



# Autonomous Collection Vehicles: Testing the Equipment, Not the Driver

Mandli Communications – Michael Richardson, PE

# About Mandli

- Established in 1983
- Based in Madison, WI
- Worked with over 30 State DOTs
- First pavement collection in 2002
- Michael Richardson, PE, with Mandli for over nine years

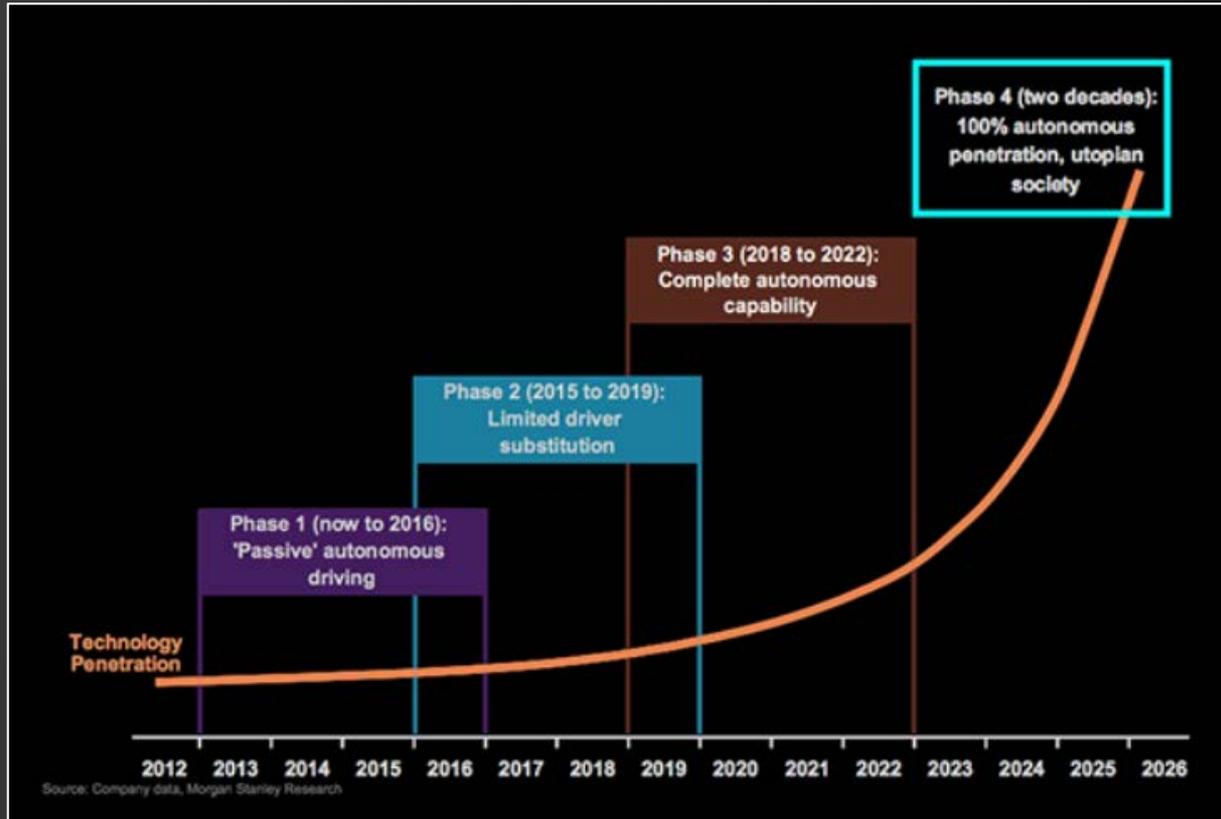




# Autonomous Data Collection Vehicle



# Autonomous Vehicle Adoption Timeline



# How Do We Utilize This Technology?

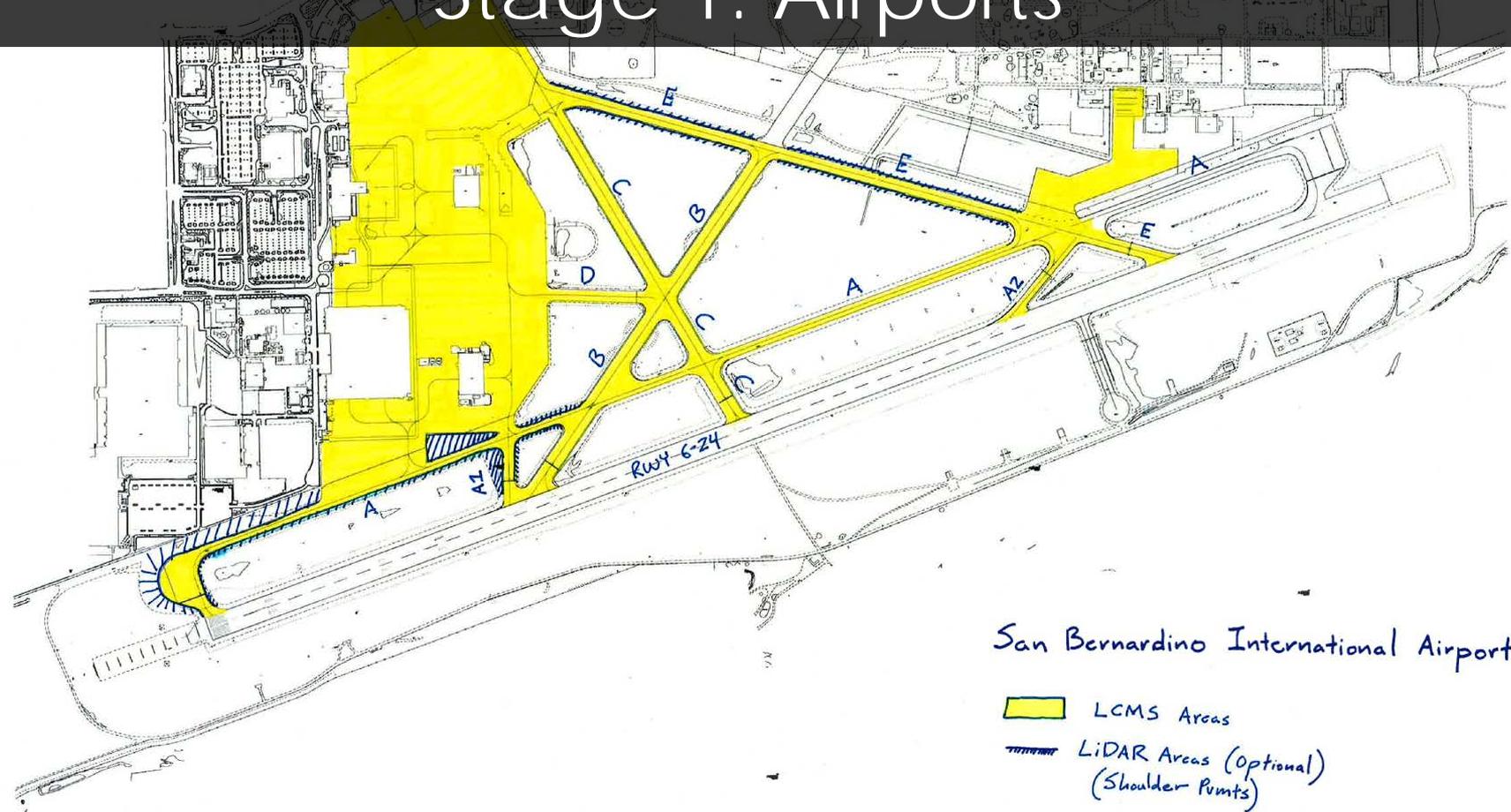




# Stage 1: Airports



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San Bernardino International Airport

