

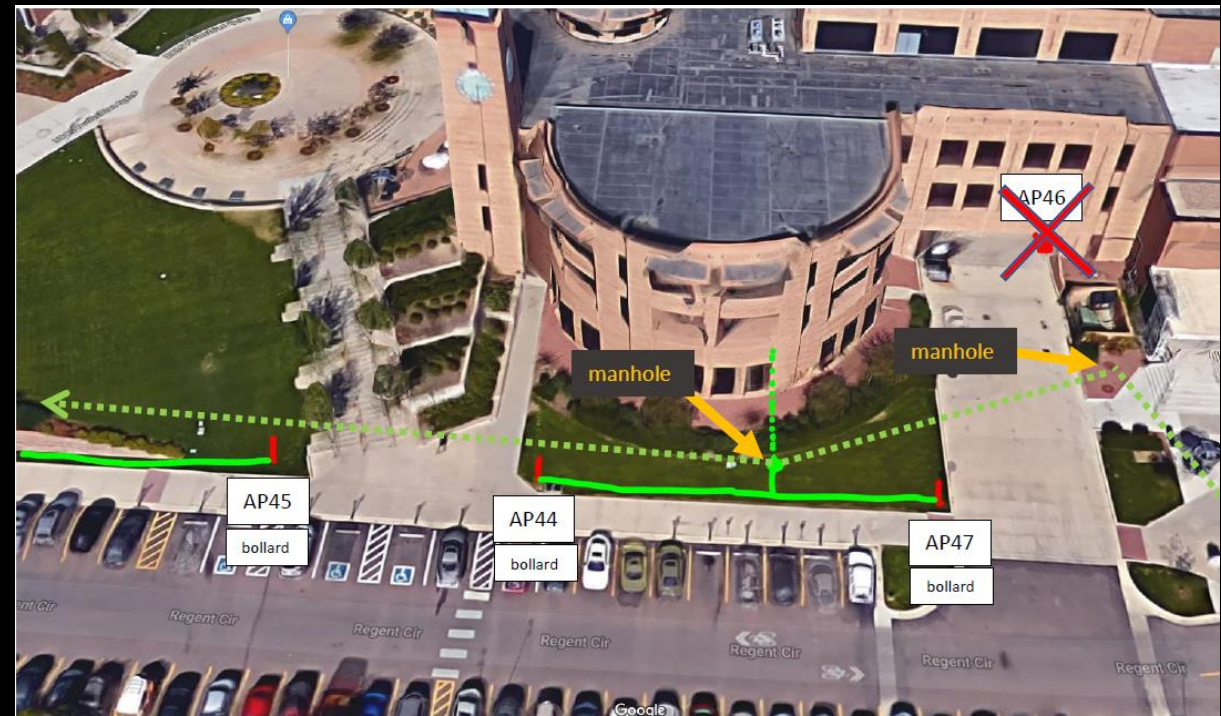


OUTDOOR WIRELESS PROJECT

University of Colorado Colorado Springs

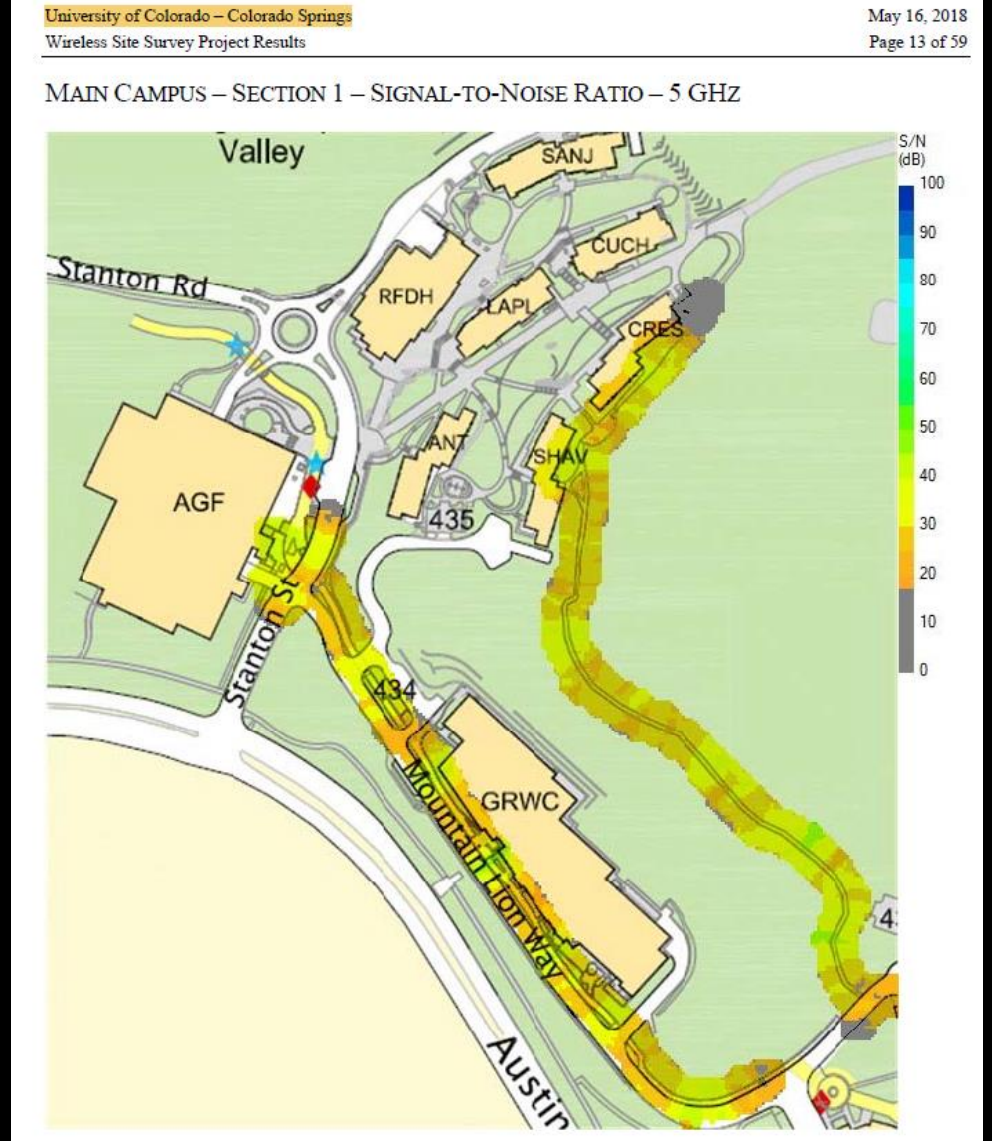
GOALS OF THE PROJECT

- Increase wireless coverage outdoors along the main pedestrian spine and highly trafficked areas.
- Outdoor AP count prior to this project: 23
 - Mostly on new and recent construction, and most of these were not near main campus where high traffic is located



INITIAL PLANNING

- Planning and early talks began in Fall of 2017
- Full site survey in April 2018
 - CDW engineers came on site and surveyed all proposed areas
 - Simulated with Aruba AP 365, 367 & 324 series
 - Worked within following parameters...
 - 2.4 and 5 ghz bands, No UNII-1 bands
 - Max transmit power of 25mW
 - Min signal strength of -72
 - 10% coverage overlap



INITIAL PLANNING

- The original proposal:
 - 122 new outdoor APs
 - This included east, central and west campus
- So... What did that look like???

