



**TECOLOTE  
RESEARCH, INC.**  
*Bridging Engineering and Economics*  
Since 1973

# AMPM

*(Agency Program Management Model)*

*Capabilities Overview*

*ACEIT User Conference*

*January 26-28, 2009*

*Charles Hunt, NASA HQ*

*Wayne Johnson, Tecolote Research, Inc.*

- Los Angeles ■ Washington, D.C. ■ Boston ■ Chantilly ■ Huntsville ■ Dayton ■ Santa Barbara
- Albuquerque ■ Colorado Springs ■ Ft. Meade ■ Ft. Monmouth ■ Ogden ■ Silver Spring ■ Patuxent River ■ Washington Navy Yard ■ Goddard Space Flight Center
- Cleveland ■ Denver ■ Johnson Space Center ■ Dahlgren ■ Montgomery ■ New Orleans ■ Oklahoma City ■ Tampa ■ Tacoma ■ Warner Robins ALC ■ Vandenberg AFB

## ■ Objectives

- Price out the Agency Mission Planning Model (AMPM) manifest for SMD
  - Establish PA&E “baseline” that approximates the budget and projects out-year costs
- Investigate strategic scenario what-ifs
  - Sensitivities, reserves strategies, etc.

## ■ Process

- Understand out-year missions
  - Cap policies
  - Technical and schedule data if available
- Integrate budget content
  - Budget content
  - Non-mission costs
- Establish deterministic baseline
  - Parametric-based for out years (70% confidence level assumed)
  - Budget-based for budget horizon
- Generate probabilistic cost estimates
  - Historical cost growth data and anticipated discrete risks
  - Parametric and technical uncertainty included in out-year estimates
- Run Sand Chart Tool
  - Check health of mission profile
  - Understand new starts

- **Re-engineer the current AMPM**
  - Current version all spreadsheet-based
    - Separate tables for spreading and inflation
- **Estimate future mission costs**
  - Missions that have ATP beyond budget horizon (FY2014+)
  - Integrate Cost estimating model (Quickcost) currently in separate spreadsheet
- **Four major themes with several (1-2 dozen) missions/theme**
  - Earth Sciences
  - Astrophysics
  - Heliophysics
  - Planetary Sciences
- **Compare estimates to budgets**
  - Sand Charts
  - Paretos
  - Time Phased

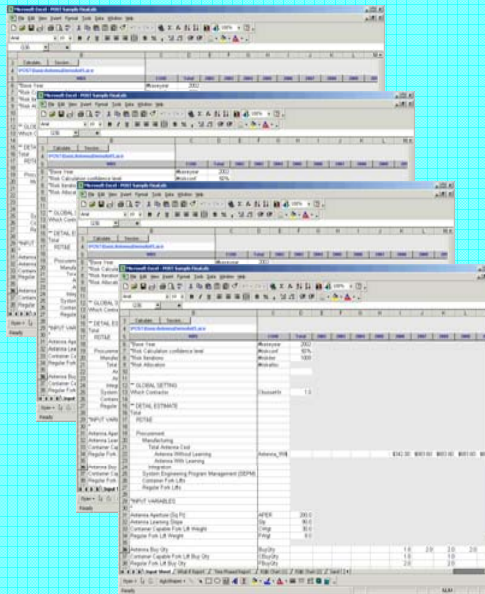
***Re-host AMPM in ACE to take advantage of cost and temporal capabilities***

