The NEMES Gazette

NEW ENGLAND MODEL ENGINEERING SOCIETY INC.

No. 251 April 2017

Errol Groff A Great Loss

Errol Groff, founding member of The New England Model Engineering Society passed away on March 17, 2017. Errol will be best remembered for his great devotion to our organization. As webmaster, Errol created a resource second to none covering many aspects of model engineering. Over the years, Errol along with his devoted wife Terri, and traveling companions "Roy Bear" and "Eddie Moose" attended hundreds of antique machinery shows throughout the northeast and midwest. A priceless treasure of some 20 years of The Nemes Gazette as well as literally thousands of pictures have been preserved for us to enjoy. Errol will be greatly missed.

Gazette Staff
Editor Dan Eyring
Publisher Jeff DelPapa

NEMES officers
President Jeff DelPapa
Vice Pres Victor Kozakevich
Secretary Todd Cahill
Director Steve Cushman

NEMES Website
Neme-s.org

Contact Addresses

Dan Eyring, Editor
editor@neme-s.org, 16 Russell Ave.,
Watertown, MA 02472

Richard Baker, Treasurer
treasurer@neme-s.org,
288 Middle St., West Newbury, MA 01985-1610

Jeff DelPapa, Publisher
publisher@neme-s.org,
288 Beal Rd., Waltham, MA 02453

Bob Timmerman, Programs
rwtimmerman@gmail.com,
25 Upton St.,Boston, MA 02118

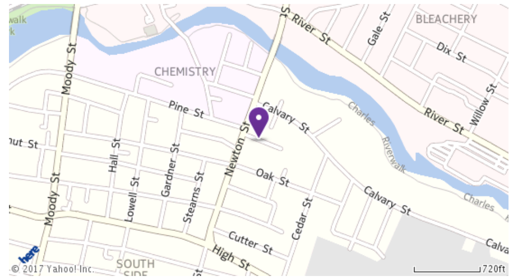
Dues. Dues are $25 by cash, check or you can try out our credit card system. If you can't make the meeting, send the dues to NEMES, c/o Rich Baker, 288 Middle Street, West Newbury, MA **01985-1610.**

NEMES Apparel. We have NEMES denim button down shirts, t-shirts, sweatshirts, and aprons for sale. They make great Christmas gifts. The aprons are $20, the denim shirts $35, sweatshirts $25, and the t-shirts $15. Contact Rich Baker at 978-257-4101 if you would like to own one.

You can also purchase these items on-line at the NEMES Store, located Here.
[https://squareup.com/store/new-england- model-engineering-society]

Next Meeting
Thursday, April 6, 2017, 7 PM
Spencer Organ Company
38A Yetten Terrace
Waltham, Massachusetts

April Speaker
We will tour the Spencer Organ Company in Waltham. They repair pipe organs, tune them, and make some organ pipes. They are located at 38A Yetten Terrace in Waltham, very close to the CRMII. See map below:



Also In April, Jeff Del Papa has reserved a table for NEMES members who wish to exhibit at the MITXMAKE student makerfest at MIT, April 16th. Please look in the Events section below for details

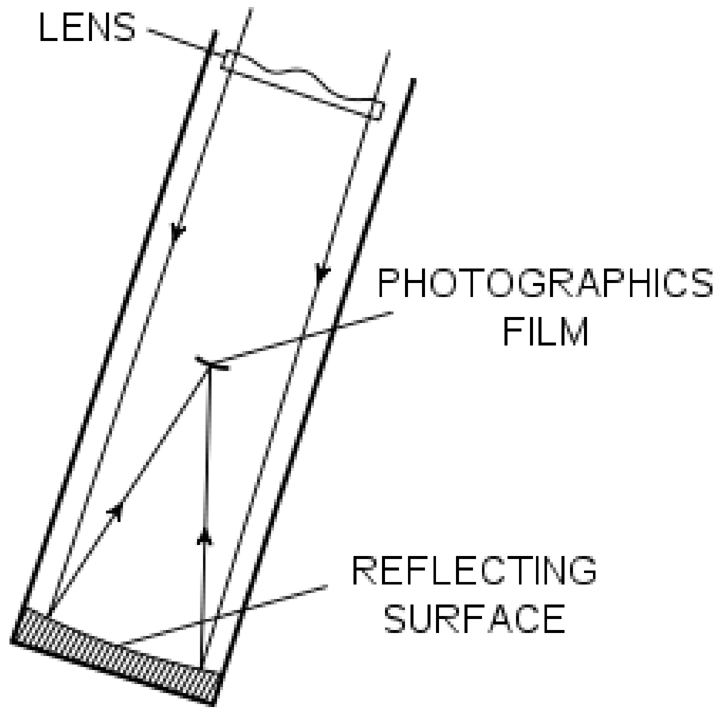
Deadline for submitting articles is two weeks prior to the next meeting.

