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# **Type Acceptance Report**

**TAR 2/21B/13**

**Air Tractor AT-602**



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## Introduction

This report details the basis on which Type Acceptance Certificate No. 2/21B/11 was granted in the Restricted Category in accordance with NZCAR Part 21 Subpart B, for the purpose of agricultural operations. Specifically the report aims to:

- (a) Record the airworthiness certification standard used for type acceptance of the applicable model in New Zealand;
- (b) Summarise any outstanding requirements which must be complied with for the issue of a NZ Airworthiness Certificate to any models covered by the Type Acceptance Certificate.

## Foreign Type Certificate Details

Type Certificate: A19SW

Issued by: Federal Aviation Administration

Manufacturer: Air Tractor, Inc.

Model: AT-602

Engines: Pratt & Whitney Canada PT6A-45A/R/B, -60AG, -65AR/B/R/AG

Propellers: Hartzell HC-B5MP-3C/M10876A(N)S

MCTOW 12,500 lb (5670 kg) – Restricted Category

Noise Category: N/A (Restricted Category)

The certification basis of the Model AT-602 is FAR 23 dated February 1, 1965, through Amendment 23-42, effective February 4, 1991, with some sections below being defined as appropriate or inappropriate for the special purpose use of agricultural spraying, dusting and seeding and for the special purpose use of forest and wildlife conservation (fire-fighting) per FAR 21.25(b)(1) and (2); including the special purpose of Drug Eradication in accordance with FAR 21.25(b)(7) for the application of herbicides.

At the Maximum restricted category gross weight the TCDS lists those FAR 23 sections which were deemed to be appropriate. At baseline weight (defined as a reference weight not to be less than 75% of the Maximum Weight) the full FAR 23 standard is applicable, except for the following requirements deemed inappropriate per FAR 21.25(a)(1):

23.1 Applicability; 23.3 Special Retroactive Requirements; 23.45(b)(c)(d)&(e) Performance General; 23.51 Takeoff Distance Data; 23.75 Landing Distance Data; 23.221 Spinning; 23.629(f)(1) Flutter (tab disconnection); 23.777(f)(1)(h)(1)(ii) Cockpit Controls; 23.781(a)(b) Powerplant Control Knob Shape; 23.867 Lightning Protection; 23.901(d) Engine Water Ingestion; 23.954 Fuel System Lightning Protection; 23.1303(e) Speed Warning Device; 23.1321(d) Flight Instrument Grouping; 23.1325(b)(3)(e) Static Pressure System; 23.1351(d)(1) Instruments – Ammeter; 23.1505(c) Maximum Operating Limit Speed; 23.1587(a)(5)(6)(7)(8) Performance Information;

The above FAR 23 sections for which compliance has not been shown are in accordance with FAA Advisory Circular 21.25-1, which provides guidance for type certification of small restricted category agricultural airplanes. Appendix 1 lists requirements found to be inappropriate. The only ones not listed in the AC are 23.51 and 23.1587, which specifies takeoff distance data for takeoff and climb over a 50-foot obstacle be determined and furnished in the Flight Manual .

The use of FAA AC 21.25-1 has been an acceptable certification basis for previous models of Air Tractor in the restricted category for agricultural operations, in accordance with NZCAR Part 21B Para §21.41, and Appendix C(b)(1). (FAA AC 21.25-1 has also been used for certification of NZ restricted category agricultural aircraft and STCs.) However no aircraft have previously been exempted compliance with FAR 23.51. (The AT-402 and AT-502 originally did not provide take-off data in the Flight Manual. However Air Tractor were able to provide take-off distance charts in a Supplement, which had apparently been required for certification in Canada. These have subsequently been incorporated into the performance section of the Flight Manual.)

Therefore compliance with FAR 23.51 was prescribed by the Director as a special condition under NZCAR §21.23. The aircraft was given effectively provisional type acceptance while flight testing was carried out and a take-off distance chart produced that would be suitable for inclusion in the Flight Manual.

## **Type Acceptance Application**

The application for NZ type acceptance was from the importer, Wanganui Aero Work Ltd, dated 22 April 2002. The first-of-type was serial number 0585, registered as ZK-LTM.

Type Acceptance Certificate No.2/21B/13 was granted on 16 January 2003 in the Restricted Category for the purposes of agricultural operations.

