

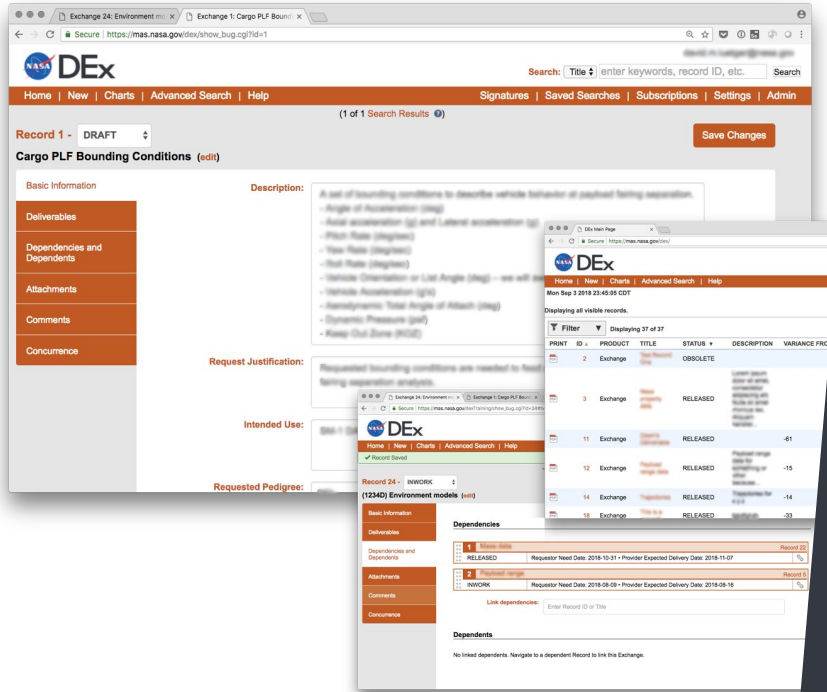
How Qualitative Data Drives Design at NASA

Dave Luetger

SJSURF at NASA Ames



**There's a lot of paperwork
to go to space!**



SLS Data Exchange (DEX)

