



# LUNAR PIT PATROLL

PRESENTS

# CRATER STATS

# MEET THE LUNAR PIT PATROL



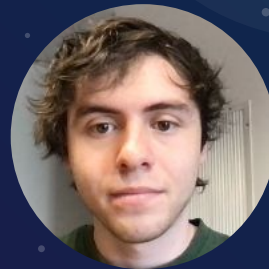
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Architect



**Alden Smith**  
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# FACULTY



**Isaac Shaffer**  
Faculty Professor



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Team Mentor

The background is a dark blue and purple space scene. It features several celestial bodies: a ringed planet in the upper left, a cratered moon-like sphere below it, and a striped planet in the lower right. The space is filled with numerous white stars of varying sizes and colors, including soft, glowing nebulae in shades of teal and purple. The overall aesthetic is clean and modern.

# 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**



# PROBLEM STATEMENT

**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**

# 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
  - ★ Intuitive interface
  - ★ Consistent design
  - ★ Simple to use
  - ★ Minimalistic python GUI
  - ★ Active user feedback (live plot updates)
  - ★ Clearly documented and readable
  - ★ Supports learning the complex CLI for sharing and repeatability

# SOLUTION OVERVIEW

- Avoids problems presented by old interfaces
  - Time inefficiency
    - GUI-based interaction eliminates need for complex commands
- Less complex than existing interfaces
  - Clean and organized interface
  - Settings partitioned into tabs
  - Plots displayed in every tab



Body  
Mars

Chronology System  
Mars, Neukum-Ivanov (2001)

Chronology Function  
Mars, Hartmann & Neukum (2001)

Production Function  
Mars, Ivanov (2001)

Epochs  
none

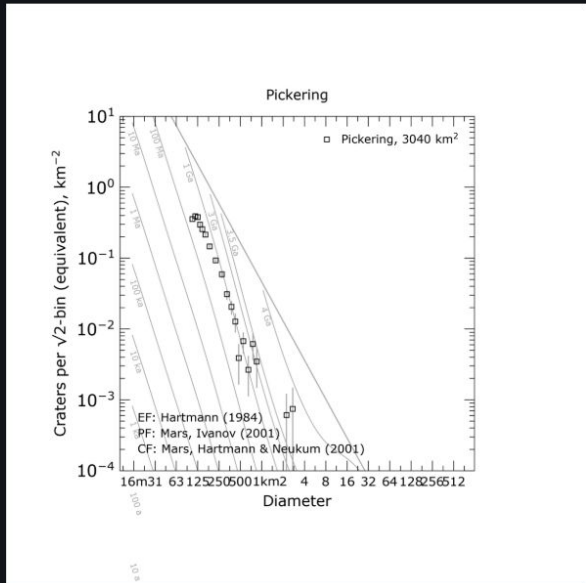
Equilibrium Function  
Hartmann (1984)

Isochrons .000000001s,.00000001s,.0000001s,.000001s,.00001s,.0001s,  Show Legends

Legend Options

X Range -3.15, 2.56 Y Range -8.0, 5.0  Auto

Style: natural



```
craterstats -cs 5 -ef 2 -title Pickering -pr Hartmann -isochrons .000000001s,.00000001s,.0000001s,.000001s,.00001s,.0001s,.001s,.01s,.1s,1s,3s,3.5sa,4s -show_isochron 1 -mu 0 -style natural -
```

Craterstats IV

File Plot Export Utilities About

Global Settings Plot Settings

Pickering  Title  Subtitle

Print scale, cm/decade (or plot width x height, cm): 7.5x7.5

Text size, pt: 12

Default

New Duplicate Delete Up Down

Pickering data  Hide plot

Source file: \Users\evanj\OneDrive\Documents\GitHub\CraterStats-Capstor Browse...

Diameter range: 0.01, 100 Binning: pseudo-log

Colour: Black Symbol: Square

Error bars  Display age  Align age left  Show isochron  Plot fit

Resurf  Resurf all Offset age: 0, 0

Pickering

Craters per  $\sqrt{2}$ -bin (equivalent),  $\text{km}^{-2}$

Diameter

EF: Hartmann (1984)  
PF: Mars, Ivanov (2001)  
CF: Mars, Hartmann & Neukum (2001)

Pickering, 3040  $\text{km}^2$

```
craterstats -cs 5 -ef 2 -title Pickering -pr Hartmann -isochrons .000000001s,.00000001s,.0000001s,.000001s,.00001s,.0001s,.001s,.01s,.1s,1s,3s,3.5sa,4s -show_isochron 1 -mu 0 -style natural -
```



