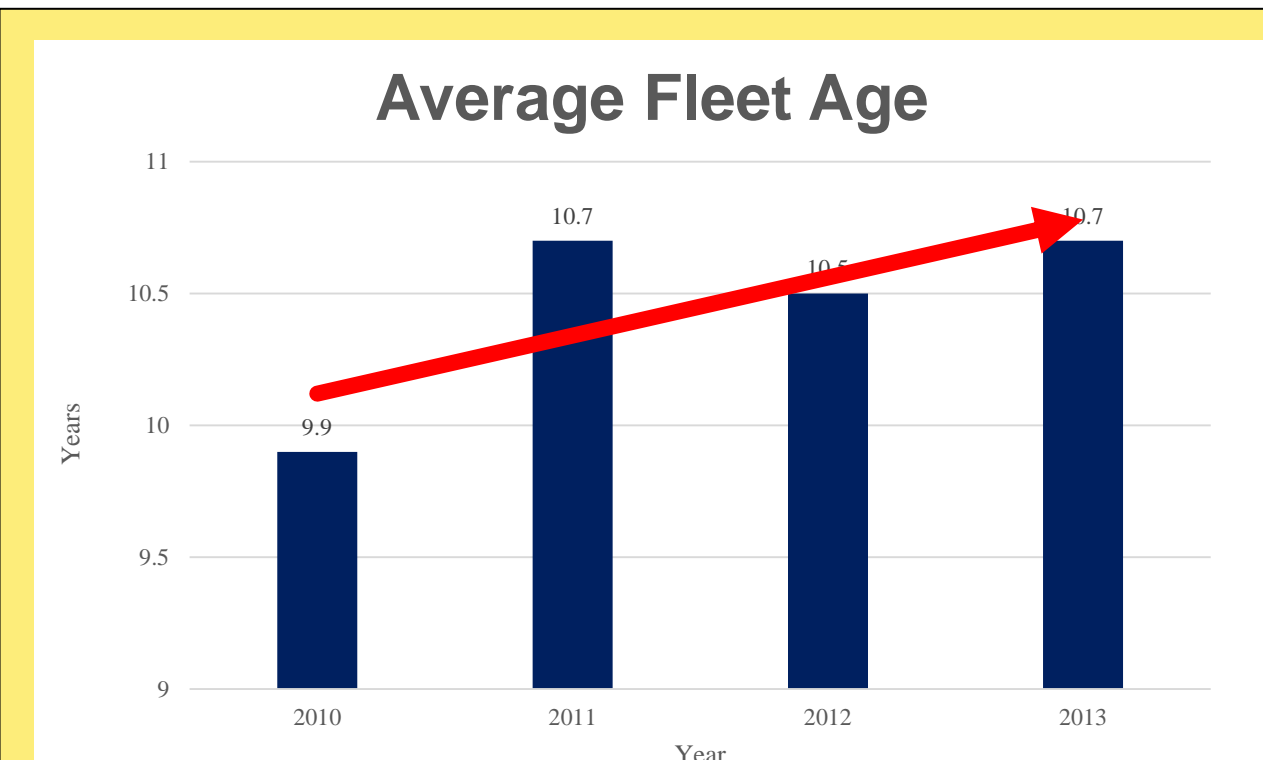
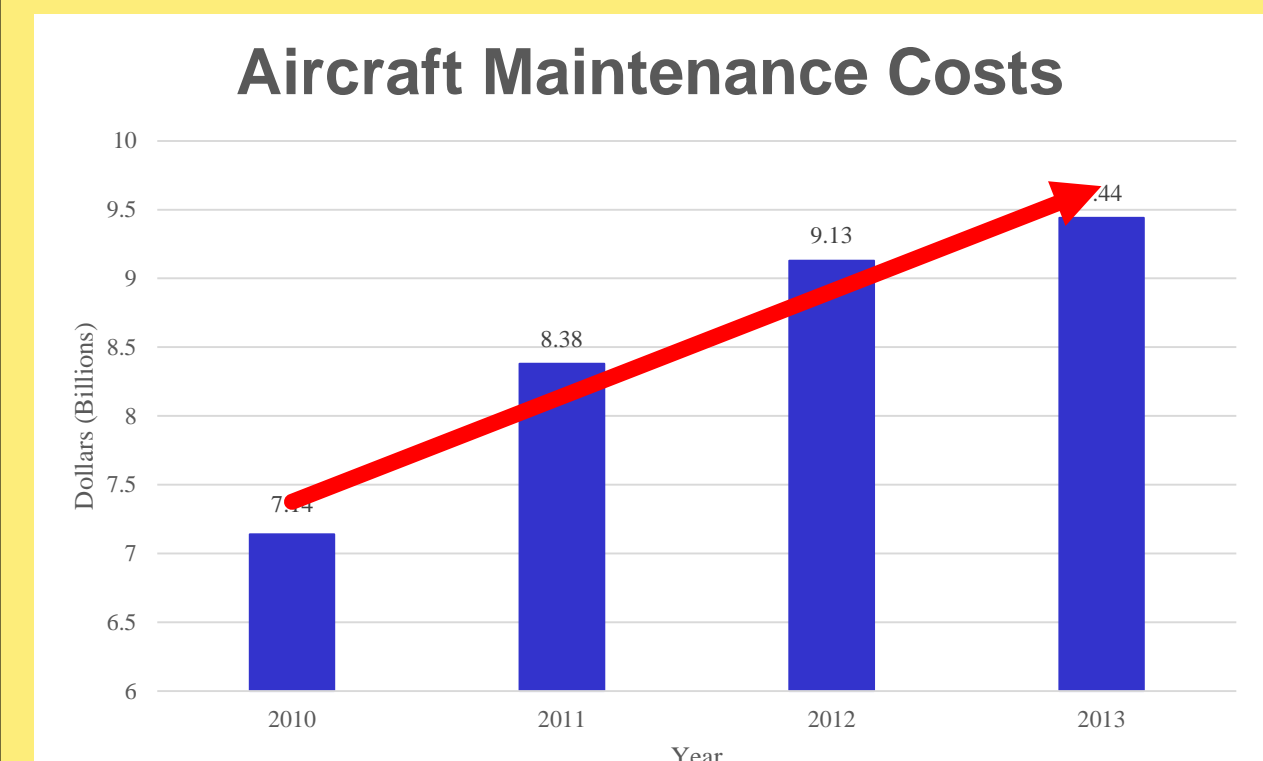


