Carbon Flux Orbiting eXplorer

FACT SHEET

CarbonFOX

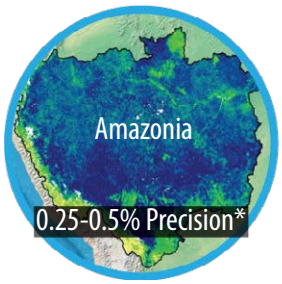
PI: Róisín Commane
Deputy PI (Science): Sparkle Malone
Deputy PI (Mission): Sean Crowell

Understanding carbon dynamics at scales from neighborhoods to continents

A national observatory is needed to measure carbon changes around the globe as they happen. *Humanity relies on carbon uptake by natural ecosystems to offset human-generated emissions. As ecosystems warm and disturbance events increase, the processes responsible for maintaining this carbon balance will change.*

CarbonFOX will measure terrestrial carbon sources and sinks with high sensitivity, resolution, and coverage, enabling us to understand and predict ecosystem carbon processes and their response to human activities and climate change.

CarbonFOX's Science Objectives meet decadal priorities including "Most Important" **E-2a** & **E-3** and "Very Important" **C-3 (a,b,c,e)** to understand changing carbon fluxes, and "Important" **E-5** to answer the question, "Are carbon sinks stable, are they changing, and why?"



High Precision CO_2, CH_4 and SIF
- Beyond plume mapping to quantify **diffuse sources** and **sinks** of carbon for global terrestrial ecosystems

Wide Swath
- Single pass regional coverage to image whole cities and area fluxes

Fine Spatial Resolution
- CO_2 and CH_4 within neighborhoods
- Detailed Solar-induced Fluorescence (SIF) to track urban CO_2 uptake

*Precision of column CO_2 and CH_4 at 2km x 2km

Measure changes in carbon dynamics over **natural terrestrial ecosystems** (boreal and tropical forests, grasslands and vegetated wetlands).

Determine how **disturbances** (e.g., hurricanes, fires, and floods) impact carbon dynamics of terrestrial ecosystems, including those managed for agriculture and undergoing large-scale land-use change.

Quantify natural and anthropogenic drivers of carbon dynamics of **coastal and inland urban area** at inter-annual, seasonal, and sub-seasonal temporal scales.

Early Adopters:
EPA, NIST
NYSERDA
NIWA
Permafrost Pathways

CarbonFOX's Application Program will engage Communities of Practice and Potential, to inform climate policy and management decisions worldwide on local, state, and national levels, and enable quick integration of CarbonFOX data into decision-making processes and operational tools.

SCIENCE TEAM

Senior Advisors: David Crisp, Steven C. Wofsy

Natural Ecosystems:
Lead: Ben Poulter
Jennifer D. Watts
Susan Natali

Disturbed Ecosystems:
Lead: Sparkle Malone
Benjamin Runkle
*Beata Bukosa**

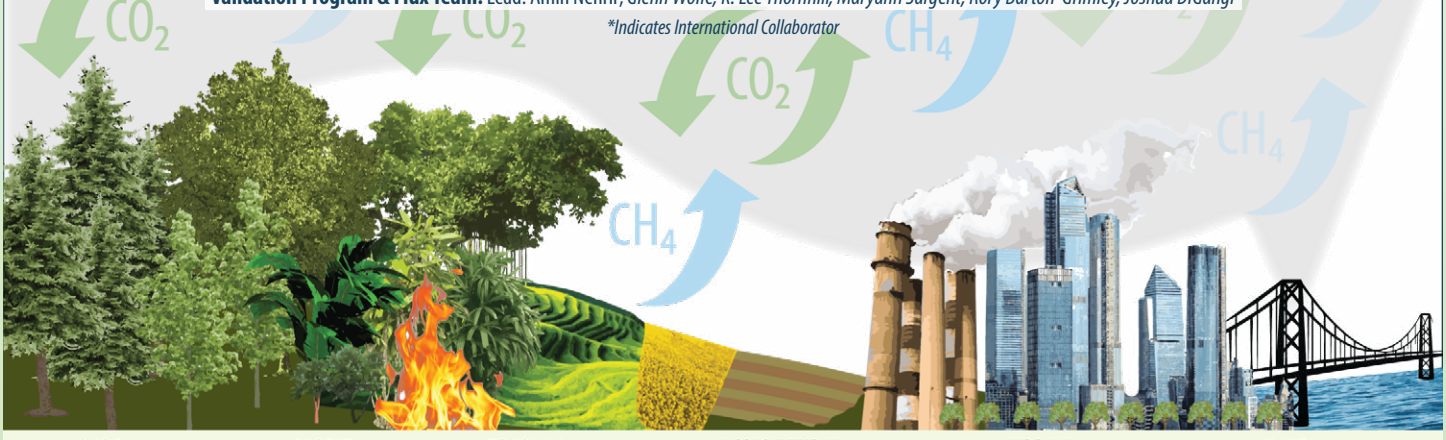
Urban Ecosystems:
Lead: Róisín Commane
*Debra Wunch**
*Jia Chen**

Applications Program:
Lead: Maria Tzortziou
Joshua Benmergui
Jonathan Franklin
*Sara Mikaloff-Fletcher**