Contents

Shop Talk

Max ben-Aaron

[Bernhard Woldemar Schmidt](#) (11 April [O.S. 30 March] 1879, a German optician, was born and grew up on the island of [Naissaar](#) ([German](#): *Nargen*), off the coast of [Tallinn](#) (*Reval*), [Estonia](#), then part of the [Russian Empire](#) In 1930 he invented the [Schmidt telescope](#) which corrected for the optical errors of spherical aberration, coma, and astigmatism, making possible for the first time the construction of very large, wide-angled reflective cameras of short exposure time for astronomical research.



***Optical ray paths inside a Schmidt camera*.**

An extremely inquisitive, inventive, and imaginative young person, Bernhard built his own camera from a purchased lens and old concertina bellows and succeeded in photographing his local surroundings and various family members, and even sold some of his photos. He also became fascinated with the night sky and constellations.

Experimenting with gunpowder, at the age of 15, he packed an iron pipe with a charge, but through a mistake with the fuse the pipe exploded, and he lost the thumb and index finger of his right hand, leading to the amputation of the whole hand. Though this tragic misadventure marked him for the rest of his life, he was soon experimenting and inventing again in spite of his loss.

He gradually found his true calling: the grinding and polishing of highly precise optics for astronomical applications. He began making mirrors sometime around 1901, and soon began to sell some of his products to amateur astronomers. By March 1904, he had made so much progress in his new enterprise that, soon after finishing his studies, he was in contact with professionals at the major observatories in Germany. He took impressive photos of the sun, moon, and major planets, using a long focus horizontal mirror and a [plane coelostat](#), both of his own manufacture His business rapidly flourished as astronomers recognized the excellence of his mirrors for their researches. His skill was astonishing, considering that he did most of the fabrication literally using just his left hand.

