

Automated Region-of-Interest Localization for Visual Assessment

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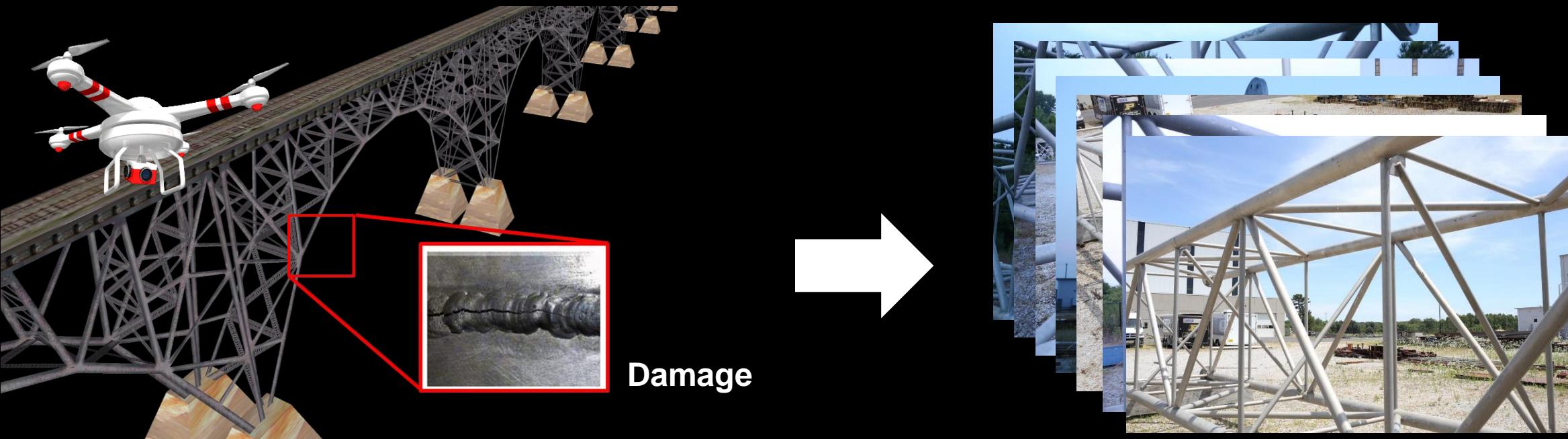
·86.9.1







Opportunity



Automated visual Inspection using
drones

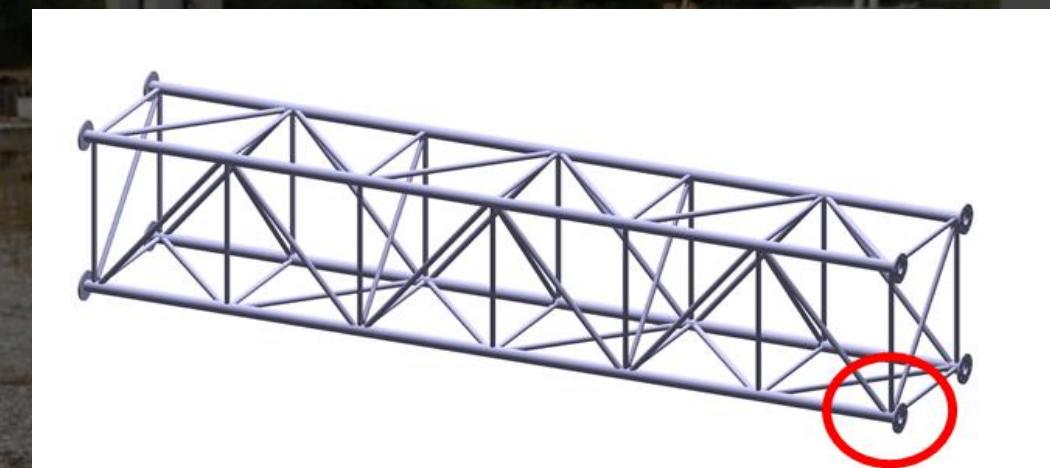
A large volume of images collected
from drones

Regions-of-interest (ROIs)

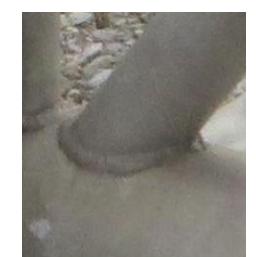




Regions-of-interest (ROIs)

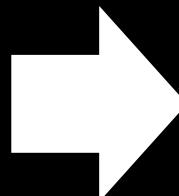


...



