LAA TYPE ACCEPTANCE DATA SHEET
TADS 355
TYPE TITAN T-51 MUSTANG

Issue 1	Initial issue	07/01/13	FD

This TADS is intended as a summary of available information about the type and should be used during the build, operation and permit revalidation phases to help owners and inspectors. Although it is hoped that this document is as complete as possible, other sources may contain more up to date information, e.g. the manufacturer's website.

Section 1 contains general information about the type.
Section 2 contains information about the type that the LAA considers mandatory and must be complied with.
Section 3 contains advisory information that owners should be aware of to help them maintain their aircraft in an airworthy condition.

Section 1 - Introduction

1.1 UK contact

Name & address of UK importer/agent.
Moccas Mustang (Ben Chester-Master)

Tel: 01981 500019
Email: bencmaster@btconnect.com
Website: www.moccasmustang.co.uk

1.2 Description

The Titan T-51 Mustang is a small sporting two seat cantilever low wing aircraft with a retractable undercarriage, resembling a small scale version of the North American WWII fighter, which is manufactured in kit form by Titan Aircraft of Austinberg, Ohio. The T-51 is of conventional riveted aluminium construction but incorporating epoxy adhesive bonding, with a welded steel tube fuselage frame, and is supplied in the form of a kit for amateur construction. A quick build kit is also available. In either form the aircraft easily falls within the 51% rule. The T-51 design first flew in the late 1990s and many examples have subsequently been built in the USA and other countries.

The T-51 Mustang is designed to seat two in tandem with a rearwards-sliding bubble canopy and fixed windshield. An alternative razorback configuration is available. The aircraft has partial dual control. The undercarriage is of retractable tailwheel type, operated electrically via a hydraulic pump and selector system. The aircraft is fitted with electrically operated fowler flaps.

G-MUZY, the first example to be completed in the UK, uses a Rotax 912-ULS engine of 100 BHP initially with a 72" Whirlwind 4 bladed constant speed propeller, (later exchanged for an MT unit), bubble canopy and fabric covered control surfaces. Despite this, this aircraft was significantly tail heavy and required the fitting of substantial amount of nose ballast to correct the empty cg position. G-MUZY incorporates a number of safety enhancing modifications developed in conjunction with the LAA. Max gross weight is 1450 Lbs.

G-TSIM is a second example, fitted with a Suzuki V6 automotive engine, and aluminium skinned control surfaces. The Suzuki V6 automotive engine converted for use in the T51 using a conversion developed by Titan, embodying a reduction gear unit driving an 84"

Whirlwind 100-4-84 four bladed constant speed propeller. Maximum gross weight authorised by LAA is 1600 Lbs

The aircraft is manufactured in the form of a kit for construction by amateurs. The kit is manufactured by Titan Aircraft of Austinburg, Ohio. The aircraft is of conventional riveted aluminium alloy construction except that the fuselage has a welded steel tube frame, and the leading edges of the flying surfaces use blue polyurethane foam cores bonded to the skins and spar rather than conventional ribs.

The wing is of single spar construction, incorporating a full depth I section spar with extrusions forming the spar caps, and a sheet aluminium web. The wing is entirely aluminium alloy covered. The ailerons and flaps are aluminium skinned. The control surfaces are operated by a conventional system of stranded steel cables, pushrods and bellcranks.

A conventional steerable retractable tailwheel type undercarriage is fitted, the two main undercarriage units being cantilever telescopic oleo type legs. The undercarriage retraction system operates via hydraulic jacks and an electric motor and pump. The primary system pumps the gear down. The Emergency system is a 'dump' system which by-passes the valve arrangement and the gear simply drops down under gravity. The crew are provided with four point harnesses. A one-piece rearward-sliding canopy is fitted, operated by a chain and winding handle as on the full-size Mustang. A fixed windscreen is fitted. The canopy is retained by a catch on the winding handle and a secondary catch. A moulded polyethylene-type fuel tank is mounted in each wing root.

