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Planning with Lanier Ultra-Short Stable Slatwings of 1920s-1970s Budget Vacu/Para-planes

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Abstract: Early 1930s witnessed curious 1/2 or 1/3rd usual wingspan, 1-2seat cheap economical Lanier planes flying reliably and extremely stable, even an early student version. They had very low landing speed of a runner i.e. short take-off/landing (STOL). All available Patents since 1929 were collected - the year Airship *Graf Zeppelin* globe-circled - plus many Lanier photos and scientific press releases of Lanier aircraft since then. Prof.Edward M.Lanier, *University of Miami*, had used wide short-span "open top" slat wings to create a partial vacuum lift, thus sucking the plane upward. A Study Group I commissioned applied *FastFlo* Software to Modeling the Wing. This paper attempts to finally enthuse Aero Improvement advocates into reinitiating Lanier plane model testing or full-scale R&D, an activity in which the author has been vitally involved since 1970s. Efficient and quiet Laniers have "great safety", "almost fly themselves", "almost hover", "STOL in 20m", "Every Field an Airport" and "Hangering greatly enhanced"; thus no need of vast airports and hence introducing significant transformation to Public Transport Planning. Only the plane's lifting surfaces and propeller are aeronautical, the remainder fine Engineering.

Keywords: *Unconventional Aircraft, Fluid and Aero Dynamics, Flight, Lanier, Flight Control and Aircraft Mechanical Design.*

1. MOTIVATION INTRODUCTION

Land transport should no longer be so grossly dependent neither on massive amounts of fossil tarmac nor on energy for road making, on usual 1-Dimension vehicle waste and gridlocks, nor on vast ungainly airports. Moreover, from author's basic news survey over decades, one can conclude globally that at least a *Jumbo* jet passenger complement is pulverised, plus several smaller flying machines meet their downfall weekly; if not all, the remainder are significantly vulnerable; plus 600 often-crippled *Martin Baker* ejection pilots over recent years! Conventional flight, other than by powered balloons or kites, paragliders, ultralights and fast economical Ramwings is largely unpredictable and too dependent on every item functioning to survive crashes. Evidently, inherent Lanier stability and safety could in principal eradicate iniquitous weekly airline crashes and stalled car-traffic because, like many components in cars, slower trains, buses or in boats that fail, one still arrives, stops or is rescued safely. If such as a child's toy, fan heater or small automobile component proves slightly unsafe, it is generally recalled or banned from sale. For whatever reason (including pilot error, terrorist takeover, slapdash maintenance, inferior instruments, dubious wiring inspection or inadequate plane freight door locks...), aircraft failsafe, redundancy, backup, failure modes, reliability, MTBF and absence of safer reversed-seat facilities are largely ignored. Airlines often quote remarkably low deathrate/million-passenger-km - depending how many million passengers fly weekly and how far could assist in determining crash frequency.

However, there is seldom an obvious hint when a plane's number is up (see *Air Crash Investigation Unit* TV series), but *Sydney Morning Herald*, 28 Jan '08 quoting an extensive Study, assures some that aircraft crash survival is "quite good", adding that in USA between 1983 and 2000 there were 568 crashes, involving 53,487 passengers when about 95% (51,207) were claimed to survive; in fact, nearly 90% of such crashes are quoted as survivable. Even if a Lanier were to crash, its tiny wingspan on a wide body present far less hazard to those aboard or ground-based, and flotation is much more manageable. Moreover, city CBDs seem less significant as increasingly 35% of workforce is now home-based (Bill Metcalf, PhD Thesis, Griffith Uni) and 50% of Australian workers plan a more self-reliant "downshifted" lifestyle. Perhaps, like Canada, 70% of businesses started annually evidently tend also to home-work, naturally still needing planes for vacations etc!

