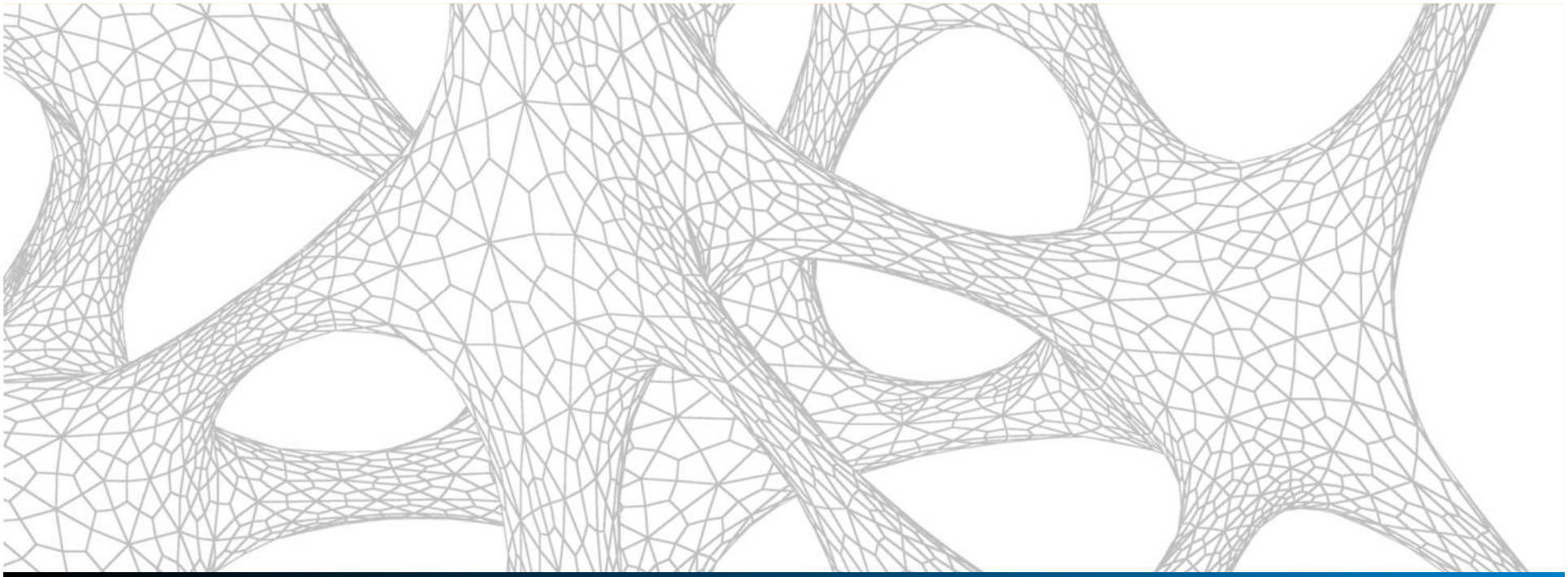
UAS REALITY CAPTURE AT ATLANTA INTL AIRPORT

Chris Harman, Senior Engineer, Atkins

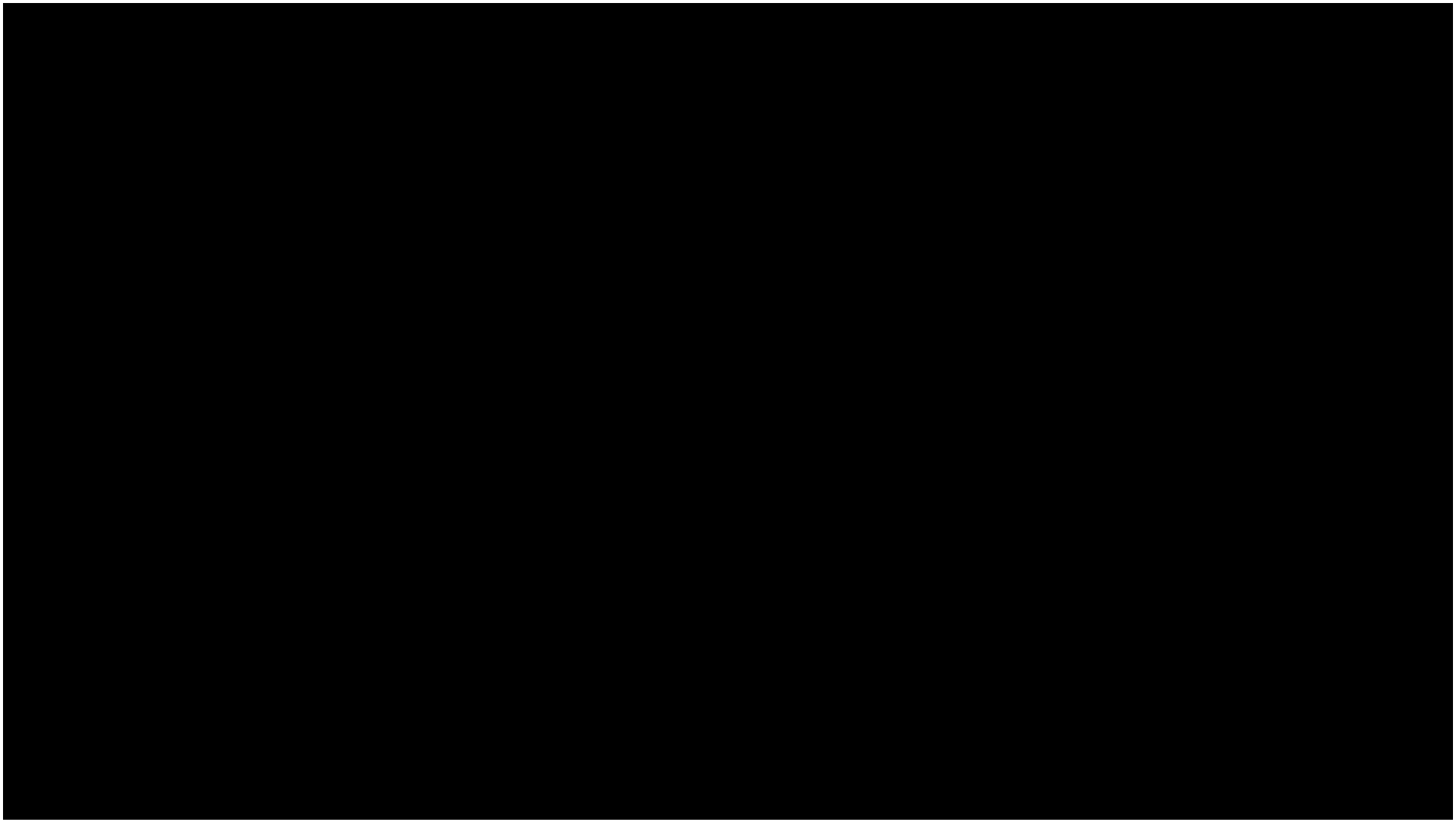
Jeremiah Johnson, Sr. Solutions Architect, 3DR

ATKINS
Member of the SNC-Lavalin Group

3DR



Introduction – Autodesk Short Film



Chris Harman, Senior Civil Engineer at Atkins

ATKINS
Member of the SNC-Lavalin Group

- Joined Atkins in 2010.
- Over 14 years experience in the delivery of infrastructure designs for aviation, transportation and site development projects, both in the United States and abroad.
- Digital Engineering coordinator for Atkins North America, focusing on standards, tools, and process improvements for the business.
- Based in Atlanta, GA, USA.

- Email: Chris.Harman@atkinsglobal.com

ATKINS
Member of the SNC-Lavalin Group

Who is Atkins?

EST. 1938

- Atkins is one of the world's most respected design, engineering and project management consultancies. We build long term trusted partnerships to create a world where lives are enriched through the implementation of our ideas.

18,300 people worldwide

UK's largest engineering consultancy
(NCE Consultants File 2015)

Jeremiah Johnson, Sr. Solutions Architect, 3DR

- Joined 3DR in 2015.
- Prior experience in survey and aerial mapping.
- Certificated Private Pilot Airplane, sUAS Pilot.
- Main role is helping architecture, engineering, and construction companies augment current workflows with unmanned aerial reality capture.
- Based in Berkeley, CA
- Email: jeremiah@3dr.com

About 3DR

3DR is the leader of AEC drone data technology. Founded 2009.

In 2015 made strategic shift to Enterprise Aerial Data Capture Software platform serving the extended AEC sectors

Nearly 1,000,000 3DR-powered aerial vehicles worldwide

Hardware, software, comprehensive onboarding, industry-leading support

Autodesk made a strategic investment in 3DR to partner and meet the needs

2009 - 2015 DIY Pixhawk, Consumer

3DR + AUTODESK.

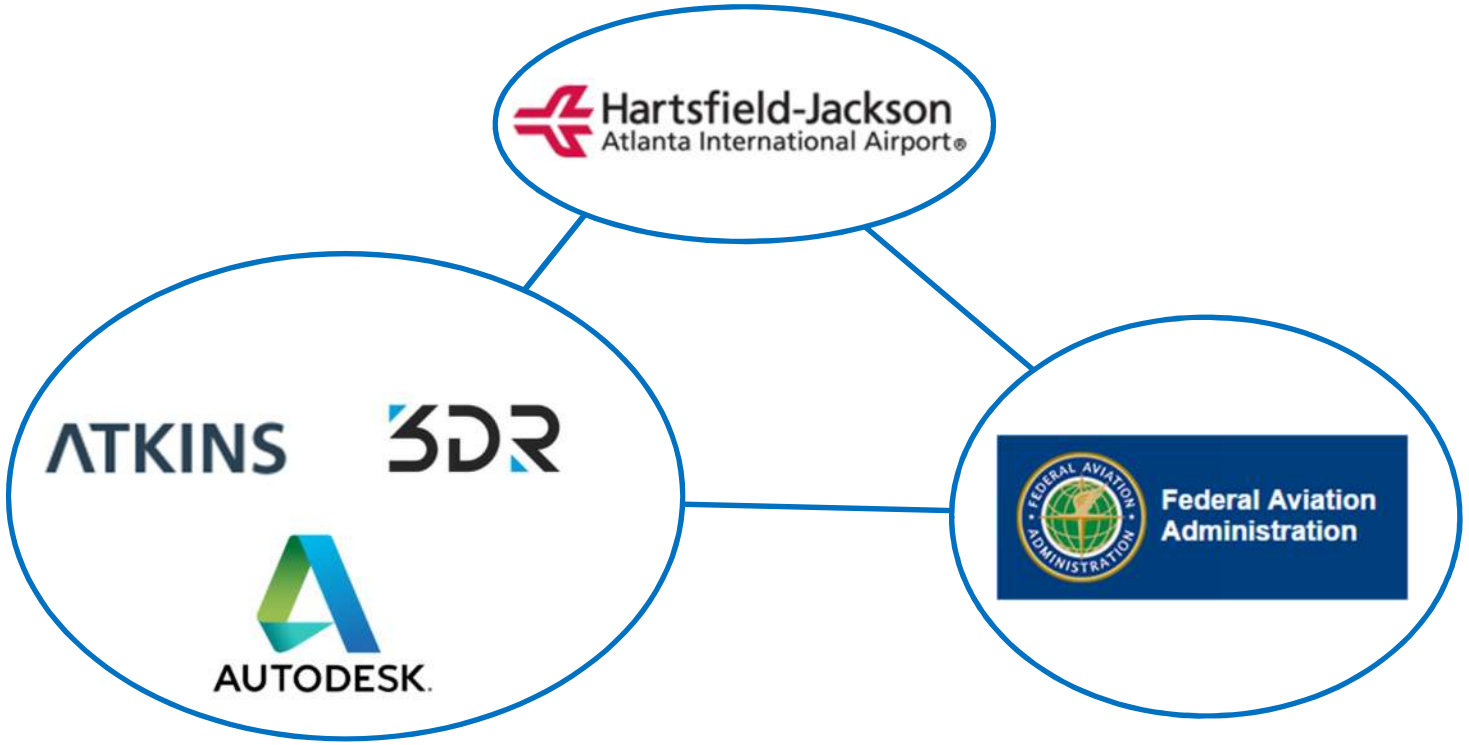
3DR Partnered with Autodesk to begin design of aerial analytics platform 2015

