2015 NASA Cost Symposium

Livin' Life, Lovin' Estimating

Welcome to the 2015 NASA Cost Symposium

Office of Evaluation *Cost Analysis Division*

- Second most presentations ever - 39 presentations!
- Most Special Sessions ever - 9 Special Sessions!
- An Awards Banquet packed with:
  - Special Guest Speaker: Tom Edwards (Ames Research Center Deputy Center)
  - Great Food
  - For the first time in years – we have nominations in every category
- The second largest attendance ever for the Cost Symposium
  - Over 160 attendees!

This year's agenda is as awesome as an awesome possum!

Symposium Logistics

- Registration Desk
- Restrooms
- Refreshments/Snacks
- Special Sessions (Rm's 105/106 and 108)
- Lunch
  - Where do you eat? Please refer to your welcome package – which was emailed to you on August 17th by Thanh Dinh
    - Registration desk has eatery information
  - Cafeteria is open
    - Building 3 – opens at 11am
- Questions

The Symposium is a Team Effort

- Mr. Doug Comstock, Director of the Cost Analysis Division
- Mr. Ted Mills, Lead Symposium Coordinator
- The Valador Ladies
  - Lisa Connell
  - Thanh Dinh
  - Emma Roberts
  - Anna Huntemann
- Awards Committee
  - Eric Plumer
  - Doug Comstock
  - Larry Wolfarth
  - Susan Bertsch
  - Ted Mills
- Ames Research Center Staff
  - Tommy Paine
  - Michael Saing
  - Ana Burton
  - Marco Boldt

Special Sessions

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- We have 9 Special Sessions this year
- Sessions will be held in parallel with main session
- Sessions will have limited seating – please use sign in sheet located where you registered this morning
  - We have limited seating

Special Sessions

Day	TIME	Title	Location	Author/Presentor (s)	Org	Time (mins)
Tuesday	13:45- 14:45	ONCE DEMO	Rm 105/106	Johnson/Plumer	HQ, SAIC	60
Thursday	8:30 – 9:15	SONIC DEMO	R Rm 108 106	H Kanner	KSC	45
Wednesday	10:45- 11:30	Acquisition Strategies for Complex Systems	Rm 108	T Mills	HQ	45
Wednesday	13:15- 14:15	MOCET DEMO	Rm 108	M Hayhurst	Aerospace, SOMA	60
Wednesday	15:00- 16:00	PCEC DEMO	Rm 105/106	TBD	MSFC, Victory Solutions, BAH	60
Thursday	8:30- 9:30	NASA Software Tool	Rm 105/106	J Hihn	HQ, JPL	60
Thursday	10:45- 11:45	JACS DEMO	Rm 105/106	D Elliott	TRI	60
Thursday	13:15- 14:15	Polaris	Rm 105/106	G Gilmer	BAH	60
Thursday	15:30- 16:30	NICM DEMO	Rm 105/106	J Mrozinski	HQ, JPL	60

Members of the Community

Office of Evaluation *Cost Analysis Division*

PCEC

Hello. My name is PCEC. You killed my father. Prepare to die.

All-Stars

JCL Tools – Polaris and JACS

You fell victim to one of the classic blunders - The most famous of which is "never get involved in a land war in Asia" - but only slightly less well-known is this: "Never bet against JCL when death is on the line"!

ONCE

ONCE. ONCE is wot bwings us togeder today. ONCE, that bwessed awangment, that dweam wifin a dweam...

PRICE and Galorath

As you wish

NICM

“NICM got better? INCONCEIVABLE”
“You keep using that word. I do not think it means what you think it means.”

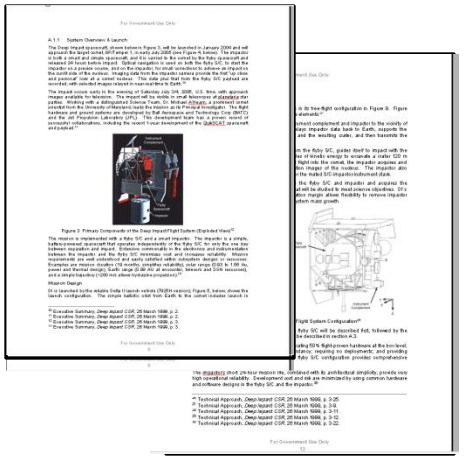
CADRe Update for 2015 Cost Symposium

CADRe Outline

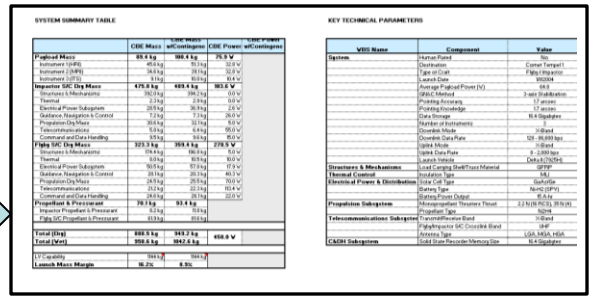
- CADRe Document
- CADRe Requirements & Uses
- CADRe and NSCKN
- 2014-2015 Accomplishments
- CADRe in 7120.5E and PM Handbook
- 2015 CADRe Workshop Highlights

Cost Analysis Requirements Document (CADRe)

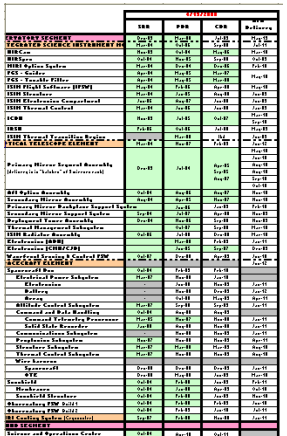
- A Three-Part Document, (usually ~50 pages)
  - PART A Describes a NASA project at each milestone (SRR, PDR, CDR, SIR, Launch and End of Mission), and describes significant changes that have occurred



