated in the roof in the centre of the cockpit between the pilot and co-pilot seats. Two markings of flap were provided: No 1: Take-off. No 2: Full Flap. The aircraft had a steer-able nose-wheel coupled to the rudder pedals. The aircraft was fitted with a 120Hp Jabiru engine model No 3300 serial number 33A1611. It was also fitted with a Brent Thompson Fixed wooden propeller no 22J 3300/105.

1.4 Test Scope.

The scope of the testing was a qualitative assessment of performance, stability, control and handling qualities. Quantitative data was used where possible, and where necessary to report on any anomalies. Testing was limited to operations around Bloemfontein and did not include sea level or high-level tests.

2 FACTORS AFFECTING THE TEST

2.1 Project Team

Test Pilot. Petri van Zyl

Safety Pilot Andre Boshoff. (Owner)

2.2 Operations Support.

Schedule. The test took place at a private airstrip in the Bloemfontein area on Friday 07 March on an aircraft owned by Mr Boshoff – ZU-DII.

2.3 *Mass and Balance.*

The mass and balance was calculated by using the Mass and Balance report as for the aircraft weighed on 26/01/2008.

Mass and Balance ZU-DII on 07/8/2008					
		Mass	Mass	Arm	Moment
	litre	Kg	Lbs	mm	
Empty Mass		233	512.6	35.156	18021
Fuel	48	34.56	76.032	52	3953.7
Pilot LH		105	231	35.55	8212.1
Pilot RH		78	171.6	35.55	6100.4
Baggage		0	0		0
Total		**450.56**	**991.23**	**36.608**	**36287**

The above table reflects the mass and balance of the aircraft on start-up. The maximum take-off weight of the aircraft was 450 Kg and the cg limits was between 37.2 and 38.8 inches aft of the datum. The mass was representative of a normal dual flight.

	FLIGHT TEST REPORT	

Weight and Balance Calculator

Date 26/01/2008
Registration ZU-DII

Measured W	Reading	Tare	Weight	Arm	Moment		
Right wheel	95.0	0.0	95.0	760	72,200		
Left wheel	94.0	0.0	94.0	760	71,440		
Nosewheel	44.0	0.0	44.0	(540)	-23,760	Empty CoG	
BEW (Basic Empty Weight)			**233.0 kg**		**118,765**	**509.7 mm**	**Aft of datum**

Operating Cof G

Fill in the yellow cells, read takeoff weight and CoG in blue cells

Item	Lt at 0.7sg	Weight	Arm	Moment		
BEW		233.0 kg	450.7	105013.1		
Fuel	48	34.608	935	32358.48		
Baggage		0	935	0		
Pilot 1		105	516	54180		
Pilot 2		78	516	40248		
Total		450.608		231799.6	C of G	
MTOW		450			Location	
					514.4 mm	Aft of datum
					min 470 mm	
					max 603 mm	

Weighed by Terence Pappas. AP Number 274
Max C of G 2 Pilot + fuel

3 DETAILS OF THE TEST

3.1 General

The philosophy of the test was to determine the suitability of the characteristics of the Bantam fitted with the 120Hp Jabiru engine for private use. The federal air regulations were introduced to ensure that the performance and handling qualities of aircraft under the specific section conforms to a norm and all aircraft should perform and handle in a certain manner. Although the Bantam fell in the NTCA category and therefore was not required to meet the FAR 23 requirements, it is generally accepted that an aircraft should conform more or less to the guidelines of the FAR 23.

3.2 Ground Handling

3.2.1 Objective

To determine the ground handling qualities of the aircraft.

3.2.2 Test Method

- Taxi along taxiway in prevailing wind whilst manoeuvring the aircraft.
- Determine pilot workload using Cooper Harper handling qualities rating scale, and Bedford workload rating scale.
- Determine if the control forces required to manoeuvre the aircraft are acceptable.

3.2.3 Test Conditions

- Along taxi way with wind from all four major directions (as far as practical). Unfortunately, the wind was light and variable on the day of testing and testing in crosswind conditions was not possible. The aircraft was taxied on smooth grass conditions in light winds and no conclusions could be made to the requirements of the FAR regulations.

3.2.4 Data Obtained

- Wind Direction and Strength – The wind was light and variable.
- Cooper Harper Rating – A rating of 4 was allocated

- Control Forces – A control force of about 5 kg on the pedals was estimated.

