



# ***Aerospace Viewer of NASA Project Staffing Data (aView)***

***A Practical Tool for Analyzing Staffing  
Levels and Cost Across Missions***

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J. A. Rice, T. Tran, C. J. Zhang  
The Aerospace Corporation***

***2023 NASA Cost & Schedule Symposium  
May 2-4, 2023***

# Outline

- Introduction

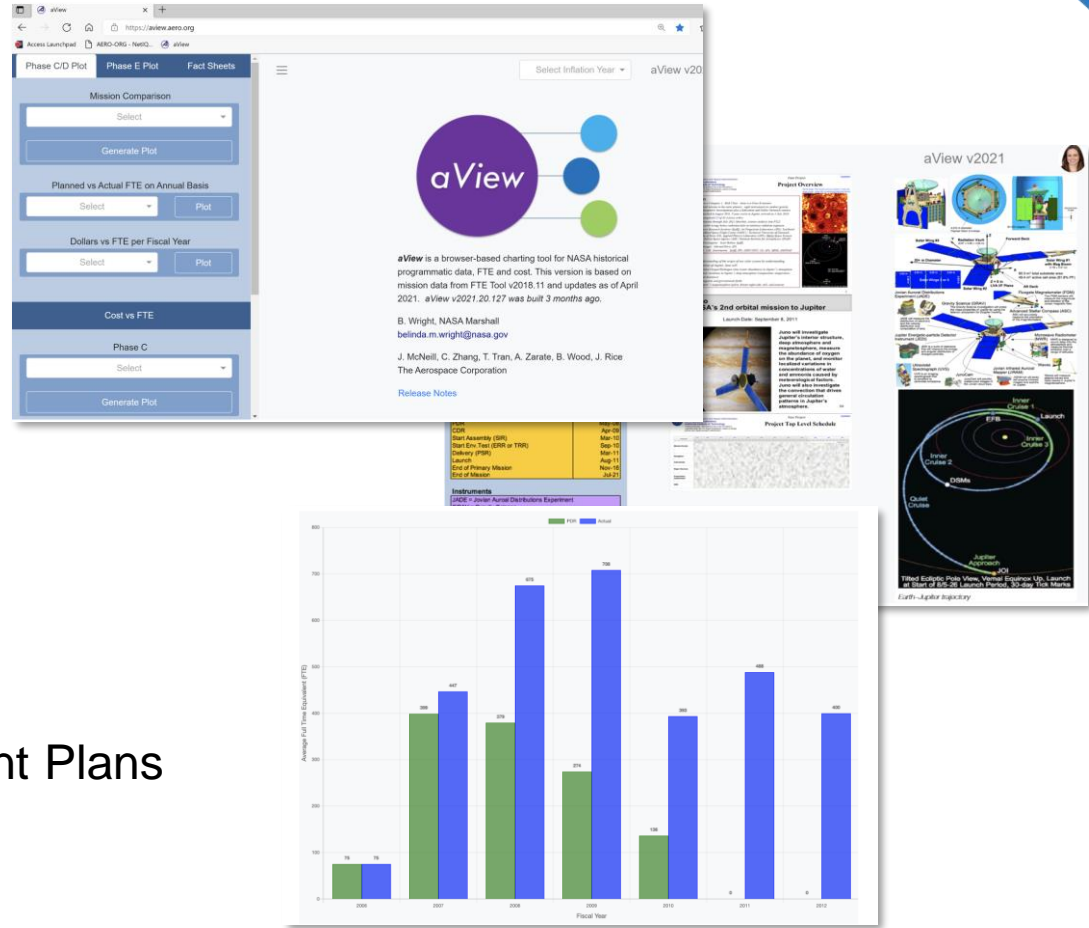
- Purpose
- Timeline
- Data Sources

- Its Utility and Capabilities

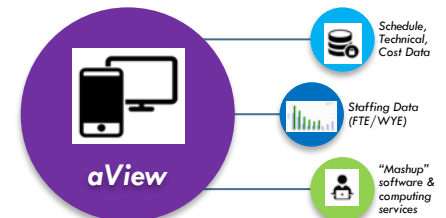
- Why aView?
- Plot Types
- Capabilities
- Mission Fact Sheets

- Architecture and Deployment Plans

- Summary



**aView – the Aerospace Viewer of historical staffing profiles of NASA science missions**



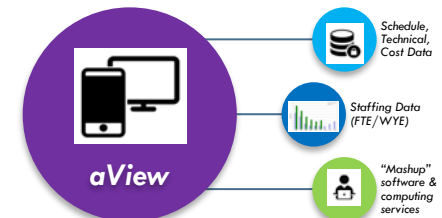
# Introduction

## Purpose

- aView**, the Aerospace Viewer of archive of missions' staffing profiles, provides
- *A curated, validated archive of FTE/WYE data for 28 science missions*
  - *Comparative analysis of mission programmatic data (FTE/WYE) from PDR through operations (Phases C, D, E)*
  - *Illustrations of how well projects keep to staffing plans at PDR and highlights excursions*
  - *Quick reference pages for missions' technical parameters and related information*

Cassini	Dawn	Deep Impact	Europa Clipper	Genesis
GRAIL	InSight	Juno	Kepler	LADEE
LCROSS	LRO	LUCY	MAVEN	MESSENGER
MER	MRO	MSL	New Horizons	NuSTAR
OCO	OSIRIS-REx	Phoenix	Psyche	Spitzer
Stardust	STEREO	WISE	<b>Mission List</b>	

***aView is underwritten by the NASA  
Planetary Missions Program Office***



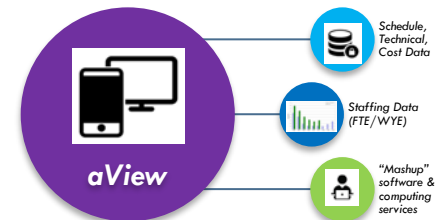
# Introduction

## Timeline



2009  
thru  
2018

- FTE Tool, released with staffing data from thirteen missions
- Built on MS Excel with embedded macros
- Grew to contain historical staffing data for 24 science missions, mostly planetary
- Various features added to aid cost analysts within the NASA PMPO
- Presented at the NASA Cost and Schedule Symposium 2014



# Introduction

## Timeline

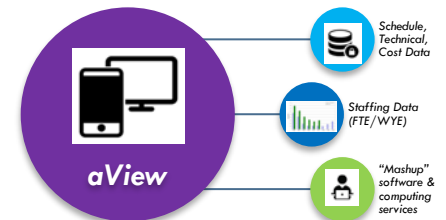


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Based on open-source JavaScript for its front-end and SQLite database backend (DB)  
Aerospace made a modest internal investment for the initial DB schema