2. OPERATIONAL REVIEW STATUS

Extraordinary detailed patents (**17**) filed by Research Prof.Edward H.Lanier (Cincinnati inventor) of *Miami University*, *Aviation Dept* (now defunct) Florida USA from 14 Oct 1929 - the year *Graf Zeppelin* globe-circled - and 1930-1960s scientific press releases relate to ultra-stable, ultra-short slat-wing frugal flights, as shown by Howden (1979 book *Eco-Logistics*), including enhanced pictures. Prof.Fred H.Givens, then head of same *Aviation Dept*, made several Laniers, bigger 1-2 place planes followed. High speeds are achievable with less or zero slat angle. 1935 *Miami University* students of Professor Lanier built and piloted a crude 36HP *Aeronca* two-cylinder engine, junk parts *Vacuplane* having 4.3m slatwings (about 1/3 to 1/2 usual wingspan!), 260Kg gross weight, top speed 154km/h, landing 48km/h.

Lanier principals involve a one-sided slatted venturi effect - like a distributed *Pitot* tube, if not the 3-D analogy of a semi 2-D laboratory aspirator (using air instead of water), or as an opened-out venturi to achieve a reasonable partial vacuum. To wit, a slatted wing or wide-body top like this profile shown moving left**:**
Wind -> ***(***<u>//////</u> as in **Fig 1** with flat underneath and lifting close to CG - like Venetian blinds lying on a table albeit suspended over a thin air cell as here sketched because there are experimental suggestions that a lower chamber, would smooth out lift over the entire slat matrix - a good spot for retractable wheels. Each trough experiences reduced air pressure that equates to lift. Tip boards at the extreme lateral end of the wing are said to prevent tip loss and tip drag through vortices. Flutter, rigidity, fatigue, stall and spin, lateral slip-off, dive at stall and skid in turns, the killing banes of aero-designers since 1900, are Slatwing-irrelevant. Nose-dives are stabilized differently from canard wing Airfoil cross-section, see **Fig 1**.

Slatwings trade short span for greater chord. From 1940-50s, *Vacuplane* became *Paraplane,* a more streamlined design. Dozens have flown. Original engineering articles quote a plane of 'great safety...that almost flies itself', and 2-seat planes 'hovering' at 30.6Km/h - humans can run this fast! Even bigger craft STOL in 20m! Fuselage-painted logos read: *'Every Field an Airport'*! Paraplanes can have safe stall-free steep parachutic-effect landings in tiny areas only having to stop from quoted athlete's running speed. Similarly, they also fly out of areas previously limited to helicopters. Climb angle and rate is much greater than typical aircraft; hangering much enhanced. Hence airports should be re-Planned as vast *Public Edible Parks* + solar/wind/biofuel (sugarcane) farms to save/make $billions, or simply rendered nonexistent! 'Save' because note vast convoys of planes retired to Texas deserts when superseded by models just a few % improved. Slat wing aircraft can also be near-emissionless: PV-solar, hydrogen, bio-fuel and steam heat are feasible-power. Such should inspire modern aircraft design. Some Laniers had 2.69m wingspan, takeoff/land in 15.3-18.3m,

265km/h speed, silent running and control at 24.2km/h. Early conventional aircraft apart from wheels and engine, like barges, were largely constructed from far more renewable resources (wood and ply, cloth, string, wire, pitch, bamboo, shellac, rubber...) than were cars. Likewise Lanier aircraft that can pickup freight in full slow flight.

3. *FASTFLO* SIMULATION SOFTWARE

During 24-28 Jan 2005 as a 72year age pensioner, author paid $4,000 + CDs of data to have Lanier-wings super-computer analysed and simulated by a mathematical team using *FastFlo* software at the regular extended problem-solving *Math in Industry Study Group* workshops, Massey Uni, New Zealand. Curiously, more weeks would be needed than the one available. Results to date as in Fig 5 are available on a second CD. Much interesting information arose however, such as Lanier planes seemed the first to use more appropriate thick wings at slow speeds, though only coincidentally on Lanier compared to usual airfoils. This field is rich in potential rewards for the research of aero enthusiasts, wind millers, modellers and Planners.