3.2.5 Discussion

The taxiing of the aircraft was done using the conventional controls in the conventional sense. The brake lever was situated on the front of the control stick. The throttle was situated on the outside of the respective seats and was pushed forward to open and pulled to close. Taxiing was easy and all controls operated in the correct sense. It was possible to turn the aircraft very tight and to end up with the nose wheel turned to an angle where it could not be straightened by using the pedals. This needed a high power application to turn the aircraft straight. It is recommended that the design of the nose wheel steering mechanism should be investigated and redesigned to prohibit it from turning to an angle from which it cannot be turned back by using the pedals only.

3.2.6 Acceptance Criteria.

FAR 23.231, FAR 23.233, FAR 23.235.

The aircraft did not show any uncontrollable tendency to ground loop or nose over during the limited test

3.3 Airspeed Indication Error

The instrument error on the airspeed indication system could not be determined. A combined instrument/Pressure error correction (PEC) was calculated using the GPS four legged procedure. The calculated PEC was 10 knots, which meant that the aircraft indicated (Vi) about 10 knots less than the actual calibrated airspeed. Unfortunately this error was only discovered upon reducing the data after the flight and thus a detailed test was not conducted at other relative airspeeds.

This indication/pressure error would impact on the take-off performance, cruise performance, climb performance, landing performance and stall performance of the aircraft.

It is recommended that a proper airspeed instrument error followed by a position error determination should be conducted and be reflected in the manual of the aircraft to the correct indication of airspeed during take-off, stall and approach speeds.

3.4 *Takeoff*

3.4.1 Objective.

To determine if the takeoff handling qualities of the aircraft.

3.4.2 Test Method.

A normal takeoff with take-off flap was executed on the dirt runway.

3.4.3 Test Conditions.

The wind was light and variable and the wind was crosswind at 10 knots during the take-off.

3.4.4 Discussion

The aircraft was trimmed to the take-off trim setting before take-off. The distance needed for the take-off was about 100 meter and rotation was done at 42 KIAS indicated airspeed. The forces on the controls were light and the movements needed on the control stick were conventional. The pitch attitude was normal at approximately 6 degrees nose up. The influence of the instrument/PEC errors as discussed in par 3.3 above would influence the length of the landing run.

3.4.5 Data Required

- Rotation airspeed - 42 MPH
- Cooper Harper HQR – 4

3.5 *Climb*

3.5.1 Objective.

To determine the performance and handling qualities during climb.

3.5.2 Test Method for a Climb

- After takeoff, set aircraft for climb at 45 Knots with flaps in the up position.
- Record altitude and time in a straight climb

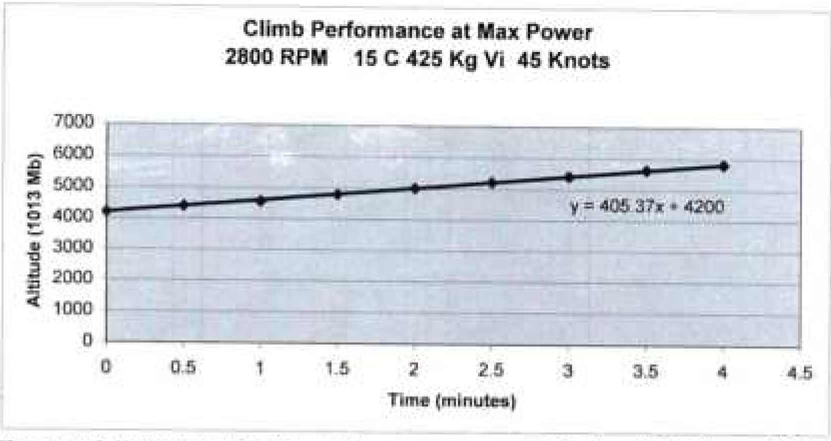
3.5.3 Test Conditions.

The wind was light and variable and the wind was about 10knots during the climb. The temperature was 15ºC.

3.5.4 Discussion

The climb was conducted at a stable indicated airspeed of 45 KIAS. The PEC/Instrument error discussed in par 3.3 above, would have an impact on the accuracy of the climb data. The error could however not be determined in the climb and therefore the indicated airspeed had to be accepted. The indication is however that the climb performance will improve once the corrected airspeeds is applied.