2016 March 1- Launch of Site Scan

2017 - Site Scan Enterprise Platform
(Enterprise Solution)

3DR

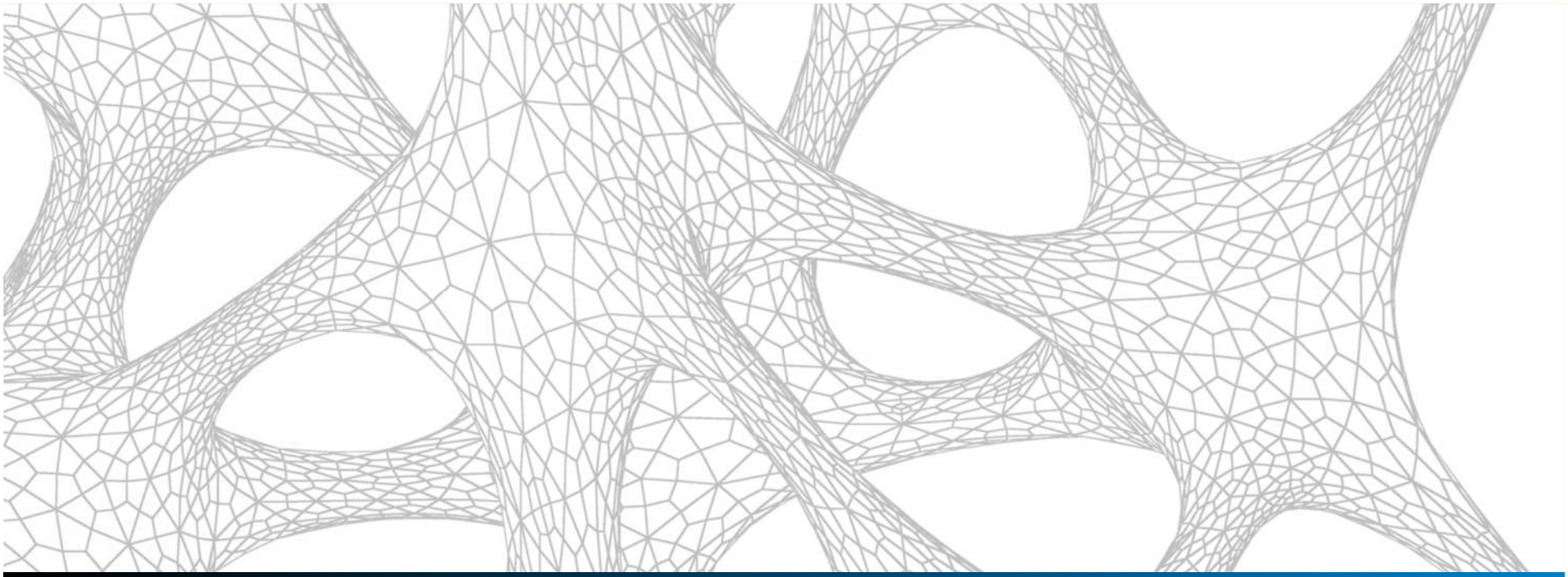
The Project Team



Class Summary

ATKINS
Member of the SNC-Lavalin Group

- The reasons for using UAS to capture data at ATL
- The considerations you need to be aware of when operating a UAS on an airport
- The FAA Waiver and permit process for flight on/near an airport
- The flight logistics, procedures and operation
- Key benefits of the data and project use examples



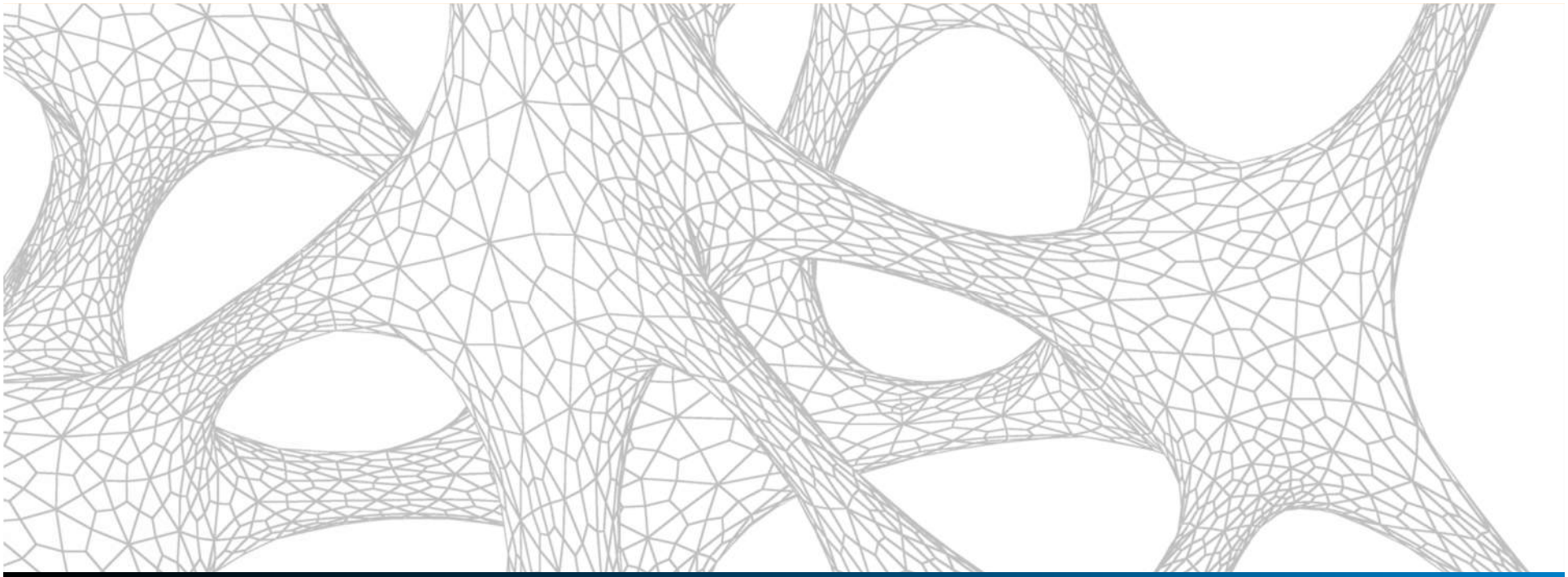
Hartsfield-Jackson Atlanta International Airport Capital Improvement Overview

ATL Capital Improvement Overview

ATKINS
Member of the SNC-Lavalin Group

- Demolish and Replace both parking decks
- Re-design the passenger pick-up for the “West Curb” project – including canopies and roadway arrangements
- Realign the landside roadways and expand Concourse T North

Domestic Terminal Complex - Via Google Earth Pro

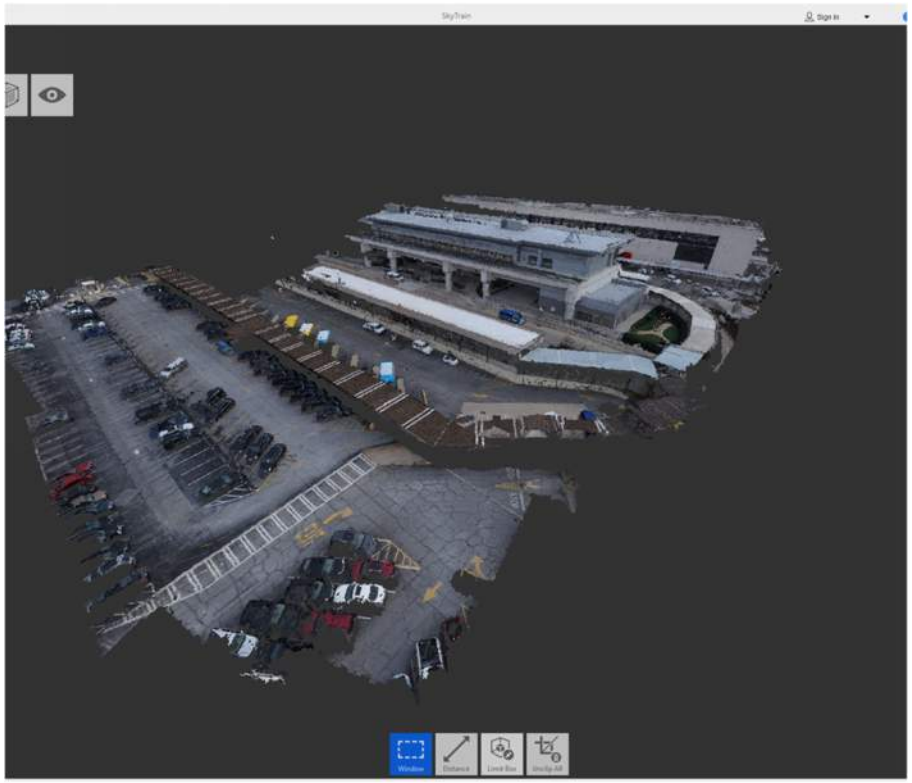


Why drone data?