4. WHY NEVER CONTINUED?

Remarkable performance even on current balsa models (see Fig 6) suggests asking where are these wings? For analogies to such questions, consider a list containing 100s of vital ignored activities, including**:** 1929 wind-turbine-driven propeller ships (can go straight windward) and *Flettner* rotors are far more efficient than conventional sail; 1929 film music hinted that long-play quality multi-track film recording could have avoided inadequate 78 etc vinyl records; at school we wasted years multiplying by slide rules or worse by log tables instead of simple mechanical calculators available since 1700s Leibnitz; and why sinking *Titanic* passengers excess to lifeboats didn't climb onto icebergs until rescued... As in quoted text by Howden (1979 book *Eco-Logistics*), we now suggest applying Lanier Alexander Lippisch's to *Ramwings* as in *Ground Effect Machines* (GEM) surface skimmers as perhaps the most economical kwh/passenger-km, fast, cheap transport, albeit relegated to open spaces and just above waves***!*** Hovercraft, hydroplanes and helicopters are far down in efficiency. Another picture in *Eco-Logistics* shows a conventional shortest wing plane of about 2.74m, less than many model planes, whilst the British *Shuttleworth* Collection contains a 1920s plane giving 100miles/gallon. So where are they? Or how do us pensioners comfortably live on < 5% pension. But why never adopted? From 1940-50s after his father died just prior to Pearl Harbor, brilliant son Edward M.Lanier became president of *Lanier Aircraft Corp* of New Jersey, having few funds to further develop the superb alternative *Lanier Paraplane*. At that time, only Germany had a helicopter and all allied warplanes urgently needed speed, evidently not helicopter-like near-hovering, or takeoff from tiny spaces. After WW2 he formed *Lanier Aircraft Corp* of Marlton, New Jersey to build it. A New Jersey airfield sadly closed after author's last *Paraplane* photo of 29-8-70, engine and prop stolen.

5. ENHANCED AIRCRAFT CONTROL

The author proposes: (a) Slat wing surfaces to be port-starboard split including across aircraft's wide body, each side having differential slat-angle variation to control lift, hence roll; speed is fastest with both closed; though raising a single slat is an airbrake. (b) Largely variable slat patches along fuselage ends (top, bottom and sides) - much shorter than conventional inconvenient tailplane assemblies - to control pitch-yaw directions. (c) A fuselage-top-mounted hinged check vane counters stalling backward tailspins. (d) Modern technology and light structures would make weight and performance even more outstanding.

6. SPARSE LANIER DATA

Remarkably, little Lanier data (see **NET DATA SOURCES)** exists though enough to compile 2 *PowerPoints* + Reports + Patents available on CD. Slatwing has held author's fascination and awe - though remarkably little of other's - since 1976, so colleagues are offering a humble $2,000 Prize for the first modeller we photograph to fly a controlled engine-powered all-Lanier model of any size (ie including every lift and control surface, though Lanier wing alone would be acceptable). Engine power would probably be miniscule! Also, $200 offers for quality photo(s) of a full-size authentic earlier flying Lanier Vacuplane - not Paraplane.

7. PARAPLANE LANIER WINGS

These by Lanier's son - also Edward - have 6 pairs of controlled hinged aerofoil slots (see Fig 1), where both are full open for landing with the wing at a high angle of attack. Air is led from the under-wing slots into a venturi passage within and passes over the wing-top surface to maintain abnormally high lift for low speeds. At take-off, only the small lower vane need be open slightly for slot effect (or both). For cruising, both vane sets are retracted and airflow over a normal aerofoil keeps the Paraplane airborne at far higher speed than for

earlier Vacuplanes, i.e. 48.3 to 193k/h. Separate Vane control could replace ailerons etc. Lanier's *Vacu-Jet* airfoil circulation augmenter and boundary-layer control device that also acts as its own parachute if engine fails, was fitted to 5 basic successful research aircraft.

