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FAST TIMES, BLOWN ENGINES AT THE RENO AIR RACES

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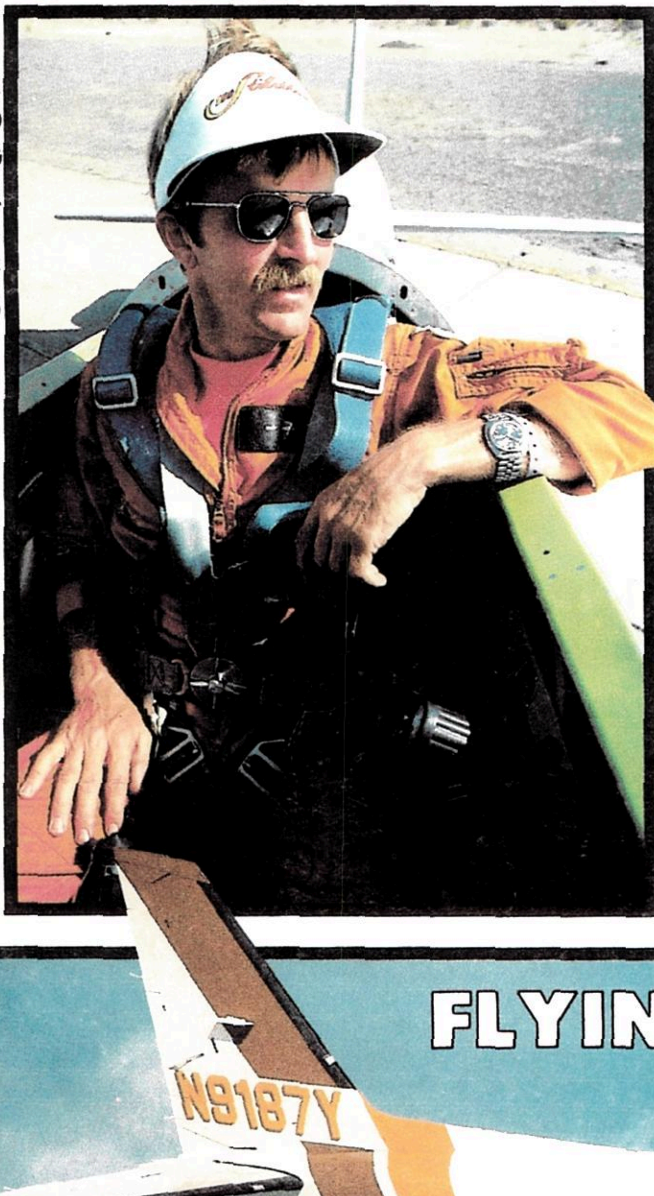

AVIATION'S EXTRAVAGANZA: FARNBOROUGH

HOW I WON RENO SKIP HOLM FLIES STILETTO

FLYING PIPER'S MOJAVE

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As I started this pilot report on *Stiletto,* I was reminded of the English test pilot who was asked to report on a new, unimpressive fighter he'd just flown. In true English fashion he replied, "The aircraft was lacking in flying qualities but, more importantly and to begin with, the aircraft is very difficult to mount and I recommend we make it impossible." *Stiletto* can also be said to be lacking in some flying qualities and is definitely not the easiest to mount but the "hummer does move" and that's what we had set out to accomplish when we started the project in early 1984.

Those of us in the crew thought it ironic when the local Reno press referred to *Stiletto* as a *Jeannie/Spectre* clone (since the same group of people built both aircraft) but, in retrospect, any person looking at the two aircraft can see the similarities and these similarities were the basis for the additional modifications and expected flying qualities of *Stiletto.*

Our early philosophy was to take the known stock Mustang or known *Jeannie/Spectre* racer and, by means of calculated modifications on *Stiletto,* establish both an expected speed increase and handling quality for a given condition. The only two conditions we concerned ourselves with were the takeoff/landing condition and the max power/max speed condition—with the overriding emphasis on max speed regardless of how this affected the takeoff/landing qualities.

