# Exporting Geospatial Expertise

## Python Scripting for ArcGIS

Patrick Flanigan
09/17/2015


BOOST PHASE
Ascent Phase
MIDCOURSE
Descent Phase
TERMINAL PHASE
Apogee
Ascent Phase Engagement
Descent Phase Engagement
Exit Earth's Atmosphere
Boost Burn Out
Re-entry
Boost Phase Engagement
Terminal Phase Engagement
Launch Site
Target


THREATS
OPPORTUNITIES

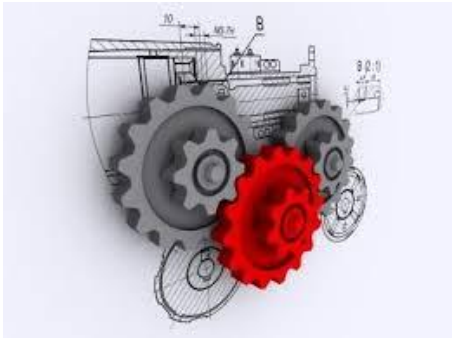
*What if we could hire someone to create geospatial products?*

*Contractors are expensive I don't want to spend anymore money!*

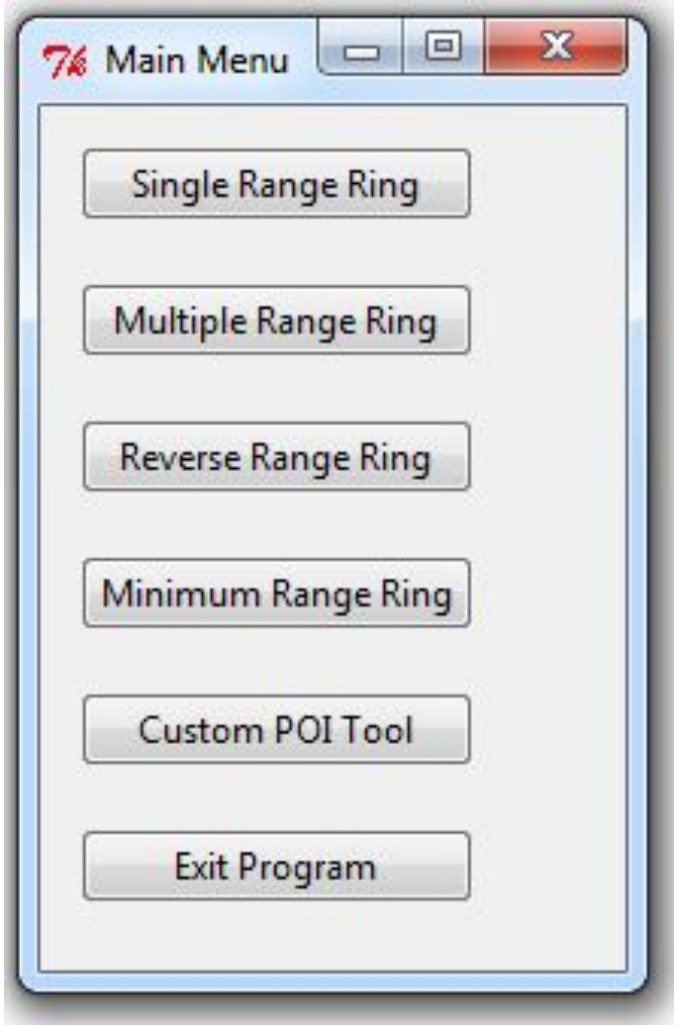
*A programmer*

*An analyst*

*A process*



# Range Ring Generator Tools




--Product: Single range ring around a country's border

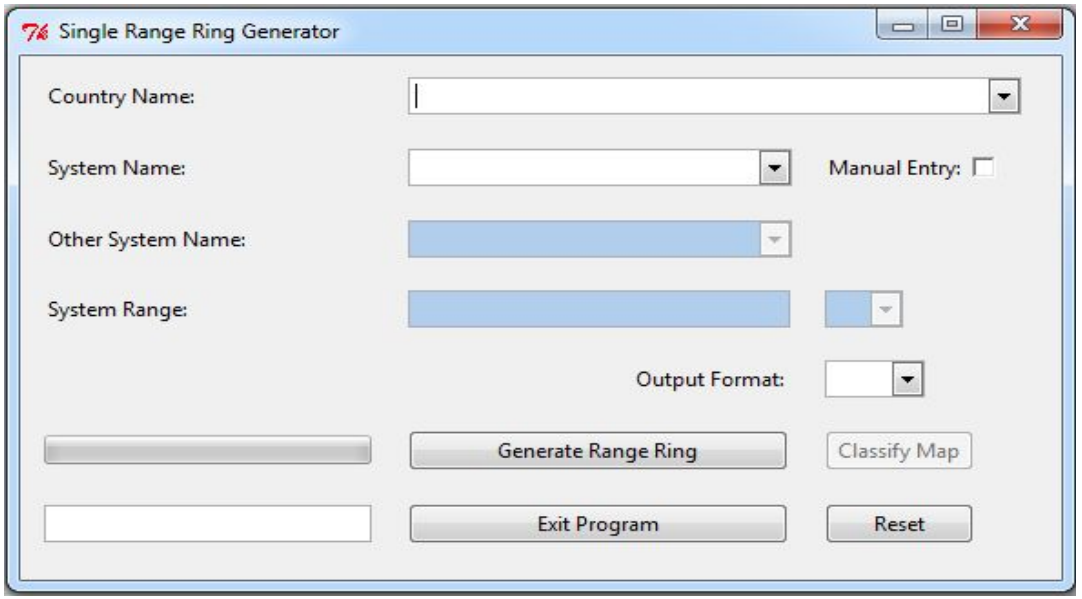
--Product: Multiple range rings around a country's border

--Product: Shaded region of country where a system has to reside in order to reach a point target (i.e. major city)

--Product: Single range ring representing minimum distance between a shooter and a target country.

--Product: Single or Multiple range rings with a minimum and maximum range for a place and associated weapon system.