The forces on the controls were light and the movements needed on the control stick were conventional. The stability of the aircraft was stable and conventional. The throttle remained in position and the trim authority was enough to maintain the attitude of the aircraft. No performance graphs were provided in the manual but the following graph was drawn from data recorded during the climb:



The rate of climb was 405 ft/min at the average pressure altitude of 5000 feet at 15ºC. the maximum power obtained was 2800 RPM at full throttle. The average mass during the climb was 425 kg. The engine temperatures stabilized after 1 min in the climb. The oil temperature was 80ºand the CHT was stable at 240ºF.

3.6 Level Flight Handling Qualities

3.6.1 Objective.

To determine the level flight handling qualities and performance.

3.6.2 Test Method for level flight performance

- After takeoff, set aircraft for maximum level flight with flaps in the up position.
- Set power at maximum continuous.
- Record control positions and forces in straight and level flight.

The maximum continuous power was not indicated in the aircraft. The maximum power obtained in the climb was 2800 rpm. The maximum continuous power was thus set at 200 rpm below at 2600 rpm. The performance of the aircraft was measured at a pressure altitude of 5500 feet and an OAT of 14°C.

The PEC/Instrument error discussed in par 3.3 above, indicated that the aircraft actually cruised 10 knots faster than indicated.

The maximum level cruise indicated cruise speed (Vh) at the maximum continuous power of 2600 rpm was 51 KIAS (61 KCAS). The scheduled stall speed was at 35 KCAS. The normal straight and level range was thus between 35 and 61 KCAS.

3.7 Longitudinal Static Stability

3.7.1 Objective.

To determine the longitudinal static stability of the aircraft.

3.7.2 Test Method.

Control displacement tape measures was not installed. Testing was done at the same time as level flight performance testing.

- When decreasing or increasing airspeed to the next test point, note the initial direction and direction of the force required to make the airspeed change.
- Repeat for each airspeed.

3.7.3 Test Conditions.

The tests were conducted at a pressure altitude of 5500 feet and a OAT of 14°C. Conditions were stable.

3.7.4 Discussion.

The longitudinal static stability of the aircraft was stable and the speed decreased when the controls were moved back and increased when the controls were moved forward. A rearwards pressure was required to reduce airspeed from the trim position and a forward pressure was required to increase the airspeed from the trim position.

3.8 Lateral-Directional Static Stability

3.8.1 Objective.

To determine the lateral directional stability of the aircraft.

3.8.2 Test Method.

Qualitative data only.

- Trim the aircraft at the correct airspeed.
- Apply a steady heading sideslip (2°).
- Determine the force direction on the controls.
- Increase the steady heading sideslip angle in increments of 2° (until the maximum sideslip limit is reached for that airspeed).
- Determine the force direction on the controls.
- Release the forces, and note if the aircraft returns to trim.
- Repeat for the opposite directional input.

3.8.3 Test Conditions.

Testing was done at the same time as level flight performance testing, and the same altitude was used. Conditions were stable enough for the test data to be within limits.

3.8.4 Discussion

When the aircraft was put in a sideslip, the control positions were positive. That meant that left pedal displacement and right bank angle had to be maintained to maintain a sideslip to the right. This indicated that the basic static stability in terms of control deflections were positive. Stability for FAR 23 aircraft with a reversible control system were however not measured in control deflection, but in control forces as the pilot has no idea of deflections, but only experience force. The lateral stick forces followed and were positive which meant that a right hand force had to be applied to the control stick when a right bank angle had to be maintained in a sideslip and vice versa. The pedal forces were also positive however the forces were light.

3.9 Handling Qualities at VNE

3.9.1 Objective.

To determine the handling qualities and engine response at VNE.

3.9.2 Test Method for VNE

- At maximum level speed, and maximum continuous power, dive the aircraft to VNE.

3.9.3 Discussion

The maximum continuous power was thus set at 2600 rpm. The scheduled VNE was set at 81 KCAS. The aircraft was dived to 81 KIAS. The engine response was stable and the aircraft handling qualities was acceptable.

3.10 Stalls

3.10.1 Objective.

To determine the stall characteristics of the aircraft.

3.10.2 Test Method.

Stalls were evaluated qualitatively. The Cooper Harper handling quality rating was used to report on stall handling qualities. Stall speed was measured using the aircraft airspeed indicator.