Now that we had a basic philosophy, we listed various mods that would increase the speed of the aircraft such as: liquid imbalance, P-factor and torque consideration, trim drag, incidence drag, profile drag, drag due to lift, control surface deflection, wing incidence, weight and horsepower. After all was said and done, we settled on a minimum cost for each mph speed increase modification package that resulted in a wing radiator, light weight, low profile, low trim drag, Merlin powered high thrust to weight, high thrust to drag aircraft—*Stiletto!*

As this aircraft came together over the months, I, along with scores of other pilots, mechanics, and engineers, each had our own guess as to how this new puppy would fly. The guesses ranged from one extreme to the other, with statements such as "not enough structure," "not enough rudder," "not enough wing," "not enough aileron," "not enough canopy," "not enough prop" and "not enough time." One thing that we were all sure of was that we knew we were on the right track since everybody thought we were short something! We were just hoping we weren't getting short of good sense.

I remember distinctly just a few days before "roll out" when Dennis Schonfelder, Dave Zeuschel and myself were discussing the wing air slots and, once more, we wondered why the largest slot had ended up on the left wing. This was after engineer Pete Law had stopped by, expressing extreme concern from another engineer that we'd ruined the left wing's lifting ability. Pete was also concerned about the change in the wing pitching moment and the air mass flow through the wing.

It's hard to even think about correcting a wing design a week before the first flight so, with much concern, I went home, dug out our strategy plan on modification changes and placement—trying to think clearly and reconvince myself that we hadn't screwed it up!

In the air STILETTO shows off its exceptionally clean lines.

Luckily, early thoughts and unhurried thoughts are generally better than harried thoughts, with the four month old plan describing the left wing as the most optimum location to place the large slot-louver arrangement for three considerations: engine incidence P-factor; left turning race courses and growth to a Griffon engine; and less optimum than the right wing for two considerations: torque and right roll authority.

The apprehension we all had over the wing slot-louvers was probably the foremost concern on the first flight. Other concerns that I'd discuss with Dick Contrell (Lockheed Skunk Works' Chief Engineer and consultant on *Stiletto)* were: 1) reduced or marginal roll control due to the short ailerons and airflow washing off the louvered wings; 2) high stall speeds due to both the short wings and the lift loss of the louvered wing surfaces; 3) reduced rudder authority due to the absence of the lower air scoop which provides directional stability on the stock Mustangs and, 4) pitch sensitivity due to the modified longitudinal control system and static margin/aft center of gravity flight conditon. Our only concern which wasn't aerodynamic was that of engine cooling—which would turn out to be a major consideration.

THE FIRST FLIGHT, IN THE TRADITION OF MOST *first flights,* slipped by more than a month on a five month construction schedule, with only two short flights being flown by 7 September—the day the aircraft was licensed and two days before it was to be stationed on the ramp at Reno. In planning for the first flight, which was on an FAA ferry permit, we determined that I needed to establish a few critical items on the takeoff roll prior to flying the plane. These items were elevator effectiveness, rudder authority, aileron effectiveness and some guess at wing loading/asymmetry of loading. Along with these, the engine cooling system, in conjunction with air flow through the wings, had to be determined as adequate or inadequate prior to lifting the aircraft into the air.

My plan was to allocate different portions of the takeoff roll to each of these items as a separate task, evaluate each as adequate or not, abort or not abort, then forget that portion and press on to the next! As most of you can imagine, this isn't the most sophisticated flight test technique—but then my Lockheed boss never reads anything, even *Air Progress,* and, if he did, he still couldn't argue with success!

The following is my takeoff flight card for the first test hop:

1.) Check trim settings—zero, zero, zero.

2) Set potentiometer full clockwise. Check engine coolant temp.

3) Advance power to 70 in Hg at 3100 rpm. Note rudder required at 40 mph, 50 mph, 60 mph.

4) Check full forward stick at 40 mph, 50 mph, 60 mph. Note tail position.

5) Check cooling system operation. Note engine coolant temp at 100 mph.

6) Check aileron effectiveness with small inputs. Note authority, especially right roll.

