



LUNAR PIT PATROLL

PRESENTS

CRATER STATS



MEET THE LUNAR PIT PATROL



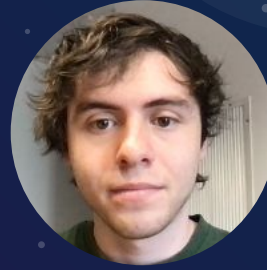
Evan Palmisano
Team Lead



Ibrahim Hmood
Customer Communicator



Caden Tedeschi
Architect



Alden Smith
Release Manager



Levi Watlington
Recorder

FACULTY



Isaac Shaffer
Faculty Professor



Vahid Nikoonejad Fard
Team Mentor

The background is a dark blue and purple gradient, filled with numerous small white stars and larger, stylized planets. In the top left, there is a planet with a ring and a cratered moon. In the bottom right, there is a planet with horizontal stripes. The overall aesthetic is clean and modern, typical of a presentation slide.

PROBLEM STATEMENT

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**Our business area is in astrogeology with the
United States Geological Survey**



- **What is USGS?**
 - **A science agency that provides scientific information about the Earth, water, and biological resources of the United States**





Our business area is in astrogeology with the United States Geological Survey (USGS)

- **Flagstaff AZ**
 - **Astrogeology Science Center**
- **Large central repository of information**
- **Celestial bodies**
 - **Natural landmarks**
 - **Age, Substance, Epochs**
- **The Space Industry**

PROBLEM STATEMENT



Trent Hare

**Cartographer at U.S. Geological Survey (USGS)
Employed for over 35 years.**

- **Crater Stats CLI application**
- **Python application**
- **Used by hundreds of scientists**
- **Crater Stats is cumbersome**





What problem are we trying to solve?

The usability of Crater Stats needs improvement!



“Scientists should not have to attend a boot camp to use Craterstats...”

- Trent Hare

PROBLEM STATEMENT

Key Problems

What's broken



- Steep learning curve
 - CLI is not the easiest and has little documentation...
 - Previous GUI attempts were not user friendly...
- Craterstats is time inefficient
 - Rewrite an entire command for a slight change...
 - The original GUI was not ported to Python and was no longer usable

OUR OBJECTIVE

- Standalone GUI environment for running craterstats
- Frequent iteration and testing
- Customer collaboration
- Continuous improvement



SOLUTION OVERVIEW



SOLUTION OVERVIEW

- Our solution was a minimalistic GUI that solves our problems
 - Astrogeologists can:
 - Upload plot data
 - View live plot constantly
 - Customize plot appearance and data usage
 - View equivalent CLI commands

SOLUTION OVERVIEW

- Improved usability
 - Easier to find and change settings
 - Visual feedback on changes
 - Eliminates need for complex CLI commands
 - Simplifies file upload and export

SOLUTION OVERVIEW



Global Settings



Plot Settings

Global Settings was filled with options that changes the data used in the plot generation

Plot Settings was filled with options that change the plot directly

SOLUTION OVERVIEW

- Toolbar
 - Containerized Features
 - Features are specialized tools that are often used

File

Plot

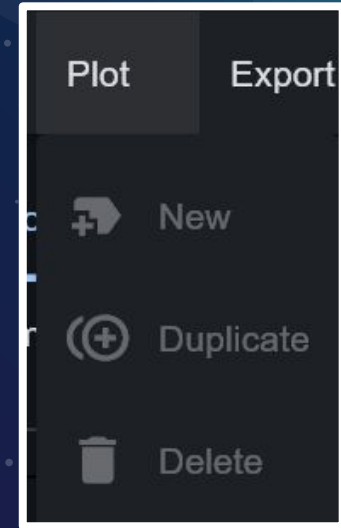
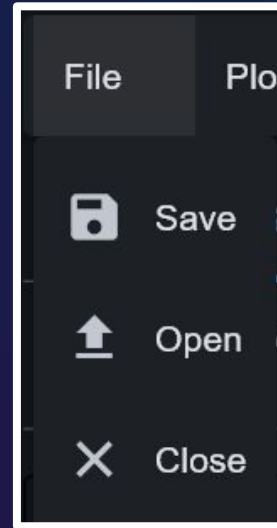
Export