8. CONCLUSION FAR-REACHING PLANNING APPLICATIONS

Besides cheap safe fuel-crises-friendly economic airliners and backyard private plane takeoffs, wide shorter Slat air propellers and helicopter blades, unlike conventional units, would be feasible together with Planned yacht slat sails and windmill blades; as well as boat propellers although these latter now enjoy profoundly greater efficiencies via such as a concentric freewheel prop etc. Ship speeds plus wind-speed usually exceed Lanier stall speed, hence no aircraft catapult needed. Econo-Space Shuttle for takeoff-assist and landing should benefit from Slatwing lift policy, as presumably could other satellite atmospheric re-entry craft, glide vehicles, tiny spy-planes and unmanned continuously-aloft solar aircraft. Lanier patents show an ordinary plane/slatwing conversion. Slatwings integrated into safe (plane parachute backup) private wide-bodied budget micro-lights would enable 3-D travelling based from small home gardens or from water complete with GPS navigation - resulting in far less congested fossil-formed roads that could be re-planned as emergency or regular glide landings for these appropriate planes. High-speed boats or cars could more easily avoid flipping if underside was coated with small Lanier slats. Fuselages and boat hulls coated with fairly new-concept sharkskin or golf-ball-like surface could realise much less air or water friction- - -

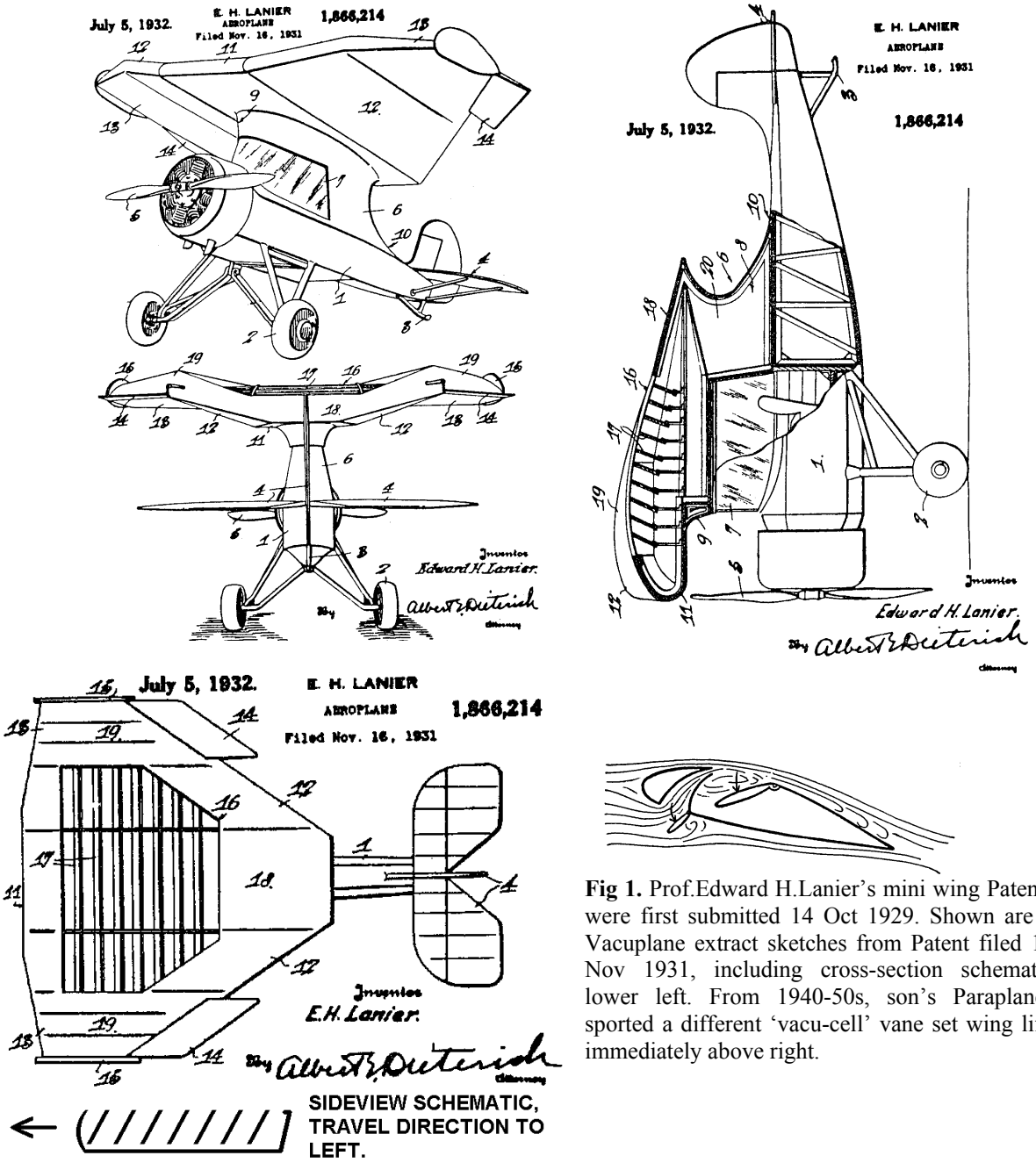


Fig 1. Prof.Edward H.Lanier's mini wing Patents were first submitted 14 Oct 1929. Shown are 4 Vacuplane extract sketches from Patent filed 16 Nov 1931, including cross-section schematic lower left. From 1940-50s, son's Paraplanes sported a different 'vacu-cell' vane set wing lift, immediately above right.