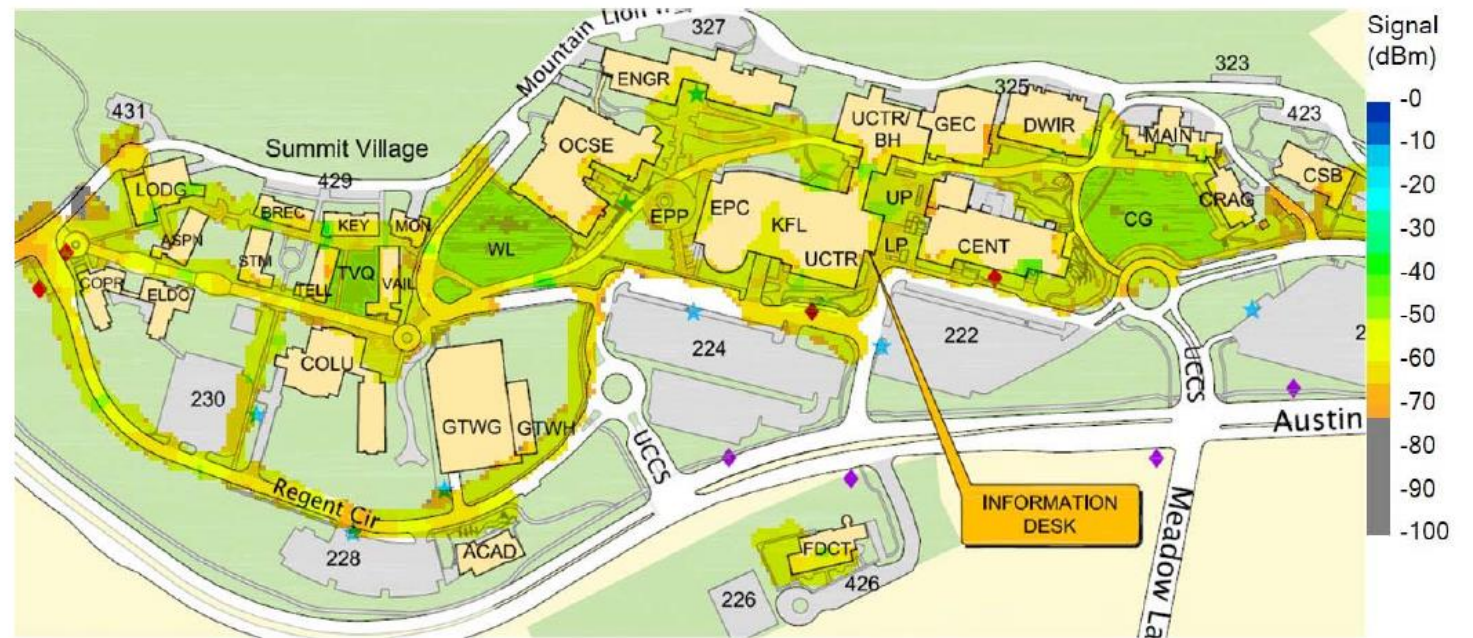
University of Colorado – Colorado Springs

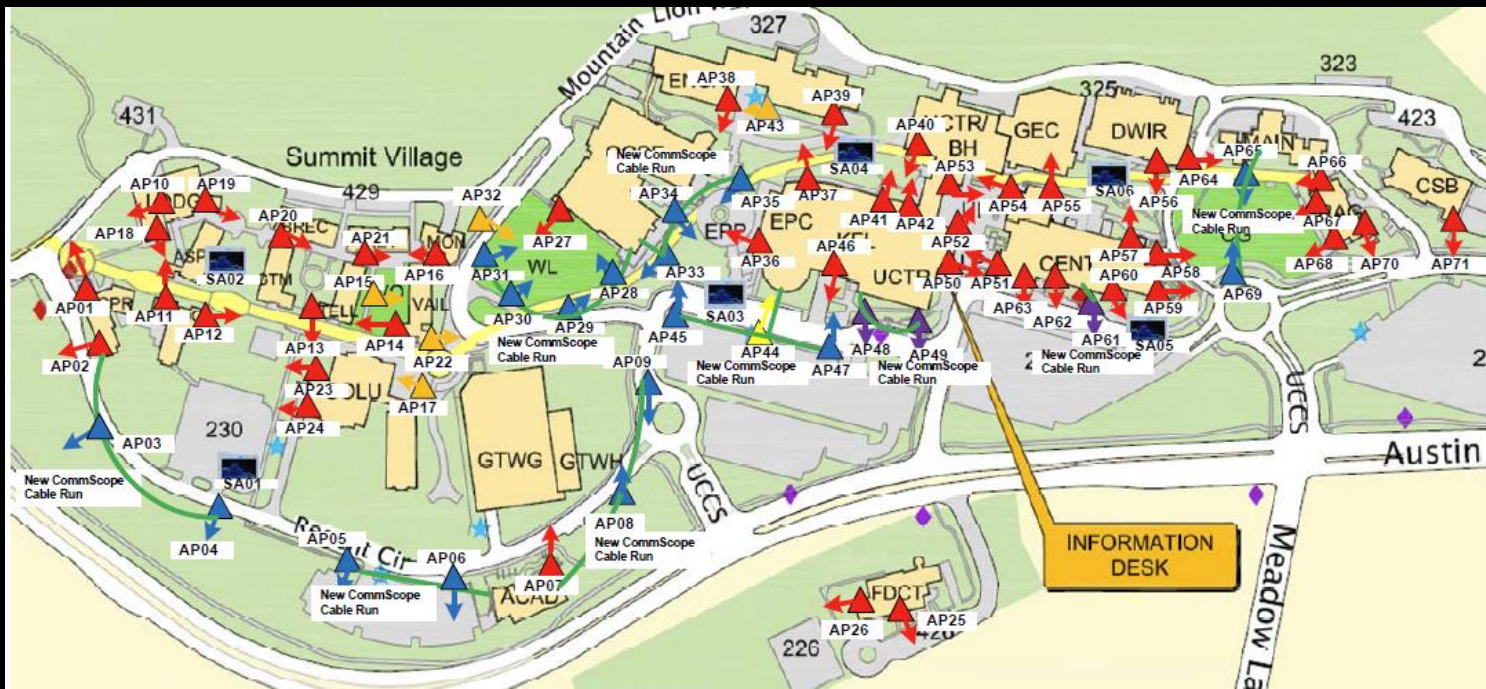
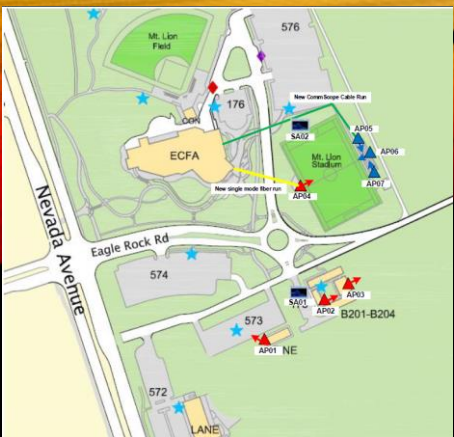
Wireless Site Survey Project Results