Utilities

About

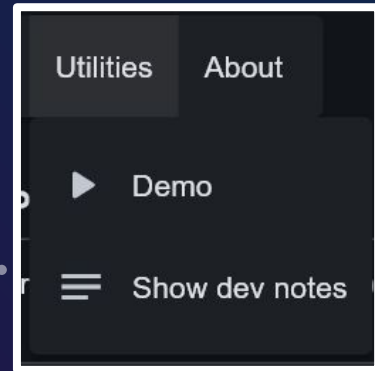
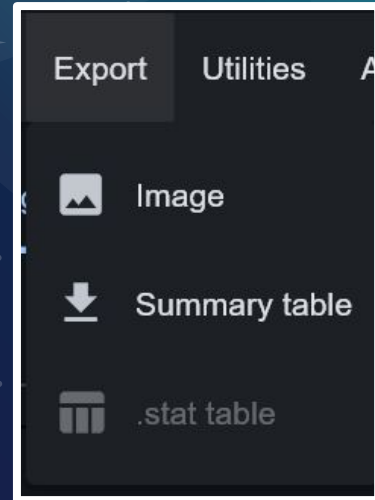
SOLUTION OVERVIEW

- ★ File
 - ★ Save plots
 - ★ Upload data
 - ★ Close program
- ★ Plot
 - ★ Plot-operations



SOLUTION OVERVIEW

- Export
 - Export plot as image
 - Export summary table
- Utilities
 - Create and view demo plots
 - Show developer notes



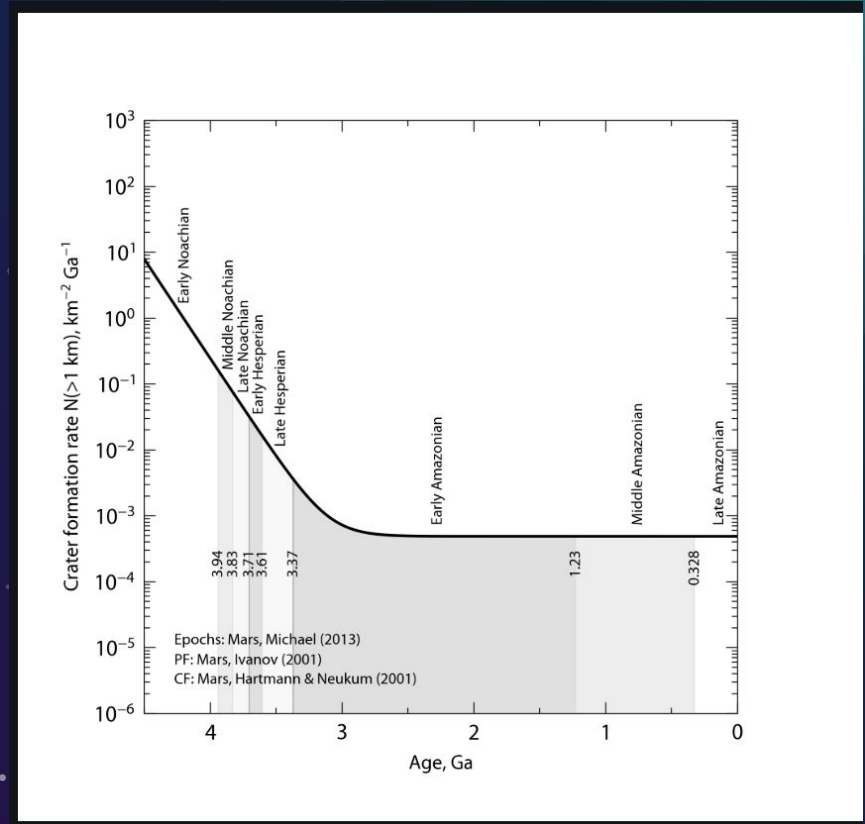
SOLUTION OVERVIEW

- Plot view
 - Most important part of the project
 - Helps astronomers date surface of a body
 - More craters = older surface
 - Displays generated plot
 - Reflects changes from "Global Settings" and "Plot Settings"
 - Includes a view of equivalent CLI commands below it



SOLUTION OVERVIEW

- Plot display of data collected from the Pickering Crater on Mars



PROTOTYPE REVIEW



File Plot Export Utilities About

Global Settings Plot Settings

Cumulative Differential Relative (R) Hartmann Chronology Rate

Body

Moon

Chronology System

Moon, Neukum (1983)

