



# Fort Wayne ENGINEERS', Club

Engineers' News

March 2024

Vol. 86 No. 6

[www.FortWayneEngineersClub.org](http://www.FortWayneEngineersClub.org)



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Participation in club tours has been on a downward trend. The FWEC cannot sustain facilitating tours without active participation. We encourage any participation by attending tours or volunteering to help plan events surrounding the FWEC. We welcome feedback as well that may help improve the current situation. Send that feedback to [Info@FortWayneEngineersClub.Org](mailto:Info@FortWayneEngineersClub.Org)

Work at a great place? Make an interesting product? Want to share your business with a local group? Host a tour! It's a great opportunity to show your unique workplace! The FWEC board will help facilitate any requirements for attendance, safety gear, advance sign ups or clearances, date planning, newsletter announcements, etc..

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## March Tour



**When:** March 28, 2024 @ 6:00 p.m.

**Where:** 1525 Directors Row, Fort Wayne IN 46808

**Special Requirements:** RSVP & FWEC approval to attend are mandatory due to a strict limit of 20 people. Contact [info@FortWayneEngineersClub.org](mailto:info@FortWayneEngineersClub.org) or (260)456-0809 (both of which are a FWEC member, do not contact Freedom Firearms directly)

**Website:** <https://freedomfortwayne.com/>

**Details:** No firing of guns will occur. This will be a double-feature sit-down presentation introducing pistol designs and introducing the assault rifle (AR) "platform". Locally-owned Freedom Firearms has shown long-term commitment to all levels of civilian education and safety. Our presentation will be condensed versions of two classes and chances to ask more technical questions about almost any topic.

## April Tour Preview



**When:** April 25, 2024 @ 6:30 p.m.

**Where:** The former St. Joe Township Fire Station, 6033 Maplecrest Rd., Fort Wayne, 46835. Enter Door 23, which is behind the building. This former volunteer firehouse is north of the intersection with St. Joe Center Road.

**Special Requirements:** None. All ages welcome (accompanied by a responsible adult if appropriate). Ample space.

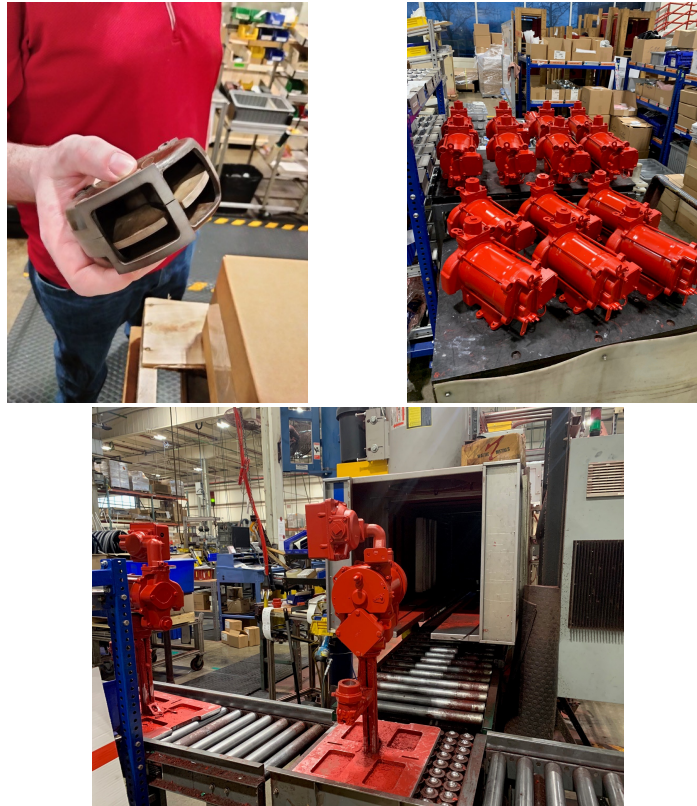
**Details:** This FWEC gathering is specifically arranged with The Fort Wayne Police Department regarding police drones and management of data from drones for crash scene investigation. Crime scenes would be similar. Some info may be shared regarding their variety of drones for crime prevention. (Crash scene data was chosen because FWEC hopes to follow up with a tour regarding what happens inside vehicles during crashes, and because crime techniques are somewhat more proprietary.)

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## January Tour Summary

# **FILL-RITE®**



It is often hard to understand differences between durable satisfying products versus copycats. Sixty years of evolution and details became starkly clear during this tour.

