Before ECHA at > https://comments.echa.europa.eu/comments_cms/AnnexXVRestrictionDossier.aspx?RObjectId=0b0236e1885e69de

Consultation on Restriction Report – Exemption / Derogation Request – Lockheed Martin Corporation

Introduction to Lockheed Martin Corporation

Lockheed Martin Corporation (Lockheed Martin) is a leading global security and aerospace and defence (A&D) company, ensuring those we serve always stay ahead of ready in the defence industry. We solve complex challenges, advance scientific discovery, and deliver innovative solutions that help our customers keep people safe and nations secure against foreign threats. Our products include but are not limited to, commercial and military aircraft, weapon systems, communications equipment, space hardware, maritime systems, energy storage systems and a sustainment and spare parts program to ensure the operability of our products for decades to come.

Discussion on Interconnectivity of Businesses and Supply Chain

Lockheed Martin's products and supply chain are very complex, amassing hundreds of first tier suppliers and thousands if not tens of thousands of second and third tier suppliers. With the globalization of supply chains, these suppliers and their goods come from a wide array of locations. As noted previously by RAC and SEAC in an opinion on a proposed restriction on hydrogenated terphenyl in March 2023[1]: "the aerospace supply chains are long and complex with many actors involved at different levels - including suppliers (importers, formulators, and distributors), downstream users, original equipment manufacturers (OEMs), design to build (DtB)) or maintenance, repair, and overhaul (MRO) providers (civilian and military) within the industry." Disruptions to these complex global supply chains cause significant costs to industry, diminish competitiveness, and can result in the inability to deliver products that are necessary for national security and public safety.

The complexity of the supply chain also often makes it difficult for Aerospace and Defence (A&D) manufacturers, OEMs, or MRO companies to identify where substances are used within final parts or assemblies (or in the early stages of their production). This is particularly challenging when dealing with a very large group of substances like PFAS (10,000+ individual substances covered in the restriction proposal). Further, as with many other industries, PFAS use has not been effectively communicated through the A&D supply chain, starting with the basic article manufacturers who often have little knowledge of the PFAS contained in the formulations they are using to make their products. In fact, many actors in A&D supply chain also have little knowledge of essential PFAS contained in the production equipment used to make those products. Regardless, the identification of PFAS within the A&D supply chain will persist long after any impending restrictions are enacted and enter into force, potentially causing significant concerns for A&D to deliver its products and services that are necessary for national security and public safety.

Discussion on Performance and Material Criticality

Lockheed Martin is reliant on formulations, materials, equipment, parts, and components that are proven successful through testing and qualification. Whether it be the displays within a commercial or military aircraft, coatings or fluids used in a combat jet aircraft, printed wire boards on naval vessels, wiring and cabling for a weapon or radar system, or the photovoltaic cells on a satellite, A&D demands

[1] https://echa.europa.eu/documents/10162/ec938800-0137-44f3-a329-c227f837a2fc

formulations, materials and products that are proven and maintain the highest level of performance and resiliency towards the harsh environments and conditions in which our products operate.

To meet these performance requirements and deliver state-of-the-art products, Lockheed Martin and the A&D industry must be able to select and utilize formulations, materials, equipment, parts, and components based on performance and qualification criteria, to ensure proper functionality, conformity with military and civilian use specifications, and the avoidance of failure. Broad prohibitions on a large class of chemicals, such as the impending restriction on PFAS may be counter to these performance objectives and is unfeasible, lacks the comprehensive science to support the overall problem statement, and is dangerous to A&D and the global customers (nations) who depend upon our products for national security and public safety.

Aside from performance-driven requirements and identification challenges of PFAS in the complex supply chain, A&D manufacturers must conform with the strictest qualification and safety protocols across all of industry. Before the production of a part or product can begin, qualification, certification, and industrialisation/implementation (including customer acceptance) must take place. Certification is a key process to ensure that aircraft, military hardware, or any other equipment parts or essential formulations comply with the required strict levels of safety and performance. Requalification may take several years to decades to identify, investigate, test, and qualify a new piece of A&D hardware or formulation manufactured with a different material or chemistry. Lastly, existing equipment including spare parts used in legacy A&D finished products must be preserved to ensure the viability of those legacy programs. It is not feasible to recertify or requalify new equipment, materials or parts used in the sustainment of legacy equipment because of a regional restriction, such as the impending restriction on PFAS as a class.

