A BRIEF HISTORY OF SUSTAINABILITY AT NASA JOHNSON SPACE CENTER

National Aeronautics and Space Administration

1961

Johnson Space Center established

- Originally named Manned Spacecraft Center

First Earth Day Logo

1970

First Earth Day

- Proposed by Senator Gaylord Nelson after witnessing a massive oil spill in Santa Barbara, California
- Images of Earth taken from the 1969 Moon Landing that frame Earth as an "isolated ecosystem floating in space" inspired the need for Earth Stewardship

Manned Spacecraft Center

1973

Federal Energy Office created

- Replaced the Energy Policy Office created earlier in the year
- President Richard Nixon created the office in response to the 1973 Arab Oil Embargo
- Responsible for controlling of oil and gasoline
- Nixon encouraged lowering thermostats, reducing driving speeds, and eliminating unnecessary lighting at the domestic level

Manned Spacecraft Center renamed to Johnson Space Center in honor of Lyndon B Johnson

1974

Federal Energy Administration Created

- Continued functions of fuel allocation, pricing regulation, energy data collection and energy supply expansion
- New offices were added that focused on petroleum allocation, energy conservation, energy data analysis

1977

Department of Energy founded

- Founded by President Jimmy Carter
- Brought the Federal Energy Administration, Federal Energy Office, and several organizations together

1986

JSC receives its initial Resource Conservation and Recovery Act (RCRA) Hazardous Waste Permit

- Led to the preparation of waste minimization plans

1992

Energy Policy of 1992 signed into law

- Signed into law by President George H. W. Bush on October 24, 1992. It focuses on making the United States a cleaner energy and more energy efficient country. It required federal agencies to:
  - Increase the use of alternative fuel vehicles in federal and state fleets.
  - Reduce energy intensity of non-industrial facilities 10 percent by fiscal year 1995 and 20 percent by fiscal year 2000, with a baseline of fiscal year 1985 (US EPA, "Federal Energy Requirement Archives").

George H. W. Bush signs Energy Policy of 1992

2000

Executive Order 13149 is signed

- Issued April 21, 2000 by President Bill Clinton. It required any federal agency with a fleet of 20 or more vehicles to develop a strategy to lower annual petroleum consumption by at least 20 percent with a baseline of fiscal year 1999 (US DOE, "E.O. 13149").

Bill Clinton signs Executive Order 13149

Zero-Waste Pollution Prevention System

2003

Zero-Waste Pollution Prevention system installed in the JSC Photo Lab

- Eliminated largest hazardous waste stream at JSC, initially generated 5 million pounds of waster annually

Free Range Bike Program started

2004

Ethanol Fueling Station opened

- Brought JSC into compliance with Energy Policy of 1992 and Executive Order 13149

Sustainability Partnership Team created

- Agreement between Engineering and Center Operations
- Purpose is to generate sustainability ideas and share responsibility at JSC

Ethanol Fueling Station

2005

On-site solar energy golf carts conversion

- Reduced need for carts to be plugged in to charge
- One cart is still in use today

Energy Policy Act of 2005 is signed into law

- The Energy Policy Act of 2005 was signed into law by President George W. Bush on August 8, 2005. It requires that federal agencies reduce their energy intensity by two percent per year in their facilities by fiscal year 2015 starting in fiscal year 2006, and with a fiscal year baseline of 2005 (US EPA, "Federal Energy Requirements).

