NEWSLETTER

Carb Heat

Hot Air and Flying Rumours

Vol 28 No. 3

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March 1998

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EAA Booksale List:

Next Meeting:
Thursday March 19, 1998 8:00 PM
Aviation Museum (Bush Theatre)

and

Project visits:
Saturday March 21, 1998 11:00 AM
Smith Falls Airport (Hangar 13)

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Hopefully, spring is right around the corner, and we will soon see a return to active flight status of many of our hibernating aircraft. However, as I put the finishing touches on this column, winter has returned with a vengeance. Oh well, c'est la vie en Ottawa.

Soggy Spring Field Maintenance

I would like to remind members to please keep off the apron areas and avoid the back road for the next couple of months until the ground firms up. Until the frost is out of the ground, I would encourage members to park in First Air's lot, and walk across to the chapter. If you must drive in to unload something, drive very carefully through the gate by KFC, and park on our paved apron. Please ensure you lock the gate after you.

Also a reminder to always shut off the heat in the workshop whenever it is not required. Our electrical costs are up substantially because of our lack of attention to this small detail.

Young Eagles Coordinator

As you may recall, Lars Eif has stepped down as our Young Eagles coordinator after several years sterling service. I am extremely happy to inform you that **Russ Robinson** has volunteered to fill this vital position. I am sure you will give Russ your full support as you have Lars, and we will continue to have successful, safe, and enjoyable Young Eagles events.

Annual EAA Book Sale

The annual EAA book and video sale is on once more. This is an excellent opportunity to order those invaluable Tony Bingelis books, at savings of 40% or more. Order forms are included in the newsletter, and must be pre-paid to **George Elliott** by April 17th.

February highlights

The February meeting was very well attended, with Maurice Simoneau from Transport Canada giving us a fine overview of the upcoming owner maintenance category.

However, if you are a Cessna 150 through 172 owner, you are probably disappointed to see your aircraft missing from the initial list. Most aircraft on the list are tube and fabric, with some of the older aluminum aircraft or definitely discontinued models such as the Grumman AA5s, Cessna 120/140 and even the Beech Musketeers included.

Hanger 13 Visit

I have arranged a special visit to Hanger 13 at **Smiths Falls** airport for **Saturday March 21st, 11:00 AM.** This is a return to a popular feature of winter meetings of visiting our member's own projects.

In this case we have a triple feature, starting with **Stan Ironstone's Glasair III**, which should fly this year. This is a real rocket, and first class workmanship throughout.

Hiding in hanger 14 is another beauty crafted by **Bob Crookes**. His classic **Hatz biplane** is also well along, and reflects the attention to detail you would expect from a dentist. For the nostalgic aviator in each of us, this is sure to be a winner.

Finally, a special visit to a full scale **Supermarine Spitfire** project under construction just a couple of hangers down.

The simplest way to reach Smiths Falls airport, if you are not fortunate enough to fly, is to take 416 South to Century Road, then west, through North Gower, carrying on a few kilometers past Dwyer Hill Road. The airport is on your left after a sweeping jog in the road.

Why not head down early, and enjoy breakfast at the airport restaurant; great food, prices, and ambiance.

We will be passing a sign up list around at the next meeting to get a rough attendance sizing.

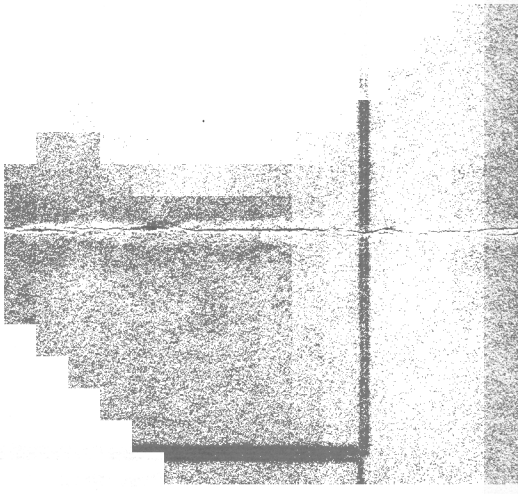
Mar. 19th Mtg. at NAM:

Our next meeting will feature **Major Claude Roy**. Many of you will remember Major Roy's adventures flying to James Bay in a Challenger ultralight, that he shared with us a couple of years ago.