Supporting the delivery of crucial data between NASA engineers



Core stage



Core stage

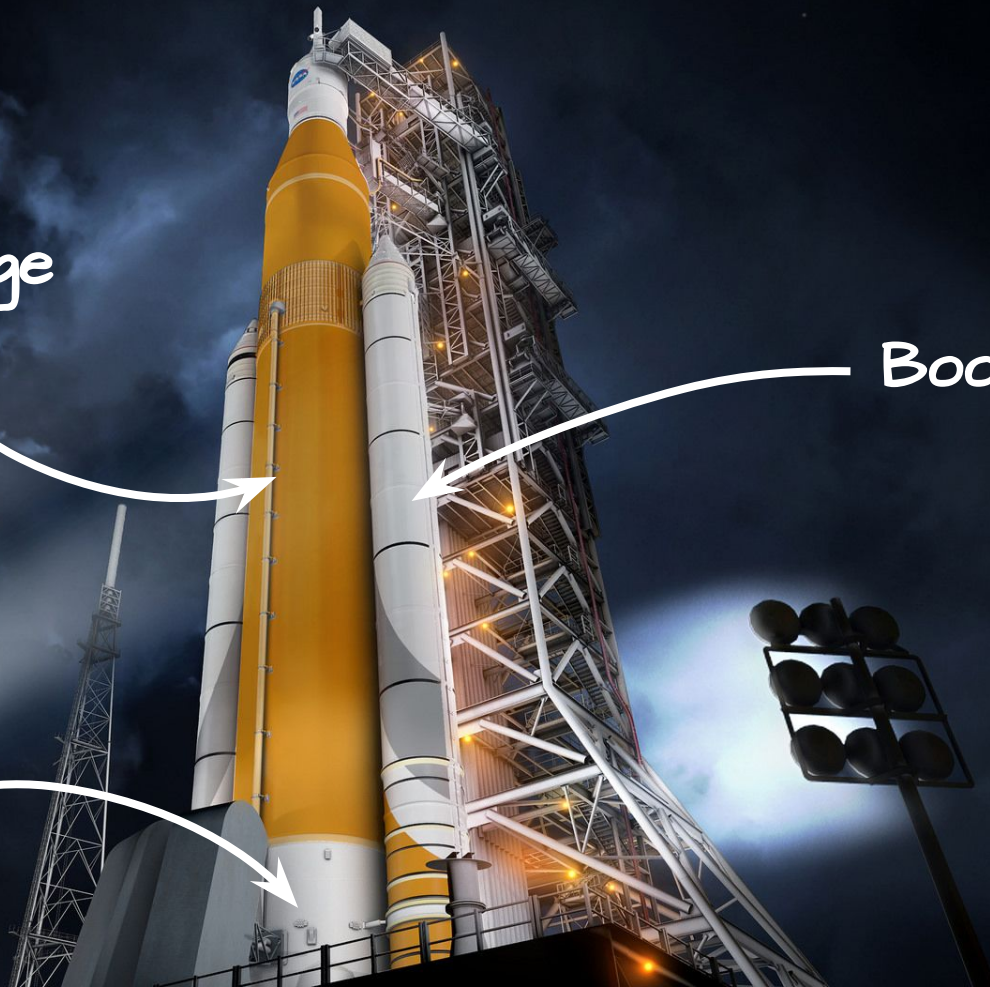
Engines



Core stage

Booster

Engines



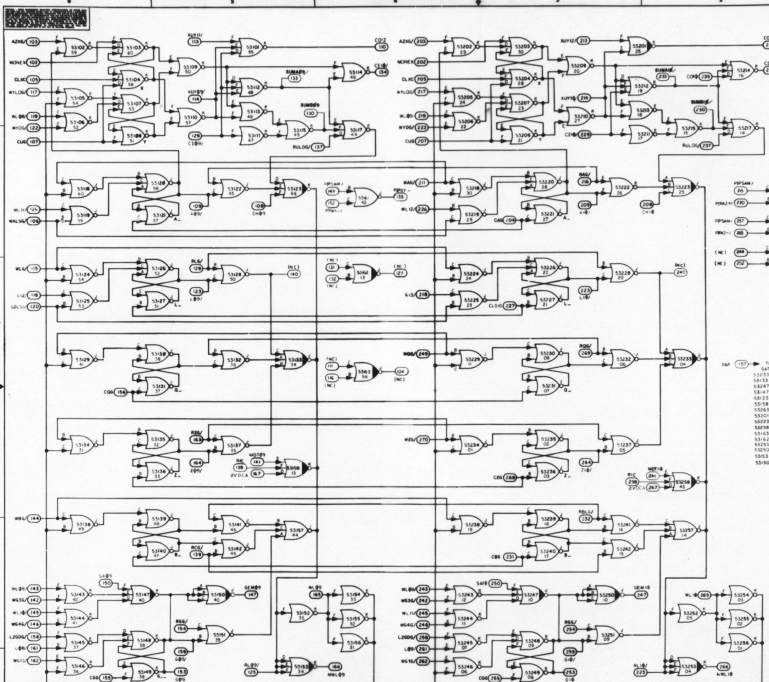


Core stage

And many more!

Booster

Engines



- TO PIN 4 OF
- 1111
 - 1110
 - 1101
 - 1100
 - 1011
 - 1010
 - 1001
 - 1000
 - 0111
 - 0110
 - 0101
 - 0100
 - 0011
 - 0010
 - 0001
 - 0000

- LEADS TO:
- (A)
 - (B)
 - (C)
 - (D)

- TO PIN 5
- (A)
 - (B)
 - (C)
 - (D)
- TO PIN 6
- (A)
 - (B)
 - (C)
 - (D)
- TO PIN 7
- (A)
 - (B)
 - (C)
 - (D)

NOTES:

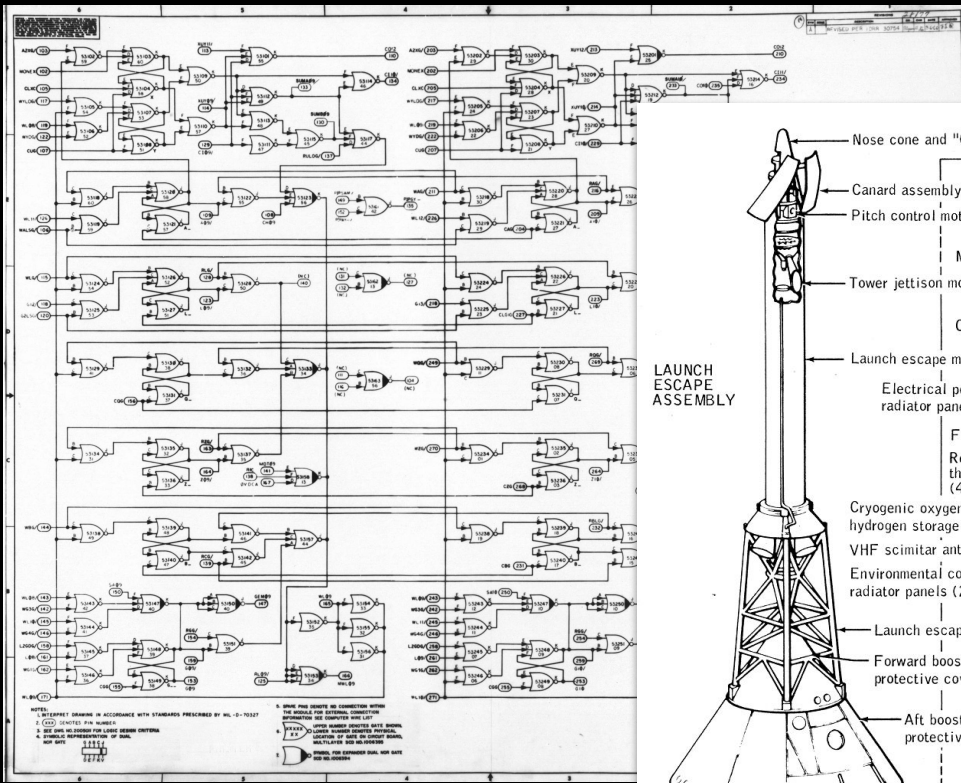
1. SYMBOLS SHOWN IN ACCORDANCE WITH STANDARDS PRESCRIBED BY MIL-STD-2000
2. (C) CONTROL PIN NUMBER
3. SEE PIN CONNECTION FOR LEAD NUMBER SYSTEM
4. SYMBOLIC REPRESENTATION OF DATA:
 - 0000
 - 1111
 - 1110
 - 1101
 - 1100
 - 1011
 - 1010
 - 1001
 - 1000
 - 0111
 - 0110
 - 0101
 - 0100
 - 0011
 - 0010
 - 0001
 - 0000

5. SHOW THIS SYMBOL AS CONNECTION WITHIN THE MODULE FOR SIGNAL CONNECTIONS
6. CONTROL PIN NUMBER SHOWN LEFT
7. (A), (B), (C), (D) SHOW NUMBER SIGNALS WILL BE INPUTS
8. (A), (B), (C), (D) SHOW NUMBER SIGNALS WILL BE OUTPUTS
9. LOCATION OF DATA BY CONTROL SIGNALS, MULTIPLY BY 1000
10. SYMBOL FOR EXPANDED DATA, NOT DATA FOR THIS MODULE

