

Industrial Products
Aerospace and Defence

Aerospace and Defence

Sector climate change responses



Background

Many aerospace and defence companies are already taking pro-active steps to reduce greenhouse gas (GHG) emissions and energy consumption. For the aerospace industry, improving the fuel efficiency and emissions profile of aircraft is a major area of focus. Significant progress has already been made. Today's jets are 70% more fuel efficient than those produced 40 years ago, however further improvements are planned. The International Civil Aviation Organization (ICAO) is leading industry efforts and has been tasked by the UN to coordinate emissions regulation for the industry. At a high-level meeting on International Aviation and Climate Change held in Montreal in October 2009, the ICAO affirmed the collective commitments announced on behalf of the international commercial air transport industry:

- A cap on aviation CO₂ emissions starting in 2020 (carbon-neutral growth)
- An average improvement in fuel efficiency of 1.5% per year from 2009 to 2020
- A reduction in CO₂ emissions of 50% by 2050 relative to 2005 levels.

The business aviation community also announced similar targets, sharing the goal of carbon-neutral growth by 2020, and committing to an average increase in fuel efficiency of 2% per year from 2009 until 2020 and a reduction in total CO₂ emissions by 50% by 2050 relative to 2005.

The ICAO also intends to establish a process to develop a framework for market-based measures in international aviation. As noted in the main document, passenger and cargo operators flying within Europe already need to cope with the impending inclusion of aviation operators in the EU Emissions Trading System (EU-ETS). Given that the ICAO has not yet developed an international scheme, the EU has moved forward and extended its emissions trading scheme to aviation beginning in 2014. Inclusion of airlines into the EU-ETS will create new assets and liabilities on the balance sheet worth around \$4.5 billion per year at current prices. Not all airlines will be impacted equally; those already making investments in a fuel-efficient fleet will be less affected.

Massive research efforts are looking to drive technological advances – for example the Clean Sky Joint Technology Initiative (JTI), a combined effort shared between the European Commission and industry, is dedicating an estimated 1.6 billion Euros to researching 'breakthrough developments' across the entire aeronautic supply chain. At the same time, many efforts are also being made to better employ existing technology. The aviation industry is actively seeking to improve the carbon profile of existing aircraft and aerospace companies are providing solutions, such as retrofitting existing aircraft wings with new winglets, which reduce drag and improve fuel efficiency. Aerospace companies are also refining aircraft operation specifications to include fuel saving attributes, e.g. continuous descent, weight reduction, maintenance actions, flight planning accuracy, fuel planning and routing etc. Infrastructure to support these approaches are already being developed through the Single European Sky and US NextGen projects, and indeed the aviation industry has stressed the importance of streamlining air traffic control processes to reduce fuel use.

Many aerospace companies are now using a lifecycle management approach in the development of energy efficient aircraft and engines. With more efficient aircraft fleets, there will be a growing interest in an industry-wide system of aircraft product eco-labelling, which could play an important role in demonstrating the industry's carbon footprint efficiencies. Efforts to reduce environmental impact don't stop when the working day ends – some companies are also actively encouraging employees to monitor and reduce their own carbon footprints, through greener commuting initiatives, for example.

The defence industry is also taking action. Many defence companies are improving their own energy efficiency and reducing GHG emissions, and helping customers do the same. Monitoring technologies now in use in the oceans, atmosphere, and even outer space are contributing to a greater understanding of the impacts of climate change. The stakes are likely to get higher, though.

Climate change and 'energy security' are at the top of the agenda for many governments. In the US, the most recent Quadrennial Defense Review Report (QDR), the document

that outlines the strategic focus of the US military once every four years, identified crafting a strategic approach to climate change as an issue that requires particular attention. According to the report, “climate change will shape the operating environment, roles, and missions that we undertake.” More frequent severe weather events will necessitate humanitarian assistance, and changing climate conditions may destabilise some regions and act as an ‘accelerant’ to conflict.

Further, the US Department of Defense acknowledges that it “will need to adjust to the impacts of climate change on our facilities and military capabilities.” This

will mean dramatically increasing energy efficiency, both in permanent infrastructure and in forward operations – indeed, the potential exists for the military sector to develop innovative energy efficiency and renewable energy projects that could be leveraged across the private sector. In the UK, in March 2010 the Armed Forces announced that it will be “doing its bit to address climate change” by implementing a Sustainable Procurement Strategy. Defence contractors will need to leverage strong existing core skills in areas such as control and automation and robust research and development (R&D) processes to offer solutions with a reduced carbon footprint.

