

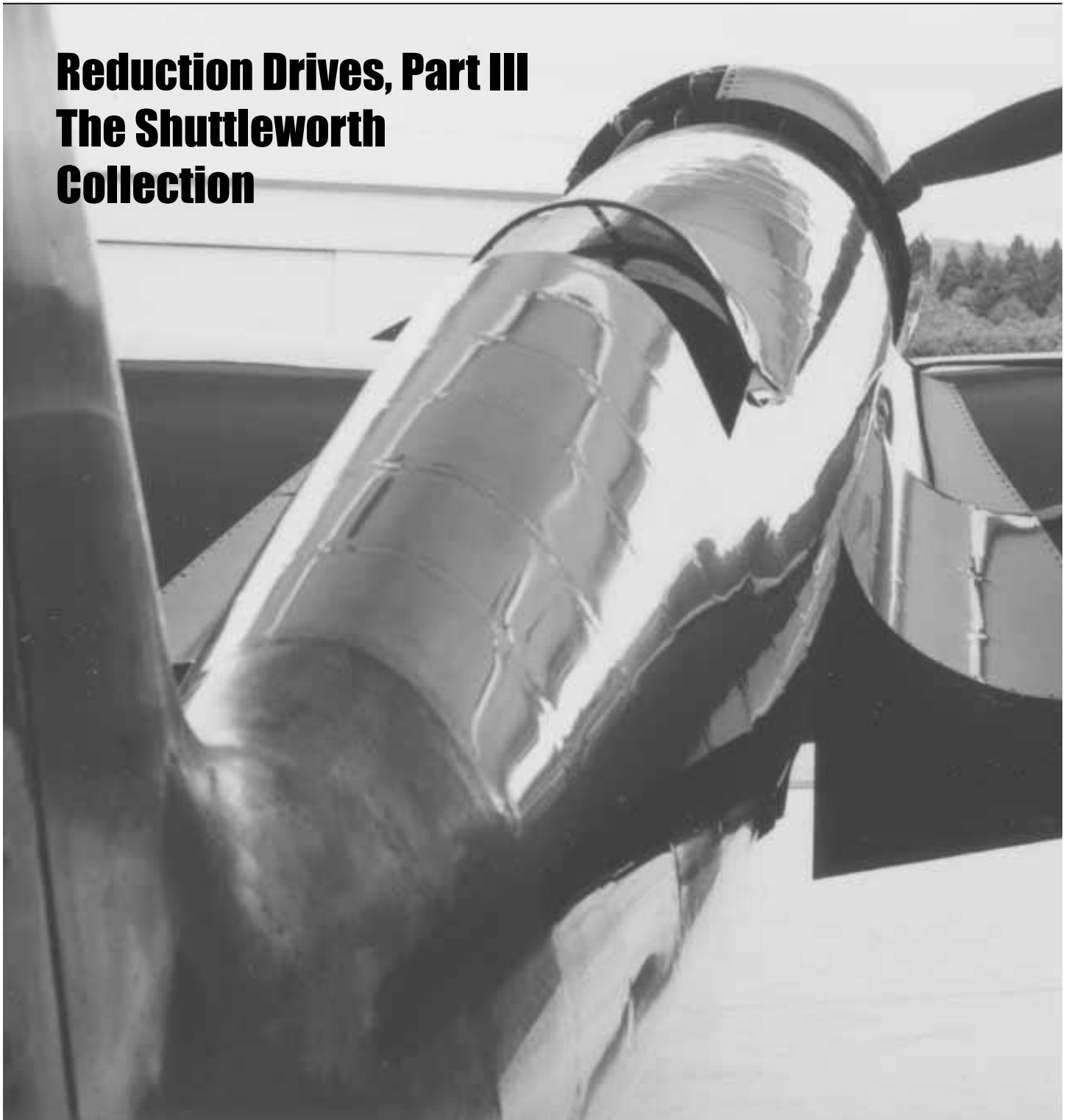
Turn & Bank



OFFICIAL NEWSLETTER OF RAAC CHAPTER 85

October 2001

Reduction Drives, Part III The Shuttleworth Collection



Inside



On the Cover:

