



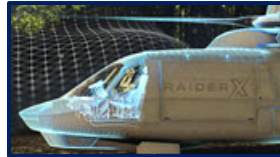
**FEA Not to Miss & More - Eclectic & Innovative**  
**December 2023** ISSN 2694-4707

**Monthly Town Hall Meeting**  
**Engineering, Research, Interests**  
[www.feantm.com](http://www.feantm.com)

**Turkish Aerospace**



**Lockheed Martin**



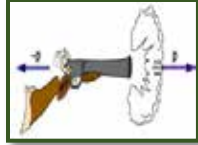
**Convention Barn**



**Ford - Tailgates**



**Abhinav - My Physics Café**



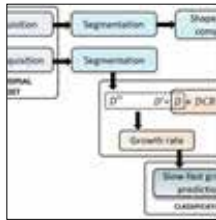
**Seppi/Marta - OASYS**



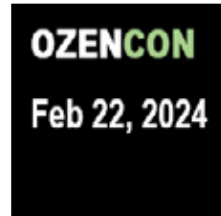
**Jenson - DFE Tech**



**Marco - MeDiTATe**



**Metin - OZEN Engineering**



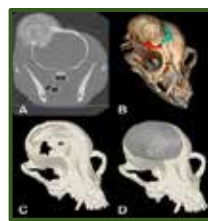
**Markus - CADFEM**



**Old Rancher - Aero Farms**



**Sabyl - Dog Health - SpaceClaim**



**Maysam - Predictive (& TTI)**



FEA not to miss a/k/a (FEANTM) a collective of individuals who exchange information  
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Editors: (alpha order) Anthony, Art, Brett, Marnie, Marsha, Sabyl, Shweta, Taylor

Jr. Editors: Rheannon and Kensington (yes, she likes pink)

Town Pretend to be Editors:

<b>The Old Rancher</b>	<b>No one in town knows his name. You yell "Hey, Old Rancher."</b>
<b>The Old Pilot</b>	<b>No one in town knows his name. You yell "Hey, Old Pilot."</b>
<b>The Old Racer</b>	<b>No one in town knows his name. You yell "Hey, Old Racer."</b>
	<b>They are all brothers - strange family</b>

Contact us at: [feaanswer@aol.com](mailto:feaanswer@aol.com)

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We will always remember



Parking & Coffee is free.

# R & D - Camping - Town Map

Horse Trail

Yield right of way to horses



- **Logos displayed represent companies/academia/research with solutions for today's world.**
- If you wish to have yours removed, kindly inform us at [feaanswer@aol.com](mailto:feaanswer@aol.com).
- Proceeds from the auction of your building will be allocated to the coffee budget.
- The map is subject to change - building sites will be rotated accordingly.



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- The individuals mentioned are the persons we wish to thank.
- The above doesn't imply that they are the author, with a particular company, or department

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# Welcome to our Town Hall Meeting & Announcements

## Town Hall Meeting

Park Cars behind building  
Park Tractors behind cars  
Tie horses to hitching rails

Free coffee & lots of cannoli

The town consists of individuals who are passionate about finding solutions, as well as caring about animals and children.

Town Gossip is at the local coffee shop.

Pets are welcome. Horses, pet goats stay outside.

### Thanks to a tie breaking vote by resident Nishant we ended downsizing.

1. We welcome, Maysam Kiani presenting a great guard rail YouTube video you can't miss:  
"This system is the Thrie beam version of its W-beam counterpart, which is a widely used MASH-compliant guardrail system."
2. The town voted to have the Rancher & his cronies re-build the convention center.  
We said a convention center – they built a convention barn! Yes, that was they built a barn!  
Why are we not surprised? See the new Social Convention Barn
3. Why is the secretary is hanging upside down from the banister wearing a pilot's helmet?  
Someone please explain to her that it will not help her be a test pilot. See Airport.

AND as we end this year we want to thank all of our virtual residents who sent us ideas, URL's and helped us make decisions.

**Who can guess my New Years Resolution for 2024?** Yes, it is the same as last year! I am going to eat healthy and become a mellow, non-alpha, calm person. WHO yelled that I can forget meeting that resolution! FINE! Then it is now changed to I'll think about healthy eating and becoming a mellow, non-alpha, calm person in 2024 – or 2025 – hmmm maybe 2026?!



#### Announcement:

OZENCON: Feb. 22, 2024, The Largest Annual Ansys Simulation Conference in Silicon Valley- FREE to attend, register to reserve your spot.



#### Article:

Guess it will be simulation engineers who build the first matrix ... When I was asked to write a tech-article, the topic was clear to me... AI with simulation



#### Article:

The development of a cost-effective Thrie beam system using readily available standard components.



#### Research Hospital:

Leonardo Geronzi - Assessment of shape-based features ability to predict the ascending aortic aneurysm growth.

**My Physics Café: CAE Analyst and a passionate blogger**

When it comes to firearms, trying to understand the underlying principles can be confusing. Is it just the Momentum or also the Kinetic energy which is responsible for the damage caused by a bullet? Let's dig out the truth ..

**The 'Momentum' mystery -**

Imagine getting struck by 2 fast moving objects having the same momentum. One object weighs 10 Kg & the other one weighs 0.1 Kg.

Which object would cause more damage? Of course! Both would cause equal damage as their momentum is equal.

**This was intuitive. Right? As it turns out, the 0.1 Kg object causes more damage! 😊 Surprised? Let's see how..**

The momentum of a particle is given by  $P = mv$

The Kinetic energy is given by  $KE = \frac{1}{2} mv^2$

If we substitute the equation for momentum above we get,  $KE = (1/2) P^2/m$

Since 'm' is in denominator, the KE is larger for smaller m, with P held constant.

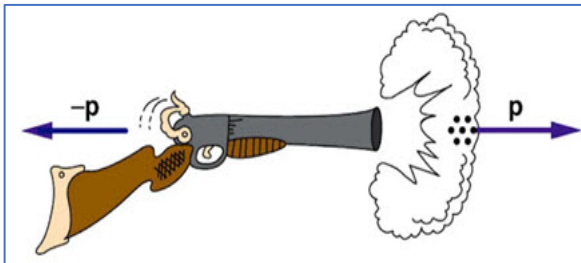
Therefore, the object weighing 0.1 Kg will have a lot more Kinetic energy than the object weighing 10 Kg.

**When a bullet leaves a gun it has same momentum as the gun, due to conservation of momentum. But, the bullet has much more Kinetic energy than the gun!**

**Here are some things you should know about Kinetic Energy and Momentum:**

**Are momentum and Kinetic energy same?** The momentum and kinetic energy are not the same as momentum is a vector (has a direction) and kinetic energy is a scalar (does not have a direction). Momentum also increases linearly with velocity while kinetic energy increases quadratically, so their values are not the same at higher velocities.

**Why is momentum a vector while Kinetic energy scalar?** Kinetic energy is considered a scalar as it describes the total energy associated with motion, meaning that kinetic energy does not have any particular direction in space. Meanwhile, momentum describes motion in a specific direction, meaning that it has a different value in each special direction



**Kinetic energy is typically more useful in problems where the direction of motion doesn't matter, while momentum is more useful when describing motion in different directions.**

**Momentum is more useful if we want to determine which way an object is moving (such as when a force is applied and we want to know which way the object will begin moving).**



**Andrea’s Sales & Marketing Café**

**Sales, Marketing, Technology**

**What customers do you want: happy, satisfied, neutral, angry, ...?**

Today, I’d like to share my experience on customer orientation and customer satisfaction based on how companies today answer the need for customer support service. We have experience with multiple customer support services daily. Be it in business or private life, we are exposed to extensive FAQ sections on websites, hotlines with band announcement to select the required support topic by numbers, pure email support, AI-driven chatbots, direct telephone line with human interaction, ... While some are really good, others are really bad and reasons are manifold.

Let us have a closer look on why we perceive some customer support services positively outstanding and why. We are led by emotions. They are our powerful invisible decision makers. Based on our emotions during an interaction and our satisfaction level afterwards, we form opinions about the company and its services. We also decide about remaining their customer or terminating the contract. Emotions lead the way to business or exit.

We all have the need to controll cost and operate profitable. Digitization is surely one solution. But is it the best solution when it comes to customer satisfaction and does it take into account economic impact for their customers? A company completely digitizing support services cuts it owns cost, but forces people who are not experts in the purchased product or solution to:



- waste their time searching the answer on the company FAQ website
- waste their time in an endless phone queueing line
- accept productivity loss and down time while waiting for an answer, that is required to quickly progress in their doings because they have dependencies
- you know many more

**This, in my eyes, has a negative financial and productivity impact on customers, because it is shifting cost and time effort onto the back of customers.**

What customers do you want: happy, satisfied, neutral, angry, short-term, long-term ...? Gittens Consulting assists you with a holistic Fit-for-Market concept that helps selling and marketing your services and products. The concept comprises of individual services custom-tailored to your company, starting with a unique strategy, planning feasible and aligned activities and choosing the right tools for your sales and marketing automation.

[Gittens Consulting](#)



Andrea Gittens successfully worked in business development of technically innovative products and services of international companies for more than 25 years. Her recipe for success is a strategy-oriented approach, spiced with easy-to-implement solutions and garnished with coordinated measures in sales and marketing for more visibility and steady growth.





**News from Livermore, CA - LLNL website:** On Oct. 30, Lawrence Livermore National Laboratory (LLNL)'s National Ignition Facility (NIF) set a new record for laser energy, firing 2.2 megajoules (MJ) of energy for the first time on an ignition target. This experiment resulted in 3.4 MJ of fusion energy yield, achieving ignition and delivering the second-highest neutron yield ever achieved on NIF.

**EXCERPT**

**[LLNL's National Ignition Facility delivers record laser energy](#)**



When the NIF laser delivered 2.2 MJ of laser energy, it started here in the Master Oscillator Room (MOR). Larry Pelz, Jean-Michel Di Nicola and John Heebner played key roles in this accomplishment along with the other MOR and High-Fidelity Pulse Shaping team members.

Photo by Jason Laurea/LLNL.

“This record laser energy level is an incredible achievement, many years in the making,” said NIF Director Gordon Brunton. “This also marks the fourth time that we have successfully demonstrated fusion ignition on the NIF. This work is foundational for the Lab’s mission, with ignition enabling unprecedented capability to support the National Nuclear Security Administration’s Stockpile Stewardship Program and potentially bringing us closer to a fusion energy future.”

LLNL achieved fusion ignition for the first time on Dec. 5, 2022. The second time came on July 30, 2023, when in a controlled fusion experiment, the NIF laser delivered 2.05 MJ of energy to the target, resulting in 3.88 MJ of fusion energy output, the highest yield achieved to date. On Oct. 8, 2023, the NIF laser achieved fusion ignition for the third time with 1.9 MJ of laser energy resulting in 2.4 MJ of fusion energy yield.



**LLNL has achieved fusion ignition on NIF four times to date.** “We’re on a steep performance curve,” said Jean-Michel Di Nicola, co-program director for the NIF and Photon Science Laser Science and Systems Engineering organization. “Increasing laser energy can give us more margin against issues like imperfections in the fuel capsule

or asymmetry in the fuel hot spot. Higher laser energy can help achieve a more stable implosion, resulting in higher yields.”

That the laser could deliver this much energy was never in doubt. The challenge lay in protecting NIF’s precious optics from debris.

