

F-35 PRODUCTION – ADVANCED MANUFACTURING AND THE DIGITAL THREAD

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TOPICS

- F-35 Production Overview
- Advanced Manufacturing and The Digital Thread
- Industry 4.0 and The Future of the Digital Thread
- Summary

F-35 FINAL ASSEMBLY - ~300 AIRCRAFT DELIVERED TO DATE



Wing Structures

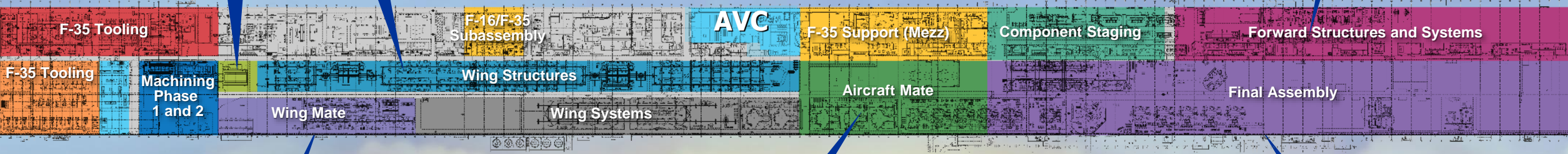


F-35 Production – Fort Worth



Forward

Coordinate Measurement Machine



Mate/Wing Systems

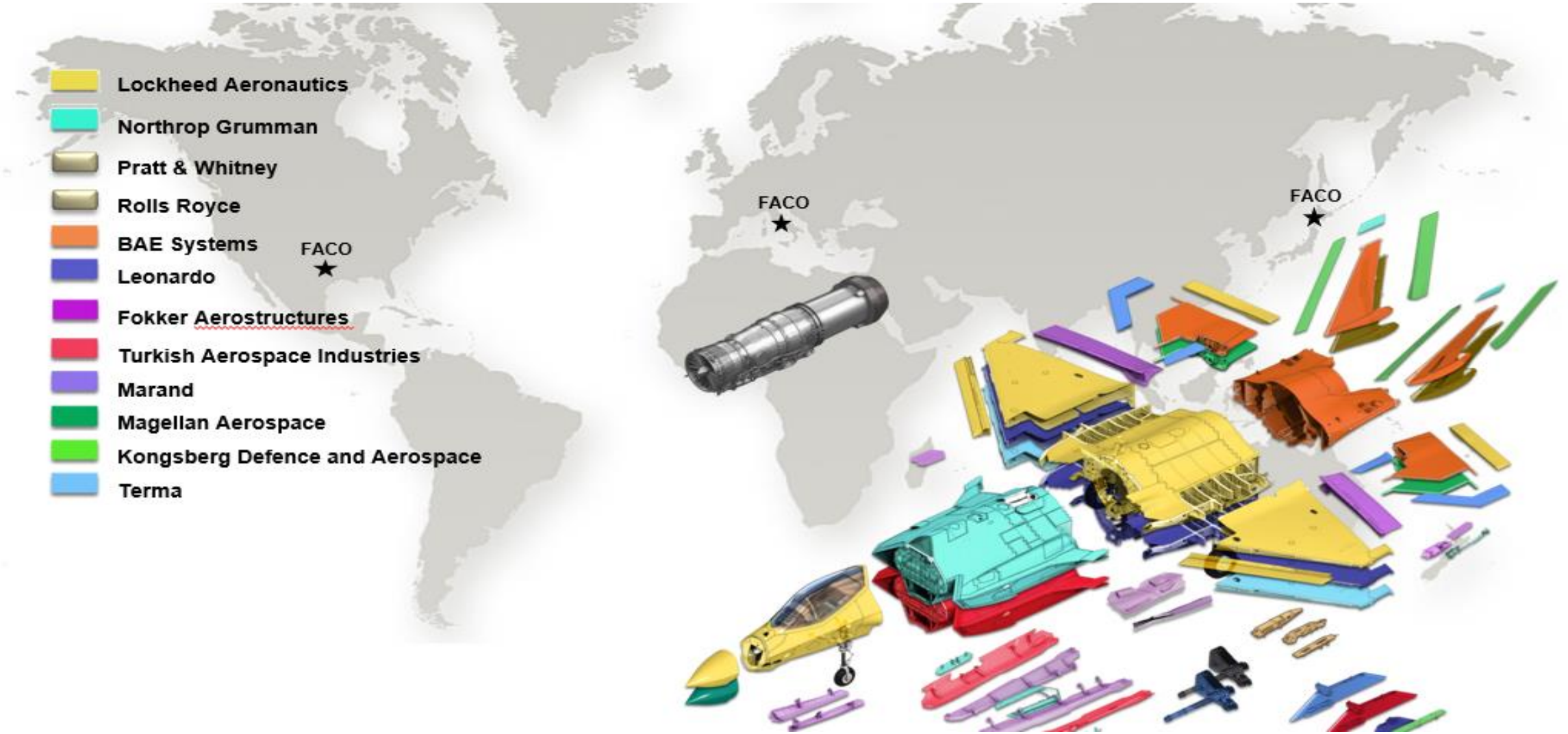


Aircraft Mate



Final Assembly

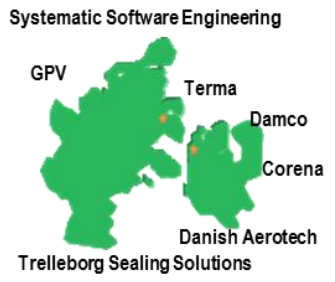
F-35 GLOBAL SUPPLY CHAIN – COMPONENT PRODUCTION



F-35 Global Supply (1450 Domestic Suppliers, 80 in 11 COUNTRIES)