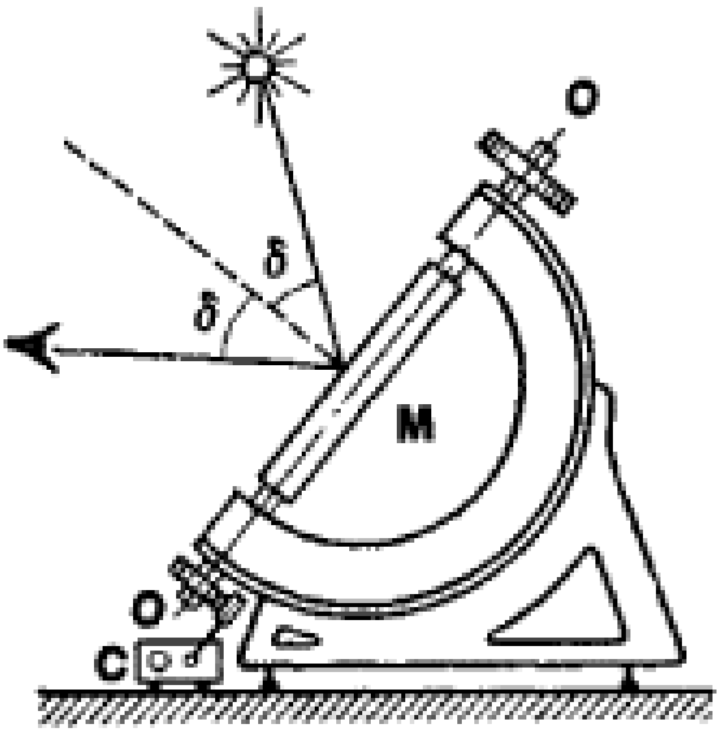


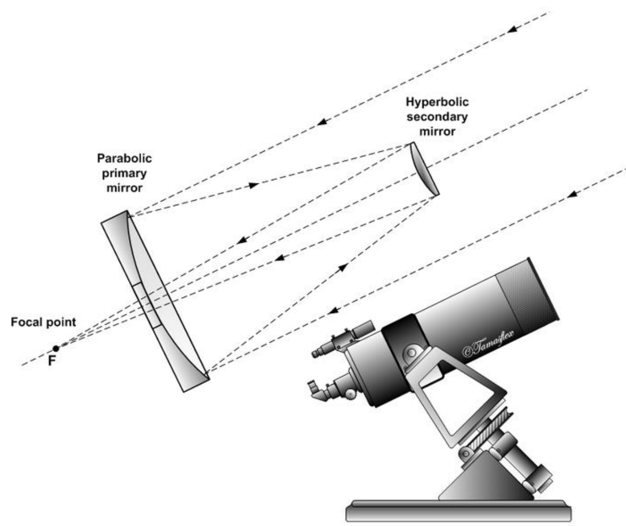
Diagram of a coelostat

Between 1904 and 1914, he acquired an immense reputation in Germany by producing some of the most difficult and precise mirrors ever attempted up to that time. He was entrusted with correcting and improving lenses originally supplied by famous optical houses.

World War I brought his boom to an end. At that time, Estonia was part of the Russian Empire, so he was arrested as an enemy alien and interned for six months. He attempted to continue his business, but the war dragged on and turned to defeat for Germany. Scientists had no money for astronomy, the political turmoil in Germany did not improve the situation, and the need to pay war reparations made inflation gallop out of control. By the mid-1920s, Schmidt's business was ruined and he had to liquidate his remaining equipment as junk.

Astronomers always desire to see further into the universe, so they build larger and larger telescopes to increase light-gathering power. The cost of constructing single-mirror telescopes increases approximately as the cube of the diameter of the aperture. So, in order to enhance light-gathering power, while keeping costs down, it became necessary to explore new, more economical and nontraditional telescope designs.

The first design of the 200" Hale telescope envisaged a Ritchey-Chretien configuration, in which the central region of the primary mirror would be deeper than that of the equivalent paraboloid, and the secondary mirror compensates for the altered depth. This yields a curved, rather than a flat, focus. Hale and Ritchie fell out, and when Ritchie left the project the design of the telescope changed to a 'traditional' Cassegrain with a parabolic primary mirror. The parabolic shape of the primary mirror has a fundamental failing; it produces a narrow field of view, a drawback when observing extended celestial objects.

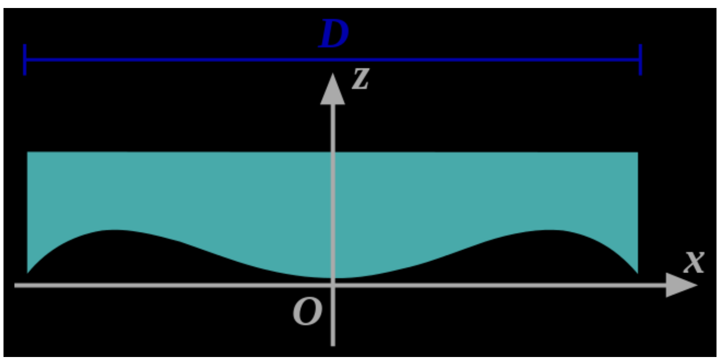


Light path in a Cassegrain reflecting telescope

A large aperture camera with fast focal ratios to decrease exposure times, and wide fields of view with good definition (imaging properties) was needed to complement the big telescope. At that time the only large aperture wide-field telescopes available were ordinary reflecting telescopes of short focal ratio (about f/3) that provided images that quickly lost their definition: they were sharp at the middle of the field of view, but, away from the field center, the images became comet-shaped and bloated, with the head of the 'comet' pointing to the middle of the photographic field. Bloating results mainly from the optical aberrations (i.e. errors) called 'coma' and 'astigmatism'.