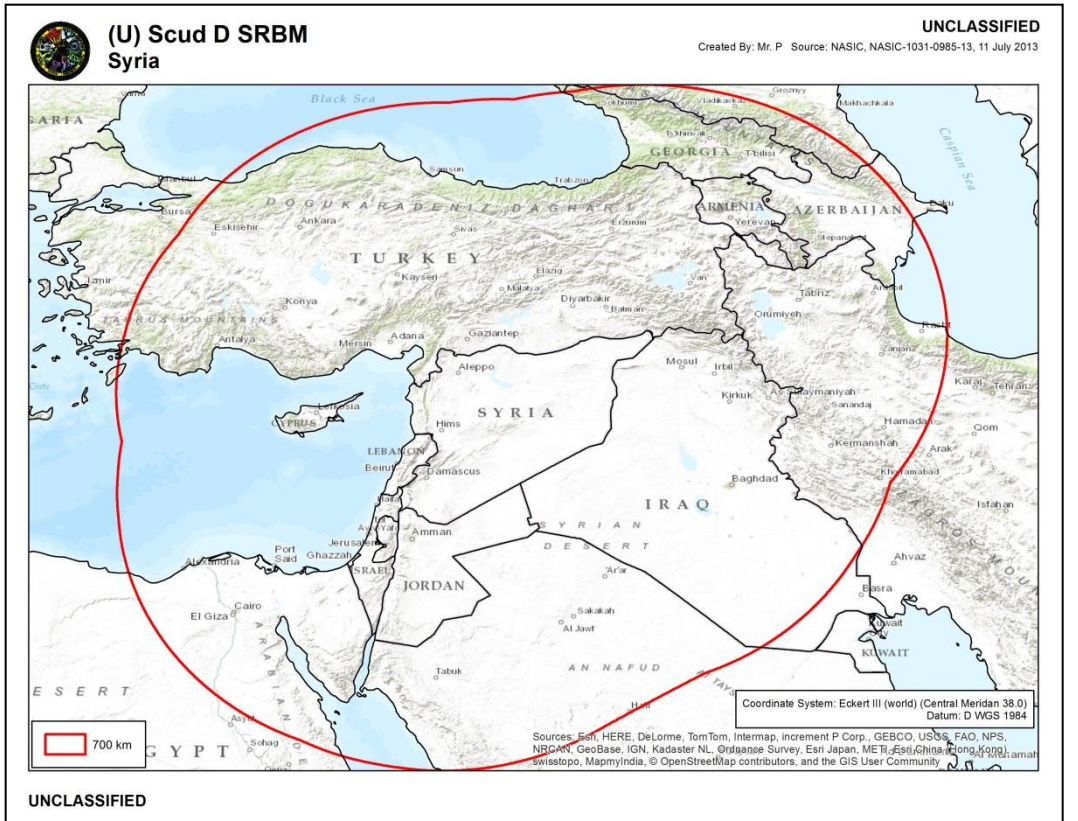
# Single Range Ring Tool



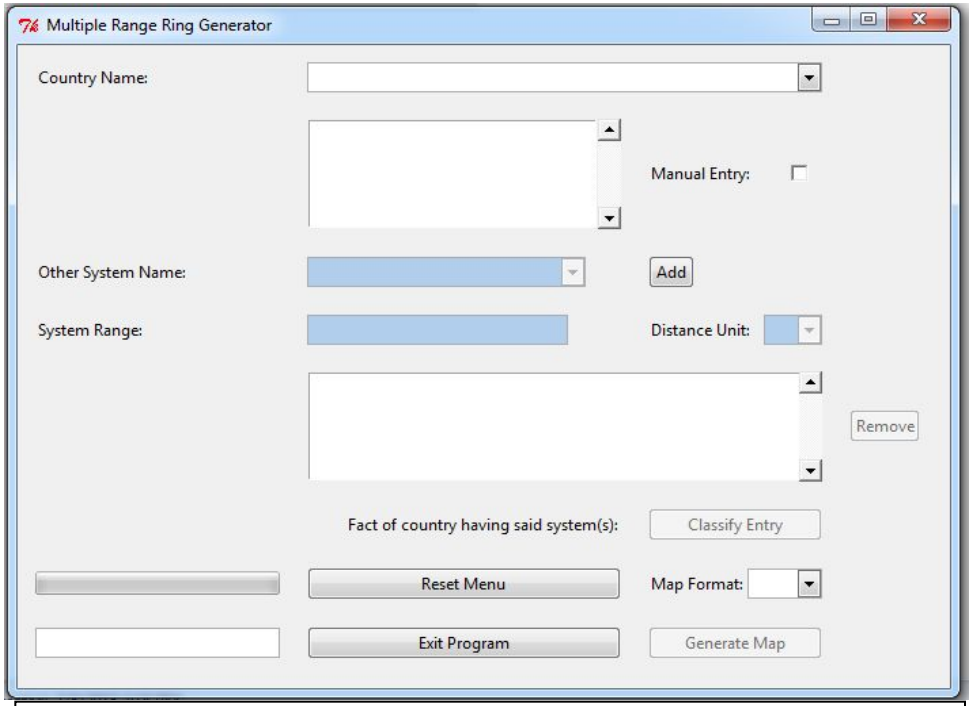

Example of Single Range