Final Assembly and Check-Out Campuses

Denmark



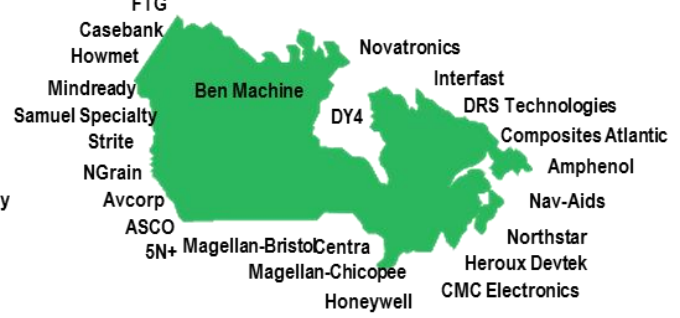
The Netherlands



Norway



Canada



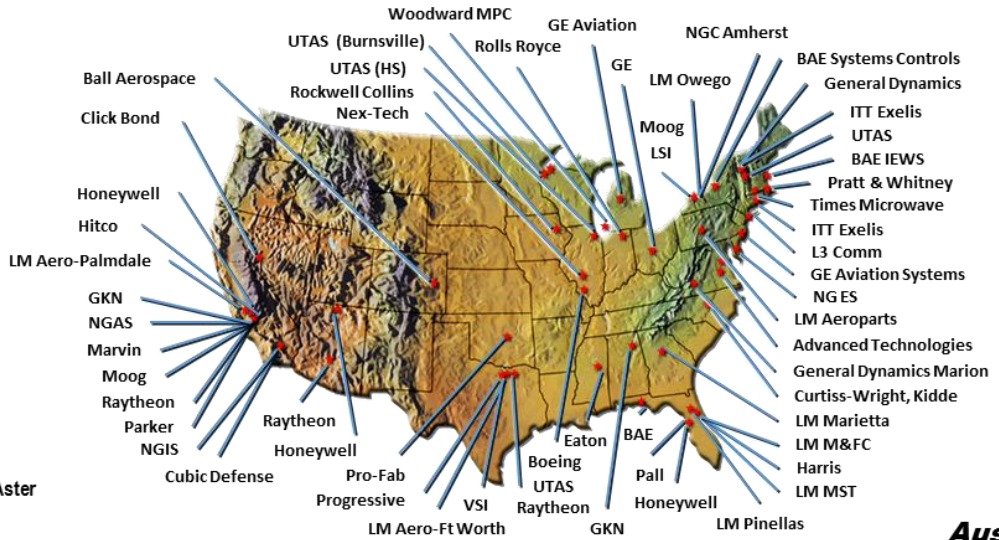
Japan