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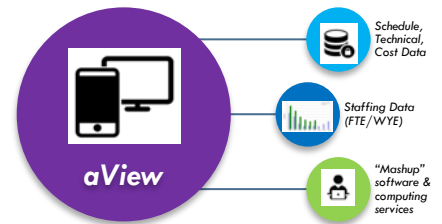
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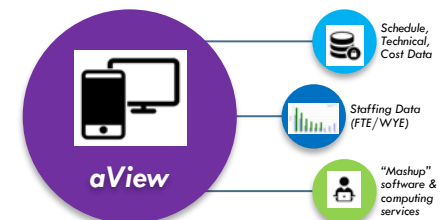
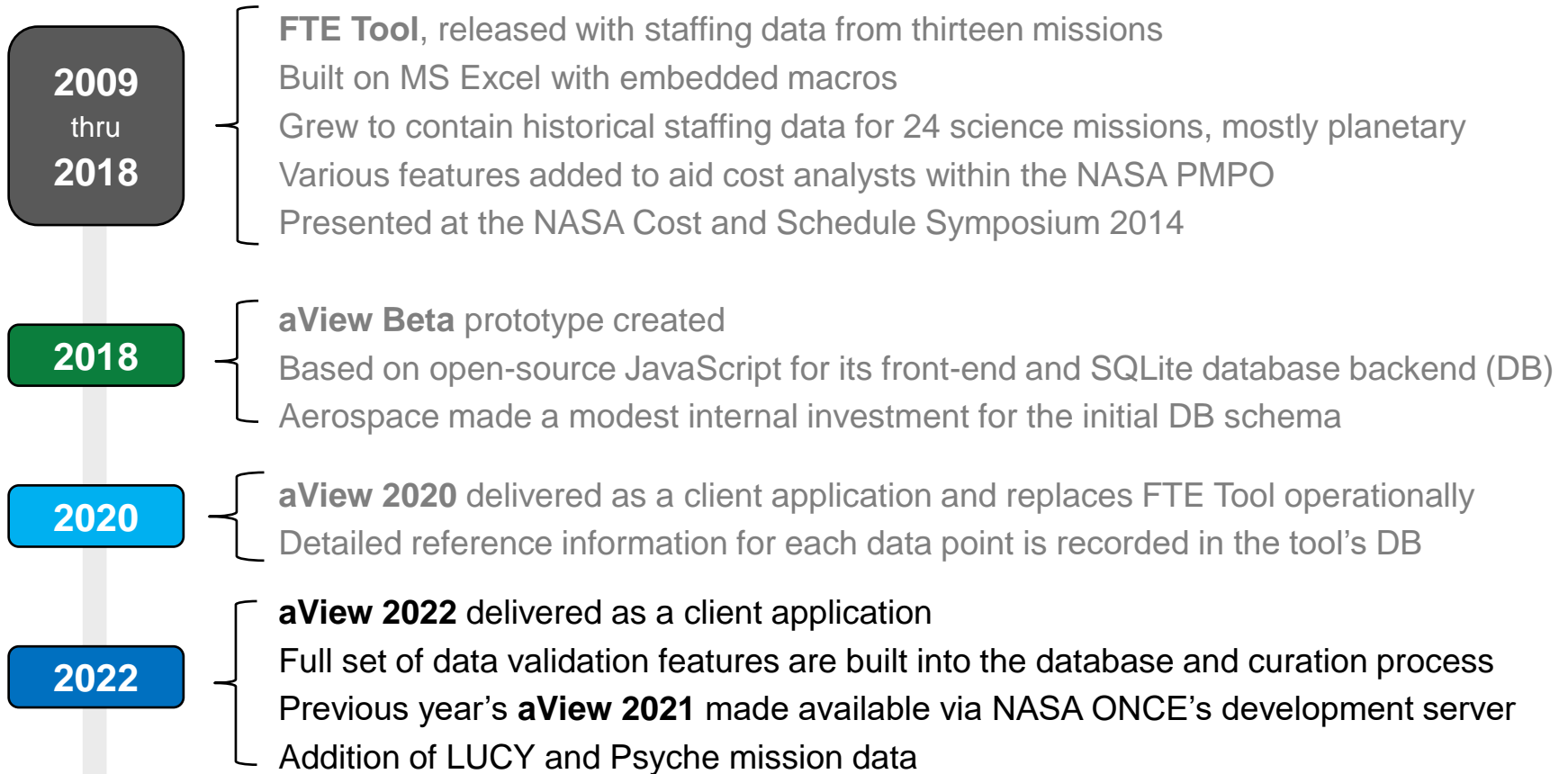
2020

**aView 2020** delivered as a client application and replaces FTE Tool operationally  
Detailed reference information for each data point is recorded in the tool's DB



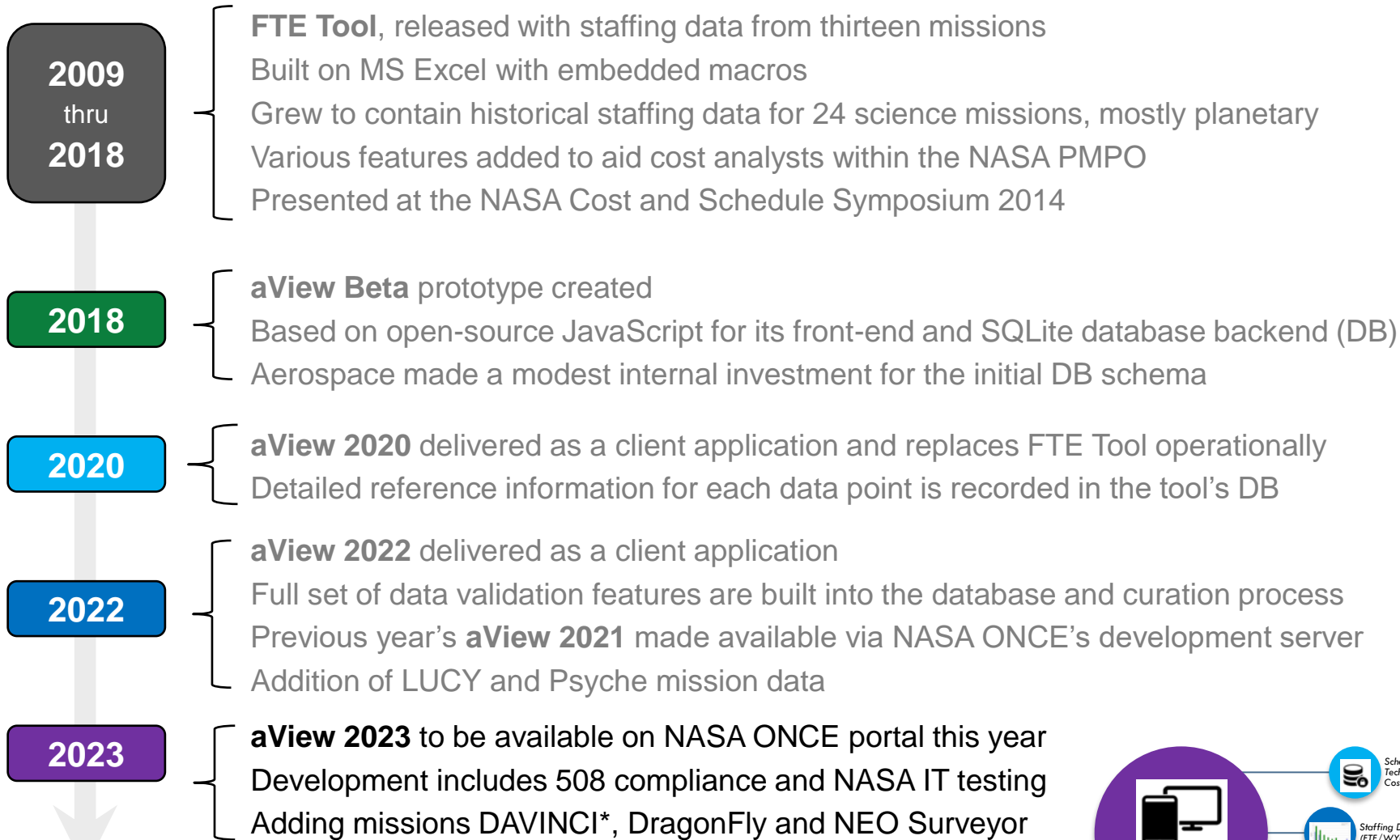
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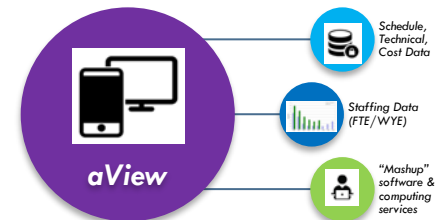