The Replica Hughes H-1

Above: The H-1 in profile. Photos by Peter Sleeman

Technical Guy	
Bill Husa, Orion Technologies	3
Bulletin Board	4
Minutes	
By Jim Hunter	4
Shuttleworth	
Text and Photos by David Smith	5
Classified	7
The Last Word	
by George Gregory	8

The TURN AND BANK is the monthly publication of RAAC Chapter 85 and is intended to keep members informed as to the club's activities, and to promote safety and technical excellence in the field of sport aviation. No responsibility or liability is assumed, expressed or implied as to the content of articles contained in the Turn and Bank: the intention is to provide a forum for discussion and exchange of ideas.

Newsletter contributions should be mailed to George Gregory, 19470-88th Avenue, Surrey, B.C. V4N 3G5 no later than the 12th of each month. Business Fax is (604)-469-3495. Please remember to indicate "attention George Gregory" on your fax. Contributions can be e-mailed to George at:

gregdesign@axion.net

Enquiries to the Membership Chairman should be mailed to Rob Prior, #204-130 E.11th St., North Vancouver, B.C. V7L-4R3

For inspections of Amateur Built Aircraft Projects contact the MDRA Inspection Services , ph. 1-877-419-2111
 fax 1-519-457-0980 email: mdrainsp@on.aibn.com
 Regular Meetings are held on the first Tues. of each month at 20:00 in the clubhouse:

Delta Airpark, 4103-104th Street Delta, B.C.

Clubhouse phone: 596-3644

Mailing Address: Chapter 85, RAAC

c/o Delta Heritage Airpark, 4103-104th St., RR#3, Delta, B.C.
 V4K-3N3

Executive meetings are on the third Tues. of each month
 at 19:30 in the clubhouse.

Chapter aircraft pilots, mail cheques
 (Payable to RAAC Chapter 85) to:

Tedd McHenry

RAAC National Homepage: <http://www.inforamp.net/~raac>

RAA Chapter 85 Homepage: http://www.b4.ca/raa_85

Delta Heritage Air Park Homepage: <http://home.istar.ca/~bb4>

Source for CARS and Chapter 549 Airworthiness Manual: <http://www.aerotraining.com>

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www.oriontechnologies.com

Reduction Drives Part 3

Finally, let's look at the reduction drive system designed to withstand the loads without the use of any torsional dampening system. This obviously is the simplest goal but in many instances a weight penalty may be associated with the beefier construction. Personally I wouldn't even try it with a geared system since generally the minimal amount of tooth contact only invites catastrophic failure. The only configuration I would be willing to seriously examine is the silent chain. Capable of high loads and high speeds while operating smoothly and quietly, this product has over the years proven durable and very reliable in applications ranging from agriculture to mining to automotive. An excellent reduction drive should be able to be put together with off the shelf components for a reasonable cost.

The only question then in this case is can the engine's crankshaft withstand the torsional loads transmitted through the chain?

But back to the list of design considerations. Torque and RPM should be self explanatory: Both drive the design of the gears, couplings, bearings and of course the shafts. Careful attention must be paid to areas of shaft diameter changes, key-ways or splines, and snap ring grooves; all being sources of stress concentrations and areas of potential failure.

Environment is most critical to reduction drives that have the components open to the surroundings. Entrance of foreign matter, be it sand or dirt, oil, loose tools, etc. will have eventual effect on the performance and life of the critical components. On the other hand too much enclosure could limit access for inspection or even more importantly, block off cooling air.