Chronology Function

Moon, Neukum (1983)

Production Function

Moon, Neukum (1983)

Epochs

none

Equilibrium Function

none

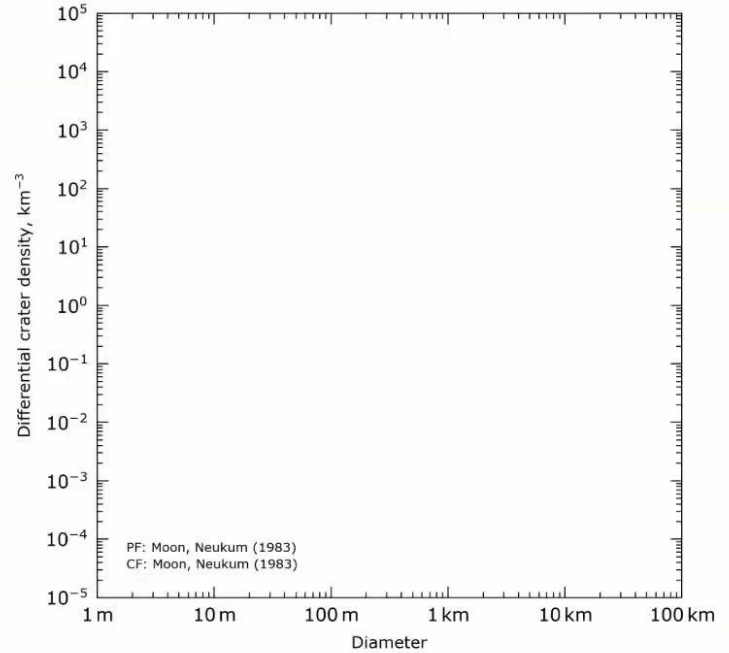
Isochrons

Show Legends

Legend Options

X Range, km -3, 2 Y Range, km -5, 5 Auto

Style: natural



```
craterstats -cs neukum83 -show_isochron 1
```

The background is a dark blue and purple space scene. In the top left, there is a large planet with horizontal stripes. To its right is a smaller planet with a ring system. In the bottom left, an astronaut in a white suit is floating, holding a long, thin rope that loops around. In the bottom right, there is a large, cratered moon. The background is filled with numerous small white stars and larger, four-pointed starburst shapes. There are also some abstract, wavy shapes in shades of blue and purple.

REQUIREMENTS & SPECS

REQUIREMENTS & SPECS

- Ease of use: enhance user experience with app
- Time efficiency: help users to do more with the app faster
- Low Learning curve: reduce time for users to learn functions
- Accessibility: have application readily available for multiple systems

REQUIREMENTS & SPECS

GUI needs to focus on:

Specs needed for focus:

★
Accessibility
Clear Navigation
Consistency

Intuitiveness
Simplicity

★
Specific
Settings Tabs,
Explicit Labels

★
Grouping
Similar Options,
Cross
Compatible

The background is a dark blue and purple space scene. It features several celestial bodies: a ringed planet (like Saturn) in the upper left, a cratered moon-like sphere below it, and a striped planet (like Jupiter) in the lower right. The space is filled with numerous white stars of varying sizes and four-pointed starburst patterns. Large, soft, wavy shapes in shades of purple and teal represent nebulae or interstellar clouds, creating a sense of depth and movement.

IMPLEMENTATION OVERVIEW

CRATERSTATS GUI FRAMEWORK

FRONT END

*The front end of our application
is created using Flet*

BACK END

*The back end consists of integration
with the previous version with extra
data handling*

HOSTING

*The program will be hosted either
through PyPi or an executable file
format*



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CHALLENGES & RESOLUTIONS

CHALLENGES AND RESOLUTIONS

- Most challenges related to integrating Craterstats CLI
- Experienced minor challenges with GUI development

CHALLENGE - DOCUMENTATION

- Very little documentation regarding development
 - Lack of comments and description
- Variable issues
 - Single Letter variables
 - Non-Descriptive variables