May 16, 2018

Page 16 of 59

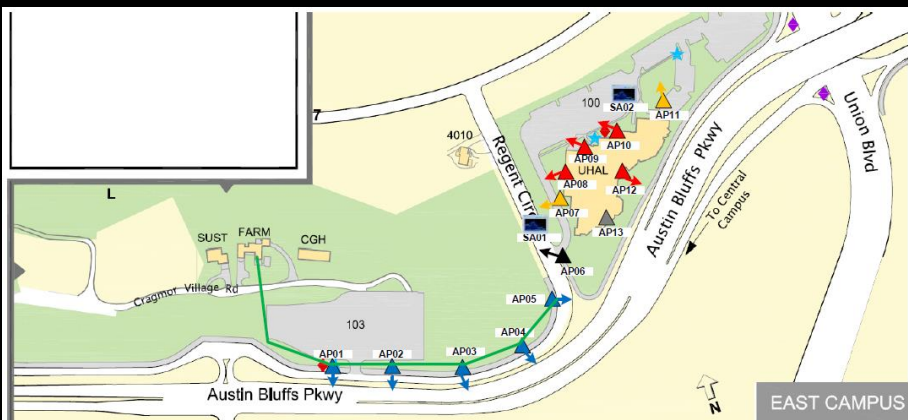
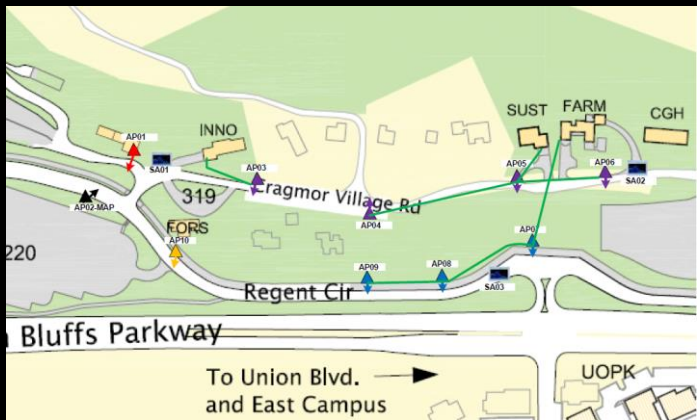
MAIN CAMPUS – SECTION 2 – SIGNAL STRENGTH – 5 GHZ





122 new APs meant...

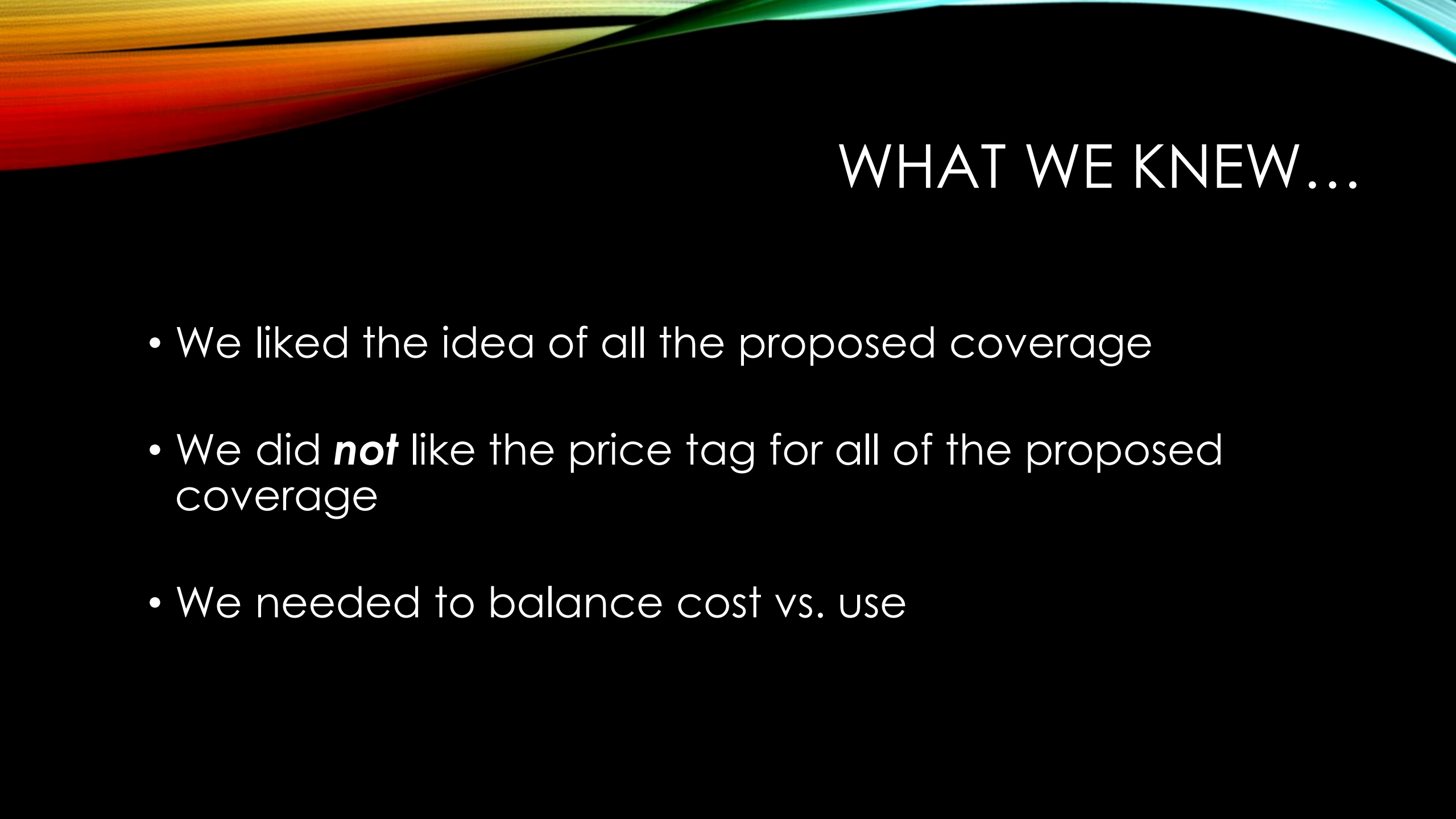
- A lot of new APs
- A lot of new construction
- High cost \$\$\$\$\$\$\$\$
- Higher costs for some APs in areas where they would get minimal use.