Material endurance properties should probably be nearer the top of the list in that this more than anything else will determine the life of the drive. Although in many instances the drive is designed for ultimate loads, its the day-to-day operations that

affect the wear, fatigue, and ultimately, the longevity of the components. The fatigue characteristics of many materials are very sensitive to material condition, the service environment and even finish. A good example is aluminum. A standard endurance limit (stress level the material can withstand for 500,000,000 cycles - also used as infinite life criteria) for smooth 2024-T3 is almost 20,000 psi; for 6061-T6, over 12,000 psi; while for casting alloys the endurance limit is less than 8,500 psi. Effects of snap ring grooves or other stress risers such as surface roughness due to sand casting, can drop the endurance limit by more than 50%. If these conditions are not taken into account when designing the case or other critical components, failure could occur even during mild loading conditions. Our reduction drive case for instance is machined from 6061-T6 billet rather than cast. Yes, it's a bit more expensive but it gives us the highest control over material quality, surface finish and overall strength.

Lubrication seems obvious but a few folks miss the secondary function of the oil: To carry away the excess heat. There is no gear, chain or friction drive that is 100% efficient. A spur gear generally loses 1.5% to 5% per mesh; a chain 2% to 8%; a traction drive 3% to 12%. What this means is that if you input 100 hp into your gear box (assume a single spur reduction for simplicity), on the average you have about three horsepower equivalent of heat generated. Over time this could of course destroy your drive system so therefore the need for oil to lubricate and cool the components. If the hot oil is not taken care of properly it will eventually deteriorate, leave deposits and again damage the components.

In simple systems the heat exchanger can be the housing, transferring heat to the

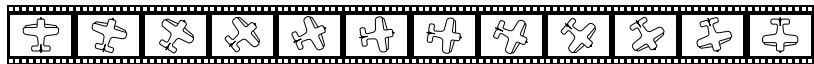
surrounding air in the engine compartment. In more complex systems a pump is used to circulate the oil not only through the gearbox but also to an external heat exchanger. If you're using engine oil for the drive, you must remember to increase the size of the oil cooler to account for the additional energy.

As far as the engine is concerned, usually you have made the selection before choosing the gear drive, so you must make sure that the reduction components can withstand the environment which the engine will generate. If the reduction drive and its coupling is designed for an eight cylinder engine but you put it on a four or six (or vice-versa), you will have to make sure that the operating conditions match the components so you don't run into the aforementioned vibration problems, cooling complications, etc. Even more critical is the application of Wankel engines as they produce a different mode of torsional vibration from that generated by conventional piston configurations. The coupling, even one designed for a bigger engine, may not be able to handle the vibration feed-back encountered with the rotary.

And finally, a few general comments about automotive engines in aircraft applications. Many seem to be of the opinion that if an engine lasts over 100,000 miles on the road that it will be a good 2,000 hour engine for an airplane. Well, maybe, but keep in mind that the aircraft application has much more severe load conditions than the engine ever sees in a car. Installed in a car the engine is generally operated at only a fraction of its rated power. Taking a 100 hp powerplant, let's say in a Honda CRX, for most of the 100,000 miles the engine operates on residential roads or on the free-

Continued on Page 8

AIRFrame



Aircraft Portraits

Rob Prior
www.b4.ca/airframe
rv7@b4.ca

3032 Carina Place, Burnaby, BC, V3J 1B5

604/422.8446

Bulletin Board

Last I heard, Norm Helmer is looking for someone to help with his Paradyne project. The Paradyne is a cutting edge new concept in STOL aircraft that shows promise. If you're interested give him a call at 943-7887.

Dan Lawler would like you to send your email addresses to him at: dan.lawler@kvaerner.com

He will create a database so he can send announcements about meeting programs, etc. Currently he has a list of about 20 e-mail addresses, and would like to expand it and keep it up to date.

Want to learn more about aircraft construction? Get involved in the J-5 project! Also, we are looking for help from someone knowledgeable in fabric work. Talk to a member of the executive and they'll put you in contact with the right people.

October 7, SHOAL LAKE, MANITOBA: Shoal Lake Flying Club Thanksgiving Day Fall fly-in breakfast. Tel.: 204-759-2095 or e-mail: deschoon@aol.com.

October 13, BURLINGTON, ONTARIO: COPA Flight 28 Annual Big Brother and Big Sister Airlift. Contact John Stairs at Tel.: 905-844-1007.