-  LCMS Areas
-  LiDAR Areas (optional)  
(Shoulder Pavts)

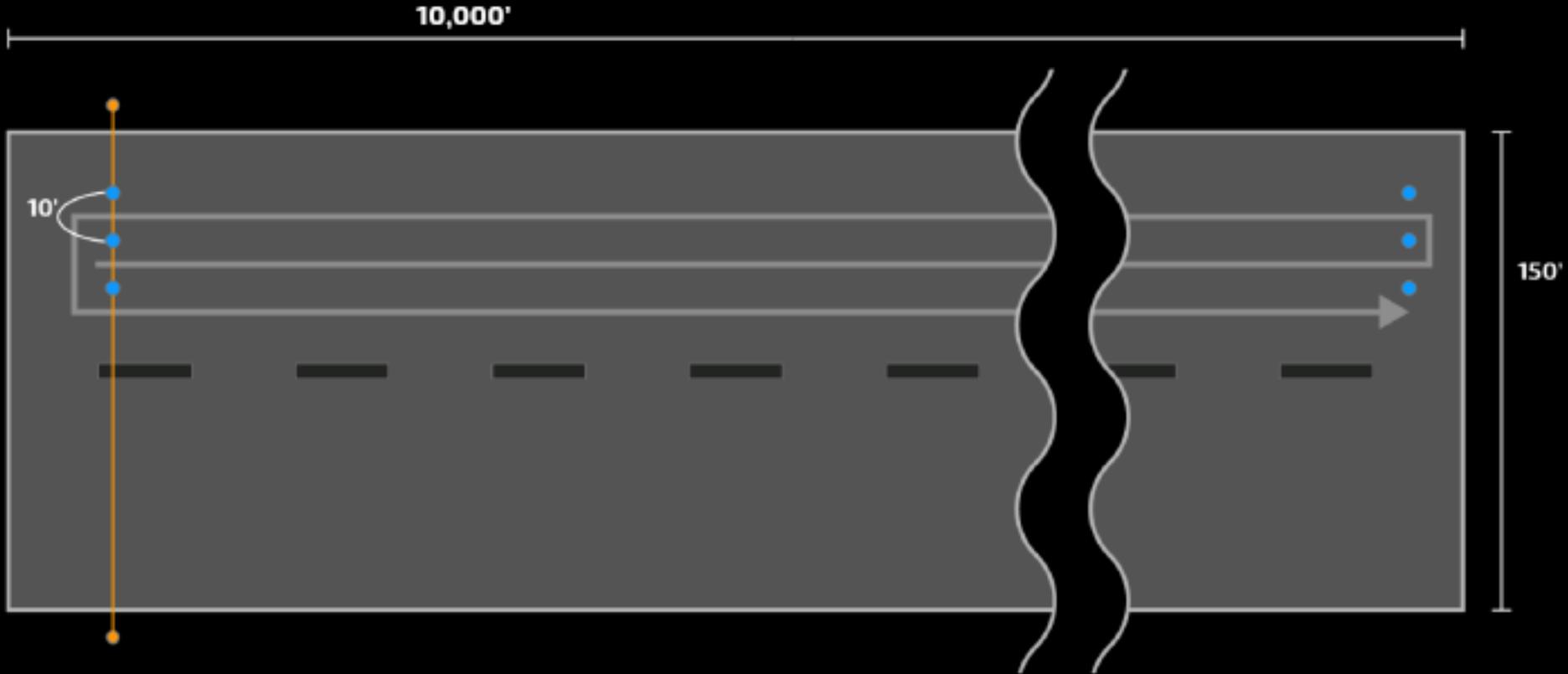


# The Visual Reference



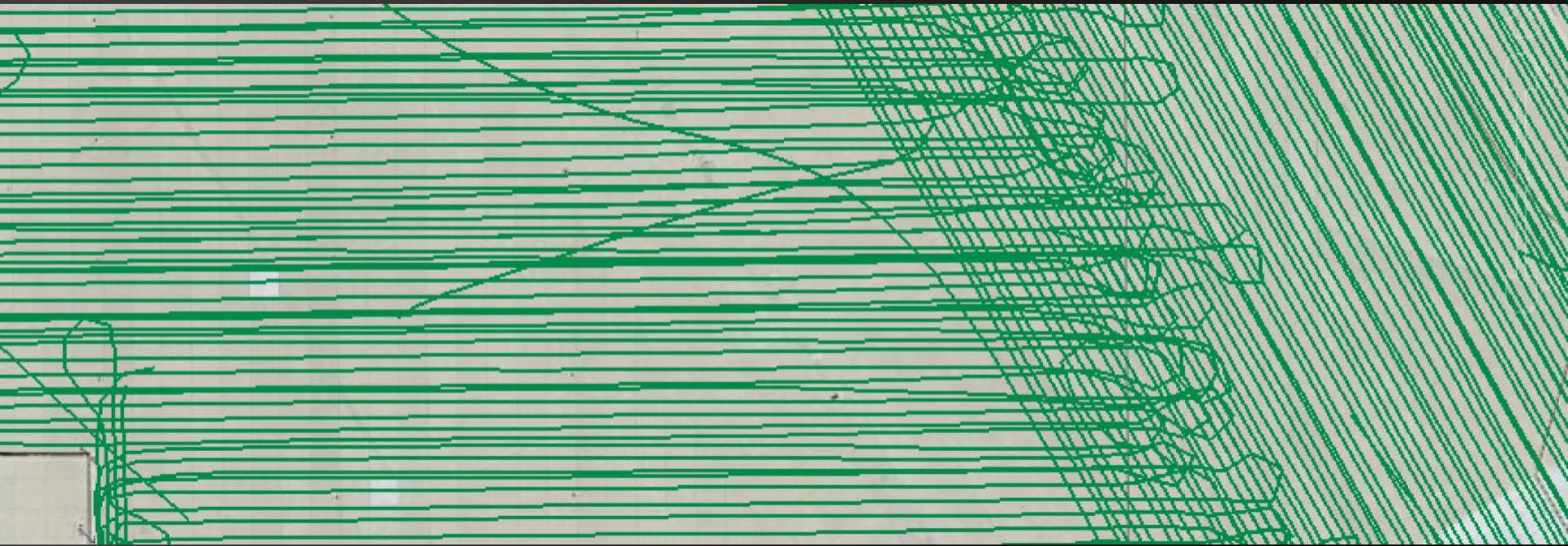


# Manual Collection Method





# Traces from Manual Collection



# Autonomous Collection Method

- Table of Contents
  - Y:\Desktop\Delivery\_Steps\SanAntonioFOD
    - SA\_RW22\_fullpts
    - SA\_TW\_N\_east\_pts
    - Ramp4\_1
    - SA\_TW\_N\_east
  - \\psf\Home\Desktop\Delivery\_Steps\SanAntonioFOD
    - SA\_TW\_R\_pts
    - SA\_TW\_Q\_pts
    - SA\_Ramp1\_pts
    - SA\_Ramp3\_pts

Table

SA\_Ramp1\_pts

FID	Shape *	Waypoint	Latitude	Longitude
0	Point	1	29.531199	-98.459677
1	Point	2	29.533692	-98.457174
2	Point	3	29.533601	-98.457056
3	Point	4	29.531109	-98.459559
4	Point	5	29.531181	-98.459653
5	Point	6	29.533674	-98.45715
6	Point	7	29.533583	-98.457032
7	Point	8	29.531091	-98.459535
8	Point	9	29.531163	-98.45963
9	Point	10	29.533656	-98.457126
10	Point	11	29.533565	-98.457008
11	Point	12	29.531072	-98.459511
12	Point	13	29.531145	-98.459606
13	Point	14	29.533638	-98.457103
14	Point	15	29.533547	-98.456985
15	Point	16	29.531054	-98.459488
16	Point	17	29.531127	-98.459582
17	Point	18	29.533619	-98.457079
18	Point	19	29.533529	-98.456961
19	Point	20	29.531036	-98.459464