Aerospace and Defence companies’ inclusion in external sustainability indices/programmes

Company	Listed on a Dow Jones Sustainability Index	Carbon Disclosure Project Leadership Index Score	Pew Center for Global Climate Change Business Environmental Leadership Council (BELC) Member	UN Caring for Climate Signatory
BAE Systems	√	56		
Boeing	√	87	√	
Bombardier	√	‘Sector leader’		
EADS	√	69		√
Lockheed Martin		NR	√	
Northrop Grumman		42		
Raytheon		48		
Thales		49		√
United Technologies Corporation (UTC)	√	70	√	

Note: Bombardier was not included in the sample for the CDP 2009 Industry Snapshots, but was listed as a Carbon Disclosure Leader in the Carbon Disclosure Project Report 2009: Canada 200. NR indicates did not respond to CDP request for information

Sources: PwC/SAM sustainability investing, The Sustainability Yearbook 2010; Carbon Disclosure Project, CDP 2009 Industry Snapshots – Global 500/S&P 500/FTSE 350; CDP 2009 Europe 300; CDP 2009 Canada 200 Pew Center for Global Climate Change website (http://www.pewclimate.org/companies_leading_the_way_belc/company_profiles); UN Global Compact website (http://www.unglobalcompact.org/Issues/Environment/Climate_Change/list_of_signatories.html)

A black helicopter is shown in flight, viewed from a low angle, against a clear blue sky. The helicopter's main rotor blades are blurred, indicating motion. Below the helicopter, a thick layer of white clouds covers the ground, with some distant mountain peaks visible through the haze. The overall scene is bright and clear.

Featured Company Highlights

Note on methodology: We reviewed information publicly available on company websites in May/June 2010, including annual reports and sustainability reports for a number of leading companies in the aerospace and defence industry, in order to provide a brief overview of what actions the industry is taking. Companies are featured where extensive information was available. The information in this report represents a snapshot of activities and approaches to addressing climate change; it does not provide a comprehensive list of every measure currently being undertaken nor does it provide assurance of the accuracy of the data provided by individual companies.

Featured Company: BAE Systems

Key achievements and targets: Goals set to reduce emissions generated via business travel and to improve the efficiency of offices and manufacturing sites. New office and manufacturing sites are designed to reduce environmental impacts and running costs. For example, according to the company, the low-energy buildings at their Samesbury site make maximum use of daylight whilst minimising solar gain and use night-time cooling and natural ventilation to reduce use of air conditioning. Similar techniques used in Quantico, Virginia, led to a LEED (Leadership in Energy and Environmental Design) Gold certification. Piloted an Environmental Sustainability Framework in the UK to improve planning for medium and long term risk and opportunities, including climate change. The framework addresses issues around both operations and product lines and will be rolled out across the company.

Research directions: Partnering with the University of Central Lancashire to develop intelligent energy management systems.

Collaboration with government, trade associations, etc.: Participated in the UK Supply Chain Carbon Disclosure project with indirect suppliers (companies who supply goods and services not related to the company's own products).

Green product offerings: 'Advanced Energy Solutions' – look to help customers improve productions, distribution, storing, management and control of energy resources.

Reporting: In 2009, commissioned The Coefficient Company to calculate the company's carbon footprint (third time running) and improve data collection. Sustainability report is verified by an external third-party. Data is reported to the Carbon Disclosure Project.

Renewable energy: Energy-efficient, renewable heating systems, such as a biomass-based boiler, in use at some sites. Small-scale wind turbines and solar panels are also in use at some sites, and the company is exploring options for more extensive use of wind power.

“We want to be recognised as a company committed to developing a culture of Total Performance. Responsible Behaviour is embedded as part of our Company Strategy. We remain firmly committed to becoming recognised as a leader in responsible business conduct.”

Ian King
Chief Executive Officer
BAE Systems

Featured Company: Boeing

Key achievements and targets: Since 2002, Boeing has reduced CO₂ emissions by 31% and energy consumption by 32% (on a revenue-adjusted basis). Since 2002, Boeing has reduced CO₂ emissions by 10.1% on an absolute basis. To calculate CO₂ emissions at major US locations, Boeing uses measurements of electricity consumption, natural gas use and fuel oil. In 2009, Boeing reduced absolute energy consumption by 0.3%.

Five-year goal to reduce GHG emissions intensity at major manufacturing facilities in the US by 25% (on a revenue adjusted basis) and to reduce energy consumption by 25% (on a revenue-adjusted basis) for the period between 2007 and 2012.

Programmes in place to reduce company business travel and encourage greener commuting option. Overall goal for the five year period between 2008 and 2012 to achieve an 18% increase in employee participation in commuting programs and a 5% annual reduction in distances driven by employees to commute to work.

In 2009, adopted the standard that all new construction and major renovation projects at Boeing owned buildings in the US will conform to the US Green Building Council's LEED Silver rating or higher.