Building 27 completed

- Astronaut Quarantine Facility
- First LEED Building at JSC
  - 16% energy savings
  - 57% construction waste diverted
  - 69% of non-roof areas have reflectance of at least 30%
  - 80% potable water reduction

Attwater Prairie Chickens arrive

- Endangered species being protected and bred at JSC to preserve the population

JSC teams with Lady Bird Johnson Wildflower Center

- Staff at the Wildflower Center designed sustainable landscapes for JSC's campus and Rocket Park

Building 27

Prairie Chicken on JSC Campus

2007

Multi-Platform Renewable Energy System (MPRES) designed and installed at Aaron Cohen Child Care Center

- Energy is provided by surface-based PV arrays and wind turbines
- Hot water generated by solar thermal panel
- Ground Source Heat Pump installed
- Assists in providing a better understanding of PV array necessary for lunar surface exploration and demonstrate sustainable building principles
- Provides energy for educational opportunities at the Aaron Cohen Child Care Center.

Executive Order 13423 is signed

- Executive Order 13423 was issued January 24, 2007 by President George W. Bush. It combined previous energy-related executive orders, including the requirements of the Energy Act of 1992 and Executive Order 13149, and requires federal agencies to comply with the following:
  - Reduce energy intensity by three percent per year by 2015 resulting in a total 30 percent decrease, with a baseline of fiscal year 2003;
  - Reduce greenhouse gas emissions through energy intensity reduction;
  - At least 50 percent of current renewable energy purchases must come from new renewable sources;
  - Construct or renovate building in accordance with sustainability strategies;
  - Reduce petroleum consumption in fleet vehicles by two percent per year through 2015 with a baseline of fiscal year 2005;
  - Increase use of alternative fuel by 10 percent per year with a baseline of fiscal year 2005 (US EPA, "Executive Order 13423").

MPRES at the Aaron Cohen Child Center

George W. Bush signing Executive Order 13423

2008

Building 207A completed

- Gilruth Center
  - 20.4% Less energy
  - 34% Reduced Potable Water Usage
  - 44% Recycled Content
  - 50% Tradable Renewable Certificates
  - 84.4% Waste diverted from landfills
  - 91.5% Regional Materials

Contractors' Environmental Partnership Electronics Recycling Event

- First of 5 electronic recycling events to recycle over 600,000 lbs of electronics after Hurricane Ike
- Led to electronic drop off at Ellington Field

Construction on Building 20 begins

Building 207A

2009

Construction on Building 20 ends

- First Platinum certified LEED Building at NASA
  - 29% Regional Materials
  - 30% Recycled Content
  - 40% Reduced Potable Water Usage
  - 57% Less energy
  - 96% Construction Waster Diverted
  - 100% Tradable Renewable Certificates

Building 20

Building 2N renovation completed

- Public affairs office
  - 10% recycled content
  - 56% reduced water usage
  - 78% regional materials
  - 85% construction waste diverted
  - 100% existing wall, floor, and roof elements maintained
  - 100% asbestos abatement in all interior space

Executive Order 13514 is signed

- Executive Order 13514 was issued October 5, 2009 by President Barack Obama. It requires federal agencies to:
  - Reduce petroleum consumption in agency fleets of 20 or more vehicles by two percent annually through fiscal year 2020 with a baseline of fiscal year 2005;
  - Ensure that all new construction, major renovations, or repairs or alterations of federal buildings comply with the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings;
  - Ensure that at least 15 percent of existing agency buildings and leases of up to 5,000 gross square feet meet the Guiding Principles by fiscal year 2015, and that the agency makes annual progress towards 100 percent compliance across its building inventory (US DOE, "Executive Order 13514").

Renewable energy system is installed at the Gilruth Recreational Center

- Solar water heater, (12) 4x8 foot solar thermal collectors
- Daylighting, collection of sky lights in roof to provide natural light in the gymnasium

Building 2N

Barack Obama signs Executive Order 13514

Gilruth Center Daylighting

Ellington Airfield Renovated Lighting

Building 26

Beetle Battles Competition

2010

Building 20 officially open

- Saves potable water by using condensation from air conditioning to water landscaping around building

Ellington Airfield lighting renovated

- Light fixtures replaced with daylight harvesting fixtures

Building 26 completed

- Columbia Center, Center for Human Space Flight Performance and Research
  - 21% Less Energy
  - 30% Regional Materials
  - 40% Reduced Potable Water Usage
  - 45% Recycled Content
  - 88% Construction Waste Diverted