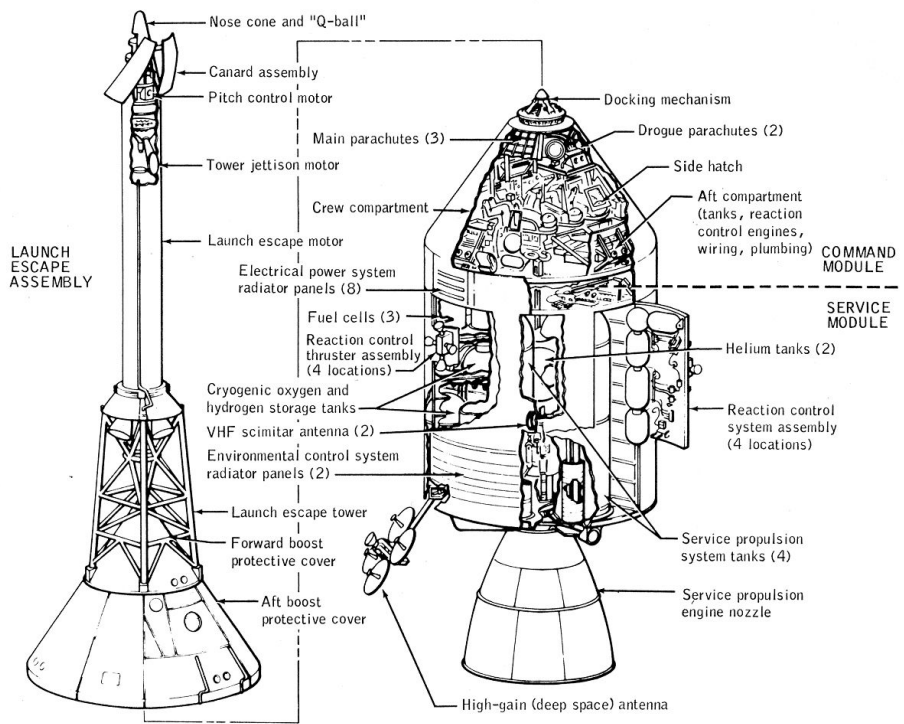
NO.	REV.	DATE	BY	CHKD.	DESCRIPTION

TITLE: LOGIC FLOW DIAGRAM MODULE NO. 410 BIT MODULE	MIL-STD-2000 2000-257
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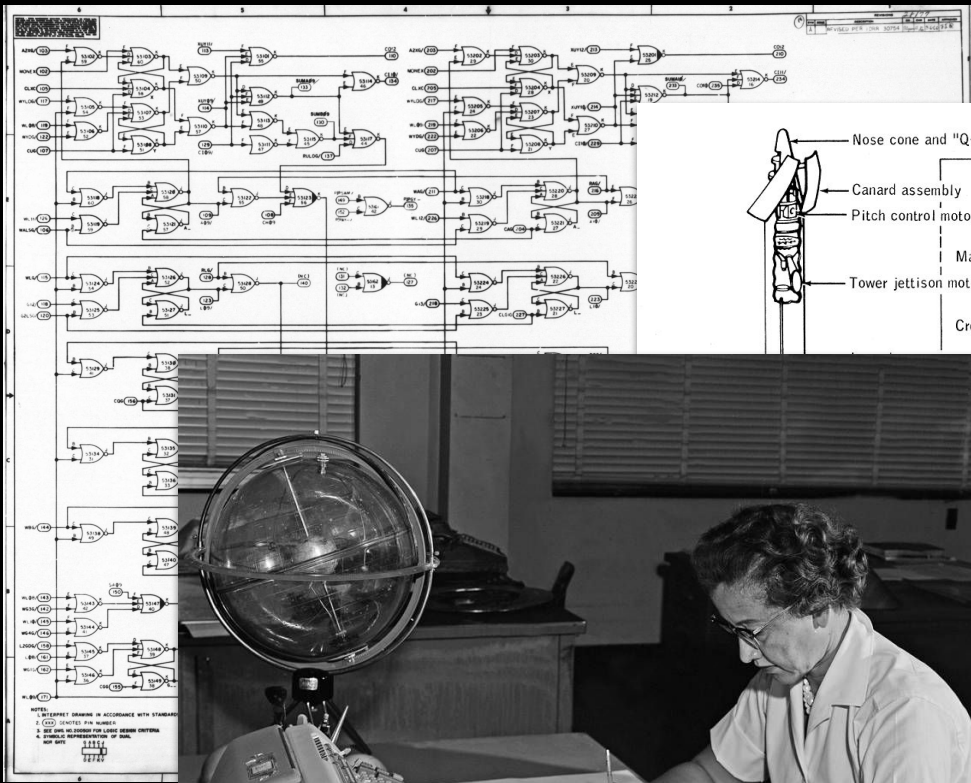
2000-257-1