Research directions: Key technology programmes are addressing lightweight advanced materials, aerodynamics, aircraft emissions, efficient aircraft operations, noise reduction, passenger comfort, solar cells, fuel cells, sustainable manufacturing processes and materials, and recycling and reuse of Boeing products. Strong focus on research around sustainable biofuels produced from algae and other renewable resources that do not compete with food crops for land or water. Research also addressing environmental concerns throughout the life cycle of the company's products. More than 75% of Boeing Commercial Airplanes' research and development effectively contributes to improved environmental performance.

Innovative use of new technologies: Tested enhanced air traffic control systems at major airports in Australia, Europe and North America. In test flights at one airport

four carriers reduced fuel consumption by 1.1 million pounds (495,000 kilograms) and lowered CO₂ emissions by nearly 3.6 million pounds (nearly 1.6 million kilograms) over a one year period. Piloting use of biofuels in aircraft; five airlines have flown Boeing jetliners with sustainable fuels in the past two years and the US military has also tested biofuel in an F/A-18 Super Hornet flight by the US Navy on Earth Day. Working with US Department of Energy and utilities to provide smart grid technology to improve the efficiency and security of power distribution systems. Adapting the clean technology that powers satellites and the International Space Station to produce the most efficient way to convert sunlight into electricity on Earth.

Collaboration with government, trade associations, etc.: Participates in the Pew Center on Global Climate Change Business Environmental Council. Member of the US EPA Climate Leaders programme and US EPA Green Building Council. On the board of the World Business Council for Sustainable Development (WBCSD). Working with biofuel research programs at 13 universities and institutions in the US, Australia, Europe, the Middle East, India and China. Boeing also works with leading experts at other companies to conduct laboratory research and engine tests with sustainable biofuels. Collaborates with the US Air Force Research Lab. Founding member of the Sustainable Aviation Fuel Users Group and participates in the Commercial Aviation Alternative Fuels Initiative. Sponsors and serves on the board of the Algal Biomass Organization. Member of the Roundtable on Sustainable Biofuels. On the board of the Air Transport Action Group (ATAG). Founding member of the Aircraft Fleet Recycling Association.

Green product offerings: Integration of environmentally progressive technologies in current airplanes, such as advanced technology 'Blended Winglets' which lower total fuel use and CO₂ emissions. Also offering Retrofit Performance Improvement packages. The company estimates that on the typical 777-200ER, the Performance Improvement Packages reduce fuel use by approximately 1 million pounds and CO₂ emissions by 3 million pounds annually. Airplane Health Management (AHM) Performance Monitoring Module, a system to automate

and enhance fuel and CO₂ emissions performance monitoring by airline personnel. Remarketed (returned to service) planes.

Reporting: In their 2009 Sustainability Report, Boeing used measurements of electricity consumption and natural gas use (and fuel oil where applicable) to calculate CO₂ emissions from major US facilities. The energy consumption at those facilities in 2008 resulted in 1.29 million metric tonnes of CO₂. Boeing reports publicly as part of the Carbon Disclosure Project and was one of 3 industrials companies to score highest on a new pilot ‘performance’ rating in the CDP Industrials sector report 2009. Boeing was named the best performing industrial company and also named to the 2009 Global Carbon Disclosure Leadership Index.

Renewable energy: Actively researching alternative fuels (including advanced generation biofuels, solar cells). Pioneering advancements in solar cells, fuel cells and environmentally progressive energy sources offering the potential to reduce GHG emissions and conserve resources. Recently formed Energy Solutions group, part of Boeing Defense, Space & Security, which is developing innovative solutions to increase the efficiency and security of local, regional and national energy systems. Spectrolab, a wholly owned subsidiary, is one of the world’s leading manufacturers of solar cells and panels, powering everything from satellites to renewable solar energy projects in Arizona and California. Spectrolab’s terrestrial concentrator cells currently hold the world’s record with 41.6% efficiency in converting sunlight to electricity.

“Operation of Boeing products represents our biggest potential impact on the environment and our greatest opportunity for a positive change. Commercial aviation accounts for 2 percent of man-made greenhouse gas emissions, and our industry is addressing this issue with credible actions.

Aerospace was the only industry to present a clear plan to the United Nations Climate Change Conference in Copenhagen. We called for global guidelines placing tough fuel-efficiency standards on new airplane designs, improvements in the global air traffic control system to cut air travel-related CO₂ emissions by 12 percent, and continued efforts to commercialize sustainable biofuels – all with the aim of achieving carbon-neutral growth across the industry by 2020.

Even though the world did not reach a comprehensive agreement, we are pushing forward.”

Jim McNerney
Chairman, President and Chief Executive Officer

Mary Armstrong
Vice President, Environment, Health and Safety

The Boeing Company

Featured Company: Bombardier

Key achievements and targets: Set a five-year 15% overall reduction target in FY2004. Reduced GHG emissions by 10%, or approximately 45 kilotonnes, short of the goal due to increases in aerospace production volumes. The company has developed a global Energy and Carbon Management Strategy based upon improved energy efficiency, improved use of renewable energy sources, and carbon offsetting if required.

