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## **Apollo Lunar Module: How a Complex and Novel Design Project Evolved Over Time and Across Perspectives**

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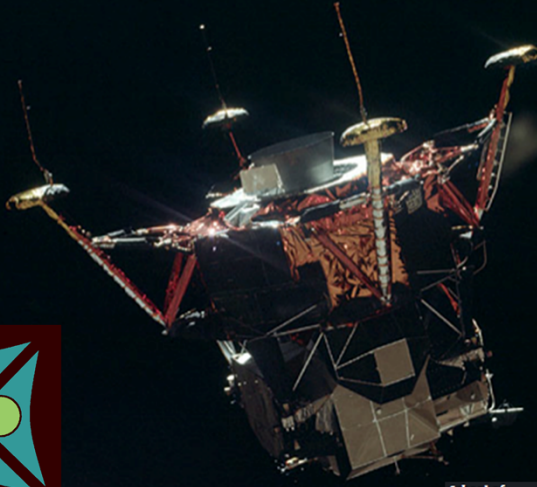
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*Apollo Lunar Module:  
How a complex and novel design project  
evolved over time and across perspectives*



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*Library Scholars Grant  
Apollo Lunar Module:  
How a complex and novel design project  
evolved over time and across perspectives*



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the question

the question

Impetus

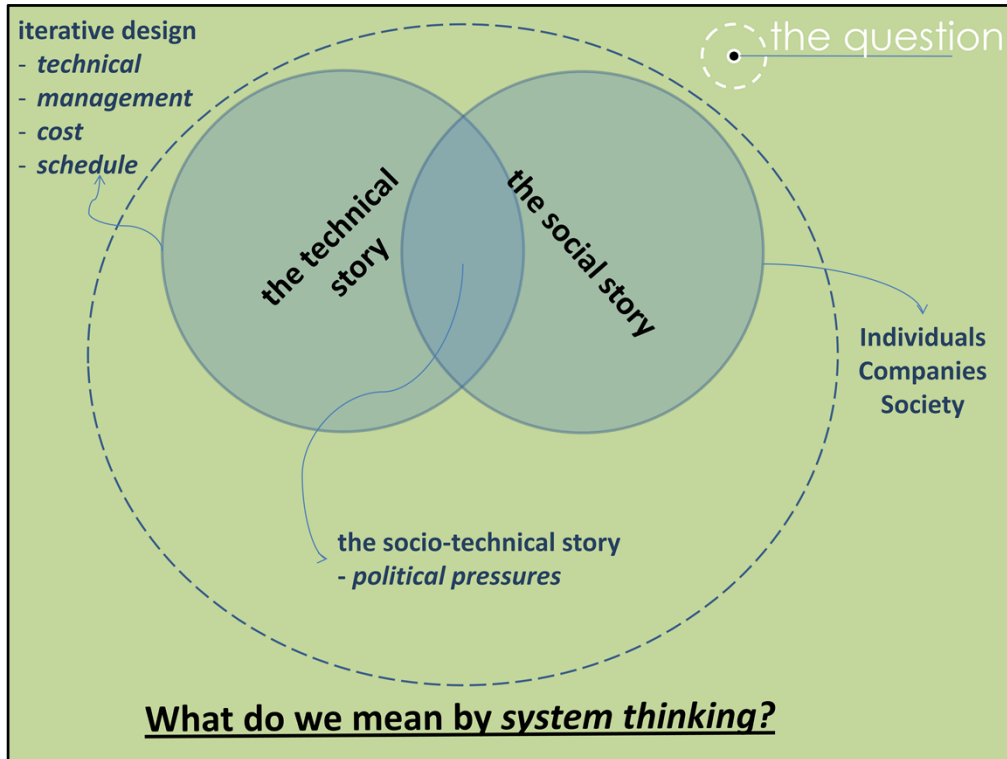
- Iterative design
- Ph.D. student's dissertation, Hadi Ali
- Passion for spacecraft design
- Unique research opportunity

Why?