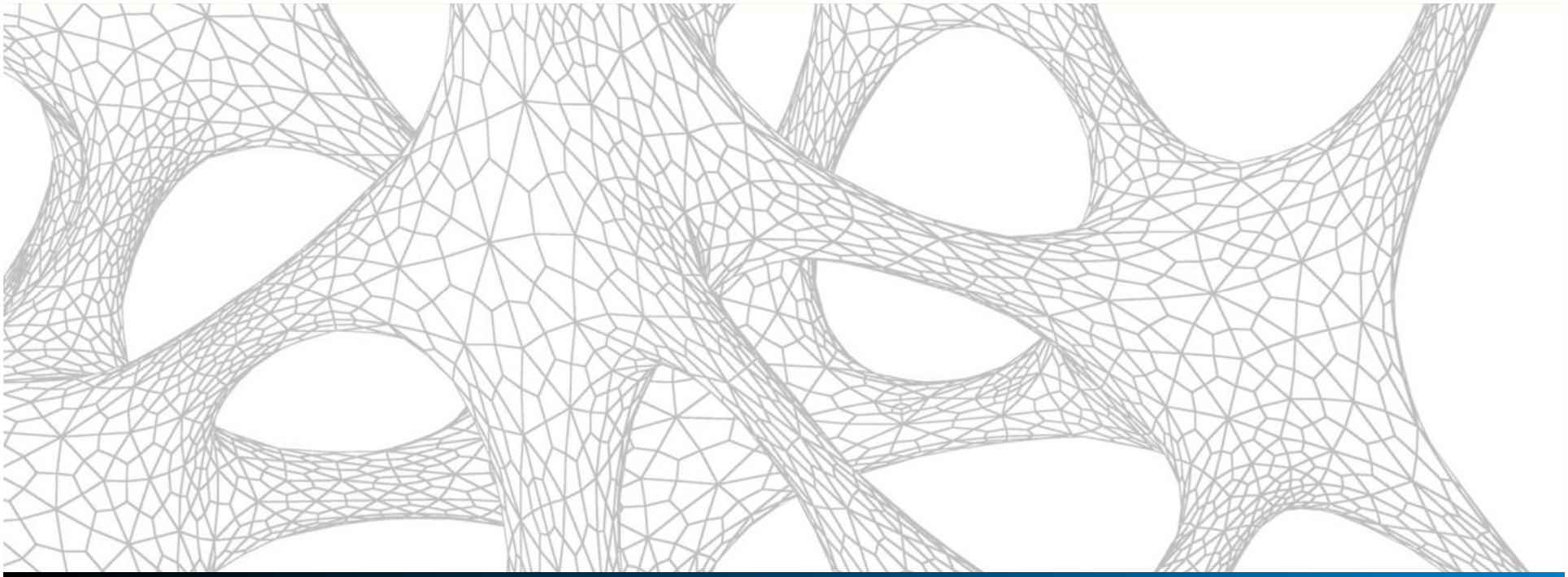
Why drone data?

ATKINS
Member of the SNC-Lavalin Group

- Multiple projects on different schedules meant the need for existing data was great without contractual way of obtaining all at once.
- Some areas were laser surveyed, but lacked information for creating top-down 3D Models
- The Airport uses a unique coordinate system that limits the use of available 3D data from programs such as Infraworks



Screen Capture from Recap

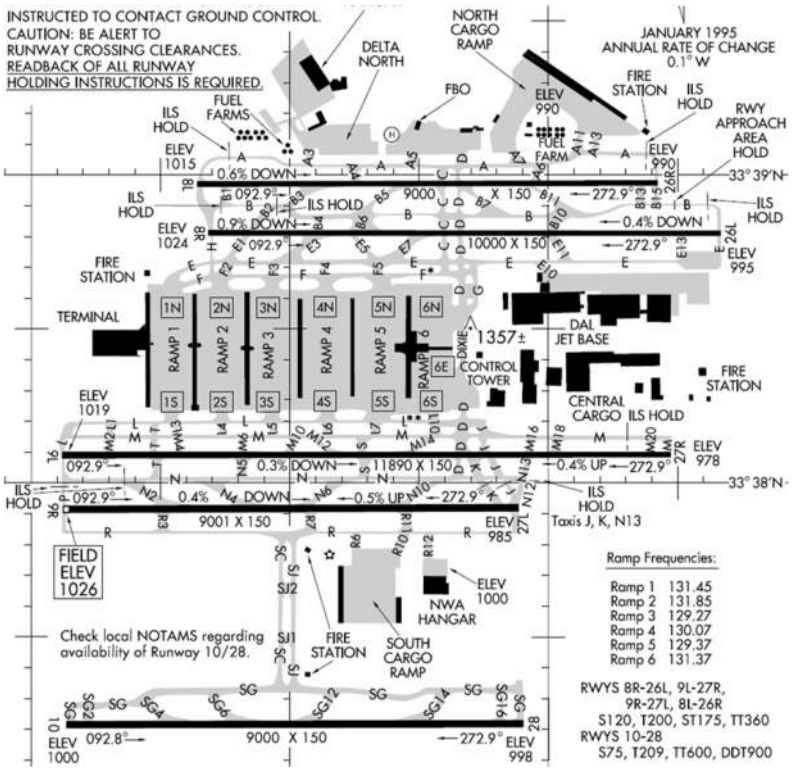


Introduction: Primary surfaces & West/East flows

Why not just close the runways?

ATKINS
Member of the SNC-Lavalin Group

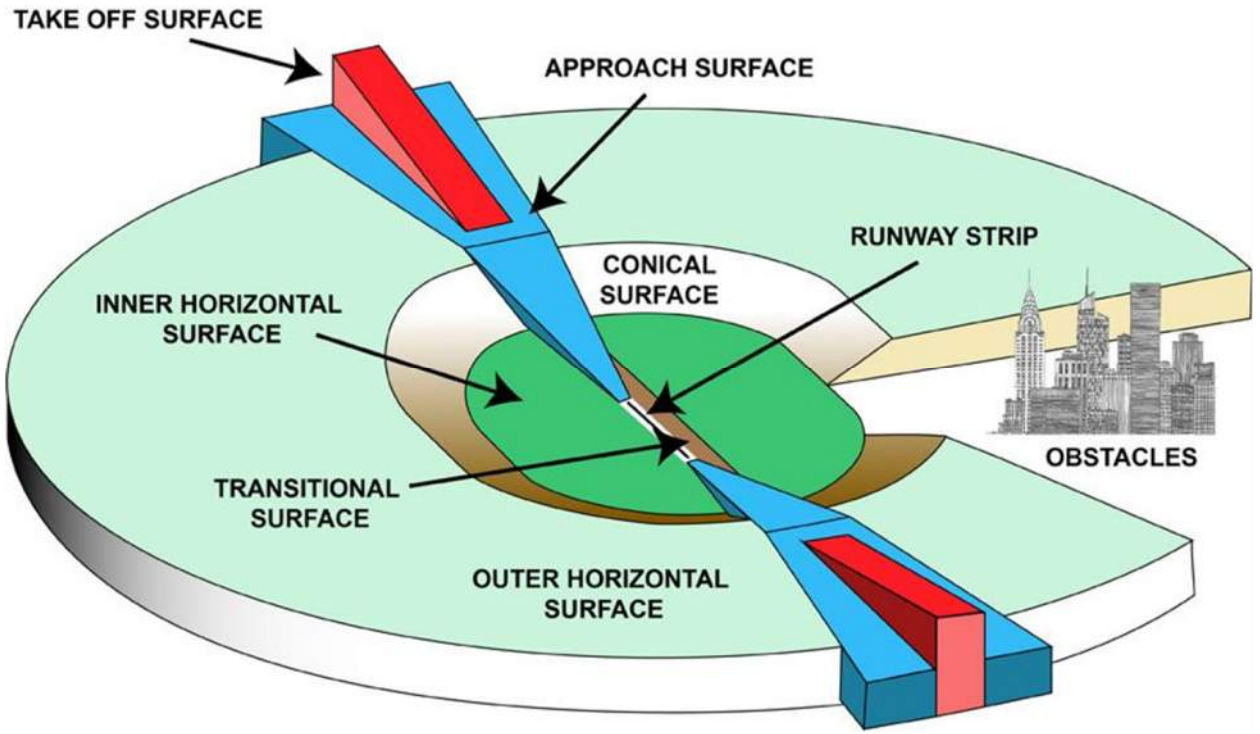
- Since 1998, Hartsfield-Jackson has been the busiest airport in the world.
- Hartsfield-Jackson serves 150 U.S. destinations and more than 75 international destinations in 50 countries.
- Hartsfield-Jackson averages 275,000 passengers a day.
- On average, there are almost 2,500 arrivals and departures daily.
- Atlanta is within a two-hour flight of 80 percent of the United States population.
- ATL has five east-west oriented runways.



