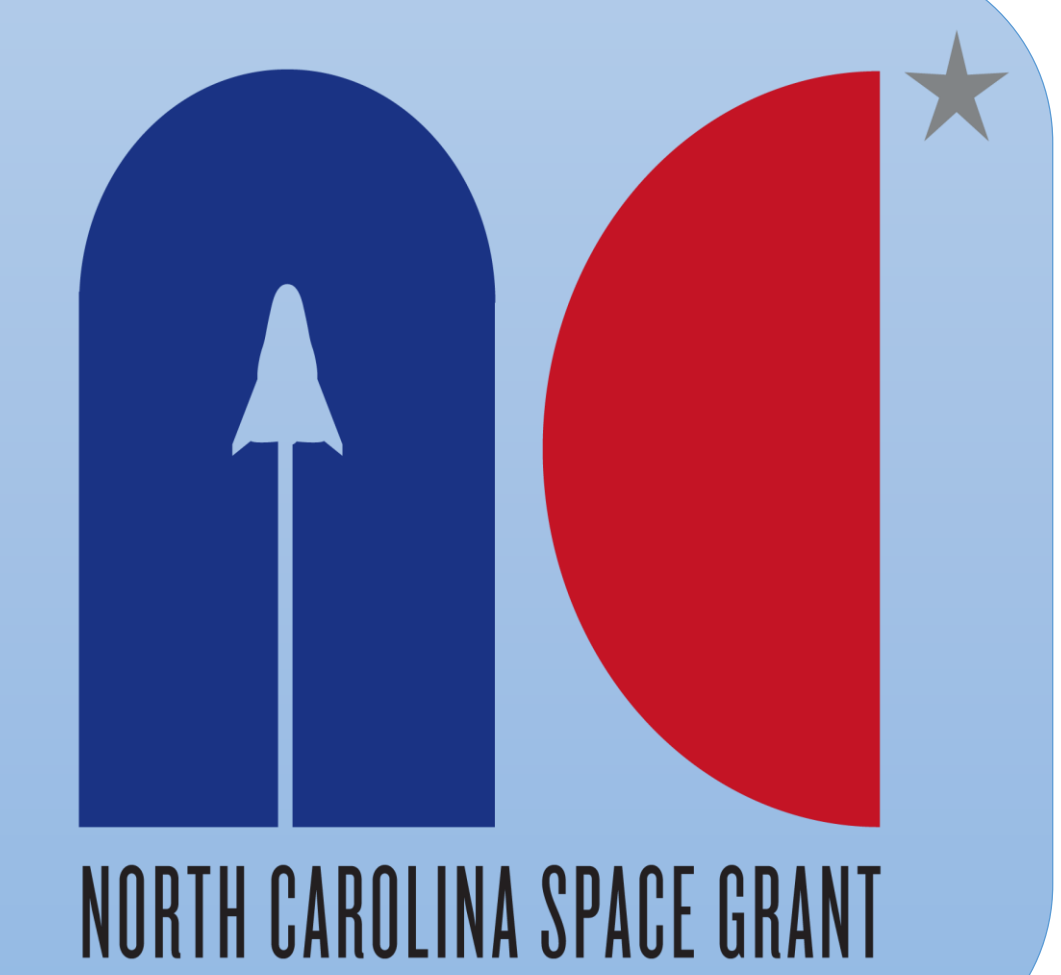


Developing a Sustainable, User-Friendly Literature Database to Support the Microgravity Simulation Support Facility (MSSF) at NASA's Kennedy Space Center (KSC)



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The MSSF at KSC

The Microgravity Simulation Support Facility (MSSF) at NASA's Kennedy Space Center is the only centralized, dedicated facility supporting ground microgravity research in the United States.

- The MSSF offers researchers access to cutting-edge technology and equipment to conduct a wide variety of ground microgravity experiments and research.
- To support its research, the MSSF has collected thousands of relevant literature pieces, creating extensive microgravity literature libraries.
- These libraries were housed in the form of electronic spreadsheets, which proved to be difficult to manage and unsustainable.



Figure 1. A 3-D Clinostat, one of the many microgravity simulator devices available at the MSSF.