# Introduction

## Timeline



\* As applicable given project schedule



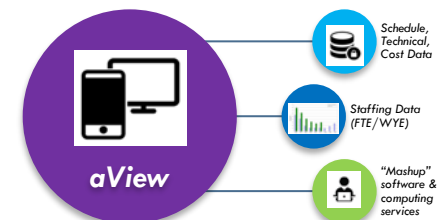




# Introduction

## Data Sources

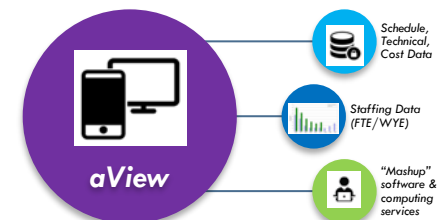
- **aView** is a repository of validated staffing and mission data
  - *Aerospace collects and validates the data in the aView DB*
  - *The sources of data and information for aView are*
    - Formally approved reports at major mission milestones from the NASA Cost Analysis Data Requirement (CADRe)
    - Monthly Status Reports (MSRs)
    - Project and mission websites
    - Our customer at the NASA Planetary Missions Program Office



# Outline

- Introduction
- **Its Utility and Capabilities**
  - *Why aView?*
  - *Plot Types*
  - *Capabilities*
  - *Mission Fact Sheets*
- Architecture and Deployment Plans
- Summary

***aView – the Aerospace Viewer of historical staffing profiles of NASA science missions***





# ***Its Utility and Capabilities***

## *Why aView?*

The **aView** tool has a number of utilities that are not currently readily available through any other source. It allows the user to

- *Visualize staffing profiles for Phases C, D and E (FTE and WYE) at the granularity of monthly data*
- *Display annual project cost data along side the annual staffing totals for Phases C, D and E*
- *Understand how the labor basis of estimate compares with past NASA science missions with similar characteristics*
- *Examine how well a project performs to its staffing plans from PDR through operations*
- *Reference technical and programmatic data of a mission, like spacecraft mass, mission schedule, launch vehicle, launch date, etc.*

# Its Utility and Capabilities

## Charting Capabilities and Fact Sheets

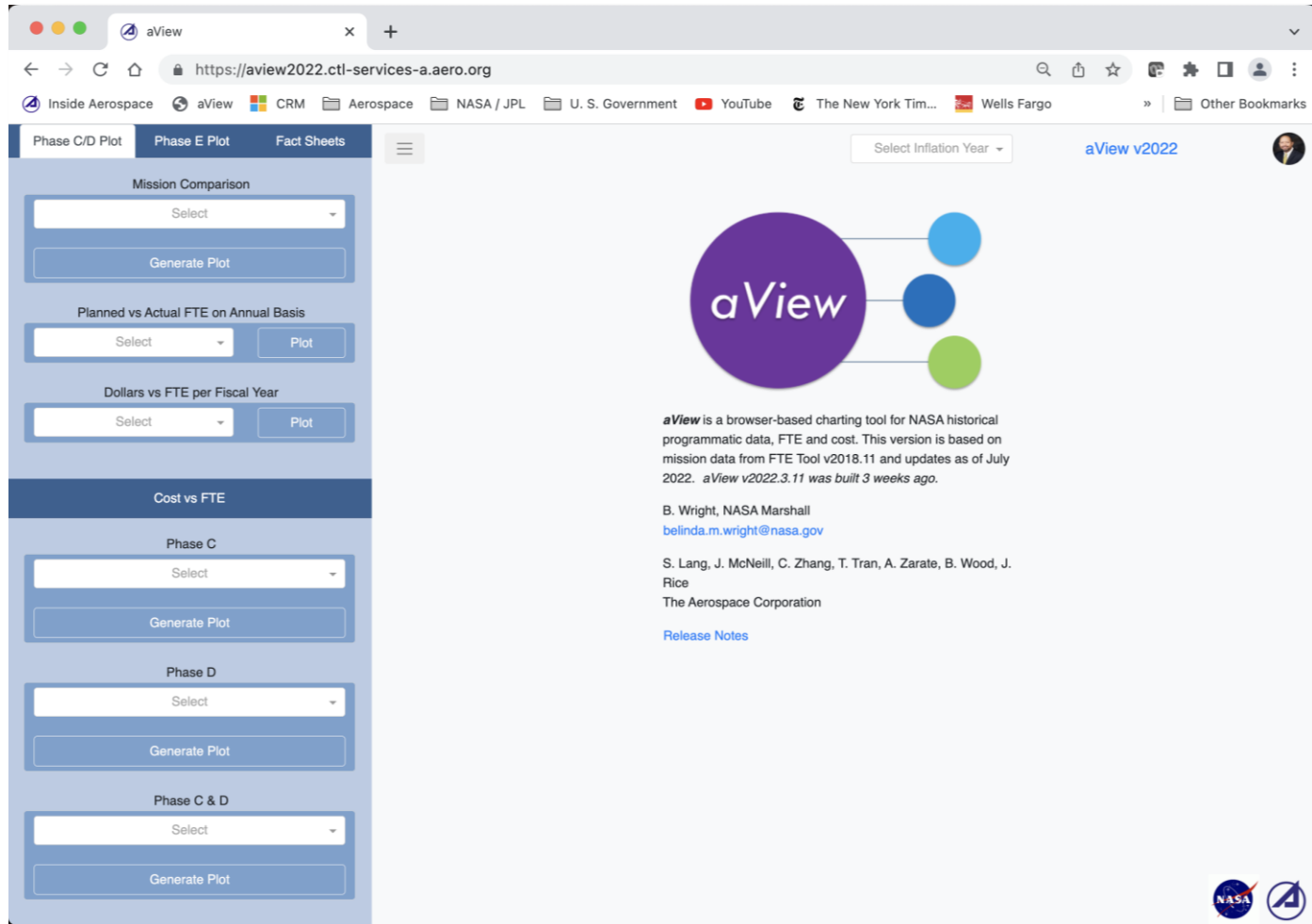


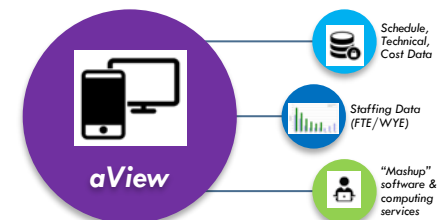
Figure A, "Front page" of aView via Google Chrome web browser



# ***Its Utility and Capabilities***

## *Chart Types*

- A variety of chart types are available in aView and enable the user to examine programmatic data in different dimensions and ways. Currently, there are four chart types:
  - *FTE Comparison Plots for defined Periods*
  - *Planned and Actual FTE by Mission*
  - *Annual Cost and FTE by Mission*
  - *FTE vs. Cost*
- Each plot can be generated from mission data for Phases C and D or operations Phase E. The user can select the year for inflation to apply to the data