CHALLENGE - SUPPORT

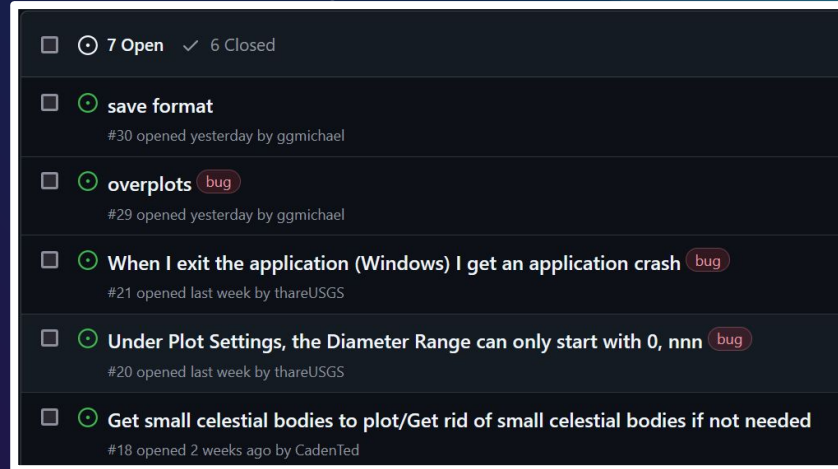
- Crater Stats CLI support was terminated after Python version 3.8
 - Caused issues with dependencies
 - Scipy
 - Required changes to programming style
 - Match case → If Else statement

MINOR CHALLENGES

- Plot file configuration styles
- Data point display
- Demo efficiency
- Code Organization

CHALLENGES - ISSUES

- Many issues arised from user testing.
 - Inconsistent Crashes
 - File Upload with Differing Drives
 - Combination of Data Files



CHALLENGES - RESOLVED

- Resolved challenges
 - Improved Documentation with comments
 - Keywords and easily identifiable elements
 - CTRL - F for code navigation

CHALLENGES - RESOLVED - CONT.

- Application directory development

- Separation of Plot and Data files allowing for ease of use

- GitHub Issue Solutions

- Plot file cleanup
- Subplot layering
- Directory path formatting

TESTING



TESTING PARTIES

Lunar Pit Patrol

- Unit Testing
- Bug Fixing

Outside Testers:

- Trent Hare
- ★ ● Greg Michael
- Tested on "Open Planetary Slack"