Bernhard Schmidt was well aware of these shortcomings, and had been pondering possible solutions during the late 1920s. In 1926 he joined the staff of the Hamburg Observatory in Bergedorf, Germany. Three years later he conceived a new mirror system for telescopes, a novel, bold departure from traditional optical practice. He succeeding in designing a telescope in which distortions were minimized by the combination of a specially figured lens and a spherical mirror placed some distance behind it.

At a stroke, he had eliminated coma and astigmatism, by using a large spherically shaped mirror complemented by a smaller aperture diaphragm placed at the center of curvature of the primary. This resulted in spherical aberration, which is just as damaging to image sharpness! Schmidt's boldness lay in understanding that the spherical aberration could be eliminated by placing a thin, very weakly curved aspheric lens (now called the 'Schmidt corrector plate') at the same center of curvature as the diaphragm. The aspheric lens cancels out the mirror's spherical aberration by creating equal and opposite aberration to the spherical mirror it is paired with, by a complex curve that is convex near its middle and concave near its periphery.



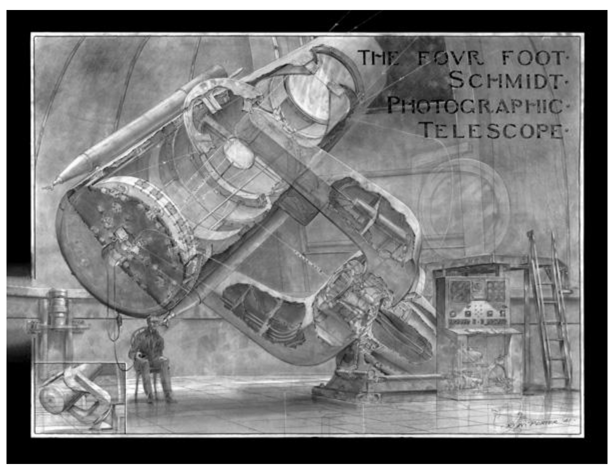
Exaggerated cross section of a Schmidt corrector plate. The real curves are hard to detect visually, giving the corrector plate the appearance of being an optically flat window

In this way, he could, very neatly and simply, construct a large camera of f/1.75, or even faster, that would give sharp images across a field more than 15 degrees in diameter, making it possible to image large swathes of sky with short exposures of a few minutes rather than an hour or more with a conventional reflector.

He invented a very clever method (the so-called 'vacuum pan' method) to make the difficult 'corrector plate', so that the system gave superb images. The vacuum pan carefully warped a parallel glass plate under partial vacuum into a slight sagging curve. The upper surface was then polished flat. After release of the vacuum, the lens would spring back into the 'Schmidt shape' needed for the camera. No one had ever made a lens in this way before.

Schmidt built his first 'Schmidtspiegel', (which came to be known as the Schmidt camera) in 1930. This first camera had an aperture of about 360 mm or 14.5" in diameter, and a focal ratio of f/1.75. His revolutionary design combined diverse optical elements (a special mirror, a diaphragm at a particular location, and a 'correction plate') into a simple catadioptric system. It was as epoch making breakthrough and caused a sensation.

Schmidt never married and had no children. Soon after Schmidt's death, through the advocacy of Walter Baade, who arrived in the US in the early 1930s, the Schmidt telescope idea took off. An 18" Schmidt was produced in 1936 and then twelve years later, the famous 48" (122 cm) Samuel Oschin Schmidt-camera was built for Mount Palomar Observatory. This telescope (a 48-inch-aperture (1.22 m) Schmidt camera consists of a 49.75-inch Schmidt corrector plate and a 72-inch (f/2.5) mirror.