Our Technique

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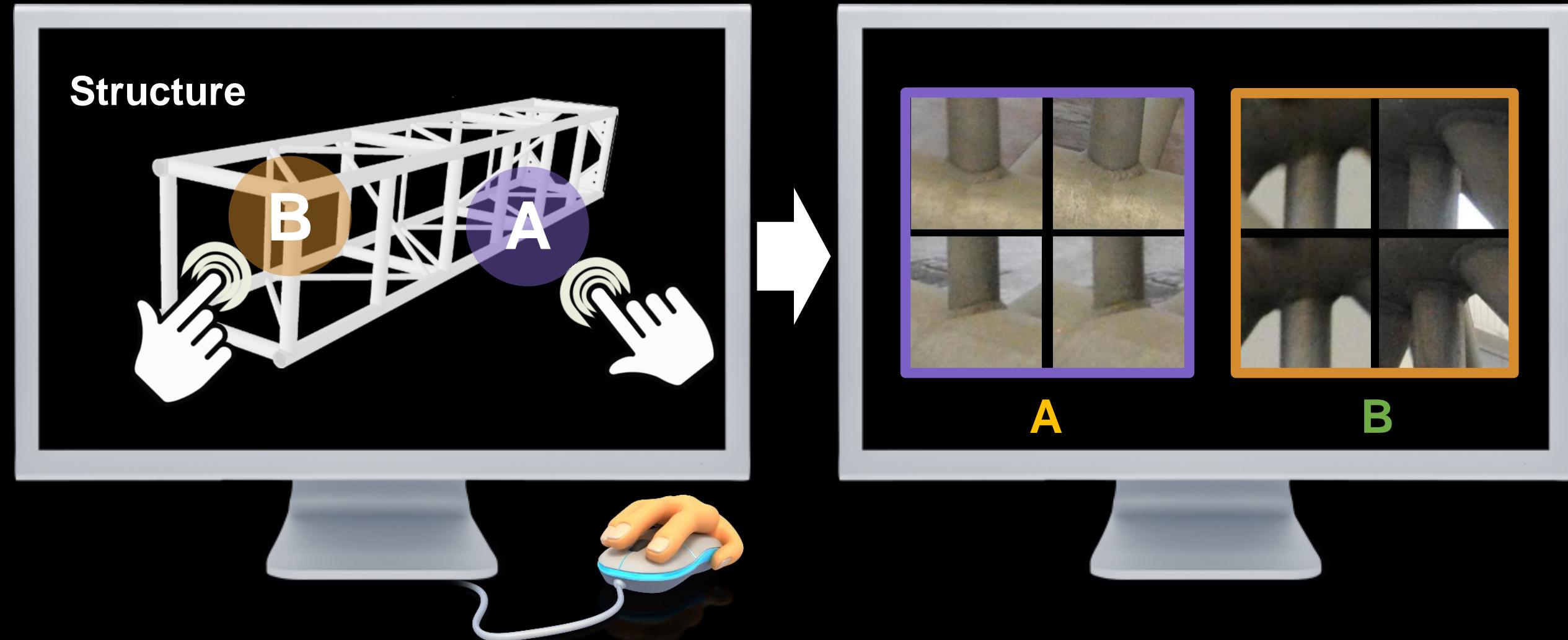


**Large volume of images
collected from drone(s)**

**Regions of interests (ROIs)
localization**

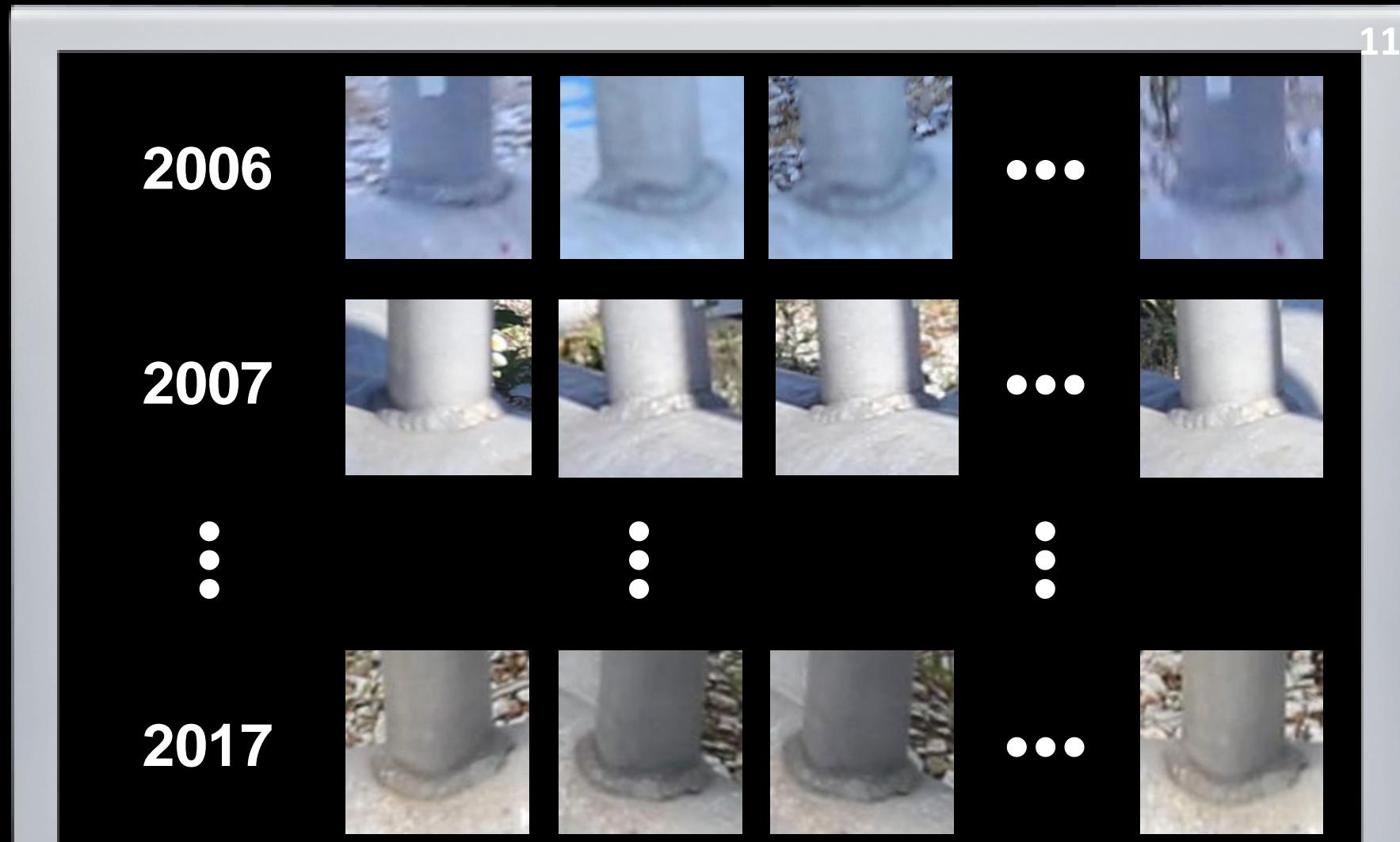
Promising Potential Applications: ROI Extraction