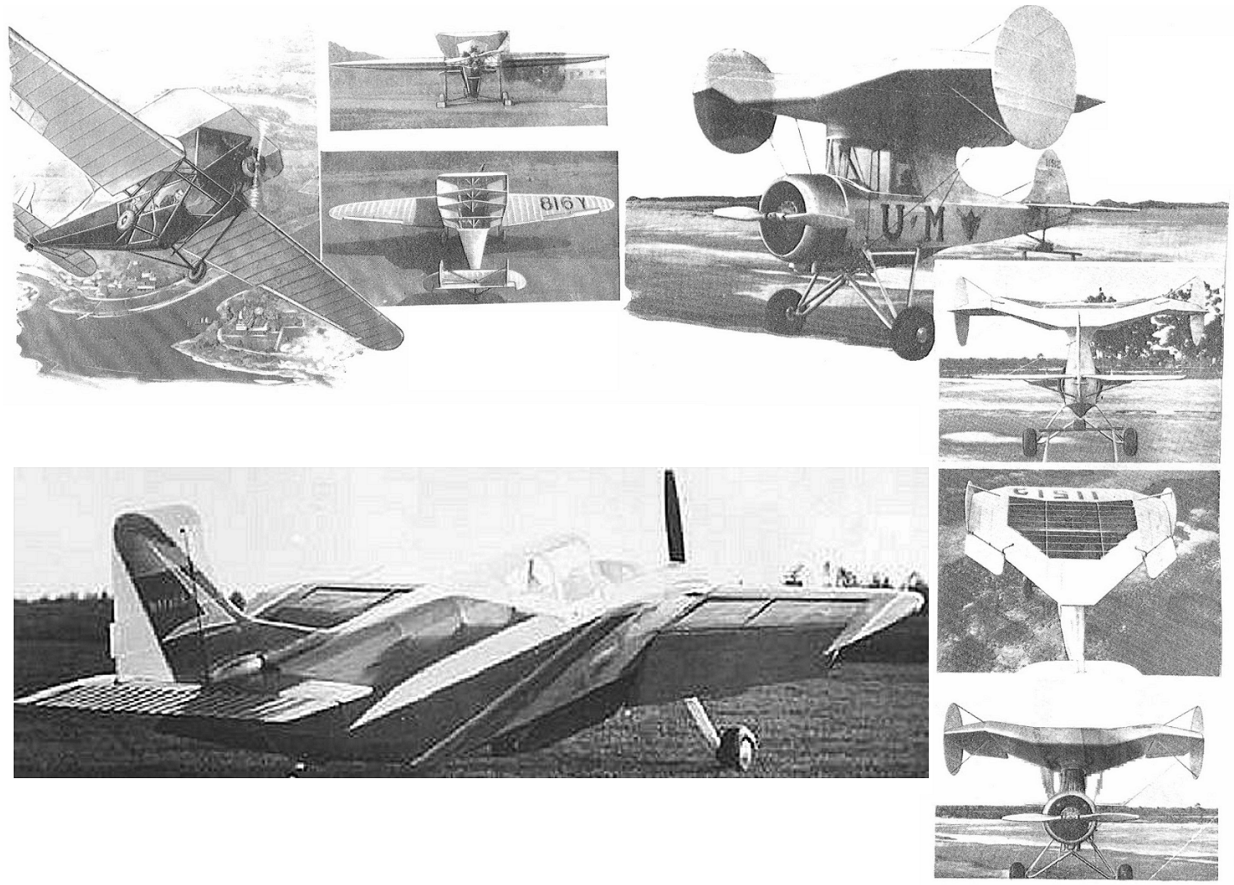


Fig 2. American insignia is #816Y for the top left three aircraft, including accurate in-flight sketch left showing how its designer lost courage by providing so much standard airfoil. #11512 is the right-hand machine. U of M = *Uni of Miami*. Lower left of these shows later 2-seat 1958 private or business *Paraplane Commuter 110* N4157A. All old photos are author-restored and enhanced, yet unchanged.
- *Popular Mechanics* Top 3 left photos Jan 1931; right 4, June 1932.

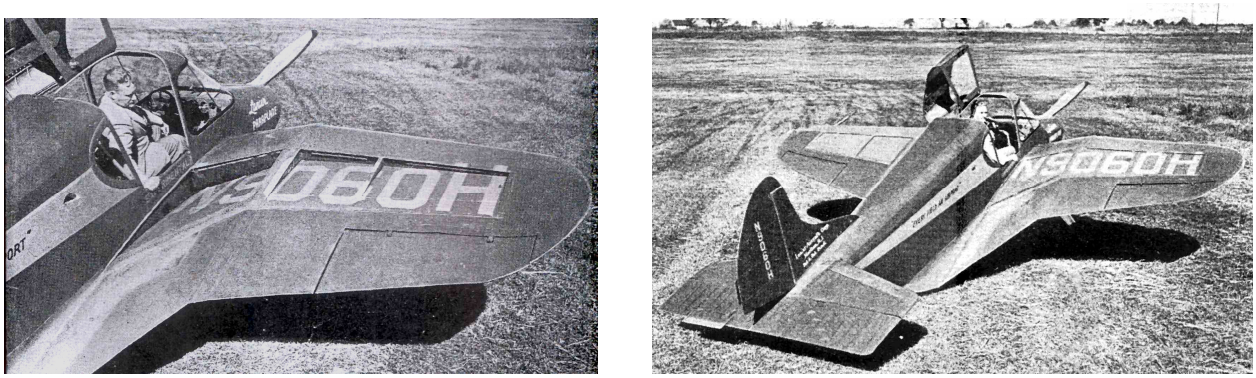


Fig 3. (Above left) Top of later Paraplane wing surface is lowered to form 6 'vacu-cell' vane sets behind the front spar on N9060H Paraplane with its 90hp *Continental*. (Right) Surface