October 14, BELLEVILLE, ONTARIO: COPA Flight 53 and the Belleville Flying Club will

be hosting a Transport Canada Owner-maintenance Seminar. Contact Gerrit van Vrouwerff at Tel.: 613- 968-4424 for additional information.

October 24-25, TORONTO, ONTARIO: The Ontario AME Workshop 2001 Contact Cara Tweyman at Tel.: 905-672-5230.

Transport Canada Pilot Currency Training

All Pilots Welcome!

Date: Saturday, October 27

Time: 09:00 - 12:00

Place: Chapter 85 Clubhouse, Delta Heritage Airpark

Topics: Mountain Flying & GPS

Presenter: Jerry Benema - Transport Canada Safety

And, for you woodworking buffs....

Wood Show

The B.C. Woodshows, Cloverdale Rodeo & Exhibition Grounds. 62 Avenue & 176 St., Cloverdale - Show Times: Friday 1-8, Saturday 10-6, Sunday 10-5 October 19-21, 2001

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Website at: <http://www.cryderman.on.ca/woodworkingshows/>

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Minutes Jim Hunter

Minutes of the general Meeting,
4 September, 2001

Call to order: 8:00 pm bb President Tim Nicholas.

Walker/Lawler: that the Minutes of the General meeting of 7 August, 2001 be adopted as printed in the Turn and Bank. Discussion carried.

Committee Reports:

Treasury: Verbal report by Treasurer Don Souter.

Membership: Rob Prior: 140 members of all categories. Members may even renew for the

year 2002.

Buildings: Dan Weinkam: OK.

Library: Tim Baker: Very large bunch of books in good condition donated by David Smith. Thanx for those. Still missing just on of the specialized Lycoming cylinder wrenches.

Newsletter: George Gregory: Going fine. George says running short of material to publish so help him out.

Program: Dan Lawler: Dan asked how many member interested in Recurrency sessions and many were so Dan will set up a session with DOT folk for a Saturday morning at the clubhouse. Will announce the exact date in the Turn and Bank. Sessions are about three hours long, so too long to be part of a regular GM.

RAAC: Rob Prior: Rob will be going to RAAC AGM in Collingwood toward the end of September, so members wishing to bring anything to the agenda, see Rob.

Aircraft: per Terry Wilshire: Turbi generator now fixed. It is re-polarized (apparently, it became de-polarized for some mysterious

reason). Airplane very busy with many hours put on it in August.

From Gaetan on the J-5 project: Thanx Peter Sleeman for the donation of some struts, Covering has started and the squad now working on Mondays and Wednesdays. It is still a very strategic time for someone who wants to learn fabric work to join the mob.

DHAPCOM: Terry Wilshire: Management Comm meeting rescheduled to 20th or 27th (will be posted). Things otherwise prosperous. Wright Flyer Committee to meet on 11th September - Clubhouse 7:00 pm. There is still room for others who are interested in this project

Old Business: none.

New Business: Bruce Prior is Nominations/Election Chairman. See him with any nominations that you might have.

Trudel/Van Dijk: that we adjourn.

Jim Hunter, Secretary.



Left, the F-2b
Below, A 1902
Peugot "Baby"

Shuttleworth

text and photos by David Smith

IF YOU GET TO VISIT THE UK, and have a chance to visit some aviation museums, make sure that the Shuttleworth Collection at Old Warden is on your "MUST SEE" list. It is a remarkable collection of vintage aircraft, cars and motorcycles, including what must be the best collection of Victorian aircraft (pre WWI) anywhere. AND THEY ALL FLY!!

Even better, if you can manage to get to one of their flying days it makes for a wonderful day out. They host at least 3 full day airshows each year, one evening flying display per month during the summer, and the "Flying Proms in the Park" day.

Margaret and I had the good fortune to attend the Old Warden WWI Airshow this past weekend. It was a bit too breezy for the early aircraft like the Boxkite and Depredussin but the WWI aircraft put on a great show. These included an Avro 504, Bristol F-2b, SE5 and a Sopwith Triplane.