THE INITIAL PLAN

(HAD A LOT GOING ON)

- Campus APs **and** Mesh APs
- CAT6a runs **and** Powered Fiber runs
- Powered Fiber hardware
- How to run the cabling to various locations?
 - Light poles? Bollards? Digging, trenching, boring, etc. A lot of construction!
- Some APs were remote to the main campus
- Did we have conduit and innerduct space? (both indoor and outdoor)
- Switchport availability for 122 new APs?!

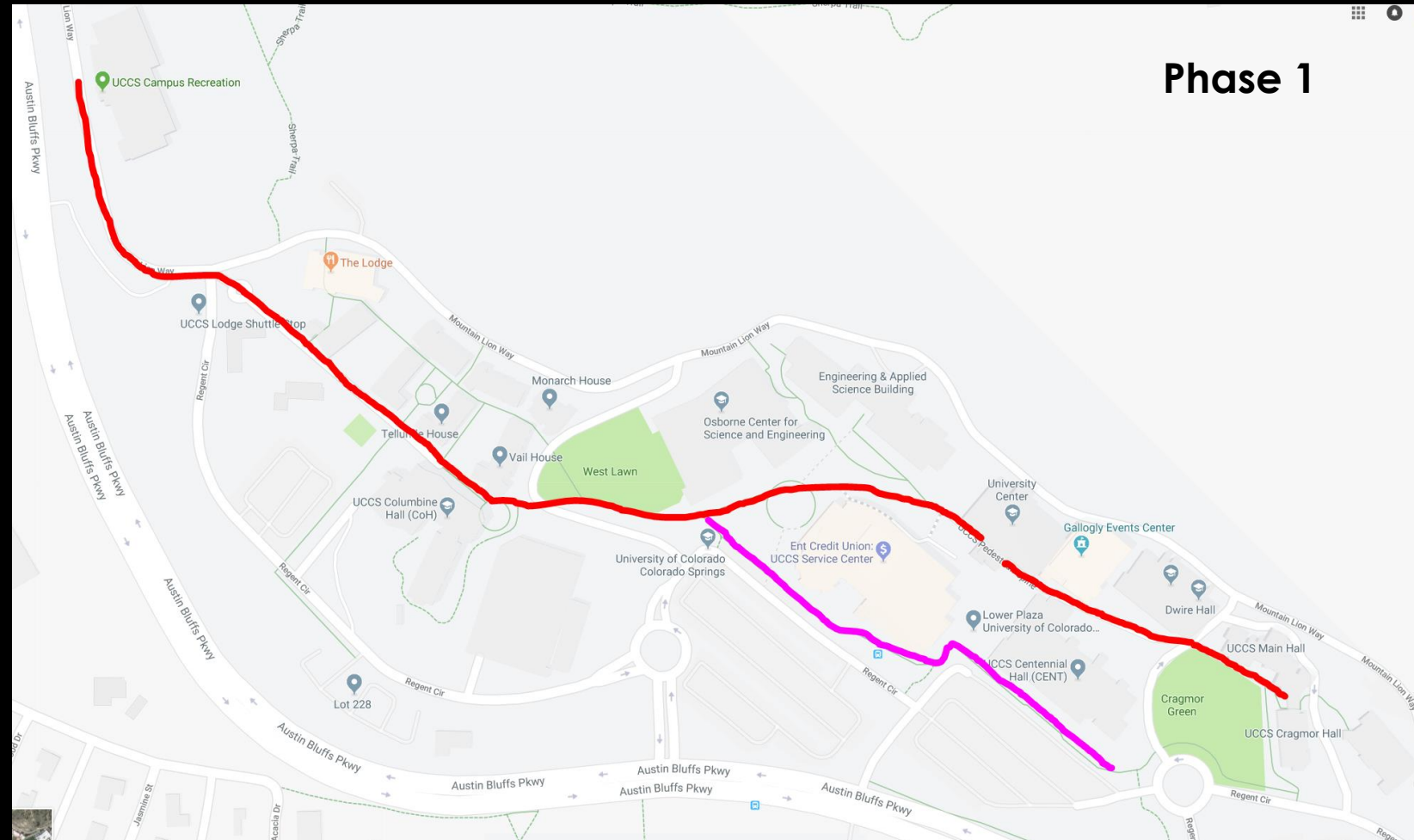


WHAT WE KNEW...