# Its Utility and Capabilities

## FTE/WYE Comparison Plot for Defined Periods

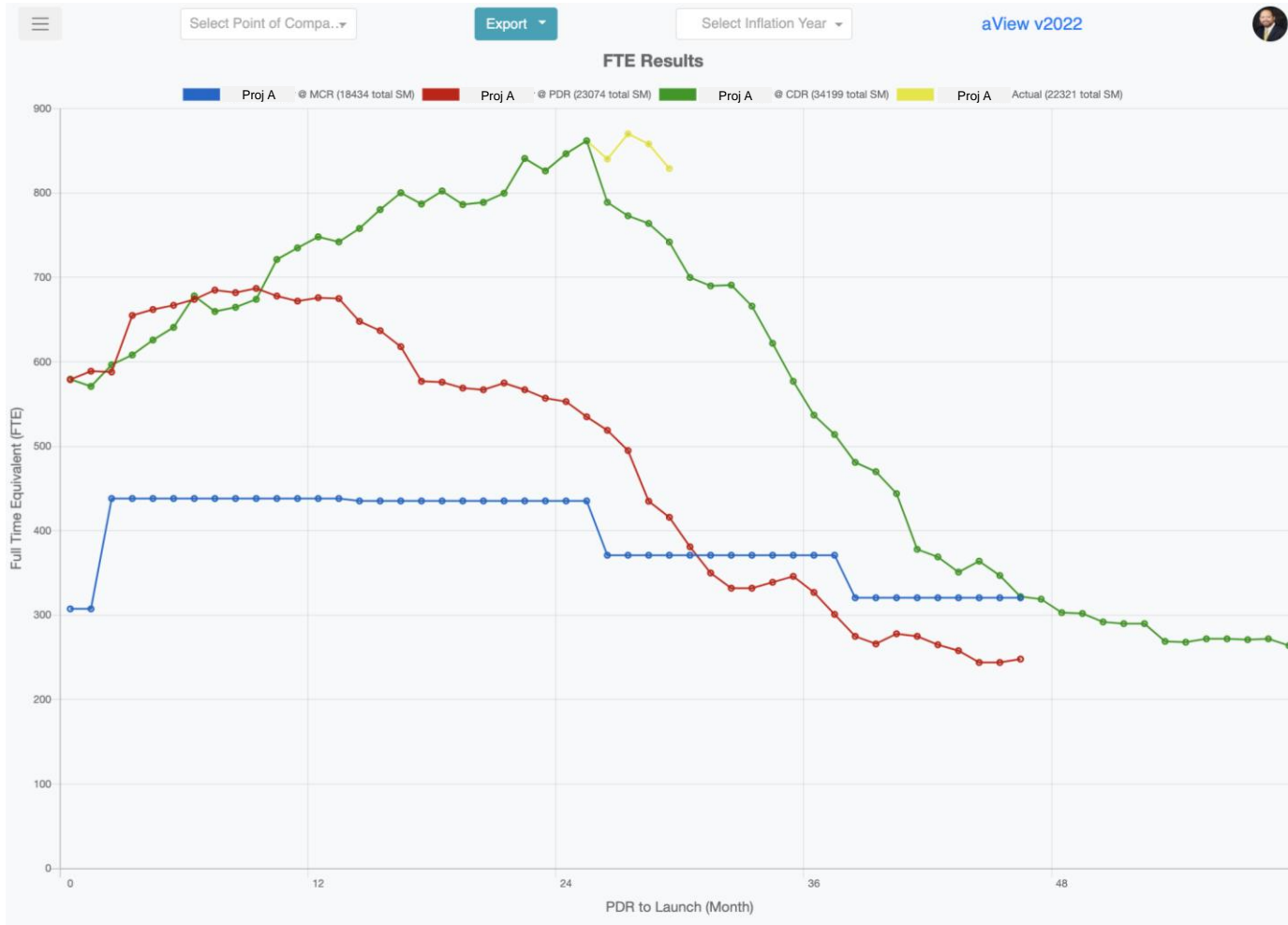


Figure B, Project A staffing actuals and plans crafted at MCR, PDR and CDR

# Its Utility and Capabilities

## FTE/WYE Comparison Plot for Defined Periods

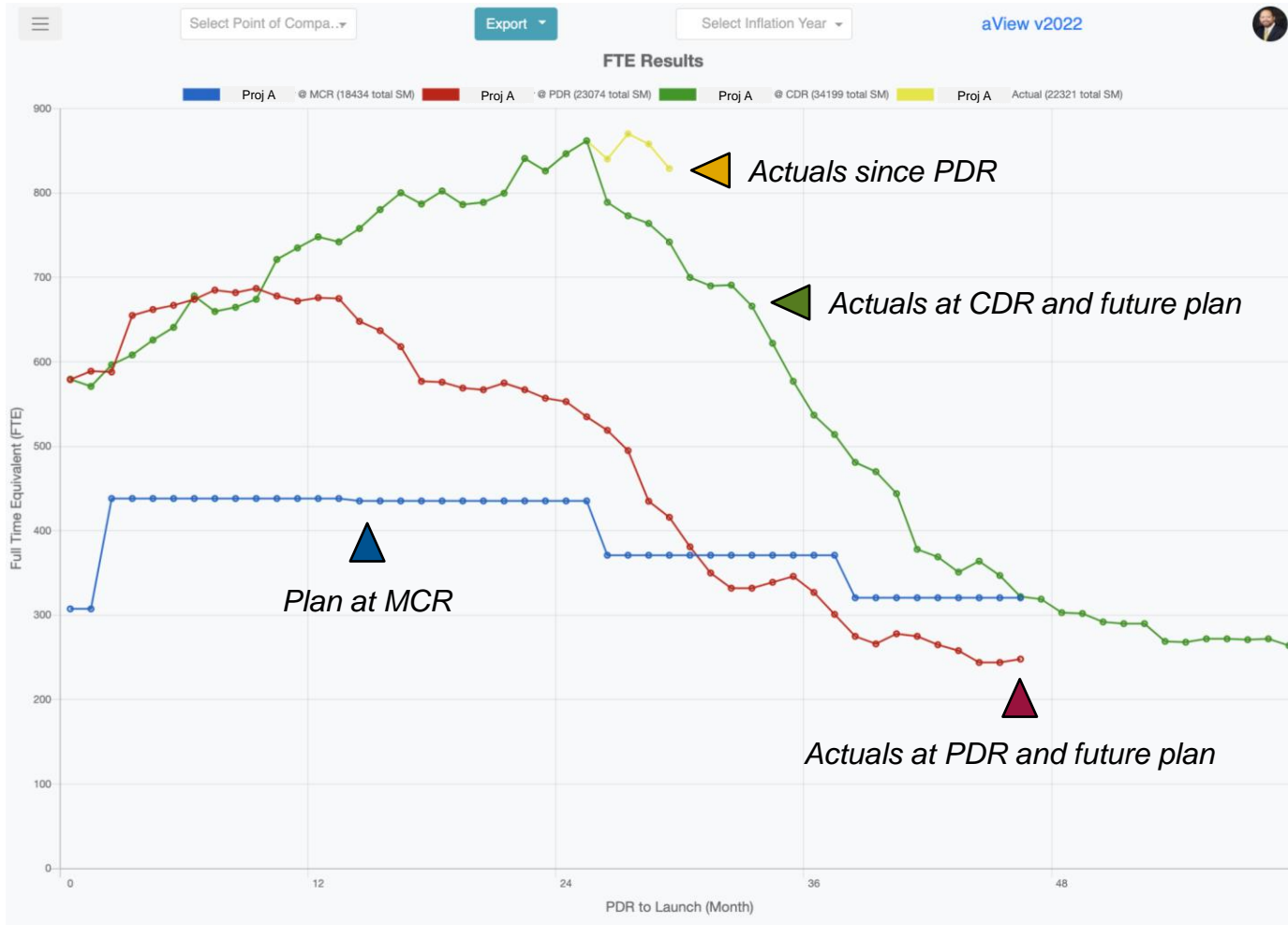


Figure B, Project A staffing actuals and plans crafted at MCR, PDR and CDR

# Its Utility and Capabilities

## FTE/WYE Comparison Plot across Projects

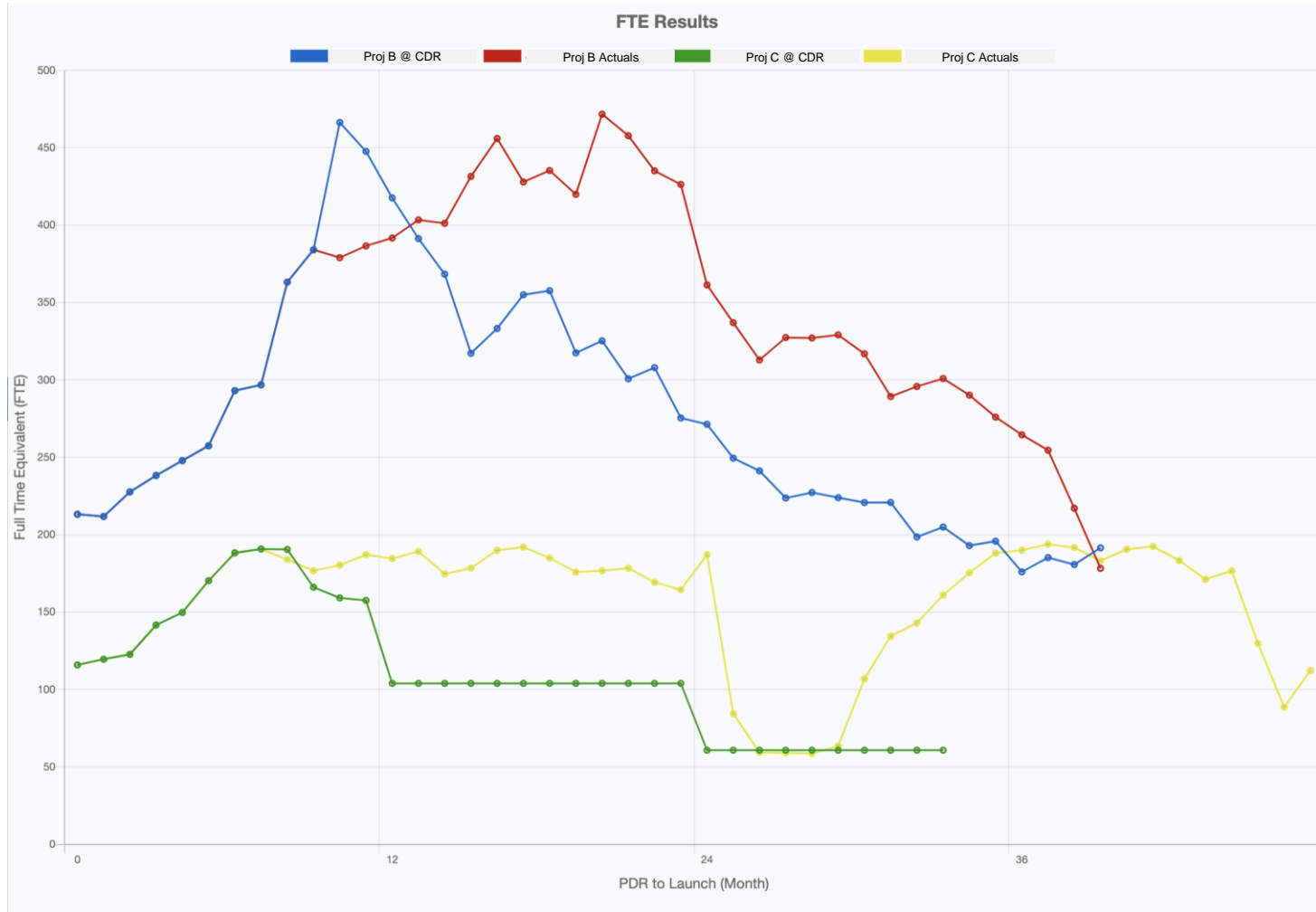


Figure C, Projects B and C staffing plans crafted at CDR and final actuals



# Its Utility and Capabilities

## FTE/WYE Comparison Plot across Projects

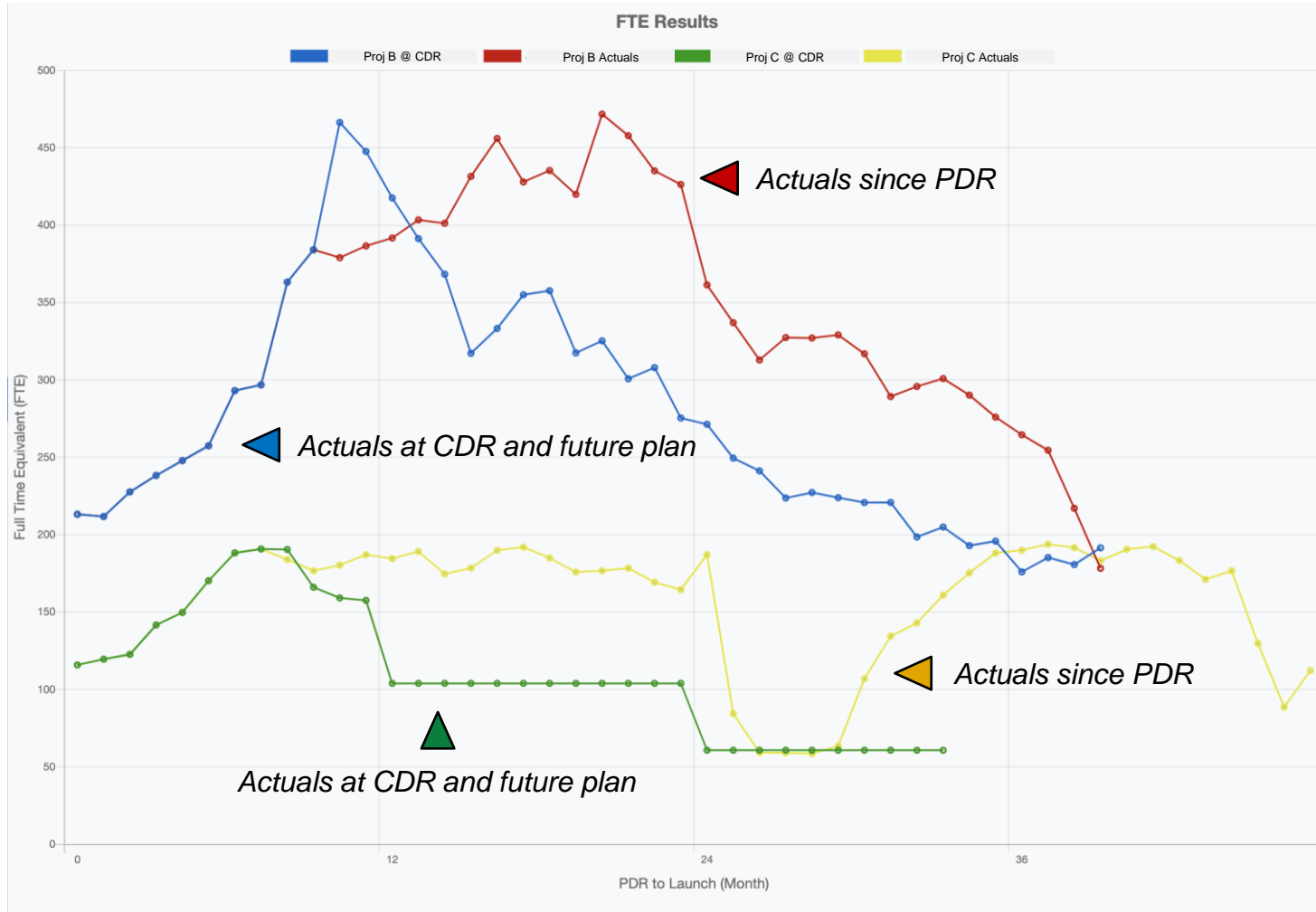


Figure C, Projects B and C staffing plans crafted at CDR and final actuals

# Its Utility and Capabilities

## Planned and Actual FTE/WYE by Project

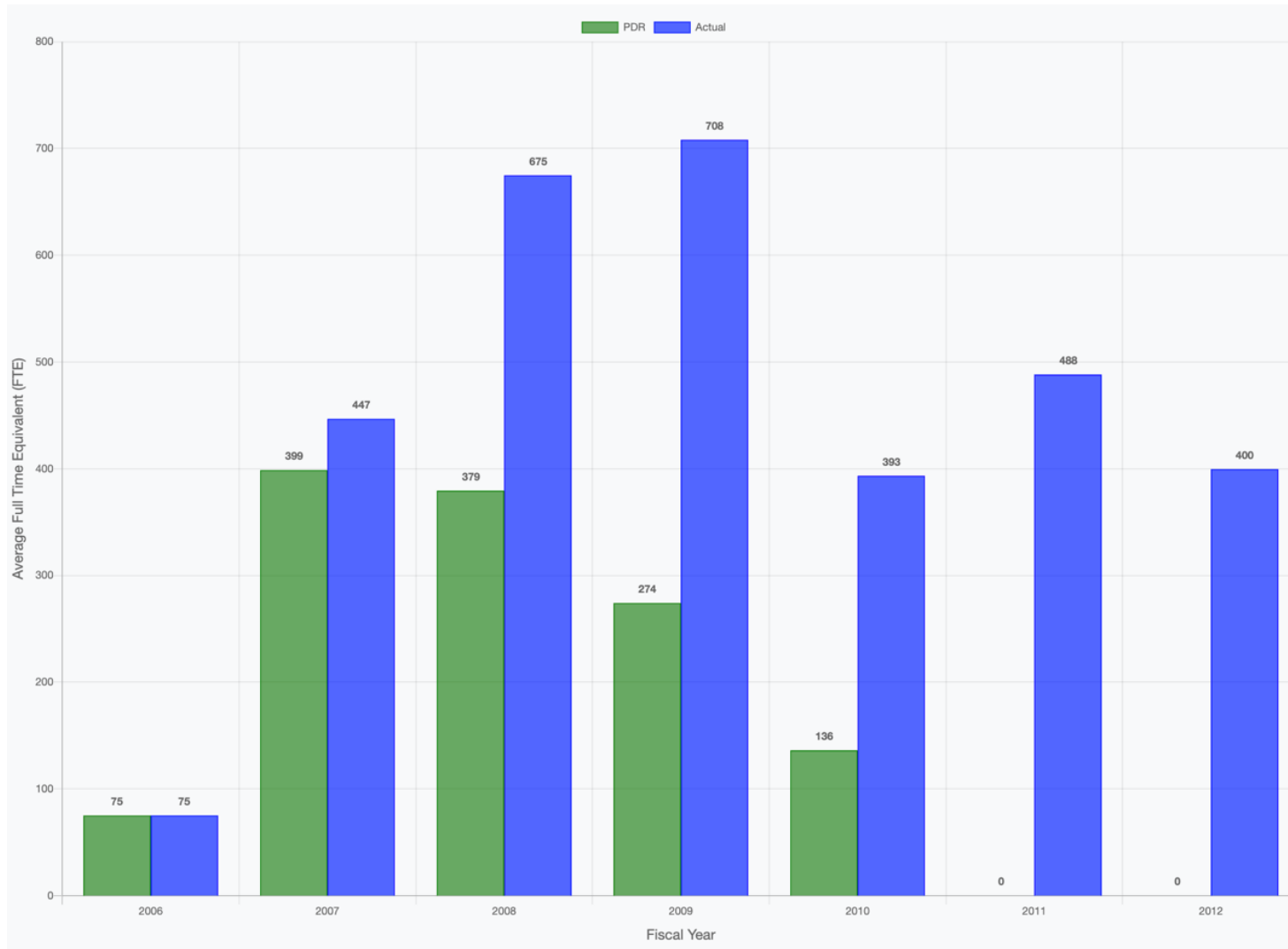


Figure D, Planned at PDR (green) and actuals (blue) at end of Phase D