Set a goal to reduce energy consumption and GHG emissions by an additional 10% between FY2010 and 2015. In 2010, will also adopt company-wide green building guidelines for new facilities.

Research directions: R&D product innovation engineering team using Design for Environment (DfE) guidelines to meet increasingly stringent environmental regulations for aircraft and enhance emissions and fuel efficiency on new products (C-Series commercial jets, CRJ NextGen and Q400 NextGen, Learjet 85 business jet).

Innovative use of new technologies: Conducted civil aviation's first test flight equipped with an all-electric braking system, technology which supports a more fuel-efficient, cleaner-burning aircraft and reduces the use of toxic hydraulic fluids.

Collaboration with government, trade associations, etc.: Signatory of UN Global Compact, listed on Dow Jones Sustainability Index.

Green product offerings: Q400 NextGen turboprop and CRJ NextGen regional jet, new C-Series of regional jets will provide substantially lower fuel consumption and achieve up to 30% reduced carbon dioxide emissions. Also offers a carbon offsetting programme.

Reporting: Uses FY2009 data to perform a detailed inventory of energy sources and GHG emissions at 85 sites, including manufacturing sites, major service locations and offices.

Report is indexed to Global Reporting Initiative (GRI) Guidelines. Company also reports to the Carbon Disclosure Project and was a 2009 Canada 200 Climate Disclosure Leader – High Carbon Impact Sectors.

Renewable energy: Increased use of renewable energy, one of three pillars of the company's Energy and Carbon Management strategy. In 2009, the company reported it is currently conducting an inventory of the renewable energy sources in the countries of operations, in order to assess the feasibility of progressively switching to this type of energy. Renewable energy usage accounted for approximately 29% of energy usage in 2009.

“As a global leader in aircraft manufacturing, we are duty-bound to play a role in addressing our industry's sustainability challenges. This includes working with industry partners to develop a global vision for carbon-neutral growth and set international environmental targets. In the years to come, our new and more fuel-efficient C-Series and Learjet 85 aircraft will help our customers meet these targets.”

Guy C. Hachey
President and Chief Operating Officer
Bombardier Aerospace

Featured Company: EADS (including Airbus)

Key achievements and targets: Group aiming to reduce energy usage considerably in order to decouple its impact from projected growth. Numerous improvement programmes have been initiated to cut the energy and carbon footprint of facilities, in order to identify potential improvements, design new environmentally friendly and energy-efficient infrastructures and promote renewable sources of energy, such as the installation of solar panels on new buildings in Spain.

Vision 2020 Targets include a commitment to reduce CO₂ emissions from industrial operations by 50% between 2006 and 2020, and reduce energy consumption 30%.

Vision 2020 also includes product targets:

- Research and technology targets compatible with the ACARE goals for aviation, including 50% reduction in CO₂ by 2020 (using 2000 as a baseline),
- Developing eco-efficient solutions for core and adjacent customer segments.

Research directions: As much as 80% of the research and technology budgets in the Airbus and Eurocopter Divisions are now devoted to finding ways to increase eco-efficiency and reduce pollution. Strong efforts around alternative fuels, including fuel cells and biofuels. Several EADS Divisions participating in the EU-funded Clean Sky JTI. Participating in a project designed to measure some of the other impacts that can influence climate change, called MOZAIC (Measurements of OZone, water vapour, carbon monoxide and nitrogen oxides by in-service Airbus airCraft). By fitting A340 long-range aircraft

with special sensors, MOZAIC measures the chemical composition of the atmosphere in order to provide a better climate forecast.

Astrium technologies under development to generate 'green' energy through the use of satellites that collect solar energy and redirect it towards the ground, using laser beams and special mirrors.

Innovative use of new technologies: Bluecopter demonstrator unveiled at June 2009's Paris Le Bourget Air Show, including a fuel-efficient, low-emission propulsion system. In the near future, Bluecopter could herald a new helicopter with 40% lower fuel consumption. Airbus and Qatar Airlines successfully conducted the world's first commercial flight powered by a cleaner gas-to-liquid fuel blend (biofuel) in October 2009. Airbus's Stade plant near Hamburg, in Germany using a combined heat and power (CHP) unit, to achieve a step change in energy efficiency in the production of carbon fibre reinforced plastic (CFRP). Astrium technology used to join together composite parts in huge space launchers now being applied to the large blades of wind turbines, allowing blades to be prepared in several parts and assembled in the field. This allows the design of much larger blades (of up to 80 metres rather than 30-40 metres previously), making wind turbines with capacities over 100 MW economically feasible, which is especially valuable for offshore operations.