Ring Output from the country border of Syria

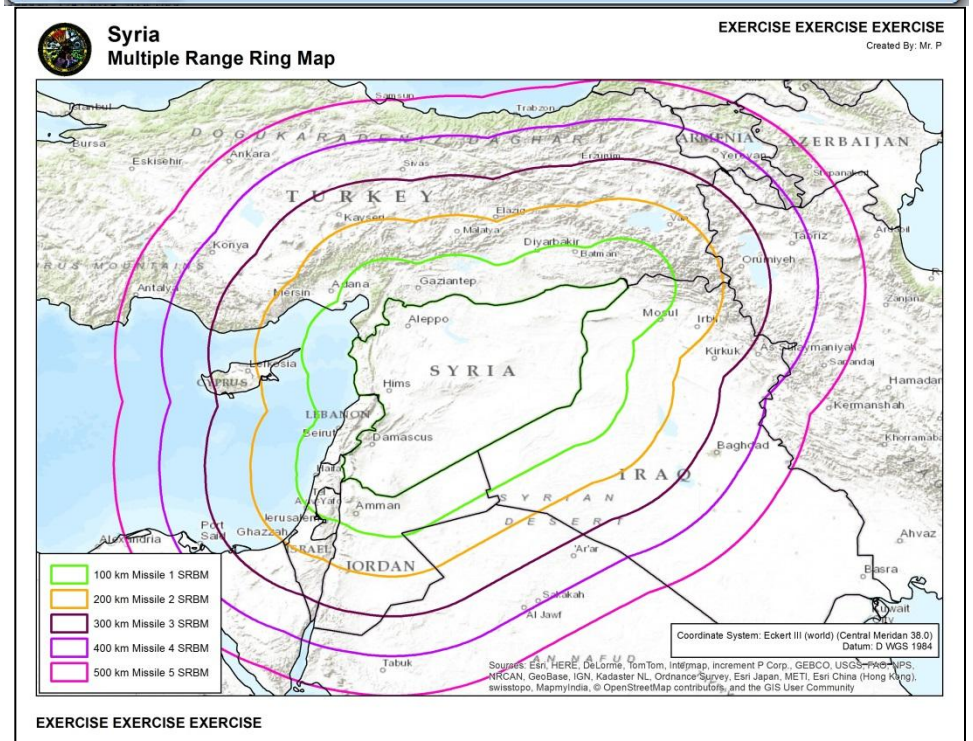
**Missile Type:** Scud D SRBM (range 700 km)