Our Objectives

- Propose, create, and develop a sustainable platform for a user-friendly database to better house MSSF literature
- Analyze and optimize preexisting literature sorting methods
- Develop metadata categories to provide the database user a variety of search queries and diverse analysis
- Manually import literature data from past libraries
- Test and optimize the database to ensure proper function and ease of access for the user in the long term

Database Development

Selecting a Suitable Platform

When comparing database options, accessibility, sustainability, and user-friendliness were prioritized, especially in the user interface layer.

Given the potential for a variety of users, centering the database around the user was essential.

Our team selected a **web-based platform** using **Microsoft SharePoint** and **JavaScript**, already hosted on local NASA servers.

Front-End Options:

- Web-Page Based
- Application Based

Back-End Options:

- Integrated
- Local Server
- Cloud-Based

Creating Metadata Categories

Developing descriptive and structural metadata categories enabled our team to best sort literature while also providing pertinent data and analysis to the user.

Sample Metadata Categories:

- Author
- Taxonomy
- Hardware
- Genotype

Testing and Optimizing the Novel Database

The novel database was then fitted with metadata categories and past literature libraries. Rigorous testing enabled our team to make significant improvements to optimize the model for user-accessibility and function.

Title	Authors	Journal/Bc Publication	Create Date	Hardware	Duration	Organism and other notes
Meristematic c	Manzano AI, Lark	BMC Plant	2013	9/7/2013	diamagnetic levitation	Arabidopsis
Tropistic respoi	Eidesmo T, Browr	Micrograv	1991	10/1/1991	somersault clinostat.	avena
Enhancement c	Heathcote DG, Bi	Planta	1987	11/16/2013	2D clinostat	triticum, avena
Ultrastructural	Podlutzky AG.	Adv Space	1992	1/1/1992	2D clinostat	Arabidopsis
Effects of clinoi	Hilaire E, Paulsen	Physiol Pla	1995	10/1/1995	2D clinostat	Sweet Clover
Simulated weig	Skagen EB, Iverse	Physiol Pla	1999	9/7/2001	2D clinostat	Brassica napus

Figure 2. A sample of the preexisting literature libraries at the MSSF. These spreadsheets, while convenient, were difficult to navigate, disorganized, and were challenging to upkeep.

Add Item Advanced Search		
Toggle column: Pub Year Hardware Language Author Citation Pub Type Journal Platform Taxonomy Treatment Duration Primary Organisms Genotype Description Analysis Type Themes Keywords		
All		
Show 10 entries		
Search: []		
Title	DOI	PMID
Growth and development in higher plants under simulated microgravity conditions on a 3-dimensional clinostat	https://doi.org/10.1016/s0273-1177(01)00165-x	11596546
Growth and development, and auxin polar transport of transgenic Arabidopsis under simulated microgravity conditions on a three-dimensional clinostat	https://doi.org/10.2187/bss.17.288	15136750
Novel, Moon and Mars, partial gravity simulation paradigms and their effects on the balance between cell growth and cell proliferation during early plant development	https://doi.org/10.1038/s41526-018-0041-4	29644337
Simulated microgravity and the antagonistic influence of strigolactone on plant nutrient uptake in low nutrient conditions	https://doi.org/10.1038/s41526-018-0054-z	30345347
Simulated microgravity, Mars gravity, and 2g hypergravity affect cell cycle regulation, ribosome biogenesis, and epigenetics in Arabidopsis cell cultures	https://doi.org/10.1038/s41598-018-24942-7	29686401

Figure 3. A sample of the current database hosted on a local NASA SharePoint server. Our database provides the user with a variety of customizable search options, ease of access, and a smooth interface.

Future Steps

- Continue user testing and debugging to improve interface usability and update speeds
- Update database with new datasets and new metadata categories as needed
- Conduct real-time user trials with members of the MSSF research community
- Expand supported import/export capabilities to improve database flexibility
- Identify knowledge gaps in microgravity research through database-supported literature searches and research

Our team is hoping to eventually expand our platform to provide the science community an open science database, especially since no literature library of space life sciences research is currently available.

References

- Microgravity Simulation Support Facility. (n.d.). Retrieved from <https://kscpartnerships.ksc.nasa.gov/Partnering-Opportunities/Capabilities-and-Testing-and-Labs/Microgravity-Simulation-Support-Facility>
- MSSF Microgravity Simulation Support Facility [PDF]. (n.d.). National Aeronautics and Space Administration.

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