The electronic equipment, parts, and components that we procure must be able to perform not only the first time, but every time without failure, to avoid disastrous outcomes related to public safety and national security. In aircraft, space applications and in a wide variety of military systems, products must meet the most stringent standards of operational efficiency, safety, and reliability over their life cycles. Failure is simply not acceptable.

To meet these stringent requirements, Lockheed Martin must have access to the top preforming products, materials and chemistries needed to achieve its targeted objective within the boundaries of strict qualification, standardization, and performance. In many cases, PFAS and fluorine chemistry in general are unique providing the necessary chemical and physical properties required to ensure these objectives. Chemical resistance, thermal stability, low surface tension, non-reactive, residue free, and desirable dielectric properties are just a few of the material characteristics that enable PFAS-containing formulations, equipment, parts, and components to conform with the required performance elements and standardization needs. In addition, high electronegativity and low polarizability of the fluorine atom, and the strength of the carbon-fluorine bond provide desirable characteristics including resistance to (among others) extreme temperatures and pressure differentials, excellent wear, and UV protection. Alternative materials, including other halogenated materials found in formulations, equipment, parts, and components may not provide an acceptable level of performance and/or the ability to satisfy conformity requirements for the industry's numerous commercial and defence/security customers.

Support of Material and Formulation Exemptions

Fluoropolymers: Lockheed Martin supports the broad exemption request and seeks an equivalent exemption for fluoropolymers (including fluoroelastomers) as petitioned by the *Fluoropolymer Group (FPG)*, *Performance Fluoropolymer Partnership (PFP)*, *ASD (voice of European Aeronautics*, *Space*, *Security and Defence Industries)* and other industries. Fluoropolymers are believed to be too large to cross cell membranes and are therefore believed to pose less risk to human and ecological health relative to nonpolymeric PFAS (Chemours, 2021; Henry et al., 2018). PFP's supporting rationale in their Socioeconomic Report[2] and Transportation Sector (Socioeconomic) Report[3] among other published reports are compelling to support the broad exemption.

> *CASE STUDY #1* – Wires, cables (including radio frequency – RF cables), connectors, antennae, and assemblies are used in many A&D products and applications and contain one or several fluoropolymers including but not limited to PTFE and ETFE. These materials are necessary to conform with applicable standards and to protect the integrity and functionality of the cabling and wire product (among others) against harsh environmental and atmospheric conditions found in aircraft, naval systems, weapon systems, space vehicles and more. Further, the fluoropolymers aid in protection against EMI (Electromagnetic Interference) and other crosstalk, without interfering with other electronics and radio frequencies.
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> *CASE STUDY #2* – Gaskets, O-rings, seals etc. are used in many A&D products and applications and contain one or several different fluoropolymers including but not limited to PTFE and ETFE as well as fluoroelastomers and other fluorine-containing synthetic rubbers. These materials are necessary to conform with applicable (mission critical) specifications and to protect the integrity and functionality of critical engine parts, pumps, air/watertight appurtenances, and other fittings used under harsh environmental and atmospheric conditions found in aircraft, naval systems, weapon systems, space vehicles and more. Conforming fluoropolymer seals, gaskets, O-rings, etc. are necessary for military and other A&D uses and must be preserved.
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> *CASE STUDY #3* - Fluorocarbon elastomers (fluoroelastomers) including but not limited to FKM and FFKM are highly fluorinated, carbon backboned polymers used in applications to resist harsh chemical and ozone attack and have a high thermal stability index. Fluoroelastomers are used throughout A&D to provide operational flexibility to products used in harsh environmental conditions including aircraft, naval systems, weapon systems and space vehicles, such as satellites. Fluoroelastomers are critical to Lockheed Martin products and sustainment programs to conform with applicable specifications and deliver superior performance.