10



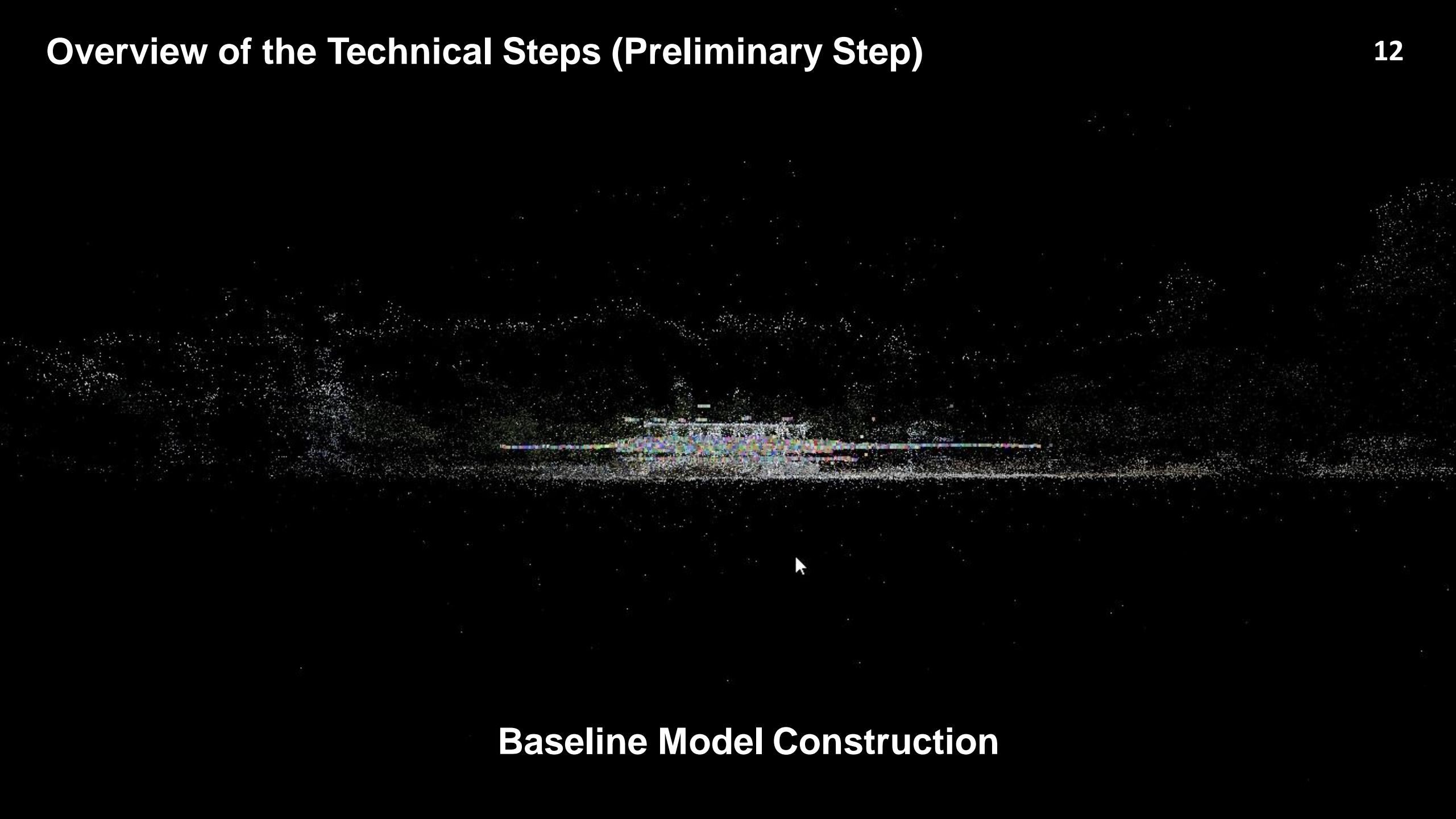
Promising Potential Applications: Life Cycle Management

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Overview of the Technical Steps (Preliminary Step)

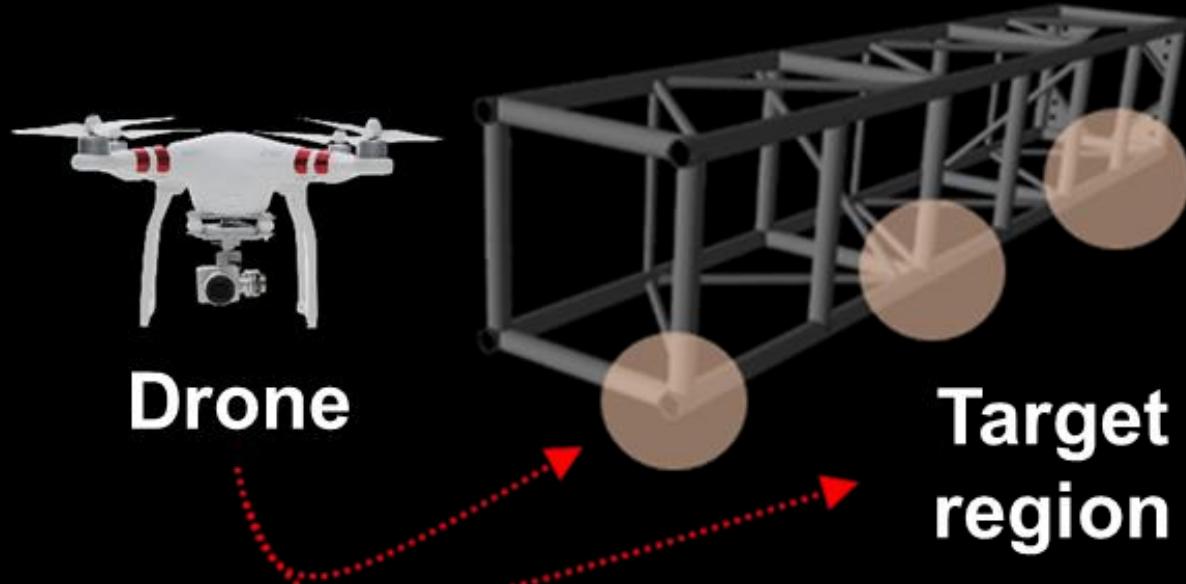
12



Baseline Model Construction

Overview of the Technical Steps (Actual Inspection)