- We liked the idea of all the proposed coverage
- We did **not** like the price tag for all of the proposed coverage
- We needed to balance cost vs. use

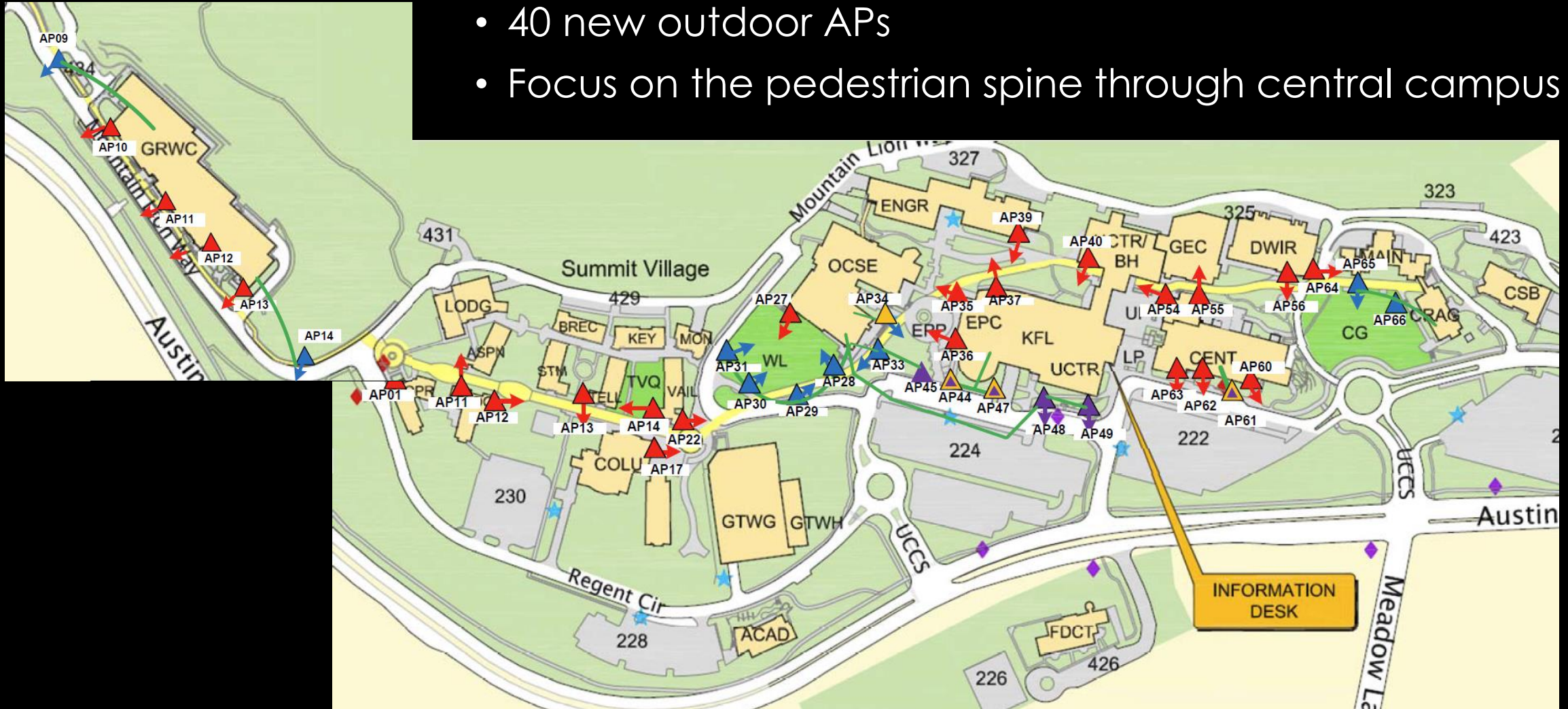
THE REVISED PLAN

- Break it down into phases
 - Phase 1 – Pedestrian Spine
 - Cover most highly trafficked areas first
 - Reduced scope to 40 APs
 - (cut out 82 APs)
 - Phase 2 and 3
 - If funded in the future...
 - Expand to more areas
 - Fill in the gaps
 - Keep up with campus expansion



THE REVISED PLAN

- 40 new outdoor APs
- Focus on the pedestrian spine through central campus



THE IMPLEMENTATION

- 10 Light Pole mounts
- 6 Bollards
- 24 Building mounts



THE HURDLES

- **Bollards**

- We wanted to match current bollards on campus
- Many current options are very large
- We found most...
 - Too large for our needs
 - Aesthetically different from our needs

**The right height,
but too wide.**



Wi-Fi BOLLARDS- TWO STYLES

Oberon



Model 3032-BK



Model 3030-BK

Although these
can house the
AP and
antenna...

They are way
too big for our
taste!

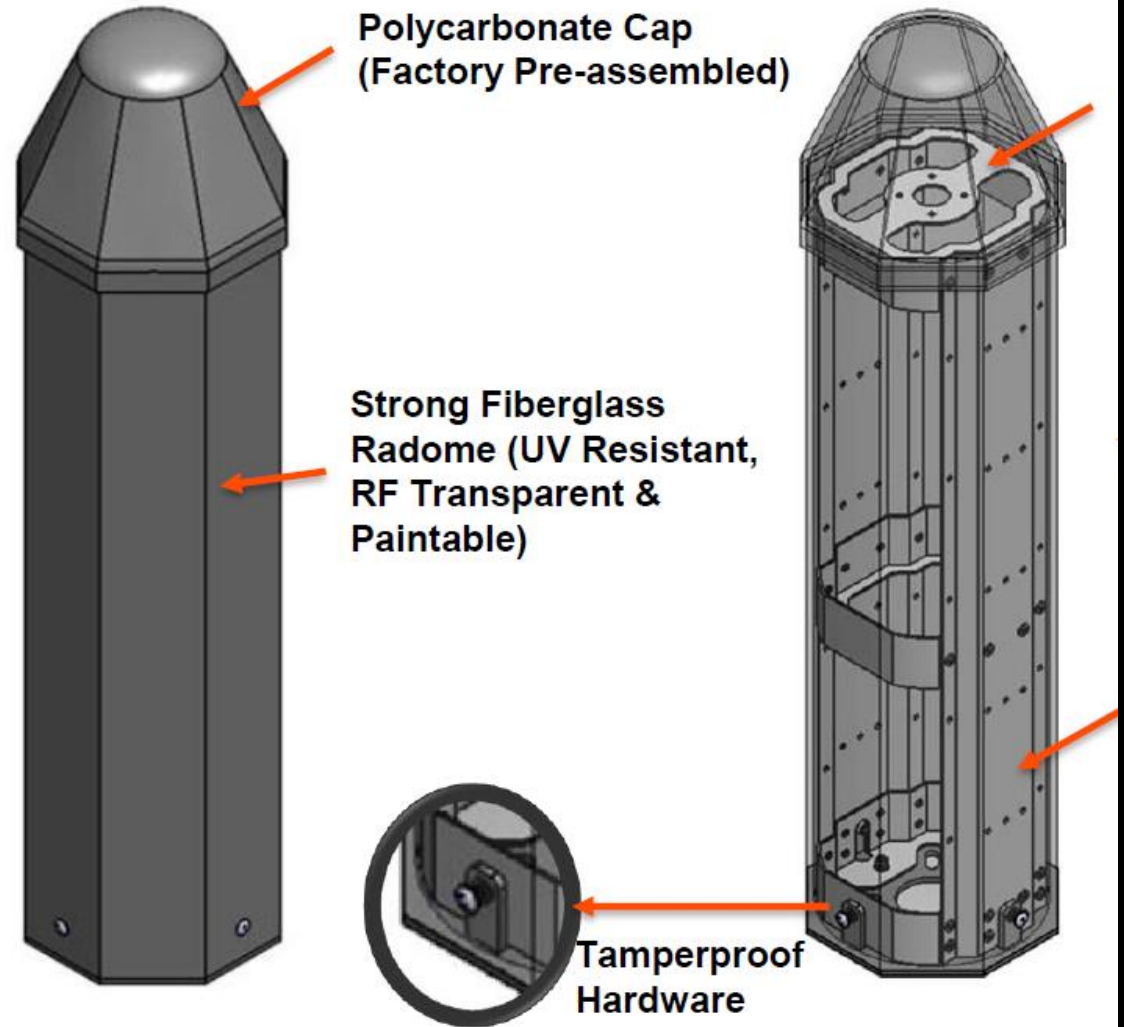
This solution was
also very large
and aesthetically
unpleasing...