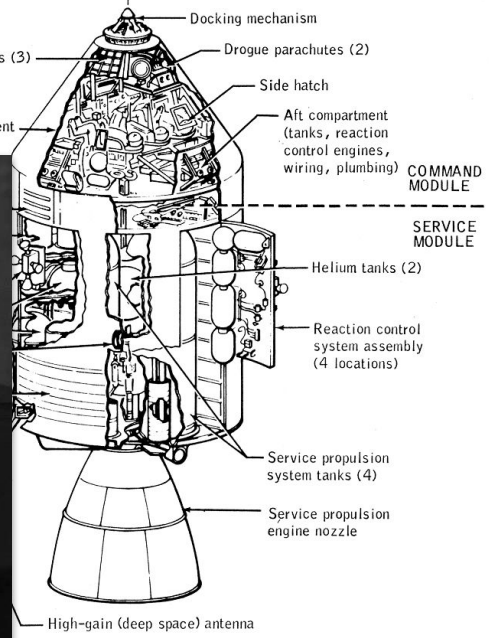
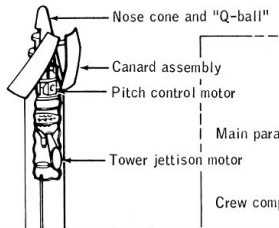
NOTES:
 1. ALL SYMBOLS SHOWN IN ACCORDANCE WITH STANDARDS PRESCRIBED BY MIL-STD-7007
 2. (C) CONTROL PIN NUMBER
 3. SEE THE END OF LINE FOR LOGIC SYMBOL DEFINITION
 4. SYMBOLIC REPRESENTATION OF DATA
 5. SEE NOTE 11111
 6. SEE NOTE 11112
 7. (S) SIGNAL FOR EXTERNAL DATA, NOT DATA
 8. SEE NOTE 11113