Fill-Rite (and Sotera) are underlying manufacturer brands for a broad range of approaches to transfer pumps, fluid meters, and/or complete systems. Some are designed for and sold under many familiar retail store names or brands. The online Fill-Rite catalog distinguishes between 29 types of fluids variously powered by hand, 12-24 volts, or 115-230 volts providing 5 ranges of flow rates. Our tour observed a number of custom units of various sizes. Products were often color-coded. Seemingly too broad an array of alphabets & numbers reflected compliance with various global regulatory and industrial requirements.

Our hosts routinely discussed engineering details and decades of experience that eliminate weak points or meaningful hazards that exist in look-alikes. Fill-Rite has roughly eleven engineers at this facility, is considering two more, and has five in Lenexa, KS. We observed ongoing development and quality control in just about all basic disciplines including chemical engineering. They use various 3-D printing materials for production as well as R&D, and recently received a significant new unit for engineering purposes. As with our tour of Franklin Electric nearly a decade ago, their initial research 3-D printer probably cost about a half million dollars but paid for itself almost overnight. That original unit could probably be replaced for \$50,000 today.

Engineering labs were one of many highlights, simple looking but complex as experience built over time. A fairly new shaker table can generate up to 50 g's, reflecting in part the severity of real world uses on the tail end of trucks. At least two lab rooms are recessed into the ground to act as containment vessels in event of a fluid release during testing. Safety was appropriate and evident throughout the building.

A major durability and safety aspect of these kinds of products is how uniformly and broadly that adjoining parts mate together. These are aspects in copycats that result in explosion hazards or decade(s) shorter service lives. Fill-Rite has spent half a century steadily improving parts as well

as approaches to machining them, all actively discussed by the engineers hosting us. Some joints could be designed out over time. Much effort went into developing high quality sintered metal parts which, if formed properly, can reduce machining and also potentially improve durability. Parts or surfaces produced in various types and grades of resins have gradually replaced much of it. Vastly better products at reduced cost (relative to inflation) became available over time, while still servicing many of the older types. We were all impressed by all of it. Tolerances between parts and housings also depend on the fluid (primarily viscosity) and efficiency/accuracy needed.

Fill-Rite is a Union shop, part they feel of Fill-Rite's ongoing success. The level of detail, productivity, and sheer volume were noteworthy. Mood seemed good and business-like. Manufacturing occurs in Fort Wayne, IN, and Lenexa, KS. Each facility does as much as reasonably possible in-house but each outsources to local specialty suppliers when advisable.

Supply chain issues, such as inconsistent quality and poor-quality copycats, slowly moved operations evermore in-house or local since over a decade ago. Testing, boxing, and warehousing is done onsite. Either facility can support the other, such as during a prolonged regional power outage in Kansas. Distribution of millions of products and parts is largely worldwide. Special arrangements in Asia are based on what-we-call "experience." (Ed.: I suspect the in-house or local policies allow continuous experimentation and improvement of products, apparent during our tour, and assures ongoing confirmation of tolerances, shaping, and consistent specialty materials in each product.)

Pump systems range from hand units for pails to large stationary or mobile affairs explicitly constructed for various rapid aviation, industrial, municipal, chemical, and trucking/railroading purposes. Clearances between moving parts (inside pumps, meters, and electric motors) may or may not need to be stunningly minimal and consistent throughout, depending on the nature of the fluid(s) and fire/explosion hazards. Warrantees can be a decade but much longer service lives are routine. An interesting set of details included broad extremely-flat surface areas between adjoining parts, and explicit choices of resins and metals internally, to safely contain potential explosions or flammability inside a pump or meter. Normally, by design, the pump or meter would continue to perform. In contrast, some military applications are robust through brutal simplicity.

The variety of and demand for metering devices surprised us. The internal mechanisms reflect more than a century of differing basic concepts. One of the simplest was "wobble-meter" diaphragms (see picture) where fluid moving in a circle across a circular plate causes an axle in a plate to wobble predictably. Another concept, also fascinating to handle, is Fill-Rite's meshed oval gears which are forced to rotate in sync by the moving fluid. A pair move within a precisely matching housing reminiscent of the block for a Wankel motor, but the meter has much less or no blow-by. The chemical nature of the rotating ovals is different depending on the fluids to be measured.