ATL Airport Diagram

Primary Surfaces

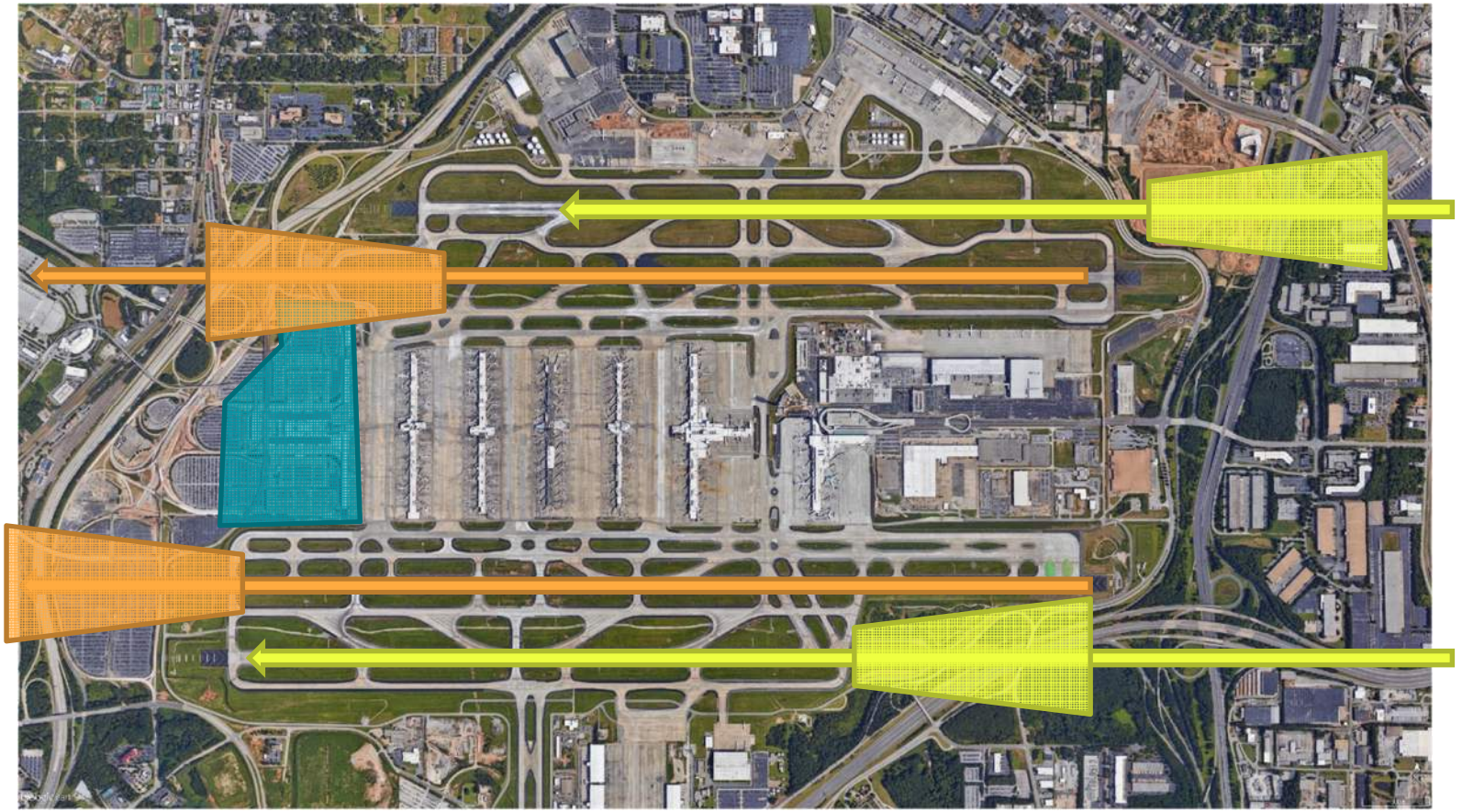
ATKINS
Member of the SNC-Lavalin Group



https://globalairspacesolutions.com/

Airport Operations - Westerly Flow

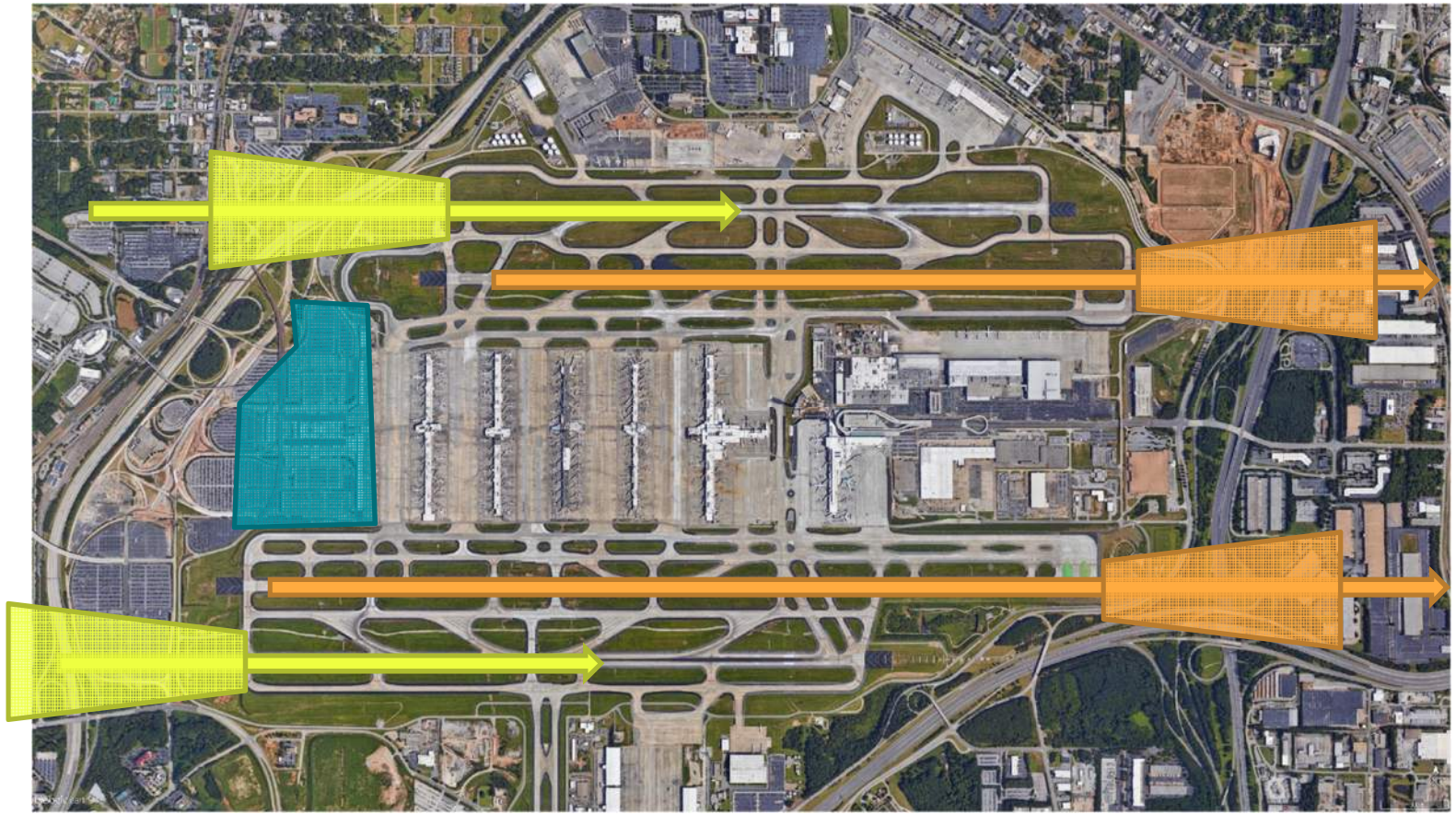
ATKINS
Member of the SNC-Lavalin Group



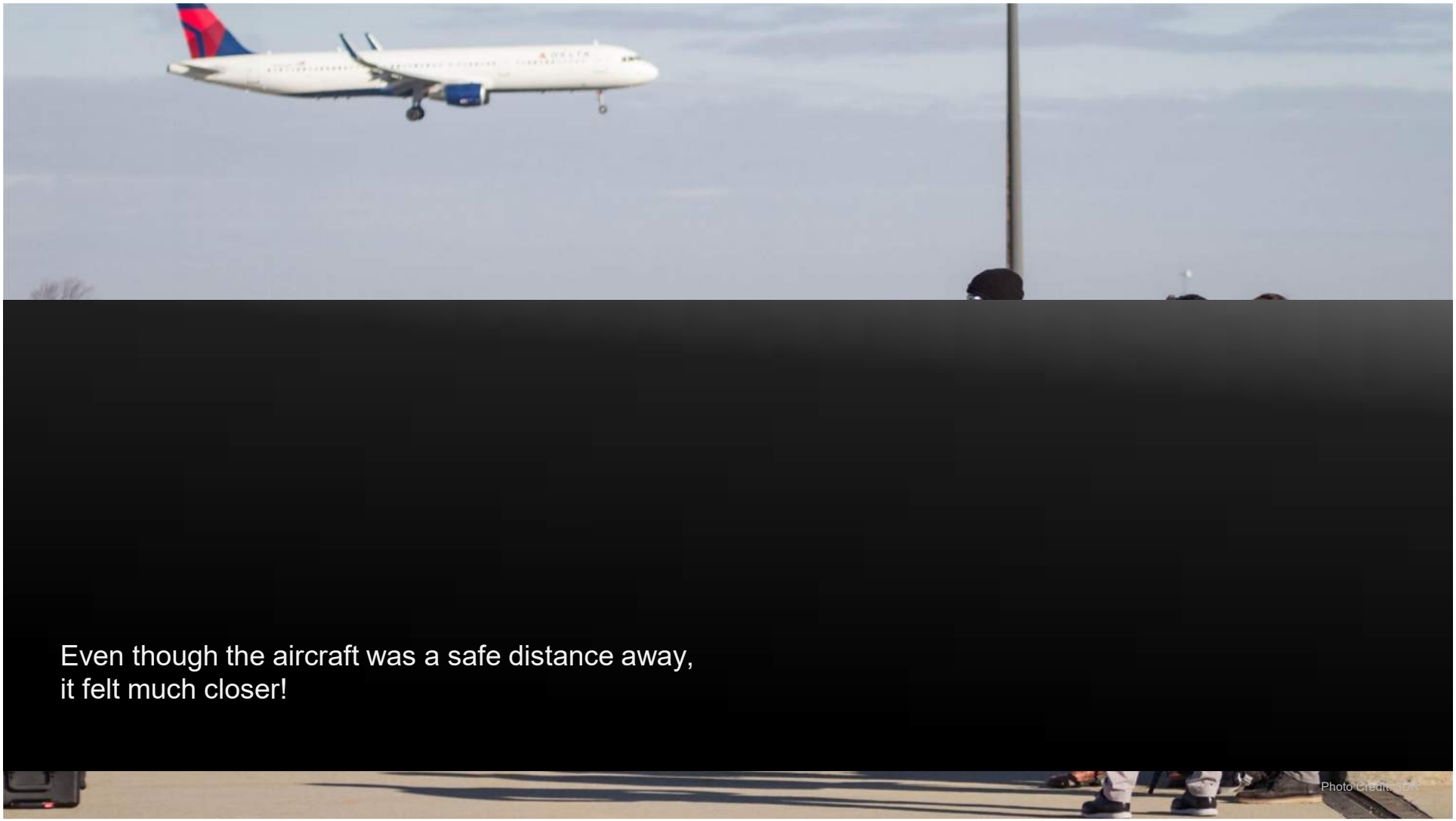
ATL Airport – Google Earth Pro

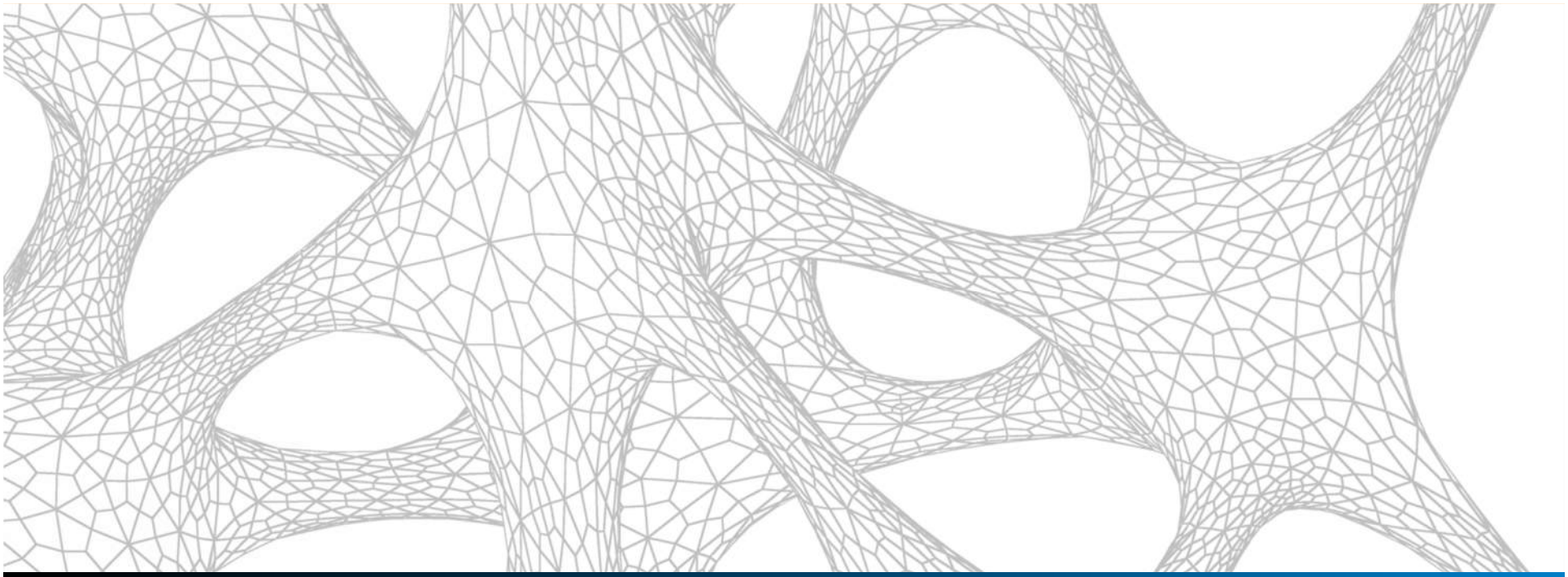
Airport Operation - Easterly Flows

ATKINS
Member of the SNC-Lavalin Group



ATL Airport – Google Earth Pro


Even though the aircraft was a safe distance away,
it felt much closer!
Photo Credit: SDR