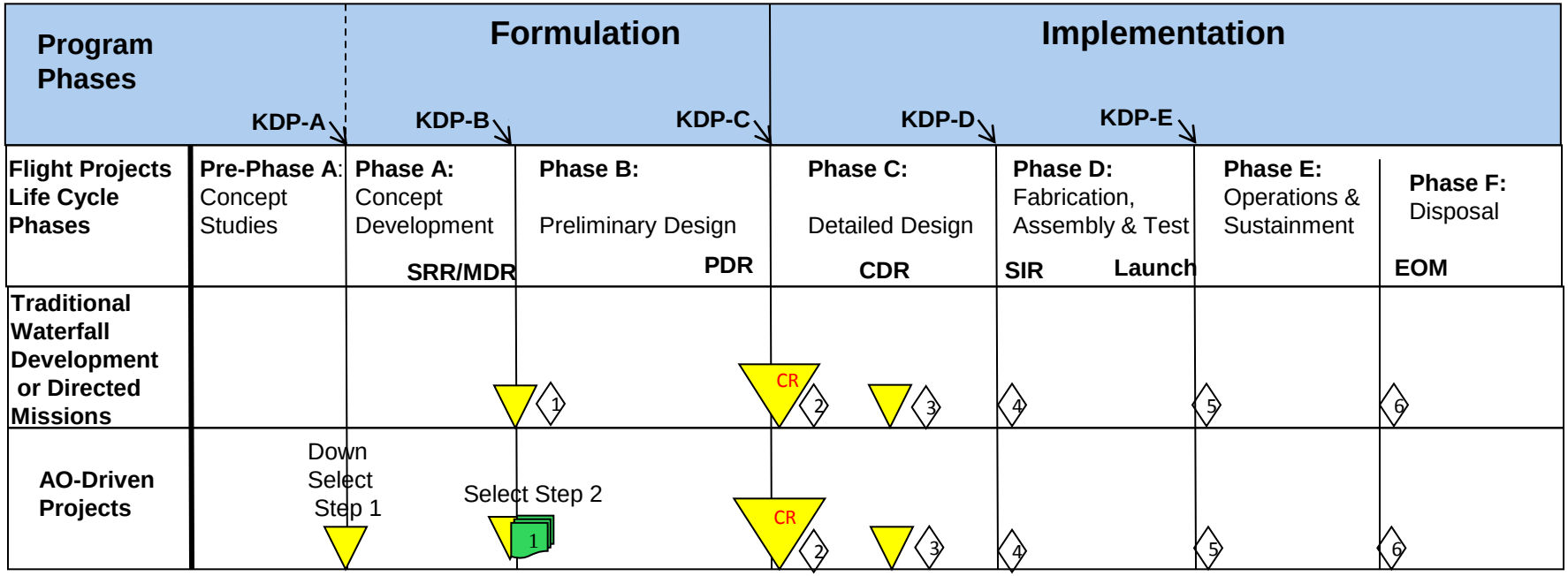
  - PART B Contains standardized templates to capture key technical parameters that are considered to drive cost (Mass, Power, Data Rates)



  - PART C Captures the NASA project's Cost Estimate and actual life cycle costs within the project's and a NASA Cost Estimating Work Breakdown Structures (WBS)..
  - Note: THE "LAUNCH" CADRes for a mission captures the final costs and as-built mass, and power data. The SRR, PDR, CDR CADRes contain Current Best Estimates



Temporal Aspects of CADRe



Mission Decision Review/ICR

1 All parts of CADRe due 30-45 days after KDP

1 CADRe delivered; based on Concept Study Report (CSR) and winning proposal

2 All parts of CADRe due 30-45 days after KDP-B using PDR material

3 Update as necessary 30-45 days after KDP-C using CDR material

4 Update as necessary 30-45 days after KDP-C using SIR material

5 CADRe, All Parts 90 days after launch, as built or as deployed configuration

6 CADRe, update Part C only at the End of Planned Mission

Basic Project Requirements for a CADRe

- **The Project Needs to have a Beginning Point and End Point**
  - Projects that have finish dates have milestone reviews which is where CADRe works besst. Having a completion date is important
  - Level of effort research projects don't make good CADRe material
    - Research on properties of propellants or making jet engines quieter won't lend itself to a CADRe.

- **The Project Needs to have a "measurable" product**
  - Requires some hardware or software that can be touched, weighed, measured in someway. Can be flight and ground articles includes HW and SW. This is necessary to complete a Part B

- **The Project Needs to be a Complete and Whole End Product**
  - Piece parts of hardware such as instruments can be done but it is more challenging.

- **The Project Needs to have a Life Cycle Cost Estimate**
  - Need to for completion of Part C.
  - Updating the LCCE allows for capturing changes over time
  - Temporal aspect

CADRe Dollar Thresholds- Clarifications

7120.5E is silent on the dollar threshold required for CADRe.

As a practice CAD funds CADRes for all 7120.5E missions over $150M dollars and will do CADRes for smaller missions on a case by case basis such as Instrument only missions

CAD also performs CADRes for large projects that are not strictly space flight projects such as 7120.8 projects (Technology Demonstration Missions) especially if they are over $150M. This is a tricky area since it's technically not a requirement.

This has both positive and negative aspects:

- On the positive side that gives us flexibility for doing CADRes on lower dollar threshold projects such as TDM missions and Instrument only missions.

- ON the negative side it give us headaches when projects want to get a CADRe waiver since they feel the dollar amount is low enough to justify not having a CADRe, and we have nothing written in policy to object.

The CADRe Requirements

What Makes CADRe Work?

"Combination of Carrots and Sticks"

- Recognition early-on that "Data Capture" is never high on a project's list of priorities. (delivering flight hardware, delivering science is priority)
- The Requirement is written into NASA Policy 7120.5E (Stick)
- While CADRe is the project's responsibility- CAD Prepares the document on behalf of the project (Carrot)
- CAD Funds CADRe 100% (Carrot)
- CAD is the single voice to communicate, Coordinate, Disseminate Templates, Structure and Policy (Consistency)
- CAD Experience contrasted with other data capture experiences.

SCOPE of CADRe

- Current funding for CADRe :
  - CADRe provides excellent project support collecting data on (Cat 1, II, III) flight and ground projects.
  - CADRes preparing CADRes for Technology Mission Directorate.
  - CADRes being considered for smaller missions such as CubeSats.
    - CAD will perform some exploratory data collection first before then evaluate if appropriate for CADRes
    - Need to meet the MIN ITEMS criteria for a CADRe
    - recognized value of this data capture.