The Suzuki V6 Mini Merlin engine installation is based on the 2.7 litre H series car engine fitted to the Suzuki Grand Vitara vehicle. A supplied the engine produces 184 BHP at 6000 RPM and 184 ft Lbs of torque at 3,300 RPM. It is a liquid cooled V6 engine using electronic ignition and multi-port fuel injection. The H series engine was introduced in 1994 and the H27A model upon which this conversion is based remained in production untiol at least 2003. Titan use only 2000-2003 units for conversion. Parts for complete rebuild, where necessary, are easily available through Suzuki.

For aircraft use, Titan supply a complete firewall forward package consisting of the converted engine, all associated accessories and four blade constant speed propeller. A 2.26:1 reduction gear unit is supplied, manufactured by Autoflight in New Zealand. This gearbox bolts to the bell housing flange and is includes a rubber doughnut type coupling/shock absorber. The gearbox casing incorporates the front mounting points for the powerplant assembly. The gearbox and PSRU share the same oil supply and oil cooler, separate from the engine oil system.

The fuel system incorporates dual electric high pressure pumps. The electronic fuel injection system is a programmable unit supplied by Simple Digital Systems, the SDS EM-4-F, initially developed for rally cars but now common on auto engine conversions for aircraft. The EM-4-F includes a mixture control knob facility, of limited authority allowing approximately 50% leaning from the baseline mixture setting. In order to satisfy LAA requirements the installation must be fitted with the Titan optional dual injection/ignition systems, switched via a relay block.

The oil system replicates that in the car engine except that a purpose made cast aluminium sump of 7 litre capacity is fitted. The water/glycol cooling system is similar to the car installation except that the radiator is belly mounted in classic Mustang style. It includes a coolant thermostat and pilot-operated air flap in the radiator duct. The electrical system incorporates dual alternators and a Rhino SLA 24-12-12 volt 26 AH battery. Either alternator is capable of supplying all essential electrical loads. A

larger diameter Whirlwind four bladed propeller, being 84" diameter. Max permitted power rating for this propeller is 250 BHP, with max RPM of 2550 corresponding to 5763 engine RPM. The propeller governor is a Jihostroj P-110-030/A made in the Czech Republic, being a lightweight centrifugal governor with a bob weight movement acting against a spring adjusted by the pilot's RPM control. It has a self-contained oil pump and independent oil tank and optional oil cooler shared with the PSRU gearbox. It is mounted on the front of the right hand head and driven off the end of the right hand overhead camshaft.

Note that while various improvements were included on T51 G-MUZY, and a different set of modifications used on G-TSIM, both these aircraft were in effect dealt with as prototypes and the finalised modification pack has yet to be developed for the type. You need to keep in contact with the agent as your build progresses to ensure that you are working to the UK mod state.

Note that the razorback version of the aircraft has not yet been examined. This will need to be carried out before a razorback version can be cleared.

Similarly LAA have only so far looked at the Rotax 912S/914 powered version, and the Suzuki Mini Merlin version. Due to structural strength implications the Suzuki version is not cleared for aerobatics, and is only cleared as a single seater at this time with a max gross weight of 1600 Lbs. Work is underway to authorise use of the second seat at an elevated max gross weight of 1750 Lbs. Heavier or more powerful engines than the Suzuki are not recommended at this time as these could exceed the inertia and torque loads presently tested on the forward fuselage, also the considerable doubt about whether with a heavier or more powerful engine it would be possible to clear as two-seater.

Section 2 – Mandatory information for owners, operators and inspectors

2.1 Fast Build Kit 51% Compliance

The aircraft is supplied in the form of a kit for amateur construction. A quick build kit is also available. In either form the aircraft easily falls within the 51% rule.

2.2 Build Manual

A build manual is supplied with the kit.

2.3 Build Inspections

Build inspection schedule T51 Mustang.
Inspector approval codes A-A or A-M or A-K. Inspector signing off final inspection also requires 'first flight' endorsement.

2.4 Flight Manual

Titan provides a very simple set of Pilot's Notes for the T-51 which is considered satisfactory, read in conjunction with the LAA flight test report. A basic build manual is also supplied, however significant inspector input has been found to be needed to

interpret the build manual requirements. The owner has also produced a draft POH applicable specifically to G-TSIM.