We called it
"The Missile."

Again, this was not
going to work for
our solution.

Outdoor Bollard

Extending Wi-Fi and Wireless



BOLLARDS

- Custom solution was needed
 - We needed a 6-7" wide pipe
 - Which meant AP couldn't go inside
 - Pipe had to accommodate our antenna
 - Antenna needed to work with our AP
 - AP needed to handle cold weather
 - Dry box located adjacent to bollard to enclose....
 - AP
 - Antenna cables
 - Lightening Suppressors
 - Grounding rod and grounding wires



BOLLARDS



- Temp setup until we migrate to AOS8
 - AP-224
 - Not outdoor-rated, but we had spares and hoped the dryboxes would help.



- Long term solution once upgraded to AOS8
 - AP-374
 - Outdoor rated

THE HURDLES

- **Buildings**

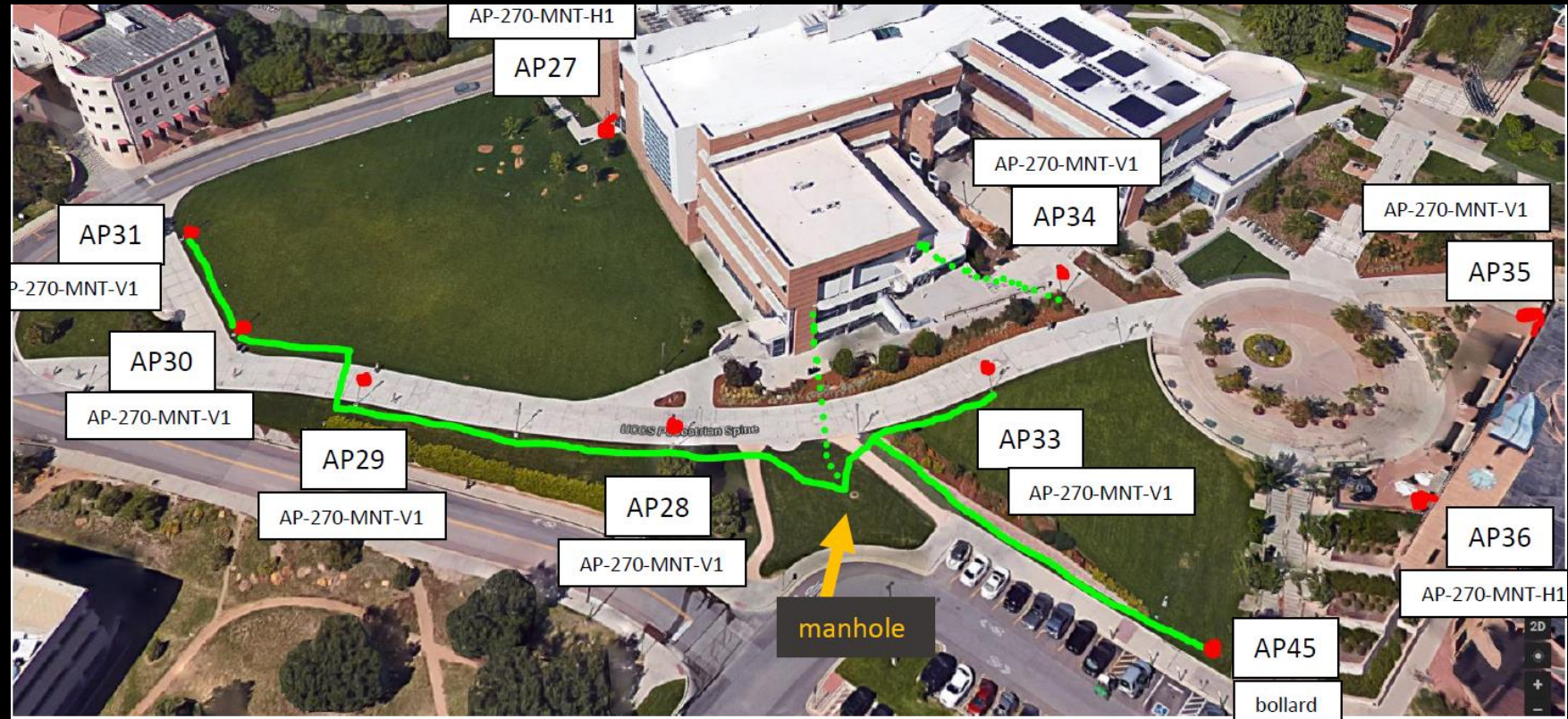
- Had to coordinate access from inside
- Where does the penetration align?
- Hard lid and hatch access for some areas
- Roof access for others



THE HURDLES

- **Poles**

- Distance limitations
- Direct CAT6a vs. running powered fiber and POE extenders
- Tapping into the poles