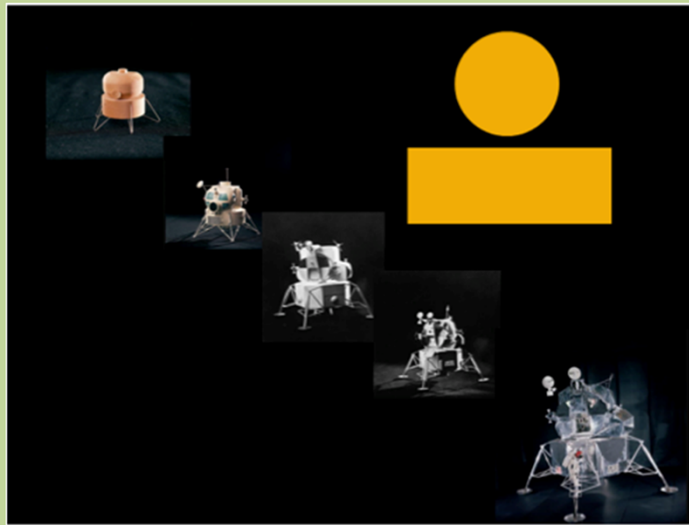
• <http://www.youtube.com/watch?v=rZNHktj14H8> ([link](#))

scenes from the HBO miniseries From The Earth to The Moon, executive produced by Tom Hanks for Imagine Entertainment.

Why is this a unique opportunity....no precedent, historically situated, emergent – with systems theory – crossing technical, social, human, political, economic



## the context of the question



**A socio-technical story of emergence and evolution...**

The story – is one of emergence and evolution of the overall configuration of the Apollo LM – from a symbol (ascent and descent stages) to a series of prototypes. Evolution in purpose and goals (what did the race to space really mean technologically and socially?), tin can to human-centered design, of capabilities (no precedent, radical transfer)

### Backdrop

Historical / social / political – “race to space”, Global competition, public morale  
Systems thinking and design thinking emerged as professional identities and research methodologies in early 60s

No precedent – majors technological and scientific advancements



We're still in the thick of the data...focus here on the story of collaborating with archivists



26 May 2011

Shelly Kelly (UHL archivist):

Prof. David Hovde provides a primer on archival research, what is expected from the researchers and what he can ask for from the archive staff, etc.

*"Our original ten-year MOU signed in 2001 with NASA and NARA ended this February and is in the process of being renegotiated. However, per the original agreement the Apollo series documents are scheduled to be returned to the National Archives Southwest Regional Facility located in Fort Worth, Texas."*

- *"It is very likely that most, if not all, of the original Apollo, ASTP, and Skylab series **documents will not be available for research this summer at UHCL.** We have spent the last 11 months scanning a large percentage of the documents to make them available via PDF via email for reference purposes. "*
- *"The final delivery of all Apollo, ASTP, and Skylab documents to the National Archives in Fort Worth will take place sometime this mid-summer, early fall and must be **completed by Feb. 2012.** **National Archives-Ft. Worth will handle requests to view the hard-copy documents after that date.** We will continue handling requests for scanned PDF copies."*

3 – 13 Aug 2011

in the archives of UHCL

it

10  
nc  
le

*"After spending some time going over your document request list, I think a trip to the UHCL Archives would be a good idea if you can do it in before June 24 or in the mid-July to mid-August range. We will be closed June 25-July 13 and we'll be closing in September for major construction/expansion."*

 what stories do we have?

**The data includes**

- **Chronological files on development of the Apollo LM**
  - From 1945 to 1978
  - Letters, memoranda, and meeting minutes
  - Operations and systems handbooks
  - Photographs
  - Flight readiness reviews
  - Configuration control board minutes

**Documenting the design, fabrication, and testing modifications through to the final Apollo mission**

**About 3,700 files and 7.9 GB**



what stories do we have?