The AT-602 is the 600-gallon version of the Air Tractor family, designed by Mr Leland Snow. It is basically an AT-502A with a longer wingspan, larger hopper and an increase in MCTOW. Two other models of Air Tractor, the AT-402B (ZK-JHG s/n 1021, and ZK-SAT s/n 990) and the AT-502B (ZK-SNO s/n 265) have been type accepted in New Zealand previously under TAR 95/06 and TAR 95/05 respectively.

## **Type Data**

The type data requirements of NZCAR Part 21B Para §21.43 have been satisfied by supply of the following documents:

- (1) Type certificate:FAA TC No. A19SW – Model AT-602 approved June 6, 1996  
FAA TCDS No. 19SW at Revision 4 dated March 21, 2000
- (2) Airworthiness design requirements:      Already held by the CAA
- (3) Certification compliance listing:

FAA Issue Paper G-1 – Change of Certification Basis Restricted Category AT-602  
FAA Checklist – Model AT-602 dated 23 April 1996

## Engineering Report 0936 – Engineering Reports Used for AT-602 Certification

Exemption No.6136 – This was issued by the FAA against FAR §23.562(d)(2) which requires single-engined airplanes to have a stall-speed under 61 knots, or increase the ultimate emergency landing load factors by the square of the ratio of the increased stall speed and comply with revised seat/restraint test criteria. The FAA determined the stall speed was appropriate. However for restricted category aircraft, as long as the public is not endangered, it is not necessary to issue an equivalent level of safety. The exemption was granted as in the public interest for the particular operations requested, provided the (ex-military helicopter design) seat and specified pilot seat belt and shoulder harness are fitted.

### FAA Equivalent Safety Findings:

FAA Letter dated 14-9-1992 – Issue Paper A-1 Approval – Agrees that AT-802 agricultural aircraft seats do not have to comply with FAR §25.562. The requirement that the pilot use a military-approved harness and helmet provides additional crashworthiness protection, and will minimize the risk of injury.

FAA Memorandum dated 4-2-2000 – The electric aileron trim system was approved without a cockpit position indicator required by §23.677(a). This was accepted (per AT-802) on the grounds that the aileron control forces with the tab fully deflected are well within the limits for a stick control airplane (30 lb), and the FM Emergency Procedures limits airspeed to 140 mph IAS in the event of a trim runaway.

- (4) Flight manual: FAA-Approved AT-602 Airplane Flight Manual dated June 6, 1996  
CAA Accepted as AIR 2775 (With Mandatory Page containing takeoff distance data.)

(No takeoff or landing distance performance data is provided in the Flight Manual. Air Tractor stated this is not required by the FAA for agricultural aircraft, although it is not mentioned in AC 21.25-1. A WAT chart for different configurations and stall speed data for various bank angles was considered sufficient.)

- (5) Illustrated Parts Catalogue: Illustrated Parts Manual AT-602 Series

- (6) Maintenance manual and service data for aircraft, engine and propeller:

AT-602 Owner's Manual 10017-OM (contains the Maintenance Manual)  
Air Tractor Service Letters & Service Information Letters Model AT-602

Data already held for PT6A-60 and -65 engines: (Not for the PT6A-45. However Air Tractor advise that variant is now out-of-production and they do not anticipate putting any more -45 engines on AT-602 aircraft. [See email dated 24 April 2002])  
PT6A-60A/-61/-61A, Turboprop Engine, Maintenance Manual Part No. 3034342  
PT6A-60A/-61 Turboprop Gas Turbine Engine, IPC Manual Part No. 3034344  
PT6A-65AG/-65AR/-65B/-65R Engine, Maintenance Manual Part No. 3032842  
PT6A-65AG/-65AR/-65B/-65R Turboprop Engine, IPC Manual Part No. 3032844

- (7) Agreement from manufacturer to supply updates of data in (4), (5) and (6):

CAA 2171 form from Air Tractor Director of Communications dated 24/04/02

- (8) Other information:

Snow Engineering Report 0612 – Seat Static Test Report AT-802  
Snow Engineering Report 1262 – AT-602 Hopper Loads – New Zealand Aircraft

## Additional New Zealand Certification requirements

Compliance with the following additional NZ Civil Aviation Rule requirements has been reviewed and were found to be covered by either the original certification requirements or the basic build standard of the aircraft, except as noted:

### CAR Part 26 - Subpart B - Additional Airworthiness Requirements

#### Appendix B - All Aircraft

PARA:	REQUIREMENT:	MEANS OF COMPLIANCE:
B.1	Marking of Doors and Emergency Exits	<i>To be determined on an individual aircraft basis</i> See TCDS Note 2(6),(11),(22) for operating instruction placards
B.2	All aircraft certificated in the Restricted Category for the purpose of agricultural operations must comply with the Crew Protection Requirements of CAM 8 Appendix B # .35 in effect 1 Feb 1965	Satisfied by compliance with FAR 23.333 and 23.561 (load factors); 23.785 (pilot weight and seat and harness restraint, and cockpit hazards); and 23.831 (ventilation requirements)

### CAR Part 91 - Subpart F - Instrument and Equipment Requirements

PARA:	REQUIREMENT:	MEANS OF COMPLIANCE:
91.505	Shoulder Harness if Aerobatic; >10 pax; Flight Training	American Safety seat belt, P/N 443220 and Shoulder harness system P/N 500702 required under FAA Exemption No.6136
91.507	Pax Information Signs - Smoking, safety belts fastened	N/A - Less than 10 passenger seats
91.509 Min. VFR	(1) ASI FAR §23.1303(a) - Fitted as Std - see Owners Manual Page 1-9 (2) Machmeter N/A - No Mach number limitations (3) Altimeter FAR §23.1303(b) - Fitted as Std - see Owners Manual Page 1-8 (4) Magnetic Compass FAR §23.1303(c) - Fitted as Std - see Owners Manual Page 1-9 (5) Fuel Contents FAR §23.1305(a) - Dual gauges fitted as Std - see OM Page 1-7 FAR §23.1305(d)(e) - Fitted Std - see Owners Manual Page 1-9 (6) Engine RPM	(7) Oil Pressure FAR §23.1305(b) - Fitted as Std - see Owners Manual Page 1-9 (8) Coolant Temp N/A - turbine engine (9) Oil Temperature FAR §23.1305(c) - Fitted as Std - see Owners Manual Page 1-9 (10) Manifold Pressure N/A - turbine engine (11) Cylinder Head Temp. N/A - turbine engine (12) Flap Position FAR §23.699(a)(2) - Flaps have external marks visible from cockpit N/A - Fixed undercarriage (13) U/c Position FAR §23.1351(d) - Voltmeter required equipment - see OM 1-5 (14) Ammeter/Voltmeter
91.511 Night	(1) Turn and Slip Slip indicator is required equipment - see Flight Manual Section 2.1 f(3) (2) Position Lights FAR §23.1385 - *	(3) Anti-collision Lights FAR §23.1401 - * (4) Instrument Lighting FAR §23.1381 - * * Light package is optional equipment
91.517	IFR Instruments and Equipment	N/A - Not Instrument Flight Rules approved
91.519	IFR Communication and Navigation Equipment	N/A - Not Instrument Flight Rules approved
91.523 Emrgcy Eqpmt.	(a) More Than 10 pax - First Aid Kits per Table 7 - Fire Extinguishers per Table 8 (b) More than 20 pax - Axe readily acceptable to crew (c) More than 61 pax - Portable Megaphones per Table 9	N/A - Less than 10 passenger seats Fire ext. is required eqpt. - see Flight Manual Section 2.1 f(4) N/A - Less than 20 passenger seats N/A - Less than 61 passenger seats
91.529	ELT - TSO C91a after 1/4/97 (or replacement)	<i>To be determined on an individual aircraft basis</i>
91.531	Oxygen Indicators - Volume/Pressure/Delivery	Oxygen system not fitted as standard
91.533 Unpress. A/c	>30 min above FL100 - Supplemental for crew, 10% Pax - Therapeutic for 3% of Pax Above FL100 - Supplemental for all Crew, Pax	Oxygen system not fitted as standard Maximum Operating Altitude is specified as 12,500 ft MSL - see Flight Manual Section 2.3.d
91.541	SSR Transponder and Altitude Reporting Equipment	<i>Operational requirement - compliance as applicable</i>
91.543	Altitude Alerting Device - Turbojet or Turbofan	N/A - Not turbojet or turbofan powered
91.545	Assigned Altitude Indicator	N/A - Not Instrument Flight Rules approved
A.15	ELT Installation Requirements	<i>To be determined on an individual aircraft basis</i>