This time, Major Roy will share his adventures as a **Jet Hitch Hiker**, during his two-year stint as Base Controller at Bagotville PQ, 1995 to 1997. Share an insider's view of the F-18's operating from Bagotville, and the view from the cockpit. Major Roy will also share a short 12-minute video on the role of the Canadian Air Force in today's world.

I look forward to seeing you Thursday March 19th at the **National Aviation Museum**, 8:00 PM start.

Gary



Deepest Sympathies

from EAA Chapter 245

We were sorry to hear of the passing of Isabel Peppler, Publisher of the well known textbook "From the Ground Up" and also a former executive of the 99s Women's Pilot association and wife of longtime EAA member Bill Peppler. Our deepest sympathies go out to Bill and his family.

Membership Renewals

by Barney de Schneider

Anyone who hasn't paid their 1998 dues has a label telling them so on the front of their newsletter. Renewals can be sent to our postal address or brought to the next meeting. Newsletters will not be sent out in April to members who haven't renewed.

We're on the Internet!

by Barney de Schneider

Chapter 245 has an increased presence on the Internet, thanks to thework of Carla de Schneider. Check it out at:

http://www3.sympatico.ca/bdeschneider

When you visit the site, you will notice that we have a section on "Aircraft our Members are Building/Restoring". This section will only flourish if you provide information on your aircraft! Pass a picture and a short narrative to me, Barney de Schneider, at an upcoming meeting, or mail the information, to my attention, to our post box and very soon you will be on the web. Take a look at George Elliottís information if you need some ideas. By the way, you will receive your picture back as soon as we scan it. Carla prefers prints rather than electronic images as she has more flexibility in creating the file.

You will also notice that information on upcoming events is included on the our site. For instance, you can already check on the dates for the Fly-In Breakfast, and I am sure that very soon Russ Robinson will be asking me to post information about Young Eagles activities.

As I mentioned at the last meeting, the newsletter is now available online - usually about five days before you get a paper copy. For anyone who wishes to be advised when the newsletter is online, drop an e-mail to me (bdeschneider@sympatico.ca) and you will receive an e-mail each time the newsletter is posted. If you find the paper copy redundant, tell me. Charles Gregoire wouldnít mind printing, folding, stuffing and mailing a few less envelopes each month!

If you have any suggestions for improvements or changes, contact Carla or Barney de Schneider - our e-mail addresses are on the site. Enjoy.

Plane Surfin'

by Curtis Hillier

This month I have visited some of the tool suppliers and materials sites.

www.dalewilch.com - here you can find info on the popular "tube notcher". This site also offers a lot of info on Hot Rod parts and accessories. The tubing notcher no doubt got it's start as a race car frame tool. I automatically centers the tube so any size tubing will work. There is also an optional drill press option which holds the work solid. Base price is $164.00 and a set of hole saws will run an additional $45 or so. The best way to go is to buy a bunch of just the size you need from a local shop. The hot rod section is as the name implies, a link to several "for sale" and "wanted to buy" sites.

www.aircraft-tool.com - very nice tools (Dick) and look brakes, air riviters, and tools, Oh my! I think we had better keep Dick away from these sites. These guys have many of the tools we would love to have laying around the club for those "Darn if I just had a...." days. They have a whats new section and some links to some very interesting and some comical topics such as the Dilbert comic strip and of course "landings.com" If you want to snoop around this is a nice place to start looking, they have a quite nice search engine for those hard to describe tools - you know the thing a ma jigs etc..

www.polyfiber.com - lots of great advice and information on Stits, classic, Polyepoxy, AlphaPoxy, SuperFil and Flight Gloss Composite finishing. You can get info on samples availability, where to buy Poly-fiber products, a question and answer section as well as workshop locations and scheduling. They have a utility for you to ask questions and give comments. This will take some time to go through it all but appears to metal flyer to be complete for those who like to "fly the cloth".

www.metalcrafttools.com - Could not find this site, I checked the spelling and case but could not find it. I tried a few variations of the name but will end up sending them an E-Mail to find out what their real web address is. Otherwise their server must have been down when I tried.

www.cleavelandtool.com - I had trouble getting on this site periodically but did connect once and found their tools, brakes, and other offerings worth the visit. I plan to go back and look around more thoroughly.

www.wagaero.com - they list their E-Mail address but not their web page. It is just "www" in front of their E-Mail. This is a minimal site with a few links to key tasks like ordering their free catalog or kit airplane brochure (covers the J3 kit). Their features section gived details on

GPS units, batteries, headsets and the like. They also have sections on Engine mounts, seat belts, wiring and magnetos.

www.ustool.com - Bucking bars, Compression riviters, metal forming machines, cold riviters, etc... Oh my gosh Dick, they even have montly specials! Say does anybody know where I can get a zillion clecos for free? These guys want 31 cents US for the TP75 if you buy 80 of them. Sheet metal shrinkers and strechers for 115US each.