Support of Sectorial Exemptions and Derogations

Electronics: Lockheed Martin supports the broad exemption and/or maximum time derogation *(with a technology readiness adjustment option to extend)* request and seeks an equivalent exemption/derogation as petitioned by the electronics and semiconductor industries such as *Digital Europe*, *IPC*, *SIA*, and others. Lockheed Martin further supports the justification and rationale on usage of PFAS found in electronics as provided by IPC. Lockheed Martin depends on the electronics and semiconductor industry to provide critical electronic parts and components that conform to broad A&D

[2] https://fluoropolymerpartnership.com/wp-content/uploads/2020/03/Socio-Economic-Assessment-of-the-US-Fluoropolymer-Industry-Executive-Summary.pdf

[3] https://fluoropolymerpartnership.com/wp-content/uploads/2020/08/031820-SEA-Transportation-Infographic.pdf

specifications, perform under harsh environmental and atmospheric conditions, and support the sustainment of legacy products for decades to come. The availability of A&D conforming electronics parts, integrated circuits, and components, among others are critical to the delivery and sustainment of finished military products and hardware, including but not limited to fixed and rotary wing aircraft, naval systems, weapon systems and space vehicles, such as satellites.

> CASE STUDY #4 – Lockheed Martin procures numerous printed wire boards (PWB) and other equipment with embedded PWBs. PWBs may contain PFAS for structural purposes on the laminate materials as well as for dielectric properties and to protect against temperature, moisture, and dust. While some PWB manufacturers are seeking alternative materials, it is unclear whether such materials will be available to A&D in a timely manner to test and requalify military and other hardware. Furthermore, spare parts utilizing the original design and composition must be available for legacy equipment under sustainment programs.
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> CASE STUDY #5 – Lockheed Martin procures and utilizes numerous OEMs displays and monitoring equipment in our complex products, including many of our military products. Some liquid crystal and flat panel displays may contain and/or be manufactured with PFAS. Procurement of these displays for use in existing and legacy military products (for example) is business and mission critical and must not be disrupted by unproven and unqualified technologies or materials.
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> CASE STUDY #6 – Lockheed Martin procures and manufactures integrated circuits. PFAS are used throughout the chip fabrication process. Due to their unique physiochemical properties, PFAS may be found in the photoresist, antireflective coatings, developers, etchants, and other formulations used to manufacture integrated circuits. Lockheed Martin supports the information (white papers) including rationale for usage of PFAS in chip fabrication, as published by the Semiconductor PFAS Consortium[4] of the Semiconductor Industries Association (SIA) in support of a broad exemption, especially for military equipment, hardware, and products.

Support of Spare Parts Exemptions

Spare parts: A&D products, in particular military products have very long service lives, and the availability of spare parts are critical to the maintenance, repair, and overhaul (MRO) of these products. Products typically have decades long service lives meaning that a continuous supply of parts and material of original design and composition must be available for their operation until the end of service life. All spare parts and materials are generally required to be as per the original design specification in all key aspects including physical, chemical, surface wear, life, reliability and compatibility with adjacent materials and components.

Lockheed Martin supports the broad exemption request for spare parts and supporting rationale provided by *ASD (voice of European Aeronautics, Space, Security and Defence Industries), the Aerospace Industries Association (AIA), the International Aerospace Environmental Group (IAEG)*[5] and other industries. Lockheed Martin requests an equivalent exemption for spare parts across A&D.

Lockheed Martin Specific Uses

[4] https://www.semiconductors.org/pfas/

[5] https://www.iaeg.com/workgroups/wg5/activities

Lockheed Martin provides the following specific use case examples of PFAS. In combination with the specific use cases listed below, we support the broad exemption requests and seek an equivalent exemption like the polymer industry (i.e., FPG, PFP) and the A&D industries (i.e., ASD, AIA, IAEG) for all polymeric forms of PFAS, including formulations and articles. Additionally, we request a full exemption for all spare parts and materials used in the sustainment and MRO of existing and legacy products. We further request a broad exemption for military products and/or maximum time derogation *(with a technology readiness adjustment option to extend)* for other A&D products containing PFAS, including perfluoroalkyl substances.

NOTE: This list is intended to provide examples of PFAS containing products and applications at Lockheed Martin. The list is not all inclusive.