# Model Architecture Construct

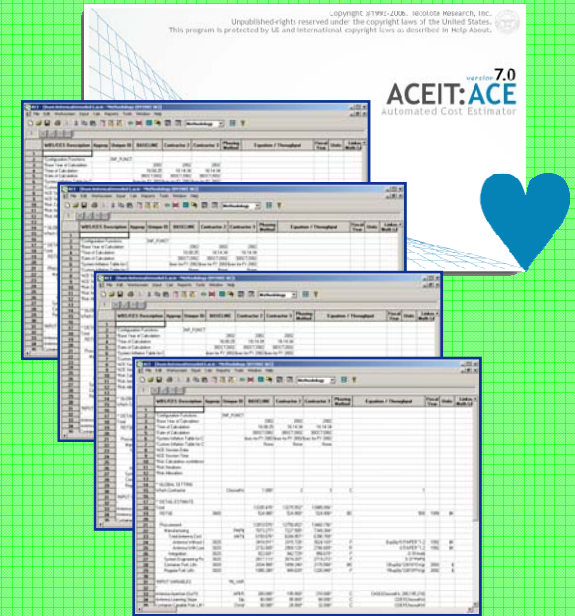
## Input Sheets



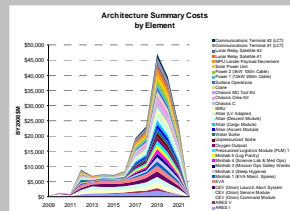
## Case Sheets



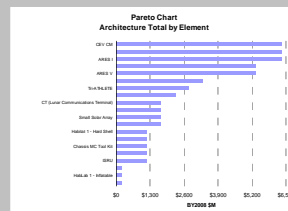
## ACE Files



## Outputs



Sand



Pareto



Tabular

# Input Screen - Earth Sciences Theme

## Cost Summary and Cost Estimation Sections

Earth Sciences		SYSP (SMAP)	ESSP (Venture 1)	SYSP (ICESAT II)	ESSP (Venture 2)	SYSP (ESDS-3)	ESSP (Venture 3)
Include/Exclude Mission From Summary ==>		<input checked="" type="checkbox"/> Included	<input checked="" type="checkbox"/> Included	<input type="checkbox"/> Excluded	<input checked="" type="checkbox"/> Included	<input checked="" type="checkbox"/> Included	<input type="checkbox"/> Excluded
<b>Total Mission Cost (FY08\$M)</b>		\$ 1,030.0	\$ 926.5	\$ 1,229.9	\$ 927.7	\$ 1,879.1	\$ 1,846.7
Pre-Phase A Costs	Percentage of Phase A/B/C/D Costs ==>	5% \$ 27.5	5% \$ 27.5	5% \$ 27.5	5% \$ 27.5	5% \$ 64.8	5% \$ 64.3
Phase A/B/C/D		\$ 817.6	\$ 714.1	\$ 1,017.5	\$ 817.1	\$ 1,460.8	\$ 1,552.3
Government Project Office		\$ 267.6	\$ 164.1	\$ 467.5	\$ 267.1	\$ 163.8	\$ 265.6
Government Project Office (NRE+TFU)		\$ 267.6	\$ 164.1	\$ 467.5	\$ 267.1	\$ 163.8	\$ 265.6
Government Project Office (Prod)		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
S/C+CommPyl+d+FU	(Calculated="C", Throughput="T") ==>	π \$ 500.0	π \$ 500.0	π \$ 500.0	π \$ 500.0	c \$ 1,297.0	c \$ 1,286.7
Follow On Production		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Fee on Total S/C	Fee % ==> Globals Off	10% \$ 50.00	10% \$ 50.00	10% \$ 50.00	10% \$ 50.00		
Ground Systems	% of Total Cost ==> Globals Off	9% \$ 45.00	9% \$ 45.00	9% \$ 45.00	7% \$ 35.00	7% \$ 90.79	7% \$ 90.07
Launch Services							
Launcher Name		Delta IV	Delta IV	Delta IV	Pegasus XL	Delta IV Heavy	Delta II 79 2015
Launch Services Cost		\$114.9	\$114.9	\$114.9	\$23.1	\$197.8	\$75.7
Phase E		\$25.0	\$25.0	\$25.0	\$25.0	\$64.8	\$64.3
MO&DA	Percentage of Phase A/B/C/D Cost ==>	5% \$25.0	5% \$25.0	5% \$25.0	5% \$25.0	5% \$64.8	5% \$64.3
Other (Misc.)		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
<b>QuickCost (Phase A/B/C/D) CER Parameters</b>							
Dry Mass (S/C Bus + Instruments) (Kg) - Nominal Value		3,142.51	3,142.51	3,142.51	3,142.51	3,142.51	3,142.51
Dry Mass (S/C Bus + Instruments) (Kg) - High Value	Hi % ==>	125% 3,928.13	125% 3,928.13	125% 3,928.13	125% 3,928.13	125% 3,928.13	125% 3,928.13
Dry Mass (S/C Bus + Instruments) (Kg) - Low Value	Low % ==>	90% 2,828.25	90% 2,828.25	90% 2,828.25	90% 2,828.25	90% 2,828.25	90% 2,828.25
Planetary Mission? (Yes/No)		<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No
Platform Factor		Unmanned Earth Orbital	Unmanned Earth Orbital	Unmanned Earth Orbital	Unmanned Earth Orbital	Unmanned Earth Orbital	Unmanned Earth Orbital
Peak Gov't Project Office Size		152.9	152.90	267.11	152.62	152.62	151.77
Civil Servant Annual Labor Rate (Loaded \$M)		\$ 0.280	\$ 0.280	\$ 0.280	\$ 0.280	\$ 0.280	\$ 0.280
Engineering Complexity (ECMPLX)		1.274	1.274	1.274	1.274	1.274	1.274
Manufacturing Complexity (MCMPLX)		10.96	10.96	10.96	10.95	10.95	10.92