Building 29 renovation completed

- Originally the Weightless Environment Training Facility
  - 10% Recycled Content
  - 11.2% Less Energy
  - 29% Regional Materials
  - 31.5% Reduced Potable Water Usage
  - 75.7% Tradable Renewable Certificates
  - 80% Wood used harvested from FSC forests
- Replaced by the Neutral Buoyancy Lab in 1996

Green Team formed

- Hosts sustainability competitions
- Informational booths and awareness pitches to various organizations

Beetle Battles Competition

- Competition between organizations to reduce paper use during 4 week period
- BA won and reduced usage by 28%

Renovation of Building 12 begins

2011

Solar Powered Street signs are installed

- Self-sustaining during the day

300 area parking lot lights are installed

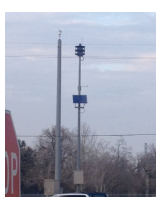
- Lights powered from solar outside lighting

JSC substituted biobased cutting fluid for a petroleum product in 20 metal fabrication machines

- Saved $30,000 per year in waste disposal

JSC vs Energy Vampires Competition

- Competition within JSC to focus on energy reduction
- Winners: B16 reduced energy by 16%, B241 reduced energy by 26%



Solar Powered Street Sign

Mall Pond Water Project

2013

Building 419 installed motion activated lighting

- Saved 76,190kWh in FY2013

Coffee (and Tea) to Compost Program started

- Saved around 18.5 millions pounds of fertilizer

Building 24 rerouted condenser water

- Saves 10 million gallons of potable water a year

Building 12 received LEED Gold certification

- 2% Renewable Energy Produced on site
- 13% Materials used are recycled content
- 44% Reduced Potable Water Usage
- 95% Construction Waste Diverted
- 100% Line of sight daylighting views

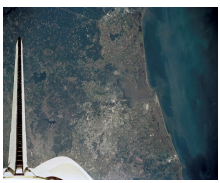
JSC transformed an area with drainage problems into habitable wetland

- The 2200 square foot area had drainage problems and was difficult to mow. Within a few weeks, the wetland was thriving and now provides homes for local animals and plants.

Flex Fridays introduced

- Has potential to save about 750 metric tons of CO_2 per year

Building 226 being demolished



Coastal Prairie view from Space Shuttle Atlantis

2015

JSC's onsite renewables generated enough energy to power 30 homes for a year

- Sources include day lighting, geothermal heat pumps, wind turbines, solar panels, solar water heaters, solar powered parking lots

Air conditioning improvements in Building 7, 9, and 46

- Expected to save 811,00kWh of energy a year, saving $65,000 annually

Building 12 update

- Since August, the Green Roof on Building 12 has diverted over 7.5 millions gallons of storm water
- Four new recycling programs implemented
- Clean wood, x-rays, garnet from industrial water knives, oily wastewater from skimmers
- Diverted 50,000 pounds in first year
- Wind monitoring project with NREL

Bird-Window Collision Program

- By 2015, this program has reduced strikes by 75%, which has saved hundreds of migratory birds' lives

Medium-fidelity Orion mock-up

- Constructed with the help of the JSC Redistribution and Utilization (R&U) Branch
- Recovering materials reduced costs by 90%
- Mock-up used for engineering-evaluation purposes, and eventually used for astronaut training

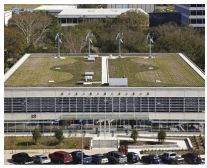
2012

Building 12 finished and opened

- 240 solar panels installed
- Green Roof installed to help stormwater management

Mall Pond Water Project

- Ponds in Mall area replumbed to recirculate instead of drain.
- Saves 10 million gallons of water per year



