Death Moon

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Inspiration

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What is a Death Moon?

- **Death Star** + **Moon** + **Esri iOS SDK AR Toolkit** = **Death Moon**

Project Goals

- Use position and time to determine the following moon's attributes
  - Azimuth
  - Altitude
  - Distance
  - Lunar phase
  - Fraction
  - Angle of illumination
- Use Esri iOS SDK AR Toolkit to…
  - Place an image of the Death Star where the moon is relative to the viewer
  - Cast a shadow on the image based on fraction and angle

The Moon’s Attributes

- SwiftySuncalc Pod by **Cristian Gonzales**
  - https://github.com/cristiangonzales/SwiftySuncalc
- Derived from SunCalc JS repo by **Vladimir Agafonkin**
  - https://github.com/mourner/suncalc

Esri iOS SDK

- Use a ArcGISARView and add a AGSScene
- Add an image of the Death Star to a AGSPictureMarkerSymbol based on the user's location and azimuth and altitude of the moon

```
// get a z value, using an adjacent value of 1 kilometer
let z = 1000 * tan(altitude!)

// create a point from the current location using the new z value (in meters)
let point = AGSPoint.init(x: locValue.longitude, y: locValue.latitude, z: z, spatialReference: .wgs84())

// move the point 1 kilometer away, at the angle (azimuth) of the moon
// since the z value and the distance away on the x,y plane are both based on a right triangle with an adjacent value of 1 kilometer, the moon is placed in the
    correct spot.
let points = AGSGeometryEngine.geodeticMove([point], distance: 1, distanceUnit: .kilometers(), azimuth: azimuth!, azimuthUnit: .degrees(), curveType: .geodesic )

// set the geometry to the graphic and add it to the graphics layer (first removing it if it exists)
let graphic = AGSGraphic(geometry: points![0], symbol: deathMoonSymbol, attributes: nil)
```

Esri iOS SDK

- Size the image based on distance from the moon, relative to the moon’s perigee

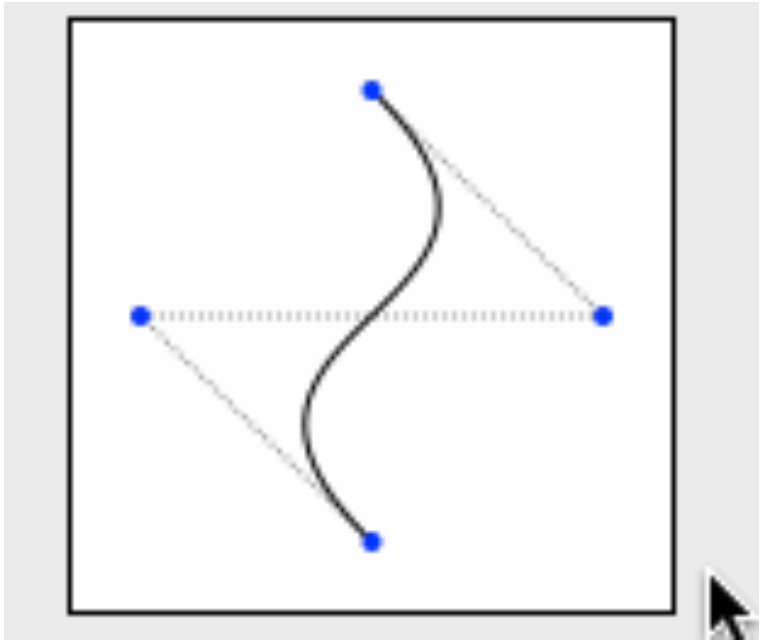
```
// scale the image based on distance from the Earth and its perigee. 100x100 at perigee (363104 km)
let distance = moonPos["distance"] ?? 363104
deathMoonSymbol.height = CGFloat((363104 / distance) * 100)
deathMoonSymbol.width = CGFloat((363104 / distance) * 100)
deathMoonSymbol.offsetY = 0
```