APOLLO COMMAND AND SERVICE MODULES AND LAUNCH ESCAPE SYSTEM

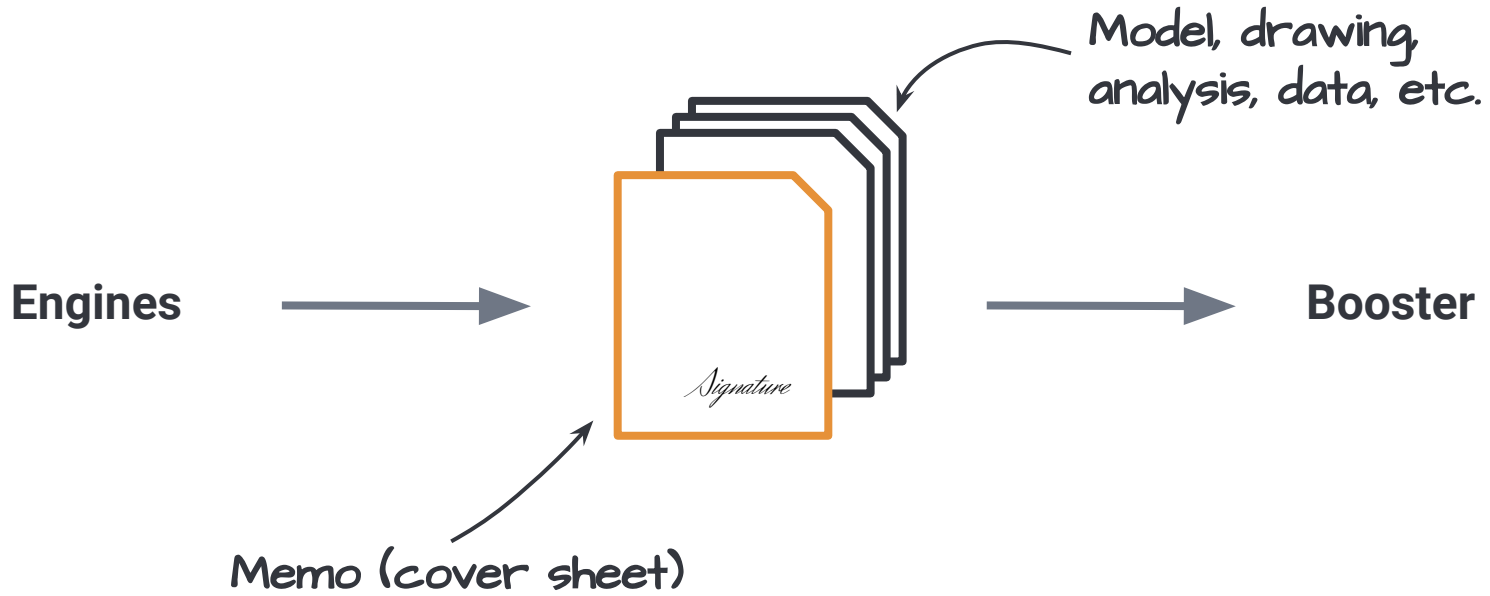


NOTES:
 1. ALL SYMBOLS SHOWN IN ACCORDANCE WITH STANDARDS
 2. (C) IDENTIFIED FROM NUMBER
 3. USE AND BE AWARE OF LOGIC SYMBOL SYSTEM
 4. SYMBOLIC REPRESENTATION OF DATA
 5. DATE: 11/15/54
 6. 117747



**COMMAND AND SERVICE MODULES
 SPACE SYSTEM**

Data exchange process



Make the data exchange process **faster** by **breaking down key barriers**, reducing stress, confusion, and scheduling risk.

**How did we gather and
organize evidence?**

- 1. Collecting our data**
- 2. Structuring the data**
- 3. Prioritizing our findings**
- 4. Translating the data into outputs**

- 1. Collecting our data**
2. Structuring the data
3. Prioritizing our findings
4. Translating the data into outputs



- 13 user interviews
- Generative workshops with clients

**It was critical to be able to
draw a straight line from our
research to the product**

Each note captures one key point from the interview and is **self-contained** – it can be understood without reference to the notes on either side.

– Holtzblatt and Beyer, *Contextual Design*

Nuggets!

- | [Nuggets are] the **atomic unit** of a research insight.
 - Tomer Sharon

Browser: DEx: Nuggets - Airtable
 URL: https://airtable.com/tblquHNb23G81rOuP/viwzqBWUFzLcW5gfB

Navigation: All changes saved | DEX | HELP | [User Profile]

Menu: User Stories | Epics | Participants | **Nuggets** | Roles | Goals Workshop | Objectives | Design Ideas | Research Questions | Artifacts | Info | SHARE | BLOCKS

View: Grid view | Hide fields | Filter | Group | Sort | Color | [Icons]

ID	Item	Tags	Category
1	I create 40-50 charts per week for milestones, summaries for analysis cycles, verification burnu...	I spend a lot of time doing documentation	
2	If I know that tasks for launch are iterative, to get from A-Z to have a launch, they're sequentially ...		
3	Describing his workflow to open the outline view in MS Project: "I always do it twice since it does...	I don't trust my tools	
4	He wanted to show us additional info in a schedule but couldn't remember what number text fiel...	I can't find the person I need I can't find the information/deliverable I need	
5	On Mondays there is an SE&I meeting where we meet with CM, disciplines, elements and we talk ...		
6	Disciplines review and provide data products and provide statuses to the technical assistant		
7	One of the challenges we've had over the last year is getting the disciplines to agree to some of t...	Getting agreement/commitments between disciplines is difficult	
8	Agreement on which deliverables are needed is currently managed in an Excel document, but it ...	I can't find the information/deliverable I need The DEM is missing data or is otherwise insuff	
9	I'm all for making people's jobs easier and I think this tool will make Erika's, Rachel's and CMs job...	I want to know the status of my deliverables	
10	My job is to understand the status of deliverables and give direction to folks to fix it	I want to know the status of my deliverables	
11	May be an email but it's often in the Monday meeting where we'll give the disciplines an action to...	I can't find the person I need I can't find the information/deliverable I need Meetings as m	
12	Automatic notifications would be very helpful since someone does this manually now.	I want to know the status of my deliverables Automation/digitization	Wishlist
13	These folks [disciplines] only have a few weeks to review something when it's available/delivered.		
14	The people asking for the data will probably be the first, but not necessarily the only ones, to us...		
15	The issue with disciplines reaching an agreement is at the program level and no tool will fix it	A tool can't solve the biggest problems Getting agreement/commitments between disciplin	
16	A tool might make the process easier or quicker when the disciplines do finally agree or when th...		
17	18 If there is a big issue [with a deliverable], they'll [the receiving discipline] reject it. Once a produ...	I need the right thing (data quality)	
18	19 It would be great to have fewer [deliverable] returns	I need the right thing (data quality)	Wishlist
19	20 We would also need to make sure we're complete upfront in our request which would help allevia...	Getting agreement/commitments between disciplines is difficult Requestors defining what t	