vanes raised for speed; note deep wing fillets. – 2 photos above + *Paraplane* in Fig 2, *Aeroplane*, (1949), pp 674-, Nov 18.

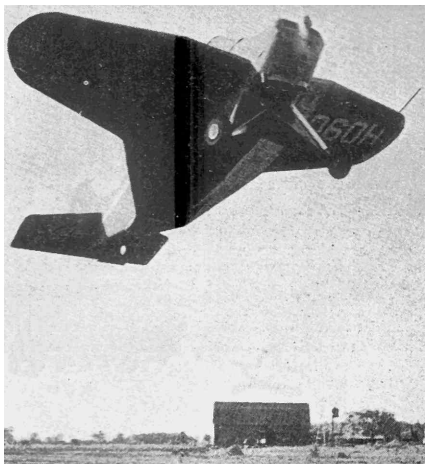


Fig 4. (Left) N9060H engine cover is far shorter than car hoods***!*** Note high climb angle from STOL of 20m. (Right) PARAPLANE-2 from *Lanier Aircraft Corp* 1952, a 2-seat variant on 1949 PARAPLANE-2, still as N9060H yet with longer nose + taller fin and rudder, which could be Lanier slat surfaces. Remarkable short wing is clear. Another 1949 PARAPLANE tested by U.S. *Office of Naval Research* was quoted to have almost "hovered". Author researched with this group in 1960s California, but in *AeroSpace Section*. - *Aeroplane*, (1949), pp 674-, Nov 18.

