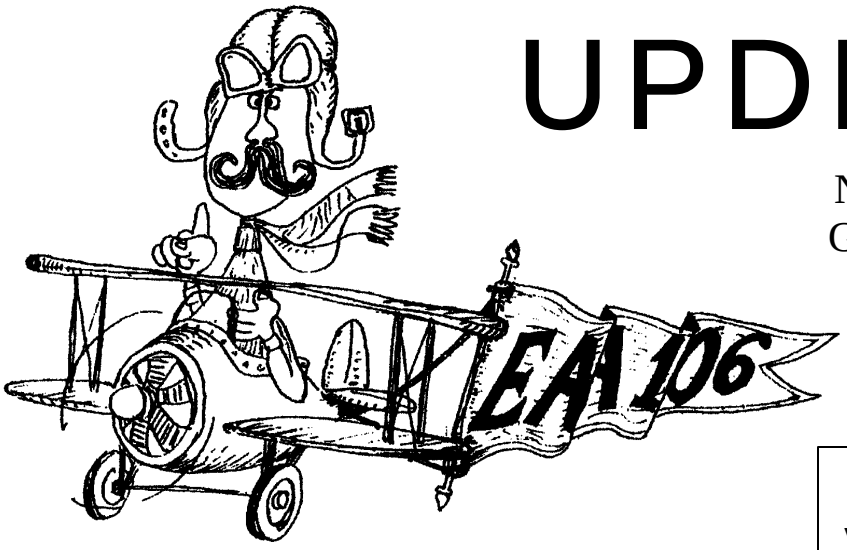


# UPDRAFT

Newsletter of EAA106
Greater Boston Chapter

We Build
Airplanes

**January 2003**
**Volume 31 Issue 1**

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## January Meeting

At the BEDFORD VA HOSPITAL

Bruce Meacham will be talking about his experiences in building/testing an autopilot for his RV-4.

The usual time, 7:30 PM

Early Notice
February Meeting is planned to Combine
the DAWN Patrol and meeting.

We will meet at the Worcester Airport
2nd Saturday in Feb.
This will be about the Electric Airplane conversion of an MCR Layfayette

**DUES ARE DUE THIS JANUARY**
**RIGHT NOW !!!!**
**Mail your dues to Joel Ventura**
**Address on last page**
**$20.00 for the E-Mail NewsLetter**
**$23.00 for the Snail-Mail version**

Roman Rasenas will be providing the victuals for January

Angier Ames, Joe Guarino, and Lee Archambault have been selected for February.

# UNLOCKING THE SKY

## Glenn Hammond Curtiss and the Race to Invent the Airplane

***By Seth Shulman, 2002***

**Publisher: Harper Collins**

**BOOK REVIEW by Mac Knapp**

"Thumbs Up!" to this book for being fun to read, and very enlightening. My conception of Glenn Curtiss had been that he was a reckless, maverick, publicity seeker. After reading this thoroughly researched and well-documented book, I know this view was totally incorrect. His contributions to aviation were enormous, in spite of daunting difficulties.

Glenn H. Curtiss was a shy, Hammondsport, NY bicycle maker with a kind of hands-on talent and perseverance that got mechanical problems solved quickly. He hired skilled workers who worked as a free wheeling team. Curtiss' intelligent, hard working, and supportive wife, Lena, pitched in and did the book work.

When Curtiss built an air- cooled engine and fitted it to a heavy bicycle, he soon became a motorcycle and engine manufacturer. He ran one 136 mph in 1904 to become "the Fastest Man Alive!" (Try this today?)

Initially, Curtiss was skeptical of the possibilities of manned flight, but his light, powerful, engines attracted "Capt." Thomas Baldwin who successfully applied one to his dirigible and became the first public flyer in America. Lincoln Beachey astonished Mrs. Teddy Roosevelt when he landed a Curtiss powered Baldwin dirigible on the White House lawn!

While tracking the life of Curtiss, the narrative provides background summaries of many early attempts at manned flight. Cayley, Lillienthal, Chanute, Langley, Santos-Dumont, Graham-Bell, Wright Brothers, Bleriot, and many others are covered to show the extent of knowledge then existing.

Descriptions, of all people mentioned, are rich in the human feelings that accompanied the suspenseful buildup to the flying contests and business disasters that the Curtiss team surmounted.

After selling an engine to Alexander Graham-Bell for his manned aircraft experiments, Curtiss was asked to deliver it to Dr. Bell's New Brunswick laboratories. There, the worldly Dr. Bell, his brilliant wife, Mabel, and the skilled staff fascinated Curtiss with their broad knowledge, mixed into easy, and humorous, banter.

