FTE Tool

A Practical Tool for Analyzing Staffing Levels and Cost Across Missions

Justin McNeill, Paul Zomkowski, Robert Bitten
The Aerospace Corporation

14 August 2014

ATR-2014-02806

© The Aerospace Corporation 2014

Outline

- Introduction
- Charting Capabilities
- Mission Fact Sheets
- Tool Construction and Future Vision
- Summary

AEROSPACE
Assuring Space Mission Success

Introduction

FTE Tool

Initially developed in 2009 for a NASA customer, the FTE Tool is a plotting capability built on a detailed repository of mission programmatic data. It provides high-level views of the historical staffing* and cost data for over twenty NASA missions.

Purpose

- Assists in performing comparative analysis across missions
- Supports analysis of data from development Phases C and D as well as in operations, Phase E
- Helps to track how well a project has kept to the original staffing plan: identifying departures from plan
- Provides a repository of programmatic mission information

** FTE is full-time equivalent, which describes a unit of labor.*

AEROSPACE
Assuring Space Mission Success

Introduction

Missions Supported

Current Data Sets of the FTE Tool			
Cassini	Dawn	Deep Impact	Genesis
GRAIL	InSight	Juno	Kepler
LADEE	LCROSS	MESSENGER	MAVEN
MER	MRO	MSL	New Horizons
NuSTAR	OCO	OSIRIS-REx	Phoenix
Spitzer	Stardust	STEREO	WISE

AEROSPACE
Assuring Space Mission Success

Charting Capabilities

Chart Types

A variety of chart types are available in the FTE Tool*. The charts 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.

** The FTE Tool is built on the MS Excel application. The tool is a detailed Excel workbook with embedded Visual Basic macros to automate the generation of plots and allow the user to navigate between them.*