Hurdles and Stakeholders Involved

Hurdles

ATKINS
Member of the SNC-Lavalin Group

- Public safety is paramount
- Airport and FAA concerned of setting precedent
- Must avoid sensitive / security data capture
- No possibility of operational disruption

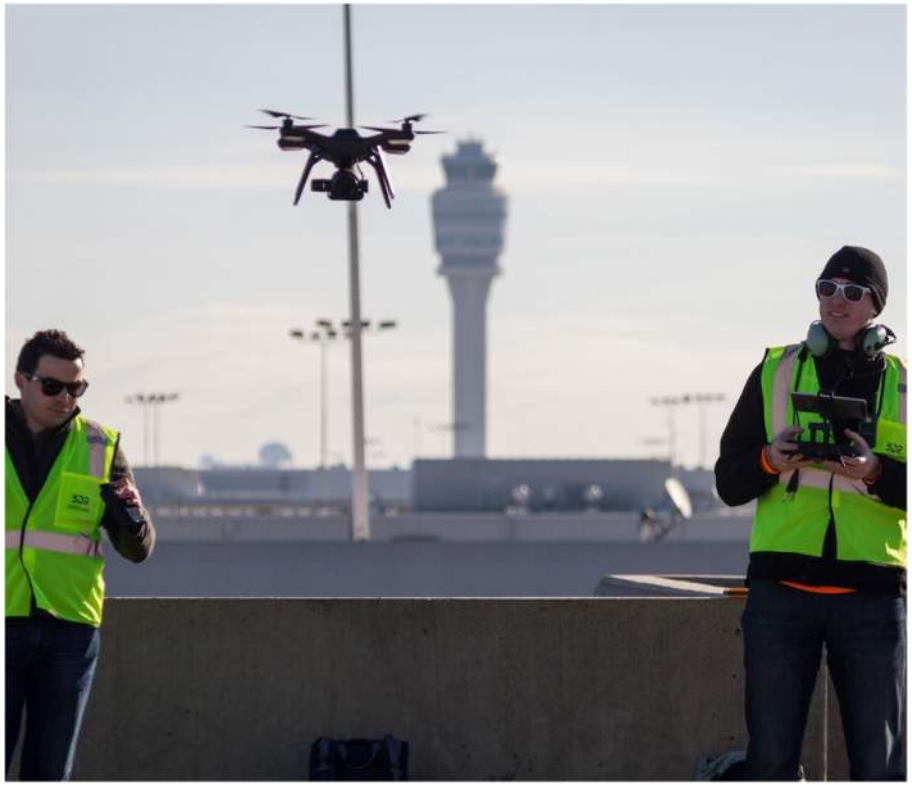


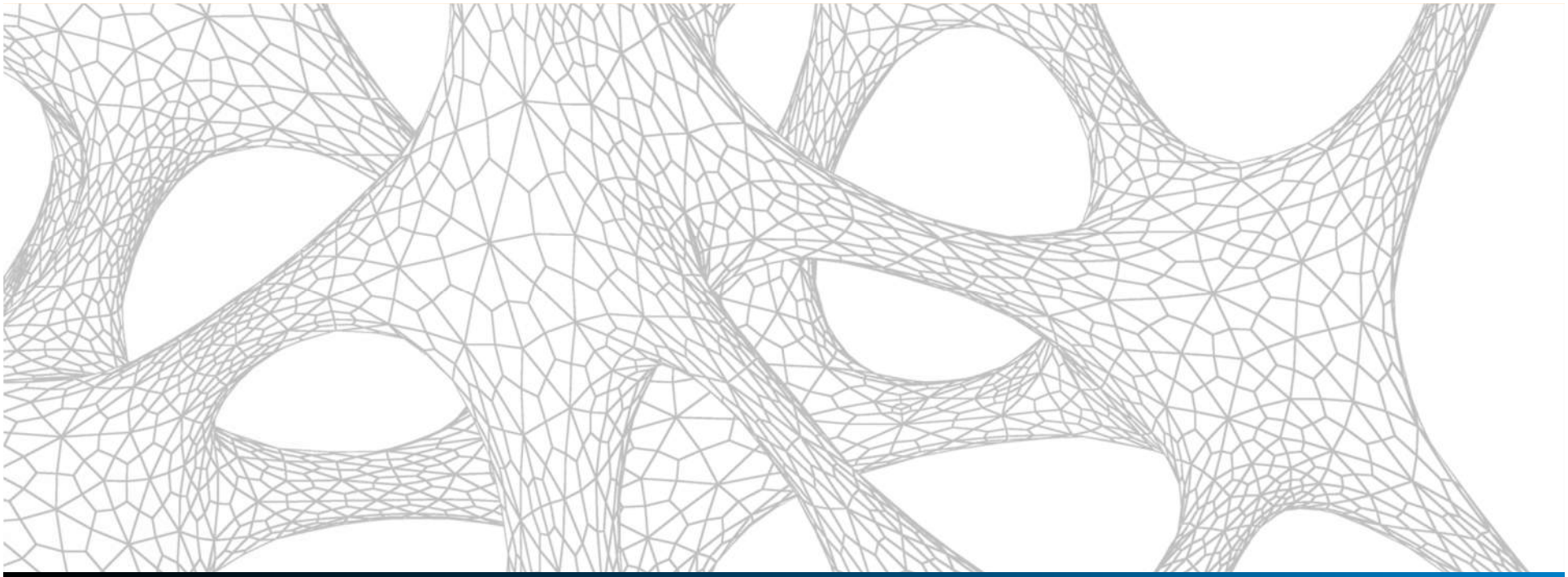
Photo Credit – 3DR

Stakeholders Involved

ATKINS
Member of the SNC-Lavalin Group

- City of Atlanta Department of Aviation
- Hartsfield-Jackson Atlanta International Airport Communications Center
- Atlanta Police Department
- Atkins
- Transportation Security Administration
- Federal Aviation Administration
- Airport Security

Photo Credit – 3DR



FAA Waiver Process

FAA Authorization Process

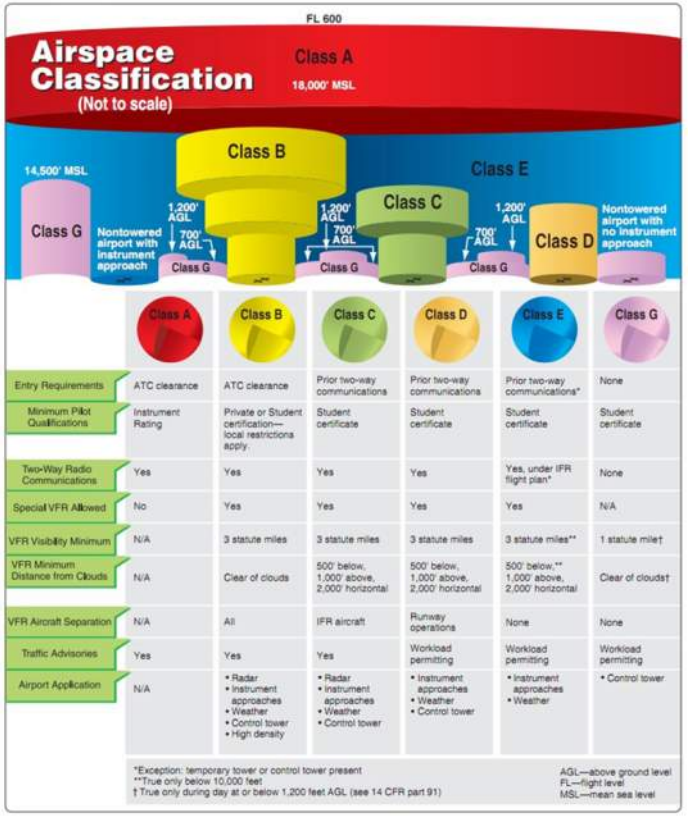
- Part 107 allows authorizations and waivers to be given on a case-by-case basis.
- Applicant must show safe operation of the UAS with mitigation steps described.
- Application must be submitted at least 90 days before planned operation.
- Authorization isn't for a single day or flight. It is for an extended period of time, typically less than 12 months.

Federal Aviation Administration

Airspace

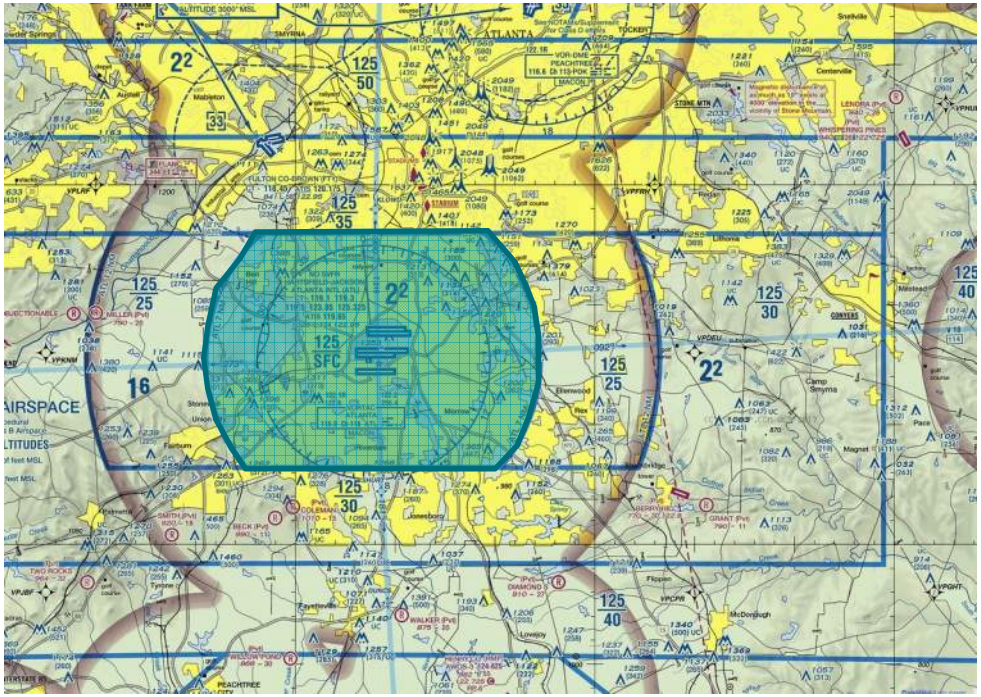
- An FAA authorization or waiver is required to operate UAS in controlled airspace. Controlled airspace includes, but is not limited to, A,B,C,D, and E.

- Hartsfield-Jackson Atlanta International Airport is within Class B.



Airspace Restrictions

- Bravo airspace is restricted to the surface around airports. This limits opportunities to operate UAS
- This project was the first approved flight on a Class B airport approved through the FAA's waiver system
- The waiver system is being updated currently to allow instant authorization through LAANC



DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

CERTIFICATE OF WAIVER OR AUTHORIZATION

ISSUED TO
Jeremiah Johnson
3D Robotics, Inc.