THE HURDLES

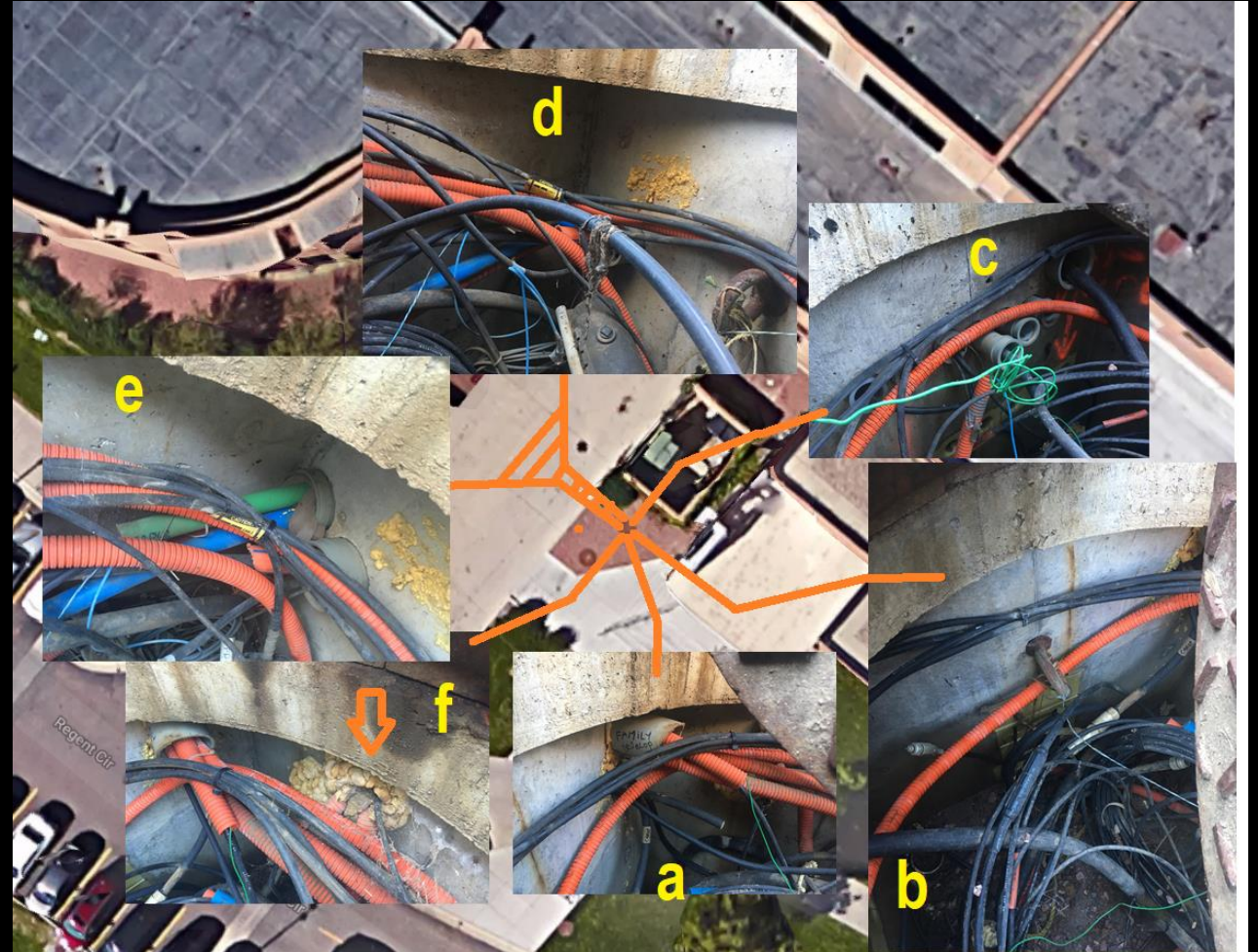
- **Poles**

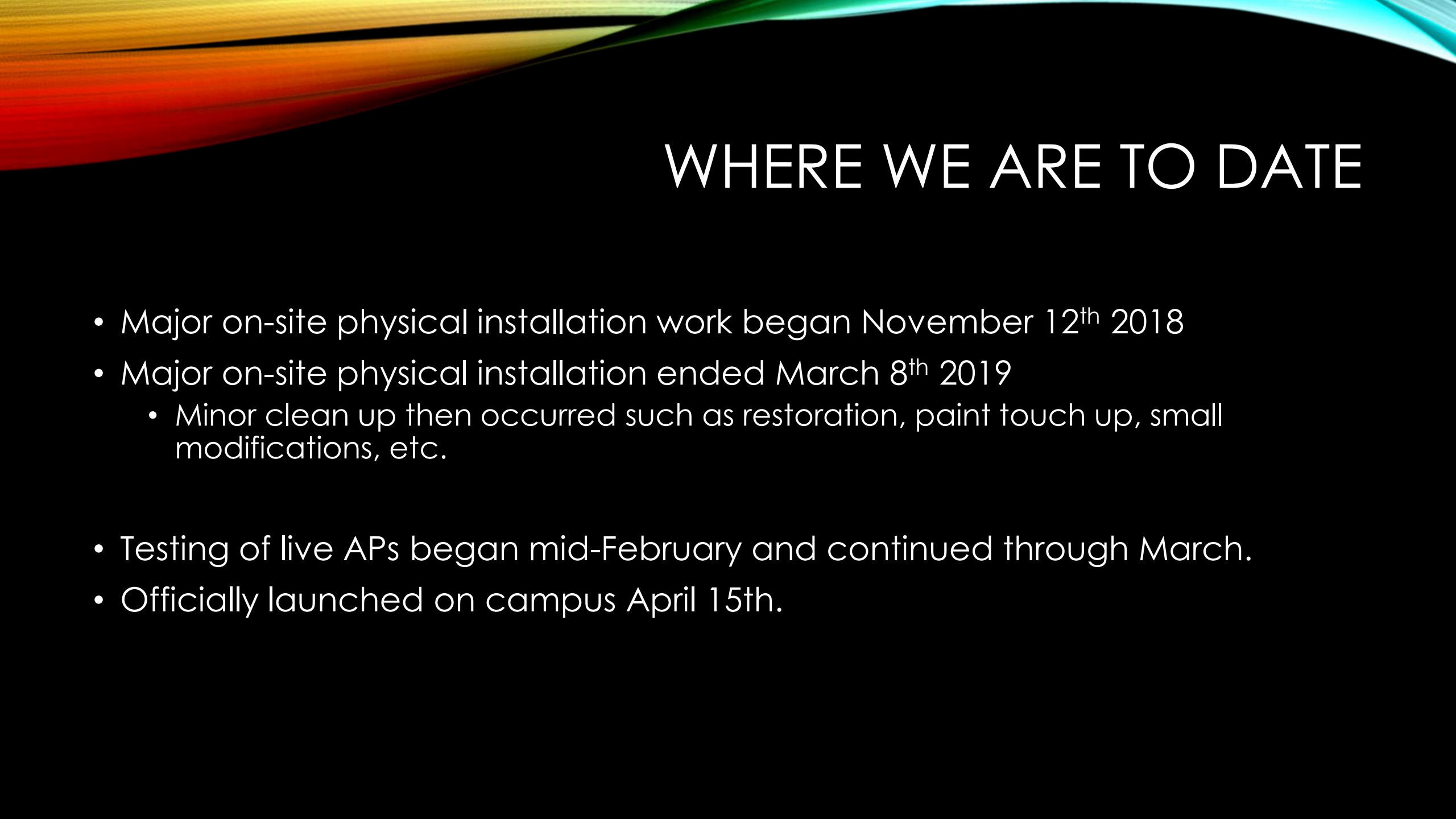
- Getting cabling into the existing poles
- Trenching and boring in high traffic areas