AEROSPACE
Assuring Space Mission Success

Charting Capabilities

User Control Panel

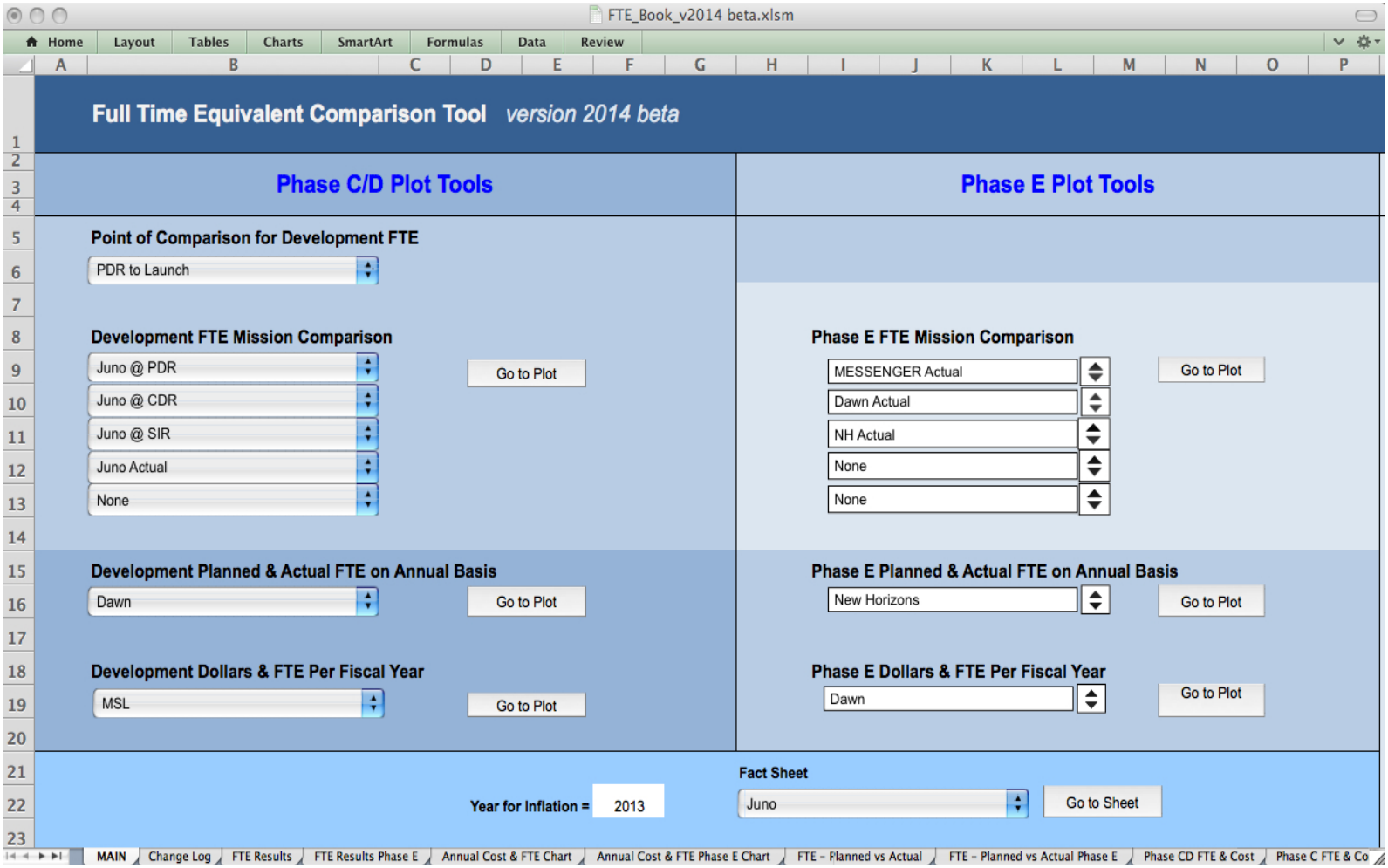


Figure 1: Portion of the FTE Tool User Interface, the *MAIN* tab

AEROSPACE