POC Phone Number
919-204-3139

ADDRESS
1608 4th Street, Suite 410, Berkeley, CA 94710

This certificate is issued for the operations specifically described hereinafter. No person shall conduct any operation pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate, and such other requirements of the Federal Aviation Regulations not specifically waived by this certificate.

OPERATIONS AUTHORIZED
Unmanned Aircraft Systems operations in accordance with Title 14 CFR Part 107.41, except "Operating limitations for small unmanned aircraft" Part 107.51 b (2) are limited to the altitude listed below.
Class of Airspace: B in the vicinity of Hartsfield-Jackson Atlanta Intl (ATL)
At or below 200 feet above ground level (AGL)
Under the jurisdiction of: Atlanta Tower

UAS operation to capture aerial imagery of pre-existing conditions of the west parking lot of ATL before renovations begins.

LIST OF WAIVED REGULATIONS BY SECTION AND TITLE
107.41 Operations in certain airspace

STANDARD PROVISIONS

1. A copy of the application made for this certificate shall be attached and become a part hereof.
2. This certificate shall be presented for inspection upon the request of any authorized representative of the Federal Aviation Administration, or of any State or municipal official charged with the duty of enforcing local laws or regulations.
3. The holder of this certificate shall be responsible for the strict observance of the terms and provisions contained herein.
4. This certificate is nontransferable.

Note-This certificate constitutes a waiver of those Federal rules or regulations specifically referred to above. It does not constitute a waiver of any State law or local ordinance.

SPECIAL PROVISIONS

Special Provisions 1 thru 4 inclusive, are set forth on page 2 and 3 of this waiver.

This certificate 2016-ATO-P107-00334 is effective from December 15, 2016, to January 18, 2017, inclusive, and is subject to cancellation at any time upon notice by the Administrator or his/her authorized representative.

BY DIRECTION OF THE ADMINISTRATOR

FAA Headquarters, AJV-115 (Region)

M. Randy Willis (Signature)
Randy Willis

December 14, 2016 (Date)

Manager, Emerging Technologies Team (AJV-115) (Title)

SPECIAL PROVISIONS

1. **CONTACT INFORMATION:**

   Jeremiah Johnson is the person designated as responsible for the overall safety of UAS operations under this Certificate of Waiver. During UAS operations for on-site communication/recall, the Pilot shall be continuously available for direct contact at 979-204-3139 by Atlanta Tower or designated representative.

2. **SCHEDULE:**

   This Certificate of Waiver and the Special Provisions shall be in effect from December 15, 2016, to January 18, 2017, between sunrise and sunset local time.

3. **OPERATIONS:**

   a. No UA operations are authorized unless ATL Tower is in an EAST operation

   b. The PIC will contact ATL Tower for approval as follows:
      i. One week prior to proposed operation, PIC must contact Thomas Manson-Hall at 404-559-5817.
      ii. Twenty four hours prior to proposed operation, PIC must contact Thomas Manson-Hall at 404-559-5817.
      iii. Prior to launch, PIC must contact ATL Tower at 404-559-2941

   c. The flight crew will consist of a certificated Remote Pilot in addition to three visual observers.

   d. The PIC will broadcast on the following ATL tower frequency both launch and recovery of UAS and monitor tower frequency throughout the UAS operation:
      i. When operating over the North Parking Deck, PIC must be on tower frequency 125.32.
      ii. When operating over the South Parking Deck, PIC must be on tower frequency 123.85.

   e. In addition to holding a valid Remote Pilot Certificate, pilots flying under this waiver will also hold a Private Pilot or Commercial Pilot Certificate to ensure familiarity with airport surface area and traffic pattern operations.

   f. ATL tower reserves the right to deny or terminate any UA operation that is deemed unsafe by ATC or when operations dictate.

4. **EMERGENCY/CONTINGENCY PROCEDURES:**

   a. If the UAS loses communications or loses its GPS signal, the UA must return to a pre-determined location within the operating area and land.

   b. The UA's pre-programmed lost link procedure shall ensure its recovery will not overfly any runway or taxiway.

ATTACHMENT 1

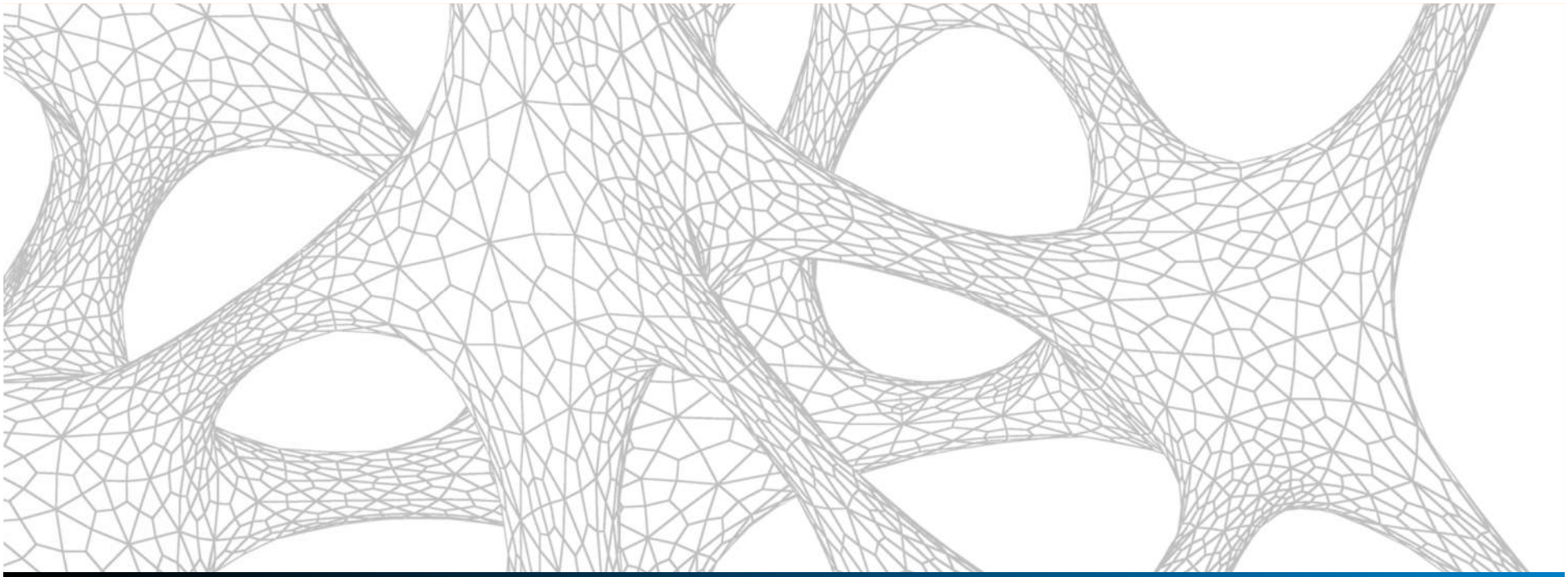
Operations Area
Class B Airspace
At or below 200 feet AGL
[Area of operation is depicted by purple shaded area]

FAA FORM 7711-1 UAS PART 107 WAIVER

2016-ATO-P107-00334

Flight Plan

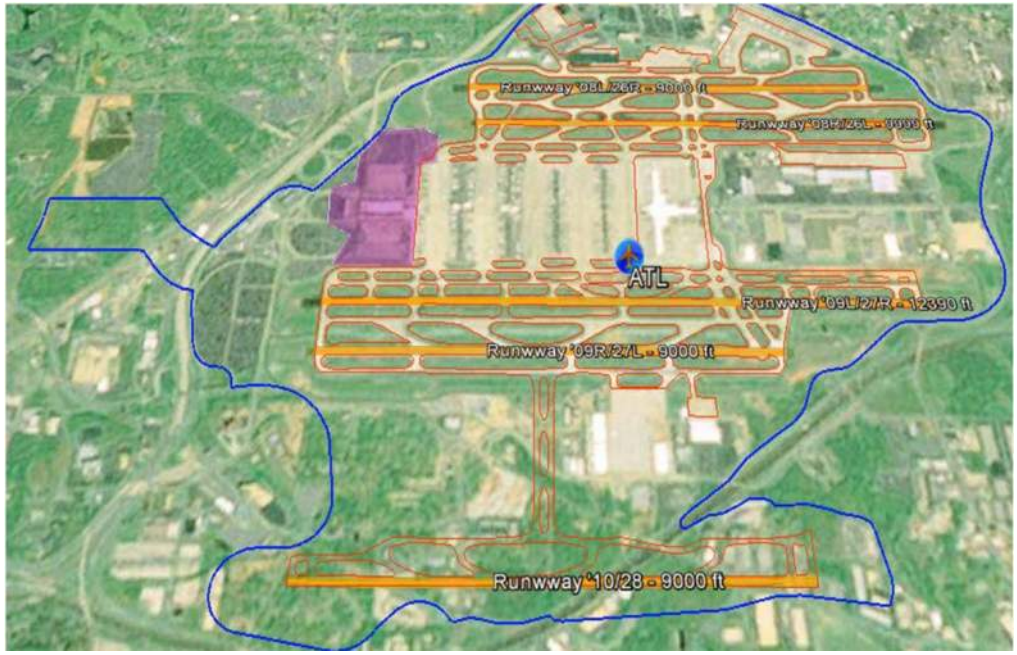
- This flight plan was created and submitted to TSA, airport security, and the FAA for approval.
- The approved operation requires a certificated Private Pilot or higher to be at the controls, with a minimum of 3 visual observers.
- Communication with Atlanta Tower was achieved through handheld aviation radios. Takeoff clearance was requested before each flight, and notice of landing was reported after each landing.



Day of Capture

Capture Area

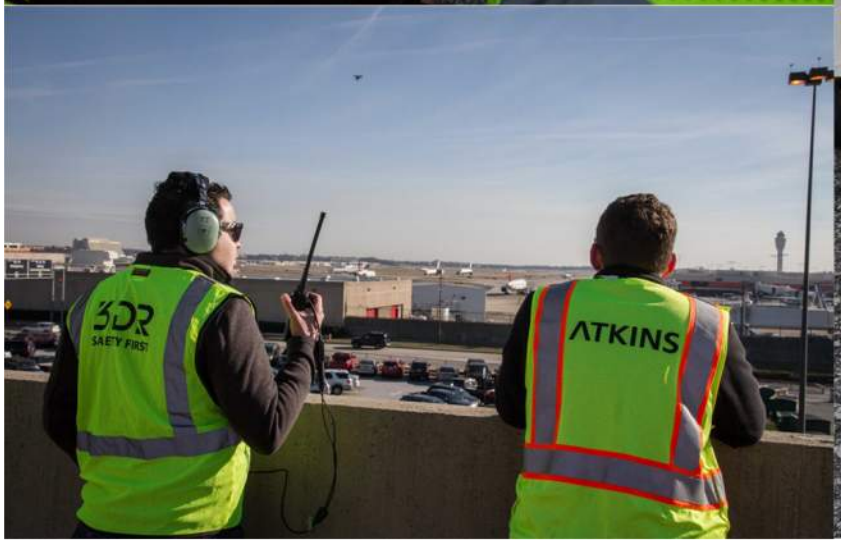
- The Project:
- Capture area of 40 Acres, approx. 700 images
- Provide client with quality ortho images as well as 3D models of building assets
- No disruption of passengers
- No time or budget for ground-run scanning. Completed in ½ a day!