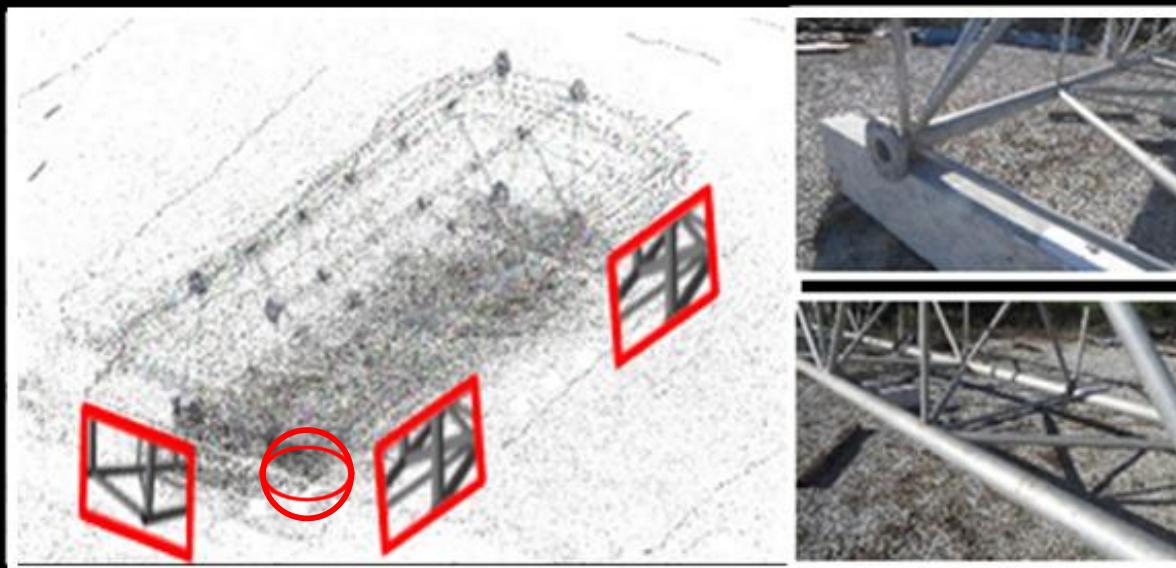
13



Step 1. Image Collection

Overview of the Technical Steps (continue)

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Step 2. Image Registration



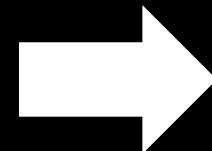
Step 3. ROI Localization

What is Structure from Motion (SfM)?