“The laser itself is capable of higher energy without fundamental changes to the laser,” said NIF operations manager Bruno Van Wonterghem. “It’s all about the control of the damage. Too much energy without proper protection, and your optics blow to pieces.” NIF is the only laser system in the world that operates above the damage threshold, a feat made possible in part by the Optics Recycle Loop.



LLNL's Optics Materials Science & Technology (OMST) program is constantly identifying new damage mechanisms and seeking ways to mitigate that damage. Those efforts stepped up in August 2021 after NIF achieved a 1.35 megajoule yield with 1.9 megajoules of laser energy.

"We were so close to ignition," Di Nicola said. "We kept working at it. We cranked up the laser to 2.05 megajoules to deliver more energy to the target and increased precision of the laser delivery. We improved target quality and fine-tuned the experimental design to maximize the impact of these changes. On Dec. 5, 2022, we did it. We achieved fusion ignition for the first time."

**Hardening the optics** - Two significant mitigations completed in June 2023 were critical to delivering 2.2 MJ of laser energy to the target — utilizing fused-silica debris shields on two-thirds of NIF's beamlines and installing metal shielding on 32 lower hemisphere beamlines, which reduced the debris-induced damage rate by a factor of 10 to 100, depending on the beamline. Optics in these lower beamlines receive the most debris from the Target Chamber thanks to gravity.

Other improvements included a new anti-reflective coating, vapor hexamethyldisilazane (HMDS) treatment and increased capacity in the Optics Recycle Loop. A new mitigation, the grey-edge blocker, solves a problem the scientists haven't quite identified yet.

"There is a subset of beams that don't behave as well as the others," Di Nicola said. "We found that if we cast a shadow on one edge of the beamline, essentially reducing the laser energy density, those beamlines perform better. We still don't quite understand the root of the problem but will actively investigate this issue in the future."

For the scientists and engineers who work on NIF — the world's highest-energy laser system — solving mysteries comes with the territory.

"We do careful laser damage studies and model and test the identified mitigations," said Tayyab Suratwala, OMST principal deputy. "However, every time we turn up the laser energy, we've entered unprecedented territory, revealing new damage mechanisms."

More than a hammer - More energy alone is not enough to continue NIF's incredible record of scientific breakthroughs.

"You need to wield that bigger hammer with control and finesse," Di Nicola said. "The laser pulse lasts for mere billionths of a second, so you need exquisite precision to get it just right."

To this end, the team recently finished deployment of the High-Fidelity Pulse Shaping (HiFiPS) system, which enables more precise and accurate pulse shaping. A project many years in the making, HiFiPS enables better power balance and symmetry control in implosions.

In another improvement, the team refurbished the facility's optical fibers to make them more resilient to repeated neutron exposure. These fibers are used to precisely measure the laser pulse delivered to targets. The refurbishment increased the signal strength by 10 to 100 times, allowing researchers to continue to "see" laser performance.

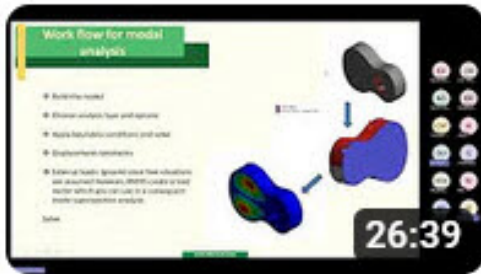
Looking forward - Now that the laser has delivered 2.2 MJ of laser energy, the team is back in the study phase following the same process they undertook after the first experiment that produced fusion ignition.

"We're studying the optics, assessing damage and developing an understanding of how often we can use this new capability," Suratwala said. "At the same time, we're celebrating this significant achievement. This is the culmination of years of hard work by a large team within LLNL and across many external partners."



**DFE-tech: Our ANSYS Mechanical Webinars on our YouTube Channel will assist you with learning with step-by-step instructions:**

The latest webinar is: Ansys Mechanical (Structural Modal Analysis)  
Noor Zulaikha Sumardi



**[Webinar: Ansys Mechanical \(Structural Modal Analysis\)](#)**

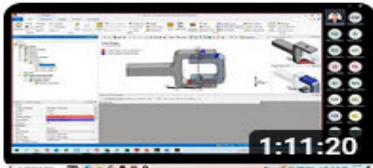
Noor Zulaikha Sumardi

Modal Analysis is widely utilized in engineering and structural analysis to explore the dynamic characteristics of various structures and systems.

**Key Takeaway :**

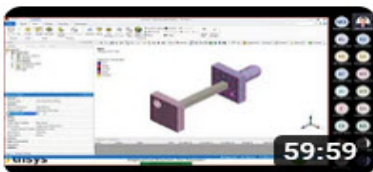
- To learn about fundamental concepts behind Modal Analysis : the nature of frequencies, modal shapes, and damping ratios of a structure.
- To explore about how to apply application : participants might learn how to apply modal analysis to solve real-world engineering problems; setup simulation, choose appropriate boundary conditions, and interpret the results.

**Our Additional webinars**



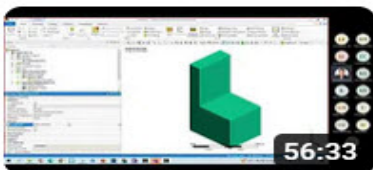
**Webinar: Ansys Mechanical (Getting Started with 3-D Elasticity)**

Dyna Forming Engineering & Technology DFETECH



**Webinar: Ansys Mechanical (Global Mesh Controls)**

Dyna Forming Engineering & Technology DFETECH



**Webiner: Ansys Mechanical (Topology Optimization)**

Dyna Forming Engineering & Technology DFETECH



**Webinar: Ansys Mechanical Webinar (Basic Nonlinear Analysis)**

Dyna Forming Engineering & Technology DFETECH



### CADFEM India YouTube Simulations:

At CADFEM India, we're excited to share how our detailed finite element models within LS DYNA are revolutionizing the crimping and dilation processes of these vital medical devices.

You are invited to visit and learn on our [YouTube Channel](#).

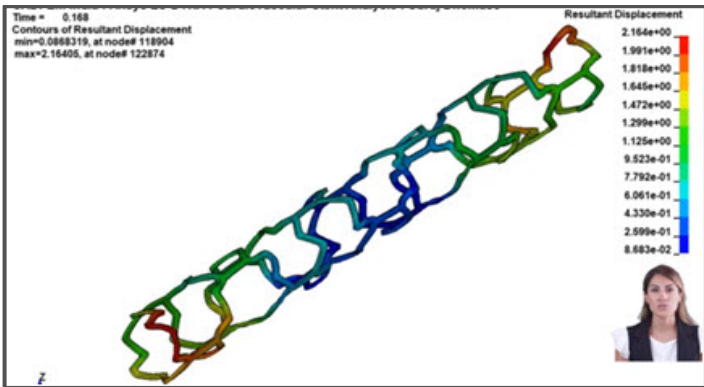
**Problem Statement**

**Analysis of Cardiovascular Stent Crimping and Dilation Using LS-DYNA**

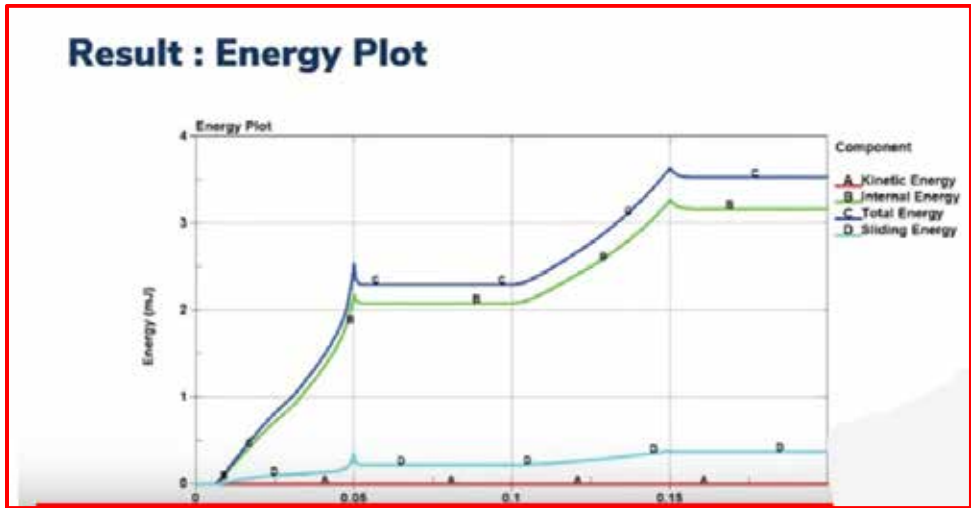
### YouTube - [Analysis of cardiovascular stent and crimping and dilation using LS-DYNA](#)

Cardiovascular stents play a crucial role in treating coronary artery disease, restoring blood flow, and enhancing patient well-being.

For higher graphics and complete explanation please visit our YouTube Video



**Result : Crimping and Dilation Process Simulation**





**CADFEM: Guess it will be simulation engineers who build the first matrix ... When I was asked to write a tech-article, the topic was clear to me... AI with simulation:** The technology of random fields is a great method to train a system with measured field data but also with field data from physics-based simulation models - on a large scale - to generate "intelligent" field models. Whether structural mechanics as in this video, temperature fields, flow fields, electromagnetic fields or other physics, the principle is always the same.

When I first got involved with this - and that was over 10-15 years ago - I didn't yet have a link to the hyped topic of "artificial intelligence", but we are asking ourselves the same questions today as we did back then. How trustworthy is the result of a trained system? Is the path to the answer comprehensible? Is the data I use to train the model safe? Can I continue to train the model at a later stage, etc. I hope you like the article



**Workflows in Ansys – Analogies to Artificial Intelligence**

Let us start with a classification. Similar to AI such as ChatGPT, the quality of the prognosis of a simulation model depends largely on a clean database, which must be trained afterwards. However, we as engineers do not have big data with billions of adjustments.

For us in the worst case, a few 100 variant studies of our design and their calculation of physical behavior form the data basis. In comparison, this is very manageable. In our case, we bend and decide our spoon by means of parameters in all possible directions. This is very simple: it is only a click in the parameter box, and the values can be changed via the parameter set (see picture below).

The database now arises when we use these parameters to create and calculate variants. A look at the resulting values of the max. Deformation is initially difficult to interpret. However, images can already help. Did you know that you can save an additional image for each variant? You can do this with APDL, for example:

```
! COPY VIEW INFORMATION HERE
/SHOW,PNG Æ PLNSOL,U,SUM Æ /SHOW,CLOSE
```

The information of the desired view can be found via the View Manager (see picture below). Create a view and copy the APDL code with the right mouse button away. With the optiSLang Data Send node, you can specify at the end that these images are not deleted.

Or use an "After Post" Python Code Snippet

```
import os
solveDir = solution.WorkingDir
camera = Graphics.Camera
camera.SetSpecificViewOrientation(ViewOrientationType.Bottom)
camera.SetFit()
viewOptsRes = Graphics.ViewOptions.ResultPreference
viewOptsRes.ContourView = MechanicalEnums.Graphics.ContourView.ContourBands
viewOptsRes.ExtraModelDisplay = MechanicalEnums.Graphics.ExtraModelDisplay.UndeformedWireframe
or myResult in solution.GetChildren(DataModelObjectCategory.Result, False):
os.path.join(solveDir,myResult.Name + ".jpg")
myResult.Activate()
Graphics.ExportImage(fpath, GraphicsImageExportFormat.JPG)
```

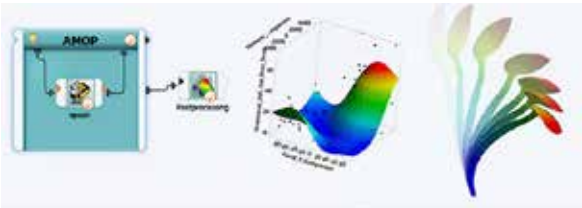


Parameterization in Ansys Mechanical + How to get the APDL Code with the View Manager (CADFEM Germany)

**What is important with a trained data model (DL)?** With this data we can train next - let's call it the deep learning phase - a metamodel, which ultimately predicts all possible maximum deformations.