Unfortunately the Fokker Triplane was down with mag troubles but the German LVG did a mock battle with the F-2b. The display also included a mock trench warfare re-enactment with the aircraft displaying overhead. The air display continued with some aircraft from between the wars like the Avro Tutor, Arrow Active II, 2 Miles Magisters and a Messenger, a Tiger Moth and a Hawker Hind. The Shuttleworth also has a large collection of vintage civilian and recreational aircraft to display but the emphasis for the day was the military aircraft.

The airshow concluded with displays by the resident Hurricane and Spitfire. No sign of the resident Lysander as it was probably at Biggin Hill for the weekend. There are not many places you get to see formation fly-bys of a Spitfire and a Hawker Hind or a Hurricane and a Gloster Gladiator, but we were treated to both! This was





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followed by a fly-by of all four together, and at close range too! Remember, this all takes place on an airfield not much bigger than Delta Airpark.

In addition to the wonderful flying displays, Old Warden is just a great place to spend a day. It is a grass field located in the midst of beautiful English countryside. Many of the airshow visitors make a picnic of the day with tables and chairs set up on the grass beside the car. Some great picnics they are too, complete with the crystal, the silverware, the best linen and the candlesticks! Many in attendance dressed in 30's and 40's style costumes while period music by the Mainline Swing Band completed the picture.

Between the flying displays you can wander the grounds to see all the static displays of vintage cars, motorcycles, steam engines and, of course, more aircraft. On the same grounds are the Swiss Garden and the School of Falconry for a bit of variety.

All in all, highly recommended!



**Don't forget:
The October Meeting is the Chapter's
Annual General meeting. We will be electing
our new executive. Don't miss out!**

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Classified Ads are free (within reason) to members. Display Ad rates are:

Business Card: \$25 per year

1/4 page: \$10/month \$100/yr

1/2 page \$15/month \$150/yr

1 page: \$25/month \$250/yr

Ads that have been in for more than 6 months are subject to removal if space is required for other stuff. Please contact George the editor if you want it kept in.

FOR SALE:

52" x 34" Shettler's propeller with hub, \$100.

Vic Gabas (604) 853-2778

For Sale: SIROCCO PROJECT

Fuselage, canopy, tail group complete. Air frame control components done except for cable. Main-wheel gear, wheels and brakes done. Tail-spring and wheel included. Panel made, no instruments. Lycoming 0-290 GPU Zero-timed. Will Neubert stainless cross-over exhaust with stainless muffler/shrouds. Bendix PSC5 carb. Bendix mags with non-shielded leads. No starter, starter ring or alternator. Weldtech engine mount. McCauley prop.

Wings: ribs and minor spars done. Spar diaphragms done. Two spar-grade spruce planks. No other wing parts.

\$15,000 firm, complete and not interested in parting-out

Jim Hunter 576-2678

FOR SALE:

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reworked. New leading edge. New ash tip. All Zinc Chromate ready to fabric. Included: 2-18 gal. gas tank, 2 - gas tank cover, landing light, aileron and flap, front and rear struts. Asking \$4000 Canadian.

Roger Gauthier (Kelowna) (250)-763-1529
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Wanted: PA 18 or PA 20/22 Wings. Some damage OK. 946-5881

For Sale: Electronic Tach 2.25" with generator (new) \$125, 6" castoring tailwheel, \$50, Electronic dimmer control, \$25, 2 New 600.6 Goodyear Tires, \$125 for pair, Combo EGT/CHT (needs probes), \$50, Tach Cont.C85-0200, \$35, Temp (OAT) gauge, new, \$35, Windscreen Ant., Van's, new, \$15, 525 battery (new) never had electrolyte, \$75, Fuel Pressure Gauge O/H, \$35, Lycoming Starter 0-290, 0235, 0320, 0360, for \$375.

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FOR SALE: Fleet F7 Biplane replica. Very close to original copy except for uncowed engine. Engine: Kinner R55 160 hp. Aircraft is modified for solo operation from rear cockpit. Extra bellytank with wobble pump. Original Fleet wheels, brakes, pedals and stick column. Original parachute accommodating bucket seats, oversize tires, Stits covering, voice activated intercom. Ted Hendrickson Propeller, manual and extra key magswitch.