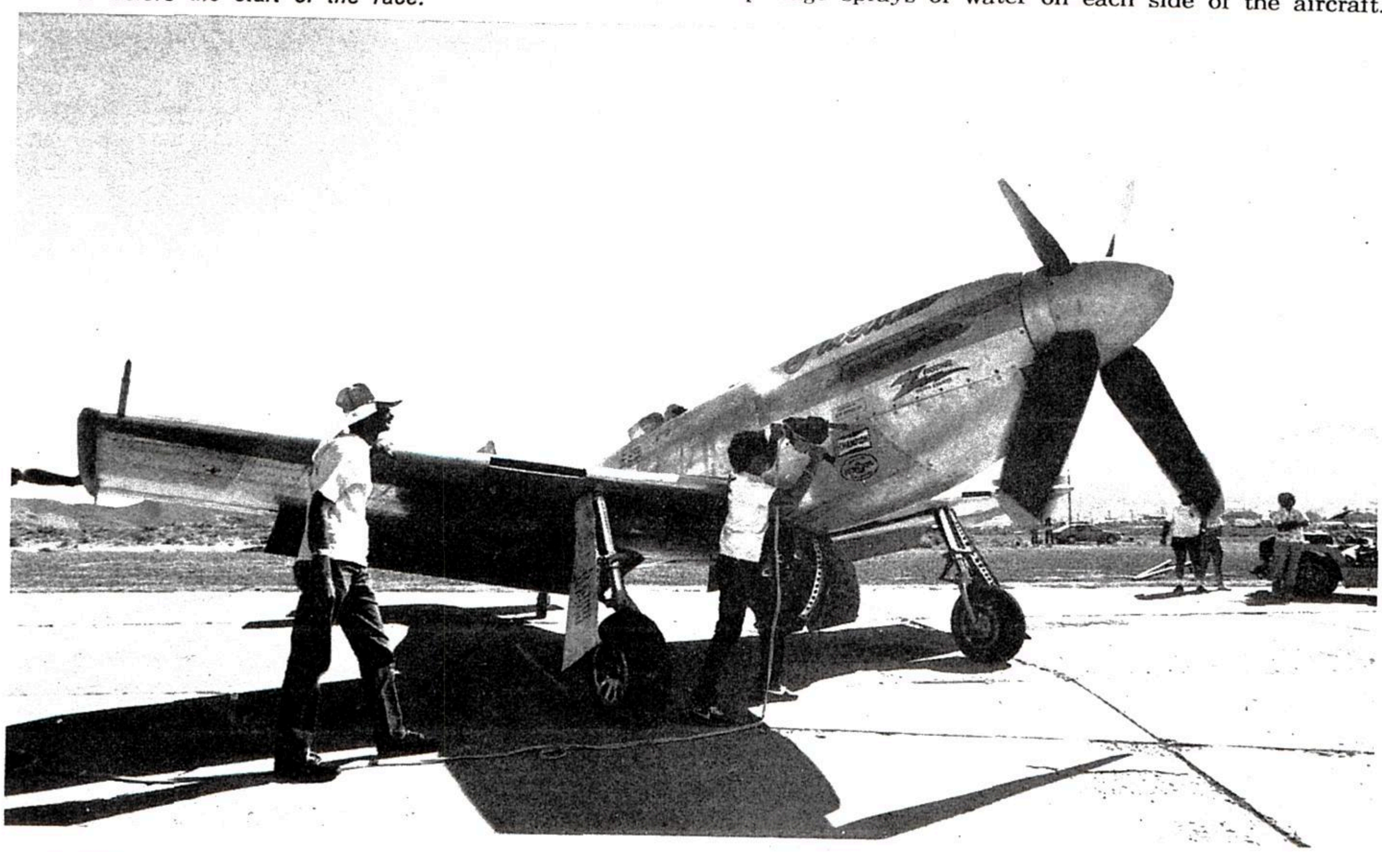
7) Determine asymmetric wing loading.