# SOLUTION OVERVIEW

- ★ Time efficiency: faster task completion
- ★ Ease of use: simple and intuitive interface
- ★ Learning curve: reduced learning time
- ★ Implementation will improve usability
  - ★ Providing a consistent, simple interface that supports user feedback

The background is a dark blue and purple gradient space scene. It features a large striped planet in the top left, a ringed planet in the top center, a small astronaut floating in the bottom left with a tether, and a cratered moon in the bottom right. The scene is filled with numerous small white stars and larger four-pointed starbursts. The text 'REQUIREMENTS & SPECS' is centered in a white, stylized, monospace-style font.

# REQUIREMENTS & SPECS

# REQUIREMENTS & SPECS

• GUI needs to focus on:

★  
**Intuitive  
Consistency**

**Simplicity  
Clear Navigation**

Specs needed for focus:

★  
**Specific  
Settings Tabs  
Explicit Labels**

★  
**Grouping of  
similar plotting  
options**

# REQUIREMENTS & SPECS



Global Settings



Plot Settings

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

Plot Settings is filled with options that change the plot directly

The background is a dark space-themed gradient transitioning from purple on the left to teal on the right. It is filled with numerous small white stars and four larger celestial bodies: a ringed planet in the top left, a cratered moon-like sphere in the upper left, a striped planet in the bottom right, and a small white planet in the bottom right. Large, soft, wavy nebulae in shades of purple and teal are scattered across the scene.

# 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*



# 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

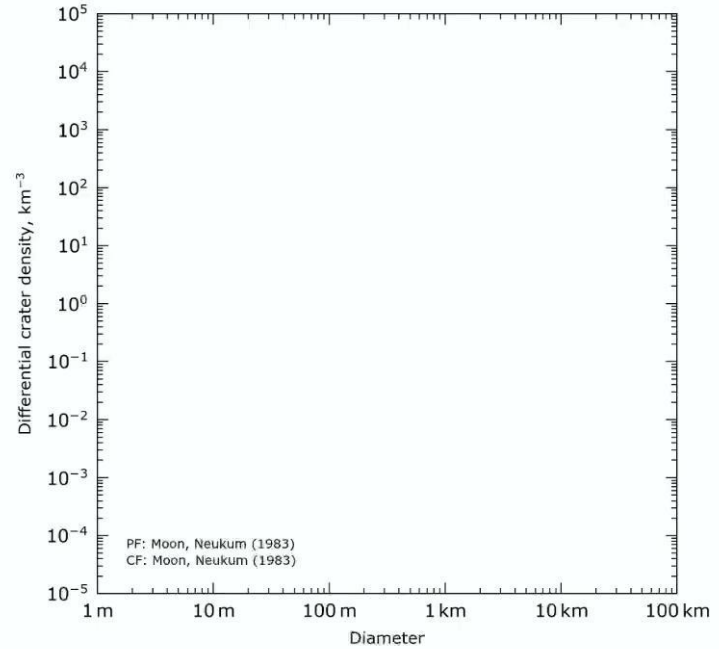
Equilibrium Function  
none

Isochrons  Show Legends

Legend Options

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

Style: natural



```
craterstats -cs neukum83 -pr differential -show_isochron 1 -mu 0 -style natural -print_dim [7.5x7.5] -pt_size 8
```

The background is a dark blue and purple space scene. It features several celestial bodies: a ringed planet (Saturn) in the upper left, a cratered moon in the middle left, and a striped planet (Jupiter) in the lower right. The sky is filled with numerous white stars of varying sizes and colors, including some with four-pointed starburst patterns. Large, soft, wavy shapes in shades of teal and purple represent nebulae or interstellar clouds, adding depth and texture to the scene.

# CHALLENGES & RESOLUTIONS

# CHALLENGES AND RESOLUTIONS

- ★ Previous challenges from DR2 resolved
- ★ Alpha version completed
  - ★ Application testing is producing new challenges

# CHALLENGE - DR2 RESOLVED

- ★ Resolved challenges since DR2
  - ★ Improved Documentation with comments
  - ★ Keywords and easily identifiable elements
  - ★ CTRL - F for code navigation