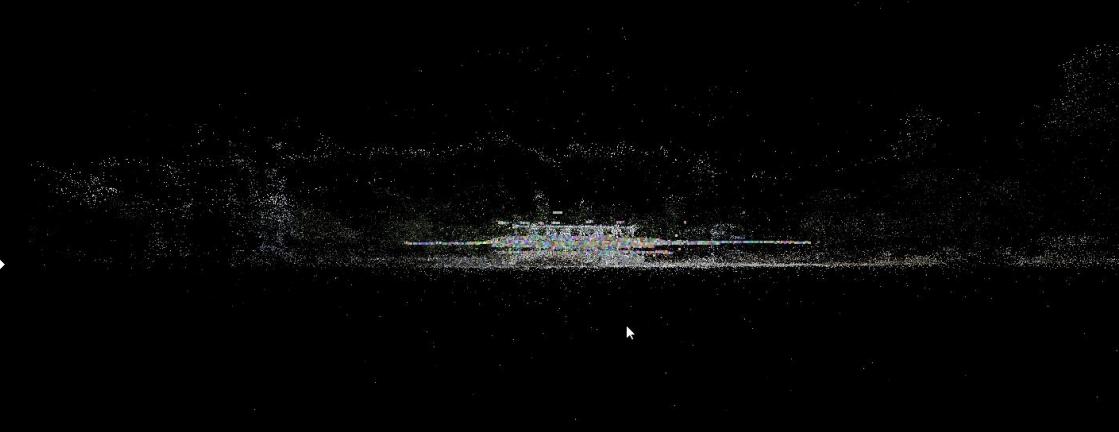
15



Pictures



Scene structure & Camera locations and parameters

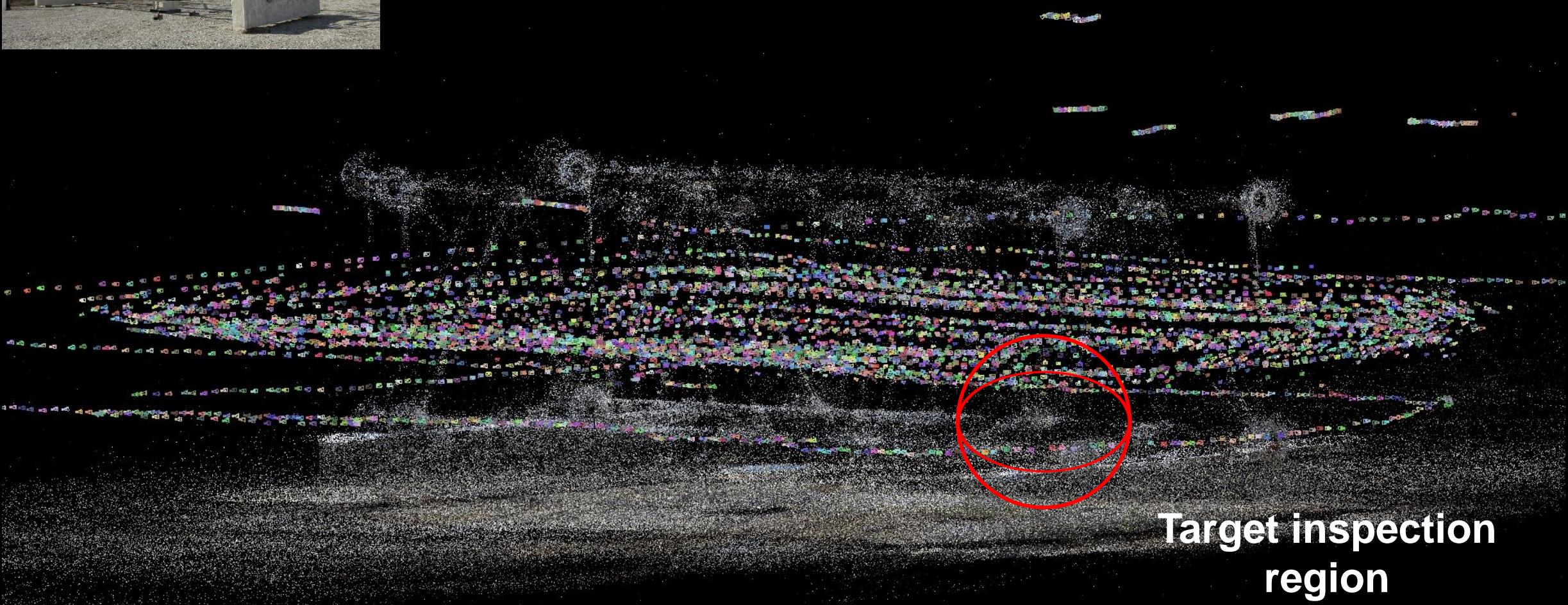


ROI Localization using Geometric Relationships

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Baseline model



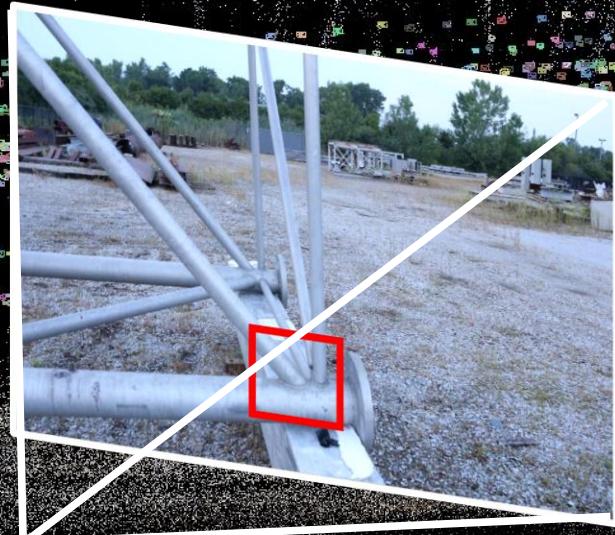
Target inspection
region

ROI Localization using Geometric Relationships (continue)