I also visited a newly listed helo site www.babybelle.com The Canadian helicopter which looks very reasonably priced for a helicopter. Lots of information and pricing.

Well, once again, I have used up my space... If there is some info any member needs and does not have access to the web, I can do some surfing for you time permitted. See Ya!

Piston Element of NASA GAP Program

by Gregory Travis

A version of this article appeared in the March 1997 issue of aviation consumer. This article was obtained off Greg's primemover web site www.prime-mover.org/engines/

Does General Aviation need new piston engines? Will an investment in new engine technology pay off by reducing acquisition and operating costs? Can reductions in engine costs lead a rejuvenation of the market? In the first half of this article I'll take a look at the technical strengths of the current engines and try and dispel some stereotypes. In the second half, I'll talk about some of the significant developments coming down the pike for beginning of the next century.

THEY'RE A LOT LIKE TELEVISIONS

Current certified aircraft engines have a reputation not unlike the television. They're ubiquitous, big ones cost a lot, and a good way to get a lot of heads nodding in agreement is to talk about how terrible they are. But is that reputation entirely deserved? The television, at least, can get PBS. What's the aircraft engine's excuse?

Derisive terms for aircraft engines abound. Two of my favorites are "Lycontinental," to emphasize the apparent similarities between the two major brands, and "Lycosaur" to emphasize the age of their design. Not a night at Oshkosh goes by without a spirited discussion of the "1930s tractor engines" that we fly behind vs. hyper-modern automobile engines. Surely, the thought goes, that if only the evil FAA certification process were eliminated, and if the dark and mysterious cabals between the major engine manufacturers and the airframe makers were exposed, we would all be flying our Mooneys behind five-hundred horsepower engines that weigh 200 pounds, consume six gallons per hour, cost $2,000 to overhaul, and have a TBO of 5,000 hours.

But is that characterization really fair? First, it implicitly assumes that piston engine development has increased linearly with time - i.e. that the engines of 1990 are roughly twice as good as the engines of 1945 which themselves were twice as good as the engines of 1900. However, anyone who follows technology will tell you that improvements generally occur rapidly only when a given technology is in its infancy. Such rapid development periods are then followed by a long period characterized by only incremental improvements.

For example, commercial subsonic jetliners have clearly emerged from the rapid development phase of their existence. Physical laws and market pressures have driven all the manufacturers to consolidate their designs and converge upon a single dominant configuration. Certainly detail refinement will continue and incremental changes will be had in areas such as fuel efficiency, passenger comfort, range, and size but its doubtful that the next forty years will see the same kind of changes that characterized the last forty. Simply compare the variety in shape and engine configuration of aircraft at large airport today with that at the same airport forty years ago.

For piston engines, the plateau of core development occurred shortly after World War Two and it's from precisely this period that today's of aircraft and automobile engines are derived. There is more than coincidence that the 700 horsepower engine which powered Jeff Gordon to victory in the first-ever Brickyard 400 first appeared in the same year as did the common-as-dirt Lycoming O-360.

EVALUATING THE STATE OF THE ART

What is the performance of current aircraft engines when compared against, say, their modern automotive brethren? Reasonable criteria for comparison would be: installed weight, reliability, fuel economy, and cost. It's nearly impossible to make comparisons on a weight basis without speaking of specific installations. However, with some exceptions, attempts at converting auto engines to aircraft inevitably end up with a lower horsepower-to-weight ratio. Examples include Stratus Development's 100HP EA-81 replacement for the 100HP Continental O-200. Both installations will set you back roughly 215 lbs installed. Other examples include Northwest Aero's Chevy V6 of 230 HP and 430lbs vs. the Lycoming O-540-J of 235 HP and 360lbs. Finally, not much is known about the super-secret endeavor to place Toyota's new certified derivative of the Lexus engine in a Piper Malibu other than the installation is "slightly" heavier than the Continental it replaces according to an individual involved in the project.