Is the deformation of the spoon tip greater if I press the spoon to the side or push backwards with the same force? How far does he bend if I still kill him at the same time with a moment? No problem, we are already able to give this answer live and without further simulation – thanks to our metamodel. 3 points are important:

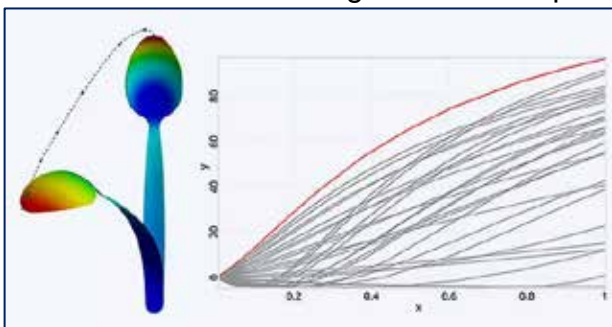
- **Data security:** We want to protect the resulting data. Nothing is to be sent on the Internet and processed there, everything is to be kept in our calculation environment. No one else should know your spoon secret.
- **Predict quality:** How good is my trained model? Does it only deliver a nice result? The so-called Coefficient of Prognosis is available to us to assess the quality, which tells us whether we can already use the model or should still train further.
- **Comprehensibility:** And what logic does AI come to achieve its answer? That is also what concerns us here. The metamodel explains the relationships of the parameters and thus contributes to understanding the interpretation of the results. So: transparency – no black box.



CADFEM Germany: Schematic structure for the production and evaluation of a trained metamodel; presentation of the maximum displacement depending on the applied load and moment; Deformation of the torded and curved bucket)

**Can metamodels for curves be created?** As a viewer of the spoon, I want to see the way next, which, for example, the spoon tip covers. So let's go to the next dimension. Away from the not-so-removing scalar values to the already more interesting signals. For this purpose, the resultfile of each variant is read in and the course of the displacement components of the node is stored in the spoon tip in so-called channels. Signals can be generated from these and a signal metamodel can be trained. Now you can see the way that the top would cover in every situation.

But not only that - we also see those parameters that determine this path significantly. If we know which parameters are responsible for the curve characteristics or for the respective curve section, we can use this information to continue working with these parameters. We ignore the unimportant parameters, save time and can achieve even higher forecast quality with this “pre-filter”.



Deformation path of the curved bucket; Signal display: Various deformation paths of the bucket tip shown in the x-y plane (CADFEM Germany)



Transparency in data analysis creates trust (Adobe Stock)

**How do I train a metamodel for a field?** But was that? No, we do not only want to see the tip of the spoon, but also be able to describe the shift of each individual place of the spoon. So off to the next dimension – from the world of the so-called. Random fields!

For this purpose, we do not train a metamodel or. Signal metamodel for individual nodes, but a field metamodel for our entire structure.

This is then able to describe the complete deformation behaviour of the bucket under all possible force and moment influences – and in real time, also without simulation. Since it appears to be an approximation model, the question of the quality of the deformation fields is inevitably once again. This can be represented directly on the structure in the form of a colour plot in order not to have to trust the whole thing blindly. Because it's like AI again – those who trust you blindly have already lost. Things must always be questioned. We do this time by comparing the standard deviations of the read random fields with the generated random field model.

**What can I use a field meta model for?** And now that the proven high-quality field meta model is available, it can also be used. So ask questions and consider answers. For this to be achieved quickly, there are so-called field inspectors – these are sliders for the input parameters – with the help of which the desired values, i.e. the questions, can be adjusted with the help of which the desired values, i.e. the questions. The answers come live in the form of simulation images.

**And what we did for the spoon can be done with all the fields calculated in Ansy**

Areas of tension - Temperature fields - electromagnetic fields - Flow fields and much more. -

**The advantage is obvious:** Once I trained, I can ask my questions and get the answer immediately. Similar to ChatGPT, this saves an enormous amount of time.



Field inspectors for the quick “position of the question”; Various answers to the questions asked (CADFEM Germany)

**optiSLang for the use of DL or ML in Ansys** - But stop,.. what if the database expands? Do new findings come up with which would make my model smarter?

For this purpose, there is the reevaluate workflow and the technology of the so-called Adaptive Metamodel of optimal prognosis (AMOP for short). On the one hand, you can extract additional, initially seemingly unimportant result sizes from your data sets, and on the other hand, you can further train the meta model. This predictive analytics approach allows thoughts to wander even further - towards integrated live feedback on web pages, system simulations or digital twins. The gate is open.

**Make a decision now:** You can continue as before - or if you want to dive into the deepest depths of the rabbit construction, we have a plan for you: Start with a free entry into this topic. And then take the path via the CADFEM Seminar Flatrate. There you will get everything you need: You will develop the most important knowledge in eLearning for “optiSLang” and deepen it with CADFEM Let’s Simulate series for the “linking of processes” and “Statistics on Structures”. Exactly what you need to do this for your own project! So do not work with tricks of well-known mentalists, but become one with the spoon!

**Continue on the website for: Andreas and Daniel discuss the influence of parameters on a deep-drawn sheet metal in the “Let’s simulate” & Andreas explains a metamodel in eLearning**



### Informative & free presentation on YouTube. SAE Detroit Section about FormulaSAE aero design

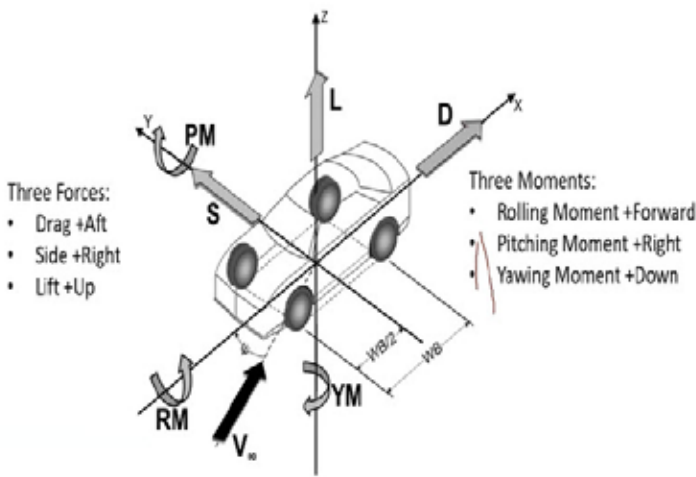
Presented by: **Max Taylor**, Aero Performance Engineer, Stellantis  
Moderated by: **Matt Meyer**, Propulsion Lead Engineer, General Motor

### Overview & a few graphics from the presentation

1. Aero Basics & Performance
2. Aero Development Tools
  - a) CFD
  - b) Wind Tunnel
  - c) Track
  - d) Lap Time Simulation
3. Aero Package Design & Summary

### Formula SAE® – Aerodynamics Design Overview

This presentation will cover the basic principles and strategy of designing an aerodynamics package for Formula SAE. Key concepts include: Aero Tools (CFD, Wind Tunnel, On-road testing), Lap Time Simulation, Aero Package Design and CP Location, and Motorsports Aero History.



- Validate CFD setup. Question results and check often
- Develop a consistent methodology to make decisions based on results
- Build what you model / Model what you build

- Regulations:
  - Read and understand the rules. Check design AND build for rules violations.
  - Most designs in modern motorsports are governed by the rules

- Operating conditions:
  - Min / max speeds
  - Track type / layout

- Is a wind tunnel available?
- Is the model blockage below 5-7% for closed jet tunnels or 10-12% for open jet tunnels?
- Is there a moving ground system?
  - If not, front wing and underbody downforce measurements will be incorrect
- What is the maximum speed of the tunnel? How does that translate to full scale speed if you are testing in reduced scale?
- Fixed ground tunnels are good for drag measurements and rear wing downforce development





**Oasys: LS-DYNA was Vectayn's solver of choice as they recognised that the flexibility it provided for multi-physics analysis would satisfy the range of investigation required.**

[YouTube – View the time lapse installation of Connectum's ClicFloats Floating Solar Panels on Bassin at greenhouse cultivator](#)



### [Game-changing redesign to floating solar panels supports sustainable food production across Northern Europe](#)

The challenge - Connectum, a producer of unique, universal, and circular products were looking to re-design the flotation systems of their ClicFloat solar panels to make them more sustainable, both environmentally and economically. Across Northern Europe large greenhouses supply much of the salad vegetables sold by supermarkets, and while more efficient than traditional growing, they require significant amounts of irrigation.

To provide water storage the greenhouses are typically accompanied by large artificial reservoirs, and one of the most significant costs associated with this irrigation system is pumping the water in and out. Connectum identified that the solution was to float solar panels on the reservoir surface to both provide power for pumping and cover to minimise evaporative losses. After developing an initial prototype, they turned to engineering consultancy Vectayn to progress and validate their designs prior to manufacturing using Computer Aided Engineering (CAE). With the brief that the solar panel arrays had to withstand the various natural elements (wind, wave, snow) and maintenance loads, Vectayn required a CAE suite that was flexible enough for the range of analysis that they needed to conduct, while maintaining an efficient workflow due to the large model sizes and geographical spread of their team.

**The solution - LS-DYNA was Vectayn's solver of choice as they recognised that the flexibility it provided for multi-physics analysis would satisfy the range of investigation required. The Oasys LS-DYNA environment was also selected for its complete compatibility with LS-DYNA keywords, enabling Vectayn to unlock the full potential of the solver.**

**Oasys PRIMER was used as their pre-processor to efficiently prepare and build their models to run through LS-DYNA.** As presented at the 2023 UK Conference, Oasys D3PLOT, was used for analysis visualisation, overall design checking and to simulate joint interactions between parts using the cross-section tools. The fluid-structure interaction between the waves and the solar panels was also modelled using LS-DYNA's Arbitrary Lagrangian-Eulerian (ALE) capabilities and Oasys D3PLOT, allowing Vectayn to determine the stress experienced by the solar panels caused by the force of different waves.

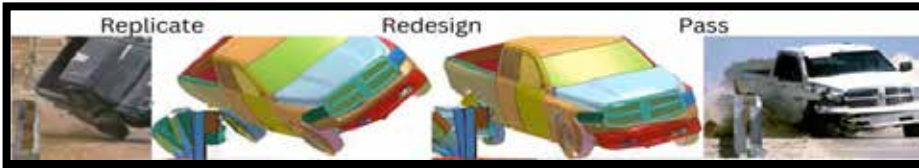
FEMZIP proved to be an instrumental tool in achieving workflow efficiency, allowing the team to compress large files without compromising on quality, achieving a file reduction size of 97% to facilitate the transfer of data across team members.