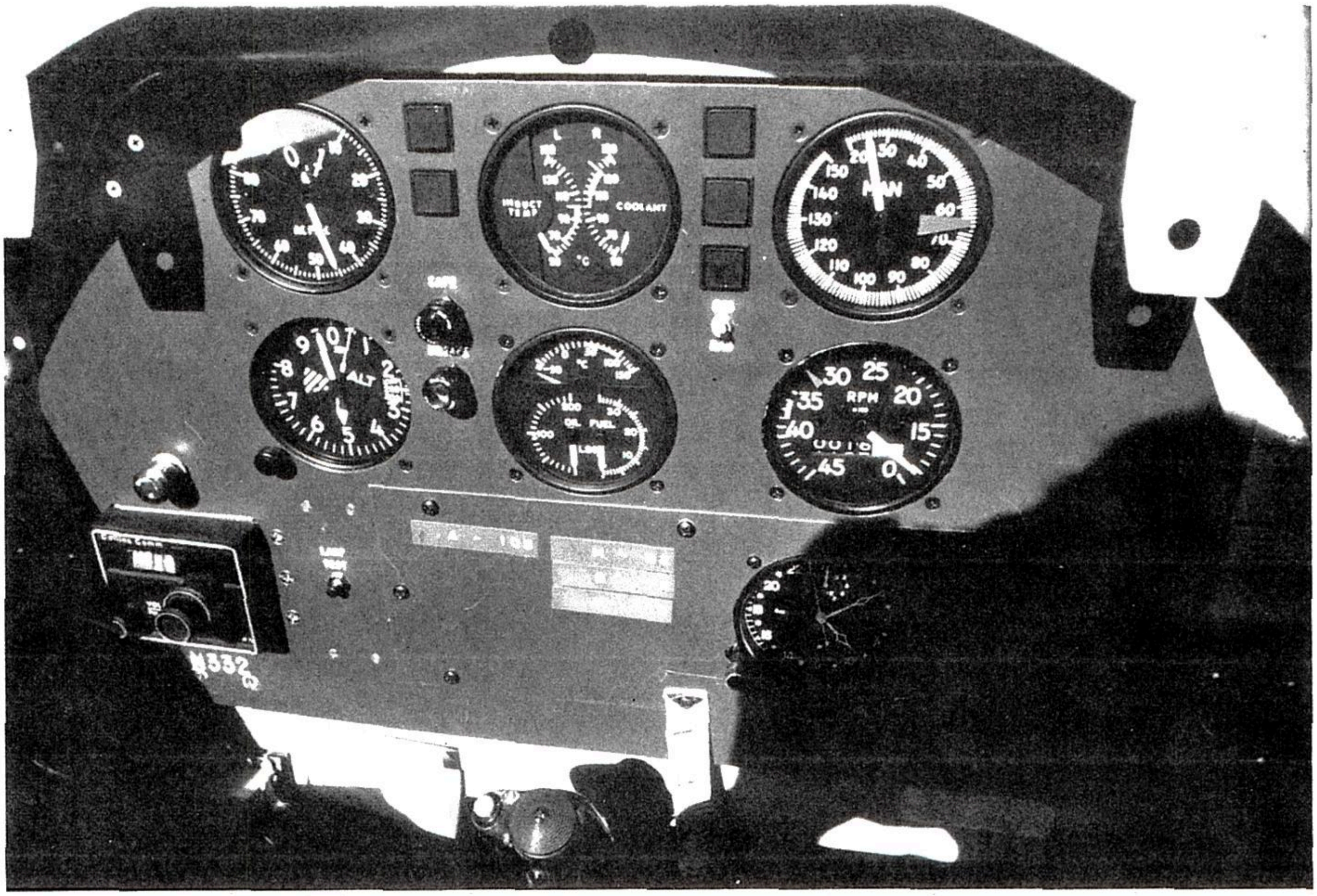
The actual takeoff remained surprisingly similar to the planned flight card except for the initial lineup for takeoff. Due to the radiators being in the wing outboard of the prop wash, there is no ground cooling of the engine. We knew this from other engine run ground tests but had never related this to a taxi/takeoff situation. On the first flight we'd stationed the aircraft about a mile from the takeoff point, thinking that would allow plenty of time to taxi to the runup area, do a runup, get ready for takeoff and then start the takeoff before the engine temperatures got out of limits.