### Civil Aviation Rules Part 137 - Subpart F - Instrument and Equipment

PARA:	REQUIREMENT:	MEANS OF COMPLIANCE:
137.255	Seating and Restraints - Shoulder harness required	Complies - See under 91.505 above
137.257	Additional Instruments - Slip indicator required	Complies - See under 91.511(1) above
137.259	Additional equipment	See Appendix D compliance statements
	Appendix B - Overload Weight Determination	
B(a)	The AT-602 design positive load factor is 3.8 @ 9200 lb. - Maximum Recommended Weight Increase per Fig.2 is 131% → MTOW = 12052 lb. However the AT-602 Flight Manual permits a MTOW of 12500 lb. based on a linear reduction of flight load factor to +2.8, -1.4.	



Appendix D – Instruments and Equipment Airworthiness Design Standards		
D.1	Seating and Restraints – Ultimate fwd inertia load of 12g – Complies – FAR 23.561(b)(2)(ii) requires a fwd load of 9.0g, plus a fitting factor of 1.33 per FAR 23.625. Air Tractor Report 0612 shows the seat sustained a test load of 5023 lb. and exceeded the requirement by a large margin. (For dynamic conditions under 23.562 the forward load case $g_{req}$ was 26g.)	
D.2	Hopper permitted maximum load Based on empty weight of 5796 lb, pilot 170 lb, one hour fuel at 75% power of 280 litres Avtur 224 lb, and oil allowance of 10 lb, → Max hopper load = 6300 lb. (Note the Maximum Hopper Load per Flight Manual is 6,500 lb. (2948 kg.))	
D.3	Hoppers and spray tanks – 12g fwd/1.5 rear/1.0 sideways	The hopper is forward of the pilot. Report 1262 shows the hopper support structure will easily withstand the D.3(b) loads
D.4	Hopper upper level contents – Indication, density allowance	Hopper has viewing port visible in the centre instrument panel
D.5	Jettison gear – 80% of max. load in 5 seconds; – simple to operate, single action required – Air Tractor initially considered this requirement could not be met by the AT-502 and applied for an exemption. A dump test was subsequently performed with the standard 38" x 16" Eastern box (with additional hopper venting). The result was a 92% discharge in 5 seconds. (See ADA Report 062.) Note the standard Air Tractor linkage was found to be too flexible and had to be strengthened. A similar modification was approved for the AT-602 under Modification WAW 230. A jettison test for this modification was carried out at Wanganui on 4 July 2002. (See Visit Report 2002/LTM). The AT-602 was only able to jettison the equivalent of 61% in the required 5 seconds, and the aircraft is therefore restricted to a maximum hopper load of 76% (1812 litres) when carrying solids. This is a condition of approval of the modification and is specified in the Flight Manual Supplement.	
D.6	Markings and Placards – hopper or tank maximum loadings – representative jettison times – pax location, flight limits	<i>To be determined on an individual aircraft basis</i> Hopper maximum load placard required by TCDS Note 2(9)

## Certification Issues

DUAL SEAT – Wanganui Aero Work requested approval for the fitting of the Air Tractor P/N 11360 Buddy Seat System. This is the same installation as on the AT-502, as cockpit is identical to the AT-502. The approval basis was checked with the FAA who confirmed that FAR 23.562 was effectively exempted for the AT-802 and subsequently AT-602, even though the TCDS states an ELOS was granted.

## Summary

Type Acceptance Certificate Number 2/21B/13 has been granted to the Air Tractor Model AT-602 and all serial numbers, except those aircraft fitted with the PT6A-45 engine, are now eligible for the issue of an Airworthiness Certificate in the Restricted Category in accordance with CAR §21.177, subject to any outstanding rule requirements noted above being met. (The PT6A-45 powered variant could become type accepted after supply of the applicable Flight Manual, in accordance with the provisions of CAR §21.43(2).)

## Attachments

The following documents form attachments to this report:

- Photographs first-of-type example serial no. 602-0585 ZK-LTM
- Three-view drawing Air Tractor Model AT-602
- Copy of FAA Type Certificate/ Type Certificate Data Sheet A19SW

## Sign off

David Gill  
Team Leader Airworthiness

Date: 16 January 2003