Aerospace Electrification Presents Opportunities for Nycote

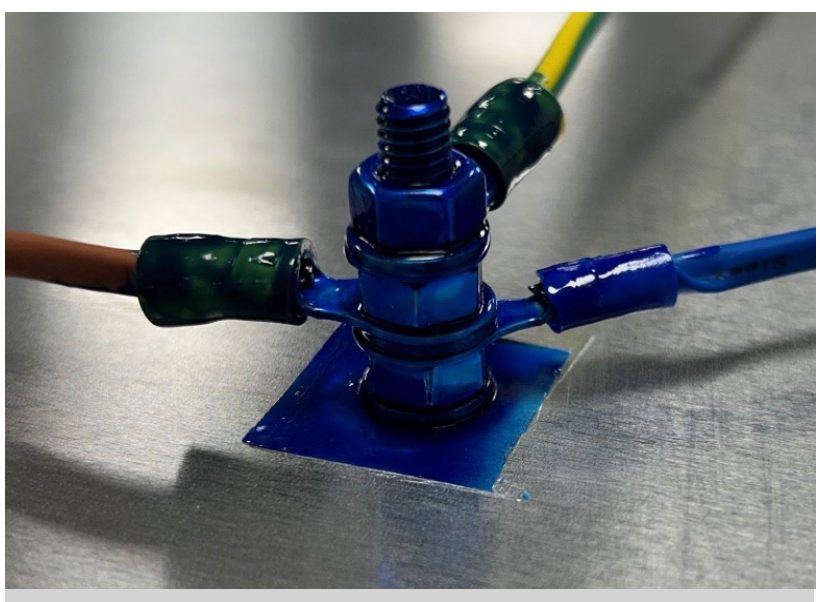
February 2025

By Jim Rowbotham, VP of EMEA Nycote

Through its 60 year history Nycote Laboratories Corporation has produced coatings used on the electrical features of aircraft. Coatings like Nycote 7-11 and Nycote 88 are based on an electrically inert and very strong polymer matrix of nylon and epoxy. This allows a thin film with high dielectric properties to be deposited; providing a corrosion resistant barrier on metal substrates and lending itself well to electrical applications.

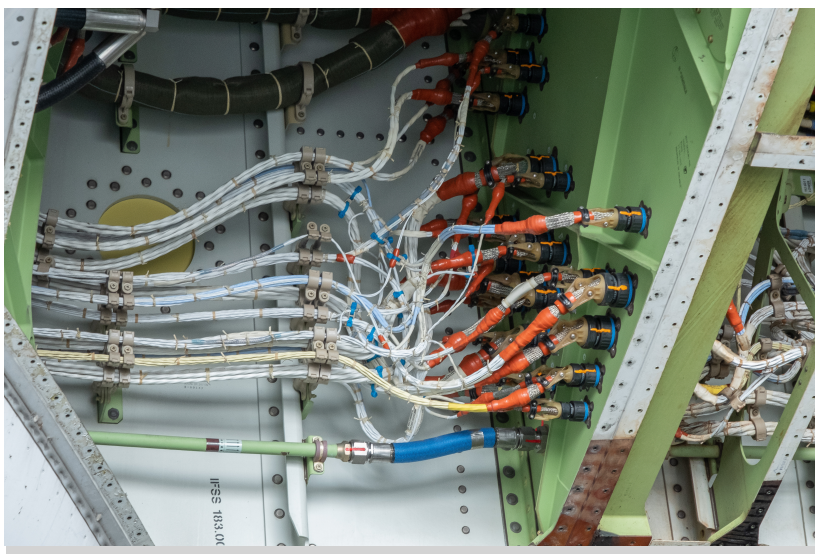
Conventionally powered aircraft contain many electrical installations. They need to be protected from environmental damage, corrosion, and to make sure that no stray contact or unwanted grounding occurs. Typical examples include -

Electrical bonds:
There are numerous electrical bonds inside any aircraft, they are used to ground components into the airframe for safety, to equalize potential, and to channel static electricity. Usually attached to the structure by bolt assemblies with connectors and nuts holding them in place, these small structures incorporate complex geometries and multiple materials. Nycote coatings work perfectly to adhere, conform to the shape and provide a fully waterproof encapsulation. This prevents corrosion and provides a dielectric layer to insulate from unwanted contacts.