(0 out of 28 Selected)

SA\_Ramp1\_pts



# Autonomous Collection Method

Table Of Contents

Layers

- Y:\Desktop\Delivery\_Steps\San Antonio FOI
- SA\_TW\_N\_east\_pts
- SA\_TW\_N\_east
- \\psf\Home\Desktop\Delivery\_Steps\SanAntonioFOI
- SA\_TW\_R\_pts
- SA\_TW\_Q\_pts
- SA\_Ramp1\_pts
- SA\_Ramp3\_pts

Table

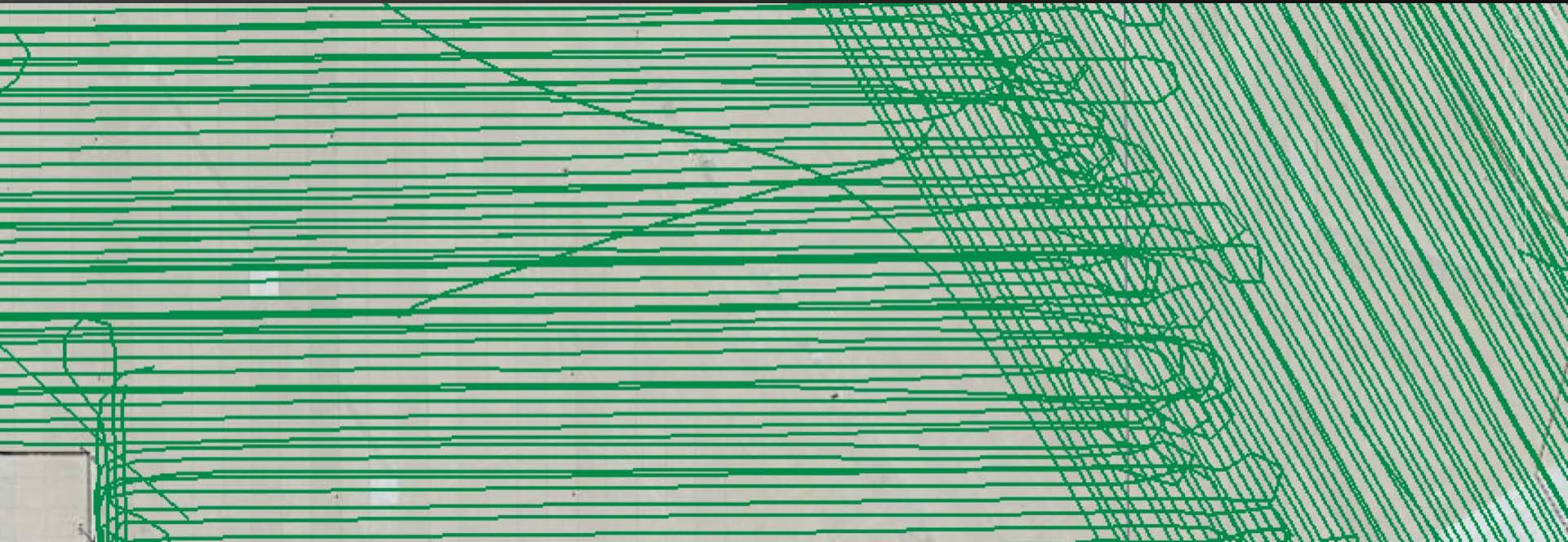
SA\_Ramp1\_pts

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SA\_Ramp1\_pts SA\_TW\_N\_east\_pts