As it was, the engine temperature started rising significantly during the taxi, at which time I switched to the tower, requesting a takeoff clearance still well down the taxiway, rolled out onto the runway and stopped to do an engine run-up. On the taxiway, I had selected "auto cooling" on the computerized temperature control system panel, thinking this would help cool the engine prior to takeoff. This was the first of many times we found the aircraft would not cool on the ground for, as I stopped on the runway to do the engine run-up check, I noticed water boiling out of the wing louvers, steam coming out of the wing leading edge slots, the cockpit coolant gauge in the red, the Merlin coolant relief valve starting to release, and the coolant beginning to cook off! And all I thought of was "this puppy is hot!" My first reaction was to abort, but then realizing we had numerous points of abort already built into the flight card and then (not being too optimistic that we'd fulfill each of these points, only to abort anyway) I pushed the power up gradually to 70 in Hg.

Almost instantly (at least from where I sat!), the airflow caught the water pooled in each wing and sent up huge sprays of water on each side of the aircraft.

To keep weight down to an absolute minimum (5,800 lbs), the standard internal starter was deleted in favor of using an auxillary unit that could be inserted into the cowling just minutes before the start of the race.





The sparse instrument panel of the racer—certainly not fully IFR!

From that point on, the takeoff went as advertised, with the tail coming up, the temperature going down, the directional and roll control criteria being satisfied and at 180 mph and still on the runway, I gingerly lifted the aircraft off the runway, being surprised that there was no wing asymmetric roll off.

The remainder of the first flight progressed as planned with an airspeed calibration, stall evaluation, short look at flutter, some aircraft dynamics, a roll repsonse evaluation and a no flap landing. As might be imagined, the stall evaluation was particularly interesting, both because of the short wings and because of the louvered wing surfaces.

A STOCK MUSTANG POWER OFF, FLAPS UP STALL speed is approximately 90 mph; 75 mph for power on dirty configuration. STILETTO'S stall speed, power off flaps up, was 127 mph; flaps down 124 mph; power on flaps up was 112 and flaps down 107. Besides *Stiletto's* stall speed being approximately 32 mph higher than a stock P-51D, the airspeed spread between flaps up and flaps down was very small. The reason for this small spread is easy to see if you're sitting in the cockpit watching the water flow out the wing louvers during an approach to a stall. The water flow becomes more and more spanwise as the airspeed decreases, finally flowing out of the louvers spanwise toward the cockpit at about a 60 degree angle and washing out approximately two-thirds of the flap area. The direction of the spanwise flow was a welcome surprise to us, since our fear was that the small ailerons would become washed out and ineffective at the stall; but, instead, aileron authority remained very good throughout the speed regime of the aircraft.

Even at high speeds the roll response is good and comparable to a stock or clipped wing Mustang when evaluated over 400 mph. The roll similarity over 400 mph is basically just a function of muscle power where a brute like Ron Hevle or the Jolly Green Giant would have rolled a stocker twice while I was still grunting through the first half roll. The other surprise at the stall was that *Stiletto* doesn't have a stall break in the typical fashion of a straight wing airplane; the C_L versus α curve is flattened out more like a swept wing aircraft—all due again to the flow separation across the louvered wing surfaces.

With the exception of a quick look at dynamics and flutter which were developed over the next three flights, the air work of the first flight was complete and I was ecstatic with the results.