**Time:** 25 seconds
(Alienware M11x Intel i7 CPU (quad core) U640 @ 1.20 GHz 4.00 GB RAM)



# Multiple Range Ring Tool



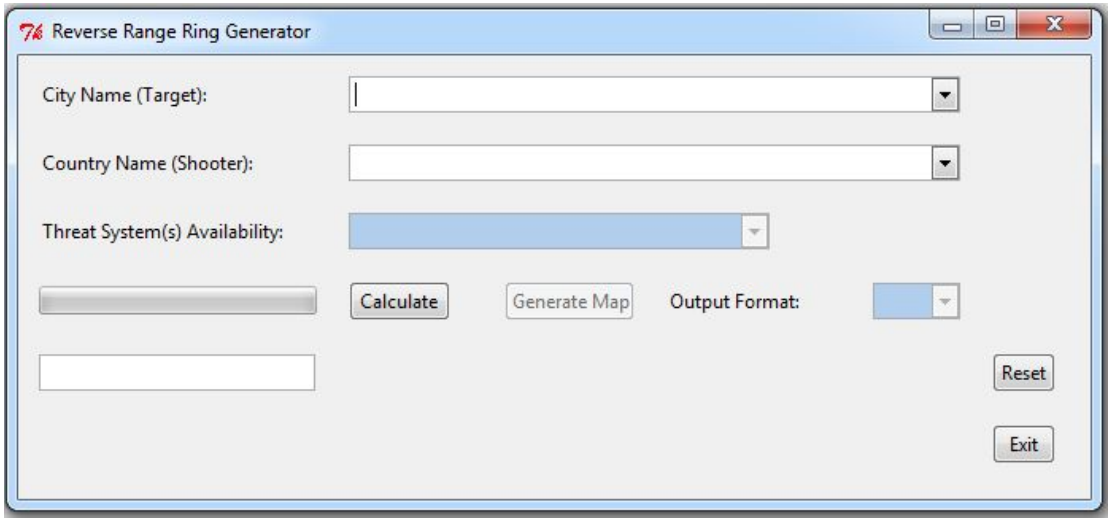




Example of Multiple Range Ring Output from the country boundary of Syria

**Missile Type:** SRBM (ranges from 100-500 km)

**Time:** 1 minutes 28 