Specific use case	**Application area (not all inclusive)**	**PFAS**
Wires, cables (including RF cables), wire harnesses, cushioning substrate, and other plastic components	Fixed and rotary wing aircraft, weapon systems, naval systems, including radars, communication devices, ground transportation, and space hardware including satellites	Fluoropolymers, particularly PTFE and ETFE
Hydraulic hoses and seals	All hydraulic systems in A&D including military products	Fluoropolymers, particularly PTFE and ETFE Fluorosilicone (seals)
Seals, O-rings, gaskets and similar	Hydraulic and fuel systems, engine components, propulsion system for space vehicles and rockets, elsewhere where necessary to protect against water and atmospheric condition	Fluoropolymers, including fluoroelastomers (various)
Heat transfer fluids & and dielectrics	Aircraft cooling systems, heat transfer equipment, electronic cooling devices, instrumentation cryogenics, capacitors, RF transmission equipment, steering systems, braking systems	Perfluorocarbons Perfluoroethers Hydrofluoroethers (HFEs) Triclorotrifluoroethane Fluoropolymers (general) Perfluoro compounds (C5-C18)
Hydraulic fluids	Aviation hydraulic systems	Fluorinated phosphate-esters, perfluoroalkanes and salts Other perfluoro compounds potentially including fluorotelomers and surfactants
Electronic equipment	All electronic equipment in A&D plus military products, including displays, PWBs, monitors, equipment housing, etc.	Fluoropolymers (various)
Oils, greases and lubricants	Missile lubrication systems, engines, bearings, gears, ball screws, pumps	Synthetic perfluoropolyether- (PFPE) Poly[oxy]trifluoro(trifluoromethyl) and trifluormethylene compounds PTFE and other fluoropolymers
Surface coatings	Aircraft primers and topcoats to protect base material and provide reflective and anti-static properties. Moisture barrier coatings. Topcoats (proprietary). PTFE-filled polyurethane coatings are used on aircraft part surfaces where low friction, abrasion resistance, chemical resistance, erosion resistance, and impact resistance are required. PTFE coatings are also used on flight control cables and other surfaces to prevent fretting. Fretting can result in excessive wear, surface	Fluoropolymers (PTFE) Parachlorobenzotrifluoride (PCBTF) Proprietary PFAS

Specific use case	Application area (not all inclusive)	PFAS
	fatigue and component fracture. Critical components such as flight controls, powerplant controls and tail surfaces are susceptible because they are exposed to vibratory motions associated with fretting. Specialized conductive coatings for EMI/EMC protection.	
Erosion resistant coatings, abrasion resistant coatings	Airframe: areas subject to abrasion and erosion (e.g. leading edges, flap / slat mechanisms)	Fluoropolymers (PTFE, others) Fluoroelastomers (FKM, FFKM)
Life-saving equipment and TULAC (Textiles, Upholstery, Leather, Apparel, Carpets)	Seatbelts, life jackets, pilot jump suits, PPE, firefighting equipment	Fluoropolymers, particularly PTFE
Cleaning agents	Electronic contact cleaners, cold immersion cleaners (aerosol and liquid) flux/maskant removal products, general cleaning where hydrophobic solvents are required (space and other products)	Hydrofluoroethers (HFEs) Perfluoroethers Perfluoro compounds (C5-C18) Other perfluoroalkyl substances
Mold release agents	Processing materials for composite production, prepregs, FRP products. Solid and perforated films are used to release composite aircraft parts and vacuum bagging materials from molds, after the curing operation.	Fluoropolymers, particularly PTFE
Structural adhesive films, pressure sensitive tapes, other tapes	Fuel systems, other areas subject to abrasion, composites, and honeycomb structure bonding. Adhesive bonding systems used for structural components contain thermosetting modified epoxy adhesives. PFAS compounds are used in the manufacture of these resin systems. Structural adhesives are used to bond metals, honeycomb and composites and provide lightweight structures that are resistant to temperature and other environmental extremes. Metallic tapes.	Hexafluoropropene tetrafluroethene polymer Proprietary PFAS Fluoropolymer (PTFE, ETFE, others)
Sealants / Dry Film	Thread locking agents, anti-seize compounds. Dry films for moisture barrier.	Fluoropolymers, particularly PTFE
Ceramics, including coated ceramics/fibers	Radome covers. PTFE impregnated glass tape is used to secure parts in the autoclave vacuum bag. Tapes have high dielectric and tensile strength and good performance at high autoclave temperatures. Acrylic adhesives have limited use, may pose tooling maintenance issues, and do not replace the PTFE within the tape system.	Fluoropolymers, particularly PTFE and ETFE
Batteries	Lithium-ion batteries, binder, and separator coatings	PVDF PTFE
Energized devices	Primers, squibs, cartridges	Fluoropolymers
Refrigerants	On-board refrigeration, aircraft support equipment, mobile transport military equipment	HFCs Olefins (HFOs and HCFOs) Trifluoroacetic acid (TFA)