Cutaway drawing of the 48-inch Samuel Oschin Telescope by Russell W. Porter. The 48-inch corrector lens is at the top of the tube. Halfway down the tube is a photographic plateholder—electronic detectors have since replaced plates in this instrument. The 72-inch spherical mirror is at the bottom of the tube. An observer is shown looking through one of the auxiliary 10-inch refracting guidescopes. (Palomar/Caltech/Caltech Archives)

Construction on the Schmidt telescope began in 1939 and it was completed in 1948. The instrument is strictly a camera; there is no provision for any eyepiece. Originally using 10- and 14-inch glass photographic plates, the camera has been converted to use a CCD imager with a mosaic of 12 CCDs covering its whole (4 degree by 4 degree) field of view. Recently, the corrector plate was replaced, using glass that is transparent to a wider range of wavelengths. The camera is now fully automated and remotely-controlled. It has produced a flood of new observations and information proving the brilliance of the Schmidt concept beyond doubt.

Tool Corner

Frank Dorian

This month's focus is on a set of tools for measuring hole diameters. Brown & Sharpe, Lufkin and Starrett made many tools for hole measurement, but I believe Brown & Sharpe's No. 672 Taper Parallel Gage Set was a unique item for this purpose. I would be very interested to know if anyone has seen a similar set by another tool company.

The set consisted of 10 gages made of high grade tool steel, hardened and ground to very close tolerances. Photo 1 shows the set in its fitted mahogany case.

Photo 1

This set will measure any hole size from ¼" to 1". It was intended to be used as an alternative to plug gages. When you consider that it would take 750 plug gages to cover the same range of diameters, it's easy to see how valuable this little set can be in the shop (That's a 6" rule to the left of the case). In addition, plug gages progress in size by .001" increments whereas the Brown & Sharpe gages, being tapers, are, in theory, infinitely adjustable and should be accurate to at least half a thousandth. The set can also be used instead of plug gages to measure distances between holes (as long as the holes are different sizes).

Each gage is tapered in length with one edge being flat and the other edge ground to a specific radius (see Photo 2).

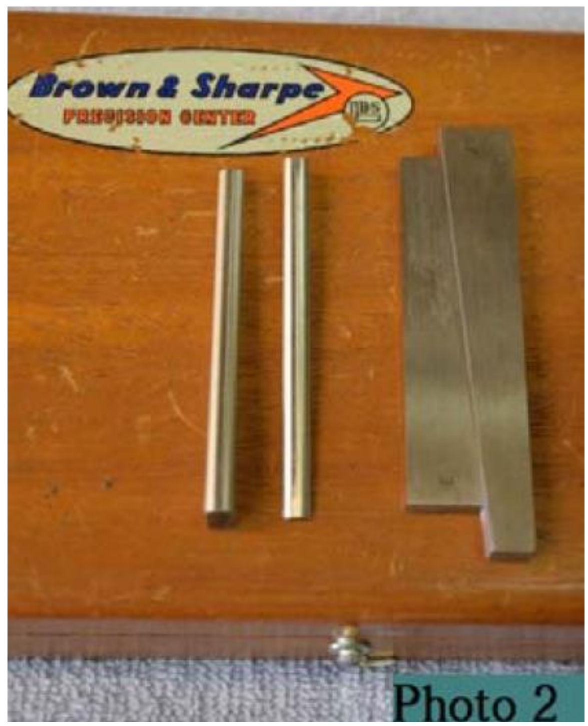


Photo 2

The two smallest gages are on the slender side, so they were spring tempered to prevent damage. Since each gage has the same taper, when the flat sides of two of the gages are put together with their tapers opposed, they create an adjustable parallel whose outer edges are radii that will automatically seek the hole's full diameter as the gages are slid lengthwise in opposite directions. Each gage is stamped with a letter code. A table fastened to the inside of the case lid (Photo 3) gives the gage combinations for each range of hole sizes.