3.10.3 Test Conditions.

The accurate combined error of the airspeed indicator/pressure error was not determined for the speed around the stall (See par 3.3) Stall testing was executed at a pressure altitude of 5800 feet, in the following configurations and the following speeds and HQR's recorded:

- V_{s0} (full flap) – 27 KIAS HQR 2
- V_{s0} (take off flap) – 28 KIAS HQR 2
- V_{s1} (flaps retracted) – 28 KIAS HQR 2

The published stall speed for the conditions were 35 KCAS. The actual indicated stall speed was 7 knots lower. This could partly be attributed to the instrument/pressure error discussed previously.

The response of the aircraft was however mild in all three configurations. Following the stall, the aircraft responded with a nose drop of about 10° and a left wing drop of 5°.

3.10.4 Discussion

The stall characteristics of the aircraft were normal and the recovery from a stall was conventional. If the control stick was held fully back during a clean stall, (no recovery attempted) the aircraft went into a descend but with no serious wing drop and showed no immediate tendency to develop into a spin.

There were however no stall warnings of any kind. The aircraft did not provide any natural stall warnings such as buffeting in any of the three configurations and was not fitted with an artificial stall warning. It is recommended that some sort of stall warning should be introduced to the aircraft.

This was no worse than many of the other NTCA aircraft flying in our skies, which also does not provide any stall warning. The stall characteristics of the Bantam were also better than some of the NTCA aircraft without stall warnings. This general lack of stall warnings in the NTCA aircraft environment should be addressed in general.

3.10.5 Comparison Criteria.

FAR 23.49, FAR 23.201, FAR 23.203.

3.11 COMMERCIAL USE OF NTCA AIRCRAFT – CERTIFICATION PROCESS

3.11.1 Application for Commercial Operations – Flight Test

The use of NTCA aircraft for commercial use such as training will become more and more. The NTCA aircraft category consists of so many types of different aircraft from ex-military to micro lights that it is impossible to place them in one category for commercial operations. Because some of these aircraft are amateur build or kit build, even two aircraft of the same type does not necessarily have the same performance or handling qualities. Every NTCA aircraft applying for commercial operation should undergo a professional flight test to determine the suitability to the role it is intended for.

3.11.2 Application for Commercial Operations – Limited Certification Process

The different intended roles of the NTCA aircraft is in essence what makes the NTCA aircraft so attractive for the private owner. The intention to fly this aircraft privately in a rural area away from built-up and controlled airspace asks for very limited certification. Operating the aircraft in a more congested area like controlled airspace should warrant some basic certification. Using the aircraft for commercial operations, which includes training, should warrant a level of certification, which must at least meet the basics of FAR 23 certification. It will be very advantageous to establish a standard of certification for non-certified which should provide a limited form of certification of NTCA aircraft in accordance to the environment it will operate in and the intended role it is to be operated in.

4 CONCLUSIONS

4.1 *General*

The test aircraft was generally stable and the performance of the aircraft was satisfactory. The aircraft did not possess any kind of stall warning and an airspeed error of 10 knots but was generally suitable for private use.

4.2 *Unacceptable*

Nil

4.3 *Unsatisfactory*

4.3.1 Nose wheel overturn

It was possible to turn the aircraft very tight and to end up with the nose wheel turned to an angle where it could not be straightened by using the pedals. This needed a high power application to turn the aircraft straight.

4.3.2 Airspeed Indication Error

The calculated PEC was 10 knots, which meant that the aircraft indicated (Vi) about 10 knots less than the actual calibrated airspeed. This indication/pressure error would impact on the take-off performance, cruise performance, climb performance, landing performance and stall performance of the aircraft.

4.3.3 Stall Warnings

The aircraft did not provide any natural stall warnings such as buffeting in any of the three configurations and was not fitted with an artificial stall warning.

4.4 *COMMERCIAL USE OF NTCA AIRCRAFT*

4.4.1 Application for Commercial Operations – Flight Test

- The NTCA aircraft category consists of so many types of different aircraft from ex-military to micro lights that it is impossible to place them in one category for commercial operations. Because some of these aircraft are amateur build or kit build, even two aircraft of the same type does not necessarily have the same performance or handling qualities.