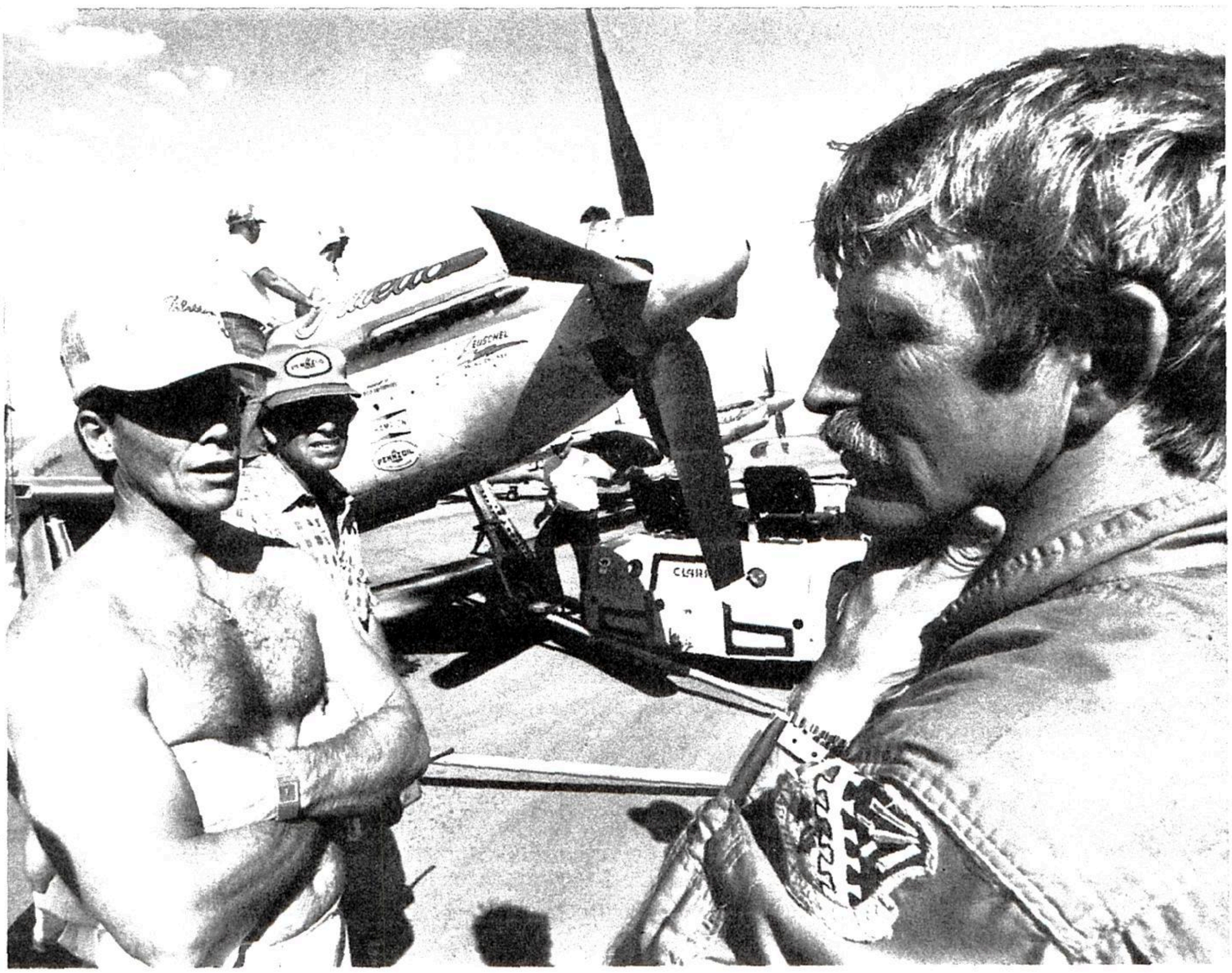
The landing task, even with the set back cockpit (moved two feet aft of the stock P-51 location), was similar to *Jeannie* type racers or an F-4 backseat—no visibility during landing; *i.e.*, I found I shouldn't be too concerned on short final when the nose blanked out the world and the runway couldn't be seen any longer. Mostly, it's a situation where you have to just hold the descent attitude until the wheels get close to the . . . hey, isn't this the same technique the long nose Navy prop airplane drivers use? And if Howard Pardue can do it—you know what I'm saying? Like easy man! Like totally!