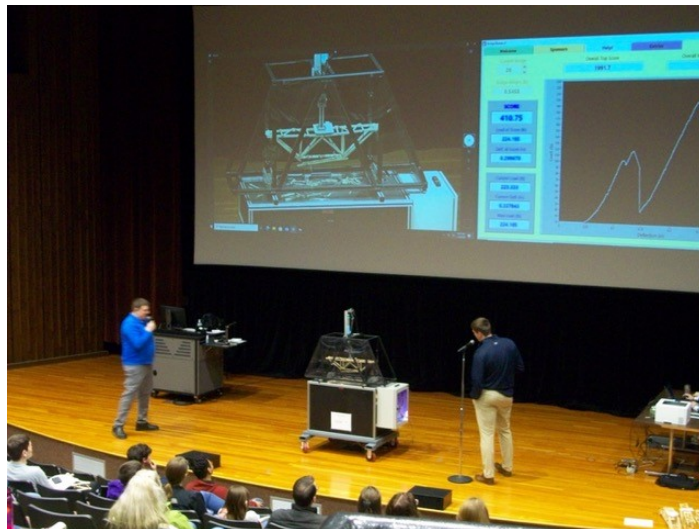
Design concept and required tolerances often depend on service requirements. There may or may not be need to detect slow leaks (such as in municipal water meters) or evaporative losses (such as retail gasoline installations). As with many items in today's world, rotating part(s) may contain embedded rare earth magnets whose movement is monitored electromagnetically, effectively eliminating traditional moving parts. Other units observed were relatively large old-fashioned mechanically-analog ruggedness for military or farm purposes. We observed a variety of circuit boards and it seemed each type had in-house testing and engineering behind it for improved durability, software, and/or type of fluid. A variety of electric motors are ostensibly produced onsite, in part to control consistently tight clearances between rotor and stator to mitigate explosion hazards. Most hoses and some cables are assembled onsite with assured quality control, at reduced cost.

We saw a small consumer-packaged flow meter produced for the end of hoses, but optimized to endure severe beatings every time the hose was retracted into a commercial hose reel - see our tour report for Reelcraft. Electronics survive inside this Fill-Rite meter that allow 20 different settings including choice of fluid. Retail cost is the same as my use of such meters 20-30 years ago but accuracy and durability appear incomparably better now.

Both Fill-Rite location also offer an array of aftermarket parts, remanufacturing, and technical services. All provide clues for product improvement or development. Much more could be said about product line, continuous improvement, management, and building design. We greatly thank our hosts Craig Cavanaugh (25 years at Fill-Rite) and Jack Castleman (recent Purdue Fort

Wayne grad). Our sincere compliments to Fill-Rite and well-liked recent acquirer Gorman-Rupp.

## Bridge Building Contest Summary



The contests were a combination of competition for Grades 6-12 (with returning champions) and rousing all-ages spectator sport. The gist of it all was turning 200 or fewer popsicle sticks into 2-foot spans that often support over a half metric ton (1,100 lb.) at the center. Bridges themselves typically weigh 0.11-0.32 kg (0.25-0.7 lb.) and can only use conventional rigid wood glue, not wire or flexible glues/fasteners. The "bridges" can also be analogous to roof trusses or other structures, revealing load transfers and failure processes to youngsters destined for family building trades. Experienced private and Purdue engineers narrated as events unfolded in a positive family atmosphere. The contest itself is in a comfortable auditorium with huge screen displaying real-time video of a bridge under testing alongside computerized display of changing parameters.

At the high school level of competition (done in the morning), even preschoolers seemed to enjoy it. Older siblings were involved and structures could suddenly send popsicle debris flying with a loud pop or crack. At the middle school level (afternoon), many parents were trades people passing skills on to the next generation, often with technical experience worth overhearing. There was much more variability in design and quality during the middle school competition, but the best middle schoolers performed close to the best high schoolers. As used to be normal in the U.S., many enter family businesses or additional vocational training full-time after Grade 8.

Each structure was awarded points based on gross weight-carrying capacity divided by its empty weight. So, a thousand-pound capacity divided by a one-pound (overweight, not legal) bridge would earn 1,000 points. A half-pound bridge would garner 2,000 points. The highest actual contestant this year scored nearly 1,900 points. Testing ended when the load platform (potential roadbed) deflected downward a half inch, essentially the limit allowed for most real bridges if scaled to size.

Separate recognitions were given for aesthetics by judges evaluating form, cleanliness, and workmanship. Sanding away excess glue or wood would involve care and time, but had obvious visual qualities and could meaningfully reduce empty weight. Popsicle sticks may be laminated together, including offset in various ways to create joints. Sticks may be shortened, cut, notched, or drilled. No cables, wire, or flexible glue are allowed.