### Cost Estimation Method (Quickcost Calculation or Throughput)

Input Value  
 Calculated Value

# Input Screen - Earth Sciences Theme

## Temporal Factors Section

Earth Sciences		SYSP (SMAP)	ESSP (Venture 1)	SYSP (ICESAT II)	ESSP (Venture 2)	SYSP (ESDS-3)	ESSP (Venture 3)
Include/Exclude Mission From Summary ==>		<input checked="" type="checkbox"/> Included	<input checked="" type="checkbox"/> Included	<input type="checkbox"/> Excluded	<input checked="" type="checkbox"/> Included	<input checked="" type="checkbox"/> Included	<input type="checkbox"/> Excluded
<b>Mission</b>							
Launch Date (DDMMYYYY)		01Oct2014	01Oct2014	01Oct2014	01Oct2014	01Oct2014	01Oct2014
<b>Phase Duration Factors</b>							
Pre-Phase A Duration (Months)		6	6	6	6	6	6
Phase A/B/C/D Duration (Months) - Input/Calculate ("I" or "C")		Calculated	Input	Calculated	Calculated	Input	Calculated
Production Duration (Months)		46	46	46	46	46	46
Calculated Override Phase A/B/C/D Duration (Months)		75.0	75.0	75.0	75.0	75.0	75.0
Phase E Duration (Months)		36	36	36	36	36	36
<b>Override Factors</b>							
Override Calculated Start Dates (Yes/No)		<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No
Pre-Phase A Start Date Override		<input type="checkbox"/> 01Oct2011	<input checked="" type="checkbox"/> 01Oct2011	<input type="checkbox"/> 01Oct2011	<input checked="" type="checkbox"/> 01Oct2011	<input type="checkbox"/> 01Oct2011	<input checked="" type="checkbox"/> 01Oct2011
Phase A/B/C/D Start Date Override		<input type="checkbox"/> 01Oct2013	<input checked="" type="checkbox"/> 01Oct2011	<input type="checkbox"/> 01Oct2011	<input checked="" type="checkbox"/> 01Oct2011	<input type="checkbox"/> 01Oct2011	<input checked="" type="checkbox"/> 01Oct2011
Phase E Start Date Override		<input type="checkbox"/> 01Oct2011	<input checked="" type="checkbox"/> 01Oct2011	<input type="checkbox"/> 01Oct2011	<input checked="" type="checkbox"/> 01Oct2011	<input type="checkbox"/> 01Oct2011	<input checked="" type="checkbox"/> 01Oct2011
<b>Beta Phasing Factors</b>							
<b>Spent % Factors</b>							
Pre-Phase A Spent %		Globals Off 60	60	60	60	60	60
Phase A/B/C/D Spent %		Globals Off 60	60	60	60	60	60
<b>Time % Factors</b>							
Pre-Phase A Time %		Globals Off 50	50	50	50	50	50
Phase A/B/C/D Time %		Globals Off 50	50	50	50	50	50
<b>Peakness Factors</b>							
Pre-Phase A Peakness		Globals Off 0.4	0.4	0.4	0.4	0.4	0.4
Phase A/B/C/D Peakness		Globals Off 0.7	0.7	0.7	0.7	0.7	0.7
<b>Launch Vehicle</b>							
<b>Beta Phasing Parameters</b>							
Spent %		60	60	60	60	60	60
Time %		50	50	50	50	50	50
Peakness		0.5	0.5	0.5	0.5	0.5	0.5
Duration (Months)		24	24	24	24	24	24
Lag from Launch Date (Months)		3	3	3	3	3	3