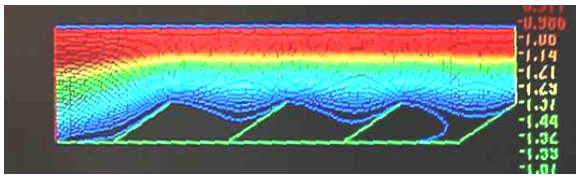


Fig 5. (Left) All too brief time to Model *FastFlo* software Vacuplane; results are summarized above in replicating 3-trough low pressures and streamlines. (Right) The models**:** Team did manage to glide a crude 3-trough Lanier Vacuplane wing from Massey Uni, NZ, roof despite heavy cardboard construction and lack of stability controls. That light paper plane held by Team Moderator Yvonne Stokes didn't fare so well.

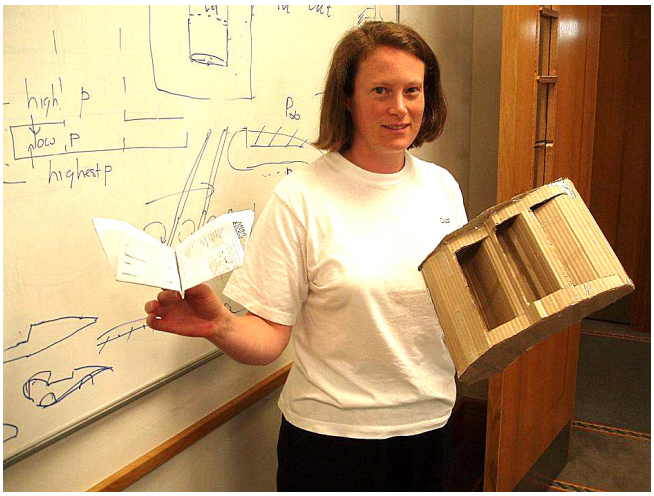
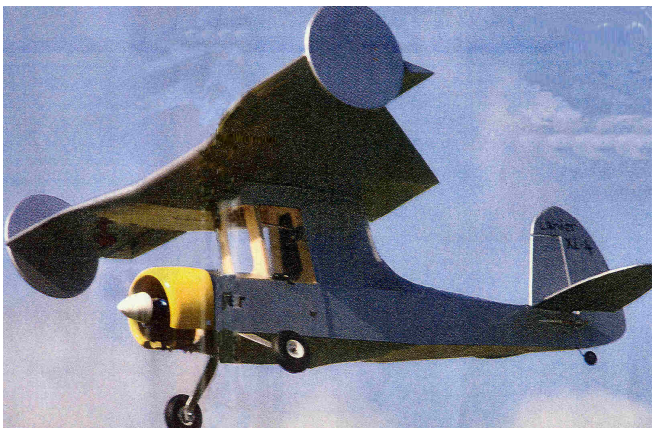


Fig 6. (Right) Splendid control, performance and stability of flying balsa Vacuplane model by *Radio Control Model Flyer* Mag, UK, Editor and Designer-Builder Dr.Jurgen Stengele. Wing Span 90cm, smaller than 113cm length, weight 1.87kg, OS 40 LA 2-stroke motor. Has flown for years. Leaps skyward after 20m, same STOL as full-scale 1930s planes***!*** Curiously, the RC instructions stated if losing control, simply ignore the radio and let craft regain stability - like full-scale plane.



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UNCONVENTIONAL, SUPPRESSED, DORMANT, ALTERNATIVE. This brings up an INDEX page, so click LANIER on the first line, which reveals another INDEX list. Scroll down to EDWARD LANIER: VACUPLANE to click on for details of 6 patents, drawings and descriptions. Other links on REXRESEARCH page are worth pursuing***!*** Or simply *Google* edward h lanier.