**Cold storage to maintain  
integrity of documents**

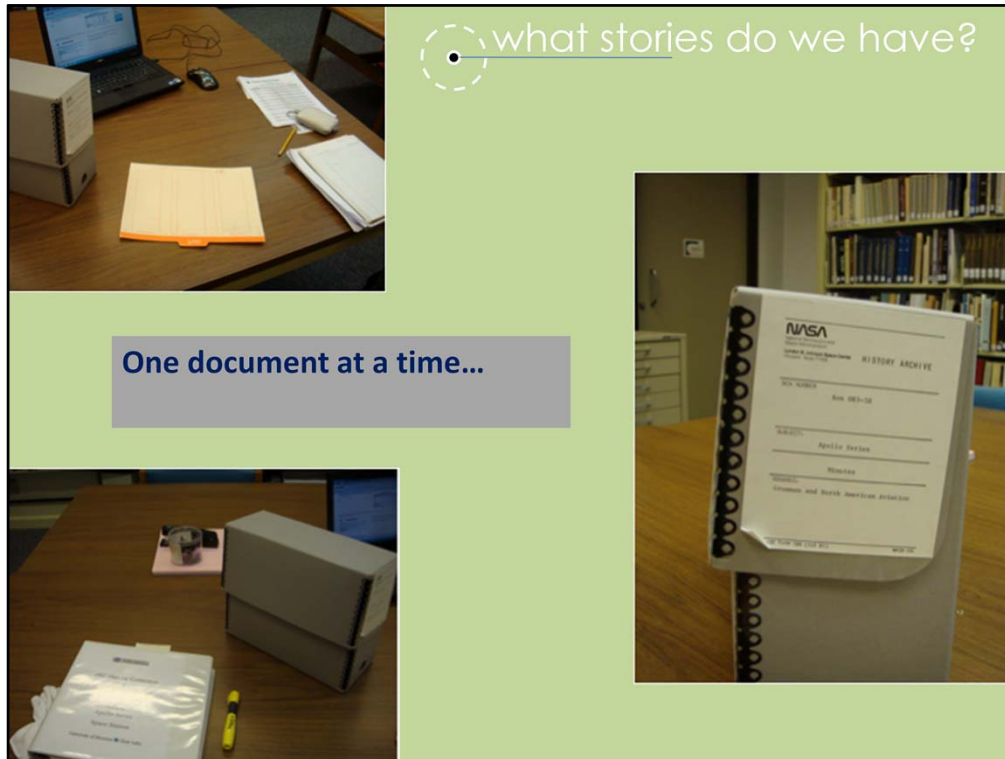
**Indexed database**

This room was so cold to maintain the integrity of the documents, and to minimize their deterioration over time.. Following the archives protocols, I told the archivist which box I needed after checking the specific document and its location in the indexed database, and then the archives brought the box for me.

what stories do we have?



A place to work, scan documents...



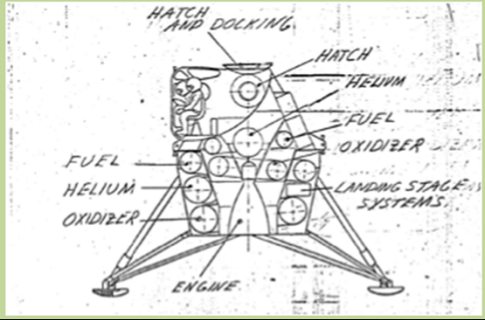
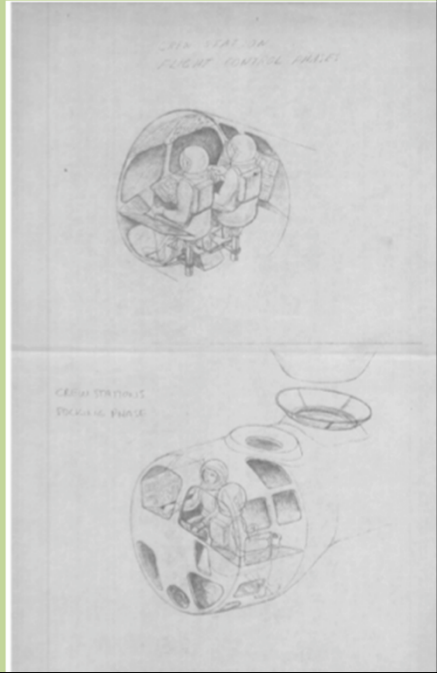
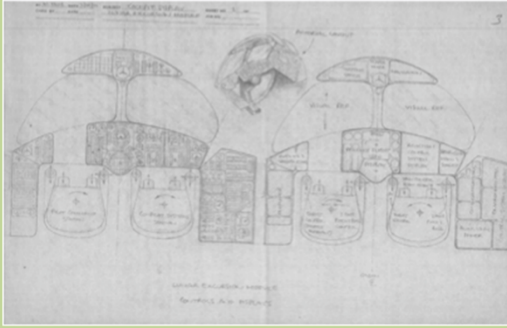
I took pictures of the label of each box I checked documents from, to know and record where the document I picked was located (also for future reference).