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Continued on Page 8

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Pat O'Donnell 533-1839
FOR SALE: Zenith 250 plans and parts, wing rib moulds \$360. Christavia Mk IV project, 4130 steel tube, wing ribs, flaps ailerons, gear legs, wheels and brakes, tail

stab and rudder, \$3600.
Paul Trudel 532-8570
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partially completed Kitfox Model IV-1200. Time too limited to complete myself. Seeking building partner with some experience. Partnership arrangement - terms to be discussed. Call Marty Billinkoff/Days (604) 322-7545 Cell (604) 351-0222 Evenings (604) 946-6475 email: martyb888@aol.com
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Technical Guy

Continued from Page 3

way. For the CRX it only takes on the order of 18 horsepower to maintain 60 mph on a level highway, and about the same or less is used in the city, so for most of its expected life the engine operates at only about 20% of its rated power with only brief excursions to eighty or ninety percent for acceleration or hill climbs.

In an aircraft however, the engine will be expected to operate between seventy and ninety percent of the rated power for its entire life, or almost four times that of a road application. Furthermore, other factors also enter into the equation, the chief of which I talked about earlier, gyroscopic loads. Most automotive engines need to be turning quite fast to generate the higher power levels, that's why we need reduction

drives. As with the prop, couple this crank rotation with a sudden pitching or yawing of the aircraft and you get a gyroscopic moment maybe even an order of magnitude higher than the engine will ever see in a car. This can lead to early bearing wear, fatigue cracking of bearing supports, or even catastrophic crankshaft failure.

Careful selection must be made of the engine and its associated components before installation into an aircraft can be made safely and successfully enough to give the same perception as Lycomings or Continentals do today. Some serious engineering and testing will need to be done, especially on the smaller, lighter automotive engines (Honda, Subaru, etc.), to determine their ultimate suitability for flight application. This is not to imply that automotive engines cannot or should not be modified for aircraft use, all I mean to say is that the buyer must

make a careful selection of the engine(s) and reduction drive to his or her airplane and expected flight conditions. Don't take the manufacturers' company line and pretty brochures as gospel; do some digging to see whether enough substantiation has been done to assure the highest level of safety. Have the components been tested under all flight conditions or has the test pilot just hopped around for forty hours or so in mostly level flight with calm air? Have the tests been flown in your airplane or just a slow moving ultralight or light plane?

Ask for the hard data and design assumptions. If you don't have the background, ask someone to represent you. If the company refuses to give this information out, go somewhere else. Remember, your life depends on your choice. 🌱

First of all: it's been said a lot in the last few weeks, and will be said a lot in the future, but I would be remiss if I acknowledge the victims of September 11: our thoughts and prayers are with those left behind. It is particularly galling as aviation enthusiasts that aircraft could be used for such evil.

Thank you to Peter Sleeman for his excellent pictures of the Hughes H-1 replica. What a lovely aircraft! According to the handout he supplied me with, it was started in March of 1998 and has an estimated completion date of 2002 (90% done, 90% to go?) It looks pretty good right now, but I imagine those of you who have built aircraft are profoundly aware of what there is probably



left to be done; connections, fuel systems, who knows what else. At any rate, a worthy project. For further info, go to:

www.wrighttools.com

then click on the racer link.

With Howard Hughes at the controls the original shattered the land plane speed record in September of 1935 at a then astounding 352 mph and covered the dis-

tance from Los Angeles to New York in 7 hours and 28 minutes. It represented the "next step" in aviation evolution. I can't help but wonder if they will be trying a re-enactment of this historical event once the replica is completed.

Thanks to David Smith for his Shuttleworth article and pictures as well. He has also written an excellent article on the Scottish National Aviation Museum which has appeared in the Recreational Flyer and will get into the Turn and Bank soon. Keep up the contributions, everybody; any publication is only as good as the material contributed to it.

Lastly: the October GM is the Chapter's AGM. Have you thought of serving? 🌱