FLIGHT DESIGN

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Performance CTLS LSA
Supplement to CTLS LSA AOI

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I List of Revisions

Rev.	Description	Date
0	Original issue	18 Jun 2009

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1. General

This document provides additional information amending the Aircraft Operation Instructions (AOI) of the CTLS-LSA. Data provided in this document is preliminary and based upon a limited number of test flights. This information shall be enhanced and supported by wider testing in the near future. When this is done this information will become a regular part of the AOI.

Warning: As soon as this information is displayed as chapter within the most recent revision of the AOI CTLS-LSA, this document becomes invalid and may no longer be used.

Warning: All data presented within this document are based on an aircraft in good overall condition with an engine delivering nominal performance. Individual condition of each individual aircraft can have significant effect to the performance that can be obtained. It is therefore required to verify the validity of the data for the individual aircraft before using these data to plan missions anywhere near the range limits.

Warning: All data presented within this document are valid for the Neuform 3 blade propeller with the factory defined blade adjustment that in horizontal flight, full throttle, ISA 0 conditions the achieved engine speed is 5500 rpm. Usage of other pitch settings or propellers leads to different values than presented here. The data presented here can not be used for variable pitch propellers.

2. Aircraft Performance

The following data can be used to plan a flight mission with a CTLS-LSA. The data shown below allow to determine cruising speed and fuel consumption for a complete trip.

Data provided by the engine supplier can be used for the phases of taxiing and climb. Data determined from in flight measurements of the aircraft are provided for the cruise flight phase.

2.1. Ground Operations

Fuel consumption for engine start, warm-up, check (5 minutes)	0.26 gal	1 l
Taxiing per minute	0.04 gal	0.15 l

2.2. Takeoff and Climb

Takeoff and climb is considered with full throttle operation. As no propellers are distinguished, the fuel consumption for the critical propeller (variable pitch as permitted in different countries) is considered.

Takeoff-run (1 minute)	0.12 gal	0.45 l
Climb per minute	0.12 gal	0.45 l
Takeoff distances	… as per AOI	
Climb performances	… as per AOI	

2.3. Cruise

The performance data in cruise flight vary strongly with density altitude and power setting. The following table provides typical data obtainable with a CTLS-LSA in good conditions and at a flap setting for cruise (-6°).

Density Altitude [ft]	Engine Speed [RPM]	Engine Power		power rate [% MCP]	CAS [kt]	TAS [kt]	Fuel Flow		Range (exhausted)	
		[kW]	[hp]				[US Gal/h]	[l/h]	[Nm]	[km]
3000	5500	69	94	100%	120	125	6,4	24,2	625	1160
3000	5025	52	70	75%	109	116	4,8	18,1	780	1440
3000	4750	45	61	65%	103	108	4,3	16,3	800	1480
3000	4375	35	47	50%	95	99	3,6	13,5	885	1640
4000	5475	68	93	99%	118	125	6,3	23,7	640	1190
4000	5025	52	70	75%	109	116	4,8	18,1	780	1440
4000	4750	45	61	65%	102	108	4,3	16,4	800	1480
4000	4350	35	47	50%	93	99	3,6	13,5	885	1640
5000	5450	67	91	98%	116	124	6,1	23,3	645	1190
5000	5025	52	70	75%	108	116	4,8	18,2	775	1440
5000	4750	45	61	65%	101	108	4,3	16,4	800	1480
5000	4325	35	47	50%	91	98	3,5	13,4	885	1640
6000	5400	66	90	96%	114	124	6,0	22,7	660	1220
6000	5050	52	70	75%	108	115	4,8	18,1	770	1430
6000	4750	45	61	65%	100	108	4,4	16,5	795	1470
6000	4300	35	47	50%	90	98	3,5	13,4	890	1650
7000	5375	66	89	95%	113	124	5,9	22,4	670	1240
7000	5050	52	70	75%	106	115	4,8	18,3	760	1410
7000	4800	45	61	65%	98	107	4,3	16,4	790	1460
7000	4300	35	47	50%	88	97	3,5	13,3	880	1630
8000	5350	65	88	94%	111	124	5,8	21,8	690	1280
8000	5050	52	70	75%	103	116	4,8	18,2	770	1430
8000	4800	45	61	65%	96	107	4,3	16,3	795	1470
8000	4300	35	47	50%	85	95	3,5	13,3	860	1590
9000	5300	63	86	92%	108	123	5,6	21,2	705	1310
9000	5050	52	70	75%	100	114	4,8	18,1	760	1410
9000	4800	45	61	65%	94	107	4,3	16,1	800	1480
9000	4300	35	47	50%	81	93	3,5	13,3	840	1560
10000	5275	61	83	89%	105	123	5,5	20,7	720	1330
10000	5050	52	70	75%	98	114	4,9	18,4	750	1390
10000	4800	45	61	65%	92	107	4,3	16,2	795	1470
10000	4300	35	47	50%	79	92	3,6	13,6	820	1520
12000	5200	57	77	83%	100	120	5,2	19,7	740	1370
12000	5100	52	71	75%	94	113	5,0	18,9	725	1340
12000	4850	45	61	65%	89	107	4,3	16,5	790	1460
12000	4300	35	47	50%	74	90	3,7	14,1	770	1430