Collaboration with government, trade associations, etc.: Member of the Clean Sky JTI. Actively involved in discussions for the Copenhagen COP 15 climate change

conference through participation in the ATAG and the ICAO and also preparing for COP 16 in Cancun, Mexico. Airbus is a partner of the Atlantic Interoperability Initiative to Reduce Emissions (AIRE) proposed by the European Commission and the US Federal Aviation Administration (FAA). EADS also a signatory of the UN Global Compact, including the Caring for Climate Initiative. EADS has leading roles in the Single European Sky ATM Research (SESAR) project, which is developing the technology for Single European Sky.

Green product offerings: More fuel efficient aircraft, retrofitting solutions to improve efficiency of existing aircraft. Satellites for use in measuring climate change impacts and monitoring global forest cover.

Reporting: Report uses GRI – G3 Sustainability Reporting Guidelines; a selection of key environmental indicators is verified by an external auditor. Assisting development of new WBCSD/World Resources Institute (WRI) standards for accounting for Scope 3 and Product Life Cycle emissions and taking part in road test.

Renewable energy: Actively researching alternative energy such as sustainable biofuels and fuel cells. Also using renewable solutions in own manufacturing settings, for example, the final assembly line for Airbus' A350 XWB will use 22,000 square metres of roof-mounted photovoltaic solar panels, generating 55% of its own power.

“As one of the world’s largest aerospace and defence groups, we are involved in some of the most critical questions of our times – sustainable mobility, the security of nation states and the evolution to a ‘green’ economy. We recognise the responsibility to society that our position implies, and are excited about the opportunities presented by the global changes taking place.

We are energetically transforming our businesses and products so that they lead the way towards a sustainable future: we integrate the concept of eco-efficiency in the culture of our businesses; we develop quieter aircraft that emit less greenhouse gas; and we build security products that protect people from emerging threats. In all fields, we are committed to meeting and even exceeding social and statutory requirements, to ensure that we act as a responsible citizen.”

Louis Gallois
Chief Executive Officer
EADS

Featured Company: Lockheed Martin

Key achievements and targets: Absolute goals to reduce waste, water and CO₂ emissions by 25% by 2012 from a base year of 2007.

Pledge to reduce the Corporation's GHG emissions by 30% per dollar of revenue by 2010.

Currently implementing best practices to reduce carbon emissions associated with fleet operations; in one example, the company replaced internal combustion vehicles used within a facility with electric scooters, resulting in significant savings.

The company is also improving building energy management systems and lighting. In addition a new 'server virtualization program' saved more than 11 million kilowatt-hours of electricity.

Research directions: Partnering with the MIT Energy Initiative on research in the areas of climate change and alternative energies, as well as energy storage and management.

Innovative use of new technologies: Selected by NASA to design, build and operate the spacecraft for NASA's Mars Atmosphere and Volatile Evolution (MAVEN) programme. MAVEN will analyse the upper atmosphere with a view to understanding past climate change on Mars.

Has proposed a conceptual design for the Integrated Ocean Observing System (IOOS), the first step in a proposed multiyear program to build an integrated environment for the collection, distribution and application of coastal and ocean information. Information collected by the system is intended to help improve predictions of climate change and weather, and better understand the effect of these elements on coastal communities and the nation.

Collaboration with government, trade associations, etc.: Member of the EPA Climate Leaders programme.

Green product offerings: Energy efficiency, management, next-generation alternative energy generation, and climate monitoring.

Reporting: Energy, Environment, Safety & Health Sustainability Report follows GRI Guidelines.

Renewable energy: Comprehensive approach to increasing use of renewable energy sources, including the sun, wind, moving water, organic plant and waste material (biomass), and the earth's heat (geothermal). The company now operates a biomass boiler system at a 1.8-million-square-foot Lockheed Martin facility in Owego, N.Y. The system is expected to decrease the facility's carbon footprint by 9,000 metric tonnes a year. In Sunnyvale, Calif., an on-site solar plant designed to reduce energy usage is expected to generate savings of 1.3 million kilowatt-hours of energy per year.

'Green power' represents around 5% of the company's total electricity purchases.

"Each year, we set goals and objectives to reduce injuries and accidents, energy usage, waste and our carbon impact on the environment. We integrate these goals into our regular business planning and day-to-day operations so that they remain "front and center" - as important to our business as sales and profit. Our proactive approach is making a difference. (...) Lockheed Martin has invested \$40 million in energy efficiency programs that save 125 million kilowatt hours of energy annually - enough to power 10,000 homes - and reduce our carbon dioxide emissions by 96,000 metric tons."