Typical application of Nycote to an aircraft bonding point

Wiring bundles:
Wires are bundled into groups insulated with wrappings like braided nylon, they are then channeled into small spaces and races throughout the aircraft. Again they are at risk of moisture ingress and if the sheathing has any gaps or wear, then there is a risk of a stray contact or spark. Here Nycote products are used to coat the bundle to provide an additional anti -friction/fraying effect as well as a layer of insulation and moisture resistance. The race can also be coated as Nylon provides a good surface to minimize wear.



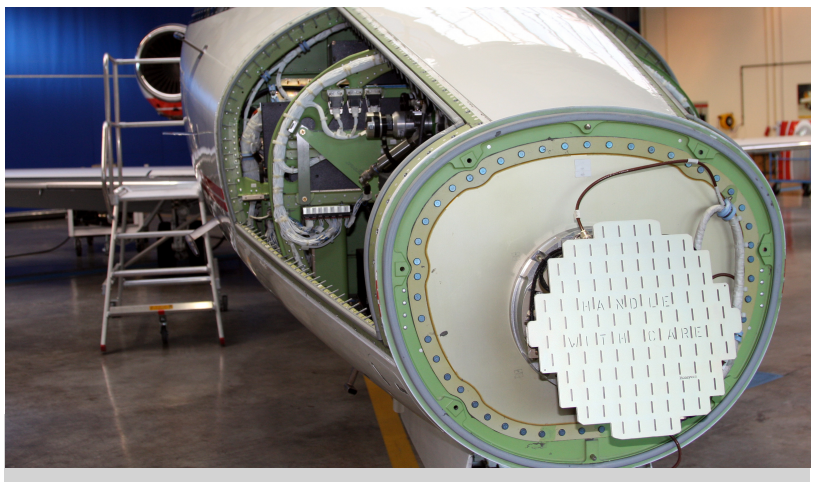
conventional aircraft wiring installations

Cabin electrical systems:
Galley electricals, IFE and lighting systems all have electrical systems and risks associated with them. Nycote coatings are qualified and used to encapsulate connectors, enclosures and PCBs to protect them from dust and moisture ingress and to provide additional protection against wear and tear.

picture of galley electricals

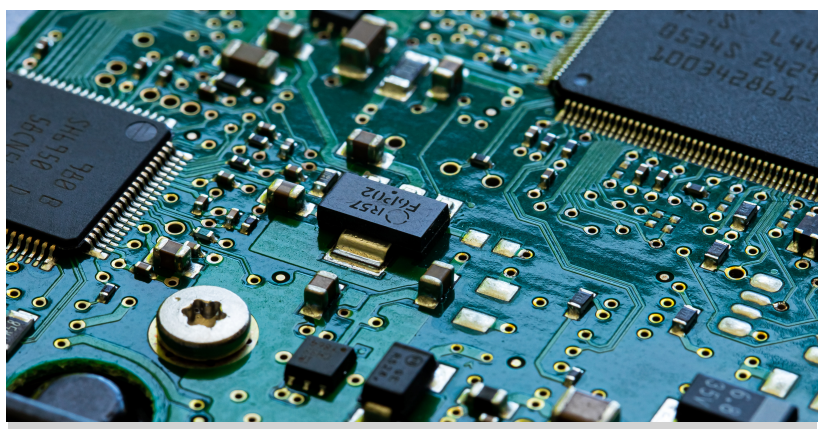
As electrification becomes more widespread, the number and variety of electrical installations will increase. More systems will be connected to electrical power sources. These include batteries, which need to be insulated, protected and cooled as well as propulsion motors, actuators etc. There will be a correspond

ing increase in the amount of electrical protection needed around the airframe. Nycote Laboratories is perfectly positioned to take advantage of these changes. Combining decades of proven protection with a significant database of electrical compatibility makes a powerful tool to protect electrical systems from the rigors of flight.



Conventional aircraft avionics wiring

The challenges of protection in electric aviation include many which Nycote has been overcoming for years in conventional aircraft. Weight reduction is even more of a factor, as the energy to weight ratio of batteries is crucial and eVTOL aircraft have lift provided by rotors rather than more efficient wings. Typical Nycote applications are at 10-20 microns of dry film thickness to provide complete protection, which creates a very low weight addition for critical parts. Aircraft coatings must be heat and cold resistant and able to operate in both wet and dry conditions. The points of failure of conventional aircraft are very well modelled, with over a century of experience. For new systems, modes of failure must be predicted and additional redundancy and protection need to be built in. Coatings which add a layer of protection to the basic design are a useful tool and Nycote products are easy to apply in local “trouble spots” with little penalty.