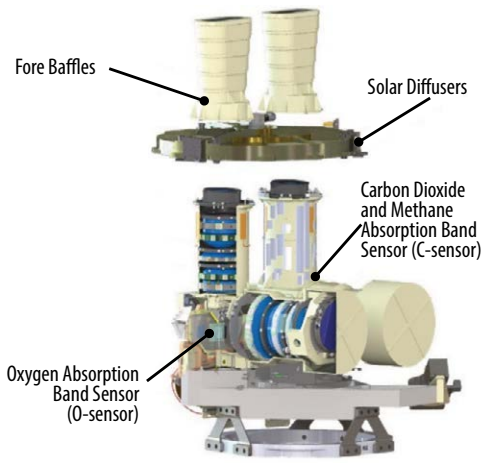
Science Data Team:
Lead: Sean Crowell
Can Li
Lok Lamsal
Peter Somkuti
Yasuko Yoshida
Christopher O'Dell
*Luis Guanter**
Sourish Basu
Lesley Ott

Validation Program & Flux Team: Lead: Amin Nehrir; *Glenn Wolfe, K. Lee Thornhill, Maryann Sargent, Rory Barton-Grimley, Joshua DiGangi*

**Indicates International Collaborator*



SCIENCE IMPLEMENTATION APPROACH OFFERS GREATEST SCIENTIFIC RETURN AT LOWEST RISK

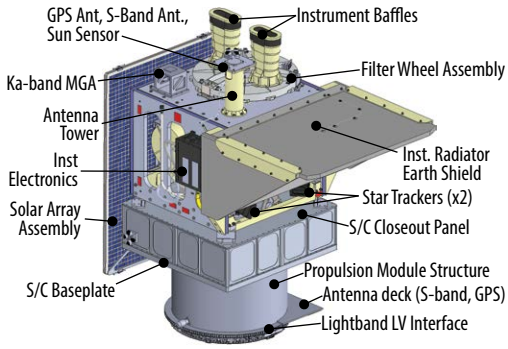


CarbonFOX is a pushbroom imaging spectrometer with high spatial resolution (to understand sources) and high sensitivity (to quantify sinks) to illuminate the carbon processes. CarbonFOX studies the full globe with the range to see entire cities and the precision to resolve neighborhoods. The CarbonFOX instrument is based on MethaneSat heritage and is built by the same Ball Aerospace team using processes successfully used to deliver OMPS, OLI, TEMPO, and CALIPSO.

CarbonFOX leverages MethaneSAT heritage

ROBUST MISSION DESIGN & FLEXIBLE ARCHITECTURE

LABELED STOWED VIEW

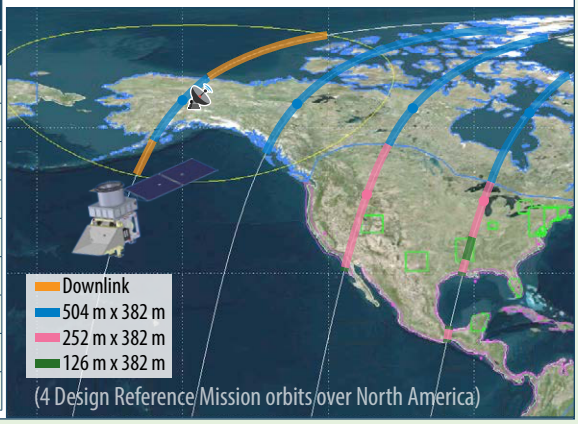


Uncomplicated three axis stabilized spacecraft with single axis S/A and body mounted instrument and subsystems

TECHNICAL PERFORMANCE MARGINS

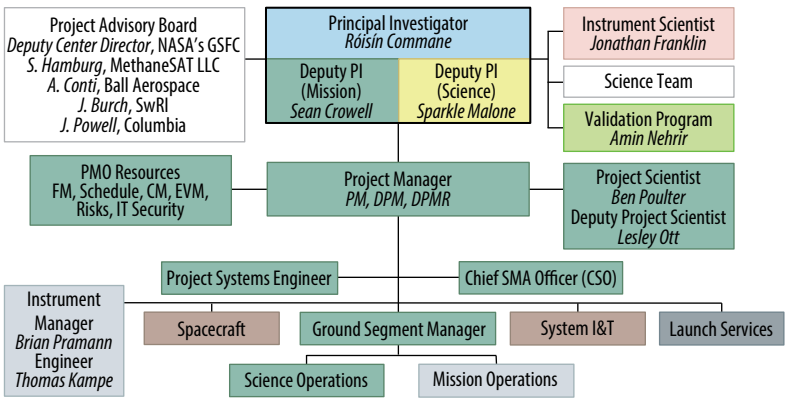
Observatory Resource	MEV	Margin
Mass (dry) - ΔV limit	373.6 kg	30.1%
Safe Mode Power (Deployed)	317.7 W	92%
Science Mode Power (Nadir)	279 W	38%
Sci Downlink Power (Ka-band)	4.3 dB	1.3 dB
Sci Data Peak Storage Power (S/C)	420 GB	138%
Pointing Knowledge (Sci 3σ 3-axis)	73″	105%
Pointing Stability (Sci 3σ RSS, 30s)	138″	70%
Pointing Control (Comm 3σ RSS)	0.12°	733%
Propellant (ΔV)	77 m/s	31%

Flexible resolution to satisfy science objectives



(4 Design Reference Mission orbits over North America)

MANAGEMENT & ORGANIZATION



CarbonFOX is led by a diverse group of Atmospheric Carbon Scientists with deep technical, operational and scientific experience. The CarbonFOX instrument is implemented by the same engineering team that effectively delivered MethaneSAT & TEMPO and a spacecraft team that successfully delivered PUNCH and CYGNSS.

SCHEDULE