seconds
(Alienware M11x Intel i7 CPU (quad core) U640 @ 1.20 GHz 4.00 GB RAM)

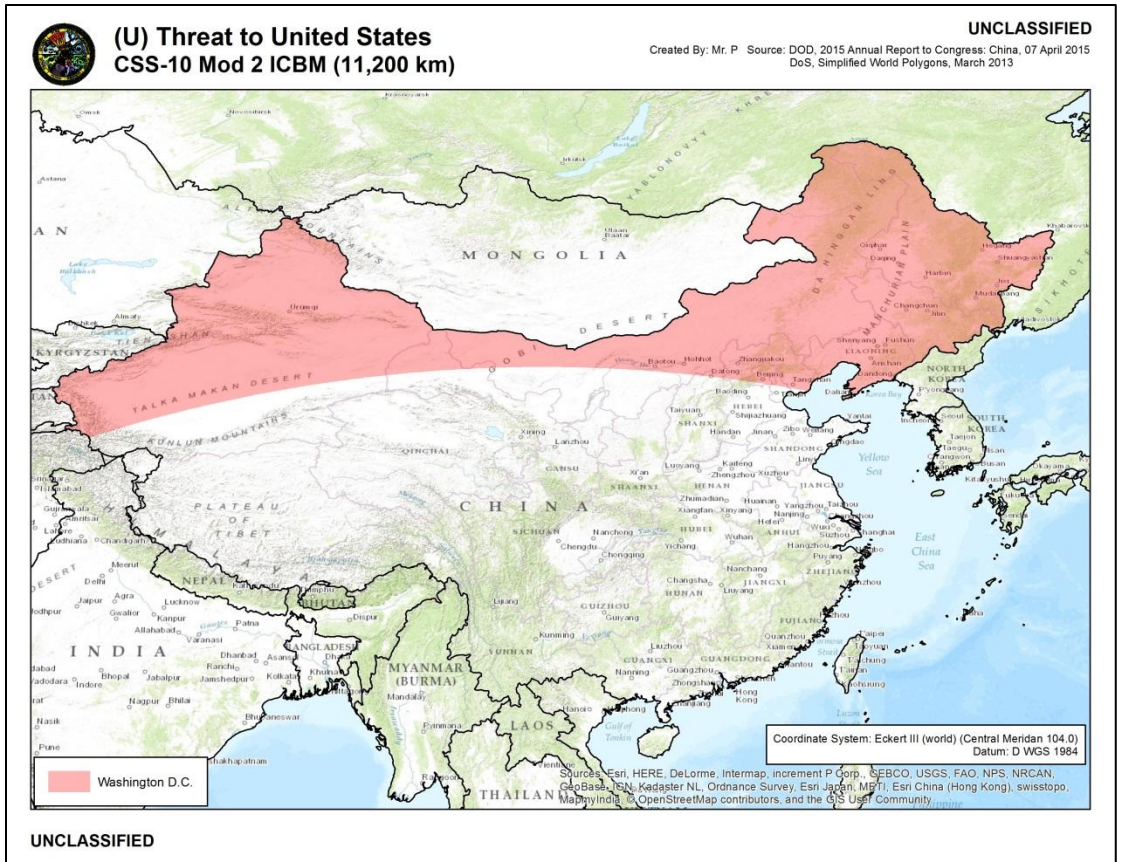
# Reverse Range Ring Tool



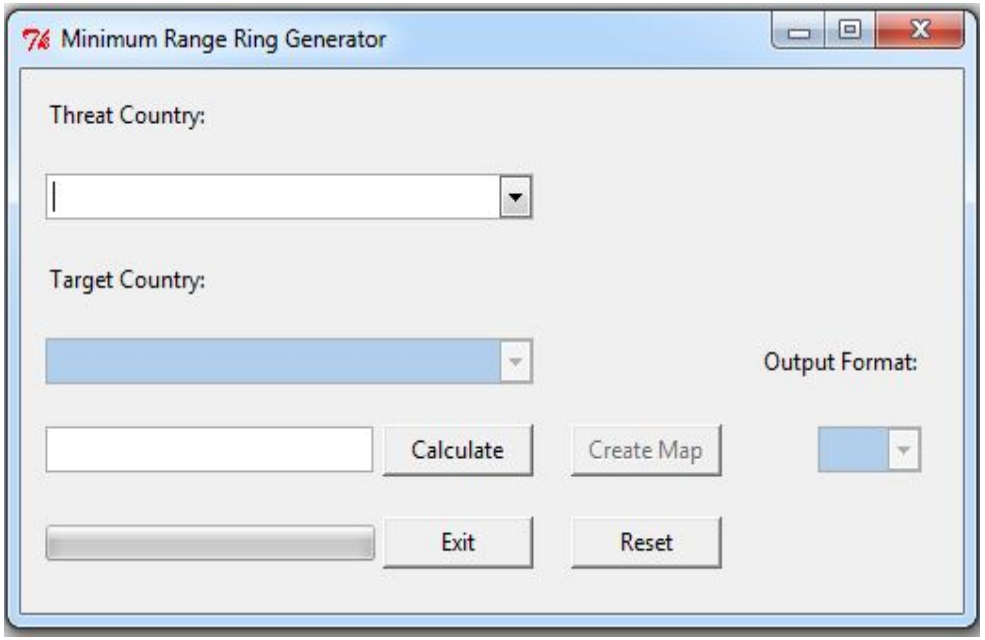

Example of Reverse Range Ring Output

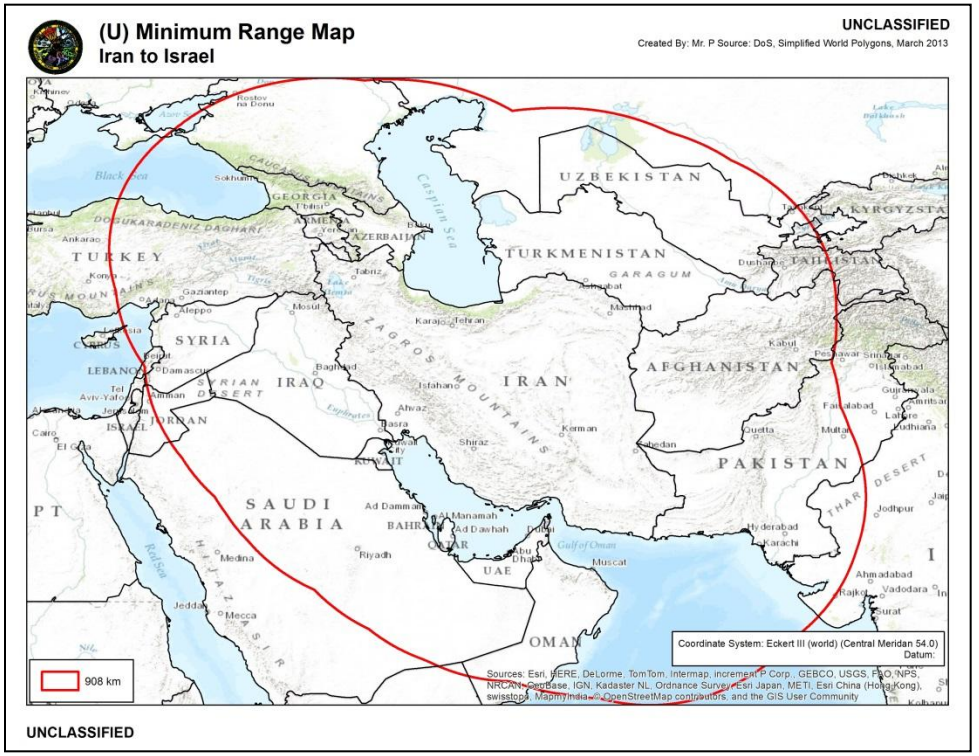
**Missile Type:** CSS-10 Mod 2 ICBM (11,200 km)