Soon Dr. Bell organized the AEA, Aerial Experiment Association, and included Curtiss along with Army Lt. Thomas Selfridge, and young engineers Casey Baldwin, and Douglas McCurdy. Mabel sold property for the funding. Bell's *Cygnet* tetrahedron glider Selfridge's *Red Wing* biplane, and Baldwin's *White wing with ailerons* each flew briefly, But Curtiss' June-Bug was a fully controllable biplane. It easily won their first contest. See the following photo.

After this, Curtiss had many adventures in a series of competitions to fund and publicize his engine and aircraft businesses. Rheims, France, Albany to New York, *the successful flying of a replica Langley Aerodrome*, and flying boats, were some of the AEA / Curtiss achievements. Often, they competed with untested new designs, and meager funding.

Throughout, the Wrights harassed them with lawsuits and obstructive money-grubbing attempts. By contrast, Curtiss freely shared some *500 inventions* that are credited to him. Some major ones are Ailerons, Hydro-airplane (now seaplane), tricycle landing gear, aerodynamically balanced rudder, retractable landing gear, pontoons with step and vent, Vee-bottom and multi-engine flying boats, double surface wings, Gyroscopic aircraft stabilizer

(with Elmer Sperry), and hundreds of others that are mostly still in use.

In World War I over 6,000 Curtiss "Jennies" and three *America* seaplanes, were built in Hammondsport!

After Glenn Curtiss' retirement, much to the chagrin of Orville Wright, Curtiss' company absorbed Wright's to become Curtiss-Wright. Orville wanted the Wright name first, but the Curtiss firm was simply larger and more powerful.

After reading this book, though I might miss First Flight 2003 re-creation ceremonies, I will be sure to visit the Curtiss Museum in Hammondsport, NY!

*This book is a winner!* mhk

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SALUTE TO VETERNS ON NOVEMBER 11TH, 2002.

The aircraft in the formation are the T-38 Talon, the supersonic trainer flown by USAF student pilots from the Air Education and Training Command at Randolph AFB, San Antonio, Texas. The building shown is Bldg. 100, best known as the "Taj Mahal", and originally served as the administration building for Randolph Field.

Today, the building serves as the 12th Flying Training Wing headquarters. Secretary of the Interior Gale Norton recently named the base.

The formation was flown on Veterans Day, November 11th, 2002.

# Spark Plug Heat Range, Pre-ignition, and Detonation

This bit of info from our Joel.

*Below is a response I [Joel] made on a forum to a guy that noted a 10 degree cylinder head temperature increase when he switched to colder spark plugs. He therefore planned to switch back to hotter plugs in the summer because they would conduct less heat into the cylinder head and therefore keep his CHTs down.*

Paul:

I was hoping that someone with more expertise would comment on your plan to go to hotter plugs in the summer to reduce the heat transfer to the cylinder head, but since they didn't, I will. My comment is that I believe that is a bad idea.

My understanding is that in selecting the heat range of sparkplugs for an engine there are two extremes one tries to avoid. If the plug tip runs too cold, deposits will form on the central insulator tending to short out the plug as Bruce Vinnola described in his response to your post. Lead deposits can also form and bridge the electrodes (especially in that lead magnet, the O-235). If the plug tip gets too hot, this can lead to pre-ignition, which can lead to detonation, which can lead to engine failure.

Normally as the piston comes up on the compression stroke the temperature of the mixture goes up due to mechanical compression of a gas, but the temperature will not reach the ignition point until the spark plug fires. But if the tip of the plug is running hot enough, then as the piston compresses the mixture and the temperature rises, it will reach the ignition point before the sparkplug fires. So effectively the ignition timing has been advanced, just as if the magneto timing was advanced. But if you advance the timing, the cylinder head and plug are going to get hotter, so on the next cycle pre-ignition is going to happen sooner, which is going to heat things up more, so on the next cycle pre-ignition will happen even sooner…

Eventually the ignition advance and temperatures reach a point where detonation begins to occur. Normally the spark plug ignites the mixture and it burns in a relatively slow controlled fashion as the flame front (or two flame fronts with dual ignition) sweeps through the combustion chamber. This flame front travels in the order of 10's of meters/second depending mainly on temperature, mixture, compression ratio, and manifold pressure. The initial ignition causes a sharp increase in pressure. This pressure wave travels through the combustion chamber at the speed of sound, thousands of times faster than the flame front. Normally this wave will have little effect on the mixture. But when conditions for detonation are present, this pressure wave will cause spontaneous ignition of the mixture to occur in several places in the combustion chamber. This is going to heat things up more and eventually full blown detonation will occur where the mixture will be ignited everywhere along the pressure wave front as it travels through the combustion chamber. The mixture will burn thousands of times faster than in the normal controlled flame front fashion. This will cause very large temperature and pressure spikes that can weaken engine components, like pistons, and then blow holes through them. We hear these pressure spikes as hammering, pinging, or knocking from the engine. At least we hear them in our cars. Our aircraft are so noisy that, unless we have some kind of detonation detector, our first signs of problems may be when pieces start coming out the exhaust pipe and the tach starts down.