**The results** - By utilising the Oasys LS-DYNA Environment, Vectayn were able to collaborate globally and successfully conduct their analysis. They significantly refined and enhanced the initial prototype based on their analysis to fulfil all loading requirements and the redesigned ClicFloat solar panels have since been deployed, achieving lower cost installation, reduced running costs for irrigation and direct environmental benefits. **“Vectayn has used LS-Dyna and the Oasys suite for over 30 years. Its flexibility and widespread use make it ideal for consultancy work. The team's ALE method was instrumental in accurately modelling structure and fluid interaction.”** – Dan Page, Director, Vectayn



### Predictive Engineering

A publication authored during my time at the Texas A&M Transportation Institute in Bryan, TX, and by James Danila from the Highway Division of the Massachusetts Department of Transportation in Boston, MA, details the development of a cost-effective Thrie beam system using readily available standard components. This work has been published in the Transportation Research Record: Journal of the Transportation Research Board by the National Academies of Sciences, Engineering, and Medicine.



Using computer simulations, we were able to redesign a previously failed system to make it work effectively.

This system is the Thrie beam version of its W-beam counterpart, which is a widely used MASH-compliant guardrail system.



[YouTube Video](#) - If you're interested in learning more about the project and seeing the results of our research, check out the YouTube video. On the video page you will find the links to the paper published in Transportation Research Record: Journal of the Transportation Research Board as well as the project's final report





### Predictive Engineering

News & Events



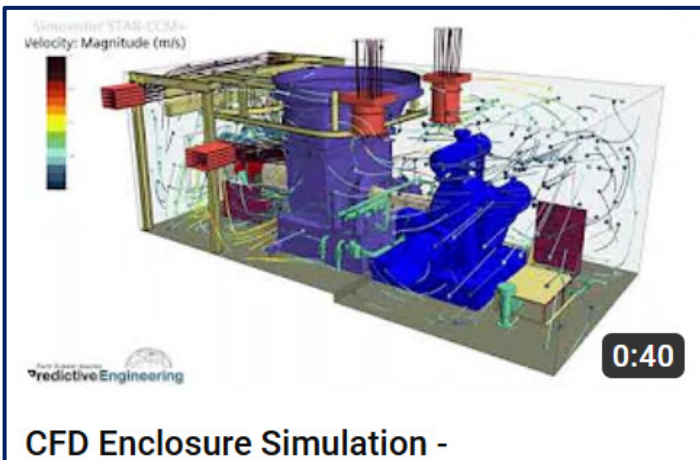
### Visit Us at Booth 427

Predictive Engineering will be attending the TRB conference January 2024.

[Exhibit Hall Information](#)

The 2024 Transportation Research Board (TRB) Annual Meeting is the largest global gathering of transportation professionals and researchers with a focus on innovative solutions for all modes of transportation.

### [Predictive Engineering Videos on the YouTube Channel](#)



CFD Enclosure Simulation - Understanding Air Flow in a Room with CFD - Airflow dynamics within a room or an enclosure can have significant impact on human thermal comfort, production efficiencies, and even safety. By performing an analysis beforehand, designers and engineers can achieve optimal flow conditions and avoid costly rework later. Computational Fluid Dynamics (CFD) is a remarkable tool that offers unparalleled insight, often surpassing the capabilities of traditional testing methods.

This technology empowers engineers and designers to gain a detailed understanding of fluid dynamics within systems, making it an indispensable resource for various industries.

When compared to conventional testing methods, CFD often proves to be superior, particularly in scenarios where assessing flow patterns within an enclosure is crucial. Consider the challenge of evaluating airflow within a room. Traditional methods involve using probes to take local velocity measurements, which can be not only time-consuming but also expensive. Furthermore, such measurements cannot provide a comprehensive view of flow patterns. Alternatively, visualization techniques like smoke tracing could be used, but they offer only qualitative assessments and lack quantitative data.

CFD, on the other hand, revolutionizes this process. It enables us to comprehensively visualize and analyze all aspects of flow within an enclosure. Most importantly, it allows us to identify potential dead spots where stagnant flow could lead to performance issues or even safety hazards. At Predictive Engineering, we have used CFD extensively in numerous projects to assess and optimize flow within critical environments, including public parking garages, data centers, cleanrooms, pumping stations, and electrical cabinets.



**OZEN Engineering:** Mark your calendars; (Feb.22, 2024) we're going to have our next conference during National Engineers Week at the Computer History Museum in Silicon Valley. We have customers presenting on topics like Digital Twins, Optics, Photonics, Fluid Mechanics, Crash Simulations, Signal Integrity...

Dr. Prith Banerjee (Ansys CTO) will be the keynote speaker and giving a talk on Digital Engineering.

**The Largest Annual Ansys Simulation Conference in Silicon Valley is FREE to attend, register early to reserve your spot.**



**OZENCON:** Feb. 22, 2024

This one-day conference will provide detailed insight into how leading companies are utilizing simulation to advance their product development. We will bring together ANSYS users, partners, developers, and industry experts for networking, learning, and sharing of new ideas.

**Venue on Feb 22, 2024**



**Computer History Museum**

1401 N. Shoreline Blvd., Mountain View, CA 94043

From the heart of Silicon Valley, we share insights gleaned from our research, our events, and our incomparable collection of computing artifacts and oral histories to convene, inform, and empower people to build a better world.

CHM mission - CHM decodes technology—its computing past, digital present, and future impact on humanity.

**Sponsors**

**We thank in advance and welcome our Sponsors**



**The website has the complete information**



**d3VIEW:** I would like share a few categories under our High-Performance Computing where you are able to submit, monitor and visualize jobs.

Submit simulations on the HPC using on-premise, full web-based, or hybrid configurations. Process, manage, and explore data in real time, enabling you to quickly extract relevant information from the data.



### **HPC Management - High Performance Computing**

With high performance comes more aptitude to keep the system running smoothly. d3VIEW streamlines the challenges associated with managing and sustaining your HPC system by effectively standardizing and monitoring computational processes, eliminating disruptions. Facilitating the utilization of HPC resources is simplified through our web-based configurations and customizations. With d3VIEW you can seamlessly incorporate any CAE solver with comprehensive support for all solver options.

Our collaboration extends to various cluster management software, ensuring smooth integration with HPC systems.

**HPC configuration is a concern with all jobs.** With d3VIEW you can initiate simulations using on-premise or cloud resources, or utilize on-premise availability for burst processing. You can deploy additional computing power on demand through cloud bursting, with compatibility across a range of cloud service providers

**Simulation submission is made easy.** Our job submission configuration simplifies the process, ensuring simplicity and smoothness. You can save time by submitting multiple simulations simultaneously. Additionally, you can customize your submission based on HPC servers, meta data, compute resources and solver attributes, with the ability to save a particular set-up for later.

D3View gives you the advantage to view intermediate or preview data while a simulation is actively solving through our Mid-Run Simulation Data Extraction. You can extract and re-extract missing or stale responses and transformations.

Through Resource Monitoring you can click on the HPC server status visualization in the job submission window to view a live, interactive summary of usage. Review available cores and nodes, licenses, storage information, applications and partitions.

### **Additionally with full information video and explanations on the website you will find:**

- Simulation Interactions - Abort or Stop your job with a simple click. Examine your simulation visually in real-time as it progresses with a live preview. Customize the live-preview summary using integrated and specialized templates.
- Job Submission Tracking - Use the HPC jobs app to keep track of all you job submissions with a summary and different view options. See a visualized grouped view of your submissions or even explore them in Simlytiks®, d3VIEW's data visualization application.
- HPC Management with Turings Application - Explore an extensive summary and visualization of your servers, how they are being used, which users are using them and much more. Use the moving time frame to examine usage in more detail. Review Cores allocated, Elapsed time (hours), Wait time (hours) and Core Hours for every week.
- Maximize Your HPC Productivity - With the importance of data-driven decisions, expediting these processes derives better business solutions.

**At our monthly town meeting we vote to acknowledge a resident of the town. This page is to bring you a few articles that you may have missed.**



**Metin Ozen - OZEN Engineering – Ozen Engineering**

At Ozen Engineering, Inc., we are experts in simulations of structural, thermal, fluid, electromagnetic fields and Optics and Photonics. As an Ansys elite channel partner, we offer customers best-in-class software tools, consulting, training, mentorship, and technical support.



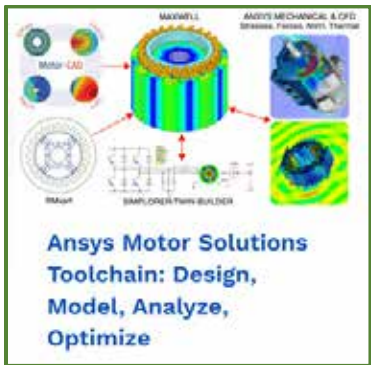
[Turbomachinery retrofit](#) is a valuable strategy for improving efficiency, reducing environmental impact, and extending the lifespan of equipment in various industries. CFturbo's reverse engineering capability enables users to start with an existing solid CAD model or segments of flow domain. This feature becomes essential due to retrofit and/or upgrade/uprate opportunities for aged turbomachinery parts or systems in the after-market business.



[Glass Bottle Packaging Drop Analysis -](#)

Two glass bottles, one with carton packaging, are used to demonstrate the effect of packaging.

- Johnson–Holmquist damage model is used for Glass (MAT\_JOHNSON\_HOLMQUIST\_CERAMICS)
- The isotropic elastic material model is used for carton box packaging.
- Bottles will be dropped from a height of 300 mm.



[ANSYS MOTOR SOLUTIONS TOOLCHAIN:](#)

DESIGN, MODEL, ANALYZE, OPTIMIZE

Ansys offers three motor design simulation tools to collectively provide quick analytical results, advanced FEA analysis, and automate CAD model development with full settings established so you can run the simulation.



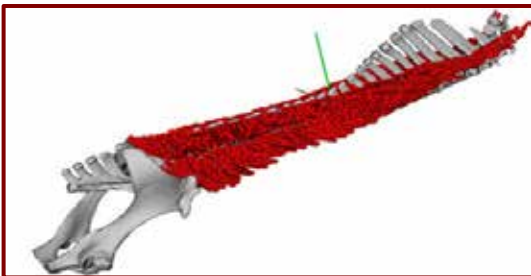
All things we love about horses

**Engineering software & physics are an integral part of all horse activities**



**OpenSim was used. It is a freely available user extensible software system that lets users develop models of musculoskeletal structures and create dynamic simulations of movement... The model was used to simulate muscle activity within OpenSim software.**

**Quote from the publication, "Back pain is a very common problem in horses and very hard to detect. It is often discovered too late by poor performance or gait abnormalities... Due to the variety of possible clinical signs, equine back problems are often challenging to diagnose.... To avoid long-term effects, such as secondary skeletal modifications, early detection of pain and its cause is essential and poses a challenge to horse owners and veterinarians."**



Open Source MDPI - [Muscle Fibre Architecture of Thoracic and Lumbar Longissimus Dorsi Muscle in the Horse](#)

Johanna Dietrich, Stephan Handschuh, Robert Steidl, Alexandra Böhler, Gerhard Forstenpointner, Monika Egerbacher, Christian Peham and Hanna Schöpfer

Figure 10. The model of the longissimus dorsi muscle based on the fibre digitalisation of the study.

**Simple Summary** - As the longissimus dorsi muscle is the largest muscle in the equine back, it has great influence on the stability of the spine and facilitates proper locomotion. In general, muscle function is determined by its specific intramuscular architecture. .... **Three-dimensional coordinates along individual muscle fibre bundles were digitised from the origin to the insertion and 3D models were created using imaging software and computed tomography...**

**This study lays the anatomical basis for a biomechanical model to simulate muscle function.**

**Excerpt – Abstract - As the longissimus dorsi muscle is the largest muscle in the equine back, it has great influence on the stability of the spine and facilitates proper locomotion.** The longissimus muscle provides support to the saddle and rider and thereby influences performance in the horse. Muscular dysfunction has been associated with back disorders and decline of performance. In general, muscle function is determined by its specific intramuscular architecture. However, only limited three-dimensional metrical data are available for the inner organisation of the equine longissimus dorsi muscle. Therefore, we aimed at investigating the inner architecture of the equine longissimus.