OTHER HURDLES

- Lack of documented OSP
- Campus Architect's requests
- Procuring & coordinating access to various locations such as...
 - Roofs
 - Meeting rooms
 - Fac/Staff rooms
 - Class rooms
- Weather
- Dealing with Subcontractors

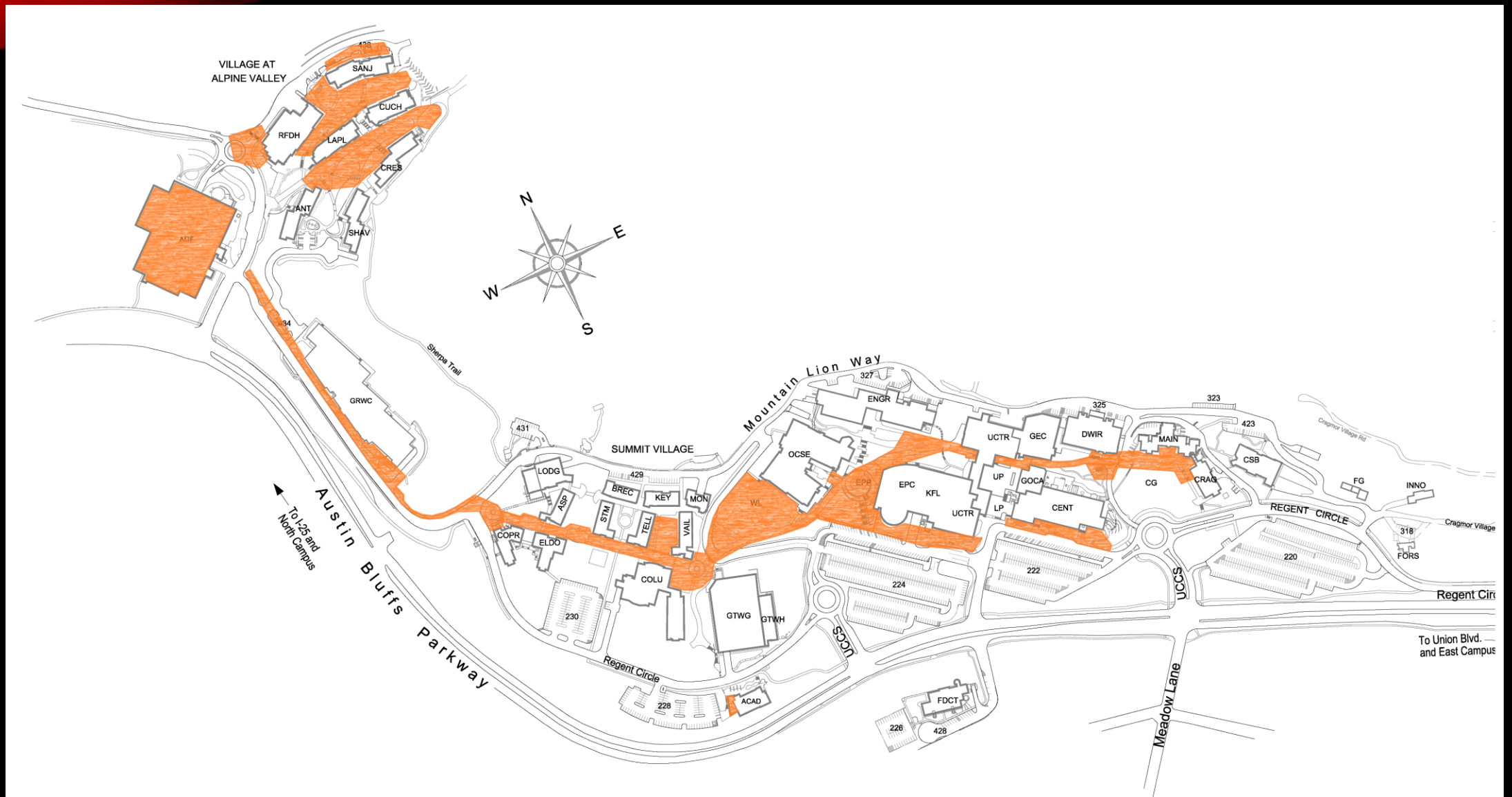




WHERE WE ARE TO DATE

- Major on-site physical installation work began November 12th 2018
- Major on-site physical installation ended March 8th 2019
 - Minor clean up then occurred such as restoration, paint touch up, small modifications, etc.
- Testing of live APs began mid-February and continued through March.
- Officially launched on campus April 15th.

COVERAGE TODAY



QUICK STATS

- Added 40 new outdoor APs
 - From 23 to 63 = 270% growth
- Coverage area
 - Approx. old coverage area = 2.8 acres
 - Approx. new coverage area = 7.3 acres
- New APs added coverage along over 5000 linear feet of sidewalks and walkways
- Unique clients seen on outdoor APs (on an average Monday b/w 6a-6p)
 - Before project: 466
 - After project: 7,413

PHOTOS



SOME LESSONS LEARNED

- Find out ALL of the needs of the installers and subcontractors...
 - Do they want to store equipment on site?
 - Do they need 100s of gallons of water?
- Make sure bollard conduits will accommodate thick antenna cables
- Outside Plant was poorly documented from the start
- Dryboxes are finicky and sometimes not dry
- Paint matching is a pain
- Estimated costs significantly lower than actual costs
 - Vendor's initial estimate: ~\$120K
 - UCCS estimate: ~\$200K
 - What we budgeted: ~\$400K
 - Original full scope cost after subcontractors got involved: ~\$800K
- Time to implement took a lot longer than originally thought
- Involve your campus architects early in the project