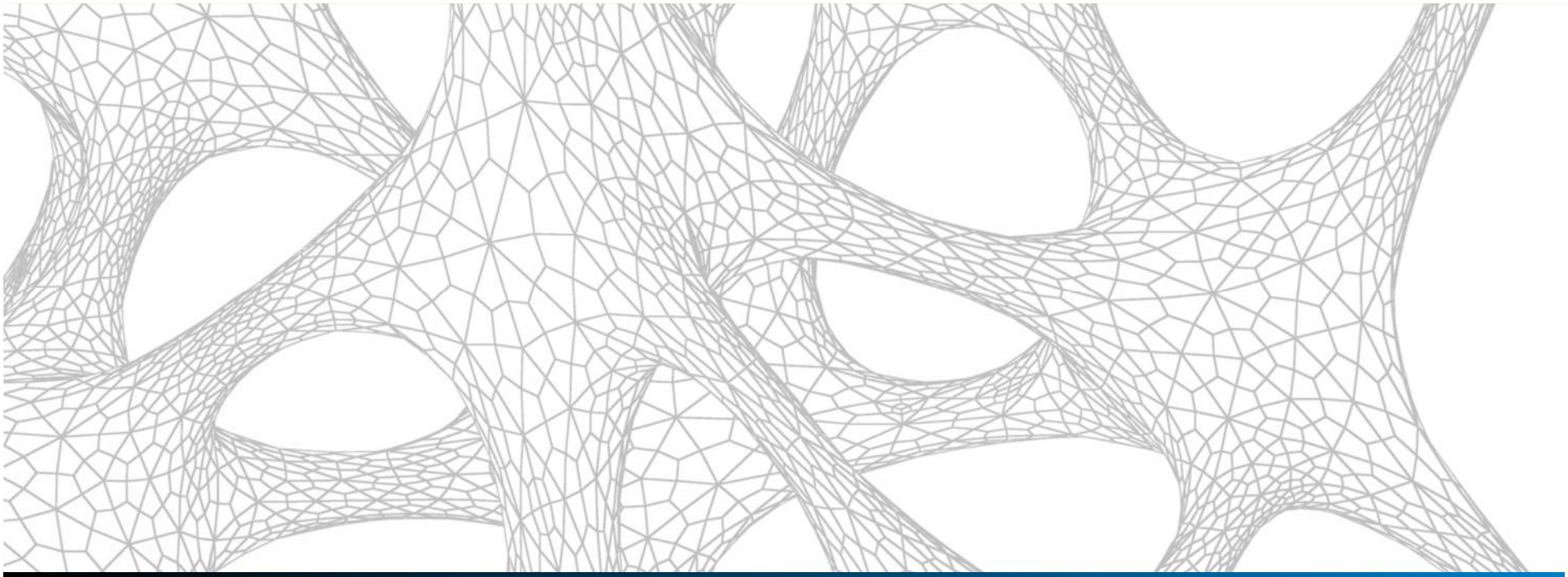


Day of Capture

- Flights began at sunrise
- Each takeoff was coordinated with Air Traffic Control.
- There were 4 flight areas: West Skytrain, East Skytrain, North Garage, and South Garage.

Photo Credit – 3DR


3DR
SAFETY FIRST
ATKINS



Using the Data

Model Types and Creation

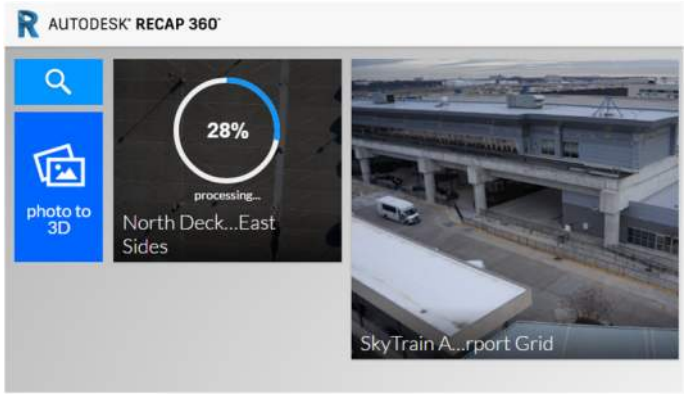
ATKINS
Member of the SNC-Lavalin Group

- Collected images can be added to the photogrammetry compiler of your choice

Screen Capture from Recap

Model Types and Creation

ATKINS
Member of the SNC-Lavalin Group

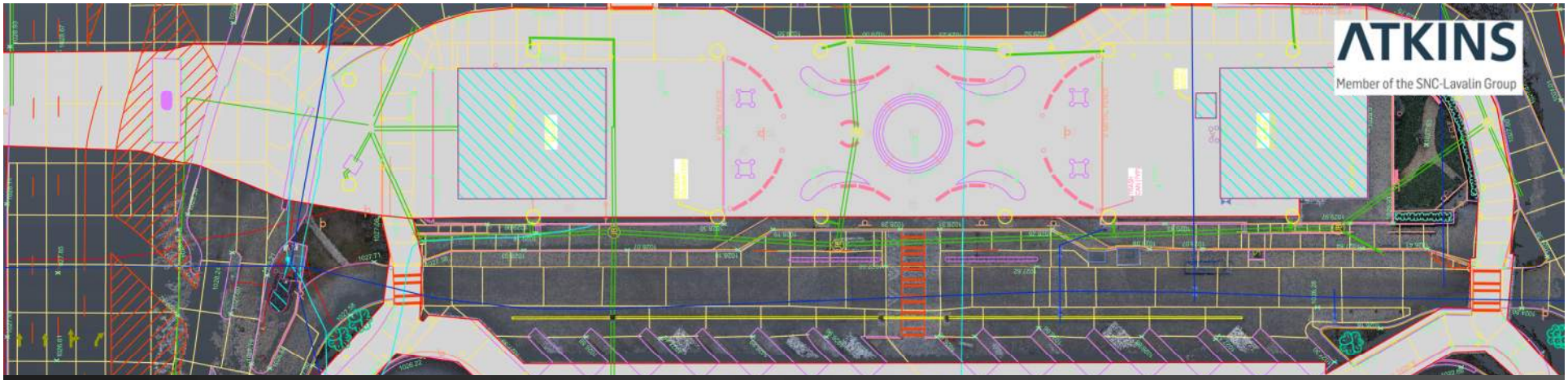


- Orthographic Map/Aerials
- FBX – Generic 3D Object
- OBJ – Generic 3D Object
- Point Clouds

NAVISWORKS

REVIT

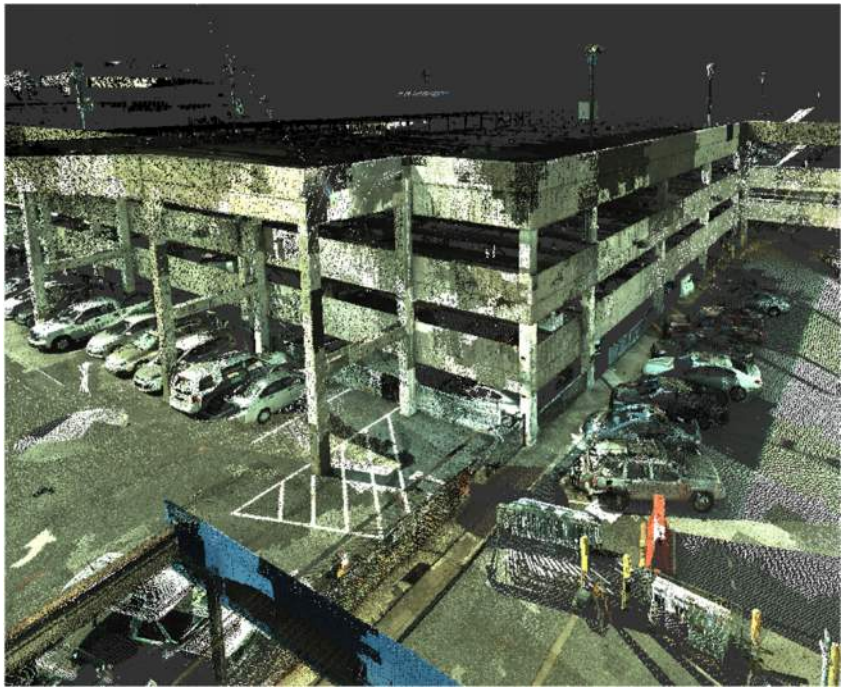
AUTOCAD CIVIL 3D



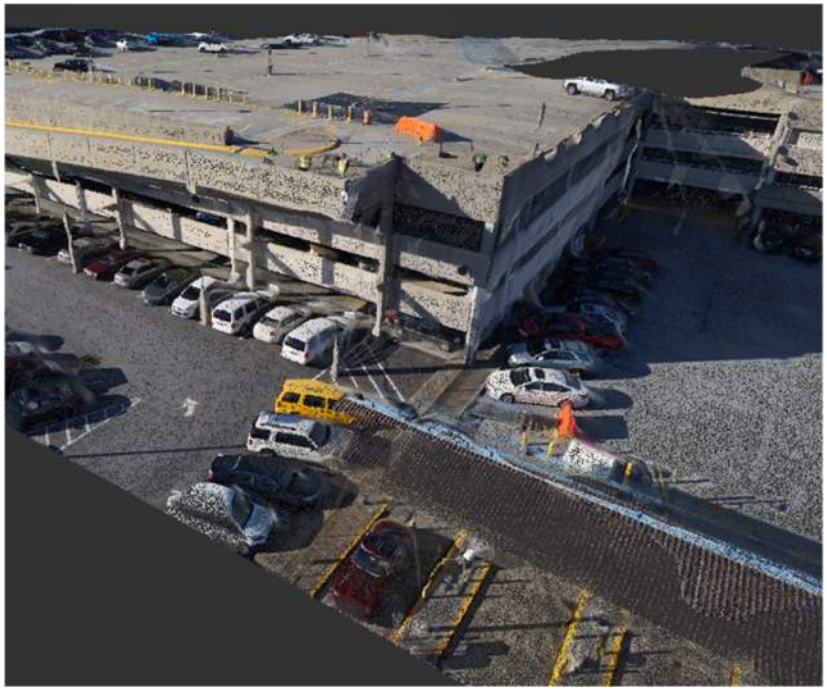
High quality orthographic as provides opportunity to view as-is conditions on site