2.5 Mandatory Permit Directives

Applicable specifically to this aircraft type: Nil

Also check the LAA website for MPDs that are non-type specific (TL2.22).

2.6 LAA Required Modifications (including LAA issued AILs, SBs, etc)

The following modifications have been incorporated on G-MUZY and G-TSIM and these modifications, or equivalent, are considered mandatory for LAA acceptance of the type.

MOD/355/001	Structural reinforcements to kit as supplied by Titan, consisting of the following: deletion of fuselage frame transport joint, modified wing attachment brackets on welded fuselage frame, reinforced tailplane surfaces. These are now part of basic kit standard for kits sent to the UK.	Mandatory
MOD/355/002	Stiffening of canopy winding handle bearing mounting for the sliding cockpit canopy to make the winding handle more firmly mounted. On G-MUZY, LAA Mod 12542 refers. On G-TSIM, the later style stiffened canopy winder fitment is installed per drawing B T51-07-INS-1633-F.	Mandatory
MOD/355/003	The dual rudder pedals have not been fitted in the rear cockpit seat position, because of the perceived risk of the passenger's feet interfering with the rudder or brake controls, risk of jamming etc. (Pedal design for kits has changed since G-MUZY but were in any case omitted from G-TSIM)	Mandatory
MOD/355/004	Elevator bellcrank in rear fuselage stiffened against lateral deflections by adding a riveted stiffener channel between the side arms of the bellcrank. LAA mod 12596 refers.	Mandatory
MOD/355/005	The cable 'outer' support for the dog box/radiator duct flap has been reinforced by the addition of a support bracket, mod 12541 refers. (This flap could actually be fixed open and services very little purpose in the UK climate)	Mandatory
MOD/355/006	On G-MUZY the riveted control stop has been changed to include two fasteners to prevent the stop rotating about the single fastener. Steel rivet added as precautionary measure and avoid risk of jammed elevator. Mod 12595 refers. On G-TSIM, the alternative arrangement of the later drawing on instructions page 1692 has been fitted.	Mandatory
MOD/355/007	An additional bolted steel tube support assembly has	Mandatory

	been added to better support the mountings for the elevator bellcrank in the rear fuselage. This has been embodied in G-TSIM as part of the welded fuselage frame in the standard kit.	
MOD/355/008	On G-MUZY, an undercarriage control unit has been fitted to reduce the currents passing through the micro switches in the undercarriage retraction system. This is a proprietary after-market unit for the T51 Mustang available from Ken Smith in New Zealand. Mod 12543 refers. On G-TSIM, a control unit has not been fitted, instead the micro switches have been uprated to higher current proprietary micro switches appropriately rated for this application. Mod 12890 refers. (Despite LAA reservations, no recorded issues with factory approved arrangement and th need for this this mod may be looked at again in due course)	Mandatory
MOD/355/009	Upgraded engine mount for the Suzuki V6 'Mini Merlin' engine. The original V6 mount when analysed against the appropriate inertia and torque load cases by a finite element method was found to be significantly understrength as designed. The design has therefore been significantly reinforced to satisfy LAA requirements and a new mount of the amended design is available from Titan.	Mandatory when V6 Suzuki engine fitted
MOD/355/010	In order to satisfy LAA requirements for an independent ignition system for an aircraft of this category, the Titan optional back-up SDS ECU system has been fitted, which is brought into circuit using a multi-pole relay deck.	Mandatory when V6 Suzuki engine fitted

2.7 Additional engine operating limitations to be placarded
(or shown by instrument markings)

(Refer to the engine manufacturer's latest documentation for the definitive parameter values.)

