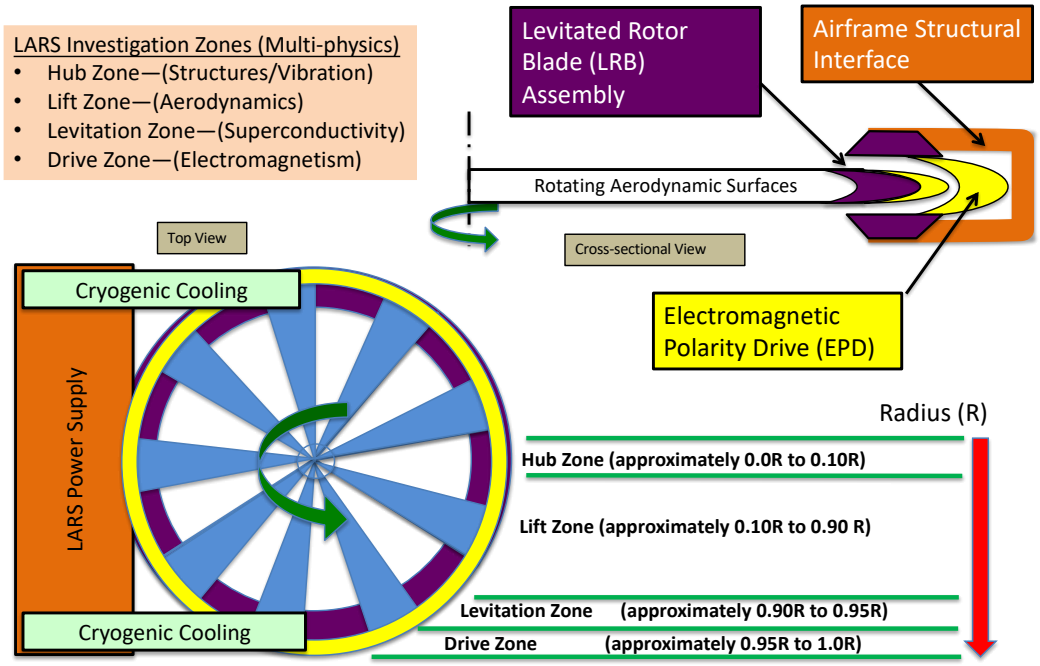
What is LARS?

LARS is a tip drive rotor system that will free vertical flight vehicles from their mechanical and aerodynamic limitations and create transformative opportunity for commercial and military operations.

Tell me more…

LARS stands for Levitated Annular Rotor System and whose beginnings stem from the conceptual redesign of the helicopter made possible by advancements in motor, material and energy storage/transport technology.



Levitated Annular Rotor System (LARS) Provisional Design

LARS functionally imparts mechanical torque to a rotor blade assembly electromagnetically to an outer tip ring within the confined space of a shrouded annulus. The blade assembly's rotational speed is controlled by current manipulation which offers a wider range of thrust response for air vehicle performance, stability and control. The rotating blade assembly is also magnetically suspended within the shrouded annulus design to minimize frictional energy loss and provide a means for active turbulence control. Comparatively, LARS integrates the disparate functions of a helicopter's engine, gearbox and rotor system into one blended energy transfer system.

What is the focus of LARS Research and Development?

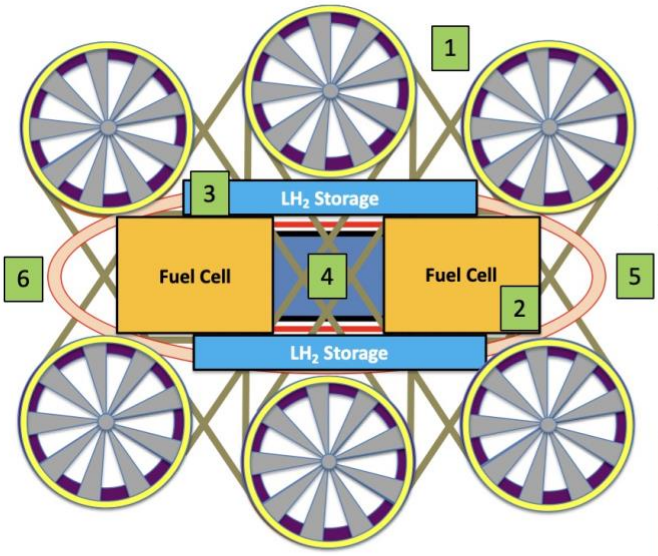
The LARS development team is focused on modeling the multi-physics energy transfer occurring within the LARS annulus between the stationary electromagnetic polarity drive (EPD) and the levitated rotor blade (LRB) assembly. Modeling results will directly inform the engineering trade space between the aerodynamic domain of the rotating LRB and the electromagnetic domain of the EPD. Modeling will also validate the key performance parameter of power density in a hover, and deliver an optimized family of solutions for EPD geometries inclusive of the Multiphysics challenges such as vibration, material stress and heat transfer. These results will inform LRB design options that are scalable and useful for off-design point (non-hover) operations.

What specifically can LARS do for vertical flight?

