Outline

- Problem Statement
- Common Techniques & Tools used?
- Mobile Mapping System (MMS)
  - Added Values from MMS
- Asset Management Strategy
- Wrap-up and questions
Problem Statement

• How do we apply modern technology to improve and more efficiently manage pavements?

Key components in Maintaining Airfield Pavements?

• Timely data collection
• Accurate pavement condition assessment
• Multi-year funding constraints
• Prioritization
• Lack of a performance baseline
• Proactive repairs vs pavement life cycle
Airport Pavement R&D

• R&D to extend runway pavement life from 20 to 40 years
• Will require a precise life-cycle cost analysis

Current methods?

• Visual identification of stress
• Tablets or Clipboard
• Photography
• Geotechnical Cores/Borings
• Laser Systems
• NDT
Mobile Mapping System (MMS)

- **LIDAR SENSORS AND CAMERAS**
  - **MMS VEHICLE**
  - **EQUIPMENT**

Lynx “M1” Mobile LiDAR Mapping System

- Up to 200Khz LiDAR Sensors
- 200 meter range
- 4 integrated cameras (5mp)
- Real-Time point cloud viewing
- Ability to adjust density by distance
- Ability to adjust images on the fly
Mobile Mapping System (MMS)

How Accurate is It?
- When used with survey control it can be made to comply with aGIS deliverables (5300-16, 17, 18)
- Topography can be controlled to 1” or less in some cases

Technological Limitations?
- Cannot replace ASTM D5340-112 (visual); however, MMS can accelerate reviews
- Some distress/severity limitations
- Weather, night (imagery only)
- Similar to some “video” collection systems

Crack Identification >
1/4”
What types of projects?

- Medium to Large Project Area
- Multiple Distress Types
- Value Added Services
- Restricted Access/Areas of Safety Concern

System Condition Assessment

Case Example - George Bush Intercontinental

- 286 Drive Lane Miles; 22 Million Sq. Ft.
- 5 Runways, All Taxiways, No Aprons
- Part of an Asset Management Strategy
- Fast Tracked Pavement Condition Assessment
- Difficult Access Areas; Constant Escort from Airport Operations
- Panel Level Inspection - 100%
  - Types and Severities
- Deliverables:
  - System-Level Condition Assessment (PCI and PCN)
  - Panel-Level GIS Data
  - Marking Assessment

Legend
Collect
--- COLLECTED
System Condition Assessment

Case Example - George Bush Intercontinental

- 12 Day MMS Collection
- Worked in Between Aircraft Ops
- Over 25 Lane Miles a Day (Avg.);
  3 days over 40 Miles;
  2 days under 20 Miles
- Average 8-10 Hours per Day
- To comply with ASTM, Visual Inspection of MMS Data to be Validated at Panel/Section Level Using Combination of Office Workstations and Handhelds
- 90-120 Days from Start to Finish

Data Development Steps

MMS Collection → MMS Data Processing → Pavement Distress Mapping → Distress Validation → Condition Assessment

Project Workflow

WOLLPERT PROCESSES
1. Define project area
2. Define Drive Paths
3. Define Control
4. Acquire Data
5. Coverage & Usability Checks
6. Verify Accuracy of LiDAR to Survey Control - Demo
7. Process LiDAR and Imagery Data
8. Process LiDAR for Surface Model & Intensity Images
9. Compare Features & Intensity Images
10. Extract & QC Features
11. Prepare Data for Delivery

APTECH PROCESSES
1. Office Review
2. Field Validation - Distress Mapping Tool
3. MicroPAVER Import, PCI Analysis
Design/Reconstruction

Case Example - Porter County Regional (VPZ)

- 7,001 Ft. x 150 Ft. Runway
- 50 Ft. Parallel Taxiway
- 1.6 Million Sq. Ft. of Asphalt
- Multiple Sections Built over Time
- Accelerating PCI Deterioration Rate
- Significant Cracking; All Severities
- Previous Material Placement Concerns
- Deliverables:
  - System-Level Condition Verification (PCI)
  - Design Analysis with Repair Recommendations
  - Design Level Survey: Mapped Features
  - GIS Features and Attributes

Mapped Asset Data Collected from LiDAR

Design/Reconstruction

Case Example - Porter County Regional (VPZ)

- <8 Hour HMS Collection
- Worked in Between Aircraft Operations
- >200,000 ft. of Cracks Mapped
- Geospatially Overlaid with NDT and Traditional Geotech for Evaluation
  - Identified Isolated “Layered Problem” Areas
  - Improved Distress Quantification
- Imagery Links in CAD Aided Designers
- Served as Project Justification to Agencies - Request in Funding Increase by $8 Million.
- Airport Director was Pleased with Reduced Operations Impacts and Boots on the Ground

Pavement Cracks Visible in LiDAR Point Cloud Data (Not a Photograph)

LiDAR Point Cloud
GIS Deliverable – Features and Attributes

LiDAR allowed for more efficient evaluation of features and the input of their attributes.

Inventory/Repair

Case Example - Indianapolis International (IND)

- >400,000 Sq. Ft. of Concrete
- Former Tenant Occupied; Who Performed Little to No Maintenance
  - Poor Drainage at Inlets
  - Cracks Above Existing Pipes
- Airport Took Possession in 2012
- Panel Level Inspection - 100% Drive Lanes Shown in Purple/Green
  - Types and Severities
- Deliverables:
  - Repair Assessment and Recommendations
  - System-Level Condition Assessment (PCI) at End of Project
- <6 Hour MMS Collection
- Worked in Between Aircraft Operations
- Imagery Links in CAD aided Designers (>26,000 Images)
Inlet Drainage Evaluation

LiDAR Contours
With minimal as-built data and surface drainage distress conditions identified, especially at inlet panels with cracking, contours were generated to allow for a detailed evaluation as well as an as-built for the entire site.

Distress Outlining and Coding
Processing Technicians use both LiDAR and imagery together in identifying, outlining and coding distresses directly on-top of the distress. This can then be better seen in the imagery as “completed”.
Pavement Distress Identification

NOTES: Variation in assembled Ortho image hue is normal in “production quality” imagery. Color corrections possible if “display quality” ortho desired.

Distress Outlining and Coding
Images are also ortho-rectified or stitched together for a complete image of the panel for evaluation relative to their drive paths. The technician can identify, outline and code along with severity here as well.

Added Values

- Increase field safety
- Reduce runway closure times
- Baseline for future assessments/analysis
- More detailed, high resolution dataset
- Geospatially referenced
- Increased accuracy
- Future data extraction without additional field visits
GIS Deliverable – Features and Attributes

LiDAR allowed for more efficient evaluation of features and the input of their attributes.

Point Cloud Fly-Through
Current State of Asset Management

• How are assets being managed now?
  - Airside
    • Pavement
  - Landside
  - Terminal
  - Utilities
• What are the main drivers for an asset management program?
• What are the barriers to moving forward?

Defining Asset Management

Asset management means different things to different people:
  - Asset Management is a work order system
  - Asset Management is moving from reactive, planned, preventative, to reliability centered maintenance (RCM)
  - Asset Management can equate to a direct ROI
  - Asset Management is relevant across multiple business lines
Why do we need Asset Management?

- Doing more with less
- Airports are complex
- Multiple lines of business require data from different systems
- Asset Management programs will improve performance and create measurable increases in benefits to every department

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