NTSGIS Jan 2017 Agenda
• Introduction to Terrain360
• Why?
• Hardware
• Software
• Notable Place we have Mapped
• Media Coverage
• Accomplishments
• Uses
• Vision
• Questions
Introduction
Terrain360 Introduction

- GIS/Spatially Referenced 360° Image & Data Mapping Platform (think a better version of google streetview)
- To Date mapped 5000+ miles of waterways & 2500+ miles of trails
- Our Passion is to showcase places not easily accessible with ultra high resolution imagery & map data and encourage people to get outside.
- Typically we capture 100’s – 1000’s of high resolution (130mpx) 360° images per trail or waterway
- Recently added LiDAR to our sensor stack (experimental)
TERRAIN 360

Why
• Inception 2012 *(Frustrations with existing Streetview)*
• Love of the Outdoors
• Combine Maps & Photography
• Few players in market

Challenges to MVP
• Bootstrap Financing
• Software development
• Camera Development
• Creating a capture pipeline to manage massive amounts of data
Hardware
• Mapping “Vehicles”
  • Simple camera & gps on tripod (long haul backpacking) – very manual

• Weeks of on board power
• Simple Garmin GPS
• Possible upgrades in 2017 include a Pi to control lighting
- Mapping “Vehicles”
  - Fat Tire Mapping Trike—Fully automated capture process

- Lithium ion Powered (72 hours of battery)
- On board PC (atom processor)
- Lighting Sensor
- IMU/GPS/Weather Sensors
- Touch Screen
- 5 Canon t5i cameras
• Mapping “Vehicles”
  • Custom 16’ Catacraft Boat—Fully automated capture process
  • On board Generator
  • On board PC i7 SSD
  • Lighting Sensor
  • IMU/GPS/Weather Sensors
  • Touch Screen Controls
  • 6 Canon t5i cameras
  • VLP-16 Lidar Puck
  • Completely weatherproof
TERRAIN360

• Mapping “Vehicles”
  • Custom 13’ Catacraft Boat—Fully automated capture process

• On board Generator
• On board PC i7 SSD
• Lighting Sensor
• IMU/GPS/Weather Sensors
• Touch Screen Controls
• 5 Canon t5i cameras
• VLP-16 Lidar Puck
• Completely weatherproof
• Mapping “Vehicles”
  • Backpack—Fully automated capture process

• Lithium ion (28 hours)
• On board PC i7 SSD
• Lighting Sensor
• IMU/GPS/Weather Sensors
• Touch Screen Controls + iPhone
• 5 Canon t5i cameras
Technology Used

- Custom Data Capturing Application
  - Windows .NET C# App
  - Canon SDK
- Image & Data Processing Application
  - Windows .NET C# App
  - Open CV Image Rendering
  - Spatial > Image matching App
  - AWS Lambda (Structure From Motion)

- Web App and Custom Viewer
  - Laravel PHP + Docker
  - AWS S3 + Cloudfront
  - Mapbox Basemaps
  - PostgresGIS
  - WebGL
  - Three JS, Leaflet JS
Data Stats

- Images
  - 22 Million original Images
  - 165 Million geo tagged Image objects in AWS S3
- Data
  - 53 TB to date of original image data
  - 140 TB to date image objects (tiles)
  - 100Gb Lidar (experimental)
  - Fun Fact – 3 500GB SSD in field drives exceeded the read/write cycle of 800TB
Places We have Mapped
Appalachian Trail (2013) Springer Mountain
AT over the Potomac River
Mt Tam SP Muir Beach
Bryce Canyon NP – Queen’s Garden
Zion National Park – Angel’s Landing
Media Coverage
• Over 400 Write-ups
• 10+ TV Stories
• 1 TEDx Talk
Accomplishments
In just 4 years w/limited resources...

- 2000+ miles of trails
- 3500+ miles of waterways
- Highest Quality imagery *(120 MP w/ 300MP capability)*
- Best In Class All Custom Built 360 Viewer
- 2017- Object & Scene Detection
TERRAIN³60

Uses
Terrain360 Uses

- Showcase Places unknown or unseen – Drive awareness
- Encourage Conservation & Appreciation
- Remove fear of visiting
- Trip Planning & Education
- Utilize high-res images for object detection (species detection, foliage density, objects)
- Asset Management
- Detailed change over time assessment (time-machine)
- Partner map sharing (embed, links) all maps open to public
Vision – My Dream For The Platform

- Real Time 360° + Image Scene, Object & Facial Detection
- Transferable cameras & data capture
- Crowd Sourced Image Gathering—REI Adventure Projects – For large scale image & data collection
- Map all National Scenic Trails (even those with streets), National Parks, State parks, etc. - with hi-res imagery
- Ultimately use Terrain360 to drive conservation policy through education
Questions
Example Links

- [https://www.terrain360.com/map/appalachian-trail](https://www.terrain360.com/map/appalachian-trail)
- [https://www.terrain360.com/map/zion-national-park](https://www.terrain360.com/map/zion-national-park)
- [https://www.terrain360.com/map/potomac-river-2](https://www.terrain360.com/map/potomac-river-2)
- [https://www.terrain360.com/map/fones-cliffs/visual](https://www.terrain360.com/map/fones-cliffs/visual)
- [https://www.terrain360.com/map/acadia-national-park](https://www.terrain360.com/map/acadia-national-park)

- [https://www.terrain360.com/about](https://www.terrain360.com/about)