Assuring Space Mission Success

Chart Types

FTE Comparison Plots for Defined Periods

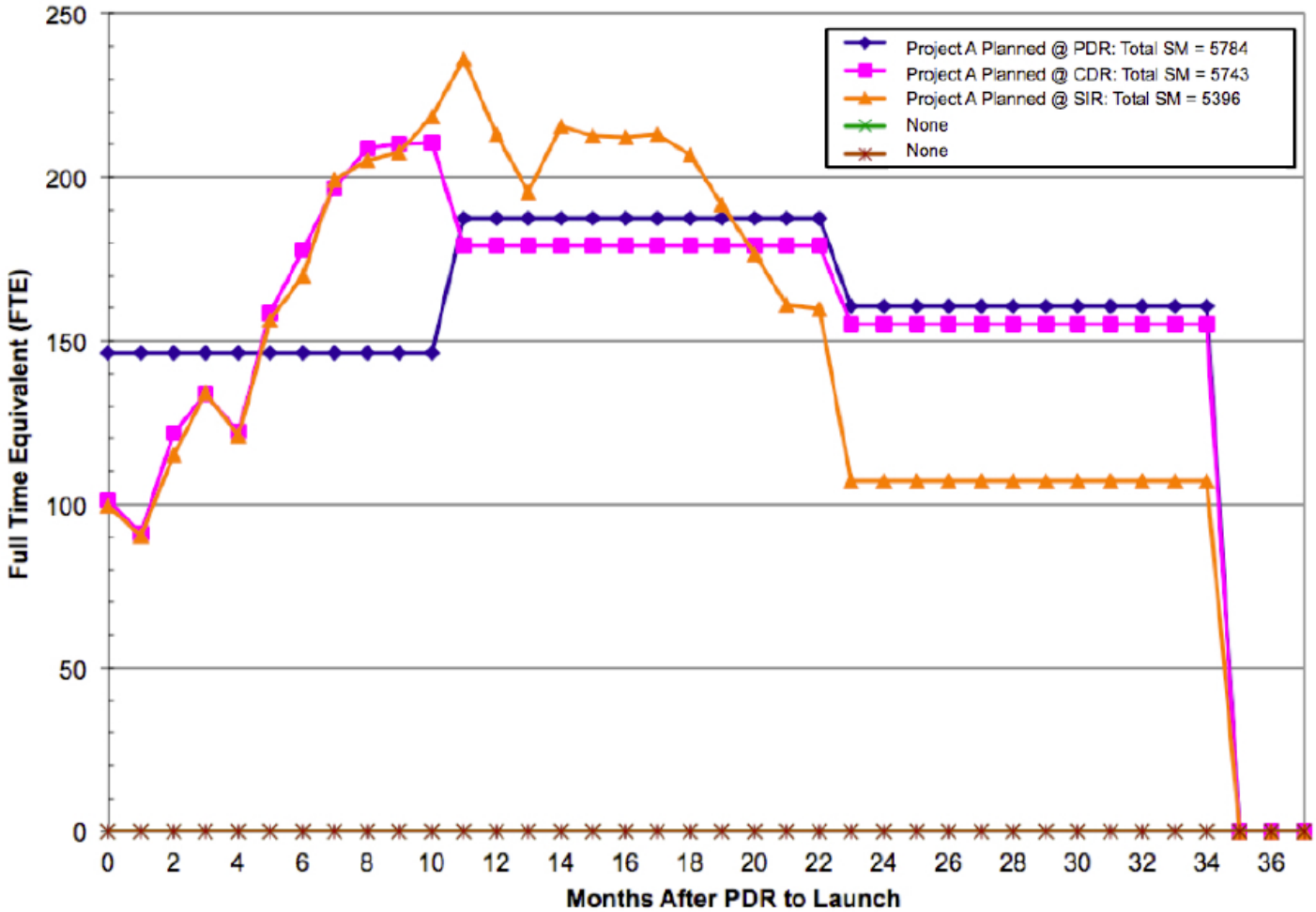


Figure 2: Comparison Plot of FTE for a Selected Project at Various Phase C/D Milestones