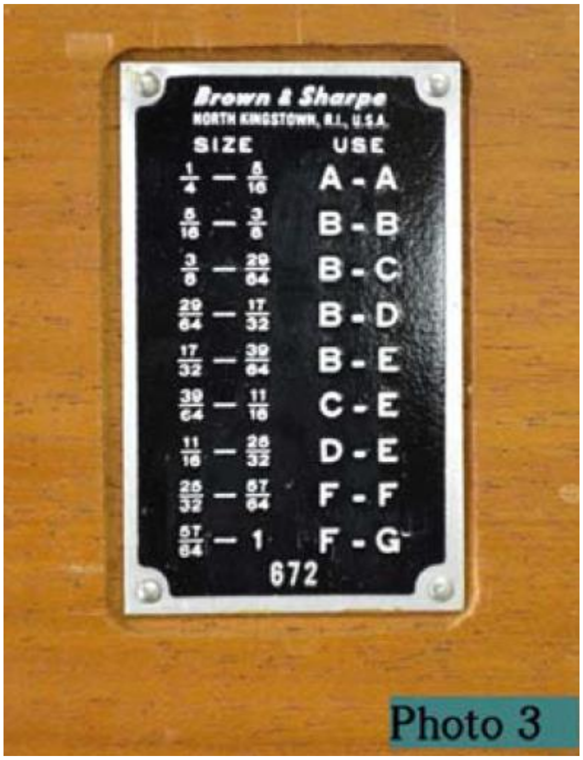


Photo 3

With the gages adjusted to a snug fit in the hole, a micrometer measurement over the pair of gages gives you the hole diameter directly (Photo 4). As an added feature, if your hole happens to be bell-mouthed, the gages will reflect the dimension of the hole's minimum diameter.


Photo 4

Judging solely by my tool-hunting experiences, this set is not common. However, they do turn up from time to time, and when they do, they often go for a fairly modest price because they are unrecognized. The last set I saw on eBay went for less than $50. To give you a sense of the set's value, Brown & Sharpe's 1952 net price list showed a price of $29.75 for No. 672. That is equivalent to $253.68 in 2011 dollars.

A Vertical Shear Bit for Finishing

* John Moran - GadgetBuilder.com *

Last Modified: 21 April 2015

The "vertical shear bit" is an adaptation of a finishing bit used on shapers as described by Moltrecht in "Machine Shop Practice" Vol. 2, ppg 13-15. The idea is to use a cutting edge nearly parallel to the direction of motion so it slices across the work at a narrow angle, a shearing/slicing type cut. It is limited in depth of cut to three thou or so but provides an excellent finish on many difficult materials, e.g. HRS round which can be cantankerous at times. Works well for very small infeeds, into the tenths. For such a simple to grind tool, the results are remarkable.

Grinding is simple because there are only two surfaces. Grind the rebate shown so it goes from top to bottom of the bit along the side at about 15° as shown in the picture. The angle is necessary but can be most anything from 10° to 40° from vertical as long as it is in the correct direction so the bit will cut when advanced from right to left. Larger angles allow faster feed and may not dull as quickly; Moltrecht suggests 25°. After grinding the rebate on the wheel circumference I grind it flat along the top to bottom line by touching the rebate to the side of the wheel - this makes it easier to hone later.

Grind an end relief angle to meet the rebate, 10° has worked well for me but again, it's not critical as long as it is greater than 5°.

If you expect to use the bit for facing then you can grind a gentle curve from top to bottom; if ground straight it will work for normal turning but not for facing. The gentle curve will work for turning and/or facing. When facing, the contact point *must* be below center. I've tried a rounded version for facing but results weren't as dramatic so I use the flat shear tool shown here and face with the tangential. In this picture the rebate is inked to improve contrast.

Hone or stone the edge to a fine finish, preferably polished, on both surfaces. This is easily done by hand if both surfaces are flat.

This lathe bit is unusual in that center height isn't critical - whatever section of the nearly vertical cutting edge contacts the work will slice a thin chip. As one might expect, it works best with fine auto-feed. The swarf is wispy - long, thin, and twisted, unlike any other bit I've used. If the edge dulls just change the height to use a different part of the edge or re-hone when the whole edge is dull. Since the chip slides along in contact with the bit for a fair distance (due to the narrow angle) this promotes heat transfer and wear. It is helpful to run at modest RPM with fine feed plus use cutting lube to minimize wear on the bit.