# Its Utility and Capabilities

## Planned and Actual FTE/WYE by Project

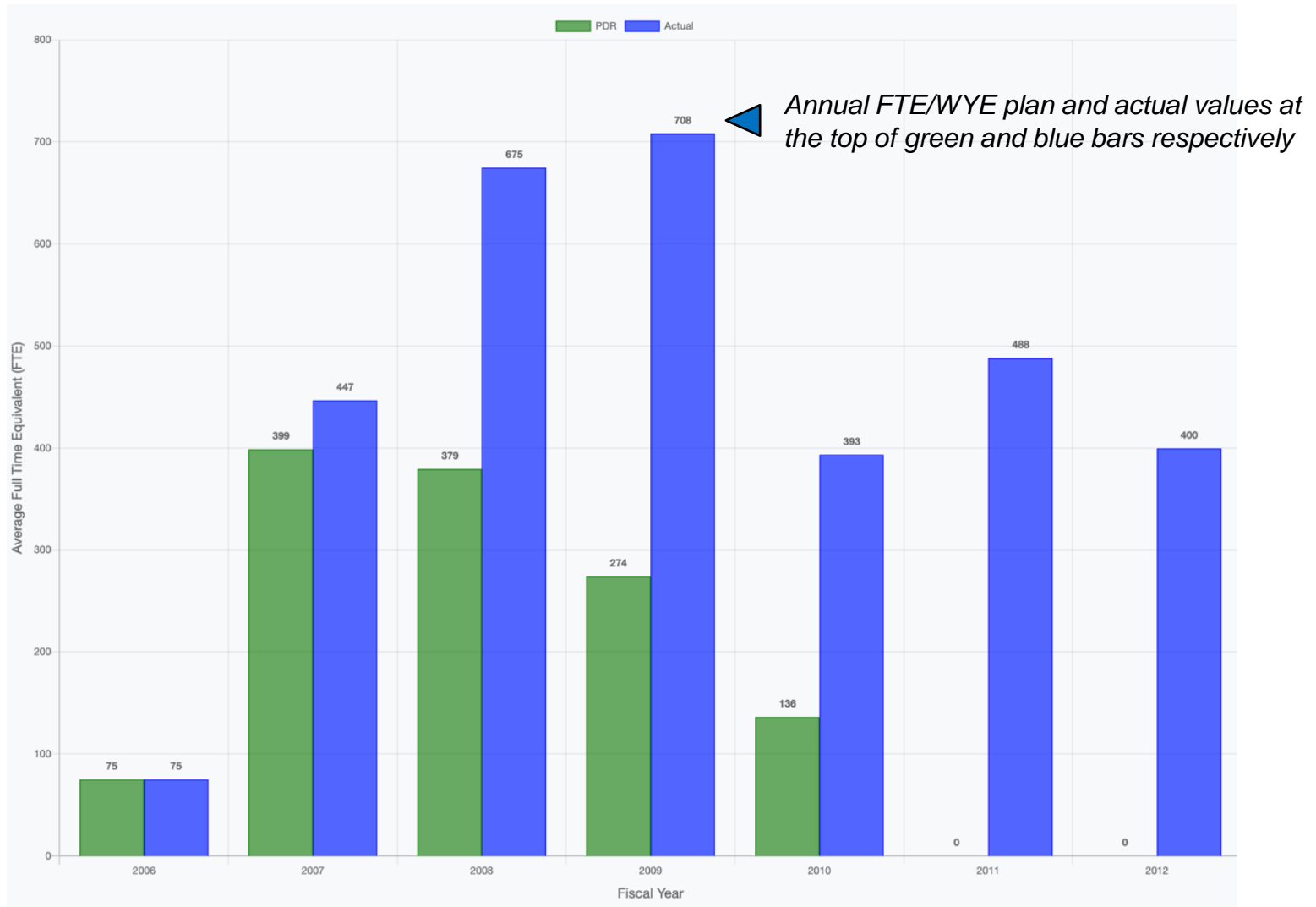


Figure D, Planned at PDR and actuals at end of Phase D

# Its Utility and Capabilities

## Annual Cost and FTE/WYE by Project

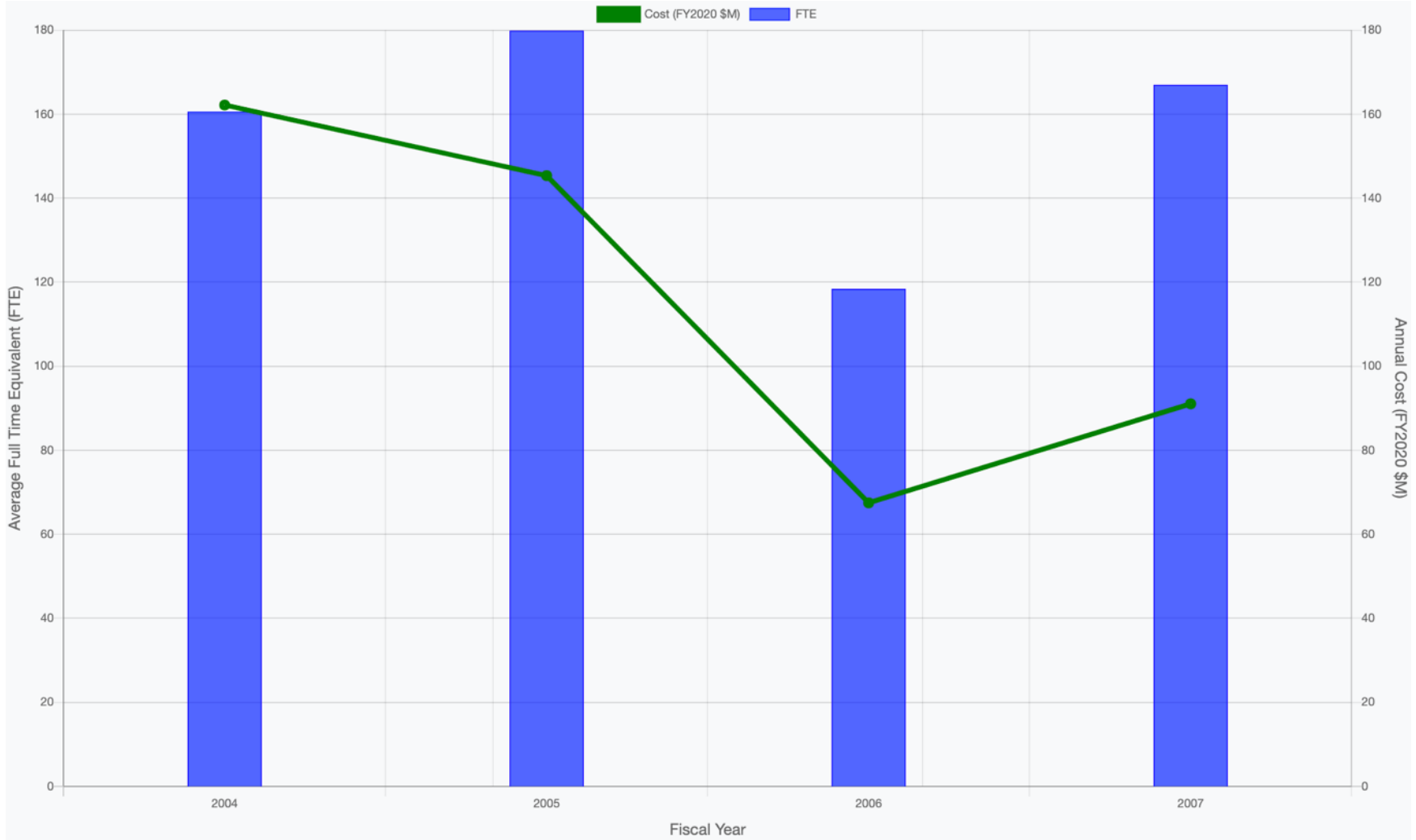


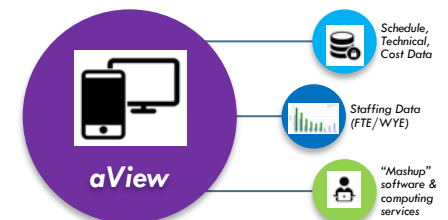
Figure E, Annual FTE/WYE and cost actuals by Fiscal Year



# ***Its Utility and Capabilities***

## *Mission Fact Sheets*

- Provide a capsule summary of the mission and project, providing some or all of these items
  - *Overview of the science objectives*
  - *Hosted payloads – instruments, sensors*
  - *Mission plan and characteristics*
  - *Project development milestone dates*
  - *Technical performance metrics*
  - *Basic concept-of-operation*
  - *Diagrams depicting the physical layout of components*
- NASA CADRe is the primary source for information given in these fact sheets
- As missions progress, fact sheets are updated with new, pertinent information