Bob Stevens
Chairman and Chief Executive Officer
Lockheed Martin

Featured Company: Northrop Grumman

Key achievements and targets: Energy consumption reduced through a variety of programmes including the Flexible Office program (Using alternate work weeks, telecommuting and commuter services programs) and the Managed Print Services (MPS) programme. By the end of 2009, more than 40% of company sites had launched MPS, resulting in the use of fewer electronic devices and reducing energy consumption. Approximately 60% of lamps have been replaced with high efficiency bulbs. Also using load consolidation programmes to reduce freight miles – in 2009 these measures cut 1.85 million freight miles, translating to a substantial reduction in GHG emissions. Also installing reflective roof systems to reduce the need for air-conditioning.

In 2009, Northrop Grumman established a five-year commitment to reduce its GHG intensity by 25%. GHG emissions (Scope One and Two) are to be calculated in carbon dioxide equivalent terms (CO₂e), normalised by sales and measured against a 2008 baseline.

greeNG programme established in 2008 to drive sustainability efforts across the company.

Innovative use of new technologies: Introduced Global Hawk unmanned aircraft system to be used for environmental science research, including collecting data to help understand climate change. Provided the Northrop Grumman-built flight cryocooler for Japan's Ibuki, also known as the Greenhouse Gases Observing Satellite, which will monitor global warming. The Northrop Grumman cryocooler enables Ibuki to gather data critical to understanding how carbon dioxide is affecting the environment.

Collaboration with government, trade associations, etc.: Partnering with the Earthwatch Institute on a programme that provides educators with hands-on experience around environmental issues, such as participation in an expedition studying 'Climate Change on the Arctic's Edge.'

Green product offerings: Climate sensors (i.e. Clouds and the Earth's Radiant Energy System (CERES) sensor), amphibious assault ship powered by a gas-turbine engine and electric drive, Global Hawk unmanned aircraft system (suitable for long-duration flights to collect atmospheric and climate data), etc.

Reporting: In 2009, the company implemented a GHG inventory system based on the Carbonnetworks toolset, which follows the WRI protocols. The company was able to capture 95% of emissions to establish a robust 2008 baseline for future comparisons. Reports to the Carbon Disclosure Project. Reporting follows GRI guidelines.

At Northrop Grumman, we are focused on both outstanding performance and our increasing commitment to environmental sustainability. ...

To further ensure emphasis on and accountability for environmental sustainability, the company has implemented a Performance Dashboard that contains six critical operating metrics along with several financial metrics. Because of its importance to our performance, sustainability represents one of the six operating metrics, performance against which will be tied directly to the company's annual incentive compensation plan for its top leaders. Progress will be measured quarterly and annually, and reported each year in our Corporate Social Responsibility Report.

'Responsible Steward – Environment', Northrop Grumman Corporate Social Responsibility Report, 2009

Featured Company: Raytheon

Key achievements and targets: Comprehensive programme of energy conservation and improved efficiency. Company-wide ‘Enterprise Energy Team’ leading efforts, including projects such as high-efficiency lighting; variable speed drives for motors, pumps and fans; premium efficiency motors; and state-of-the-art automated energy management and control systems. Employee awareness programmes such as the company’s ‘Energy Citizens’ campaign to raise energy awareness and encourage employees to make a personal commitment to minimising his or her personal impact on the environment.

Beginning in 2009, now reporting progress toward a number of long-term sustainability goals, with a baseline year of 2008, including a reduction of total GHG emissions by 10% by 2015 (not normalised by revenue).

Absolute energy consumption down almost 3% in 2009 and GHG emissions were down 2% in 2009 from 2008 levels. Since 2002, have reduced GHG emissions 20% (not normalised by revenue). When measured on a per dollar revenue basis, the company reduced its energy use 10% in 2009. Since 2002, the energy per dollar revenue reduction has been 38%.

Innovative use of new technologies: ‘Green IT’ programme re-designed company data centers to increase energy efficiency and automate the power-down of desktop computers in the evenings and on weekends. Global Aerosol Polarimetry Sensor to help measure the impact of aerosols on global climate change when deployed from space.

Collaboration with government, trade associations, etc.: Actively involved in the US EPA Climate Leaders programme.

Green product offerings: Tempwave systems – radiant heating systems using radio frequency waves that warm crops to protect the growing season. The National Polar-orbiting Operational Environmental Satellite System

(NPOESS), a satellite system used to monitor global environmental conditions.

Reporting: As part of Climate Leaders programme, developed comprehensive GHG inventories based on standards developed by the WRI and WBSCD. Measures emissions in metric tonne/\$B Revenue.

Renewable energy: Exploring greening the company energy portfolio through renewable energy sources such as solar, wind, fuel cells, and geothermal. Also looking at other opportunities for on-site renewable energy projects in company facilities.