Most bridges were truss types, but all entries were entertaining and informative thanks to the narrators and various failure modes. Underslung trestles (support structure under the platform or roadbed) seemed inherently twice as strong compared to the overslung types (such as Fort Wayne's historic Wells Street bridge). There are many reasons. Tension versus compression in the structure is mostly reversed. Also, the load can be applied straight downward from the platform (potential roadbed) onto the trusses, reducing the tendency of the trusses to splay as load increases. Underslung trusses may have shorter vertical components, which are easier and lighter to keep aligned. More efficient or extensive bracing fits between trusses when under the platform, to prevent splay. The audience could observe why some classic Nineteenth Century designs only appear sturdier than later, lighter, concepts.

Whimsically minimal designs seemed appropriate as garden decorations for imaginary fairies, weighed a quarter or third of a pound, and could have supported two adults.

Purdue Fort Wayne hosts a weekend class on design considerations about a month prior to each annual contest. Adults would likely be welcome, but the contests are limited to Grades 6-12. This could be a fascinating hobby, perhaps akin to the comic Addams Family TV shows that played with toy train wrecks. The limitations here are lack of flexible joints or cables. The contest rules preclude most cantilevers. But, this is a clear, level, fun, and instructive playing field for all ages.

Bridge "foundations" for the contest is a deceptively simple looking but expensive machine on wheels. It had to be updated because the popsicle bridges nearly doubled in strength over time. A bridge must span 24 inches between square steel bars. An overhead piston provides downward pressure halfway between the steel bars. The machine also hosts some plexiglass blast shields and a video camera. There is need for an additional camera to view truss splay (donations welcome).

Many people and organizations provide enormous effort for months to make these contests

possible. FWEC contributes some funding. It seems immensely worthwhile, and wonderfully instructive free entertainment to attend.

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## Items of Note

FWEC member Rod Vargo is Chair of the 28 year-old and all-volunteer [Utility Advisory Group](#), which formally advises Fort Wayne City Utilities and often City Council. Your comments are welcome at [rodvargo@comcast.net](mailto:rodvargo@comcast.net)

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## Volunteer Positions within the Club

**Membership and Contact Chair: Open**  
**Northeast Indiana DiscoverE Chair: Open**

### Vice President:

Club Vice President needed! It's time once again to ask club members to fill this vital spot in the club's leadership roster this year. The Vice President is generally in charge of arranging club tours, though this has traditionally been a team effort so it's not really all that much work. You would be expected to attend the monthly officers meeting (from the end of August until the end of May) and at the end of your one-year term, you would automatically become club president. The typical monthly time involved would be roughly 2 hours (including attending the officers meeting). If you enjoy the club and would like to see it continue to function, please consider volunteering for this spot.

Let us know if you're interested!

### Volunteer

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## General Club Info

Fort Wayne Engineers Club dues are \$0. Donations are welcome but strictly voluntary. In recent years, club funds have helped support Discover-E, the Regional Science and Engineering Fair, annual bridge building contests in schools, academic awards, networking events, mentoring, our website, and facilitating free tours.

Please see [FortWayneEngineersClub.org](http://FortWayneEngineersClub.org), [LinkedIn](#), or [Facebook](#) for updates on current Club

activities, other news, and past newsletters.

Those participating in activities or hosting tours through FWEC do so strictly at their own risk, including disease exposures. Participation in club events is voluntary, free, nonprofit, and solely for the benefit of participants and the community at large. Anyone with an interest may participate unless restrictions are specified for specific events, such as minimum age or minimum safety attire.

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## Interested in hosting a tour?

Contact us today!

**Host a Tour**

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## FWEC Roster for FY2023-2024

President: Nathaniel Wisel

Vice President: *Open*

Secretary: Rod Vargo

Treasurer: John Magsam

First-year Board Members: Dave Gordon, Bert Spellman

Second-year Board Member: Ryan Stark, Ed Woodward

Third-year Board Member: Marna Renteria, Mike Magsam

Editor of Engineer News: Nathaniel Wisel

**Membership and Contact Chair: Open**

**Northeast Indiana DiscoverE Chair: Open**

**Vice President: Open for FY2023-2024**

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## Job posting and resumes listed

The club accepts both job openings from around the area, as well as resumes from those seeking employment. Please submit these to the following email address:

[Info@FortWayneEngineersClub.org](mailto:Info@FortWayneEngineersClub.org)

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## Advertise in the Engineers' News

The FWEC provides advertising space within the Engineers' News.  
Advertisements are only \$10 per issue and limited to ½ page of content.

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### Advertise Your Business

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