# Its Utility and Capabilities

## Mission Fact Sheets



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Phase C/D Plot Phase E Plot Fact Sheets ☰ Log In

Dawn
Deep Impact
Dragonfly
Europa Clipper
Genesis
GRAIL
InSight
Juno
Kepler
LADEE
LRO
Lucy
MAVEN
MER
MESSENGER
MRO
MSL
NEOSM
New Horizon
NuSTAR
OCO
OSIRIS-REx
Phoenix
Psyche
Spitzer
Stardust

### Dragonfly

**Technical Data**

Program	New Frontiers
Lead Center	MSFC
Bus Manufacturer	APL
Mission Class	B
Launch Vehicle	Atlas-V521
Development Time (months)	
Design Life (months)	
Destination	
Max Distance from Sun (AU)	
Satellite Wet Mass (kg)	
Propellant Mass (kg)	
Satellite Dry Mass (kg)	
Spacecraft Bus Dry Mass (kg)	
Payload Mass (kg)	
Number of Instruments	
BOL Power (W)	
Solar Array Mounting Type	
Solar Array Area (m <sup>2</sup> )	
Pointing Control (deg)	
Pointing Knowledge (deg)	
Stabilization Type	
Star Tracker?	
Mono or Biprop or Ion	Mono
Transmit Power (W)	
Downlink Datarate (kbps)	
Communications Band	X-Band

**Schedule Data**

ATP Start	Nov-17
SRR	Aug-20
PDR	Oct-22
CDR	Nov-23
Lander SIR	Jan-25
Lander PSR	Jan-26
Flight SIR	Jan-26
PSR	Dec-26
ORR	Feb-27
FRR	Apr-27
LRR	Jun-27
Titan Arrival	Nov-33
End of Primary Mission	Mar-37

**Instruments**

- DraMS mass spectrometer
- DraGNS gamma-ray and neutron spectrometer
- DraGMet geophysics and meteorology package
- DragonCam camera suite
- DRACO sampling system

### Dragonfly Mission Concept Summary

• Dragonfly uses its rotorcraft mobility system to execute surface flights.

• Mission science is enabled by traversing to different sites of interest on Titan's surface, traveling from our initial landing site to Selk crater.

**Preliminary Dragonfly Trajectory**

- Launch: 04/05/2026, C3 = 19.2 km<sup>2</sup>/s<sup>2</sup>
- VEGA: 04/15/2027, Alt = 3779 km
- EGA1: 05/27/2028, Alt = 1355 km
- EGA2: 09/05/2031, Alt = 1095 km
- Titan Arr: 12/06/2034

### aview v2022

**Lander Diagram**

**Spacecraft = Cruise Stage + Entry Vehicle**    **Entry Vehicle = EDL Assembly + Lander**    **Rotorcraft Lander**

EDL assembly includes aeroshell (heatshield and backshell), parachutes, ESI, and support equipment.