I won't speculate on reliability here since so many variables are installed, except to say that many auto conversions are, by all accounts, operating safely and

reliably. I know of particularly well engineered installations approaching one thousand hours of trouble-free service. Auto engines in aircraft can be as safe and reliable as certified engines so long as the same cautions are observed regarding component strength and longevity.

Fuel Economy

Fuel specifics (the efficiency of turning fuel into horsepower - see the sidebar on BSFC) is an area in which aircraft engines really come into their own. For example, even our fifties-vintage carbureted aircraft engines return fuel specifics in the 0.43-0.48 range (depending on leaning and RPM) and modern fuel injected Lycoming and Continental engines are delivering BSFCs of 0.39-0.43. Those numbers are for bone-stock, straight from the factory, engines.

Start of BSFC Sidebar

Reciprocating engines are nothing more than energy conversion devices. They convert a fuel (usually gasoline or diesel fuel) into various other forms of energy such as heat, smoke, noise, vibration, and horsepower. What's really interesting is how well, that is how efficiently, a given reciprocating engine converts its fuel to useful work - horsepower. The relative energy conversion efficiency of any two engines can be determined by looking at their BSFC numbers. BSFC stands for Brake Specific Fuel Consumption. It's a measure of how many pounds of fuel an engine consumes per hour per useful horsepower that the engine produces.

To illustrate, let's compute the BSFC of a hypothetical engine: the Travis-300:

Dynamometer tests of the Travis-100 disclose that it is capable of a maximum of 300 horsepower. At a reasonable cruise power setting of 70% of maximum, or 210 HP, we find that the engine requires 17 gallons per hour of gasoline.

Gasoline weighs six pounds per gallon so our engine requires 102 pounds of fuel per hour. By dividing this number by our power output (210HP) we get a BSFC of 0.48 which is pretty middle of the road.

Diesel fuel weighs more than does gasoline per volume but its energy density is approximately the same. That makes it possible to compare the relative efficiencies of gasoline vs. diesel engines simply by comparing their BSFC numbers.

Why are BSFC numbers important to us? Simple economics. For example, over a 2000 hour TBO run, the Travis-300, with a BSFC of 0.48, will burn 34,000 gallons of fuel. If, somehow, we could either improve the Travis-300 or find an alternate engine with a BSFC of 0.38 (13.33 GPH) then we would reduce the fuel used over a TBO run to 26,660 gallons. At an AvGas price of $2.30 per gallon, that's a savings of over $17,000 for fuel. Also note that the same reduction in BSFC allows us to make a four-hour trip in the airplane using 15 gallons less fuel. That's equivalent to a full-fuel payload increase of 90 pounds.

Two caveats: Aircraft engine fuel consumption figures are generally specified in two ways. One is with a so-called "best power" mixture and the other is with a "best economy" mixture. In this article I have consistently used BSFCs obtained with the "best economy" mixture.

Also, be careful when comparing horsepowers between two different engines. Aircraft engines are rated in the old SAE "standard" conditions of 29.92 inches of atmosphere and an ambient temperature of 59 degrees F. Some auto engines (but not all) are rated with the SAE J1349 method which differs in that the standard atmosphere is 29.38 and the ambient temperature is 77 degrees F. The difference between horsepower obtained with the two tests is less than 5% or a BSFC difference of 0.02.

Typical BSFC ranges are as follows. As usual, there will be exceptions, but this should serve as a general guide:

- 0.26-0.34 Large industrial four-stroke diesel engines (very small hp/weight ratios)
- 0.28-0.36 Other four-stroke diesel engines
- 0.32-0.38 Two-stroke diesel engines
- 0.37-0.44 Fuel injected four-stroke gasoline aircraft engines
- 0.40-0.48 Fuel injected four-stroke gasoline automobile engines
- 0.43-0.48 Carburetted four-stroke gasoline aircraft engines
- 0.48-0.60 Carburetted four-stroke automobile engines
- 0.55+ Two stroke gasoline engines
- 0.55-0.70 Four-stroke aircraft engine takeoff fuel flows

Engines don't maintain a fixed BSFC over their entire range. Typically an engine's BSFCs when producing only a fraction of its rated power are quite high. This is due to thermodynamic factors which limit the engine's efficiency when it runs cold. BSFCs typically reach their lowest value for the engine in the 50-80% power range. Then then begin to trend upward again as friction begins to play a dominant role and/or the mixture must be enriched to provide for adequate engine cooling.