Context

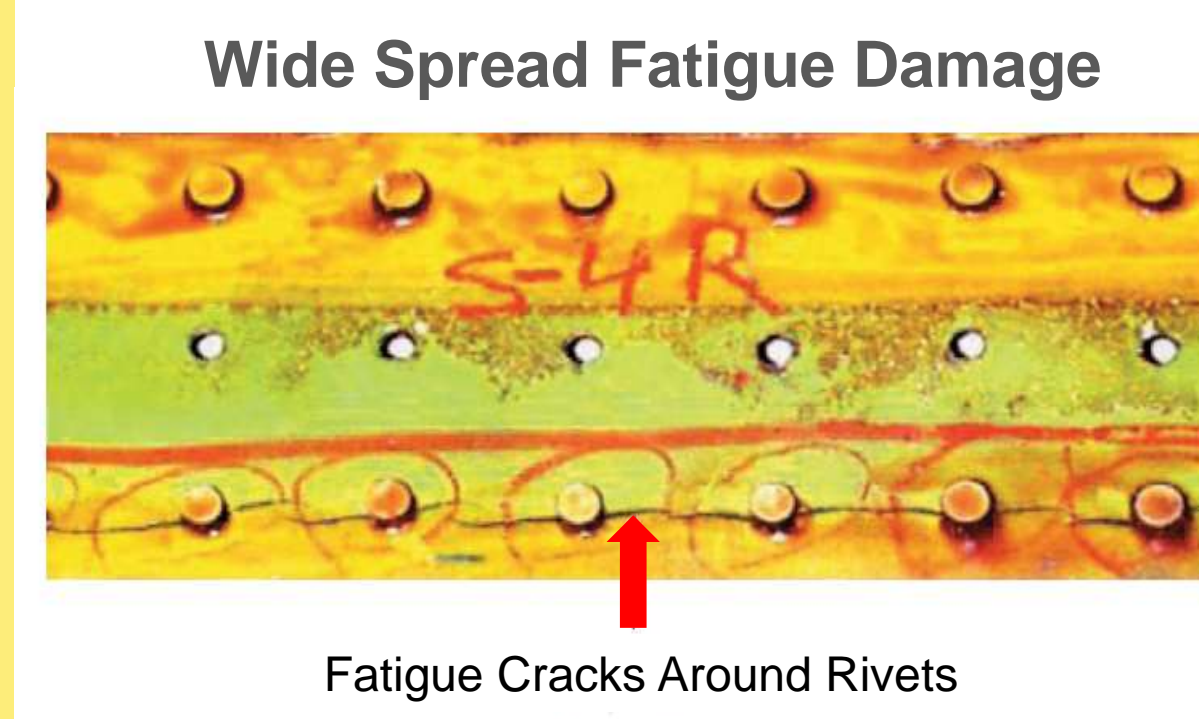
Aircraft of airlines must undergo regular preventative maintenance to meet FAA airworthiness standards. Maintenance, repair, and overhaul companies are tasked with inspecting and maintaining aircraft under strict timetables.



