PREPARE FOR HIGH ALTITUDE SOARING

by Victor M. Saudek

The following article is presented to give those who are participating in the proposed SCSA HIGH AND WIDE SOARING EXPEDITION at Bishop, Calif., this Easter sufficient time to investigate the fitness of their sailplanes for the BIG ONE. The fitness of the pilot is not discussed here, though it is equally as important as the mechanical integrity of the craft.

The facts presented here are based on experience obtained by enthusiasts and by enthusiastic professionals over the past ten or so years, including the SIERRA WAVE PROJECTS.

The purpose of this story is to implant a basic philosophy: "Given an adequate pilot, a successful high altitude flight is a matter of good equipment."

Accordingly, the design of details and the care of the installation of oxygen, instruments, radio, etc., must be undertaken with each act monitored by the policy: "It must *always* work - and *never* fail."

Before one undertakes to earn the high diamond or to exceed an International Record for altitude in a wave or in a Cumulo-Nimbus, he should realize that failure of even unlikely details can easily cause his death.

Item: An aluminum bearing on a steel torque tube or push rod may so shrink in the -100°F (or colder) temperature at the Tropopause as to lock that control in a grip like a vise.

Item: Plexiglas (Lucite and Perspex are other names for commonly used transparent canopy and window material) will shrink .007 inches per inch between +100°F and —100°F. If the canopy mounting details are not thoroughly considered, the pilot may find himself literally "quick frozen" as the overstressed "glass" breaks away. Anyone who is interested in comparisons can consider the following: Quickfrozen meats are subjected to temperatures of —20°F for 20 minutes, at which time they are as hard and brittle as ice. This is in relatively still air. At 100 mph and —100°F . . . . . Keep your face covered when high - goggles and oxygen mask are better than nothing, but not complete.

Well, then, what are one's chances for survival if he bails out at, say, 40,000 feet? The answer: It is *possible* to survive, but it again depends on the excellence of the equipment and training of the pilot.

ABOUT THE AUTHOR

Vic Saudek is 44 and works as a consulting mechanical-aero engineer. He holds U. S. Silver C #164, a commercial glider pilot certificate and is presently a member of the Douglas Soaring Club and president of the Southern California Soaring Assn.

Introduced to soaring in 1932, he later founded the Carnegie Tech Gliding Club and helped design and build the "Flying Anvil," of short history. In addition to aircraft and missile work for North American Aviation and Hughes Aircraft, he was co-project engineer on the Pratt-Read sailplane, project supervisor of the Sierra Wave Project and author of a paper on stratospheric sailplane design at the sixth OSTIV Congress. He presently is designing a high-performance two-place sailplane.

Part of the considerable cost of our high-performance military and commercial aircraft is due to the necessary detail design and testing of each part by highly trained experts. Even they are not infallible. It is hoped that eager amateurs will take note and not proceed to try their own hot theories - not all of the input required is in books, and this article is not intended to make the reader an expert, since the author does not consider himself an expert.

Here are points to ponder:

Given an all-metal wing, relatively thin skinned and with a beefy single spar: the skin will chill more quickly than the spar during a rapid ascent creating temperature induced stresses which should be looked into. On the way down, the skin can warm up much faster than the spar and, in most cases, will crinkle alarmingly. Again, do not take a chance - make certain that rivets won't pop and webs go beyond the yield if, as has happened, high accelerations are experienced at just the wrong moment. Consider that 10 G's have shown on the gage many times in waves, as attested by several pilots.

Or consider a wood wing with long, rugged steel fittings tying the roots together: When the fittings shrink, the wood may be crushed by the bolts. Also, steel control cables may shrink so that, if not rigged loosely enough, the pulley brackets will tear loose from their mounting structures. There is not much that can withstand these implacable molecular forces. Typical of an amateurish "hot theory" might be the one which adds a heavy spring to the control system so that the tension is kept "within bounds." Well, two things are critical here: Most springs are big invitations to control surface flutter, also, it may be of a metal that is so embrittled in extreme cold that any sharp shock will break it like glass; "Hot Theorists" may find this a chilling thought.

Shrinking control pushrods of metal in a wood wing may cause flaps to deflect up if the stops allow up travel. If the stops are positive, something will give. Aluminum structures shrink more than steel cables, loosening the cables. In every case, be sure your controls will take the cold. There are, by the way, control cable tension regulators. These have springs, but the springs are active for only *fractions of a second at a time* as the tension is adjusting. This is a concept that took a lot of time, brainpower and facilities to develop, it is not likely to be junked by a brainstorm. Lubricants that set up like a rigid thermoplastic may be in your control and wheel bearings. This can cause embarrassment even if in only one place. Low temperature lubricants are available, but don't just take a salesman's word for its performance.

Ice can form in some points of your control (or oxygen) equipment. How? Well, a flight reaches, say, 30,000 feet and frost forms on the

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