**Among the important items when your child wants to learn:**

- Know the horse. The best is those that are “bomb-proof” and comfortable with children. A horse that won’t mind a child learning who makes a few mistakes.
- Start with ground work. They should know how to lead a horse, stop, start.
- Make sure your child understands what might make a horse spook, such as flapping clothing, or sudden loud noises.
- Don’t believe that smaller horses or ponies are better to use. It’s not the size of the horse/pony but it’s the temperament and reliability.



NEWS IN A NUTSHELL  
By Dinky the ranch squirrel



December

Mom yelled at me that she already put out a 2-quart scoop of sunflower seeds. I'm a squirrel - I don't measure quarts - I do squirrel measuring - fill your cheeks measuring. When I can't fit any more sunflower seeds in my mouth then I know it's enough. Easier than trying to measure it like Mom does!

Chester decided to stay very still and keep eating. He was pretending he didn't hear Mom tell us what we call, "WHAT is Mom trying to give advice about?" Mom is babbling something about you don't have to follow the line just because they're in front of you. I tried to explain to her that we're squirrels, we don't walk in a line - those are cattle that is what cows and cattle do! Mom was then going to go talk to them about walking in a line! It's not an easy job for the CERT Squirrel team keeping Mom safe from disasters.



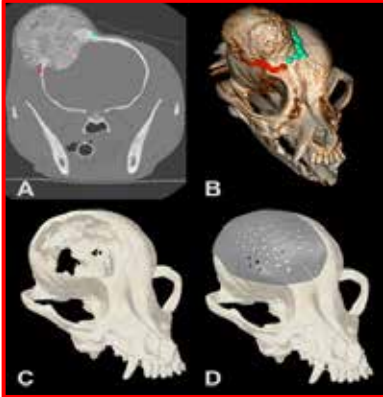
WHAT is with humans and nose booping! Our CERT Squirrel team teaches that noses are for breathing and not nose booping! We need Alan to teach a nose boop disaster course: "Don't Boop, Save A Finger." Geordan nose booped Quincy and last month Mom nose booped me. Do. Not. Nose. BOOP!







**Sabyl – Animal Health** – Excerpt: In the Implant design and fabrication - The x,y,z point data from the .csv file were extracted and converted into a text file which was imported into ANSYS SpaceClaim. Additive manufacturing has allowed for the creation of a patient-specific custom solution that can resolve many of the limitations previously reported for canine cranioplasty.



**Schedule feasibility and workflow for additive manufacturing of titanium plates for cranioplasty in canine skull tumors**

J. James, M.L. Oblak, A.R zur Linden, F.M.K. James, J. Phillips & M. Parkes

**Background** - The purpose of this pilot study was to determine the schedule feasibility and workflow in manufacturing patient-specific titanium implants for canines undergoing cranioplasty immediately following craniectomy.

**Results** - Computed tomography scans from patients with tumors of the skull were considered and 3 cases were selected. Images were imported into a DICOM image processing software and tumor margins were determined based on agreement between a board-certified veterinary radiologist and

veterinary surgical oncologist...In collaboration with a medical solution centre, **a custom titanium plate was designed with the input of an applications engineer and veterinary surgery oncologist.** Plates were printed in titanium and post-processed at the solution centre. Total planning time was approximately 2 h with a manufacturing time of 2 weeks.

**Conclusions** - Based on the findings of this study, with access to an advanced 3D metal printing medical solution centre that can provide advanced software & printing, patient-specific additive manufactured titanium implants can be planned, created, processed, shipped and sterilized for patient use within a 3-week turnaround. **Background** - Canine cranial tumors are often challenging to treat due to complex regional anatomy and reconstruction...More recently, the use of titanium mesh has been described. Titanium mesh for canine cranioplasty is easy to use and has a good cosmetic outcome with limited complications...The use of additive manufacturing for preoperative printing of patient-specific titanium implants has the potential for significant impact in canine cranial reconstruction.

**Caring for Eggsy (Sabyl has adopted Eggsy, a blind older dog)** –A Halo is designed to help safely navigate. The halo's hoop acts as a bumper to alert of any nearby obstacles so they can safely get around. A head helmet protects their heads from any minor head trauma that can occur. Don't move the furniture around at home. Your dog will make a mind & scent map & be able to get around – don't change things.





**Bulletin Board - Engineering is an important part of safety before, during & after a disaster. Be prepared work with your CERT Team**

**Alan, from a neighboring town, is helping FEANTM establish our Disaster Plan Worksheet.**



### [PDF - Disaster Plan Worksheet](#)

ALL families in all countries need a Disaster Plan Worksheet to be tailored to that country/area – from earthquake, tsunami, fire, volcano, tornado, and the list goes on and on for each country. Remember – your cell phones may not work during a disaster! Have a radio that works for emergency situations!

Additionally, we learned Emergency planning and preparedness is the process of systematically preparing for future events such as major incidents or disasters.

### **5 phases of emergency management**

- Prevention. Prevention focuses on preventing hazards from occurring, whether they are natural, technological or caused by humans. ...
- Mitigation. Mitigation is the effort to reduce loss of life and property by lessening the impact of disasters and emergencies. ...
- Preparedness. ...
- Response. ...
- Recovery.

**Every Country has plans and procedures in place including the EU – Be sure to know yours.**



**Website - [European Disaster Risk Management](#) - ...natural hazards and human-induced disasters threaten people, property, environment and cultural heritage. Disaster risk management policies aim to tackle these risks through preventive, preparedness, response and recovery actions... EU countries and 10 other participating states regularly exchange information on disaster risks...**

They also run exercises together and pool rescue teams and equipment that can be rapidly mobilized when a disaster overwhelms any other country in the world.



**There's no denying that firefighters work in a dangerous business. They put their lives on the line every time they go to work — often running toward danger when everyone else is running away.**

And the numbers back it up. According to the National Fire Protection Association (NFPA), 60,825 firefighter injuries occurred in the line of duty in 2019. Also, that year, 39% of all reported firefighter injuries occurred at the fire ground. Despite the hazards of the job, firefighters selflessly serve a vital role in their communities, and their safety is of the utmost importance.



**Excerpt - [The Future of Firefighting: Firefighting Robots](#)**

Advance your career with Eastern Oregon University

The future of firefighting is always evolving, and new firefighting technology has helped keep firefighters safe and increased their ability to more effectively put out blazes in many different settings. Arguably, the most impactful and significant of these recent technological advances are firefighting robots. Since they were first introduced by Howe & Howe Technologies, firefighting robots have been a game-changer in helping battle blazes of all kinds. For anybody looking to rise through the firefighting ranks, becoming familiar with all the new technology to fight fires is crucial.

**History of Firefighting Robots** - The first commercial firefighting robot in the U.S. was developed by Maine-based Howe & Howe Technologies. Named the RS1-T2 Thermite, the initial firefighting robot was unveiled in 2012 and was based on technology the company created for the U.S. Army.

The Thermite was designed to fight fires in environments where it is too dangerous for humans to go, such as airplane fires, nuclear reactors and other high-hazard situations. In addition to going into dangerous scenarios, the Thermite is also more mobile and agile, which provides fire departments with an added tool in their arsenal.

Since the initial Thermite was developed by Howe & Howe, they expanded the technology considerably. Look no further than the Thermite RS3, which boasts a flow rate of 2,500 gallons per minute and has the strength to push vehicles from its path and pull up to 8,000 pounds.

Although the Thermite was the original, it's certainly not the only robot that has been called into battle blazes. Firefighting robots became more well-known in 2019 when crews used them to help battle the flames at the Notre Dame Cathedral in Paris. The Paris Fire Brigade used the Colossus robot. The tank-like technology navigated the centuries-old structure and provided vital information to firefighters on the outside. In an interview with the Institute of Electrical and Electronics Engineers, Cyril Kabbara, cofounder of Shark Robotics, explained how important a role the Colossus played.

“Colossus acts as a kind of technical support station to the firefighting team by supplying information from its sensors to both the remote pilot and the other firefighters in real-time,” Kabbara said. “This is an essential function in the dangerous circumstances the workers face when they enter an emergency scene, and it's very important that all the information is in the same place, as opposed to different sensors that the team has to carry with them into the building.”



While not every fire department will encounter such daunting challenges, firefighting robots provide many benefits. In 2020, the Los Angeles Fire Department became the first department in the United States to debut this game-changing technology.

The LAFD debuted its Thermite RS3 in October 2020 and put it to work right away. Before the department even announced its acquisition, it was helping out at an early-morning structure fire. Take a look at the video for details. In an interview with the Los Angeles Times, LAFD Chief Ralph Terrazas said the biggest advantage offered by firefighting robots is that it provides the department a look inside dangerous environments when they would not risk sending humans inside.

“I can afford to lose one of these wonderful machines. I cannot afford to lose a firefighter,” Terrazas told the newspaper. Whether it’s the RS3, Colossus robot or any future technology, it’s clear that firefighting robots have changed the industry and are helping keep firefighters and citizens safe.

#### Advantage of Firefighting Robots

The high-profile uses of firefighting robots prove they can be put to work in a variety of scenarios. Of course, not every fire is as challenging and unique as the Notre Dame in Paris — that does not make these technological marvels any less valuable to departments around the United States. Firefighting robots can be used in many of the following scenarios:

- Providing safe interior fire operations on large commercial fires
- Tackling blazes on wood-framed structures under construction
- Establishing a structural defense against wildfires
- Completing the rescue of large animals
- Helping to extinguish fuel tanker fires
- Fighting auto storage fires

In addition to providing a safe alternative to putting firefighters in harm’s way, firefighting robots are exceptionally effective at extinguishing fires thanks to their impressive specifications. Need proof? Look no further than what the Colossus robot is capable of. The Colossus can spray 660 gallons per minute, and its 1,100-pound frame makes it extremely durable.

And it’s not just the Colossus. Lockheed Martin developed a remote-controlled firetruck dubbed the FireOx. According to a segment on Bloomberg Television, the FireOx can be programmed to follow GPS directions in addition to being remote-controlled, and it was developed by repurposing a base vehicle they used in Afghanistan — so you know it can withstand some of the harshest environments.

What does the future hold? Brian Lattimer, the vice president of research and development at the safety engineering and consulting firm Jensen Hughes, told The Washington Post the opportunities are vast.

“Eventually, we’ll have collaborative teams of robots — in the air and on the ground — that will work closely with people and reduce the risk to human life,” he said.

**Learn About Firefighting Robots** - As firefighting technology continues to advance, it is crucial for those looking to move up in rank to be familiar with the emerging tech...