CraterStats



OpenPlanetary

TESTS

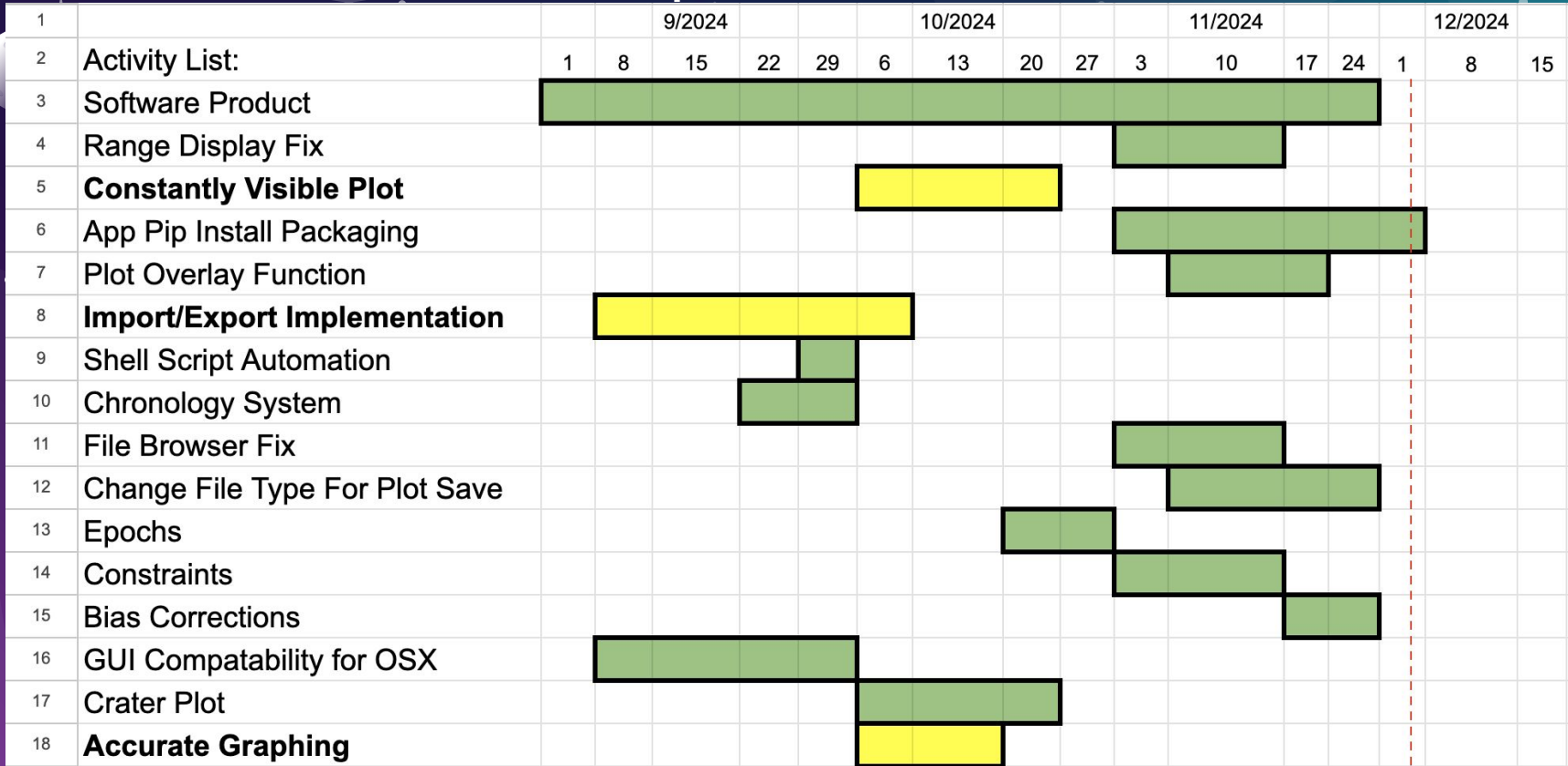
- Integration Testing:
 - GUI Multi-OS with Anaconda
 - File input and output path validation
- Usability Testing:
 - Numerous file uploads (plot & data)
 - Command Line Regeneration
- Unit Testing:
 - Demo Toggle
 - Dropdown
 - Plot Export
 - Subplot

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DEVELOPMENT SCHEDULE



GUI DEVELOPMENT SCHEDULE



Yellow items are Major Milestones

GUI DEVELOPMENT SCHEDULE

	9/2024					10/2024					11/2024				12/2024		
Activity List:	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15	
Range Display Fix																	

	9/2024					10/2024					11/2024				12/2024		
Activity List:	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15	
Plot Overlay Function																	

	9/2024					10/2024					11/2024				12/2024		
Activity List:	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15	
File Browser Fix																	

FUNCTIONAL MILESTONES

Completed Milestones:

- **Export/import functionality**
- **Accurate plot**
- **Constantly visible plot**
- Compatible with multiple OS's
- Finished chronology system
- Can overlay plots over one another

Milestone In Progress:

- Configure app for Pip Installation
- Application is open source on GitHub

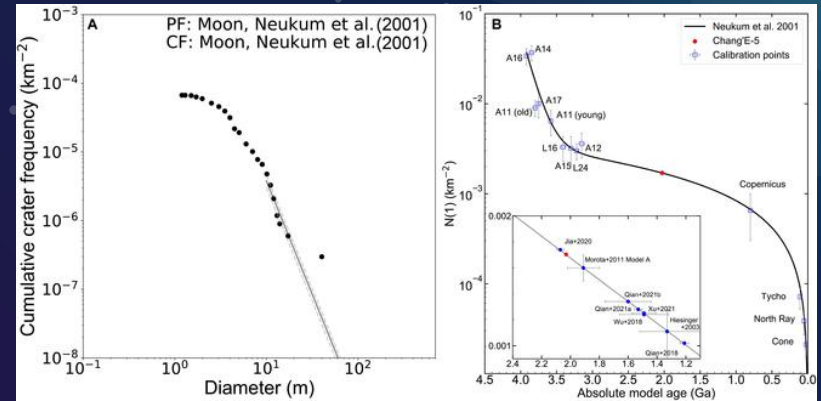


CONCLUSION

CONCLUSION



Surface of our moon



Crater Frequency
on Lunar Surface