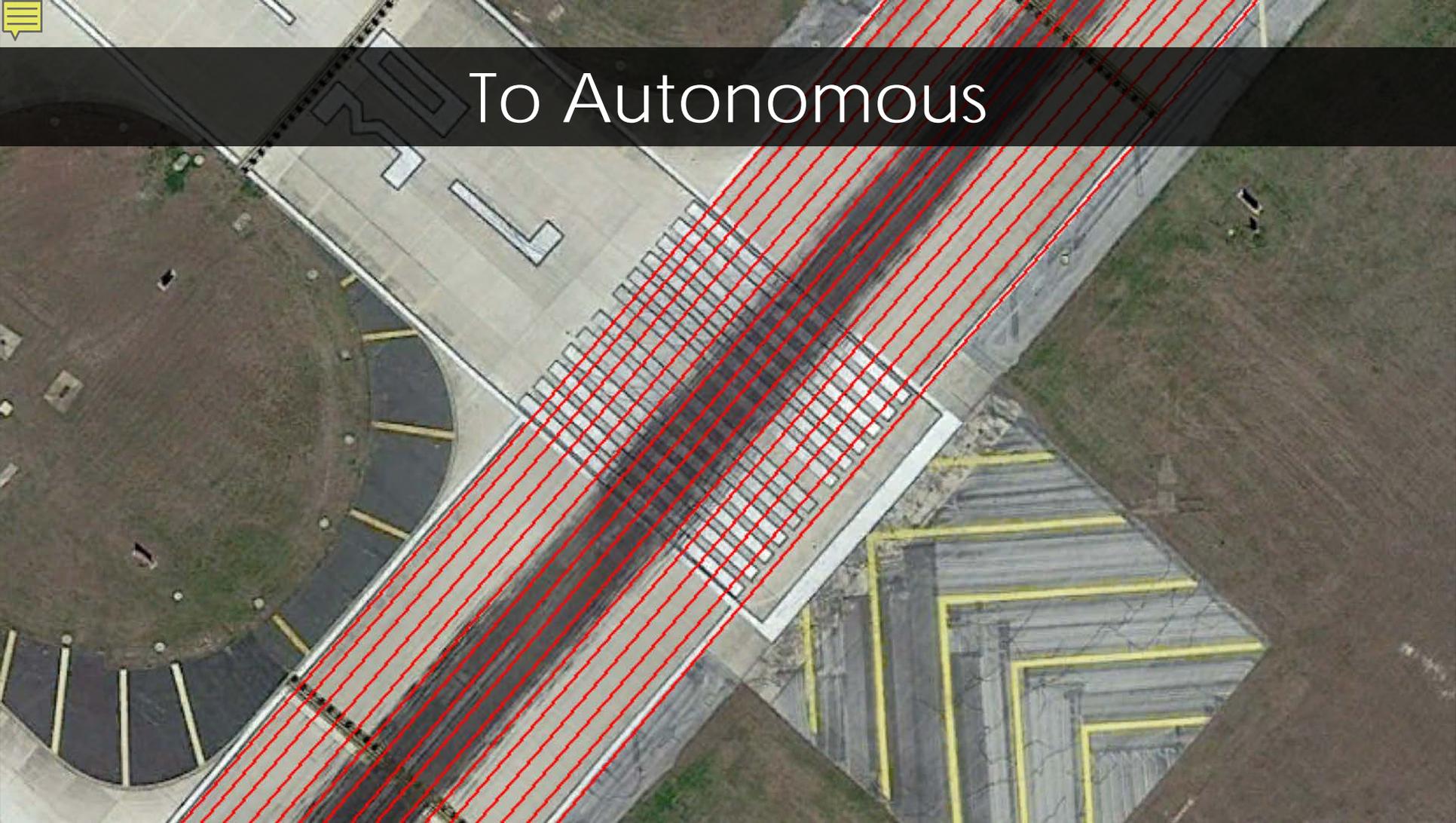


# From Manual



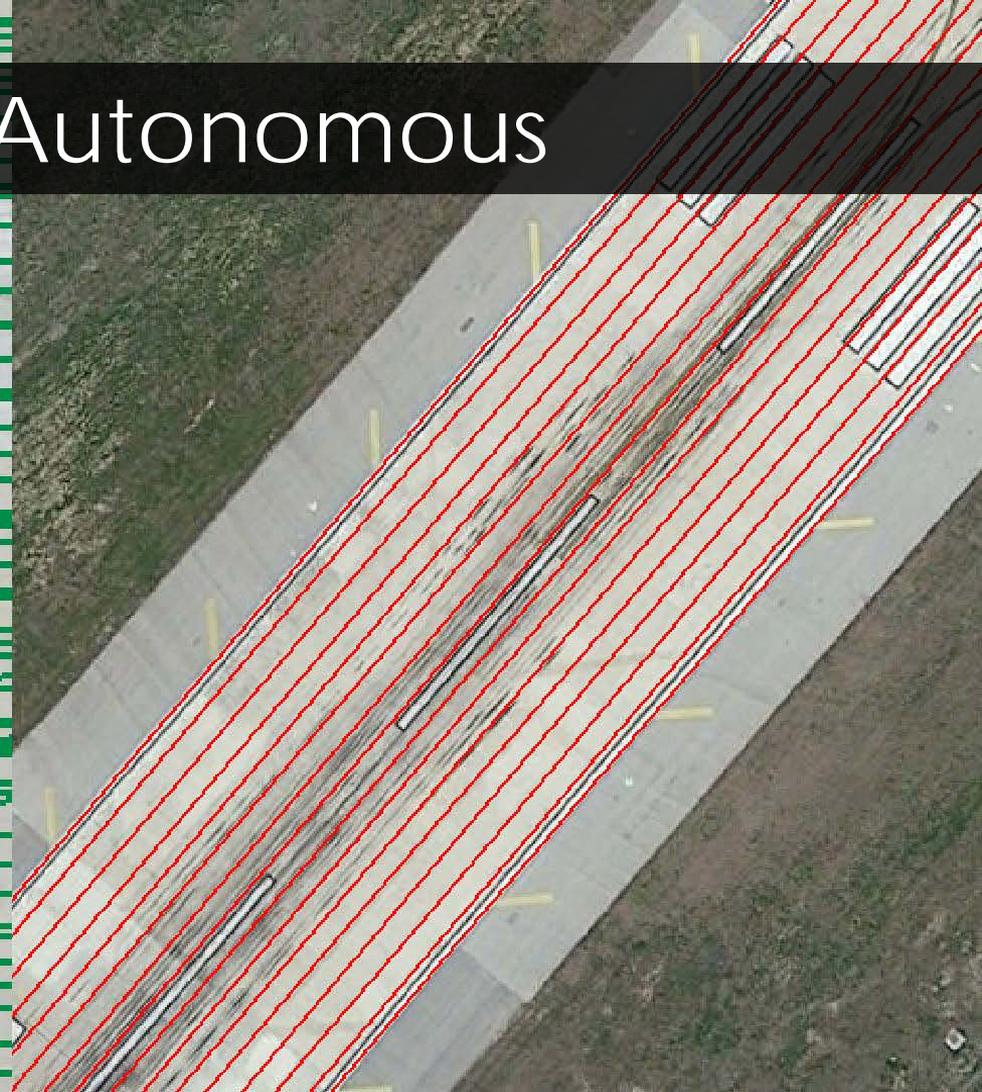


# To Autonomous



# Manual vs. Autonomous

- Increased Safety
- Reduced Collection Time
  - 4 to 6 hours manual
  - 1 to 1.5 hours autonomous
- No gaps, no secondary passes