CADRes No Longer on NSCKN

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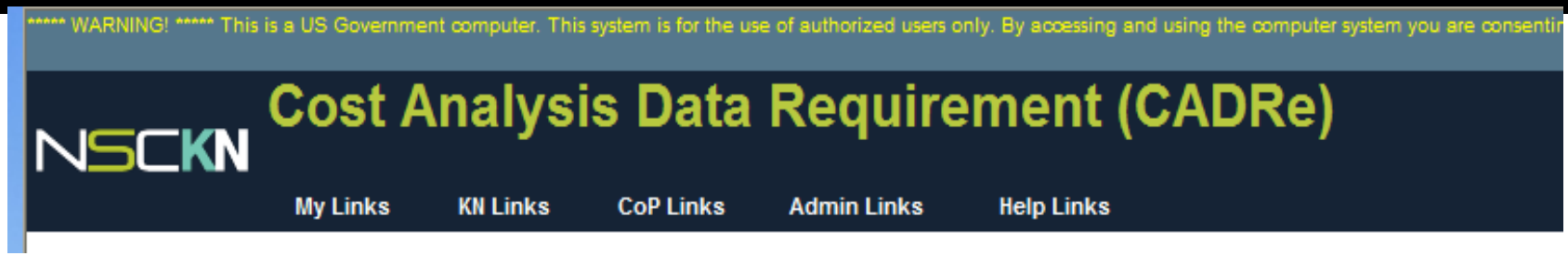

Previously was the where everyone went to Download CADREs

- Provided users with An interactive area To download and Upload CADRe data

ONCE has fully taken over that roll with both a FULL Library and structured search and reporting capabilities.

NO NEW CADRes are being loaded on NSCKN. All new CADRes are loaded into ONCE.

- CAD is not opening any new NSCKN accounts, all new CADRe users are directed to ONCE.

CADRe Accomplishments

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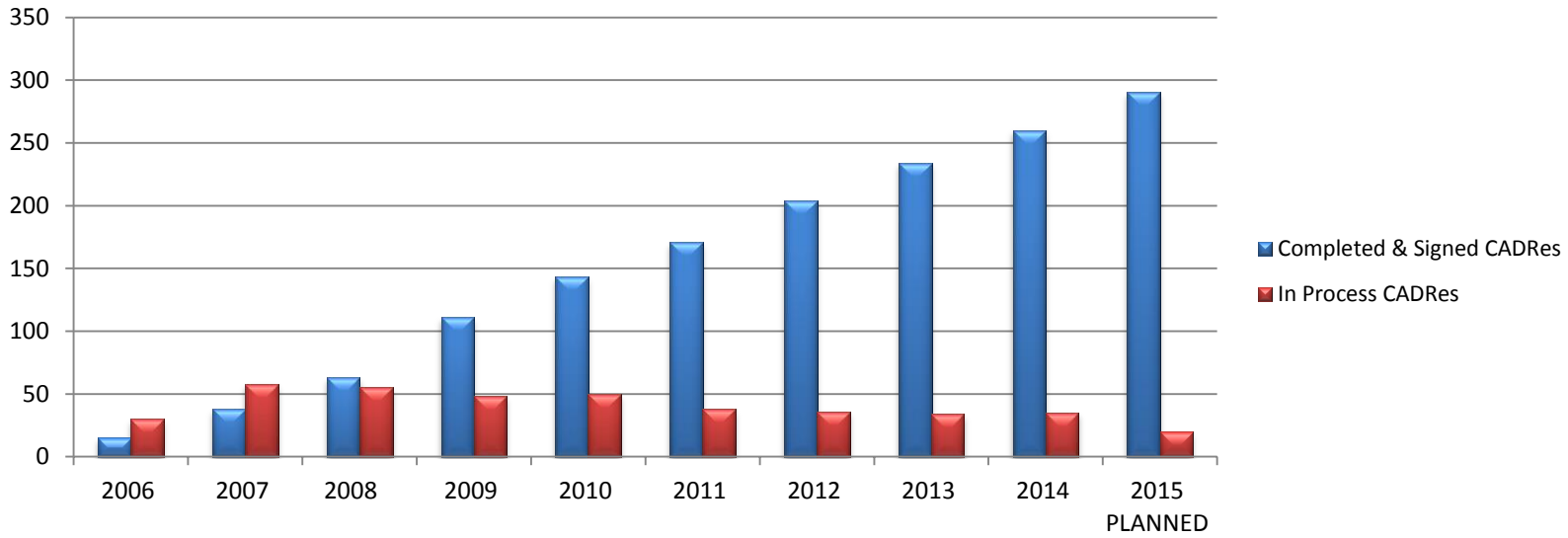
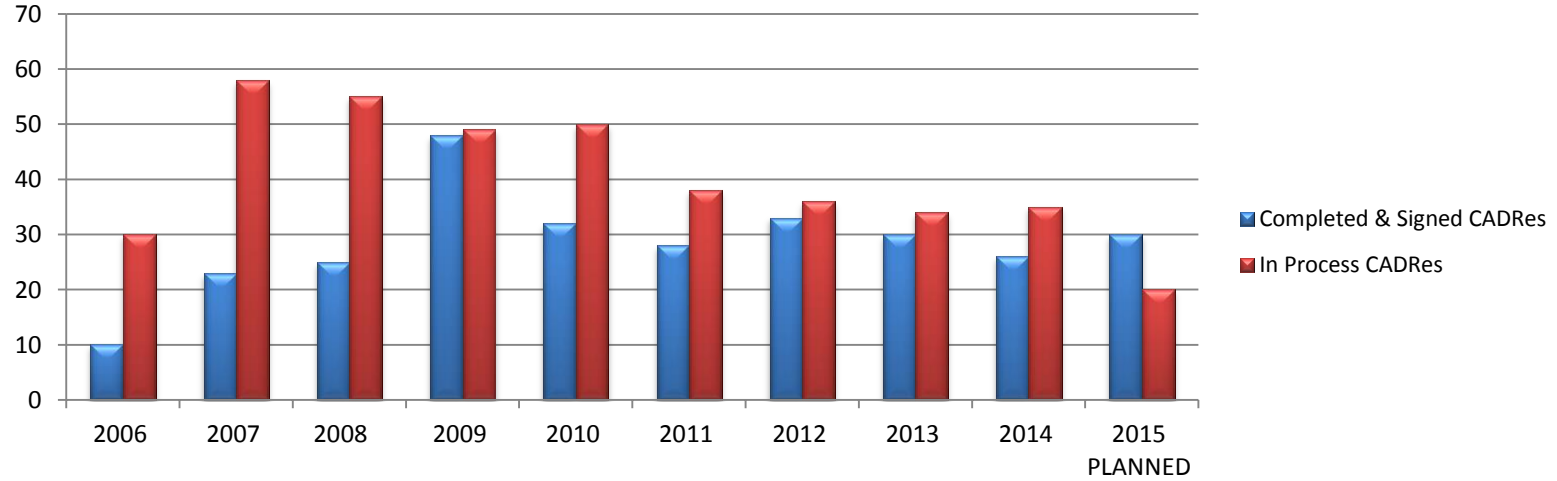