Workflows and Design Hurdles

ATKINS
Member of the SNC-Lavalin Group



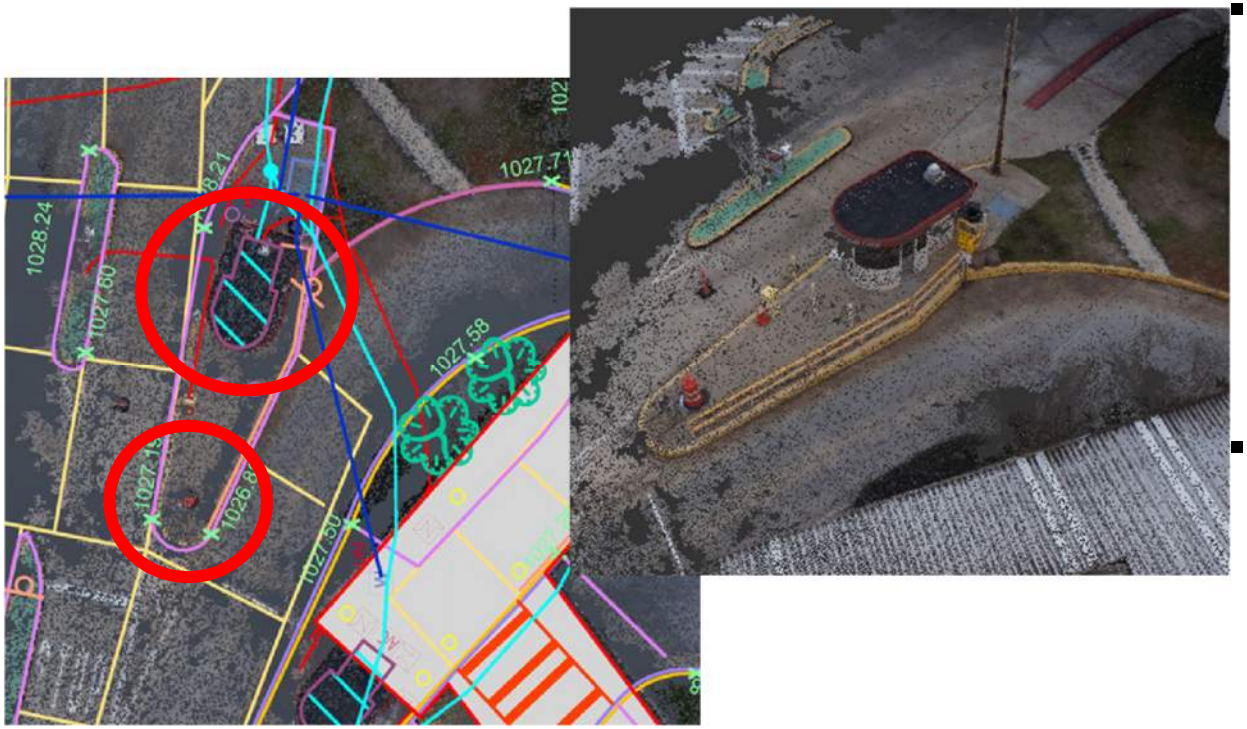
Data from ground run laser scan



Screen Capture from Recap

Workflows and Design Hurdles

ATKINS
Member of the SNC-Lavalin Group



- We can overlay the ortho maps into our CAD drawings to check for basemap irregularities and omissions
- We can further investigate any inconsistencies within the 3D point clouds created from the images.

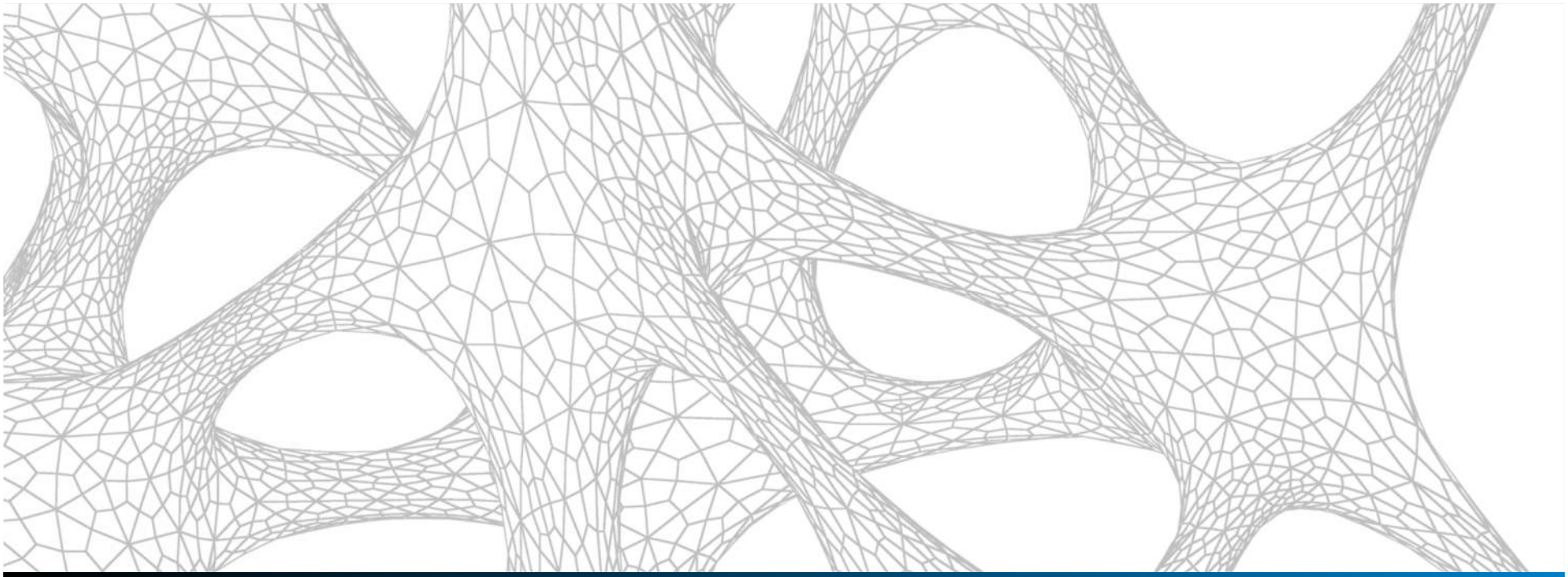
Workflows and Design Hurdles

ATKINS
Member of the SNC-Lavalin Group

- Clients are able to see design in a 3D space that is created from captured images. This allows them to comment in something very close to reality.
- This saves time and reduces the number of changes that come about through design reviews.

3D Point Clouds can be brought into Infraworks or Navisworks to contextualize your designs

3D Point Clouds can be brought into Infraworks or Navisworks to contextualize your designs



Our Learnings & The Future

Next Steps and Lessons Learned

ATKINS
Member of the SNC-Lavalin Group

- Point clouds do not export to 3D AR/VR/MR panoramas and/or massing objects without some further manipulation.

- Generic 3D Objects such as FBX are a single entity – not easily split into pieces and parts. Feature extraction tools are the future.

- Massing, sections and rendering require multiple steps to produce.

Next Steps and Lessons Learned

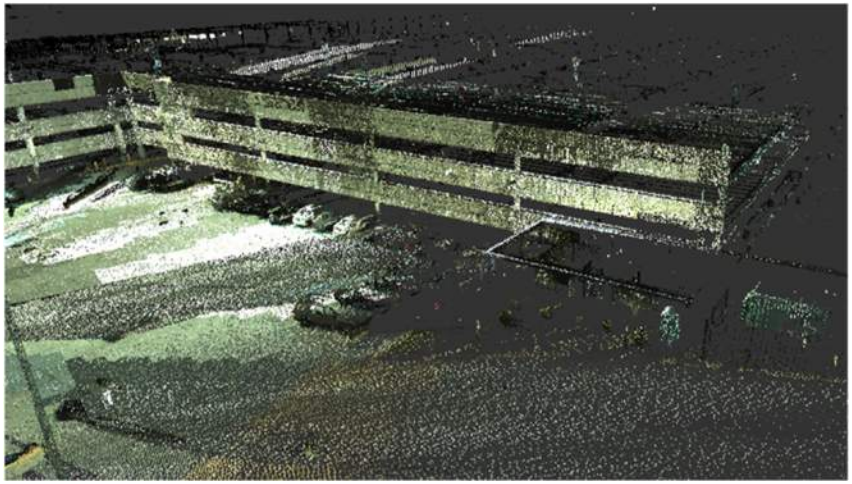
ATKINS
Member of the SNC-Lavalin Group

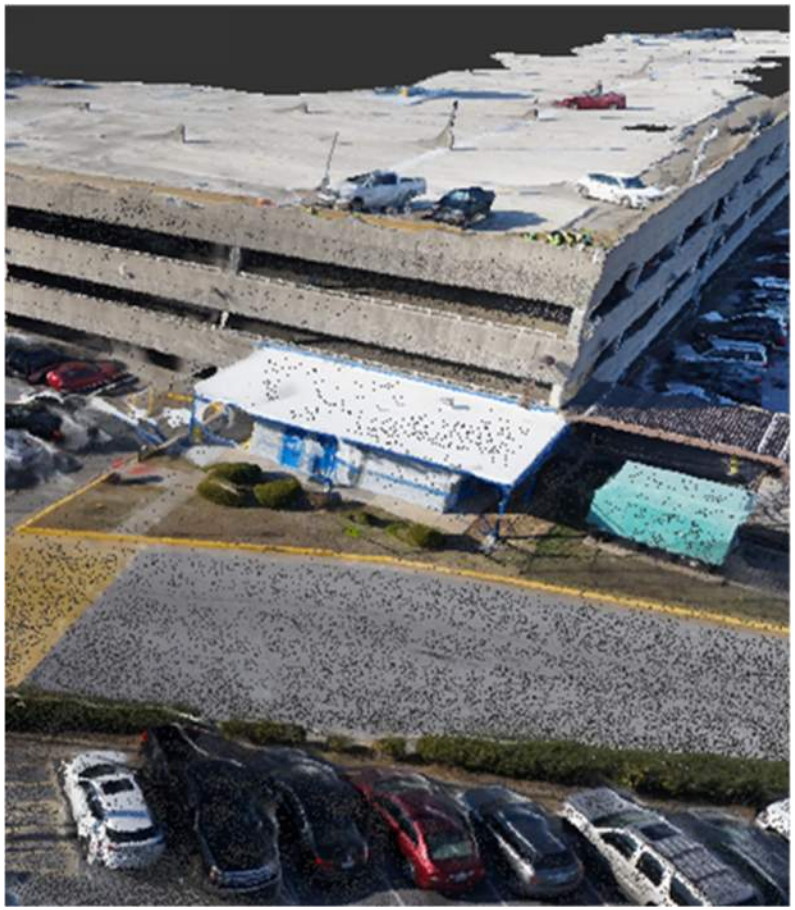
3D Point Clouds can be used to refine and develop massing inside Revit

3D Point Clouds can be viewed and exported in several different formats

Combining with structured scans

ATKINS
Member of the SNC-Lavalin Group





The Future

Since our flight there have been several other UAS operations at ATL.

- Runway closures to collect pavement condition data
- Runway closures to collect construction progress
- Runway closures for promotional events

In Conclusion

FAA is working on new technologies such as LAANC that allows instant authorization to fly near an airport

This project helped the FAA and ATL understand requirements for safe operation on an airport

The data collected is being used on multiple projects and will continue to be used for years to come