4.4.2 Application for Commercial Operations – Limited Certification Process

- The intention to fly an NTCA aircraft privately in a rural area away from built-up and controlled airspace asks for very limited certification. Operating the aircraft in a more congested area like controlled airspace should warrant some basic certification. Using the aircraft for commercial operations, which includes training, should warrant a level of certification, which must at least meet the basics of FAR 23 certification.

4.4.3 General lack of Stall warning in light NTCA Aircraft

Many of the current light NTCA aircraft does not possess over any kind of stall warning. The stall characteristics of the Bantam were also better than some of the NTCA aircraft without stall warnings.

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5 RECOMMENDATIONS

5.1 General

The airspeed errors and the lack of a stall warning should be addressed.

5.2 Essential

Nil

5.3 Desirable

5.3.1 Nose wheel overturn

It is recommended that the design of the nose-wheel steering mechanism should be investigated and redesigned to prohibit it from turning to an angle from which it cannot be turned back by using the pedals only.

5.3.2 Airspeed Indication Error

It is recommended that a proper airspeed instrument error followed by a position error determination should be conducted and be reflected in the manual of the aircraft to the correct indication of airspeed during take-off, stall and approach speeds.

5.3.3 Stall Warnings

It is recommended that some sort of stall warning should be introduced to the aircraft.

5.4 COMMERCIAL USE OF NTCA AIRCRAFT – CERTIFICATION PROCESS

5.4.1 Application for Commercial Operations – Flight Test

- Every NTCA aircraft applying for commercial operation should undergo a professional flight test to determine the suitability to the role it is intended for.

5.4.2 Application for Commercial Operations – Limited Certification Process

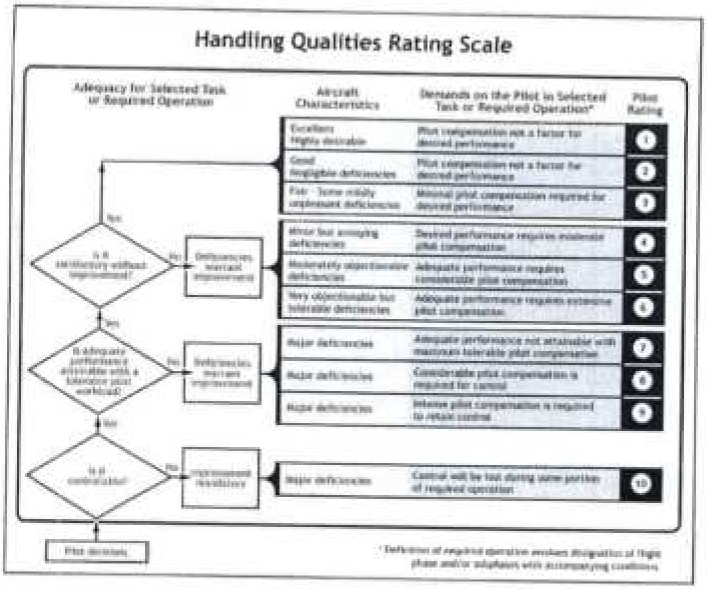
- It will be very advantageous to establish a standard of certification for non-certified which should provide a limited form of certification of NTCA aircraft in accordance to the environment it will operate in and the intended role it is to be operated in.

5.4.3 General lack of Stall warning in light NTCA Aircraft

This general lack of stall warnings in the light NTCA aircraft environment should be addressed in general.

APPENDIX A

COOPER HARPER RATING SCALE



APPENDIX B

Mass and Balance ZU-DII on 07/8/2008 for Flight Test					
		Mass	Mass	Arm	Moment
	litre	Kg	Lbs	mm	
Empty Mass		233	512.6	35.156	18021
Fuel	48	34.56	76.032	52	3953.7
Pilot LH		105	231	35.55	8212.1
Pilot RH		78	171.6	35.55	6100.4
Baggage		0	0		0
Total		**450.56**	**991.23**	**36.608**	**36287**

DATA as from Actual Weight sheet for ZU-DII

	Kg	lbs
Left Main	95	209
Right Main	96	211.2
Total Mains		0
Nose Wheel	42	92.4
Total Empty Weight	233	512.6

L	WN	X
50.45	92.4	9.093991
	Arm	35.15601

Compiled by:

.... Date: …………………….……..
For: Director of Civil Aviation

Investigator-in-charge: ……………………………… Date: ……………….………..

Co-Investigator: …………..……………………… Date: …………………………