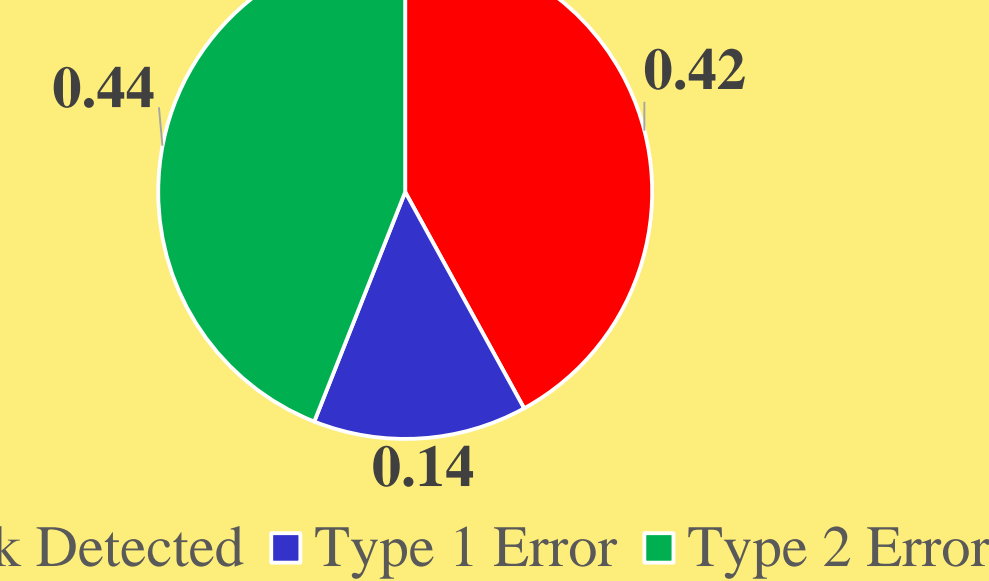
Average aircraft fleet age has **increased 8.1%** from 2010 – 2013. Older aircraft are more prone to fatigue-related damage.



Average annual maintenance costs have **increased 32.2%** from 2010 - 2013.



Human Inspector Crack Detection



Strict timetables lead to aircraft inspectors **missing or misdiagnosing 56%** of cracks and fatigue damage, which can lead to **catastrophic failure**.

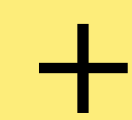
Need Statement & Design Alternatives

Need: Reduce maintenance inspection cost experienced by airlines while improving the quality and reliability of the inspection

Proposed Solution:
 Implement new technology to reduce the potential for human error.