With Rotax 912-ULS engine:

Maximum CHT: 135°C
Max Coolant Temp: 120°C (with 50/50 Glycol/water coolant)
Oil Temp Limits: 50°C to 130°C (Normal 90-110°C)
Oil Pressure: 2-5 Bar
Minimum Fuel Pressure: 0.15 bar

With Suzuki V6 engine:

Minimum Fuel Pressure: 40 psi (2.7 bar)
Coolant pressure: **NOTE:** 15 psi (1.03 bar) for take off (note: values can be misleading when at top of long climb)

Max Coolant Temp: 230 degrees F (110 C)
Oil Temp Limits: 240 degrees F (115.5 C)
Oil Pressure: Min Cold 65 psi (4.47 bar)
Min Hot 42 psi (2.89 bar)
Min Idle 30 psi (2.07 bar)

2.8 Control surface deflections

Ailerons	Up: 23° Down: 14°
Elevators	Up: 30° Down: 20°
Elevator tab	Up: TBD Down: TBD
Rudder	Left: 30° Right: 30°
Flap	Down: 27° -

2.9 Operating Limitations and Placards

(Note that the wording on an individual aircraft's Operating Limitations document takes precedence, if different.)

With Suzuki V6 engine:

1. Maximum number of occupants authorised to be carried: One

2. The aircraft must be operated in compliance with the following operating limitations, which shall be displayed in the cockpit by means of placards or instrument markings:

2.1 Aerobatic Limitations
Intentional spinning is prohibited.
Aerobatic manoeuvres are prohibited.

2.2 Loading Limitations

Maximum Total Weight Authorised: 726 kg (1600 Lbs)
CG Range: 73.0 inches to 77.0 inches aft of datum.
(Titan state 72-81 inches but restricted by LAA at this time)
Datum Point is: Joint between nose cowl and cowling side panels

2.3 Engine Limitations
Maximum overspeed RPM: 5760 RPM
Maximum Take Off RPM : 5300
Maximum Engine RPM: 5000 (5 minutes maximum)at 25" MAP
Maximum Continuous engine RPM: 4500 @ 24" MAP
Maximum coolant temperature: 230 degrees F
Maximum oil temperature: 240 degrees F
Maximum EGT: 1450 degrees F

75% power is 4200rpm @ 20.5" map
Max recommended take off rpm is 5300rpm

2.4 Airspeed Limitations

Maximum indicated airspeed: 160 KIAS
Maximum indicated airspeed flaps extended: 87 KIAS
Max indicated airspeed undercarriage extended: 87 KIAS
Max indicated airspeed for full control deflection (Va):129 KIAS
Maximum indicated airspeed in rough air (Vno): 146 KIAS

2.5 Other Limitations

The aircraft shall be flown by day and under Visual Flight Rules only.
Smoking in the aircraft is prohibited.

With Rotax 912-ULS engine:

1. Maximum number of occupants authorised to be carried: Two

2. The aircraft must be operated in compliance with the following operating limitations, which shall be displayed in the cockpit by means of placards or instrument markings:

2.1 Aerobatic Limitations
Intentional spinning is permitted.
Aerobatic manoeuvres are permitted not exceeding +4.4 or -2.2g

2.2 Loading Limitations

Maximum Total Weight Authorised: 658 kg (1450 Lbs)
Maximum aerobatic weight: 603 Kg (1330 Lbs)
CG Range: 72.0 inches to 81.0 inches aft of datum.
CG Range for aerobatic manoeuvres: 72.0 inches to 79.0 inches aft of datum
Datum Point is: Joint between nose cowl and cowling side panels

2.3 Engine Limitations

Max Engine RPM : 5800
Max continuous engine RPM : 5500

2.4 Airspeed Limitations

Maximum indicated airspeed: 160 KIAS
Maximum indicated airspeed flaps extended: 87 KIAS
Max indicated airspeed undercarriage extended: 87 KIAS
Max indicated airspeed for full control deflection (Va):129 KIAS
Maximum indicated airspeed in rough air (Vno): 146 KIAS

2.5 Other Limitations

The aircraft shall be flown by day and under Visual Flight Rules only.
Smoking in the aircraft is prohibited.

Additional Placards (with any engine):

“Occupant Warning - This Aircraft has not been Certificated to an International Requirement”

A fireproof identification plate must be fitted to fuselage, engraved or stamped with aircraft’s registration letters.