Building 12

Habitable Wetland at JSC

2014

JSC replaced lighting and controls in Building 46

- Saved an estimated 364,000 kWh, enough to power 23 homes for a year

Building 225 and 226 Demolished

- Building 226 was first building constructed at JSC in December 1962
- Bricks to be reused onsite with special signage to note their origin

Invasive Chinese tallow tree removed

- Replaced with Coastal Prairie seeds
- Part of larger effort to rehabilitate native prairie and native forest onsite

Controls for Building 40 Water Tower updated

- Ensures more efficient water use

Successful Wood Recycling Pilot test

- Recycled 8,600 pounds of clean wood during decommissioning
- JSC implementing site-wide clean wood recycling program

Incorporating air pollution control into designs

- JSC combined Heat & Power Energy Saving Performance Contract
- Building 24 Central Heating and Cooling Plant Boiler Replacement
- Building 48 Emergency Power System for Mission Control Repair Project

Orion Mock-up

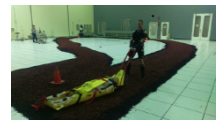
Building 12 Green Roof

Free Range Bike Program revitalized

- Efforts included repairing abandoned bikes
- Making bikes available to people on site

Reused Rubber track

- 50-meter-long track installed made from 100% recycled rubber
- Used to test simulated Mars surface



Reused Rubber Track

2016

Construction of Combined Heat and Power (CHP) plants at Building 24

- Will provide consistent and efficient electricity generation
- Decreases overall energy usage and adds steam, chilled water, and other utilities

Green Roof replanted

- Struggling non-native plants were replaced with native plants that are more acclimated to local climate

New Building 21 to receive pre-certified emergency power generator

- Avoids need for performance testing to demonstrate compliance with air regulations

First Annual Bike to Work day at JSC

CHP at Building 24

2017

Building 21 completed

- Human Health and Performance Lab
- 10th LEED Building at JSC

Building 21

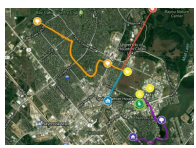
2018

Executive Order 13834 is signed

- Executive Order 13834 was issued on May 17, 2018 by President Donald J. Trump and requires agencies to:
  - Prioritize actions that reduce waste, cut cost, enhance the resilience of Federal infrastructure and operations, and enable more effective accomplishment of its mission.
  - Implement waste prevention and recycling measures and comply with all Federal requirements with regard to solid, hazardous, and toxic waste management and disposal.

Pollinator Pathways

- JSC teams with Houston Zoo
- Five gardens to form the first pollinator pathway from JSC to Exploration Green for monarch butterflies.



Pollinator Pathways around JSC

2019

ARES team reuses equipment from R&U

- Medical Geology, Curation Microbiology, and Planetary Exploration Labs
- R&U provided lab benches, pumps, centrifuges, test electronics, and computers
- Significantly accelerated the remodel process

ARES Lab

2020

JSC hosts NASA's first Plastic Free July Campaign

- Refuse, reduce, re-use, and re-purpose single-use plastics

JSC works with NREL to complete NASA's first Resilience Plan Assessment

2021

Greening and Restoring Our World (GROW) ERG is established

- Gives JSC employees the opportunity to be more involved in sustainability projects

Executive Order 14057 is signed

- Executive Order 14057 was signed and issued on December 8, 2021 by President Joseph R. Biden Jr and its ambitious plan includes:
  - Leading the Nation on a path to net-zero emissions by 2050
  - 100% carbon pollution-free electricity (CFE) by 2030, at least half of which will be locally supplied clean energy
  - 100% zero-emission vehicle (ZEV) acquisitions by 2035
  - Net-zero emissions from federal procurement no later than 2050, including a Buy Clean policy to promote use of construction materials with lower embodied emissions
  - Net-Zero emissions building portfolio by 2045
  - Net-zero emissions from overall federal operations by 2050

Plastic #5 added to JSC recycling stream

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Brief History of Sustainability Timeline