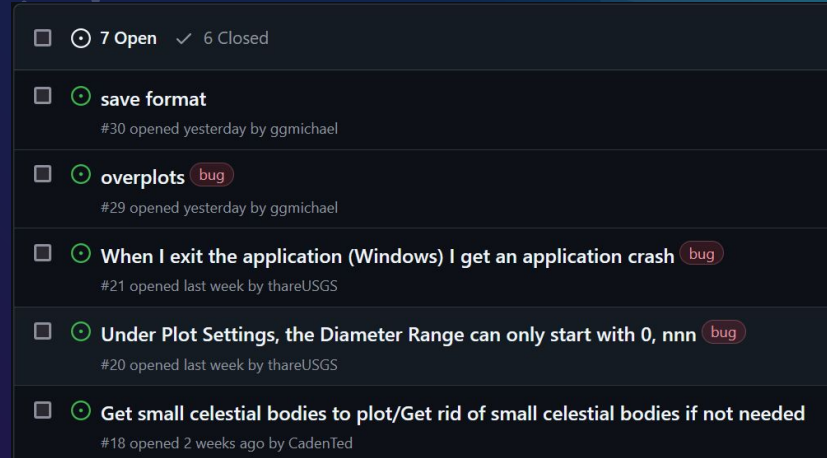
# ★ CHALLENGE - DR2 RESOLVED - CONT. ★

- ★ Craterstats CLI integration established for 70% application operation.
- ★ Application directory development
  - ★ Separation of Plot and Data files allowing for ease of use

# CHALLENGE - ISSUES

★ • Many issues arising from user testing.

- ★ Inconsistent Crashes
- ★ File Upload with Differing Drives
- ★ Combination of Data Files



A screenshot of a GitHub Issues page. The page has a dark theme. At the top, there is a summary bar showing '7 Open' and '6 Closed' issues. Below this, there is a list of five open issues, each with a checkbox, a status icon (a green circle with a white dot), a title, a 'bug' label, and the number of comments and the user who opened it.

Issue Title	Comments	Opened By
save format	#30	ggmichael
overplots	#29	ggmichael
When I exit the application (Windows) I get an application crash	#21	thareUSGS
Under Plot Settings, the Diameter Range can only start with 0, nnn	#20	thareUSGS
Get small celestial bodies to plot/Get rid of small celestial bodies if not needed	#18	CadenTed

A space-themed background with a dark blue and purple gradient. It features a large planet with horizontal stripes in the top left, a smaller planet with a ring in the top center, an astronaut floating in the bottom left, and a cratered moon in the bottom right. The background is filled with numerous small white stars and larger four-pointed starburst patterns. Abstract, wavy shapes in shades of purple and teal are scattered across the scene.

# TESTING PLAN



# TESTING PARTIES

Lunar Pit Patrol

- ★ Testing
- ★ Bug Fixing

Outside Testers:

- ★ Trent Hare
- ★ Greg Michael
- ★ Announced for testing on  
"Open Planetary Slack"