Cumulative CADRe Completions across NASA



Year by Year CADRe Completions across NASA

CADRe Accomplishments

- Deep Space Atomic Clock (DSAC) PDR
- Green Propellant Insertion Mission (GPIM) SRR
- OSIRIS-REX SIR
- Laser Communications Relay Demonstration (LCRD) SRR
- InSight PDR
- Mars2020 MDR
- CASSINI (CADRE Plus)
- Stratospheric Aerosol and Gas Experiment (SAGE) III CDR
- GOES-R (CDR)
- Orbiting Carbon Observatory 3 (OCO-3) PDR
- Solar Sail Demonstration PDR (CANCELED)
- Global Observations of the Limb and Disk (GOLD) CSR CADRe
- The Transiting Exoplanet Survey Satellite (TESS) PDR
- Gravity Recovery and Climate Experiment (GRACE) Follow-On CDR
- Cyclone Global Navigation Satellite System (CYGNSS)
- Soil Moisture Active-Passive (SMAP) SIR
- Multi-Purpose Crew Vehicle (MPCV) SDR
- The Neutron star Interior Composition ExploreR (NICER) PDR
- GALILEO (CADRe Plus)
- Green Propulsion Infusion Mission (GPIM) CDR
- **Composites for Exploration Upper Stage (CEUS) SRR**
- Tracking and Data Relay Satellite (TDRS) K & L launch
- Tracking and Data Relay Satellite (TDRS) M SIR
- Low Density Supersonic Decelerators (LDSD) annual Review
- Joint Polar Satellite System (JPSS-1) dCDR
- Deep Impact (EOM)

Also building CADRes for Tech Demo Projects

7210.5E Changes Impacting CADRe

CHANGE 1: In the SDR/SRR column the word change Preliminary to "Baseline"

- (Reason- In practice the 1st CADRe is a 100% full up CADRe just like all the other CADRes, not just a draft or collection of documents which has caused some confusion)

CHANGE 2: In the SIR column the word "Update" was added.

- (Reason- this matches what is being done in practice and matches table 5-13 as well)

CHANGE 3: Clarified that **t**he CADRe for MRR/FRR is considered the "Launch CADRe" to be completed after the launch.

- (Reason-- MRR/FRR is the closest MS to the launch event that is why the CADRe update shows up in that column even though there is technically no CADRe for MRR/FRR.

CADRe in PM Handbook

- The PM Handbook is a guidance document
  - Provides additional information and rationale to support the content of NPR 7120.5E which has been streamlined to mainly capture requirements
  - Provides guidelines and best practices for performing program/project management activities to satisfy the requirements in NPR 7120.5E.
  - Provides practical examples of successful approaches currently in use
- The intended audience ranges from experienced practitioners to individuals just starting in space flight program and project management
- The PM Handbook is applicable to all NASA space flight programs and projects

CADRe in PM Handbook

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- Worked with OCE to have CADRe Write Up included in PM Handbook
  - CADRe write up includes: Overview, Purpose, Process, Frequency, Method of development
  - Emphasizes Roles and Responsibilities of CAD and interaction with the projects (activity using project documentation)

CADRe (Cost Analysis Data Requirement)

The CADRe is a formal project document that describes the programmatic, technical, and life-cycle cost and cost/schedule risk information of a project. A 2005 initiative, the CADRe is NASA's unique response to the need to improve cost and schedule estimates during the formulation process, providing a common description of a project at a given point in time. The CADRe is prepared by NASA Headquarter's Cost Analysis Division (CAD) using existing project data prepared during the life-cycle review process. By capturing key information, the CADRe tracks and explains changes that occurred from one milestone to the next, and it helps the project manager record in an Agency document all the events that occurred during the project both internal and external.

Composed of three parts, the CADRe captures detailed programmatic, technical, and cost data in a standardized format. The document is prepared six times during the life cycle of a project at major milestones (SRR, PDR, CDR, SIR, Launch, End of Mission). See figure below:

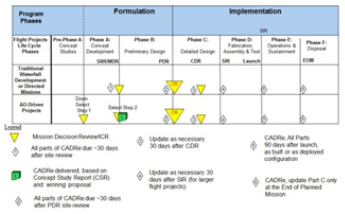

Figure 1 Frequency of CADRe Submissions

power statements, schedules, risk list, and life-cycle cost estimates, and any other technical parameters that tend to drive costs. CAD will deliver the document for the project manager's review and signature shortly after the capstone KDP briefing such as the APMC or DMPC when the cost and schedule positions are finalized.

Completed CADRes are available on an NSCKN site (see https://nsckn.nasa.gov to request access) for ease of viewing, and they are also being incorporated into the One NASA Cost Engineering (ONCE) database to facilitate fast searches and retrieval to support cost engineering development. The ONCE database is a secure web-based application containing all completed CADRes that allows for easy retrieval and faster analysis of data. The database provides advanced search routines to quickly access CADRe data across multiple projects and milestone events. Since CADRes represent snapshots of a project at successive key milestones, the ONCE database captures all the changes that occurred to previous projects and their associated cost and schedule impacts. The result provides enhanced insight and management of historical cost and technical data, which are helping to advance costing practices and analysis across the Agency. Anyone who needs access to the ONCE database, can go to the ONCE website www.oncedata.com and click on the "request access" link on that page. The key requirement for access is for someone to have a NASA identity in NASA's IDMAX system.

The application of CADRe data helps NASA and project managers analyze important attributes of projects that should better help project managers deliver projects in within cost, schedule, technical margins. With a large historical archive of project data, it is possible to determine trends and that can be very useful to project managers. Here are some examples:

1) Cost engineers use CADRe to estimate the cost of future systems based on known technical parameters such as mass and power. The CADRe data is also used to help evaluate proposals from contractors on new missions.

2) System engineers use CADRe information to perform mass architecture trades earlier in concept design by using time-tagged mass data on all major NASA projects.

3) CADRe data can be used to conduct research to help understand cost and schedule trends and patterns over time and across projects. The results of this research is already helping PMs better understand how to plan for cost and schedule risks in their projects. For example recent analysis of CADRe data has shown that schedule growth on payloads is a significant factor that increases the total cost. This recent analysis shows the average instrument development schedule growth was 33 percent or about 10 months. See table below.