“The Raytheon team continued to make significant progress in corporate responsibility in 2009—progress we have measured to gauge our success in meeting the high standards we set for ourselves. Our guiding principle is that we have a responsibility to make our company and our world better for those who follow us.”

William H. Swanson
Chairman and Chief Executive Officer
Raytheon

Featured Company: Thales

Key achievements and targets: Company-wide programme for improving energy efficiency since 2005, reinforced with the launch of the Energy/Climate Change programme in 2007, including formal targets.

Progress towards targets as of end 2009:

- 7% reduction in energy consumption (2010 target:10%)
- 12% reduction in CO₂ emissions from buildings and processes (2010 target:10%)
- 8.7% reduction in per capital CO₂ emissions from professional travel

Has performed a number of energy audits and is making a range of efforts on parameters such as heating temperature, equipment operating hours and the replacement of energy-consuming equipment to better optimise energy use.

A new, combined site for three Thales companies in the UK, known as project 'Sapphire' and designed to limit environmental impact, was launched in 2009. New buildings at the site were designed to limit energy consumption, for example by controlling light and air conditioning. In parallel, the site rolled out the "Green Travel" programme in July 2009 to reduce the environmental impact of staff commuting. Carpoolers have priority for parking spaces, and employees are encouraged to bike or take the train to work. Other Thales sites such as Colombes near Paris are also promoting car-pooling and greener commuting options.

Purchasing department now using a CO₂ calculator to help choose cleaner suppliers.

Research directions: Founding member of the Clean Sky JTI. Leading development of the 'Systems for Green Operations' Integrated Technology Demonstrator (ITD), which will enable aircraft to achieve greener performance by optimising management of aircraft energy and aircraft mission and trajectory. Thales is also coordinating the 'Technology Evaluator', which is a simulation tool to help ITD leaders make technology choices and assess the environmental impact of the Clean Sky JTI.

Innovative use of new technologies: Thales is using an earth tube cooling system at its site in Limours, along with solar screens, which significantly reduce the need for artificial cooling during the summer months.

Collaboration with government, trade associations, etc.: Involved in numerous research partnerships and industry joint initiatives (see Research directions).

Green product offerings: Designing products with minimal environmental impact during the various phases of their lifecycle. Products and systems which explicitly help protect the environment include Green IT solutions and simulators that avoid having to deploy resources on the ground, such as the SCIPPIO simulator designed and developed by Thales Communications. Soldiers can be trained by playing out exercises in a virtual environment, avoiding the costly deployment of logistics and training platforms. Thales Alenia Space offers a wide range of environmental monitoring and Earth observation equipment.

Reporting: Company's approach based on the Greenhouse Gas Protocol. Also participates in the Carbon Disclosure Project.

Renewable energy: Percentage of electricity used produced from renewable energies rose to 12% in 2009. Use of innovations such as geo-thermal heating, installation of solar panels, etc. in company sites.

"Thales has for more than 12 years been committed to a responsible approach to environmental respect. With nearly 68,000 employees in 50 countries, the Group has established a specific policy, part of its main code of ethics, aimed at reducing the carbon footprint of its activities. Environmental results in 2009, largely ahead of schedule, showed a real commitment from Group entities."

Luc Vigneron
Chairman and Chief Executive Officer
Thales

Featured Company: United Technologies Corporation (UTC)

Key achievements and targets: In 2009, UTC exceeded its GHG reduction goal of 3% by 2% on the way to its goal of achieving a 12% reduction over three years.

Goal: reduce GHG emissions 3% annually from 2007-2010. Next generation of targets and expanded goals for facilities, suppliers and products planned for 2011 through 2015.

As of 2009, have reduced GHG emissions 23% from the 2006 baseline.

Also improving emissions profile of facilities. Pratt & Whitney's Shanghai Engine Center is the first building in China to receive platinum LEED certification and is believed to be the first aircraft engine overhaul and repair facility to receive such recognition. The building uses high efficiency heating, cooling and lighting systems, water treatment and recycling and solar and wind power.

Research directions: Pratt & Whitney Rocketdyne and Hamilton Sundstrand jointly developing Compact Solar Power Tower technologies that could provide a renewable source of energy that produces zero emissions.

Innovative use of new technologies: Non-defence business unit (UTC Power) has developed a geothermal power system which received the National Energy Resources Organization Innovation Award in 2008 and was named one of R&D magazine's '100 most technologically significant products of 2007'. Pratt & Whitney has secured a \$110.4 million IRS tax credit

(under the US Government's federal stimulus package's 48C program that awards \$2.3 billion for cleantech manufacturing jobs) to re-equip existing manufacturing facilities for production of its new, more fuel efficient jet engines (see Green product offerings).

Collaboration with government, trade associations, etc.: Founding member of the US Green Building Council and the Pew Center on Global Climate Change and has been named to the Dow Jones Sustainability Index each year since it was launched in 1999. Signer of the Bali Communique.