**Calculate:** 1 second
**Generate Map:** 15 seconds
**Total:** 16 seconds
(Alienware M11x Intel i7 CPU (quad core) U640 @ 1.20 GHz 4.00 GB RAM)



# Minimum Range Ring Tool

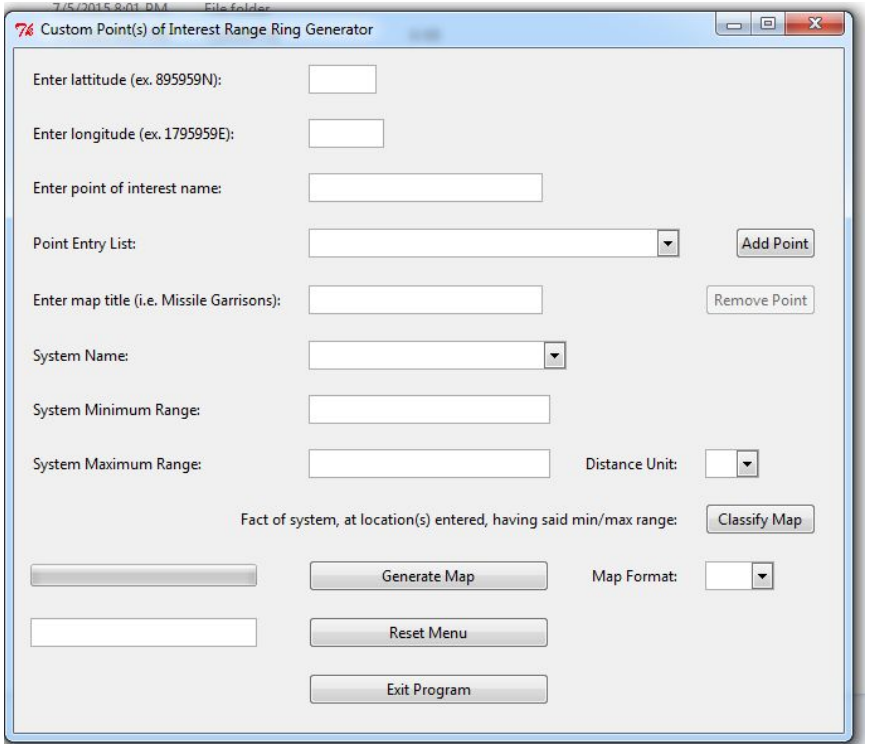


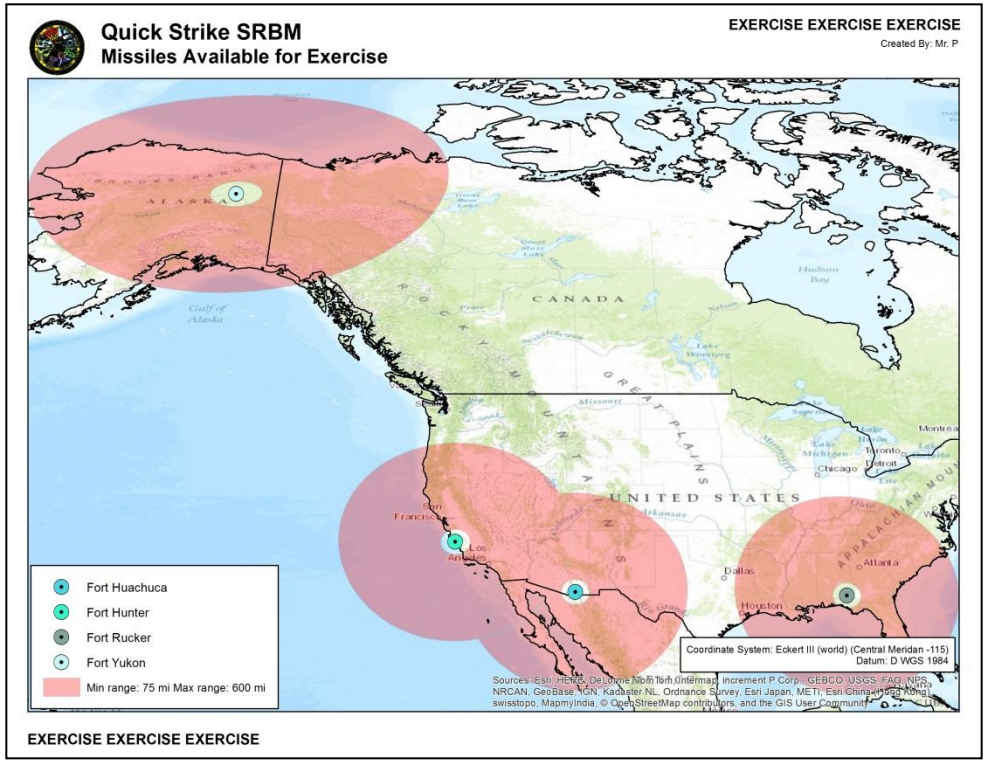




Example of Minimum Range Ring Output from Israel to Iran

**Calculate:** 2 seconds
**Generate Map:** 40 seconds
**Total:** 