The three parts of a CADRe are as follows:

- PART A Describes a NASA project at each milestone (SRR, PDR, CDR, SIR, launch and End of Mission), and describes significant changes that have occurred. This section includes essential subsystem descriptions, block diagrams, heritage assumptions needed for cost analysis purposes. The templates for robotic or human space flight missions can be found at: http://www.nasa.gov/offices/ooe/CAD.html
- PART B Contains standardized templates to capture key technical parameters that are considered to drive cost such as mass, power, data rates, and software metrics in an Excel Workbook. The formats of this template follow standard NASA terminology such as Current Best Estimates (CBE) and CBE Plus Contingency. (See http://www.nasa.gov/offices/ooe/CAD.html)
- PART C Captures the NASA project's cost estimate and actual life-cycle costs within the project's WBS and a NASA Cost Estimating Work Breakdown Structures (WBS) in an Excel Workbook. This section also captures the project schedule, risks, and ground rules and assumptions. (See http://www.nasa.gov/offices/ooe/CAD.html)

The CADRe program satisfies a foundational cost-estimating need, which is to provide historical cost data that is vital to performing estimates for future missions. The CADRe provides information to support an Independent Cost Estimate (ICE) as well as actual cost and technical information so that estimators can do a better job of projecting the cost and schedule of future analogous projects. This way important data is captured across all major flight projects at NASA including major instruments that fly on foreign partner spacecraft.

The CADRe is a project owned document and is signed by the project manager; therefore, it does not include any independent assessments or evaluations, or opinions about the project. It simply records the known configuration at the specific milestone. HQ/CAD provides the necessary funding and support to prepare the document on behalf of the project using existing project documentation prepared during the milestone review process.

The process of preparing a CADRe is as follows: after a short kickoff with the project manager approximately 60-90 days before the milestone, CAD will collect all relevant existing documentation during the life-cycle review process, and preparation of the document occurs concurrently using the most recently available data from the project. The CADRe is prepared using existing project documentation that provides descriptive information, mass statements,

power statements, schedules, risk list, and life-cycle cost estimates, and any other technical parameters that tend to drive costs. CAD will deliver the document for the project manager's review and signature shortly after the capstone KDP briefing such as the APMC or DMPC when the cost and schedule positions are finalized.

Completed CADRes are available on an NSCKN site (see https://nsckn.nasa.gov to request access) for ease of viewing, and they are also being incorporated into the One NASA Cost Engineering (ONCE) database to facilitate fast searches and retrieval to support cost engineering development. The ONCE database is a secure web-based application containing all completed CADRes that allows for easy retrieval and faster analysis of data. The database provides advanced search routines to quickly access CADRe data across multiple projects and milestone events. Since CADRes represent snapshots of a project at successive key milestones, the ONCE database captures all the changes that occurred to previous projects and their associated cost and schedule impacts. The result provides enhanced insight and management of historical cost and technical data, which are helping to advance costing practices and analysis across the Agency. Anyone who needs access to the ONCE database, can go to the ONCE website www.oncedata.com and click on the "request access" link on that page. The key requirement for access is for someone to have a NASA identity in NASA's IDMAX system.

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CADRe Workshop Summary

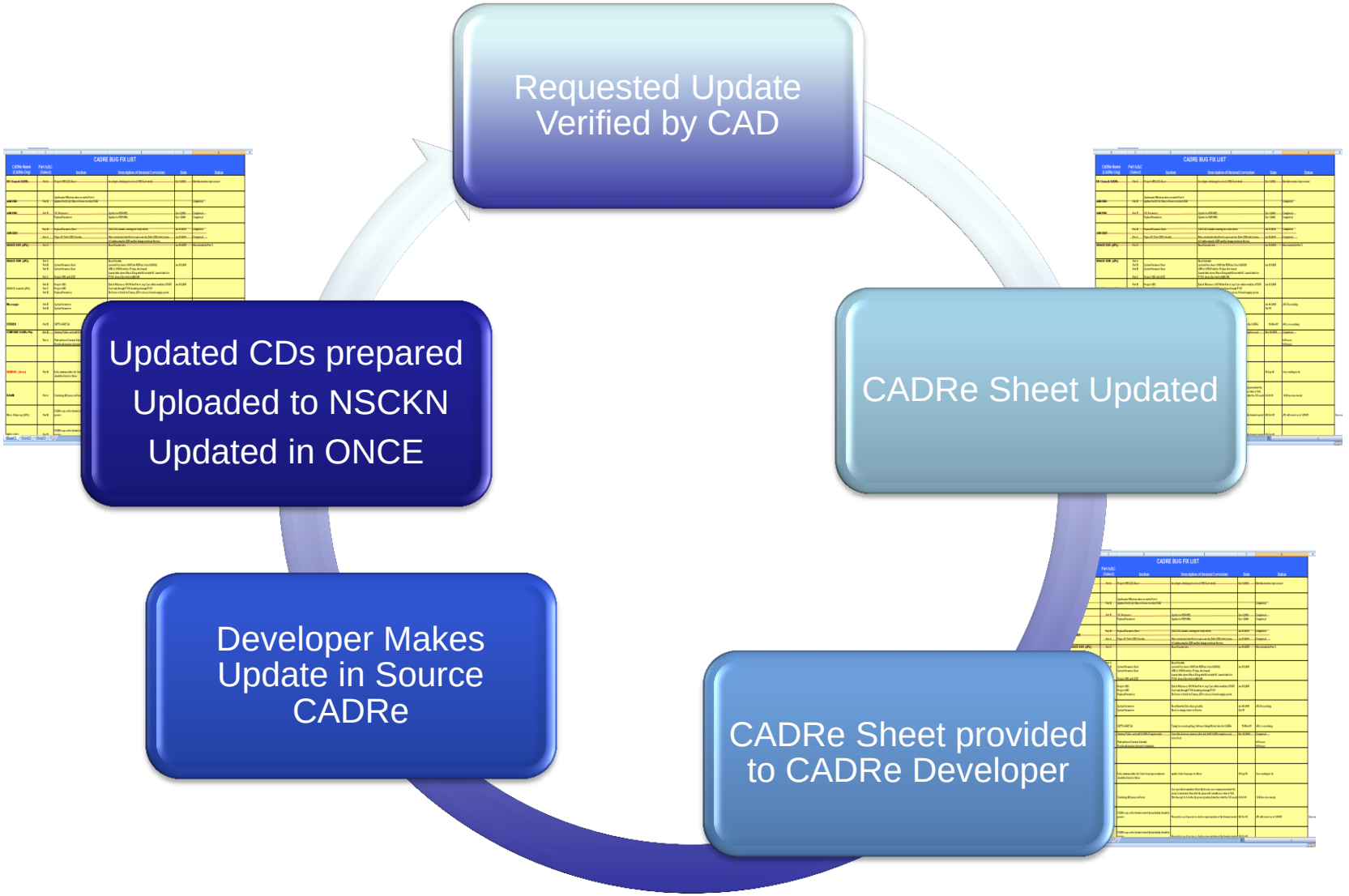
- 2015 CADRe Developers Workshop held on May 27-28 at JPL in Pasadena, CA
  - 32 attendees including phone participants (both new and seasoned CADRe developers)
  - Topics Covered:
    - CADRe History and Accomplishments, CADRe 2013 Template Updates, CADRe Process Improvements, ONCE Improvements, CADRe Upload Process, New 2015 Template Improvements, Data Completeness metrics
    - TDM missions Lessons Learned, New Proposed Risk Template, New Paths for Schedule Data.

