Cooling Improvement Project on the Lancair 320/360

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Goals:

1. Reduce cylinder head temperatures w/o sacrificing air speed
2. Greater longevity of composite parts
3. Better clearance with exhaust system
4. Retrofit with minimal changes to existing airframe
5. Stiffen sidewall – eliminate bowing and Tinnerman washers

Instructions:
1. Enter Altitude
2. Enter actual Temperature or select SA, 10 deg, or 20 deg over SA
3. Adjust mixture/EGT for Cyl. #1
4. Observe changes below

Altitude (ft)	OAT (deg F)	Cyl.#1 EGT (deg F)
8500	52.0	1330

Standard Atm | 10 over SA | 20 over SA

(Typical EGT range 1200-1350, altitude range 6500-17500)

		Cyl. 1	Cyl. 2	Cyl. 3	Cyl. 4
old cowl	EGT	1330	1295	1345	1318
	CHT	402	391	380	382
new cowl	EGT	1330	1251	1368	1346
	CHT	370	361	361	360
	CHT difference	32	31	19	23

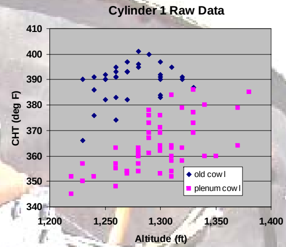
Multiple Regression Model

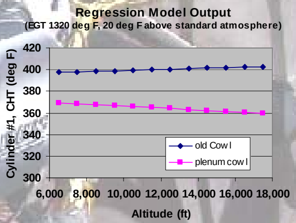
Results:

1. Highest CHTs down 30 deg F (low alt.), 42 deg F (high alt.)
2. Peak CHT during takeoff down 40 deg F
3. Reduced temperature spread
3. Cruise speed increase from 201 to 206 KTAS

Data Analysis:

Given any particular cooling system, a number of variables strongly influence the CHT observed. Primary among these are Altitude, OAT, and mixture. Large quantities of full throttle data were fed into a multiple regression model. This allows for comparison of identical operating conditions of altitude, OAT and EGT, even if that exact condition was not recorded for both old and new cowls. The model reproduces actual data points extremely well.





Design:

The cowl incorporates inlets and an exit of reduced area designed for more efficient pressure recovery and reduced leakage. Expansion is controlled through one-piece inlets and diffusers. The inlets control expansion up to a flexible coupling. The main diffuser expands the flow from the coupling to the plenum chamber. The cowl split line is matched to the forward deck split line in the rear and passes over the inlets in the front. Top and bottom halves are matched sets. The overlapping joggle is molded to the upper cowl for a custom fit right out of the mold. A new composite landing light tube was also incorporated.

Installation:

The new cowl is easier to install than the original. Top and bottom halves are already mated. Length is trimmed to match existing spinner to forward deck distance while the cowl is aligned to the spinner. A simple marking tool transfers the existing hole pattern from the fuselage to the cowl. The diffusers are then aligned to the cowl inlets and mounted to the existing aluminum baffle. The plenum top flange is trimmed and the existing hole pattern is transferred from the aluminum baffle.

Construction:

Molds and mandrels were fabricated for all parts. The cowl, cowl scoop, diffusers, landing light tube, and plenum top are epoxy/FG. The inlets have aluminum reinforcing sleeves and are bonded to the lower cowl. Plenum chamber parts attach to the original Lancair baffle kit.

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