Printed circuit board with conformal coating

We are in a rapidly evolving phase of the industry which recalls the early days of aviation. This phase will see new projects launched and technologies competing to become the common platforms of the future. The new pioneers of electrification are inventing and innovating in electric and hybrid powered flight. This includes battery electric, hybrid and hydrogen/fuel cell, but they will all require an expansion of the electrical systems of aircraft. It is an exciting time to be part of the aerospace industry. Nycote Laboratories has been part of aviation since the early days of the commercial jet airliner and is now poised to benefit from increased electrification, as its next generation products such as Nycote 99 Eco Shield and Nyform conformal coating have proven applications on electrical systems. These will be crucial to the durability and life expectancy of aircraft electricals when subjected to extremes of temperature, vibration and corrosive environments.

Pioneers of aircraft electrification

Looking at some of the leading projects currently certified or in late certification stages.

Textron eAviation Inc.

Textron eAviation Inc. was established to take the lead in Textron Inc.’s development of sustainably powered flight. Headquartered in Wichita, Kansas, the Textron eAviation team is keenly focused on emerging technologies that drive the development of more sustainable aviation solutions. Textron eAviation’s Nexus eVTOL is Textron eAviation's vision of advanced air mobility serving industries worldwide, with the potential to be customized for specific markets including passenger transport, military/civil defense, emergency or medical service, industrial/agricultural, and freight. The multi-purpose eVTOL uses tilt rotors to transport one pilot and four passengers from place to place at more than 120 knots.

Textron eAviation Nexus

Pipistrel

part of the Textron eAviation segment of Textron Inc., also produces the Velis Electro – which in 2020 became the world’s first, and currently only, electric aircraft to receive full type-certification from the European Union Aviation Safety Agency (EASA), and most recently received a light-sport aircraft airworthiness exemption from the Federal Aviation Administration (FAA). The aircraft is certified for Day Visual Flight Rules (VFR) operations in more than 30 countries. The Pipistrel Velis Electro is quiet, producing noise levels of only 60

Pipistrel Aircraft’s Velis Electro

decibels, low cost and user-friendly, making it an ideal solution for flight training with zero carbon emissions.

Vertical Aerospace

Vertical Aerospace, is a global aerospace and technology company pioneering electric aviation. Vertical is creating a safer, cleaner and quieter way to travel. Vertical's VX4 is a piloted, four passenger, Electric Vertical Take-Off and Landing (eVTOL) aircraft, with zero operating emissions. Vertical combines partnering with leading aerospace companies, including GKN, Honeywell and Leonardo, with developing its own proprietary battery and propeller technology to develop the world's most advanced and safest eVTOL. Vertical has c.1,500 pre-orders of the VX4, with customers across four continents, including American Airlines, Japan Airlines, GOL and Bristow. Vertical's experienced leadership team comes from top tier automotive and aerospace companies such as Rolls-Royce, Airbus, GM and Leonardo. Together they have previously certified and supported over 30 different civil and military aircraft and propulsion systems. In the medium-term increased electrification of conventional aircraft will occur with electric powered runway taxiing and more onboard systems powered by electricity. General aviation aircraft and air taxis will be fully electric while hybrid electric propulsion will be used for larger aircraft.

Vertical VX4

Archer Aviation

Archer Aviation, is designing and developing electric vertical takeoff and landing aircraft for use in urban air mobility networks. Archer's mission is to unlock the skies, freeing everyone to reimagine how they move and spend time. Archer's goal is to transform urban travel, replacing 60–90-minute commutes by car with estimated 10–20-minute electric air taxi flights that are safe, sustainable, low noise, and cost-competitive with

Archer Midnight

ground transportation. Archer's Midnight is a piloted, four-passenger aircraft designed to perform rapid back-to-back flights. It has successfully completed transition flying at a speed of 100+ mph. Midnight is believed to be one of the largest eVTOL aircraft to complete transition, which is critical to being able to carry commercially viable passenger payloads. A transition flight occurs when the aircraft takes off vertically, accelerates forward, transitions from thrust-borne to wing-borne flight like an airplane with tilt propellers forward before decelerating and landing vertically. Midnight's flight test program will now continue its progress with plans to fly simulated commercial routes to demonstrate the aircraft's operational readiness.

Archer continues to make certification progress as the company has now received its Part 135 and Part 145 certificates from the FAA. Additionally, Archer is one of two companies in the world to have its final airworthiness criteria for an eVTOL aircraft issued by the FAA. Midnight is now in the final "implementation" phase of its Type Certification program.

Originally published in Aerospace Manufacturing Magazine April 2025