- 2 June 2015 CADRe Workshop Action Items provided to developers
  - General Actions- Process and Product Improvements
  - CADRe Template Part B Actions- Teams provided their input to CAD
  - New 2015 CADRe Templates with Developers for review and comment.
  - ONCE Actions- Nearly Complete

CADRe Workshop Summary

- TDM Lessons Learned- Developers shared their areas of challenge and successes.
- CADRe Process Improvements and discussions of how CADRes are uploaded to ONCE.
- Worked on a tighter Integration of CADRe and ONCE.
  - Implemented methods to upload CADres more seamlessly. Format templates
  - Discussed and Resolved several pinch points
- ONCE 2014-2015 Database improvements and Data Completeness metrics.
- Introduced and Discussed new Risk Template to capture key elements for each risk element
- Full Scrub of CADRe templates Part A, B, C

CADRe Improvement Process



CADRe Template Improvements

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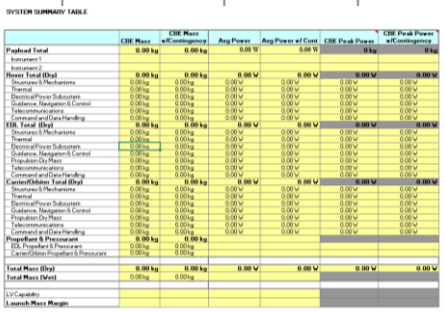
General System Level Information							
System Name	Program Name	AO or Directed	Destination	Mission Class	Mission Category	Mission Life	Is there science
		AO Mission					No
Num of contractors	Num Gov Organizations	Orbital Periapsis	Orbital Apoapsis	Apoapsis Class	Inclination	Spacecraft Jitter	GN&C M
		Km	Km			Arc Seconds	
Pointing Accuracy	Pointing Knowledge	Number of Instruments	Thermal Control	Total Dry Mass	Total Dry Mass w/Cont	Average Flight System Power / Mode	Peak Flight System
Arc Seconds	Arc Seconds			0	0	Watts / Cruise	
Beginning of Life Power	End of Life Power	Average Payload Power (W)	Data Storage	Total Data Return	Processor Type	Cruise Duration (months)	Primary Science D
Watts	Watts	Watts	GB	MB			

Downlink Mode	Average Downlink Data Rate	Peak Downlink Data Rate	Uplink Mode	Average Uplink Data Rate	Peak Uplink Data Rate	Min. Downlink to Uplink	Launch Vehicle
	Mbps	Mbps		Mbps	Mbps		
	Mbps	Mbps		Mbps	Mbps		
	Mbps	Mbps		Mbps	Mbps		
	Mbps	Mbps		Mbps	Mbps		

- Added where data range values may be used in place of single values.
- Adding specific Unit Selectors for key technical parameters (arcseconds, degrees/second, micro-radians, milli-degrees, milli-radians)
- Added pull down lists of pre-defined choices for parameters to improve consistency
- Improved Cell descriptions/definitions for every data field.
- Automated Roll-us and Check-sum formulas.

Phase A		Phase B		Phas
(Oct 20XX - Sept 20XX)		(Oct 20XX - Sept 20XX)		(Oct 2011 - S
FY2010	FY2011	FY2011	FY2012	FY2012
Actual	Actual	Estimated	Estimated	Estimated



CADRe Template Improvements

Part A

- Improved outline flow of the System Overview Section
- Section A.5 improvements- asking for which changes were external vs internal to the project
- Template includes built-in List of Figures and List of Tables

Part B

- Streamlined all System Level Parameters together in one sheet (from summary tables)
- Allow Input of "data ranges" the ONCE db can handle ranges as necessary. Ex (300 - 800) Watts
- Added dozens of Unit Selectors (KB,MB,GB,TB)
- Updated all cell definitions as necessary
- Updated Payload Sheet (new power mode menu, contract type, check-sum formulas)
- Added new check-sum formulas for Spacecraft Sheet
- Streamlined the Software Metric sheet, removed all of the subjective level inputs, with suggested notes below
- Fully updated MOS/GDS sheet with pull down menus to allow for multiple scenarios

Part C

- Added Check-sum formulas where applicable
- All Schedule related info now in Schedule Table (aligned from Sys Level Parms)
- New Risk Template and a Word Doc Guide to complete the template
- Improved Column formatting on both the project WBS and NASA STD WBS.
- Added two "below the line" WBS items to the NASA STD WBS. (Contributions and Program Office)

Risk Data Collection

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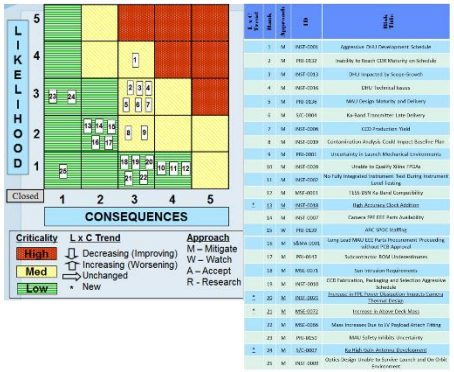
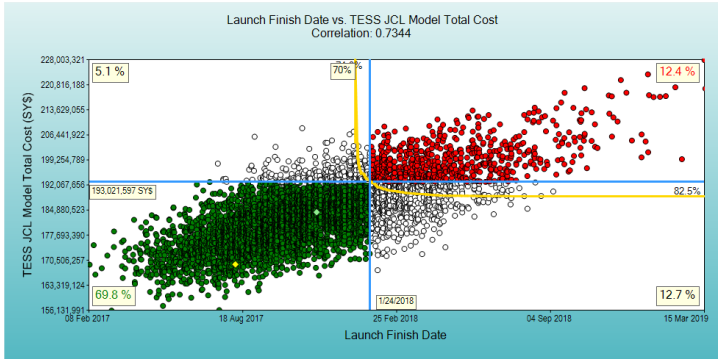
Risk Collection Current State