AEROSPACE
Assuring Space Mission Success

Chart Types

Planned and Actual FTE by Mission

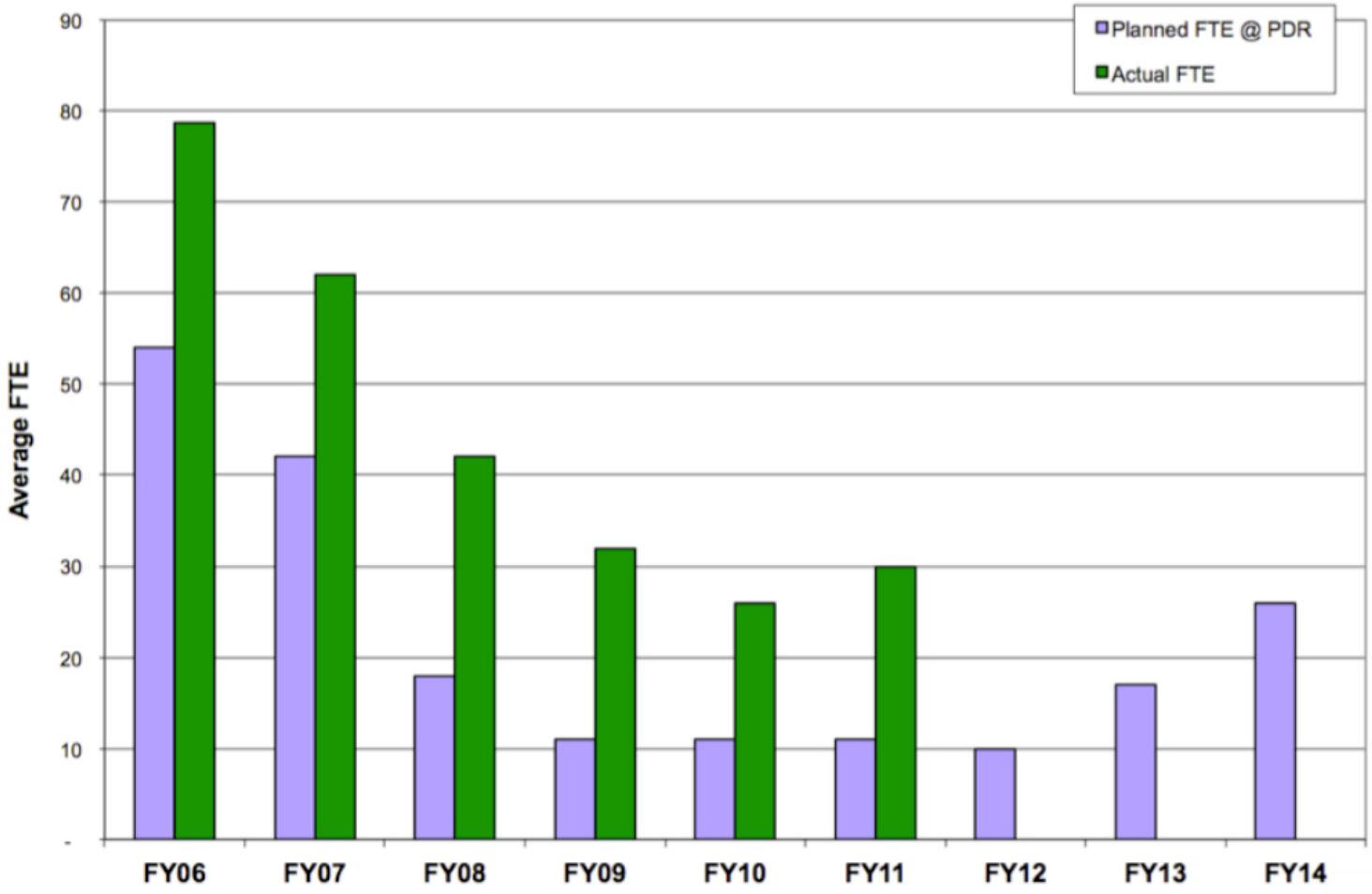


Figure 3: Plot of Planned FTE at PDR and Actual FTE for Phases C/D

AEROSPACE
Assuring Space Mission Success

Chart Types

Annual Cost and FTE by Mission