# How Do We Apply This to Roadways?



# Stage 2: Validation Sites





# Driver Wander is Always a Factor



# Test the Equipment, Not the Driver



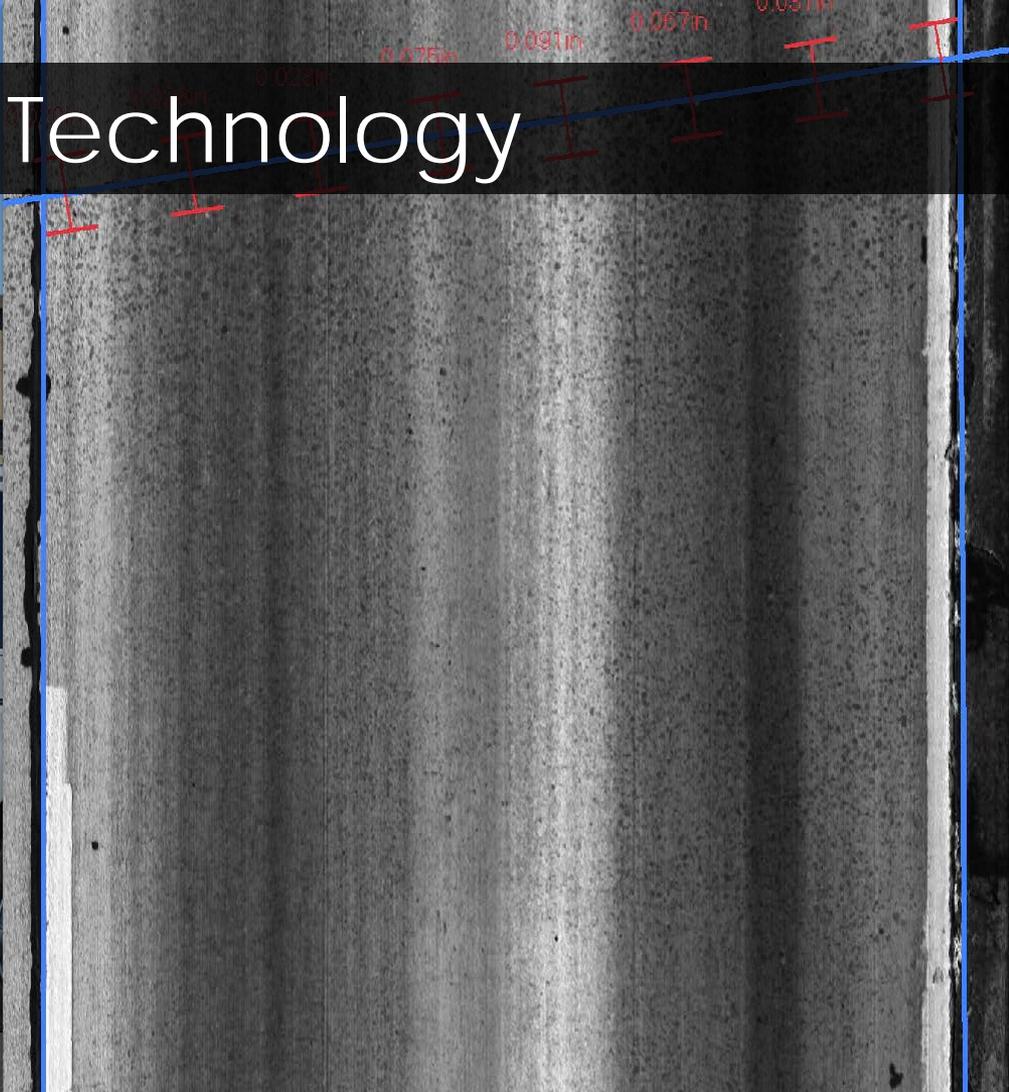
# Hurdles

- **GPS Accuracy**
  - Strong signal required
  - Good visibility
  - Real-time differential
  - System integrity
- **SurPRO Path Alignment**
  - Narrow target
  - Visual vs. measured offset
- **Emerging Technology**





# Emerging Technology





# Future Development

- Testing on Established Validation Sites
- Integrations with 3D Systems
- Monitor Advancing Technologies



MANDLI