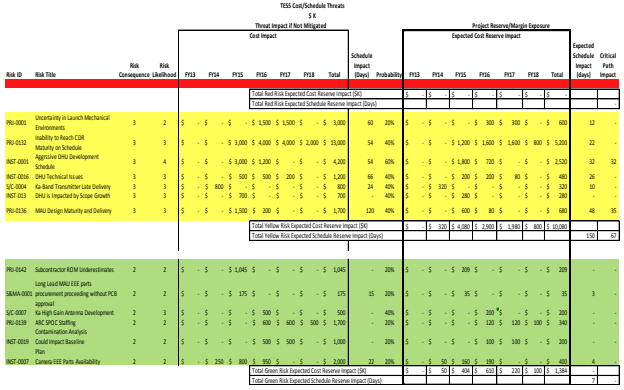
5X5 Risk Charts



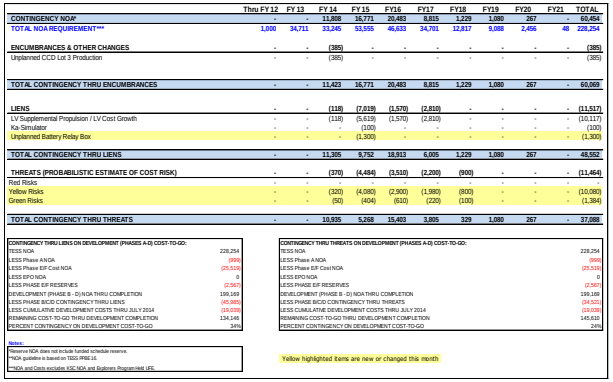
JCL Results (if a KDP-C review)



Cost and Schedule Threats (if available)

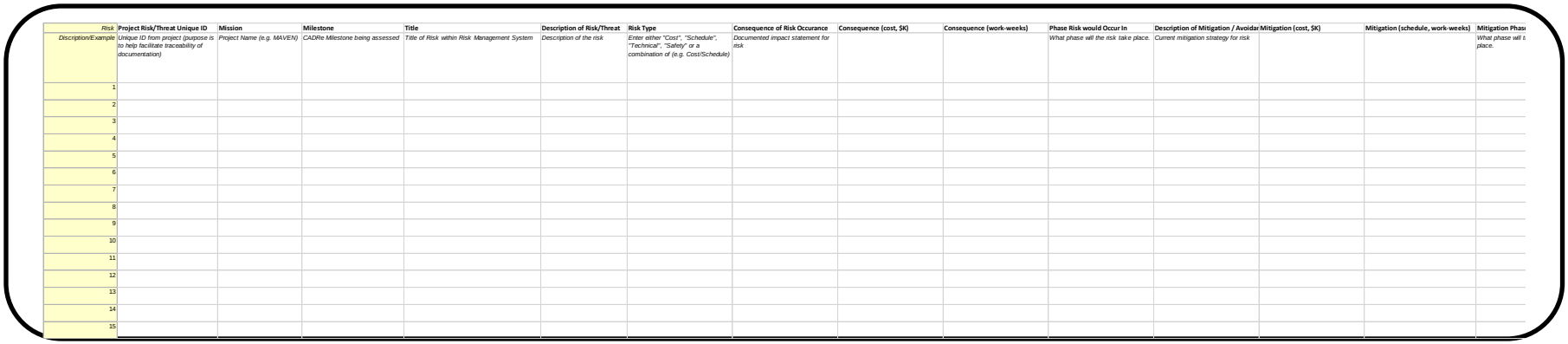


Contingency Status Charts



Risk Matrix template

Office of Evaluation *Cost Analysis Division*



Risk	Project Risk/Threat Unique ID	Mission	Milestone	Title	Description of Risk/Threat	Risk Type	Consequence of Risk Occurance	Consequence (cost, $K)	Consequence (work-weeks)	Phase Risk would Occur In	Description of Mitigation / Avoidar	Mitigation (cost, $K)	Mitigation (schedule, work-weeks)	Mitigation Phas
Discription/Example	Unique ID from project (pupose is to help facilitate traceability of documentation)	Project Name (e.g. MAVEN)	CADRe Milestone being assessed	Title of Risk within Risk Management System	Description of the risk	Enter either "Cost", "Schedule", "Technical", "Safety" or a combination of (e.g. Cost/Schedule)	Documented impact statement for risk			What phase will the risk take place.	Current mitigation strategy for risk			What phase will t place.
1														
2														
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The existing Risk Data tab is there to include the Project's 5X5 Risk Matrix and supporting Risk List, S-Curve including resulting JCL graphs.

The CAD has made a decision to codify the risk data that is currently being captured in a more consistent format to better enable ONCE queries and data analysis.

Templates underwent review with members of Risk Community. Sample of Selected Parameters:

Project Risk ID, Mission Name, Milestone, Title,, Risk Type, Cost Consequence Schedule Consequence, Driving WBS, Likelihood Value 5X5, Likelihood % 5X5, Consequence Value, Mitigation Cost, Mitigation Schedule