Note: Cruise flight below 4,800 RPM is not recommended when using leaded fuel (100LL). This can cause the valves to become lead fouled, requiring a premature top overhaul.

2.4. Descend

It is an acceptable assumption to calculate 50% of the descend distance with the cruise flight fuel consumption under the following conditions:

descend rate approx. 500 ft/min

IAS as for the cruise flight

TAS as for the median altitude of the descend

2.5. Example

The following example shall demonstrate the usage of the data provided in this document, together with those provided by the AOI. This is a simple example that shall illustrate the usage of the data, other calculation schemes may also be adequate.

Warning: all data are based upon usage of density altitudes. Pressure altitudes must be converted to density altitudes prior to the determination of the performance data. As the usage and determination of density altitude is provided by the AOI, this step is not demonstrated here, but all altitudes are directly considered as density altitudes.

The following mission shall be planned:

1. Takeoff at an airfield, density altitude 2000 ft, TOW 600 kg, no wind.
2. Climb to cruising (density) altitude 8000 ft
3. Cruise flight at density altitude 8000 ft at 10 kt headwind wit 75% power setting
4. distance takeoff – landing 200 NM
5. Descend to landing field at 2000 ft density altitude

Phase 1 – Takeoff:

a) Times:

Engine start, warm-up, check:	5 min	
taxiing:	5 min	
takeoff:	1 min	

b) Distances:

Takeoff distance is neglected

c) Fuel Consumption:

Engine start, warm-up, check:	0.26 gal	1 l
Taxiing:	0.20 gal	0.75 l
Takeoff:	0.12 gal	0.45 l

Phase 2 – Climb:

a) Times:

Climb performance is determined from the data shown in the AOI for the median altitude of the climb (5000 ft) to be 520 ft/min. Climb duration to reach 6000 ft altitude difference is:

6000 ft / (520 ft/min) 12 min

b) Distances:

Climb speed (CAS) as by AOI for this climb is 66 kt. As TAS is bigger than CAS at altitude, usage of CAS to determine distance is conservative.

11.5 min / 60 min * 66 kt 12.7 NM 23.4 km

c) Fuel Consumption:

11.5 min * 0.45 l/min	1.38 gal	5.18 l

Phase 3 – Cruise:

Cruise flight is defined at 8000 ft density altitude, 75% power setting. The table above delivers IAS 103 kt, TAS 116 kt, fuel consumption 4,8 gal/h or 18,2 l/h.

a) Distances:

To determine the cruise data the time and distance for the later descend must be known. As TAS is bigger than CAS at altitude it is conservative to use CAS for the analysis.

At a descend rate of 500 ft/min the time to descend by 6000 ft is 6000 / 500 = 12 min.

12 min with CAS 103 kt results in 12 / 60 * 103 = 20.6 NM or 38.2 km distance for the descend.

Cruise distance is 200 NM – 12.7 NM – 20.6 NM	166.7 NM	308.7 km

b) Times:

166.7 NM / 116 kt	1.44 h

c) Fuel Consumption

1.44 h * 4.8 gal/h or 18.2 l/h	6.91 gal	26.2 l

Phase 4 – Descend and Landing:

a) Times:

Descend as determined in Phase 3	12 min
allowance for approach pattern	5 min
taxi time on ground	5 min

b) Distances:

as determined in Phase 3	20.6 NM	38.2 km

c) Fuel Consumption:

Descend and approach (17 min/2) / 60 * 4.8 gal/h or 18.2 l/h	0.68 gal	2.6 l
Taxiing:	0.20 gal	0.75 l

Total Mission

a) Times:

(5 + 5 + 1 +12 + 1.44*60 + 12 + 5 + 5) min	131 min	2 h 11 min

b) Fuel Consumption:

(0.26 + 0.2 + 0.12 + 1.38 + 6.91 + 0.68 + .20) gal	9.75 gal	36.9 l

These values are without any reserve and must be enhanced accordingly, as required and sensible for the mission (planned standard reserves plus reserves to reach alternates).