Date Override Option

Phase Duration Calculation Method Option

Input Value  
 Calculated Value

Earth Sciences		SYSP (SMAP)	ESSP (Venture 1)	SYSP (ICESAT II)	ESSP (Venture 2)	SYSP (ESDS-3)	ESSP (Venture 3)
Include/Exclude Mission From Summary ==>		<input checked="" type="checkbox"/> Included	<input checked="" type="checkbox"/> Included	<input checked="" type="checkbox"/> Included	<input checked="" type="checkbox"/> Included	<input checked="" type="checkbox"/> Included	<input checked="" type="checkbox"/> Included
<b>Total Mission Cost (FY08\$M)</b>		\$ 1,826.5	\$ 1,826.5	\$ 1,229.9	\$ 927.7	\$ 1,879.1	\$ 1,846.7
Pre-Phase A Costs	Percentage of Phase A/B/C/D Costs ==>	5% \$ 65.0	5% \$ 65.0	5% \$ 27.5	5% \$ 27.5	5% \$ 64.8	5% \$ 64.3
Phase A/B/C/D		\$ 1,464.5	\$ 1,464.5	\$ 1,017.5	\$ 817.1	\$ 1,460.8	\$ 1,552.3
Government Project Office		\$ 164.1	\$ 164.1	\$ 467.5	\$ 267.1	\$ 163.8	\$ 265.6
Government Project Office (NRE+TFU)		\$ 164.1	\$ 164.1	\$ 467.5	\$ 267.1	\$ 163.8	\$ 265.6
Government Project Office (Prod)		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
S/C+CommPyld+FU	(Calculated="C", Throughput="T") ==>	c \$ 1,300.4	c \$ 1,300.4	π \$ 500.0	π \$ 500.0	c \$ 1,297.0	c \$ 1,286.7
Follow On Production		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Fee on Total S/C	Fee % ==>	<b>Globals On</b> 10% \$ -	<b>Globals On</b> 10% \$ -	<b>Globals On</b> 10% \$ 25.00	<b>Globals On</b> 10% \$ 25.00	<b>Globals On</b> 10% \$ -	<b>Globals On</b> 10% \$ -
Ground Systems	% of Total Cost ==>	<b>Globals On</b> 9% \$ 247.08	<b>Globals On</b> 9% \$ 247.08	<b>Globals On</b> 9% \$ 95.00	<b>Globals On</b> 7% \$ 95.00	<b>Globals On</b> 7% \$ 246.42	<b>Globals On</b> 7% \$ 244.47
Launch Services							
Launcher Name		Delta IV	Delta IV	Delta IV	Pegasus XL	Delta IV Heavy	Delta II 7920S
Launch Services Cost		\$114.9	\$114.9	\$114.9	\$23.1	\$197.8	\$75.7
Phase E		\$65.0	\$65.0	\$25.0	\$25.0	\$64.8	\$64.3
MO&DA	Percentage of Phase A/B/C/D Cost ==>	5% \$65.0	5% \$65.0	5% \$25.0	5% \$25.0	5% \$64.8	5% \$64.3
Other (Misc.)		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
<b>QuickCost (Phase A/B/C/D) CER Parameters</b>							
Dry Mass (S/C Bus + Instruments) (Kg) - Nominal Value		3,142.51	3,142.51	3,142.51	3,142.51	3,142.51	3,142.51
Dry Mass (S/C Bus + Instruments) (Kg) - High Value		Hi %==> 125% 3,928.13	125% 3,928.13	125% 3,928.13	125% 3,928.13	125% 3,928.13	125% 3,928.13
Dry Mass (S/C Bus + Instruments) (Kg) - Low Value		Low %==> 90% 2,828.25	90% 2,828.25	90% 2,828.25	90% 2,828.25	90% 2,828.25	90% 2,828.25
Planetary Mission? (Yes/No)		<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No
Platform Factor		Unmanned Earth Orbital	Unmanned Earth Orbital	Unmanned Earth Orbital	Unmanned Earth Orbital	Unmanned Earth Orbital	Unmanned Earth Orbital
Peak Gov't Project Office Size		152.9	152.90				
Civil Servant Annual Labor Rate (Loaded \$M)		\$ 0.280	\$ 0.280				
Engineering Complexity (ECMPLX)		1.274	1.274				
Manufacturing Complexity (MCMPLX)		10.96	10.96				