Technology Alternatives

Synthetic Aperture Imaging
 Thermographic Imaging
 Laser Ultrasonic Imaging

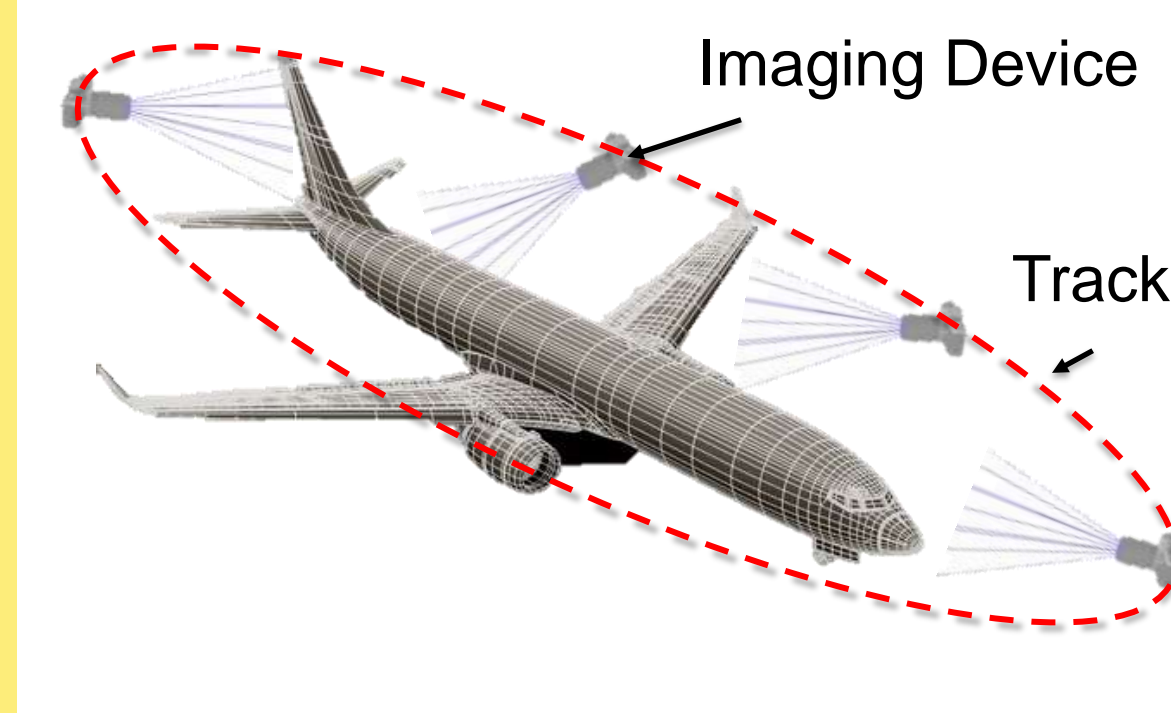


Delivery Method Alternatives

Manual
 Handheld (Contact)
Autonomous
 Robotic Crawler (Contact)
 Track or Robotic Arm (Non-contact)