Esri iOS SDK

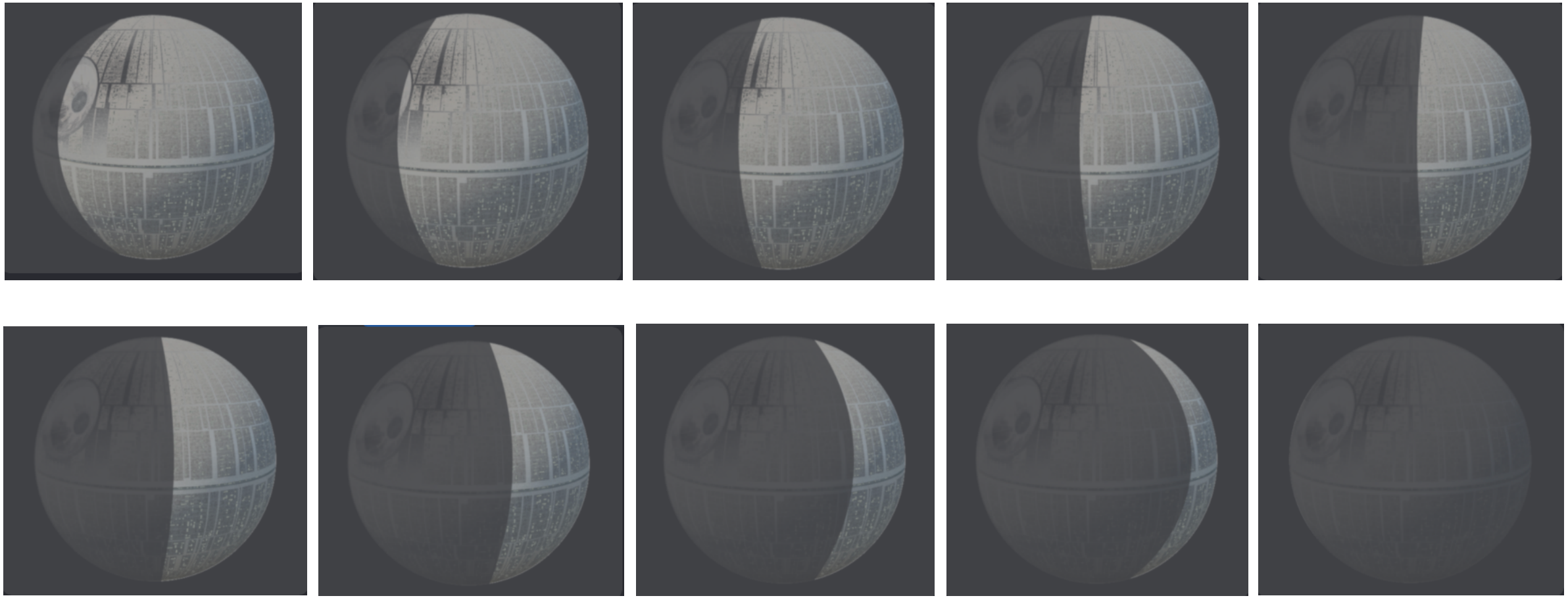
Cast a Shadow

- iOS Core Graphics and some trigonometry

```
let s = deathstar!.size
UIGraphicsBeginImageContext(s);
let g = UIGraphicsGetCurrentContext();
g!.beginPath()
g!.move(to: to1)
g!.addCurve(to: to2, control1: control1, control2: control2)
g!.addRect(CGRect(x:0,y:0,width:s.width,height:s.height));
g!.clip(using: CGPathFillRule.evenOdd)
deathstar!.draw(at: CGPoint.zero)
deathstar = UIGraphicsGetImageFromCurrentImageContext();
UIGraphicsEndImageContext();
```



Cast a Shadow



Angle of the Shadow

- More trig to rotate the points for the shadow

The Result


AT&T
9:34 PM
azimuth: 260.02°
altitude: -10.94°
fraction: 10.3%
angle: 67.3°
phase: waxing
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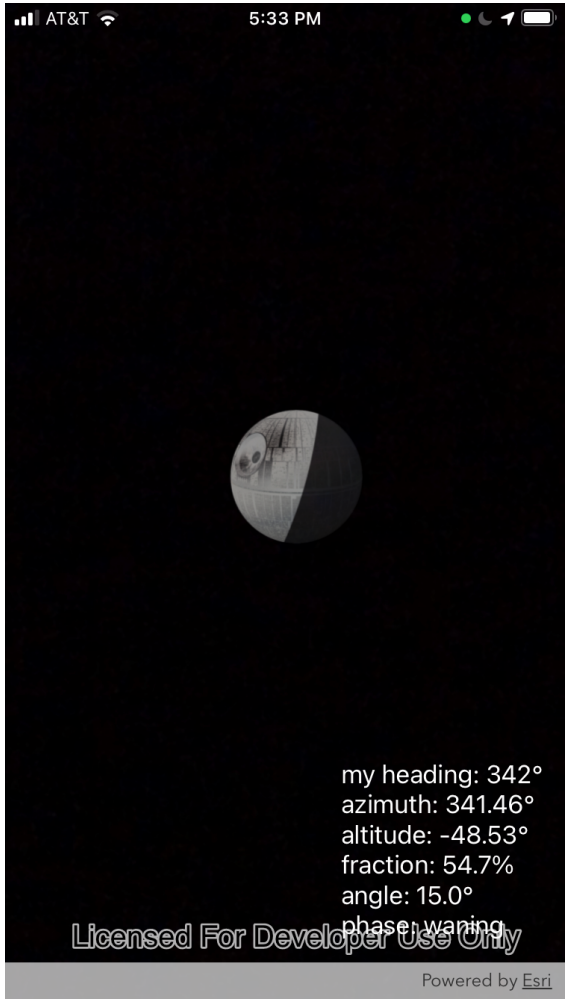
AT&T
5:33 PM
my heading: 342°
azimuth: 341.46°
altitude: -48.53°
fraction: 54.7%
angle: 15.0°
phase: waning
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Thank You!

https://github.com/mgarrod/DeathMoon