Global Parameters	Toggle	Value
Global Parameters Off	<input type="radio"/> Yes <input type="radio"/> No	
Fee %	<input type="checkbox"/> 5%	0.77
Ground Systems Percentage	<input type="checkbox"/> 19%	0.280
Pre-Phase A Beta Spent %	<input type="checkbox"/> 60	
Pre-Phase A Beta Time %	<input type="checkbox"/> 50	0.74
Pre-Phase A Beta Peakness	<input type="checkbox"/> 0.5	
Phase A/B/C/D Beta Spent %	<input type="checkbox"/> 60	0.92
Phase A/B/C/D Beta Time %	<input type="checkbox"/> 50	
Phase A/B/C/D Beta Peakness	<input type="checkbox"/> 0.5	
Confidence Level Percentile %	<input type="checkbox"/> 50	

Toggle switches for individual global factors

## Earth Sciences

C:\Documents and Settings\stjohnson\My Documents\ACEIT Data\Sessionst\AMPM\_Earth\_Science\_08\_02\_08.aceit

Costs in BY2008\$M

Monday, 08 September 2008, 1:17 pm

Calculate

VBS	Cost Interpretation	Total	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Launcher		\$114.9*						\$18.6*	\$80.0*	\$16.4*			
Phase E		\$25.0*								\$1.4*	\$8.3*	\$8.3*	\$7.0*
Other													
SYSP (ICESAT II)		\$1,264.2*	\$7.2*	\$145.5*	\$258.2*	\$280.3*	\$265.8*	\$217.0*	\$65.3*	\$8.3*	\$8.3*	\$8.3*	\$0.0*
Pre-Phase A		\$27.5*					\$27.5*						
Phase A/B/C/D		\$1,096.8*	\$7.2*	\$145.5*	\$258.2*	\$280.3*	\$230.7*	\$136.4*	\$38.6*	\$0.0*			
Gov't Project Office		\$439.6*	\$2.9*	\$58.3*	\$103.5*	\$112.3*	\$92.5*	\$54.6*	\$15.5*	\$0.0*			
Ground Systems		\$107.2*	\$0.7*	\$14.2*	\$25.2*	\$27.4*	\$22.6*	\$13.3*	\$3.8*	\$0.0*			
S/C Dev. & Prod. (Phase A/B/C/D)		\$550.0*	\$3.6*	\$72.9*	\$129.5*	\$140.6*	\$115.7*	\$68.4*	\$19.3*	\$0.0*			
Launcher		\$114.9*					\$7.5*	\$80.7*	\$26.7*				
Phase E		\$25.0*								\$8.3*	\$8.3*	\$8.3*	\$0.0*
Other													
ESSP (Venture 2)		\$959.9*					\$109.8*	\$192.6*	\$227.6*	\$200.0*	\$144.9*	\$58.4*	\$7.9*
Pre-Phase A		\$27.5*					\$27.5*						
Phase A/B/C/D		\$884.3*					\$82.3*	\$192.6*	\$227.6*	\$200.0*	\$131.0*	\$49.2*	\$1.6*
Gov't Project Office		\$251.1*					\$23.4*	\$54.7*	\$64.6*	\$56.8*	\$37.2*	\$14.0*	\$0.5*
Ground Systems		\$83.2*					\$7.7*	\$18.1*	\$21.4*	\$18.8*	\$12.3*	\$4.6*	\$0.2*
S/C Dev. & Prod. (Phase A/B/C/D)		\$550.0*					\$51.2*	\$119.8*	\$141.6*	\$124.4*	\$81.5*	\$30.6*	\$1.0*
Launcher		\$23.1*									\$13.9*	\$3.2*	\$0.0*
Phase E		\$25.0*											\$6.2*
Other													
SYSP (ESDS-3)		\$1,742.1*				\$59.4*	\$316.4*	\$618.4*	\$562.2*	\$129.7*	\$19.8*	\$19.8*	\$16.5*
Pre-Phase A		\$59.4*				\$59.4*	\$0.0*						
Phase A/B/C/D		\$1,425.6*					\$316.4*	\$586.4*	\$424.5*	\$98.2*			