2014 NASA Cost Symposium Tuesday's Agenda

Office of Evaluation — *Cost Analysis Division*

Unique ID	TIME	Title	Location	Author/Presenter (s)	Org	Time (mins)
	7:00- 8:00	Doors open, Registration, Informal Meet and Greet		CAD	HQ	60
13	8:00- 8:30	CAD Opening Remarks	Room 171 Bldg. 152	CAD	CAD	30
56	8:30- 9:00	Development of AMES Cost Model (Ames Micro/Nano-satellitES Cost Model)	Room 171 Bldg. 152	M Saing, L Shen, T Paine	ARC and BAH	30
9	9:00- 9:30	Growth Estimation Relationships (GER)	Room 171 Bldg. 152	E Plumer, V Larouche, R Carpio	NASA HQ & TRI	30
15	9:30- 10:00	An Assessment of Risk Lists and Categorization at Major Milestones Across the Lifecycle of NASA Missions	Room 171 Bldg. 152	B Bitten, J Goble	The Aerospace Corporation	30
4	10:00- 10:30	ONCE	Room 171 Bldg. 152	D Bucher	The Aerospace Corporation	30
500	10:30- 10:45	BREAK				15
31	10:45- 11:00	PCEC v2.0 Overview	Room 171 Bldg. 152	B Alford, M Pedigo	BAH	15
32	11:00- 11:45	Spacecraft and Support Function Cost Models for NASA PCEC	Room 171 Bldg. 152	M Jacobs, S Hayes	Victory Solutions	45
29	11:45- 12:15	Crewed and Space Transportation Systems Cost Model (CASTS)	Room 171 Bldg. 152	R Webb		30
510	12:15- 13:45	LUNCH BREAK		All	All	90
46	13:45- 14:15	Schedule Execution Analysis	Room 171 Bldg. 152	A Rippe, D Elliott, J Reilly	KSC & TRI	30
3	14:15- 14:45	Deferral Estimation Analysis	Room 171 Bldg. 152	V Roeum, L Wolfarth	SMD	30
43	14:45- 15:15	QuickCost 6.0	Room 171 Bldg. 152	J Hamaker, R Larson	Galorath	30
14	15:15- 15:45	NICM	Room 171 Bldg. 152	J Mrozinski	JPL	30
500	15:45- 16:00	BREAK				15
12	16:00- 16:30	o SONIC	m 171 Bldg. 152	J Johnson, E Plumer, J McAfee, M Blandford	NASA HQ and SAIC	30
20	16:30- 17:00	Mission Operations Cost Estimation Tool (MOCET)	Room 171 Bldg. 152	M Hayhurst, S Eftekarzadeh, B Wood, V Jyothindran, B Kellogg, C Daniels, W Sasamoto, L Jordin	SOMA, The Aerospace Corporation	30
19	17:00- 17:30	Development of the Small Satellite Cost Model 2014 (SSCM14)	Room 171 Bldg. 152	E Mahr, A Tu, A Gupta	The Aerospace Corporation	30

BACK UP

What's so Valuable about CADRe?

- Data is the Life Blood of Cost Analysis- Without it, the cost discipline suffers.
- CADRe is the ONLY single source of historical cost, technical, and schedule data on all of NASA's flight projects.
  - Recognized across NASA as the Go To source for programmatic data needed for cost and schedule analysis.
- CADRe is also the only comprehensive cost document in the Federal Gov't that captures the temporal dimension across milestones. Allows ability to analyze projects over time and over portfolios.
- The collection of CADRe documents has already proven very successful in providing a mechanism to:
  - Perform data driven analysis
  - Track and explain changes from milestone to milestone
  - Provides data to help perform JCL Analysis
  - Estimate cost and schedule of new projects
  - Build data driven products to help answer difficult programmatic questions.
  - Calibrate NASA's cost models which will help improve cost estimates for future projects.

CADRe = Usable Data

CAD Data Collection

- Cost Analysis Data Requirement (CADRe) – Essential Foundation for Cost Analysis
  - CADRe acts as the 'flight recorder' for all major NASA programs and projects, providing data that is the foundational life blood of NASA's cost analysis capabilities
    - **CADRe data is the primary Agency resource for historical programmatic and technical data**
  - CADRe data is collected temporally at six major project milestones, supports analysis and decision making for all major NASA acquisitions, and provides the basis for the Agency's external commitments. CAD uses the ONCE database to make the data accessible and easily analyzed
    - **Enables Agency capability to understand technical and programmatic performance temporally**
  - NASA's programmatic performance has been improving over the last decade
    - **This has been enabled by CADRe data and continued collection of this essential temporal data is high priority and must continue**
  - CADRe is a NPR 7120.5E requirement for all major flight projects
    - **The CAD provides stewardship and sponsorship for all CADRe implementation to ensure data quality and to take advantage of economies of scale**
- ONE NASA Cost Estimating Database (ONCE)
  - Cloud compliant database that automates the search and retrieval of CADRe Data
  - ONCE helps order and access the CADRe (flight recorder) data, transforming it into useful information
  - ONCE is utilized as the primary Agency database for programmatic and technical data

NASA's data collection through CADRe and ONCE is recognized as a Best Practice by GAO and other Federal Agencies.

CADRe Documents

Part A. Descriptive Information

-Project Plan
-Architecture Description Document
-Acquisition Plan
-Project Implementation Plan
-System Engineering Plan
-Risk Mitigation Plan
-Integrated Design Definition Documents (Constellation)
-Milestone Review Briefing Packages (SDR, PDR, CDR etc)
-Concept Study Report/Proposal (if applicable)
-Concept of Operations
-Integrated Master Schedule
-Integrated Test Plan
-Monthly Status Reports
-Any Instrument specific MDR, CDR, PDR packages
-ATLO Plan
-Pre Environmental Readiness Review
-Mission Operational Review
-Flight Operations Review
-Mission Readiness Review
-Launch Readiness Review

Part B. Technical Data

-Master Equipment Lists
-Mass Property Reports
-Power Budget Summary Report
-Software Design Reports
-Milestone Briefing Packages/Documentation (MDR, PDR, CDR)

Part C. Life Cycle Cost Estimate

-Project Cost Estimate by WBS
-WBS Dictionary
-POP costing details
-533 reports (used later in the project)
-EVM reports (used later in the project)

Min Items Needed for CADRe

- Part A
  - System Description and Mission
  - Spacecraft subsystem Descriptions including available diagrams
  - Payload Descriptions including available diagrams
  - Project Level Descriptions-SE, PM, Acq Plan, Science, Risk List
  - Section A.5 to discuss changes since last submission (if applicable)

- Part B.
  - Most of the General System Level Parameters filled in
  - Top Level Schedule
  - Spacecraft mass at the subsystem level
  - Spacecraft Power for the appropriate Subsystems
  - Payload Mass and Power

- Part C
  - Project Costs at least to WBS level 2
  - Mapped costs to the NASA Std WBS
  - BOEs (what the project can provide) and any GR&A
  - Risk List, 5X5 matrix, or S-Curve (if applicable)
  - Lower level Schedule captured and schedule table filled in