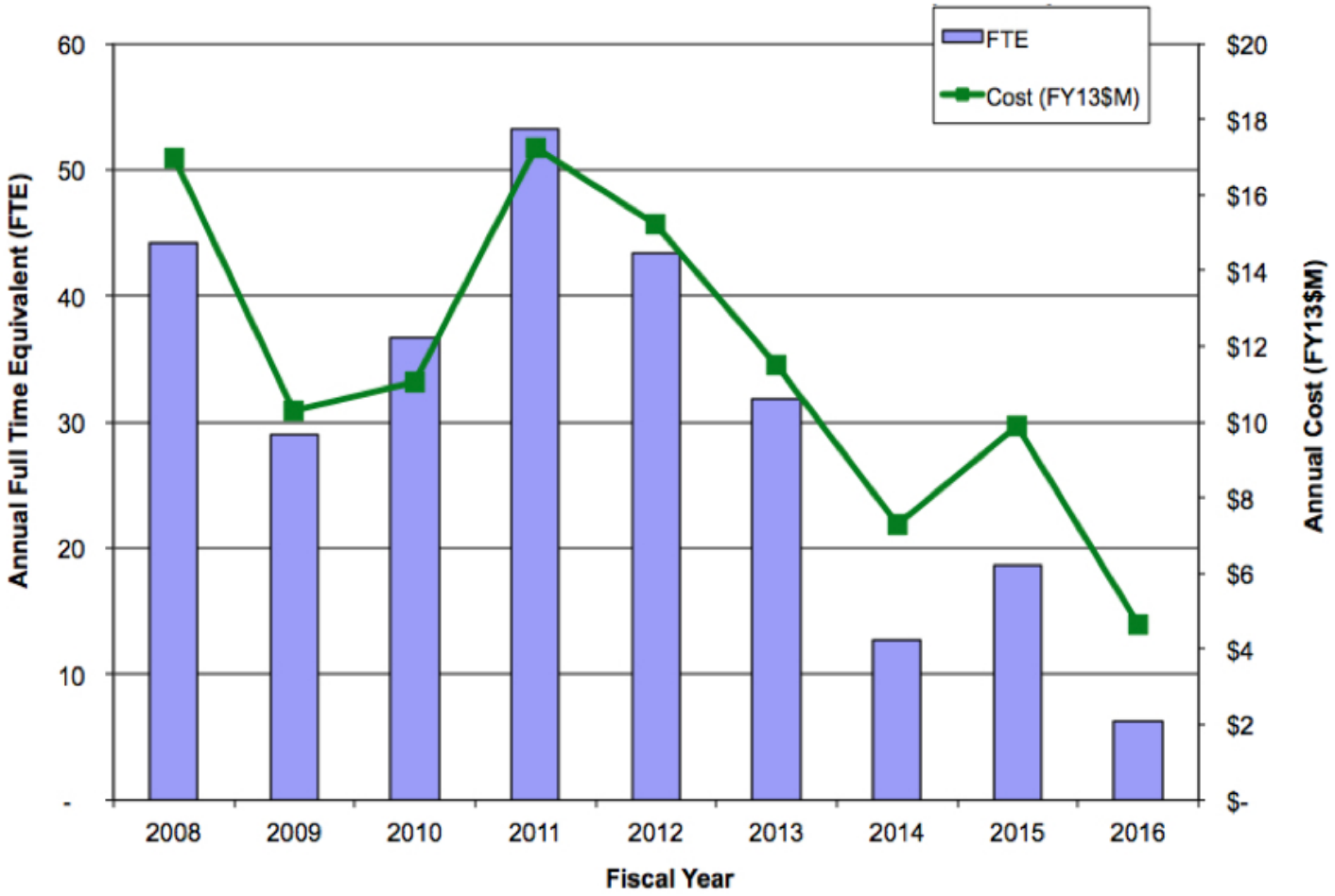


Figure 4: FTE and Cost Per Fiscal Year

AEROSPACE
Assuring Space Mission Success

Chart Types

FTE versus Cost by Mission Phase

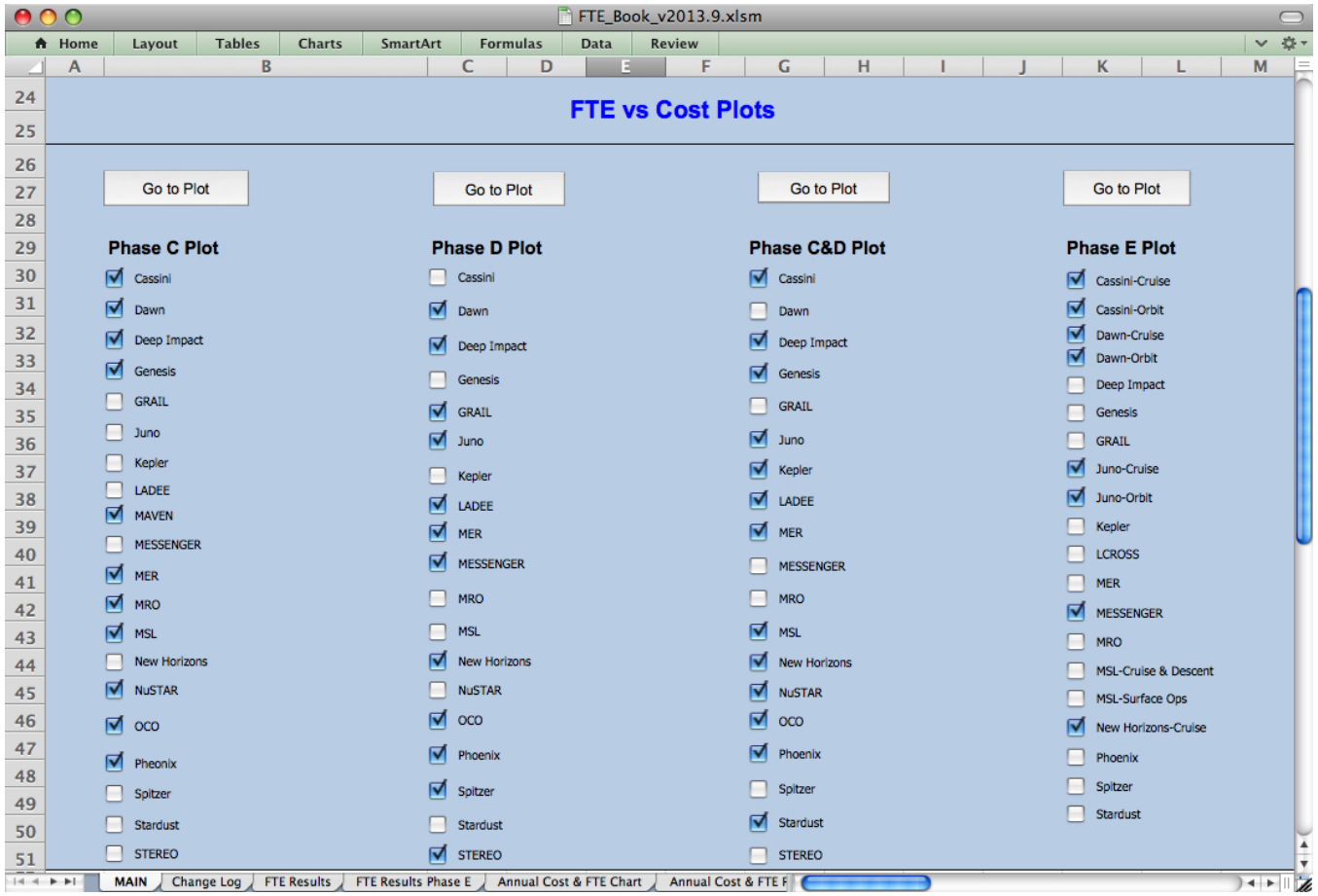


Figure 5: User Interface for the Generation of FTE vs. Cost Plots by Phase, the *MAIN* tab

