Global Ground Station Network (GSN) visualization

#### Intro

In order to enable GSOC employees to visualize Ground Segment to Space Segment situation, a custom build tool is set up. Based on the assumption that the exact position of the antenna and up-to-date TLEs are available, a simple tool is set up with the purpose of visualizing said situation.

#### Used software

As no software is provided, freeware is used to set up the system.

* As visualization tool the JavaScript library cesium by AGI is used.
* To set up simple processing, scripts in python are created with various libraries in use.

#### Used resources

## Scripts

1. create\_czml\_ground.py

This script is used to create cesium native files in .czml format. In these files geometries over time can be displayed in cesium.

Functions:

* geodetic\_to\_geocentric()

translate geographic coordiantes in cartesian coordinates. Source from web.

Input: ellipsoid, latitude, longitude, height

Output: x, y, z

* check\_nan()

check for empty cells in input\_xls

Input: value

Output: if value is empty, return string

* replace\_txt()

replace string in textfile by replacing string in file and overwriting file. Custom source.

Input: file\_path, string, substitute

Output: -

* scopy\_file()

safe copy of files. Only finishes if copy was successful. Custom source.

Input: file\_path\_source, file\_path\_target

Output: -

* lookup\_index()

get line number of line containing specific string in textfile. Custom source.

Input: filepath, string

Output: line index

* add\_line()

add line to text file at specific line number. Custom source.

Input: file\_path, line index, string

Output: -

* remove\_line()

remove specific line from textfile. Custom Source.

Input: file\_path, string

* sdelete\_file()

safe delete file. Only finishes if deletion was successful. Custom source.

Input: file\_path

Output: -

* get\_TLE\_starttime()

Get TLE timestamp from satellite class as list.

Input: stallite class

Output: list of timestamps

* get\_latest\_starttime()

Get the timestamp from satellite class. Custom source

Input: satellite class

Output: timestamp as string and variables

* get\_interval()

get interval string for czml spanning 30 days. Custom source

Input: timestamp, satellite epoch

Output: interval in string

* time\_increment()

get time increment steps for every 300 seconds. Custom source

Input: satellite epoch, counter k

Output: time stamp in variables.

* read\_TLE()

read TLE file in native format. Custom source

Input: TLE file path from global

Output: satellite name, TLE line 1, TLE line 2

* check\_tle\_format()

check if TLE format is valid. Correct if not. Custom source

Input: satellite name, TLE line 1, TLE line 2

Output: satellite class, TLE line 2

* get\_increment\_pos

get satellite position at specific time. Source from web

Input: satellite class, time stamp in variables

Output: satellite position

* define\_trailings()

get lead and trail time intervals for orbit. Custom source

Input: satellite epoch, TLE line 2

Output: trailing time stamps list, trailing interval in string

* next\_3\_passes()

Get satellite visibility from Ground Station. Source from web

Input: TLE file\_path, time stamp in variables

Output: AOS time stamp, LOS time stamp

* get\_station()

Get dictionary containing info about all GS in input\_GSN.xlsx

Input: -

Output: GSN dictionary

* get\_duration()

Get the duration between 2 points in time in seconds. Possible input formats are string and timestamp

Input: start time, end time

Output: duration in seconds

* argument processing:

It is possible through arguments to specify input TLEs in source and to specify input GSN\_list.xlsx through arguments.

1. next script

## Templates

1. template\_Ground.czml

czml template containing formatting for satellite orbit, Ground station, and visibility

Local path: D:\working\ROP\_legacy\GSN\template\_Ground.czml

1. asdf

## Info sheets

## Version ctrl

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| --- | --- | --- | --- |
| Name | Version | Deploy date | Comment |
| Create\_czml\_ground.py | V0.6 | 07.05.2019 | Added multi GS  Readable TLE failsafe  Argument options  Added comments |
| template\_Ground.czml | V0.4 | 07.05.2019 | Added multi GS |
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