Enhance Human inspector Capability
 or Replace With Automation

Concept of Operation



Autonomous Imaging Solution
 of Exterior Surfaces

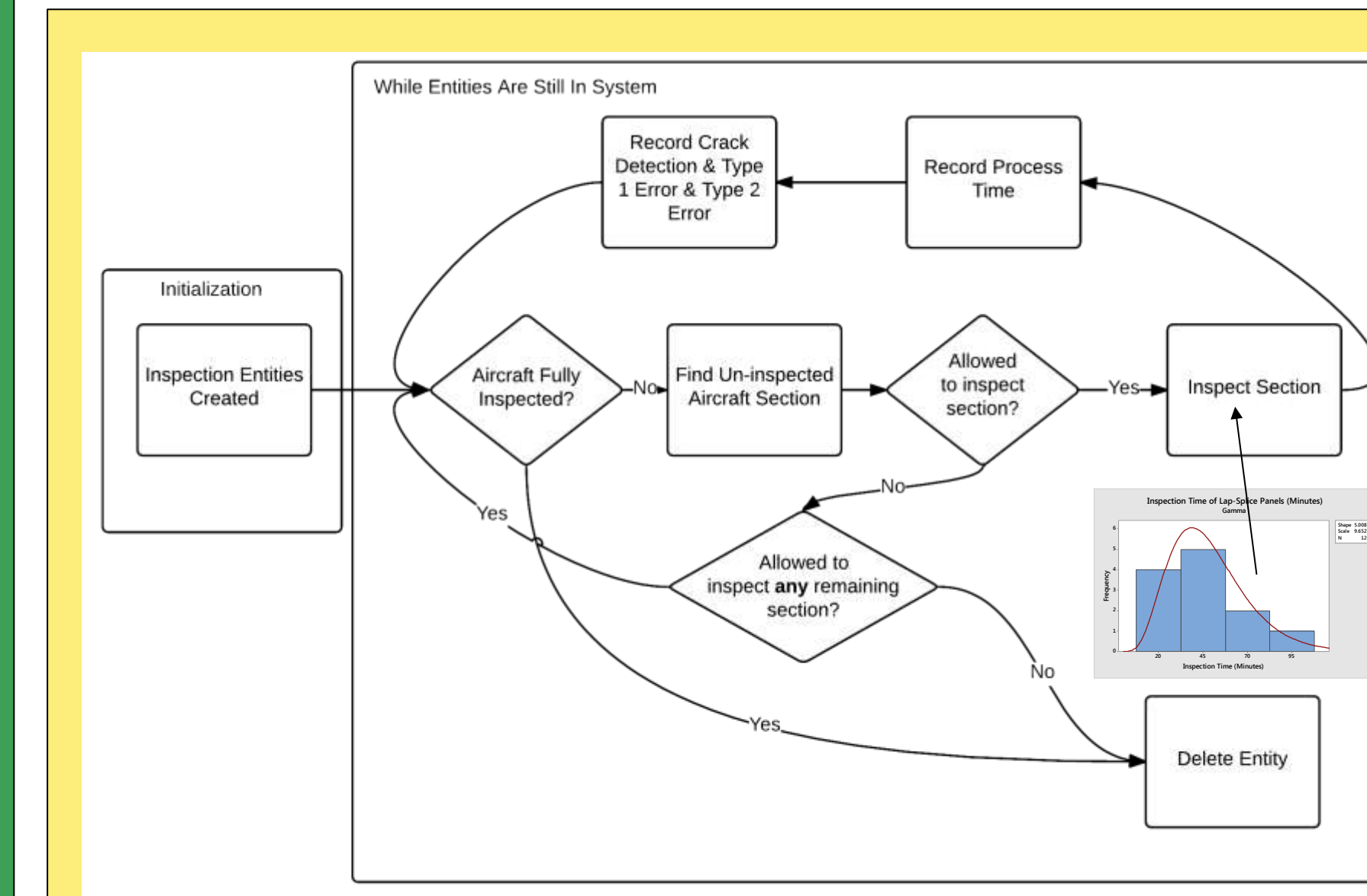
Image Processing Identifies Surface
 Deviations and Supports Decision Makers
 With Detailed Diagnosis

Key Benefits:

Improved Detection of Structural Fatigue
 Computer Aided Decision Support
 Electronic Documentation