The preliminary design of LARS targets a disruptive power density of 20 kW/kg which is the performance required for future vertical lift payloads that are operationally relevant and impactful in an Urban Air Mobility framework. Three transformational aspects of the LARS design are:

(1) Performance efficiency—a LARS powered air vehicle will return 40% power available to flight performance through highly efficient energy transport, a shrouded rotor system; and through elimination of mechanical flight control components, counter-torque devices, and engine accessories.
(2) Flight envelope expansion—LARS uses electric current manipulation to create speed compensation for constant disk loading in response to changes in density altitude, thus expanding the flight envelope deeper into high altitude, hot environments, and heavier payload operations, (high/hot/heavy).
(3) Scalability—LARS offers the aerospace professional more imaginative options for air vehicle design, more engineering trade-space in vehicle development, and more simplicity in the manufacture of the final product.

Achieving technical maturity by 2027, LARS will integrate with other developing electric aviation technologies (e.g. hydrogen fuel cells, superconducting wires and ribbons, magnetic levitation) to vector the vertical lift industry toward new mission sets with substantially increased payload capacities and greatly expanded flight envelopes.



KEY AIR VEHICLE FEATURES

1. 6xLARS electromagnetic tip drive
2. All-electric Fuel Cell power supply
3. Dual purpose LH2 fuel & HTS cooling
4. ISO 688 CONEX payload capacity with external lift
5. Manned or unmanned option
6. Lifting Body contoured fuselage

R.I.V. 3-R.

Road Independent Vehicle—

Effective, Efficient, Economical, Reliable

Mission:

- Ultra Heavy Vertical Lift Logistics
- Payload capacity = 32,500 kg
  - 1 max gross shipping container
  - 150 passenger Urban Air Mobility

Tell me more about the Market Opportunity…

The team has designed a LARS enabled novel air vehicle to carry a useful payload of 32,500 kg—the equivalent maximum weight capacity of an ISO 688 freight container or 150 embarked passengers with luggage. Operationalizing this vertical lift capacity is of extreme value to U.S. military combat sustainment that is currently reliant on mechanized ground vehicles, and therefore highly dependent on battlefield road infrastructure that may be access denied or threat laden.

Such capacity also achieves civilian Urban Air Mobility goals for short-haul passenger transport in, around and through metropolitan areas into the next decade.

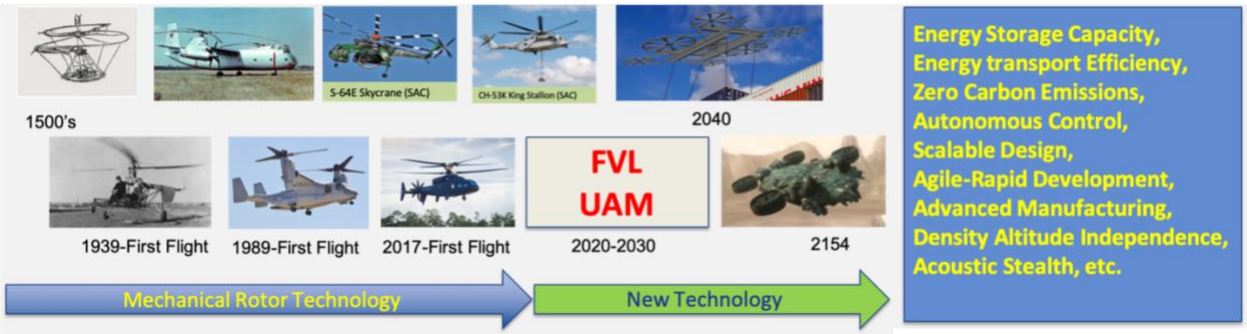
This project's largest commercial market is for short-haul containerized freight transport. By 2030, LARS can provide a vertical lift investment opportunity to global supply chain companies that rely on containerized freight transport. The LARS air vehicle customer is the future supply chain integrator or industry giant that sees true end-to-end supply chain efficiency and whose values (cost, quality, environmental awareness and social responsibility) are aligned with the consumer. By 2035, a vertical lift option for short-haul transport, including ship-to-shore offload, can be amassed to augment intermodal port infrastructure and provide relief to the persistent and growing pain points of highway congestion, road maintenance, and increasing operational costs. Value is further added to the national economic strategy with the creation of dispersed VTOL freight ports that stimulate rural development.

KRyan Creative
CREATE-DISCOVER-CHANGE

OrangeWave Innovative Science

Who is KRyanCreative and who is your LARS research partner?

KRyanCreative, LLC is a South Carolina based, disabled veteran owned, growth-stage aerospace technology development company. The project's principal investigator is company founder Captain Ken Ryan, US Navy (Retired). He holds an MS in Aeronautical Engineering and is a credentialed Experimental Test Pilot and DoD Senior Acquisition Professional. He is also the principal aircraft designer for the LARS powered novel air vehicle. The project scientists are Dr. Norton Brice Orange and Dr. David Chesny from the development team partner of OrangeWave Innovative Science, LLC (OWIS), a South Carolina based technology firm with a vast science portfolio.



Final thoughts?

The helicopter and its shaft- centric powertrain—invented circa 1950—is at its power density limit and will never be capable of ultra-heavy lift without a technological redesign. The LARS design leverages bearing-less motor technology with the application of high temperature superconductivity. Superconductivity applied to electromagnetic machines has demonstrated up to 60% more efficiency at 50% less weight and footprint when compared to non-superconductive peer designs. Investing in LARS now will enable vertical lift concepts and designs to compete for ultra-heavy lift primacy within the urban air mobility framework and in the Department of Defense Future Vertical Lift program.