Italy



United Kingdom



Israel

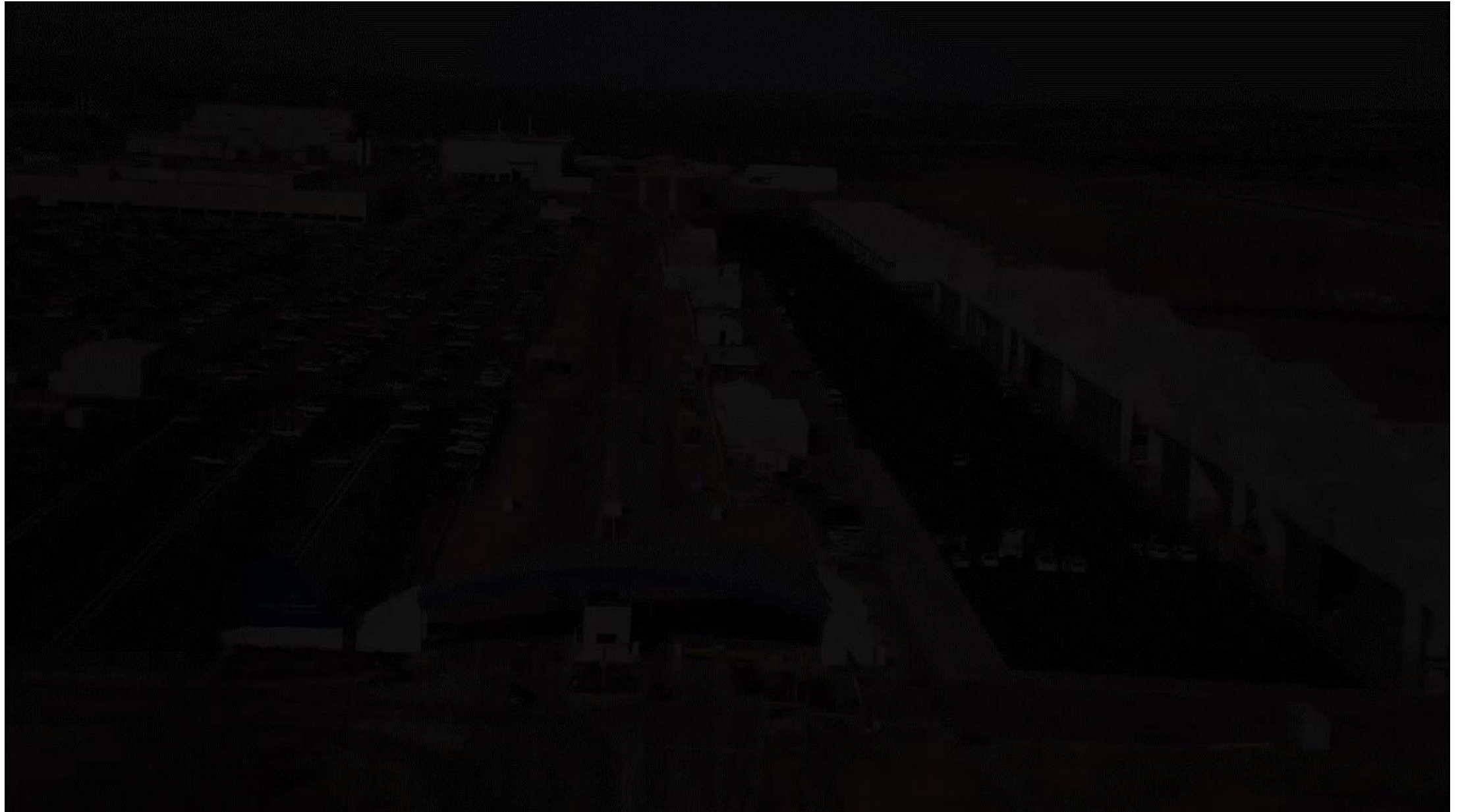


Australia