Method of Analysis

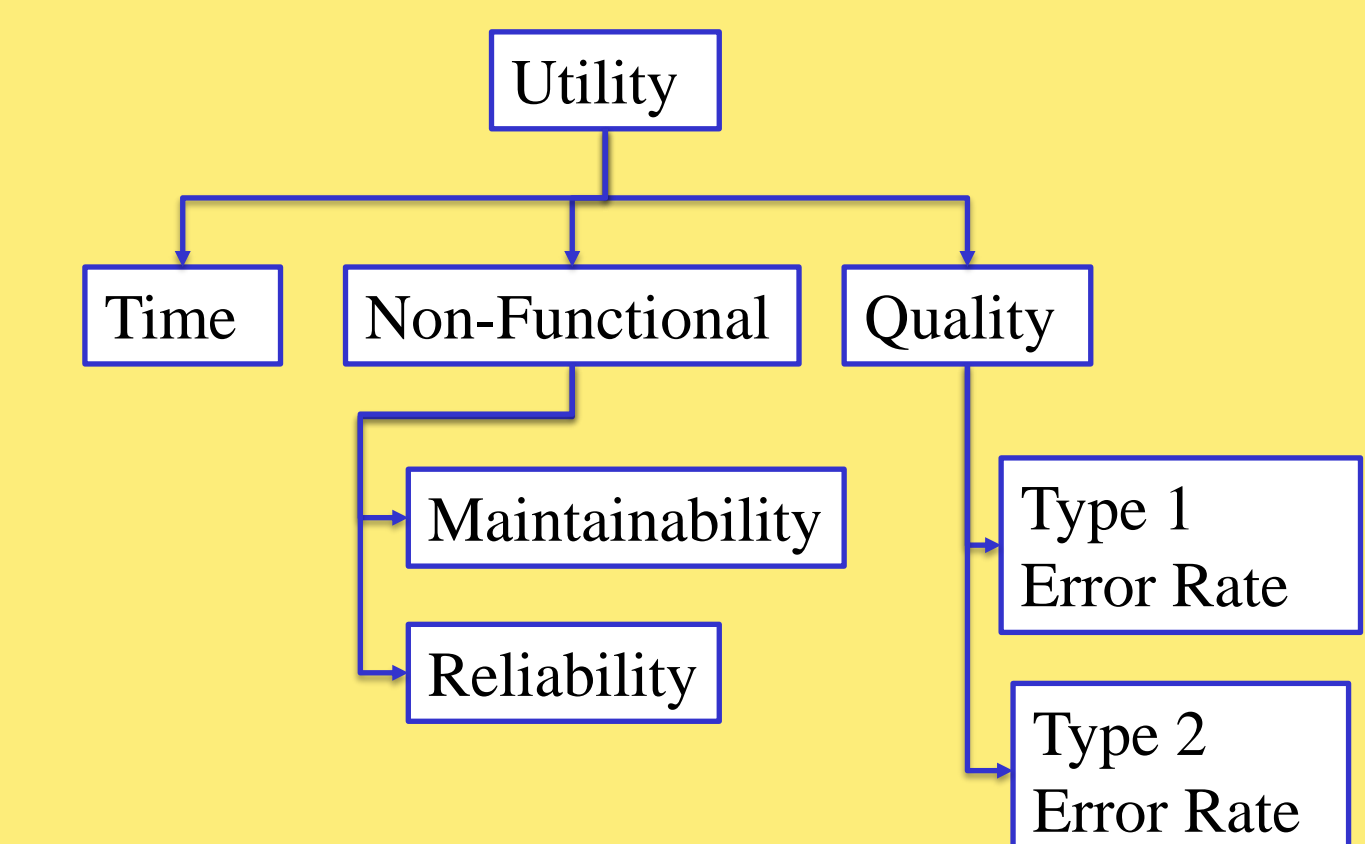
Stochastic Simulation: Ten Representative Regions of Aircraft



Entity Attributes (Input)
 Enhanced vs Automated
 Technology utilized
 Delivery method
 Time distributions
 Crack detection rates

Output
 Total Inspection Time
 Region Inspection Time
 Manual Labor Costs
 Cracks detected
 Type 1 Errors
 Type 2 Errors

Preliminary Utility Hierarchy



Preliminary Results

As-Is Simulation (Unaided human inspector)

Section	Actual (mins)	Simulated (mins)
1	122	116.47
2	28	27.83
3	75	75.38
4	68	67.71
5	37	36.1
6	104	105.64
7	95	100.23
8	35	34.68
9	16	15.2
10	48	49.56

Within 1 minute of expected value

Actual Total (mins)	Sim Total (mins)	Diff (mins)	% err
628	628.81	0.81	<0.1%

Preliminary Results

Utility vs Cost chart
 Sensitivity analysis

Recommendations

Describe the implications of these results
 Link back to the context and need statement

Show how this solution closes the gap.
 Show how it creates a win-win.