42 seconds
(Alienware M11x Intel i7 CPU (quad core) U640 @ 1.20 GHz 4.00 GB RAM)

# Custom Point of Interest(s) Range Ring Tool




Example of range rings around custom points of interest (stored in point entry list dropbox)

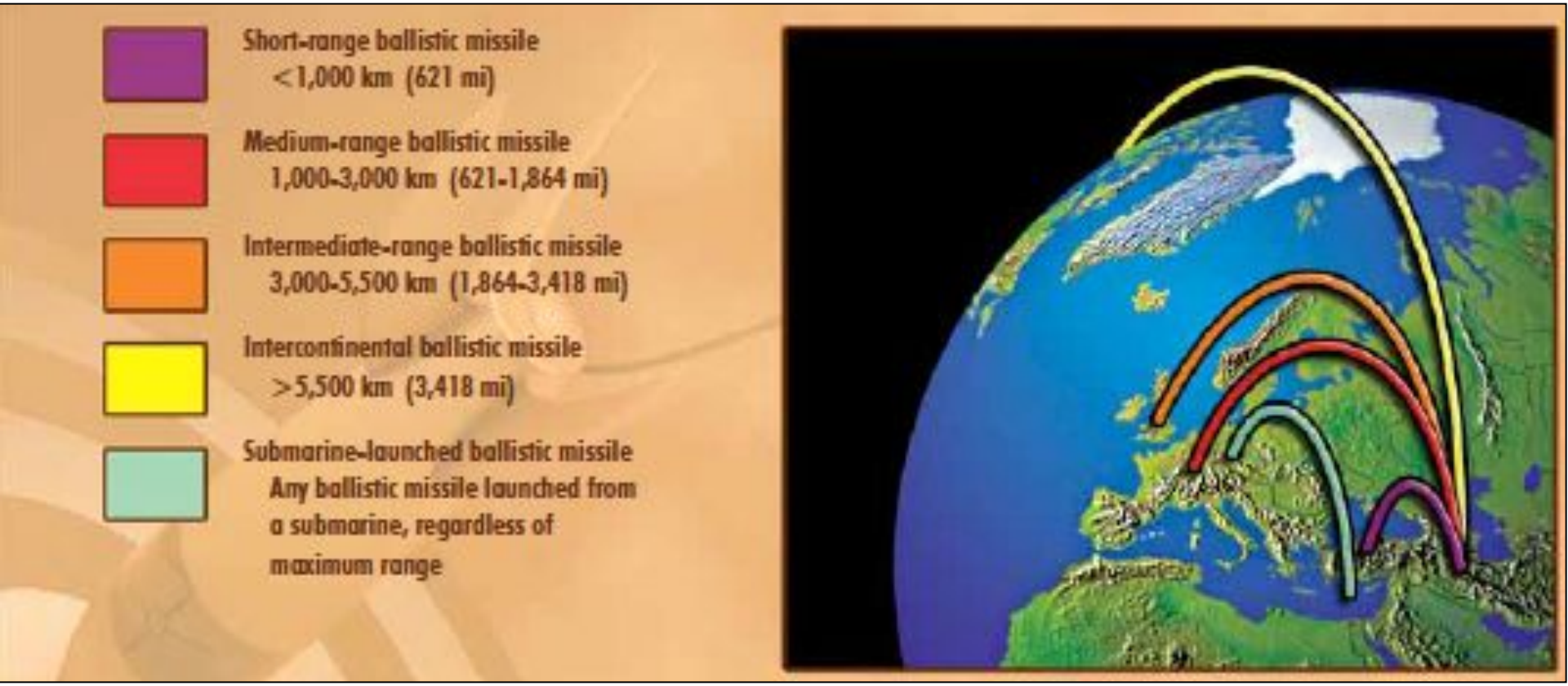
Range rings = min/max range of a given system from a given point with each place given a different color dot.