By furthering their education, firefighters stay at the forefront of the latest advancements in the field and position themselves for leadership roles within the department... **Firefighters are the first line of defense against some of the most dangerous environments imaginable, and they need all the tools at their disposal to do their job well. With the advent of firefighting robots, now is the time to help shepherd these technological marvels through to the next generation of firefighters.**

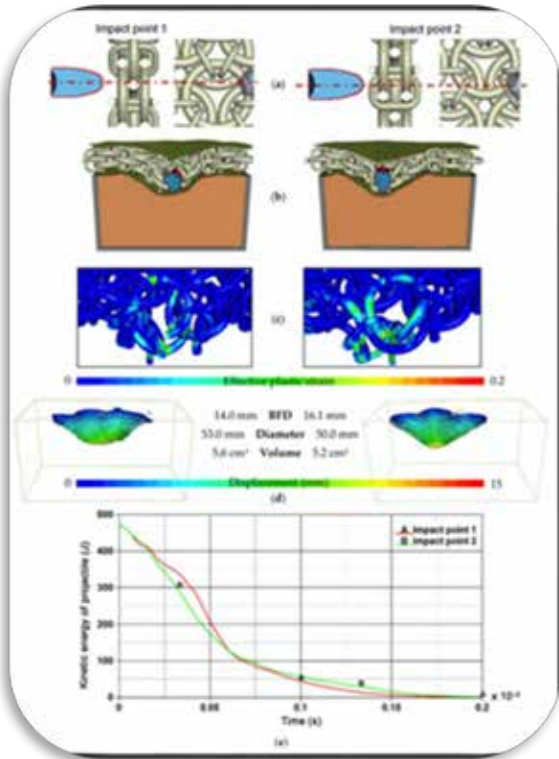


**In order to assess the ballistic resistance of the inserts, numerical simulations of ballistic impact phenomenon were carried out using LS-DYNA software...** The main aim of the work was to check the effectiveness of such solutions in soft ballistic protection applications and to select the most effective variant of 3D printed structure. Results of the numerical analysis showed a high potential for 3D printed structures made of titanium alloys to be used for bulletproof vest inserts.

### **MDPI Open Source - [Ballistic Impact Resistance of Bulletproof Vest Inserts Containing Printed Titanium Structures](#)**

P. Zochowski, M. Bajkowski, R. Grygoruk, M. Magier, W. Burian, D. Pyka, M. Bocian, K. Jamroziak

**Abstract** - Finite element modeling of ballistic impact of inserts containing titanium structures were presented in the article. The inserts containing an additional layer made using additive manufacturing technology were analyzed. The layer was created from repetitive elements made without connections (adjacent cells were inseparable). Four variants of printed titanium structures were placed between layers of Twaron CT 750 aramid fabric to create ballistic inserts. In order to assess the ballistic resistance of the inserts, numerical simulations of ballistic impact phenomenon were carried out using LS-Dyna software. In the simulations the inserts were placed on a steel box filled with ballistic clay and were fired at with the 9 × 19 mm full metal jacket (FMJ)



The main aim of the work was to check the effectiveness of such solutions in soft ballistic protection applications and to select the most effective variant of 3D printed structure. Results of the numerical analysis showed a high potential for 3D printed structures made of titanium alloys to be used for bulletproof vest inserts. In all analyzed cases the projectile was stopped by the armor. In addition, thanks to the cooperation of adjacent cells, the projectile energy density was distributed over a large area, as evidenced by large volumes of hollows in the ballistic clay. The indentations in the ballistic clay obtained in the simulations were significantly lower than the acceptable value for the back face deformation (BFD) parameter required by international body armor standards.

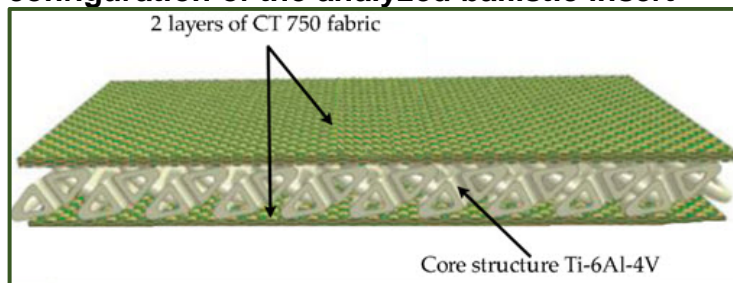
**Introduction** - The function of a bulletproof vest is to protect the human body from negative effects of an impacting projectile by absorbing and dispersing its kinetic energy. A review of structural and material solutions of ballistic inserts currently used in bulletproof vests shows that layered material systems [1,2,3], such as ceramic [4,5], ceramic-composite [6,7,8,9], titanium [10,11] and polyethylene [12,13] segments, provide effective protection against small caliber ammunition fired from handguns. Such a shield is used to protect the most important internal organs of the human body, which is about 0.5 m<sup>2</sup> of the area [14].



## Police Dept. Accident &amp; Safety Research

Thanks to continuous progress of material engineering [15,16,17] and production technologies, more efficient bulletproof vests may be developed. Current research projects in the field of personal protection [18], are focused on increasing the protected area and reducing areal density of vests related to the v50 ballistic limit. One of the ways of increasing the protective effectiveness of bulletproof vests may be by using elements made by additive manufacturing technology [19]. Recently, thanks to a wide range of possible additive production methods [20,21], their dynamic development can be observed, especially in medicine [22,23], but also in the defense industry. For example, the stab resistance body armor made of polyamide and carbon fiber plates produced using laser sintered materials technology was analyzed in the paper [24]. The original approach was presented in the paper [25], where a prototype of flexible armor was created on the basis of chitin scales manufactured with the use of 3D printing technology. The armor was composed of segments in the form of scales imitating biological organisms (e.g., crustaceans, fish or chiton). More traditional methods of manufacturing of armor elements were presented in the works [16,26]. In the paper [27], the authors presented a plymetal, which is a new type of composite metal manufactured by a laser-aided additive manufacturing (AM) process using two different metal powders. Ballistic tests were then performed on the structural components made of plymetal with impact velocities of 183–357 m/s. Additive manufacturing technologies were often used to produce porous, honeycomb [28] or cellular structures [29,30,31,32]. An interesting example of ballistic inserts produced by using additive technology was presented in the paper [33]. The inserts were made as an array of many loosely intertwined repetitive elements in the form of closed uniform cells. The cells formed a multi-object layer made of sintered powders in one technological operation. Three-dimensional printing technology is poorly described in cases of impact energy dissipative materials. Most studies refer to materials made of sintered metal powders (aluminum or titanium alloys). The remaining group of materials, for example, aramid or polyethylene, still presents a challenge for 3D printing.

**In the article, numerical simulations were performed to check the possibility of using 3D printed titanium structures as energy absorbing and dissipating layers in bullet-proof vests inserts.** On the basis of the literature review, it was noted that there is a lack of information regarding the effectiveness of such structures under ballistic impact conditions. Therefore, the phenomenon of the 9 × 19 mm full metal jacket (FMJ) Parabellum projectile impact into a 100 × 100 mm layered composite armor was modelled using LS-Dyna software. The armor included four variants of 3D printed titanium structures placed between layers of Twaron CT 750 aramid fabric. Results of studies were summarized and conclusions were drawn. On the basis of the simulation results an attempt was made to choose the most effective variant of the analyzed structures, as well as to show directions for further works in the field of 3D printing technology in ballistic applications.

**configuration of the analyzed ballistic insert**



Welcome to the Convention Barn Social – Yeehaw!  
Coffee is free and so are the cookies.  
Information is displayed in their barn booth

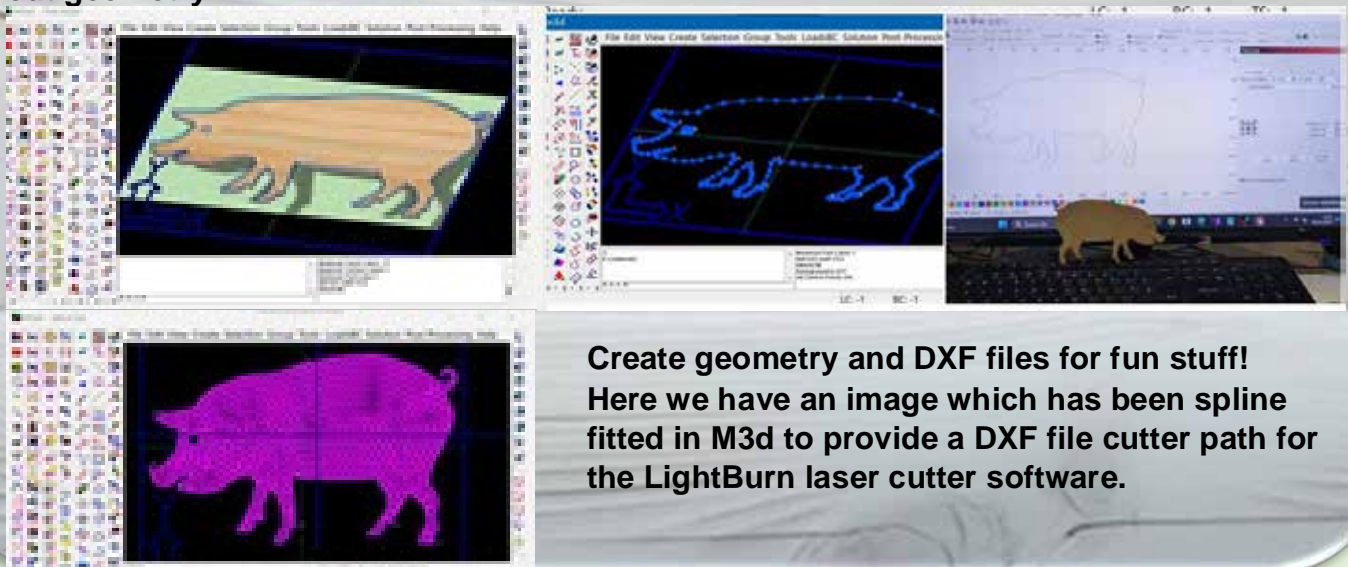
YouTube [Emma Walsh explains computational fluid dynamics \(CFD\)](#)  
How Oracle Red Bull Racing utilizes CFD to design, test and tweak multiple design variations virtually before building physical prototypes in the real world.



YouTube [ASTERIA Data Collection](#) - Our compact DGCA certified **A200 micro drone** makes it possible to map agricultural plots and farms quickly and efficiently. With its integrated RGB and multispectral cameras, the A200 can capture high-precision imagery for an acre of farmland in under 10 minutes.



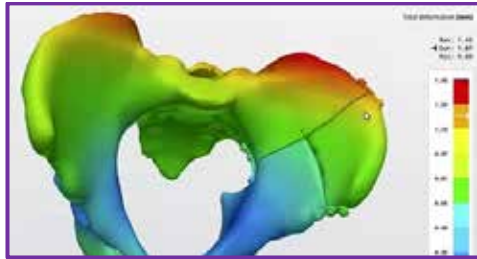
[M3d FEA](#) Free: Download & use at home. Finite Element software solution/Nastran Pre & Post Processor. Next release: load a background image (Bitmap 24bits) & use it to trace out geometry.



Create geometry and DXF files for fun stuff!  
Here we have an image which has been spline fitted in M3d to provide a DXF file cutter path for the LightBurn laser cutter software.

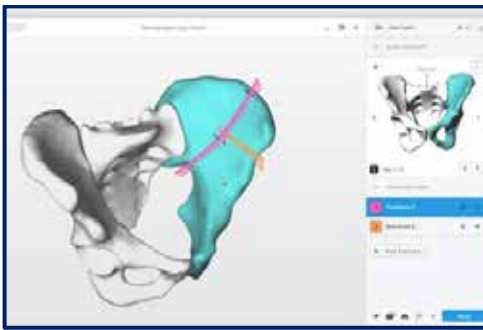


Exciting news! Introducing SimqOSP, our latest innovation that will transform the treatment of hip trauma and complex osteosynthesis. Personalization of standard implants with digital surgical planning - Shorter surgery times - Stability assessment of osteosynthesis. It is more than just analytics - its user-friendly interface is tailored to a wide range of needs, simplifying complex osteosynthesis, improving patient care and enabling more effective treatments.