Earth Sciences Case

Earth Sciences

Heliophysics Case

Heliophysics

Planetary Case



Mission names linked to input sheet

Confidence Level by mission

	CL%	TOTAL	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20
<b>Heliophysics Missions</b>		\$ 25,101	\$ 142	\$ 634	\$ 1,332	\$ 2,854	\$ 5,951	\$ 6,719	\$ 3,898	\$ 1,608	\$ 1,106	\$ 612	\$ 105	\$ 62	\$ 63
Sentinels	70	\$ 993	\$ -	\$ -	\$ 22	\$ 138	\$ 342	\$ 355	\$ 112	\$ 8	\$ 8	\$ 8	\$ -	\$ -	\$ -
ITSP	70	\$ 993	\$ -	\$ -	\$ 22	\$ 138	\$ 342	\$ 355	\$ 112	\$ 8	\$ 8	\$ 8	\$ -	\$ -	\$ -
Solar Probe	70	\$ 1,819	\$ -	\$ -	\$ 85	\$ 272	\$ 637	\$ 549	\$ 171	\$ 35	\$ 35	\$ 35	\$ -	\$ -	\$ -
ST-6	70	\$ 1,631	\$ -	\$ -	\$ 50	\$ 250	\$ 602	\$ 508	\$ 158	\$ 21	\$ 21	\$ 21	\$ -	\$ -	\$ -
Solar Orbiter	70	\$ 1,144	\$ 34	\$ 118	\$ 210	\$ 228	\$ 201	\$ 251	\$ 78	\$ 8	\$ 8	\$ 8	\$ -	\$ -	\$ -
ST-5	70	\$ 1,021	\$ 34	\$ 118	\$ 210	\$ 228	\$ 193	\$ 165	\$ 49	\$ 8	\$ 8	\$ 8	\$ -	\$ -	\$ -
New Mission 1	70	\$ 1,828	\$ 10	\$ 210	\$ 373	\$ 405	\$ 403	\$ 281	\$ 83	\$ 21	\$ 21	\$ 21	\$ -	\$ -	\$ -
New Mission 2	70	\$ 1,828	\$ -	\$ -	\$ -	\$ 62	\$ 147	\$ 345	\$ 408	\$ 359	\$ 306	\$ 136	\$ 18	\$ 21	\$ 21
New Mission 3	70	\$ 1,690	\$ -	\$ -	\$ -	\$ 236	\$ 663	\$ 557	\$ 174	\$ 20	\$ 20	\$ 20	\$ -	\$ -	\$ -
New Mission 4	70	\$ 1,699	\$ -	\$ -	\$ -	\$ 61	\$ 328	\$ 624	\$ 509	\$ 119	\$ 21	\$ 20	\$ 17	\$ -	\$ -
New Mission 5	70	\$ 1,703	\$ -	\$ -	\$ -	\$ 61	\$ 326	\$ 622	\$ 516	\$ 121	\$ 20	\$ 20	\$ 17	\$ -	\$ -
New Mission 6	70	\$ 1,894	\$ -	\$ -	\$ -	\$ 254	\$ 754	\$ 594	\$ 186	\$ 35	\$ 36	\$ 35	\$ -	\$ -	\$ -
New Mission 7	70	\$ 1,819	\$ -	\$ -	\$ -	\$ -	\$ 208	\$ 344	\$ 406	\$ 357	\$ 305	\$ 135	\$ 18	\$ 20	\$ 21
New Mission 8	70	\$ 1,728	\$ -	\$ -	\$ -	\$ 62	\$ 147	\$ 344	\$ 407	\$ 357	\$ 249	\$ 97	\$ 18	\$ 21	\$ 21
New Mission 9	70	\$ 1,635	\$ -	\$ -	\$ -	\$ 61	\$ 326	\$ 612	\$ 468	\$ 111	\$ 20	\$ 20	\$ 17	\$ -	\$ -