**Total:** 24 seconds
(Alienware M11x Intel i7 CPU (quad core) U640 @ 1.20 GHz 4.00 GB RAM)

# Backup

# What are ballistic missiles?

## Ballistic Missile Classifications




Source: NASIC, Ballistic and Cruise Missile Threat, 11 July 2013

# What are ballistic missiles?

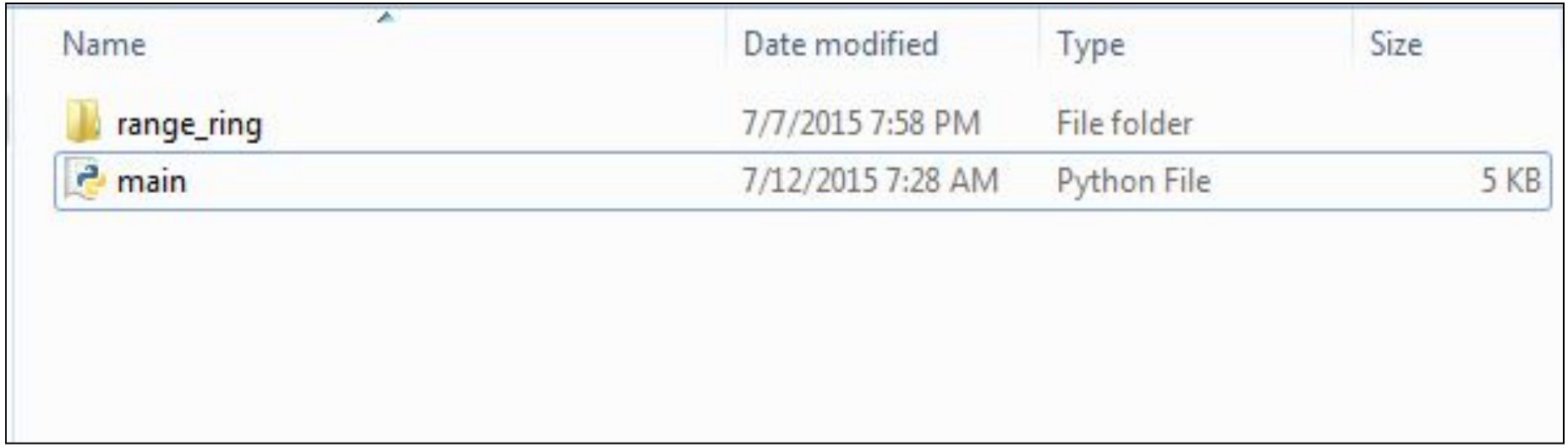
*Ballistic missiles are rocket-propelled vehicles that deliver nuclear or conventional payloads.*

*Potential uses of ballistic missiles can be for warfare and terrorism, and are an emerging threat to the global security environment.*


Image Sources: Top Right: Blake, M. daily Mail, 16 August 2013; Bottom: Wminnick, Intercepts, 01 December 2012

# Accessing the GUI

- Requirements
  - ArcGIS 10.2.2 and above
  - Python 2.7.9
- GUI built by Python's Tkinter and ttk module
  - Other: arcpy, ctypes, imp, os, subprocess, sys, time
- Double click main.py



# Common Functions

- Autocomplete
  - Over 2,500 cities, 240 countries, 70 weapon systems
- Customized projections
  - Map centers on centroid of country or point(s)
- Classification of product
  - Automatically drawn from database
  - Performed by user via classification tool
- Output format (i.e. JPEG, PDF and KMZ)
  - More output formats available for coding

# Advantages

- No GIS experience required
  - ArcGIS is never opened only accessed via code
  - Map document is accessible for advanced use
- Relatively quick execution time
- Different formats available
  - Reduced time to output of additional formats
- GUIs serve as templates for additional tools
- Works for systems other than ballistic
  - i.e. GLCM , ALCM , SAM , ATBM
  - Code allows for the easy addition of more types

# Limitations

- Licensing
  - Requires ArcGIS for Desktop Advanced
- Customized projection sets needed
  - Allow user to choose projection
    - i.e. polar projection
  - Adjust projection to center of process
    - City, country or point of interest
- Limit for range ring distance
  - Function created to find maximum ranges compatible with ESRI due to processing error in Buffer Tool.