The same slicing type edge can be adapted for finishing with a boring bar (or a fly cutter) where it will again remove only small amounts of material per pass. The shear bit was discussed on chaski and one of the machinists, BryceGTX, explored it in depth - well worth looking at his pictures and thoughts on the shear bit concept.

Some history: I found info on this tool in a file on the 7x12 group (where I moderate) when it was posted there by Bob Bickerton in December 2005. Bob found it in an article in the July/August 1997 HSM, "Grinding Tool Bits for a Smooth Cut" by Frank Burns who called it a "contrary finishing tool". Frank used the concept from a description of a shaper tool he found in "Advanced Machine Work" from 1925, reproduced by Lindsay Publications. (A similar shaper tool is found in "Machine Shop Practice Vol. 2" by Karl Moltrecht (1981) -- works well on my shaper).

Coming Events

Errol Groff

[Please note that Errol made the effort to update the 'Calendar of Events' on the NEMES website for the entirety of 2017, for which we are all grateful to him]

2 April Nashua Valley Railroad Association Railfair 2017, Show Flyer HERE
1 Hospital Road Ayer-Shirley Regional Middle School Shirley, MA

2 April New England O Scale Show,
99 Park Street, Hudson MA, Show Flyer HERE

8 & 9 April Owls Head Transportation Museum Model Festival
117 Museum Street, Owls Head, Maine 04854
On April 8th and 9th the Owls Head Transportation Museum will be hosting the annual The Midcoast Model Festival. Model builders of all ages and numerous model clubs from around the region will be exhibiting at the show. We would love to invite any members of NEMES to join us. This two-day indoor event attracts a vast array of models of all kinds including trains, aircraft, boats, automobiles and more. Miniaturists also display their impeccably crafted work. Radio controlled model demonstrations, children's activities and more highlight this popular family event. Modelers from throughout Maine and beyond display a mix of kit models as well as handmade creations. This show is a celebration of all types of models, and exhibitors are expected to bring everything from antique model steam engines to cars, planes, ships and trains. Models of all sizes will be accommodated. For more information please contact Toby Stinson at info@ohtm.org 207-594-4418 http://owlshead.org/

16 April MITXMAKE Makerfest @ 9:00 am - 6:00 pm
MIT Zesiger Sports and Fitness Center, 120 Vassar Street, Cambridge, MA 02139 Go HERE for further information:
[http://www.cambridgesciencefestival.org/event/mitxmake/]
MITxMake is MIT's student-led makerfest celebrating maker culture. We connect, educate and entertain attendees with a showcase of innovation, creativity and technology from MIT students, regional makers and tech companies. Join us for a one-day event to check out maker projects from MIT and all over Boston, tour real MIT makerspaces, join an electronics workshop and build a drone, hear from makerspaces from all over the world, and listen to MIT makers discuss their work and the future of creativity. Cost: $15/Adult, $5/Child, $5/with MIT ID. Purchase advance tickets at www.mitxmake.com or drop-in.

22 April Spring Training Model Train Show, 219 Washington Street, Wellesley Hills, MA Show Flyer HERE

22 & 23 April NAMES (North American Model Engineering Society)
Yack Arena, 3131 3rd Street Wyandotte, MI
http://namesexposition.com/

23 April 47th Annual Early Ford V8 Club's Car Show & Swap Meet
Location: Fitchburg Airport, Crawford Street Fitchburg, MA (8AM -1PM)
http://clubs.hemmings.com/earlyfordv8newengland/Fleamarket.htm

30 April 43rd Annual Belltown Gas & Steam Engine Show & Flea Market
New Location. Haddam Neck Fairgrounds, 26 Quarry Rd. Rt. 151 (Moodus Road) north from East Haddam or south from Cobalt to
Haddam Neck Road, follow signs to Quarry Road.
Contact: Peter Christianson, PO Box 211, East Hampton, CT 06424; 860-267-8394
email: **belltowncarclub@gmail.com**
www.belltownantiquecarclub.org

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