Bruce said that his rule of thumb was to run the hottest plug possible without sustaining heat damage to the plug. My preference would be to run the coldest plug possible without running into fouling problems. My reasons are:

1. Fouling is relatively easy to detect. Detonation is much harder to detect until it is too late.
2. The consequences of fouling are usually not too serious, (unless I cut my safety factor to that 50' obstacle on take off too close). The consequences of 30 seconds of full detonation are at least extensive damage to the engine, and possibly the loss of the aircraft and crew as well. I want the largest margin from detonation I can get.

To return to your engine, if you have a higher compression ratio than the standard engine, the temperatures in there are going to be higher, and you may well need a colder sparkplug than normally used. I agree that going to a colder plug will usually transfer more heat to the cylinder head, but I find it extremely hard to believe that the small increase in heat flow by going down one heat range could increase your CHT by 10 degrees, but I have seen no data on that. In any case, in the summer time your CHT, and therefore your sparkplugs will tend to run at higher temperatures. That is when you are most likely to need colder plugs, not hotter ones, to prevent pre-ignition. It is an important goal to keep CHTs down, but it is far more important to avoid pre-ignition and detonation. Go after lowering CHTs by some other means. (Note that there are other possible causes of pre-ignition like a glowing piece of carbon in the combustion chamber. There are also other possible causes of detonation besides advanced timing and pre-ignition, like low octane fuel.)

Engine and spark plug manufacturers put out charts showing color pictures of plugs that have been exposed to various conditions to help you pick the right heat range plug. I have seen pictures of plugs that have been so overheated, that not only have the central insulators blistered, but the electrodes have melted. Plugs that have been exposed to detonation have cracked insulators or even have pieces of the insulator blown away. I hope none of us ever see plugs like that come out of our engines.

Happy Flying!
--Joel

PS: Subsequently, I found out that Paul was measuring his CHT with thermocouples mounted under his sparkplugs rather than with the bayonet type of thermocouple that is designed to be inserted in special locations in the cylinder head to monitor CHT. When he switched to colder plugs, they get colder by passing more of their heat into the cylinder head, and part of that heat had to travel through the plug thermocouple. That had to raise its temperature, and may be the reason Paul saw an indicated 10 degree temperature rise in his CHT when he switched to colder plugs though the actual temperature of the head may not have changed that much. This is probably one reason why many engine manufacturers recommend the bayonet type of CHT monitoring. Lycoming specifically recommends against the use of sparkplug gasket thermocouples.

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Reading an English magazine I subscribe to, I encountered a reference to a STEAM Powered airplane. The Besler Systems of California purchased a Travel Air 2000, registered X4259 replaced the Curtiss OX-5 with a Doble 2 Cylinder, weighing 180 pounds, producing 150 HP at 1625 rpm with a boiler pressure of 1,200 psi. After 30 hrs. of bench testing, and 20 more of installed time, Wm. Besler made the first flight from Oakland Airport on April 12, 1933. The first flight was a circuit of the field with the engine reversed on landing to demonstrate a very short landing run. Besler then took off again and reversed the engine in flight to demonstrate a very steep air-braked decent.

References for further info.

*Jane's All the Worlds Aircraft*, 1934
*Scientific American Magazine* September 1933
*The Development of Piston Engines* Bill Gunston, Patrick Stephens, 1999

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**EAA 106 Hangar (978) 683-8751**

This Newsletter is for communication and enlightenment, but should **not** be relied upon as absolutely correct in content.

EAA Chapter 106 of Greater Boston
c/o William Miller, Editor
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**>> Budget Vote <<**

**As required by our bylaws, the proposed 2003 Hangar budget will be presented for approval at the JANUARY MEETING.**

## DIRECTIONS TO THE BEDFORD VA HOSPITAL MEETING ROOM

From Route 128 aka Rte I 95 take Route 4/225 West towards Bedford. Go approximately 2.2 miles on Rte 4/225, passing the Great Pond Shopping Center (on left) and Marshall's (on right). Turn right onto Hillside Road (gift shop just beyond this turn) and stay on Hillside past merge into Springs Road. Go straight at the four-way stop sign, and about 0.6 miles beyond into the VA Hospital grounds.

Turn **left** at the sign for Parking Lot #2. Proceed past the **Receiving & Warehouse,** past the buildings on the left, around the turn past the **large water tower** on the **LEFT** and enter the parking lot on your left. Park as close to the water tower as you can. Proceed on the side walk towards the long low building that ends at the road. Walk towards the connecting hallway between buildings and enter the door. Take two quick right turns and go down the hall to the classroom.