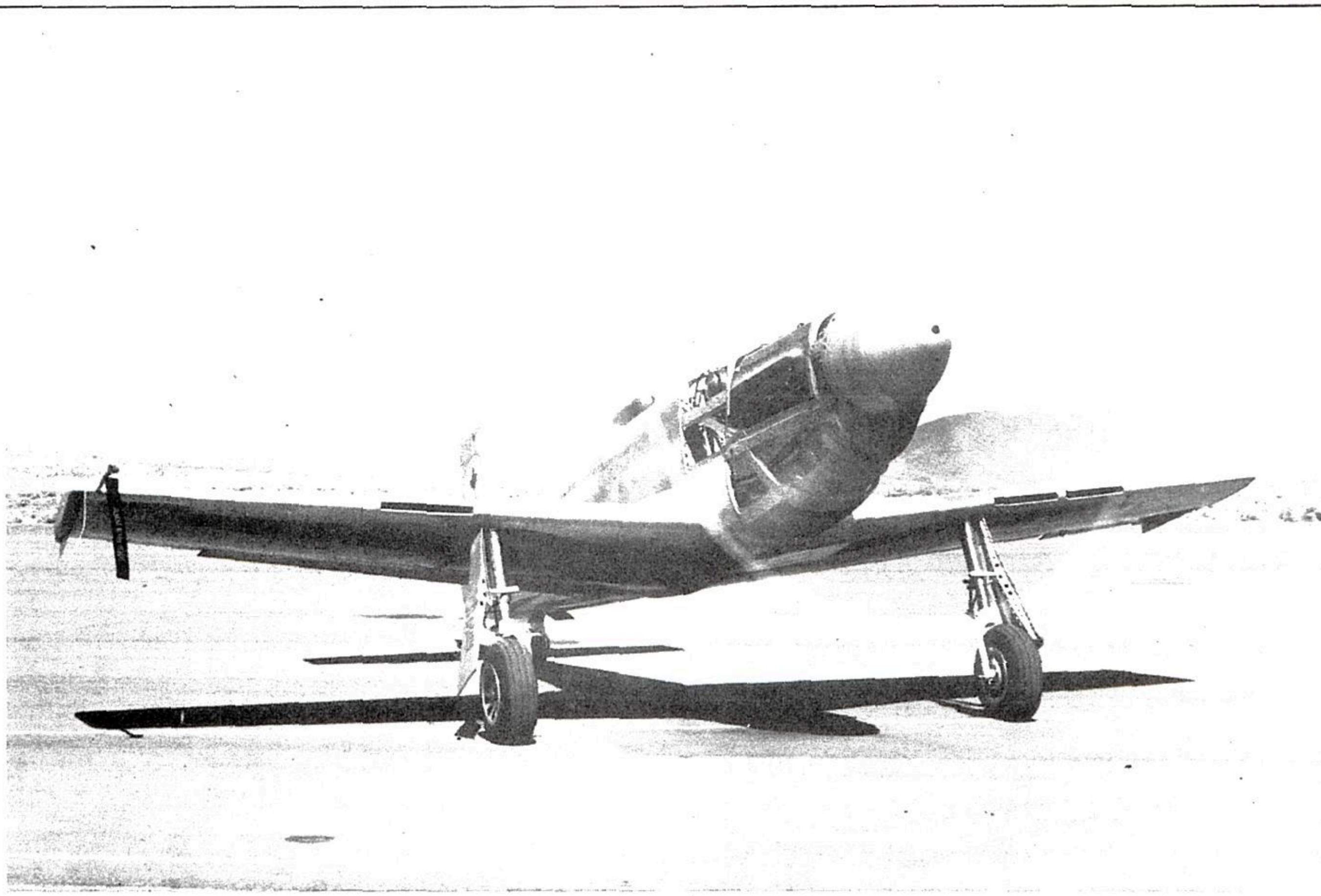
The only other landing complication I had was the unexpected no-flap landing; the flaps wouldn't stay down! This is an interesting study of how ground crews deal with pilots who bitch about little malfunctions, especially after having an excellent first flight. When I complained about the flaps not staying down as well as the flap handle having reverse logic during our champagne toast after the flight, I was begrudgingly told this was a simple fix and "not to worry." For the next three flights, the flaps either wouldn't stay up, wouldn't stay down, had to be wired up or down in the cockpit or had all sorts of flap handle position logic changes. From my point of view, these changes just weren't worth a damn. The lesson in this case, as verified by numerous other pilots, is to just quit bitching and live for the moment when you'll be pleasantly surprised during a flight to find that the system is working correctly! This occurred on the fourth flight, just prior to Reno, and I was grateful.