AEROSPACE
Assuring Space Mission Success

Chart Types

FTE versus Cost by Mission Phase

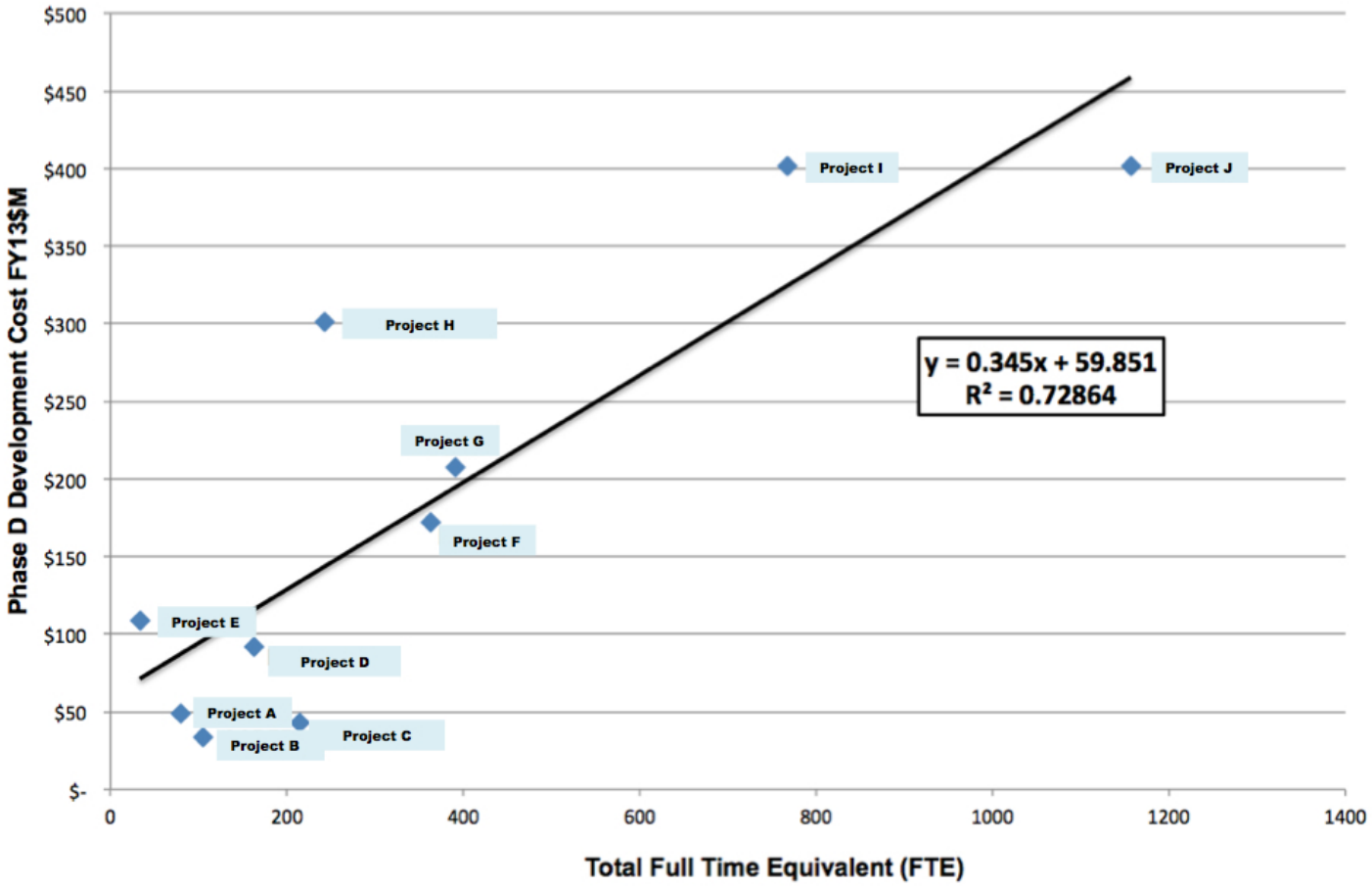


Figure 6: Phase D Development Costs and Total FTE by Project

AEROSPACE
Assuring Space Mission Success

Chart Types

FTE versus Cost for Phase E

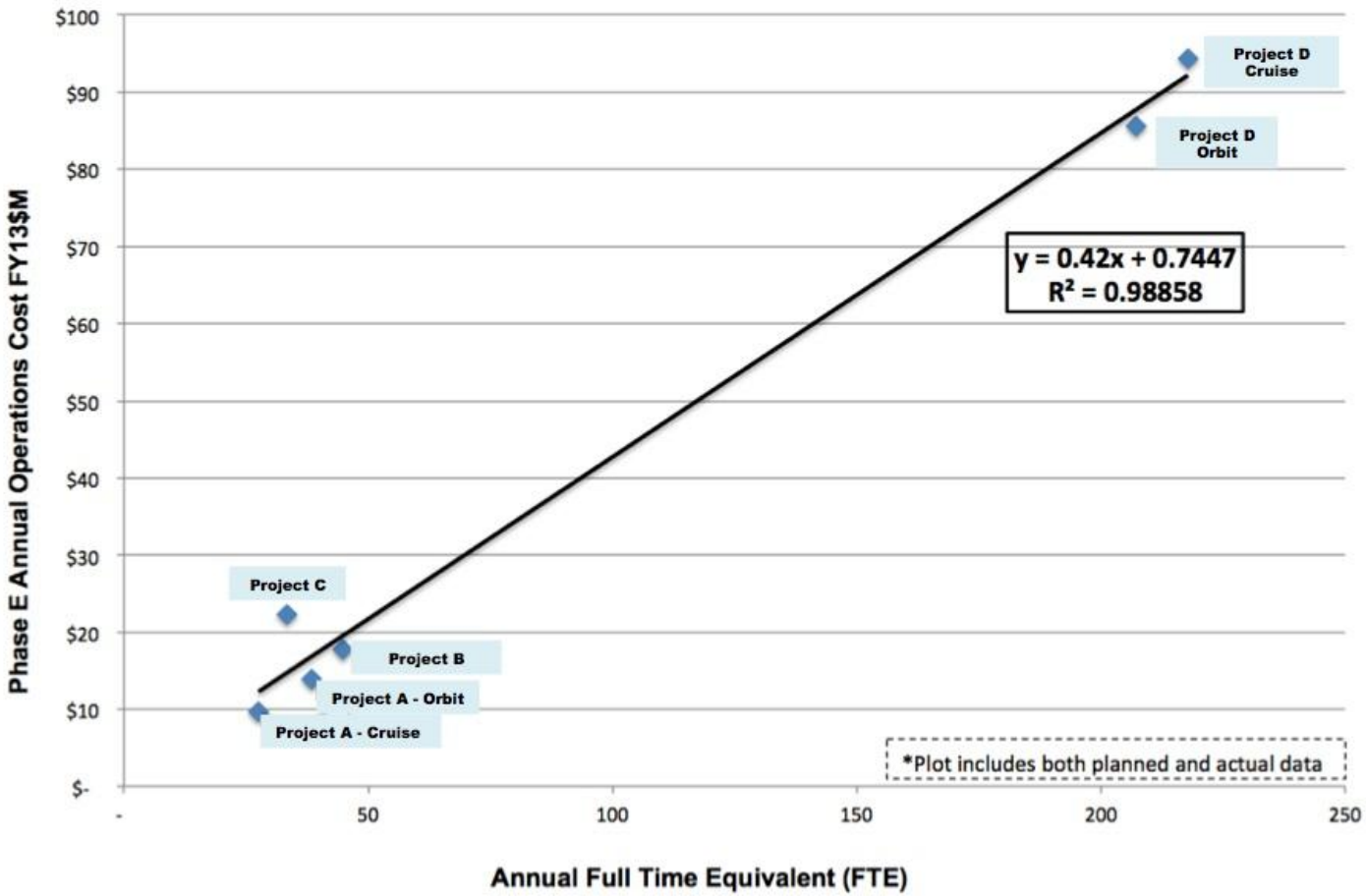


Figure 7: Phase E Annual Operations Cost and Annual FTE by Project

AEROSPACE
Assuring Space Mission Success

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 Cost Analysis Data Requirement (CADRe) is the primary source for the information given in these fact sheets. As missions progress, these sheets are updated, and pertinent information is added.