### Excerpts - [Revolutionizing Hip Trauma Treatment with Simq OSP: A Technical Overview](#)

Hip trauma treatment has entered a new era with the advent of Simq OSP. This cutting-edge numerical tool integrates advanced simulations, parametric modeling, and statistical representation into surgical planning. In this blog, we embark on a technical journey to unravel the intricacies of Simq OSP and understand how it is reshaping the landscape of hip trauma treatment for medical and engineering enthusiasts alike



**The Complexity of Hip Trauma and Surgical Planning** - Hip trauma encompasses a wide spectrum of injuries, ranging from fractures and dislocations to complex cases involving damage to tendons, soft tissues, and nerves. Treating these injuries demands meticulous surgical planning to ensure successful outcomes. Historically, this planning process was arduous and time-consuming for medical professionals.

Traditional surgical planning methods often involved manual segmentation to create patient-specific geometries, which was a time-intensive endeavor. The complexity of the hip joint, with its multiple components such as bones, cartilage, ligaments, and tendons, further compounded the challenge. Additionally, factors like fracture type, surgical approach, patient age, and overall health needed consideration to determine the most suitable intervention.

These challenges, when addressed with conventional methods, led to time-consuming processes vulnerable to human errors. Consequently, the medical field began exploring advanced technologies to enhance personalized surgical planning, reduce operating room (OR) time, and ultimately improve patient outcomes.

**Introducing Simq OSP: Personalization of Hip Trauma Treatment** - In recent years, the landscape of personalized medical treatments has evolved significantly, thanks to innovations like Simq OSP. Simq OSP represents a groundbreaking solution designed to support personalized hip trauma treatment, bridging the gap between engineering simulations and medical expertise.

**Here are the key features and capabilities that make Simq OSP a game-changer in hip trauma treatment:**

**Virtual Surgical Planning with Standard Plates:** Simq OSP enables surgeons to virtually plan the entire surgical procedure using 3D models, considering the hardware and plates available in the hospital's stock. This ensures all necessary materials are readily available, reducing the risk of surgical delays.





**Extensive Implant Library:** The software offers a vast library of implants, including screws, plates, and other hardware. Surgeons can select the most suitable implant based on the patient's injury and anatomy, all within the virtual environment.

**Personalized Surgical Planning:** Surgeons can choose the plate type and precisely determine its positioning on the 3D model. This level of customization empowers surgeons to adapt the surgical plan to each injury's unique aspects.

**Virtual Preselection and Prebending of Implants:** Besides planning, surgeons can virtually preselect and prebend the plates used in surgery. This streamlines the actual surgical process, improving efficiency and potentially reducing OR time.

**Biomechanical Analysis:** Simq OSP allows for biomechanical analyses within the virtual environment. Surgeons can compare different surgical techniques, approaches, and implant options to determine which offers the most favorable biomechanical outcomes. This adds a layer of pre-operative planning that significantly impacts surgical success.

**With Simq OSP, surgeons can manipulate virtual models and simulate various surgical approaches to assess potential outcomes before setting foot in the operating room. This integrated approach enhances the likelihood of success while minimizing the risks associated with complex surgeries.**

**The Research Project: Developing a Parametric Hip Simulation Model** - At the heart of Simq OSP lies a collaborative research project focused on developing a parametric hip simulation model. This project underscores the importance of collaboration between engineering and medical sciences experts to create a surgical planning tool that is comprehensive, accurate, and applicable to real-life scenarios.

**Collaboration with Research Partners and Project Objectives** - The research project emphasizes collaboration among stakeholders from diverse fields to address the challenges associated with hip simulation modeling. The project aims to enhance surgical planning accuracy and improve patient-specific outcomes by combining expertise and resources from multiple disciplines. Collaboration between engineers and medical professionals becomes pivotal in creating a tool like Simq OSP.

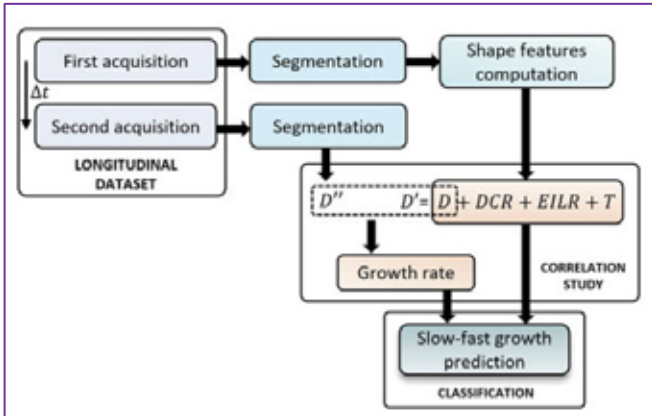
Building a Population-Based Parametric Model for Hip Trauma

Data from a diverse patient population is collected and analyzed to create an effective simulation model. This data is used to develop a comprehensive and representative population-based geometry model from which the parametric simulation model is derived. By incorporating data from multiple sources with different anatomical variations, the model can better reflect the diverse patient population encountered in clinical practice. Accurate representation of hip trauma cases in the model is critical for surgical planning, helping healthcare professionals make informed decisions based on realistic scenarios.



MeDiTATe project:  
 ESR 02 - Leonardo Geronzi

“Assessment of shape-based features ability to predict the ascending aortic aneurysm growth.”



Assessment of shape-based features ability to predict the ascending aortic aneurysm growth

FIGURE 1. Full workflow for identifying patients at high risk of aneurysm growth.

In this paper, we propose a method to obtain shape features to identify patients at high risk of AsAA growth. Besides the diameter, already proposed in the guidelines, these are the ratio between the diameter and the centerline length, the ratio between the length of the external and internal lines and the tortuosity of the ascending tract.

Excerpts from paragraphs – please read the complete paper

**The current guidelines** for the ascending aortic aneurysm (AsAA) treatment recommend surgery mainly according to the maximum diameter assessment. This criterion has already proven to be often inefficient in identifying patients at high risk of aneurysm growth and rupture. In this study, we propose a method to compute a set of local shape features that, in addition to the maximum diameter  $D$ , are intended to improve the classification performances for the ascending aortic aneurysm growth risk assessment...

**1 Introduction** - Ascending aortic aneurysm (AsAA) is a risky dilatation of a weakened area of the ascending aorta (AAo) which may lead to dissection or rupture (Guo et al., 2018). Unfortunately, it is generally a silent pathology and the first symptoms may already indicate a serious and late-stage clinical situation with severe, life-threatening internal bleeding (Papagiannis, 2017). The estimated pooled incidence is between 5 and 10/100,000 individuals per year (Kuzmik et al., 2012; Melo et al., 2021). To date, the main criterion for elective ascending aortic surgery of non-urgent cases is the maximum diameter assessment whose decision threshold is generally fixed at 55 mm (Anfinogenova et al., 2022). Unfortunately, this does not seem to correctly reflect the AsAA patient’s risk of rupture (Elefteriades and Farkas, 2010; Tozzi et al., 2021) and is often considered insufficient as criterion of choice (Sonsino et al., 2022). In fact, many studies show aneurysms with diameters below the threshold for elective surgery which experience rupture while other aortas with huge diameters remain stable over time in terms of size (Smoljkić et al., 2017). Recently, the aneurysm growth rate (GR) (Oladokun et al., 2016) has also been included as a decision criterion for elective surgery. Therefore, as further stated in the clinical guidelines (Members et al., 2014), patients with rapid growth of the aortic diameter (more than 3 mm/year) should be considered for preventive surgical replacement. Furthermore, the process of aneurysm growth seems to be accelerated by the presence of a bicuspid aortic valve and congenital pathologies (Davies et al., 2007). For these reasons, the research is now focused on determining new biomarkers (Califf, 2018) for early diagnosis that can predict the aneurysm evolution and allow an accurate risk assessment...



RheKen,

December

Town investigative reporter

I am AI and live on a small ranch on the outskirts of the town

I use chatGPT for assistance.

**Investigate: “Did anyone win at the shooting range?”**

It was a busy day and all the town turned out to watch the Rancher and the Secretary have their shoot out at the rifle range. Not at each other! A safe shoot out at the targets.



Will they ever stop arguing and blaming each other?

Do they stay up all night thinking of ways to aggravate each other?

Actually, one accidentally did let out the air on the bicycle tire. The other accidentally ran down a fence. Were these accidents?

Once upon a time in the quiet and picturesque town of FEANTM, nestled between rolling hills and surrounded by vast open fields the town secretary and the rancher were renowned for their constant and lively debates. (actually, it was bickering and arguing)

From sunrise to sundown, the two could be found locked in an ongoing rivalry. It was not the kind of rivalry that brought ill will or hatred; instead, it was a friendly competition everyone in town had grown to expect. This time, their heated argument centered around a matter close to their hearts: marksmanship.

With a challenge issued, the Rancher and Secretary decided to settle the dispute at the town's shooting range. The range, a quaint establishment tucked away on the edge of FEANTM, had targets and rifles. The townsfolk gathered to watch the contest unfold bringing picnic baskets and chairs.

The two competitors stood facing the targets, rifles in hand, their eyes sharp and determined. The shooting range owner, a wizened man named John, counted down. "Three... two... one... Fire!" The shots rang out in unison. The townsfolk started taking bets on who would win.

As the hours passed, the targets were pierced by bullets with remarkable accuracy. The Rancher and the Secretary were evenly matched, and their rivalry showed no signs of abating. Frustration began to set in as they reloaded their rifles and retook aim time and time again. The townspeople gathered around the range maintaining a safe distance and watched in amazement and amusement. The local coffee shop served free coffee, so everyone stayed to watch the continuing competition. Or they stayed to drink the free coffee?

Sweat dripped from their brows, and their arms ached from the constant firing. They were both skilled marksmen, but neither could claim victory. With their rifles empty once more, they stared at each other. "We're evenly matched, aren't we?" The Rancher remarked, wiping his brow but scowling at the Secretary.

The Secretary agreed, her competitive spirit exhausted. "You're right. We're equally skilled, and I'm tired of shooting this rifle."

The Rancher agreed, "I couldn't agree more. Let's put this rivalry to rest for now and head for coffee."

(Notice he only said "for now")



RheKen,

Town investigative reporter

**I am AI and live on a small ranch on the outskirts of the town  
I use chatGPT for assistance.**

**Investigate: “Did anyone win at the shooting range?”**

---

December

They left the range and headed to the local coffee shop, a charming establishment known for its rich brews and mouthwatering pastries. As they walked in, they resumed their argument, but now it was about the type of coffee they should order. The Rancher preferred a robust black coffee, while The Secretary was adamant about her love for a creamy latte.

Their debate continued as they approached the counter. The barista, an amiable woman named Marnie, suggested a compromise: a half-and-half combination of both coffee styles. The two agreed to her suggestion and soon had their coffee.

They sat at a corner table, and their rivalry extended to their preferred pastries. The menu was filled with delectable cakes, pies, and cookies. They couldn't agree on just one, so they ordered five cakes, each representing a different flavor.

As the town residents enjoyed their quiet conversations, they couldn't help but notice the spirited debate unfolding before them. The Rancher and Secretary argued, their voices grew louder. The passionate arguments over which cake was the best were great entertainment in the coffee shop. Everyone was taking out cell phones and taking videos to upload to YouTube and FaceBook.