Section 3 – Advice to owners, operators and inspectors

3.1 Maintenance Manual

In the absence of a maintenance schedule supplied by Titan, the builder of G-TSIM has compiled a customised version of the LAA Generic Maintenance Schedule, reference GMS/G-TSIM which is specially tailored to include appropriate checks on the Suzuki V6 Mini Merlin engine. The maintenance requirements for the Whirlwind propeller have been adopted from the manufacturer's operating manual for the propeller. (Jan 2013 note; see recent changes to service intervals - see website)

3.2 Standard Options

List of standard manufacture's options that can be installed without the need for a mod application (also applies to aircraft post-build), including hyperlink to actual document, if available.

The listing below shows the factory options that have been accepted by the LAA.

Aluminium skinned elevators and rudder. This is standard for the higher powered versions of the T51. Rotax version use fabric skinned elevator and rudder to save weight at the rear end
Fiberglass belly
Larger gear legs (standard with V6)
Alloy centre filler necks
Axe handle antennae
Aluminium Pitot tube
Fibreglass wing root fairing
Upgraded seats
Aft canopy stiffener
Main gear attach fittings

G-TSIM incorporates two additional rectangular access panels and associated doublers in the rear fuselage side skins for access to the hydraulic motor and battery. Mod 12891 refers.

The Honda engine version is specifically not accepted by LAA at this time.

3.3 Manufacturer's Information (including Service Bulletins, Service Letters, etc)

In the absence of any over-riding LAA classification, inspections and modifications published by the manufacturer should be satisfied according to the recommendation of the manufacturer. It is the owner's responsibility to be aware of and supply such information to their Inspector.

Ref	*Date*	*Description*	*Factory compliance status*	*Applicability*
	4.9.12	Check main gear scissor washers	advisory	All aircraft

4.9.12	Crack in welded fuselage frame at tailwheel mounting	advisory	All aircraft
4.9.12	Check coolant pipes hose clamp positioning and security	advisory	All aircraft
12.4.12	Check pipes for signs of cracking or fatigue, replace with braided flexible pipes at soonest opportunity	advisory	Aircraft with auto flight reduction drives and aluminium oil pipes to CSU pad
17.8.10	Install engine mount thrust plates to prevent rubber mounts pulling through	mandatory	Aircraft with Rotax 912-ULS or 914 engines
7.7.10	Fit insulation or heat shield to prevent exhaust heat damaging ignition module	advisory	Aircraft with Rotax 912-ULS engines
4.3.09	Pressure test fuel tanks prior to installation to not exceeding ¼ PSI	advisory	All aircraft
4.3.09	Replace temporary aluminium rivets in forward brake pedal assembly with steel	mandatory	Aircraft prior to s/n 50 only
4.3.09	To prevent possible inadvertent tailwheel retraction on landing, check additional strengthening tube present at station 11	advisory	Aircraft prior to s/n 67 only

3.4 Special Inspection Points

- Despite number of fasteners required to remove engine cowls, engine compartment needs frequent inspections to check for signs of problems developing eg cracking exhausts, leaking pipes etc.
- Where coolant pipes pass in vicinity of cockpit, particular care needed to avoid leaks which could release scalding steam into the crew compartment.
- Aircraft should be jacked up at each annual check and following any heavy landing, to check undercarriage operation and adjustments, over-centring etc including operation of emergency lowering systems.

3.5 Special Test Flying Issues

On G-MUZY, to provide positive longitudinal static stability in flight it was necessary to fit an elevator down-spring and balancing additional fixed elevator trim tab. The down spring tension was arranged to reduce when the flaps are deflected, to minimise the change in trim with flap. Mod 12734 refers.

On G-TSIM, the aircraft was found to exhibit just positive longitudinal static stability, without the use of a down spring and fixed tab. Without the down spring and fixed tab it was however not possible to trim the aircraft longitudinally in the power off full flap condition however the residual aft stick force was considered acceptable. An additional flap position between positions 2 and 3 has been established which produces reduced residual stick forces in a power off descent and is an acceptable position for normal landings, it being suggested that the full flap position is used only for short field landings.

On G-MUZY the aircraft was found to have just positive lateral stability (dihedral effect) in the clean configuration but this became slightly negative in the landing configuration. While non-compliant with CS-VLA 177 a (2) and (3) this was nevertheless considered acceptable in the context of this aircraft.

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Please report any errors or omissions to LAA Engineering: engineering@laa.uk.com