AEROSPACE
Assuring Space Mission Success

Mission Fact Sheets

Fact Sheet

Juno | Go to Sheet

Juno

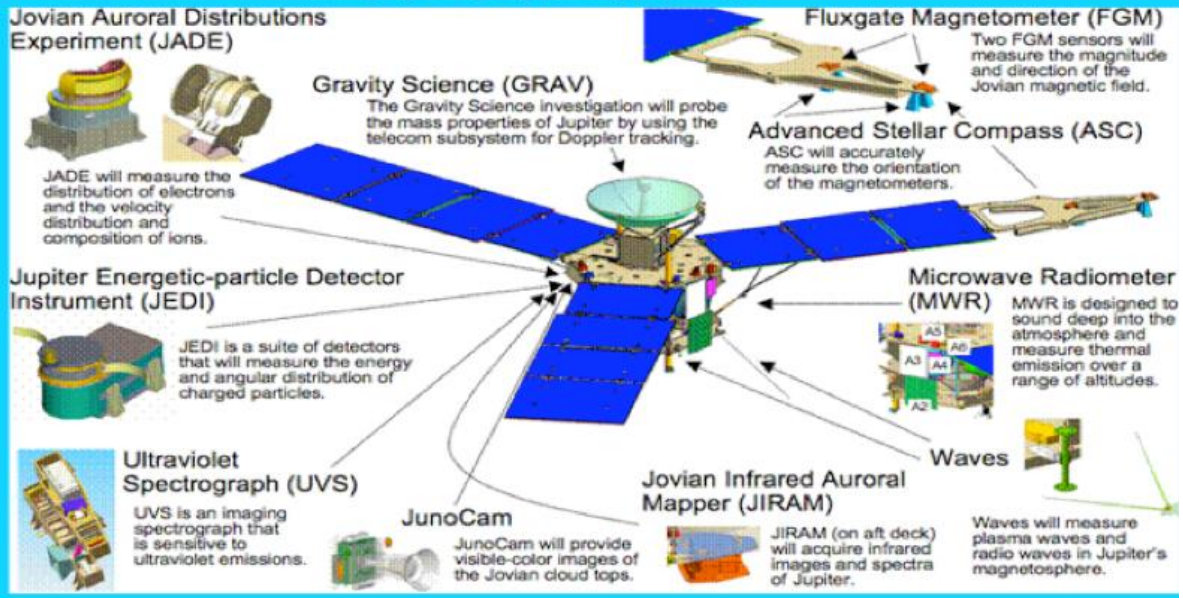
Technical Data

Program	New Frontiers
Lead Center	JPL
Bus Manufacturer	LM
Mission Class	B
Launch Vehicle	Atlas V 551
Development Time (months)	72
Design Life (months)	#REF!
Destination	Jupiter
Max Distance from Sun (AU)	5.2
Satellite Wet Mass (kg)	
Propellant Mass (kg)	
Satellite Dry Mass (kg)	
Spacecraft Bus Dry Mass (kg)	
Payload Mass (kg)	
Number of Instruments	8/10
BOL Power (W)	121
Solar Array Mounting Type	Deployable
Solar Array Area (m^2)	49.4
Pointing Control (deg)	0.17
Pointing Knowledge (deg)	0.25
Stabilization Type	Spin
Star Tracker?	Yes
Mono or Biprop or Ion	Dual-Mode
Transmit Power (W)	25
Downlink Datarate (kbps)	18
Communications Band	X-band

Schedule Data

ATP Start	Aug-05
PDR	May-08
CDR	Apr-09
Start Assembly (ARR or SIR)	Mar-10
Start Env.Test (ERR or TRR)	Aug-10
Delivery (PSR)	Mar-11
Launch	Aug-11

From: \JUNO\CADRe from PBMA\SIR\JUNO_SIR_CADRE_Part_A_032510_1_v1_0.docx, p.35



Return to MAIN

From: \JUNO\System Integration Review (SIR) 03-01-10_D-Project_Mgmt.pdf, p.7

Inset diagram courtesy NASA

Figure 8: User Interface Selector and Juno Fact Sheet

AEROSPACE
Assuring Space Mission Success

Tool Construction and Future Vision

Regarding construction, the tool is a detailed Excel workbook with embedded Visual Basic macros to automate the generation of plots and allow the user to navigate between the *Main* tab and the various charts and mission fact sheets.

- *Tool's data repository is composed of a series of managed Excel worksheets. For each mission, a worksheet tab exists that holds the development (Phase C/D) and operations (Phase E) data sets.*
- *Worksheet tabs exist for each mission fact sheet.*

As the size and functionality of the tool has increased, it has become clear that there are limitations in flexibility, durability, and robustness with the current implementation. One vision of the future implementation of the FTE Tool is

- *Web-based application hosted on secure server with controlled access for the users*
- *Data repository built on an open source relational database*
- *Fact sheets dynamically linked to various project websites*

AEROSPACE
Assuring Space Mission Success

Summary

The FTE Tool has been developed and deployed to assist users in their comparative analysis. Built on a detailed repository or database of mission programmatic data, it provides high-level views of the historical data for over twenty NASA missions for development Phases C and D as well as the operations Phase E.

Given the wealth of mission and project information, both programmatic and technical, provided by the FTE Tool, cost analysts and other users can easily leverage the tool's capabilities to answer a variety of questions like the ones listed below.

An institution has proposed an interplanetary mission with a flight system bus and instrument similar to two previous missions. What can I expect in terms of development costs and staffing during Phases C and D?

A particular NASA Center that has flown three previous deep space missions and is submitting an operations budget for Phase E for a new mission. How does this proposed budget compare to the previous estimated and actual Phase E costs for those previous missions managed by that Center?

How do staffing levels track to development costs between PDR and ARR for Project Q?

NOTE: All trademarks, trade names, and service marks are the property of their respective owners.

AEROSPACE
Assuring Space Mission Success