End of BSFC Sidebar

And it's not hard to improve these already excellent numbers. Big-bore Continental engines equipped with Continental's tuned intake and with a set of balanced injectors from GAMI (a $750.00 modification) are now running around 0.375. Engines utilizing Unison's LASAR electronic ignition (see below), can expect to increase their BSFC numbers by roughly 8%.

In comparison, according to Ford's David Hunt, Ford's ultra-modern 200 HP Duratec engine achieves a BSFC of only 0.46 at 75% power. Their 235 HP SHO engine, developed by Yamaha, has a BSFC of 0.45 at 75% power. These are the BSFCs of engines which feature

modern amenities such as dual overhead cams, four valves per cylinder, sequential multiport induction and tuned intakes. With all those advances, the Duratec still consumes as much fuel per horsepower as the engine in a 172 at the hands of a student. Why is that?

The importance of design

Current aircraft engines are able to post these kinds of figures because they are purpose-built. They have been optimized for the application and that gives them a tremendous advantage right out of the gate. An example to illustrate the point: ring friction constitutes approximately 70-80% of an engine's internal friction. Reducing internal friction directly improves fuel consumption because more of the power produced by the engine is available at the prop. Keep that in mind as you consider the following: a Lycoming IO-360-A engine, with pistons the size of dinner plates, produces 150 horsepower (75% of rated output) from 360 cubic inches at 2600 RPM. The swept area (the area traversed by the piston rings) in the IO-360 is 221 square inches per cylinder per crankshaft revolution. The entire engine sweeps 38,356 square inches per second at 2600 RPM.

The Ford Duratec produces 150 horsepower (75% of rated output) from 181 cubic inches at 4200 RPM and it has a swept area of 109 square inches per cylinder per crankshaft revolution. Because the Ford engine has more cylinders and because it must push them faster the entire engine sweeps 45,553 square inches per second at 4200 RPM while making the same power as the Lycoming does at 2600 RPM. [Image]

The Ford engine therefore must use more fuel in overcoming internal friction than the Lycoming. Moreover, attaching a propeller to the Ford engine would require a reduction unit to keep propeller speeds reasonable. Typically, reduction units consume 2-5% of an engine's output, further eroding the Ford's fuel economy in aircraft applications.

Ring friction is the dominant, but not the only, source of friction within the engine. Other sources of friction which go up as the ratio of cylinders to horsepower increases include valve train friction (more rockers, *valves, tappets, etc. The Duratec has twice as many valves* per cylinder as does the Lycoming) as well as main and rod bearing friction.

Ironically one of the negatives cited as a weakness of the aircraft engine may actually be a strength. The fit of the aircraft engine's pistons inside their cylinders is notoriously sloppy when compared to modern automobile engines. Because of the auto engine's tight clearances, an oil film is maintained between the piston and the cylinder for the entire diameter of the piston as opposed to the aircraft engine where there is oil only between the piston's thrust face and the cylinder wall. For auto engines, the extra oil film provides no benefit while contributing a significant amount of drag. Auto engines have these tight clearances to keep their operating noise down but this is not a concern in aircraft applications.

Finally, the use of large pistons allows the aircraft engine to develop its full-rated power at the engine's torque peak. This greatly increases the engine's fuel efficiency as the torque peak corresponds to the engine's point of greatest volumetric efficiency which is also the point of lowest specific fuel consumption.

I don't mean to imply that different levels of internal friction are the only reasons why aircraft engines outperform auto engines at high power settings. The former was meant merely as an example of one of the relevant design parameters which differentiate the engines. Certainly others, such as intake design and valve configuration, all can be tailored towards the specific application and help contribute to efficiency.

(...to be continued next month...)

Classifieds

Place your ads by phone with Charles Gregoire @ 828-7493
or e-mail to cbg@nortel.ca
Deadline is first of the month.
Ads will run for three months with a renewal option of two more months.