171 records

DEx: Nuggets - Airtable

https://airtable.com/tblquHNb23G81rOuP/viwzqBWUFzLcW5gfB

All changes saved

HELP ?

User Stories Epics

Hide fields Filter Group Sort Color

Research Questions Artifacts Info

SHARE

BLOCKS

Grid view

Item

ID	Item	Category
1	1 I create 40-50 charts per week for milestones, summaries for analysis cycles, verification burnu	
2	2 If I know that tasks for launch are iterative, to get from A-Z to have a launch, they're sequentially logi	
3	3 Describing his workflow to open the outline view in MS Project: "I always do it twice since it doesn't op	Information/deliverable I need
4	4 He wanted to show us additional info in a schedule but couldn't remember what number text field he us	
5	5 On Mondays there is an SE&I meeting where we meet with CM, disciplines, elements and we talk abou	difficult
6	6 Disciplines review and provide data products and provide statuses to the technical assistant	is missing data or is otherwise insuff
7	7 One of the challenges we've had over the last year is getting the disciplines to agree to some of	Information/deliverable I need Meetings as m
8	8 Agreement on which deliverables are needed is currently managed in an Excel document	Automation/digitization Wishlist
9	9	
10	10	
11	11	
12	12	
13	13 These folks	
14	14 The people asking fo	
15	15 The issue with disciplines reaching a	can't solve the biggest problems Getting agreement/commitments between discipline
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171 records

**We tagged the nuggets
with themes**

Nugget

“When signing off on data exchanges, it has to be a “wet” signature (ink). The person who had to sign off changed several times over the past four months. [Participant] had the wrong person sign and had to regenerate the memo.”

Nugget

“When signing off on data exchanges, it has to be a “wet” signature (ink). The person who had to sign off changed several times over the past four months. [Participant] had the wrong person sign and had to regenerate the memo.”



Theme

“I spend a lot of time chasing signatures.”

Opportunity statements

User stories

Opportunity statements

User stories

Opportunity statements...

- Framed the problem in a way that's easier for clients (and us) to understand
- Guided product decisions and user stories (does this help us address this opportunity?)

Rather than a list of problems dragging us down, we had a list of amazing opportunities propelling us forward!

Theme

“I spend a lot of time chasing signatures.”

Theme

“I spend a lot of time chasing signatures.”



Opportunity statement

“There is an opportunity to reduce the time required for sign off.”

Five opportunities

1. Make it easier to find and access material
2. Find the right people more quickly
3. More effectively communicate data relationships
4. Keep the conversation unified
5. Reduce the time needed for sign off

Five opportunities

1. Make it easier to find and access material
2. Find the right people more quickly
3. More effectively communicate data relationships
4. Keep the conversation unified
- 5. Reduce the time needed for sign off**

Opportunity statements

User stories

As a `type of user`, I want to `do an action`
so I `can achieve some outcome`.

As an **data user**, I want to **request a digital approval**
so I **can save time on gathering wet signatures**.