Lander in flight configuration, using mobility subsystem.

Lander in surface configuration, HGA deployed.

Figure F, Fact sheet for Dragonfly

# Its Utility and Capabilities

Mission Fact Sheets – selective pop-up, zoom feature



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MSL  
NEOSM  
New Horizon  
NuSTAR  
OCO  
OSIRIS-REx  
Phoenix  
Psyche  
Spitzer  
Stardust

**Dragonfly**

Technical Data  
Program  
Lead Center  
Bus Manufacturer  
Mission Class  
Launch Vehicle  
Development  
Design Life (m)  
Destination  
Max Distance  
Satellite Wet Mass  
Propellant Mass  
Satellite Dry Mass  
Spacecraft Bus  
Payload Mass  
Number of Instruments  
BOL Power (W)  
Solar Array Max  
Solar Array Area  
Pointing Control  
Pointing Knowledge  
Stabilization Type  
Star Tracker?  
Mono or Bipropellant  
Transmit Power  
Downlink Data Rate (kbps)  
Communications Band

**Spacecraft = Cruise Stage + Entry Vehicle**

**Entry Vehicle = EDL Assembly + Lander**

**Rotorcraft Lander**

EDL assembly includes aeroshell (heatshield and backshell), parachutes, ESI, and support equipment.

Lander in flight configuration, using mobility subsystem.

Lander in surface configuration, HGA deployed.

**Schedule Data**

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aView v2022 Log In

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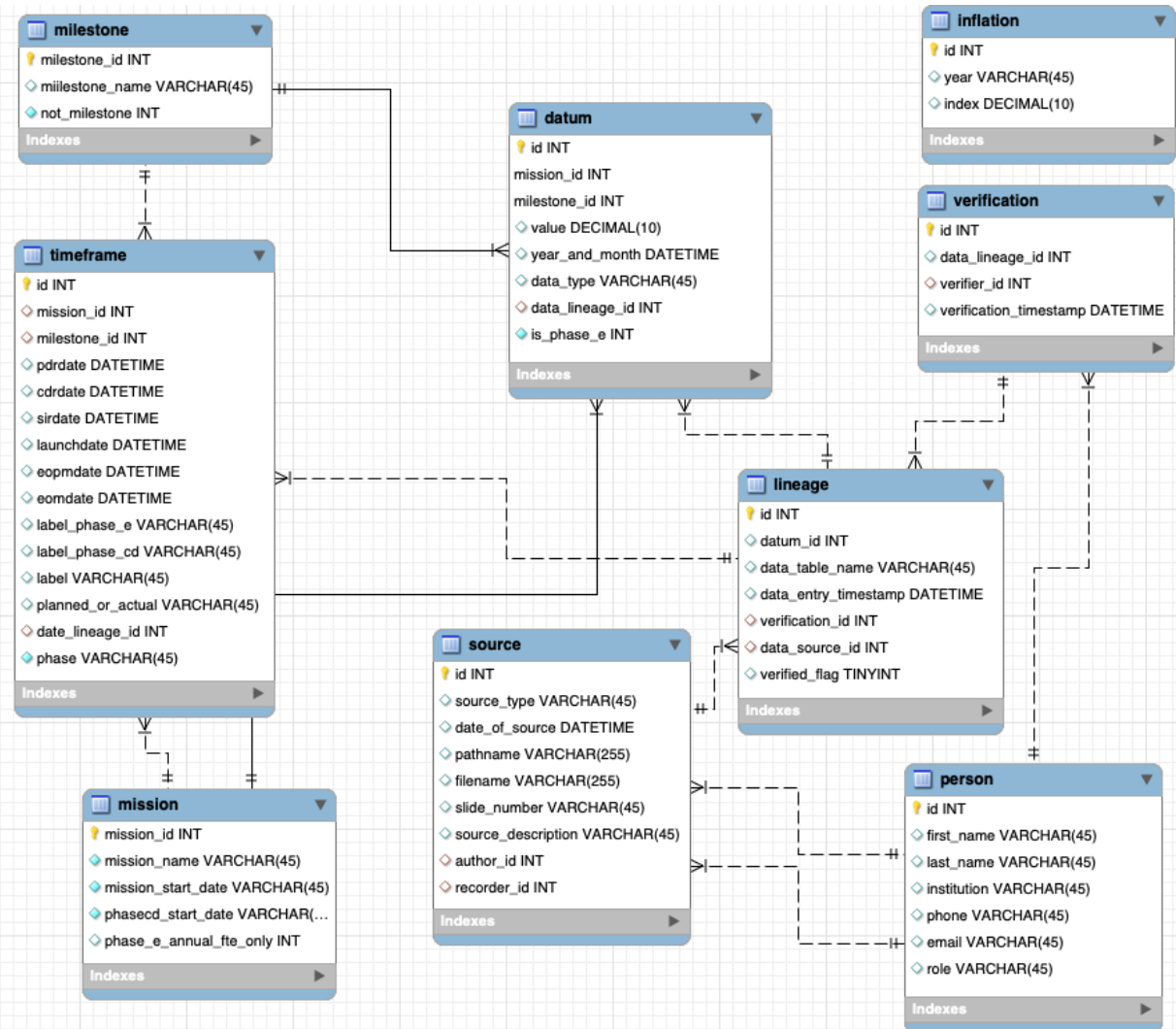
Table with columns: Name, Start, End, Duration, Status, Location, etc.

Figure F, Fact sheet for Dragonfly

# Tool Construction

- aView uses open-source *chart.js*, a JavaScript tool suite on the frontend, and a SQLite database (DB) on the backend

- *DB is designed to allow for complete traceability for every data point (datum) that is plotted*
- *aView leverages aspects of Aerospace's infrastructure developed for detailed mission assurance of the nation's launch program for national space assets*

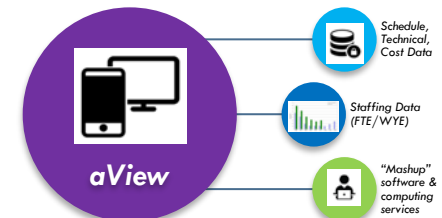




# Summary

- aView developed to assist users in conducting comparative analysis
- Built on a detailed repository of mission programmatic data, it provides high-level views of the historical data for 28 NASA missions for development Phases C and D as well as the operations Phase E
- Given the wealth of mission and project information available in aView, both programmatic and technical, cost analysts can leverage the its capabilities to answer a variety of questions
  - *Understand what development costs and staffing during Phases C and D for a proposed interplanetary mission based on similar historical missions*
  - *Understand how a proposed operations budget for Phase E compares to previous missions managed by the same Center*
  - *Understand how staffing levels track to development costs between PDR and ARR for a particular project*
- Aerospace seeks to broaden the aView DB to include more Earth Science, Astrophysics, and Heliophysics missions

**Welcome support from other customers  
to expand the mission set**





# Acknowledgments

- Customer
  - *Bradley Zavodsky, NASA Planetary Missions Program Office*
- Aerospace
  - *Sarah Lang, Lead*
  - *Justin McNeill, Advisor and Co-Lead*
  - *Tommy Tran, Software Development Lead*
  - *Alexander Zarate Garcia, Developer*
  - *C. Jason Zhang, Developer*
  - *J. Drew Rice, Curator*
- NASA OCFO & HQ IT
  - *James Johnson*
  - *Julie McAfee*
  - *Michael Blanford*
  - *Amanda Dawson*
  - *Ashley Mooney*