STILETTO owner Alan Preston (left) discusses tactics with the author shortly before the start of the Championship race.

IN THE NEXT THREE FLIGHTS STILETTO FLEW prior to leaving for Reno, we opened the G and flutter envelopes, looked at the aircraft dynamics and worked a problem with the computerized cooling system. The G and flutter envelopes were expanded by simply flying to an airspeed/Mach number and then performing stick raps and G turns, with an aircraft inspection and control surface friction check after each flight. This had not been the initial plan for the flutter and G envelope expansion, the plan having consisted of a ground shake test to determine rigidity and flutter modes for each wing/modified tail structure for speeds up to 525 mph, with an additional study of aero-elastic effects occurring at high airspeeds which could alter the aircraft stability characteristics and make its behavior unpredictable.

Knowing we only had two days before leaving for the races, we adopted the very scientific flight test approach of "just go do it" with the additional caveat of "don't screw it up!" A dynamics evaluation was accomplished at each flutter point, with the aircraft being essentially deadbeat in the yaw and roll axis but exhibiting high sensitivity in the pitch axis.





Minus its famous Mustang belly scoop, the new racer had to rely on cooling from radiators mounted inside the wing.

A phenomenom of this aircraft is that the stick position for trimmed level flight varies no more than a quarter of an inch from stall to 200 mph and then doesn't move at all from 200 to 500 mph. This is indicitive of a neutrally stable aircraft, a characteristic we had attempted to design into the aircraft for low trim drag and was also a characteristic we thought could be flown safely.

There was one occasion on the start of the Sunday Championship race where I experienced a divergent longitudinal oscillation that had been excited by my accidentally hitting the pitch trim button. We had replaced the P-51 trim system with electric trim motors from an F-86 and the pitch trim rate was too fast to be comfortable but I never considered it a problem since the stick nor the trim ever moved above 200 mph anyway. My inflight stick raps that I'd used to determine the dynamics of the longitudinal axis had apparently not been of the magnitude that the Sunday race mistrim had driven the aircraft to, resulting in a divergent motion rather than just a pitch sensitivity as I'd determined. Needless to say, I stopped the divergent motion and continued the race, being aware that the aircraft could have a destructive mode with any large upset.

This pilot report won't be complete without discussing the Reno "rumor": the *Stiletto* cooling problem. I guess I'm not clear in my own mind whether we had problems with cooling at Reno or not. The problem wasn't that we couldn't cool the engine, the problem was that we hadn't optimized the cooling system to the aircraft. We hadn't had time to optimize the wing slot-louvers for the mass flow required, for the spray bar arrangement required or the spray bar water flow required at race power. The qualifying laps and the heat races were the first opportunities we had to fly at race power and evaluate the cooling system. Actually, Friday's race was a structured flight card at a pre-set power to determine flow rates, engine/radiator temperature hysterics, thermocouple sensing, computer operation, pump pressure settings and spray bar operation—and it was just a fluke that *Stiletto* won this race!

It was also during this race that we established the design G limit and found the aircraft's weak point occurring when I followed Neil Anderson's 8G pull-up off the course at Pylon 8. This pull-out came about in our confusion as we tried to avoid a midair with two Mayday aircraft landing at the same time. The left outboard wing had bent upward, just slightly, and was hardly noticeable (only a few people noticed it). The situation would have to be fixed sometime anyway I guess! (These are just some of the statements that pilots use when they pull too many Gs! I don't know all the statements, but perhaps Neil used other ones.)

The most I can say about *Stiletto* is that I'm the only guy who has flown it—and I could have said anything! But I didn't. It's a pretty nice airplane; it's fast, it's cute, it's uncomfortable (no air conditioning, no leather seat, no leg room—not Clipper Class seating) and it's not a Mustang. Also, it doesn't have the Mustang's famous scoop. But then again, owner Alan Preston says that scoops are only for snow plows. Me, I'm just a driver. What do I know? □