4" aircraft wheels as used on the BD-5 complete with hydralic calipers and stainless steel disks $100.00
Jim Robinson 613-830-4317 03/98

1400 EDO Floats, No leaks Dual rudders, Complete Aeronca Chief rigging. $12,000 OBO
Tim Robinson 613 824-5044 or
Jim Robinson 613 830-4317 03/98

Tim's Parts Bin

MS24566-4B pulley NEW $8.00ea., Large HF radio (ex Otter), good ham project $25.00, Large Radar Screen (possible coffee table???) $25.00, Beech 18 oil cooler, new (possible rad??) $50.00, 6 Gal. J-3 wing Tanks (2) $200.00, Box of VW engine Parts (possible 1/2 vw project) $50.00, New autopilot , 12 volt trim servos and stuff $25.00, Air Path and Pioneer 3 1/8 compass cores $75.00/ea, Shark Fin pitot tube 24volt, new in box $25.00, Beaver U/L Lotus float rigging (spreader bars, etc.) $25.00, Continental prop. spacer (O.E.M. alum) $50.00
Tim Robinson 613-824-5044 03/98
75714.2136@compuserve.com

Back issues of Sport Aviation for sale. July'84, Apr'86, May'86, Feb'89 to Dec'97 inclusive plus others.
Alex Clanner 613-831-1850 02/98
ace@compmore.net

McCauley Metal Prop, 70-38 for a continental A65 or C85.
Jim Robinson 613-830-1476 01/98

Garry's Parts Bin

Dynafocal engine mount
Wheel pants $100.00
Oil, break-in, 12 litres, Shell, Esso
Wing Tip Nav Lights
NACA air inlets
Elevator trim assembly
Primer
Valves, Fuel selector
Valve, Parking brake
Accelerometer (G-meter) 2.25 inch
Oil cooler - Continental 6cyl.
CHT guage and probe
Lycoming, Accesory case, dual take-off adapter for hydraulic and vacuum pumps.
Piston rings for Continental E-185 or O-470.
Light weight starter & bracket for Lycoming O320 or O360.

Control wheel yoke assembly from Piper Tomahawk

Engine, VW 1600cc completely rebuilt
Garry Fancy (613)-836-2829 01/98

Articles Wanted

I am always interested in receiving submissions for this, your Newsletter. You may bring articles to the monthly meetings or mail information to the post office box or send me an e-mail attachment at:

cbg@nortel.ca 01/98

EAA Chapter 245 Membership Application

NEW:___ RENEWAL:___ DATE:__/__/__
EAA NUMBER:.....
EXP Date:__/__/__
NAME:.....
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OTHER AVIATION AFFILIATIONS:
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Annual Dues: January 1st to December 31st. (porated after March31st for new members/subscribers).
Associate Member ____: $30.00 Newsletter plus Chapter facilities
Full Member: ____: $55.00 Newsletter, hangar, workshop, tiedowns
Newsletter subscriber ____: $30.00 Newsletter
Note Associate and full members must also be members of EAA's parent body in Oshkosh WI, USA

Make cheque payable to:
EAA Chapter 245 (Ottawa)
Mail to - P.O. Box 24149, 300 Eagleson Road, Kanata, Ontario, K2M 2C3

Name:	
Tel #	
Payment in full by cheque to George Elliott required no later than Apr 17 Meeting **Tel: 592-8327**	

Item Qty	Item # Description **Tony Bingelis series: A must have**	Unit $	Total $	Savings
	21-30140 The SportPlane Builder; Tony Bingelis	23.00		45%
	21-01395 SportPlane Construction Techniques; Bingelis	23.00		45%
	21-13950 Firewall Forward; Bingelis	23.00		45%
	Other Homebuilder books			
	21-37864 Aircraft Welding Manual	13.50		42%
	21-18100 Wood/EAA Aircraft Building Techniques	13.50		42%
	21-13510 Custom Built Sport Aircraft Handbook	17.50		40%
	21-30157 GA Airfoils Harry Riblett	19.50		45%
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	21-12989 Golden Age of Air Racing	36.50		37%
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	21-10429 Building Your Own Airplane Get Started	24.00		40%
	21-36687 Build your own plane: Welding	24.00		40%
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	21-36217 Experience the spirit of flight- museum	14.00		46%
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	21-36976 Eagle Hangar showcase	14.00		46%
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	21-14029 Magnificent Desolation Apollo Astronauts	24.00		40%
	21-14019 First Flights in your Homebuilt	12.00		40%
	21-10289 First Flights in your Ultralight	12.00		40%
	21-12054 USAF 50th Anniversary Nellis AFB	14.00		46%
	21-15859 Eagles, A great Run	12.00		40%
	21-98044 Young Eagle Cliff Robertson	24.00		40%
	11-95015 Ultimate Flights Series (12 shows)	137.50		41%
	GRAND TOTAL			