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Baseline model



Test image

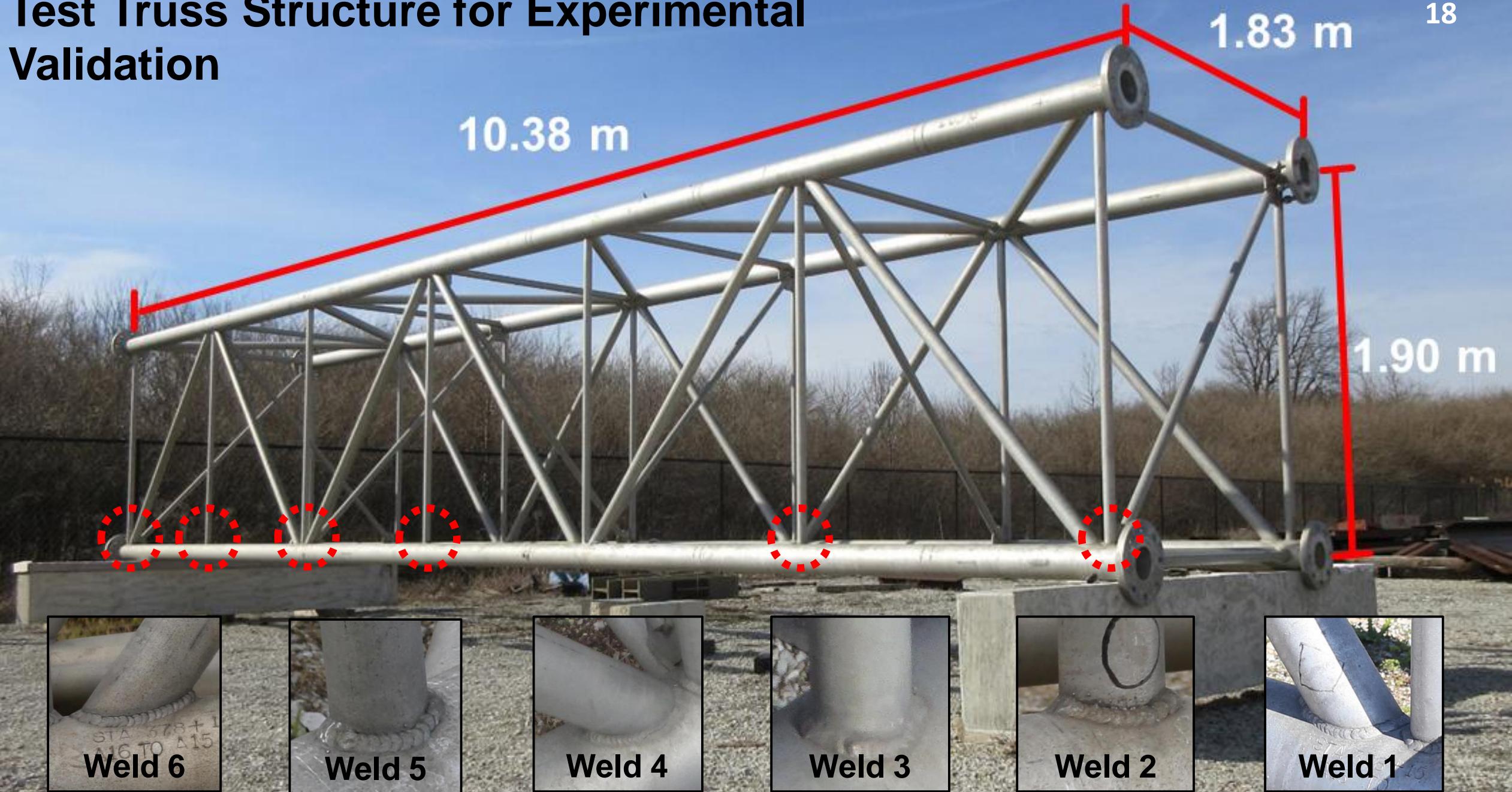
Image registration



Target inspection region

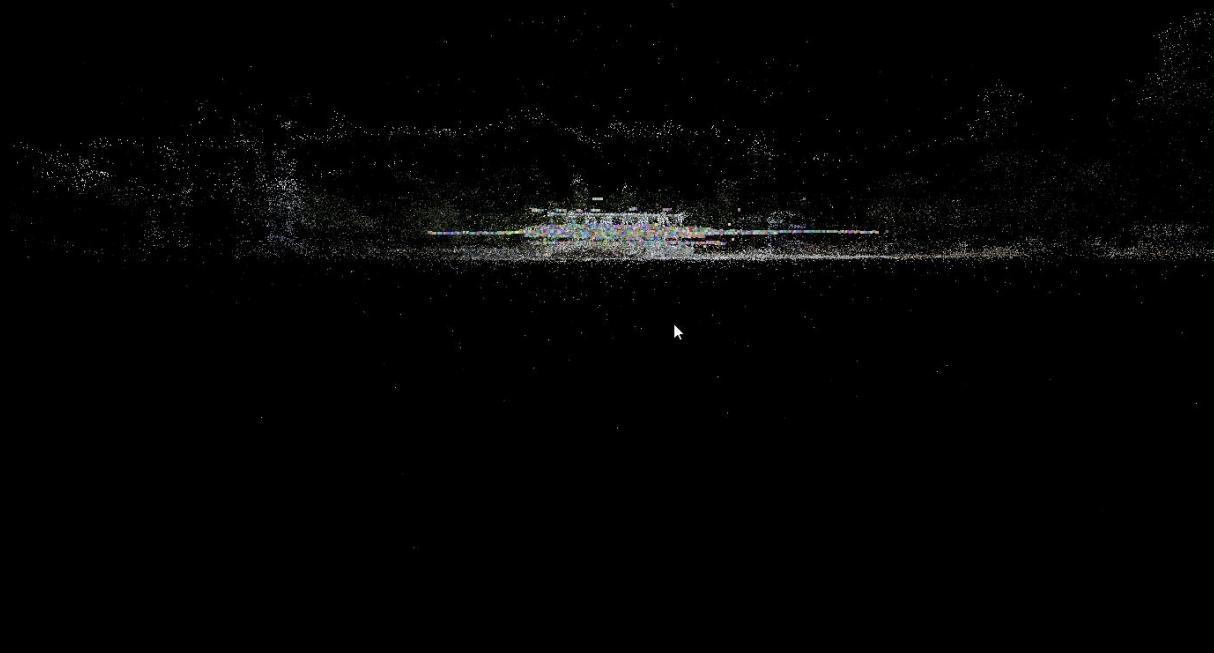
Test Truss Structure for Experimental Validation

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Baseline Model Construction

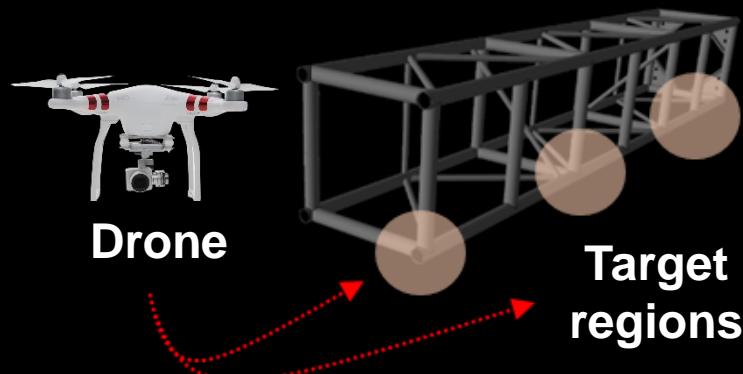
19



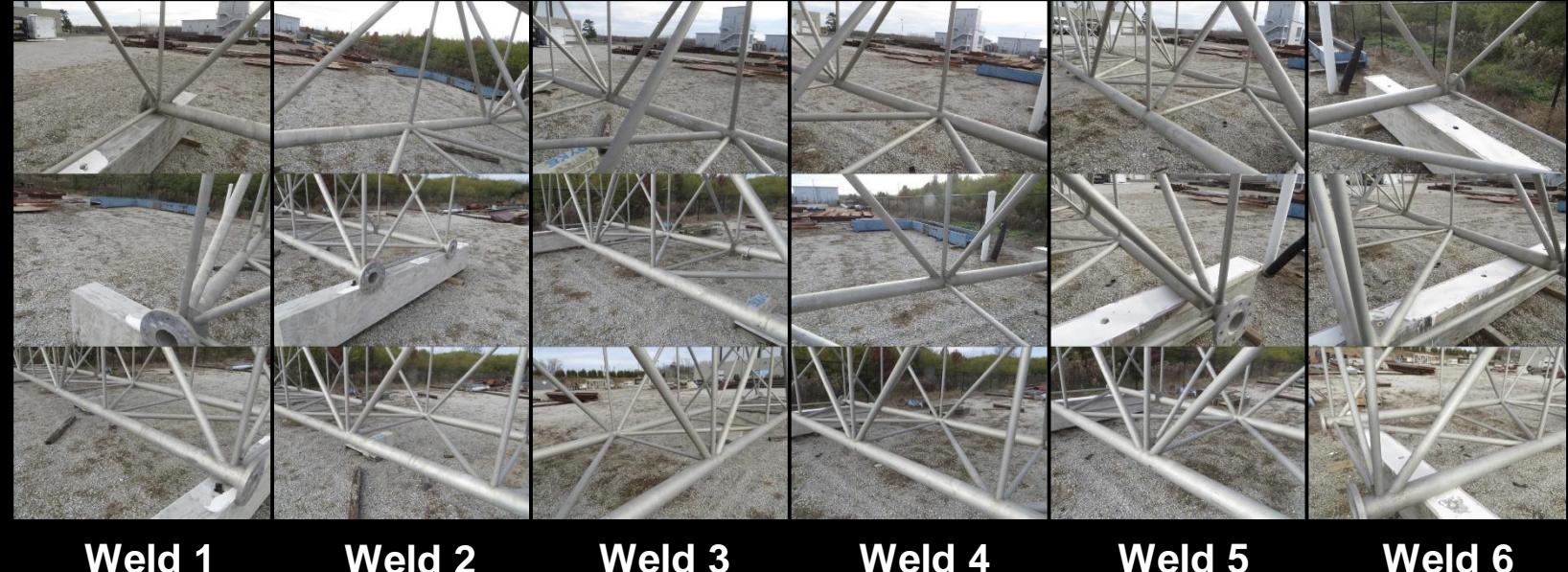
A total of **5,321** images are collected from the test structure during **five** months and **11 different days** under different time window in a day and/or weather conditions.