New Mission 10	70	\$ 1,676	\$ 64	\$ 188	\$ 360	\$ 398	\$ 332	\$ 213	\$ 61	\$ 20	\$ 20	\$ 20	\$ -	\$ -	\$ -
New Mission 11	70	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
New Mission 12	70	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
New Mission 13	70	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
New Mission 14	70	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
New Mission 15	70	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
New Mission 16	70	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
New Mission 17	70	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Astrophysics Missions</b>		\$ 18,343	\$ 267	\$ 897	\$ 1,655	\$ 2,329	\$ 3,640	\$ 3,862	\$ 2,442	\$ 1,332	\$ 1,050	\$ 584	\$ 96	\$ 84	\$ 84
JDEM	70	\$ 1,014	\$ -	\$ -	\$ -	\$ 136	\$ 378	\$ 362	\$ 114	\$ 8	\$ 8	\$ 8	\$ -	\$ -	\$ -
Astro-1	70	\$ 1,015	\$ -	\$ -	\$ -	\$ -	\$ 216	\$ 367	\$ 333	\$ 76	\$ 8	\$ 8	\$ 7	\$ -	\$ -
ExoP M1 and 2	70	\$ 1,986	\$ 116	\$ 230	\$ 408	\$ 443	\$ 367	\$ 246	\$ 71	\$ 35	\$ 35	\$ 35	\$ -	\$ -	\$ -
Astro-2	70	\$ 1,728	\$ -	\$ -	\$ -	\$ -	\$ 209	\$ 344	\$ 407	\$ 357	\$ 249	\$ 97	\$ 18	\$ 21	\$ 21
ExoP-L1	70	\$ 1,144	\$ 6	\$ 118	\$ 210	\$ 228	\$ 229	\$ 251	\$ 78	\$ 8	\$ 8	\$ 8	\$ -	\$ -	\$ -
HST-D	70	\$ 1,021	\$ -	\$ -	\$ -	\$ 28	\$ 83	\$ 194	\$ 230	\$ 202	\$ 178	\$ 80	\$ 8	\$ 8	\$ 8

Theme Summary Costs

Note: Notional Costs Displayed

- **Modeling approach takes advantage of spreadsheet, POST, and ACE features**
  - Spreadsheet
    - Visual basic enhanced user interface
    - Quickcost mission estimator
    - Common factor global overrides
    - Phasing specifications
    - Case sheet pre-processing
    - Extensive use of conditional formatting
  - POST
    - Case sheets
    - Outputs (Sand, Pareto, time phased)
  - ACE
    - One ACE file per major theme (4 total)
    - Cost integration
    - Time Phasing
    - Inflation