Ultimately, they agreed that each cake was delicious in its own way, just like the town of FEANTM itself – a place where unique residents and their friendly rivalries added charm to life in the county. The townsfolk couldn't help but smile as they witnessed the enduring arguing between the Rancher and the Secretary, who, despite their constant bickering, were always there for the town if needed.

But then they started arguing about the best way to clean the new town barn. The coffee shop suddenly became empty of customers! Why argue about how to clean a barn? Stay tuned, unless they agree on a solution - we all know that isn't going to happen!



**No one knows his name. You yell, "HEY, old racer."**

**A Century of Tailgate Innovation** - Before Ford introduced the new Pro Access Tailgate on the 2024 Ford F-150, well, there were a lot of other tailgate styles. For nearly a century, Ford engineers have adapted and improved tailgate experiences to meet the needs of station wagon, SUV and truck customers. Grab a seat – or a tailgate – and scroll through the evolution of Ford tailgates.

A few of the many images on the Ford website of the innovation and evolution of the Ford tailgate!

**1925**

First factory-assembled pickup debuts and features a cargo box and adjustable tailgate.



**1929**

Model A is company's first factory-built station wagon. It featured a tailgate and no rear window.



**1948**

F-1 introduced with tapered, rolled edge tailgate. Anti-rattle drop chains hold tailgate flush with floor or let it swing all the way down.



**1959**

Reflector added to right side of F-Series tailgate for safer nighttime operation.



**1961**

Ford pickup tailgates marketed as "grain-tight." Now with one-handed instant-lock capability, steel chain locks are no longer used and replaced with Instant-Action latches. Tailgate width increased by 13 inches.



**2021**

Power tailgate and new tailgate work surface with variety of useful holders and grained texture offered as options on F-150. All F-150 truck tailgates include tie-down hooks that double as bottle openers and standard clamp pockets.



**2023**

Opening from the driver's side, Pro Access Tailgate reduces walking distance to the tailgate handle, facilitates operation when towing, and even features a specially designed integrated handle for easy entry and exit of the swing door opening, which can open 37, 70 or 100 degrees.





YouTube

Turkish Aerospace at TEKNOFEST

[GÖKYÜZÜNDE HÜRKUŞ DANSI](#)



**You Tube**

[Thunderbirds 2022: Edwards Air Force Base, CA](#)

- "It was an amazing weekend headlining the Aerospace Valley Air Show at Edwards Air Force Base! Not only did we get to perform on the 75th anniversary of the first supersonic flight, but at the very place where it happened!"

**US Airforce Picture of the Month [Upside Down](#)**



**Maj. Kristin Wolfe, F-35 Lightning II Demonstration Team commander**, performs aerial acts over hundreds of spectators during the Gowen Thunder Airshow, Aug. 27, 2023, at Gowen Field in Boise, Idaho.

The purpose of Gowen Thunder is to provide a safe and memorable community event thanking Idaho's citizens, employers and community partners for their unwavering support.

(U.S. Air National Guard photo by Master Sgt. Becky Vanshur)



[The Army's New Piloted Scout Helicopter is Critical for Tomorrow's Missions](#) - Nearly a decade ago, the U.S. Army retired its last helicopter designed specifically for the attack reconnaissance mission – the OH-58 Kiowa Warrior. Since then, a combination of AH-64 Apache helicopters and unmanned aerial vehicles (UAVs) have filled in, performing the attack reconnaissance mission the best they could.

But near-peer threats demand next-generation aircrafts specially designed to stay ahead of the fight through continuous evolution. Unlike the Kiowa Warrior, the Future Attack Reconnaissance Aircraft (FARA), Army Aviation's top modernization priority, is a Division, Corps and Joint Forces-level strategic asset operating deep in the battlespace. And it's the only reconnaissance platform that delivers deep reach providing a level of survivability never before obtained in Army Aviation.

**Delivering Mission-Critical Capabilities at the Front of the Fight** - Sikorsky, a Lockheed Martin Company and one of two companies vying for FARA, is offering RAIDER X®. Flying low and fast to stay hidden below the tree line, RAIDER X will deliver crucial intelligence and keep forces connected through a secure mesh network. Built to find, fix and finish anti-access/anti-denial (A2AD) and enemy forces, RAIDER X operates in contested environments at the front of the fight. It's a sophisticated sensor, a central network hub and a powerful armed reconnaissance helicopter all in one.

**“RAIDER X is a complete weapon system,” said Jay Macklin, Sikorsky's director of Future Vertical Lift Business Development and a retired Army Aviator. “It provides significant reach, survivability and lethality – much more than exists with today's enduring fleet. RAIDER X will be plugged into the network as a key part of the combined arms force, enabling the ground commander to see and shape the battlefield.”**

With an increasingly complex future threat environment and swift pace of technological change, enabling rapid upgrades and putting real-time decision making closer to the fight is critical for mission success. RAIDER X is purpose-built with the Army's Modular Open Systems Approach (MOSA) to provide leap-ahead capability and enable rapid upgrades. Its adaptability is the starting point for decades of innovation.

This merger of superior physical performance with transformational digital capabilities is exactly what Lockheed Martin's 21st Century Security strategy seeks to achieve – helping warfighters meet the challenges of tomorrow's multi-domain missions. ...



[YouTube - Flying low and fast to stay hidden below the tree line, RAIDER X will deliver crucial intelligence and keep forces connected through a secure mesh network.](#) Built to find, fix and finish anti-access / anti-denial (A2AD) and enemy forces, RAIDER X operates in contested environments at the front of the fight. It's a sophisticated sensor, a central network hub and a powerful armed reconnaissance helicopter all in one.



[NYU Tandon School of Engineering researchers develop algorithm for safer self-driving cars](#)

In a promising development for self-driving car technology, a research team at NYU Tandon School of Engineering has unveiled an algorithm — known as **Neurosymbolic Meta-Reinforcement Lookahead Learning (NUMERLA)** — that could address the long-standing challenge of adapting to unpredictable real-world scenarios while maintaining safety.

The research was conducted by Quanyan Zhu, NYU Tandon associate professor of electrical and computer engineering, and his Ph.D. candidate Haozhe Lei.

Artificial intelligence and machine learning have helped self-driving cars operate in increasingly intricate scenarios, allowing them to process vast amounts of data from sensors, make sense of complex environments, and navigate city streets while adhering to traffic rules.

As they venture beyond controlled environments into the chaos of real-world traffic, however, such vehicles' performance can falter, potentially leading to accidents.

NUMERLA aims to bridge the gap between safety and adaptability. The algorithm achieves this by continuously updating safety constraints in real-time, ensuring that self-driving cars can navigate unfamiliar scenarios while maintaining safety as the top priority.

The NUMERLA framework operates as follows: When a self-driving car encounters an evolving environment, it uses observations to adjust its “belief” about the current situation. Based on this belief, it makes predictions about its future performance within a specified timeframe. It then searches for appropriate safety constraints and updates its knowledge base accordingly.

The car's policy is adjusted using lookahead optimization with safety constraints, resulting in a suboptimal but empirically safe online control strategy.

One of the key innovations of NUMERLA lies in its lookahead symbolic constraints. By making conjectures about its future mode and incorporating symbolic safety constraints, the self-driving car can adapt to new situations on the fly while still prioritizing safety.

The researchers tested NUMERLA in a computer platform that simulates urban environments – specifically to ascertain its ability to accommodate jaywalkers — and it outperformed other algorithms in those scenarios.



**Quanyan Zhu**

Associate Professor

**Publication PDF available on the website** - Neurosymbolic Meta-Reinforcement Lookahead Learning Achieves Safe Self-Driving in Non-Stationary Environments, Haozhe Lei and Quanyan Zhu





## The Old Cattle Rancher's Ranch

No one knows his name.  
You yell, "HEY, old rancher."

**Agriculture, Animals, Soil, Equipment, Cattle,  
and whatever he wants.**

Right Picture – My dog, Scout, & my horse, Cowboy

December



**AeroFarms** -WE'RE GROWING THE BEST PLANTS POSSIBLE FOR THE BETTERMENT OF HUMANITY. As a Certified B Corporation, we use the latest breakthroughs in indoor vertical farming, artificial intelligence and plant biology to grow a wide array of products, delivering superior flavor, better quality and improved nutrition with the most sophisticated levels of traceability and food safety in our



**Excerpt - ANSYS White Paper - [AeroFarms Addresses Food Insecurity Through Indoor Farming](#) - Ansys CFD Helps AeroFarms Achieve New Heights**

AeroFarms, the world leader in indoor vertical farming, builds and operates environmentally responsible farms throughout the world, enabling year-round, local production of leafy greens at a commercial scale. **Using Ansys CFD de-risked highly critical decisions regarding environmental control and airflow distribution**

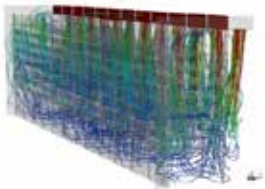


Figure 1: Airflow streamlines used to visualize flow of air through vertical racking systems



Figure 2: Vertical slices through simulation used in the analysis of environmental uniformity through racking system.



Figure 3: AeroFarms Indoor Farm tailors lighting and environmental variables to grow the best plants possible!

Their facilities use up to 95% less water than field-farmed food while producing annual yields 390 times higher per square foot. To produce healthy plants from seed to harvest in less than two weeks, AeroFarms uses aeroponic technology, which feeds the plants using a targeted mist containing nutrients, water and oxygen. LEDs enable precision photosynthesis in the most energy-efficient way.

**Challenges** - AeroFarms grows millions of lbs. of leafy greens a year at its largest facility, a 70,000 sq. ft. indoor farm where 48 ft. tall towers provide 27.3 million sq. ft. of vertical growing space. The company is building a new facility twice as large and needed to verify how airflow and other environmental conditions that drive plant biology processes could be scaled to higher towers with a greater density of plants and lighting.

**Technology Used - Ansys CFD - Engineering Solution** - AeroFarms engineers began by using Ansys CFD to simulate the current air distribution and irrigation systems in their 70,000 sq. ft. facility.

- The simulation accounted for all of the variables in the growing environment, from the heat produced by LED grow lights to the humidity produced by the aeroponic mist.
- The engineers then projected the data onto a full-scale physical mock-up of the next generation of grow towers. By mapping and comparing the Ansys CFD and 3D physical models, engineers could test and validate multiple design iterations quickly and confidently...



Thank you for joining me on my monthly visits to museums.



The Tank Museum

The regimental museum of the Royal Tank Regiment and the corps museum of the Royal Armoured Corps.

Our purpose is to tell the story of tanks and the crews who served in them.



Tiger1



Little Willie



M31A Stuart



Sherman



Traveling through Mount Shasta and Weed, CA [View The complete picture set](#)



## Supervisors Goodbye Page - Come Back Soon - December

FEA Not To Miss & More  
Please come back soon!  
Buildings & campsites  
are available

Goodbye from Marsha/Molly & Friend



And here we have our two miniature horses who don't want to come in to the barn and kept running around bucking!

Cute but that hoof can kick you if you're behind them when they do it. And Dusty kicks to the side!

The dark one running is Quincy. The light brown bucking horse in the background is Dusty.



We will always remember. Our Town Always Salutes:

- Our US military, NATO and Friends of the US & NATO - First Responders, Police, Fire Fighters EMT's, Doctors, Nurses, SWAT, CERT Teams, etc.
- We salute engineers, scientists, developers, teachers AND students because without them we would not have technology.