Image Collection

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(b) Step 1: Image collection



	Weld 1	Weld 2	Weld 3	Weld 4	Weld 5	Weld 6
# of images	119	77	88	84	60	55

ROI Localization

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Weld 1

Weld 2

Weld 3

Weld 4

Weld 5

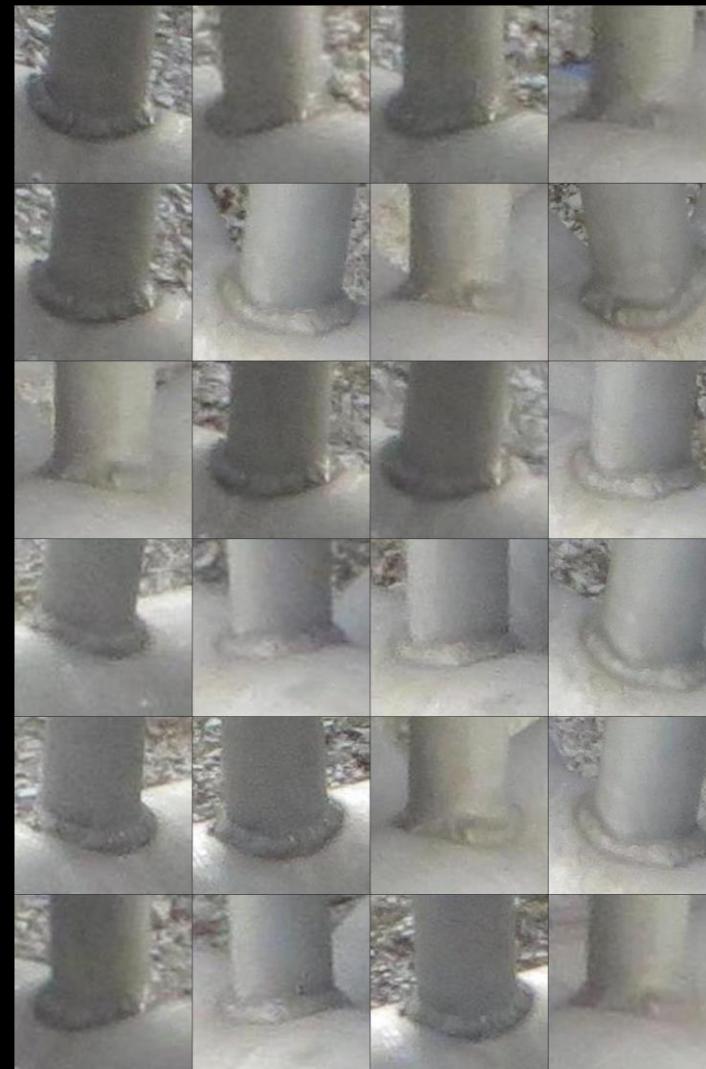
Weld 6

Samples of Localized ROIs from Weld 1, 3, and 6

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Weld 1



Weld 3



Weld 6

Results of the ROI Localization

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	Weld 1	Weld 2	Weld 3	Weld 4	Weld 5	Weld 6
# of images	119	77	88	84	60	55
# of localized ROIs	104	51	54	70	45	47



Too small (insufficient resolution)

