

## UTSI student and professor featured in Royal Society Review

University of Tennessee Space Institute (UTSI) doctoral candidate Tony Saad and Prof. Joe Majdalani are a team from Tennessee that will publish a review article in the Proceedings of the Royal Society A, considered by most to be the oldest scientific academy still in existence.

Their manuscript is entitled "On the Lagrangian optimization of wall-injected flows: from the Hart-McClure potential

to the Taylor-Culick rotational motion."

This scientific study introduces several new concepts for modeling gaseous motions in solid and hybrid rocket motors.

The study focuses on the Taylor-Culick model, a rotational motion that arises in several captivating applications, such as isotope separation and rocket internal ballistics.

In this context, the Lagrangian optimization

principle is used to unravel two complementary families of solutions showcasing energy signatures. These extend from the irrotational Hart-McClure potential with minimum kinetic energy to a highly rotational flow motion with peak energy.

The Taylor-Culick motion is found to be at the confluence of both families.

To better understand the inclination of fluid

particles to toggle between energy states, the entropy maximization principle is used. This principle helps to identify the Taylor-Culick configuration as the most probable pattern among those starting from rest.

The Taylor-Culick solution is found to correspond to a local equilibrium point at the convergence of both Type I and Type II families.

Finally, the study culminates in a unique recon-

struction of Kelvin's 1849 energy theorem, mostly known for its applicability limitation to a specific class of fluid motions and surface boundaries.

In their review article, Saad and Majdalani extend the theorem to a wider range of applications such as those involving open boundaries and arbitrary inlet and outlet conditions. In applying the generalized Kelvin theorem to the two families of injection driven

motions, these researchers show that the Hart-McClure potential indeed carries the least amount of power among all possible solutions.

The Royal Society currently publishes seven peer reviewed journals covering many facets of mathematical, natural, and engineering disciplines.

Article by UTSI office of the Associate Vice President and Chief Operating Officer.

### Deer from page 4

ance Institute for Highway Safety, about 1.5 million DVCs are estimated to occur annually in the U.S., resulting in around one billion dollars in property damage and 150 deaths. The results of close analysis of DVC data collected since 1987 by ATA Security Forces and Conservation personnel can answer some important questions regarding safety.

1) Have the DVCs on base increased? Analysis of the annual number of DVCs indicates that there has been a significant decline.

2) Are there months of the year in which DVCs are more likely to occur? Analysis by Lamb indicates that there is a significant difference in the pattern of DVCs. Drivers should always be vigilant watching for deer when driving but take extra care in the fall and winter months.

3) Are DVCs more like-

ly to occur during certain times of the day? The time of the DVC is not a variable recorded on base. However, numerous other studies have found that DVCs are more likely to occur during the hours around dawn and dusk. Drivers are asked to take extra precaution at these times when deer are more active and drivers are less likely to see them.

4) Are there areas where DVCs have been concentrated in the past and are, therefore, more likely to occur in the future? A Geographical Information System analysis was used to identify areas with "extreme, high and medium" risk of DVC. A DVC can happen on any road, but drivers should slow down and be extra vigilant in the high DVC probability areas.

For more information contact Rick McWhite at 454-5086.

## Tips to prevent, avoid deer vehicle collisions

No strategy can completely eliminate the risk, so it is up to drivers to take due diligence on the road. The following tips are for avoiding DVCs:

- Use extreme caution during the months of October through January – this holds true on the base.
- If you see one deer you should expect others.
- Be attentive from sunset to midnight and hours shortly before and after sunrise. These are the highest risk periods for DVCs.
- When driving at night, reduce your speed and also use high beam headlights when there is no oncoming traffic. The high-beams will better illuminate the eyes of deer on or near the roadway.
- Brake firmly when you notice a deer in or near your path, but stay in your lane. Many serious crashes occur when drivers swerve to avoid a deer and hit another vehicle or lose control of their cars.
- Do not rely on devices such as deer whistles to deter deer. These devices have not been proven to reduce DVCs.
- Avoid the use of cell phones and other distractions while driving.
- Make sure you buckle up.
- Scan both the roadway and roadsides.

- Be especially careful in the rain – deer can be harder to see and they slip easily on the pavement.

*If a DVC is unavoidable, the same sources offer this advice:*

- Don't swerve, brake firmly, stay in your lane, hold onto the steering wheel and bring your vehicle to a controlled stop.
- Pull off the roadway. Turn on the vehicle hazard flashers and be careful of other traffic when you leave your car.
- Don't attempt to remove a deer from the roadway unless you're convinced it's dead. A deer can inflict serious injuries.
- Contact law enforcement to report the incident. On base, be sure to report it to the AEDC Police.
- Contact your insurance agent or company representative to report any damage to your car. Collision with a deer is usually covered under the comprehensive portion of your automobile policy.
- Tennessee law allows deer killed in a collision to be taken and used as food as long as the driver contacts the nearest TWRA regional office to report the accident within 48 hours.

## Free holiday greetings from video-conferencing center

The video conference center is open for morale and welfare holiday videoconferences. This service is available for family members to contact DoD personnel and their families located in the continental United States, Hawaii and Alaska. AEDC has expanded the program to include deployed members overseas, including Reserve and National Guard members. Videoconferences will be scheduled on a first-come, first served basis. Reservations are being taken now through Dec. 23, Monday – Friday, from 7:30 a.m.-4 p.m. For additional information or to schedule a videoconference, contact Mike Arnold at ext. 7500.

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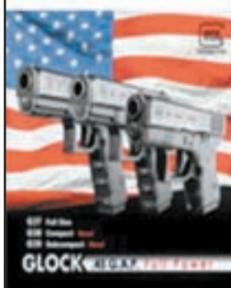
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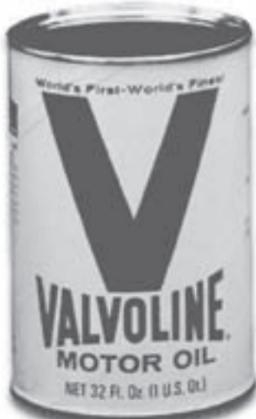
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