The page "OUT" next to the laptop in the upper picture was used as a place holder for a document that I took out from the box. As a protocol, I was only taking one document at a time from the box.

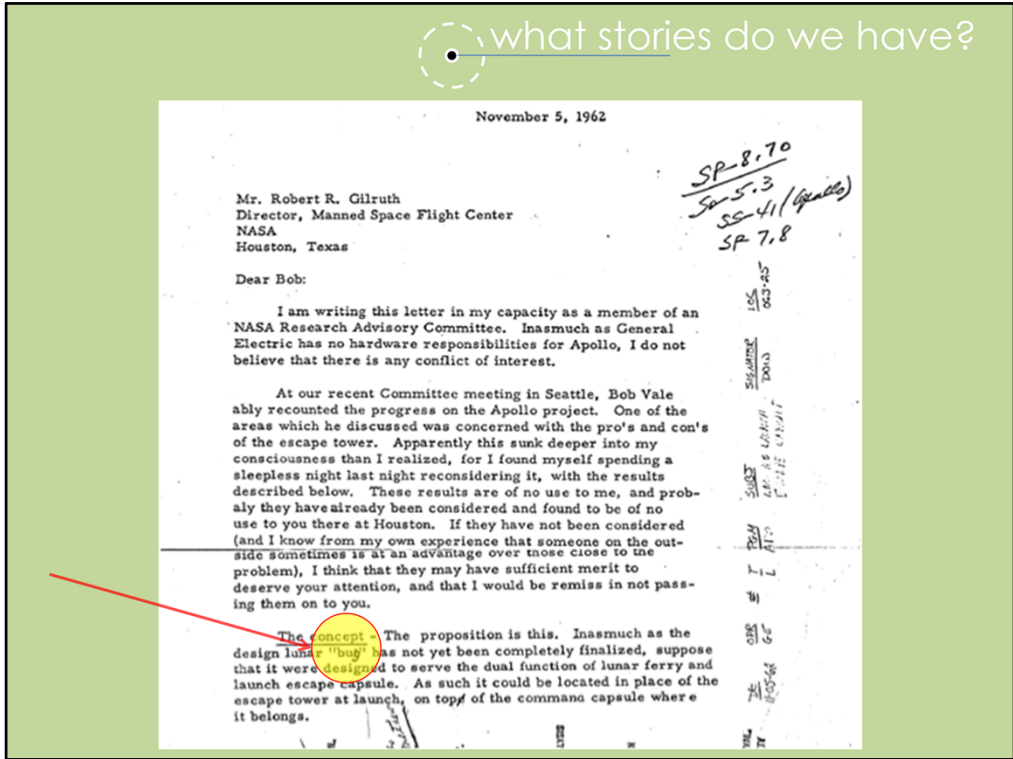
The lower picture shows the folder and the laptop that were my index to locate documents in the archived collection.

You can see gloves under the folder that I was requested to use, especially when dealing with photographs.

what stories do we have?



what stories do we have?



A letter from a top NASA manager calls the LM the “bug” in this correspondence, because it resembles one!





building the story



- Method: Integration of historical and design research
- Using LM chief engineering Tom Kelly's book (*Moon Lander: How we developed the Apollo Lunar Module*) to identify major iterations indicative of **systems thinking**
- Connecting with NASA's Jet Propulsion Lab (JPL) on oral history and knowledge management projects
- Paper accepted - AIAA SPACE 2012 Conference & Exposition, 11 - 13 September 2012
  - Configuration Control Board (CCB) Activities during the Development of the Apollo Lunar Module: Insight into the "Art" of Systems Engineering



acknowledgements

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Thank you!

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