# 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:

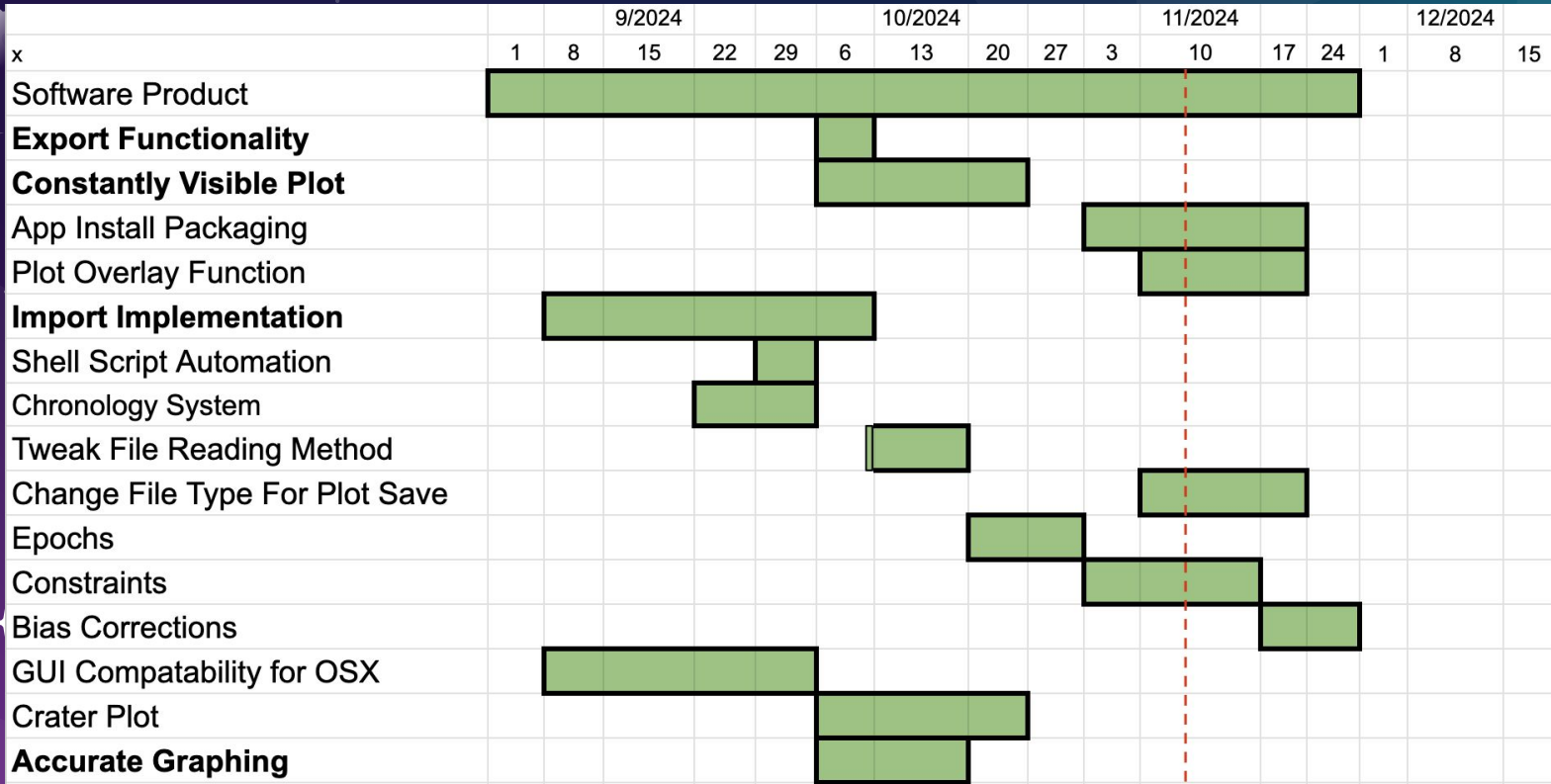
- ★ Demo Toggle
- ★ Dropdown
- ★ Plot Export
- ★ Subplot

# DEVELOPMENT SCHEDULE





# GUI DEVELOPMENT SCHEDULE



\*Bolted items are Major Milestones\*



# GUI DEVELOPMENT SCHEDULE

	9/2024					10/2024					11/2024			12/2024		
x	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15
<b>Accurate Graphing</b>																

	9/2024					10/2024					11/2024			12/2024		
x	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15
<b>Constantly Visible Plot</b>																

	9/2024					10/2024					11/2024			12/2024		
x	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15
<b>Import Implementation</b>																

	9/2024					10/2024					11/2024			12/2024		
x	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15
<b>Export Functionality</b>																

# FUNCTIONAL MILESTONES

## Milestone Complete:

- **Export functionality**
- **Import functionality**
- **Accurate plot**
- **Constantly visible plot**
- Integrated Ubuntu
- Finished chronology system
- Compatible with multiple systems



## Milestone In Progress:

- Package the app so it can be pip installed
- Ability to overlay graphs on each other
- Change the save format of plot files



# CONCLUSION

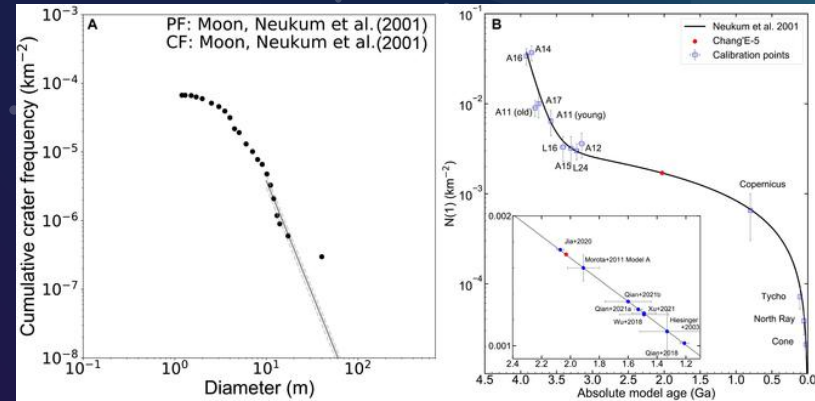




# CONCLUSION



Surface of our moon



Crater Frequency  
on Lunar Surface