Green product offerings: PureCell® fuel cell systems (UTC Power), PurePower® engines with Geared Turbofan™ technology (Pratt & Whitney) that can provide double-digit fuel burn improvements and significant reductions in emissions and noise, EcoPower® engine wash service (Pratt & Whitney), which improves efficiency, fuel burn, and reduces emissions.

Reporting: Measures GHG emissions using the Greenhouse Gas Protocol established by the WBCSD and the WRI. Assisting development of new WBCSD/WRI standards for accounting for Scope 3 and Product Life Cycle emissions.

Renewable energy: Using renewable power for facilities such as the use of solar and wind power at the Pratt & Whitney Shanghai Engine Center. Provider of fuel cell systems.

“We continue to invest in products and technologies that will allow UTC to take advantage of megatrends that will shape the world in coming decades, including rapid growth in emerging markets, urbanization and demand for energy-efficient as well as environmentally sound solutions. Last year, UTC spent \$3.7 billion on company- and customer-funded research and development. Hamilton Sundstrand delivered nine major systems that contributed to the successful first flight of Boeing’s 787 Dreamliner airplane. Hamilton Sundstrand is the largest integrated systems supplier on this remarkable new airplane. Flight testing confirmed Pratt & Whitney’s revolutionary PurePower Geared

Turbofan engine technology, delivering double-digit reductions in fuel burn, emissions, noise and maintenance costs.

..

We made significant investments at the same time in our commercial businesses where demand is growing for products that reduce building energy consumption and associated greenhouse gas emissions. This demand creates extraordinary opportunities for UTC with our unique portfolio of energy-efficient products and solutions as well as our strong presence in rapidly urbanizing emerging markets.”

Louis R. Chênevert
Chairman & Chief Executive Officer
United Technology Corporation

Global aerospace and defence team

Neil Hampson
Partner, Global Aerospace & Defence Leader
 neil.r.hampson@uk.pwc.com
 Tel: +44 (0) 20 7804 9405

Katrine Ellingsen
Director, Global Aerospace & Defence Marketing
 katrine.ellingsen@ca.pwc.com
 Tel: +1 (514) 205 5066

Aerospace and defence sustainability contacts

Malcolm Preston
Global Sustainability & Climate Change Leader
 malcolm.h.preston@uk.pwc.com
 Tel: +44 20 721 32502

Mark Thompson
UK Industrial Products Sustainability & Climate Change Leader
 mark.z.thompson@uk.pwc.com
 Tel: +44 20 780 49643

Ian Milborrow
Global Industrial Products Climate Change Specialist
 ian.p.milborrow@us.pwc.com
 Tel: +1 (703) 918 3837

Territory contacts

Brazil
 Augusto Assuncao
 Tel: +55 (19) 3794 5408
 Email: augusto.assuncao@br.pwc.com

China
 Malcolm MacDonald
 Tel: +86 (10) 6533 2266
 Email: malcolm.macdonald@cn.pwc.com

Middle East
 Alistair Kett
 Tel: +971 (0) 2694 6831
 Email: a.kett@ae.pwc.com

Canada
 Mario Longpré
 Tel: +1 (514) 205 5065
 Email: mario.longpre@ca.pwc.com

France
 Guillaume Rochard
 Tel: +33 (0) 1 56 57 8208
 Email: guillaume.rochard@fr.pwc.com

UK
 Neil Hampson
 Tel: +44 (0) 20 7804 9405
 Email: neil.r.hampson@uk.pwc.com

Canada
 Katrine Ellingsen
 Tel: +1 (514) 205-5066
 Email: katrine.ellingsen@ca.pwc.com

Germany
 Jürgen Seibertz
 Tel: +49 69 9585 1460
 Email: juergen.seibertz@de.pwc.com

US
 Scott Thompson
 Tel: +1 (703) 918 1976
 Email: scott.thompson@us.pwc.com

Central Eastern Europe
 Stewart Blackburn
 Tel: +48 (0) 22 746 7143
 Email: stewart.blackburn@pl.pwc.com

India
 Dhiraj Mathur
 Tel: +91 124 3306005
 Email: dhiraj.mathur@in.pwc.com

US
 Charles Marx
 Tel: +1 (602) 364 8161
 Email: charles.a.marx@us.pwc.com

Central Eastern Europe
 Andrzej Karkoszka
 Tel: +48 (0) 22 746 7142
 Email: andrzej.karkoszka@pl.pwc.com

Italy
 Corrado Testori
 Tel: +39 (06) 5702 52442
 Email: corrado.testori@it.pwc.com

US
 Gina Dockiewicz
 Tel: +1 (973) 236 4648
 Email: gina.dockiewicz@us.pwc.com

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