**How did we use
our evidence to make
a product?**

Mission Assurance System (MAS)

(1 of 1 Search Results)

Record 1 - DRAFT

Save Changes

Cargo PLF Bounding Conditions (edit)

- Basic Information
- Deliverables
- Dependencies and Dependents
- Attachments
- Comments
- Concurrence

Description:
 A set of bounding conditions to describe vehicle behavior at post-fail spring separation.
 - Angle of Acceleration (deg)
 - Roll acceleration (g) and Lateral acceleration (g)
 - Pitch Rate (degrees)
 - Yaw Rate (degrees)
 - Roll Rate (degrees)
 - Vehicle Orientation or List Angle (deg) -- see all...
 - Vehicle Acceleration (g)
 - Aerodynamic Total Angle of Attack (deg)
 - Dynamic Pressure (psf)
 - Keep Out Zone (KIZ)

Request Justification:
 Requested bounding conditions are needed to feed spring separation analysis.

Intended Use:
 See 1-3

Requested Pedigree:

Exchange 24: Environment mo... Exchange 1: Cargo PLF Bound...
 Secure | https://mas.nasa.gov/training/show_bug.cgi?id=2480
 NASA DEx
 Home | New | Charts | Advanced Search | Help
 Record Saved

Record 24 - INWORK (1234D) Environment models (edit)

- Basic Information
- Deliverables
- Dependencies and Dependents
- Attachments
- Comments
- Concurrence

Dependencies

1	None data	Record 22
RELEASED	Requestor Need Date: 2018-10-31 • Provider Expected Delivery Date: 2018-11-07	
2	Preload range	Record 8
INWORK	Requestor Need Date: 2018-09-09 • Provider Expected Delivery Date: 2018-09-16	

Link dependencies:

Dependents

No linked dependents. Navigate to a dependent Record to link this Exchange.

DEx Main Page
 Secure | https://mas.nasa.gov/dex/
 Home | New | Charts | Advanced Search | Help
 Saved Searches | Subscriptions | Settings | Admin
 Mon Sep 3 2018 23:45:05 CDT
 Displaying all visible records. Change Columns | Edit Search | Chart Search | Email Search Results | Save Search
 Filter | Displaying 37 of 37 | Download

PRINT	ID	PRODUCT	TITLE	STATUS	DESCRIPTION	VARIANCE FROM NEED DATE (IN DAYS)	REQUESTOR NEED DATE	PROVIDER EXPECTED DEL
	2	Exchange	See Record 24	OBSELETE				
	3	Exchange	None currently data	RELEASED	Learn your use of graph... containing... of all... of the... of the... of the...		2018-08-23	2018-08-31
	11	Exchange	Search conditions	RELEASED		-61	2018-08-31	2018-10-31
	12	Exchange	Preload range data	RELEASED	Preload range... of all... of the... of the...	-15	2018-09-30	2018-10-15
	14	Exchange	Preload range	RELEASED	Preload range... of all... of the... of the...	-14	2018-10-31	2018-11-14
	18	Exchange	See 1-3	RELEASED	Preload range... of all... of the... of the...	-33	2018-11-29	2019-01-01

**An opportunity to reduce the
time required for sign off**

Digital signatures

Requesting Reviewer Signature:

 **Requested** — Naomi Nagata requested that James Holden sign this signature

2018-11-13 18:31:32 CST


Unset

Request

Approve

Reject

Requesting Reviewer Signature:

 **Approved** — This signature was approved by James Holden

2018-11-13 18:34:24 CST

Unset

Request

Reject

Rationale

james.holden@no-mail.nasa.gov (Approved)

2018-11-13 18:34:24 CST

Looks good!

**How did our product
support outcomes?**

2x

**faster from
beginning to end**

From 30 days to 15

~3x

**faster to gather
all signatures**

From 8 days to 3

Bonus


**How did our evidence help
us communicate?**

Building trust and using evidence to facilitate tough conversations

- **Don't dictate a process, but push them further**
- **Get people involved early**
- **Don't design a solution to a disagreement**

Designers can design a solution to a problem, but they can't design a solution to a **disagreement**.

– Mike Monteiro, *You're My Favorite Client*



We like having you on the phone
for emotional support.

– SLS Lead Systems Engineer

1. Nuggets helped us **agree on a common reality**.
2. Opportunity statements helped us **frame and communicate the problem**.
3. User stories helped us **take *measurable* action** on those opportunities.



MLA Citations

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