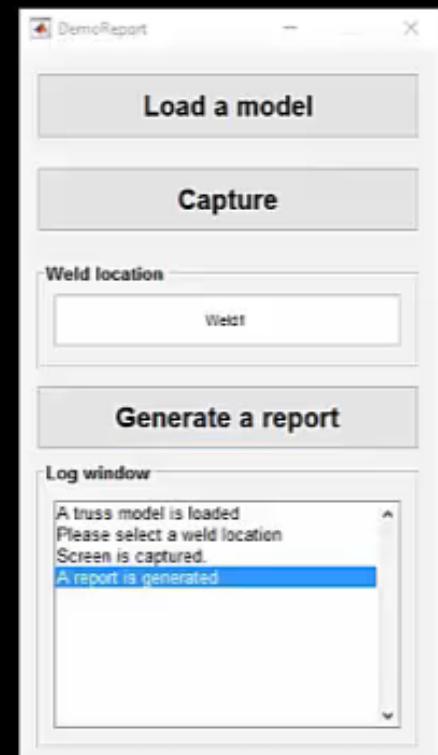
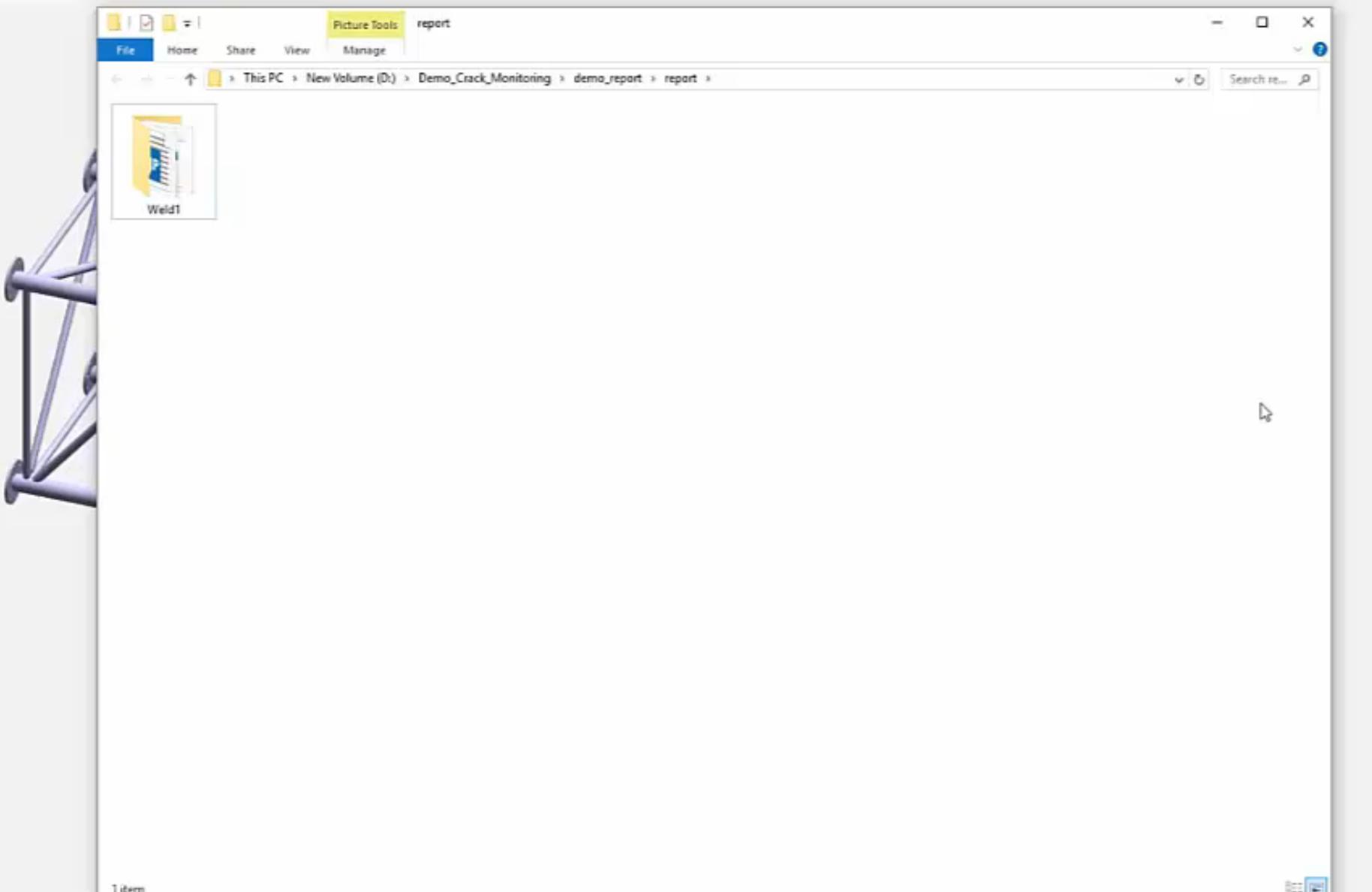
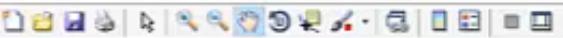


Not visible

The screenshot shows the MATLAB IDE interface. The top menu bar includes FILE, EDIT, BREAKPOINTS, and RUN. The toolbar contains icons for Find Files, Insert, Comment, Breakpoints, Run, Run and Advance, Run Section, Run and Time, and Run and Advance. The code editor window displays a script named DemoReport.m located at D:\Demo_Crack_Monitoring\demo_report\DemoReport.m. The script contains several MATLAB functions, including varargout = DemoReport(varargin), DemoReport_OpeningFcn(hObject, eventdata, handles, varargin), DemoReport_OutputFcn(hObject, eventdata, handles), Load_Callback(hObject, eventdata, handles), capture_Callback(hObject, eventdata, handles), and TRIname_Callback(hObject, eventdata, handles). The command window at the bottom left shows 'fx >>'. The workspace browser and current folder browser are visible on the right side of the interface.

```
1 function varargout = DemoReport(varargin) ...
44 % End initialization code - DO NOT EDIT
45
46
47 % ---- Executes just before DemoReport is made visible.
48 function DemoReport_OpeningFcn(hObject, eventdata, handles, varargin) ...
60
61 % UIWAIT makes DemoReport wait for user response (see UIRESUME)
62 % uiwait(handles.figure1);
63
64
65 % ---- Outputs from this function are returned to the command line.
66 function varargout = DemoReport_OutputFcn(hObject, eventdata, handles) ...
74
75
76 % ---- Executes on button press in Load.
77 function Load_Callback(hObject, eventdata, handles) ...
117
118 % ---- Executes on button press in capture.
119 function capture_Callback(hObject, eventdata, handles) ...
133
134 function TRIname_Callback(hObject, eventdata, handles)
135 % hObject    handle to TRIname (see GCBO) %...
138
139 % Hints: get(hObject,'String') returns contents of TRIname as text
140 %         str2double(get(hObject,'String')) returns contents of TRIname as a double
```

Software implemented using MATLAB





Conclusion

- A novel automated image localization technique is developed to extract **regions of interest** on each of the images in a large set of images before applying vision-based inspection techniques.
- Analysis of such highly relevant and localized images will enable efficient and reliable visual inspection.
- The capability of the technique is **successfully demonstrated** to extract the ROIs of weld connections using **a full-scale highway sign structure**.

Acknowledgement

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