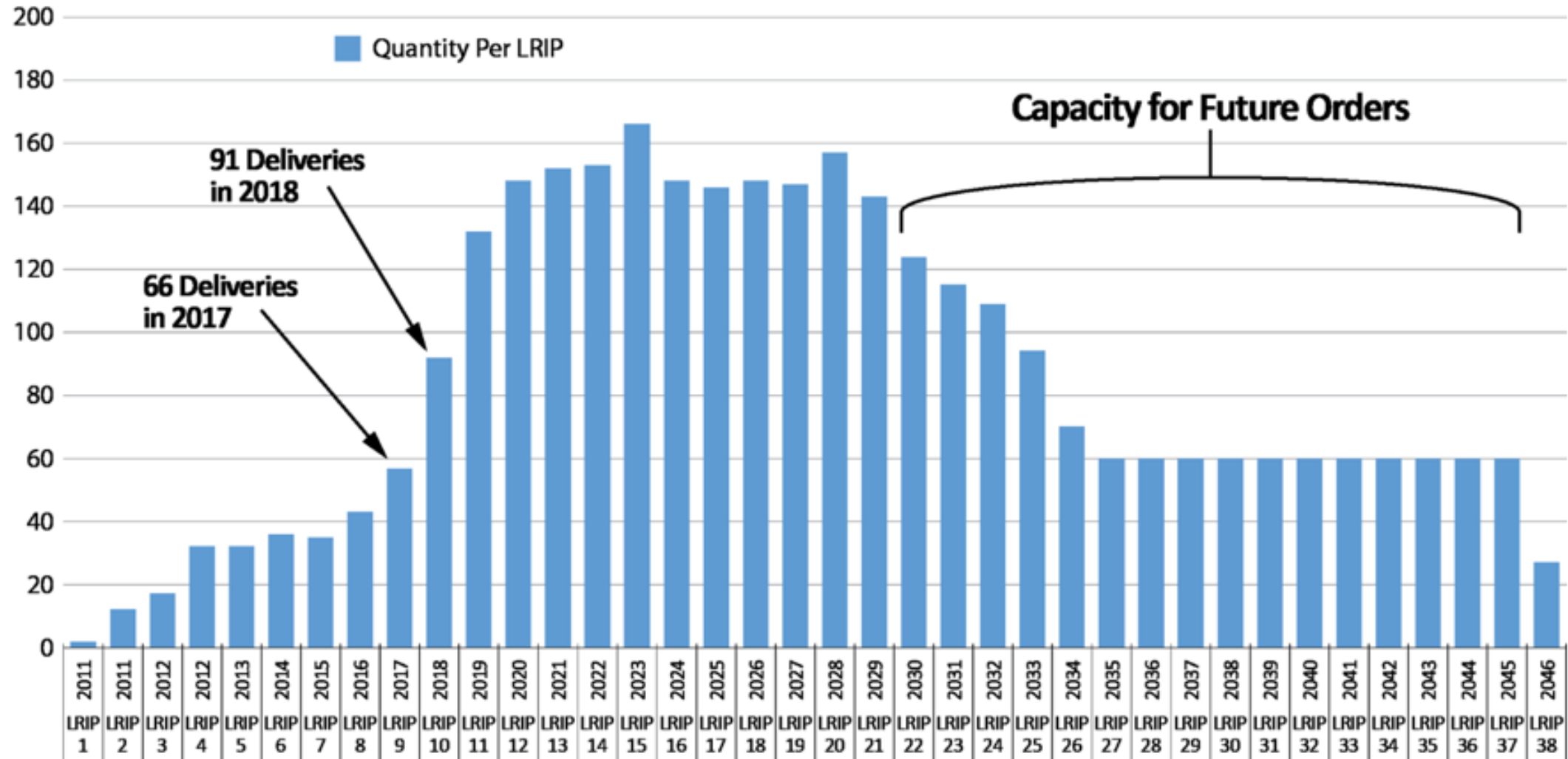


Turkey

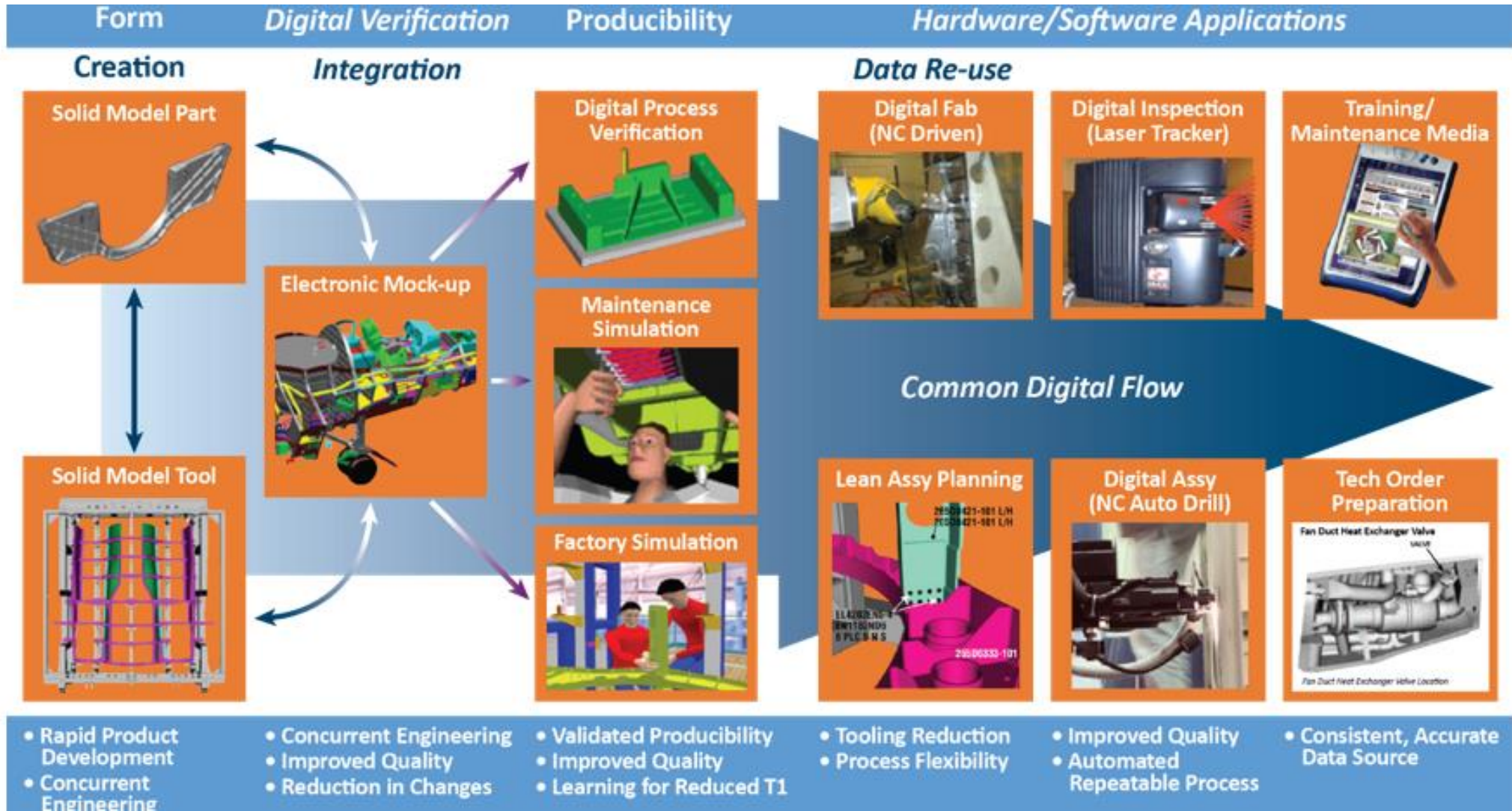




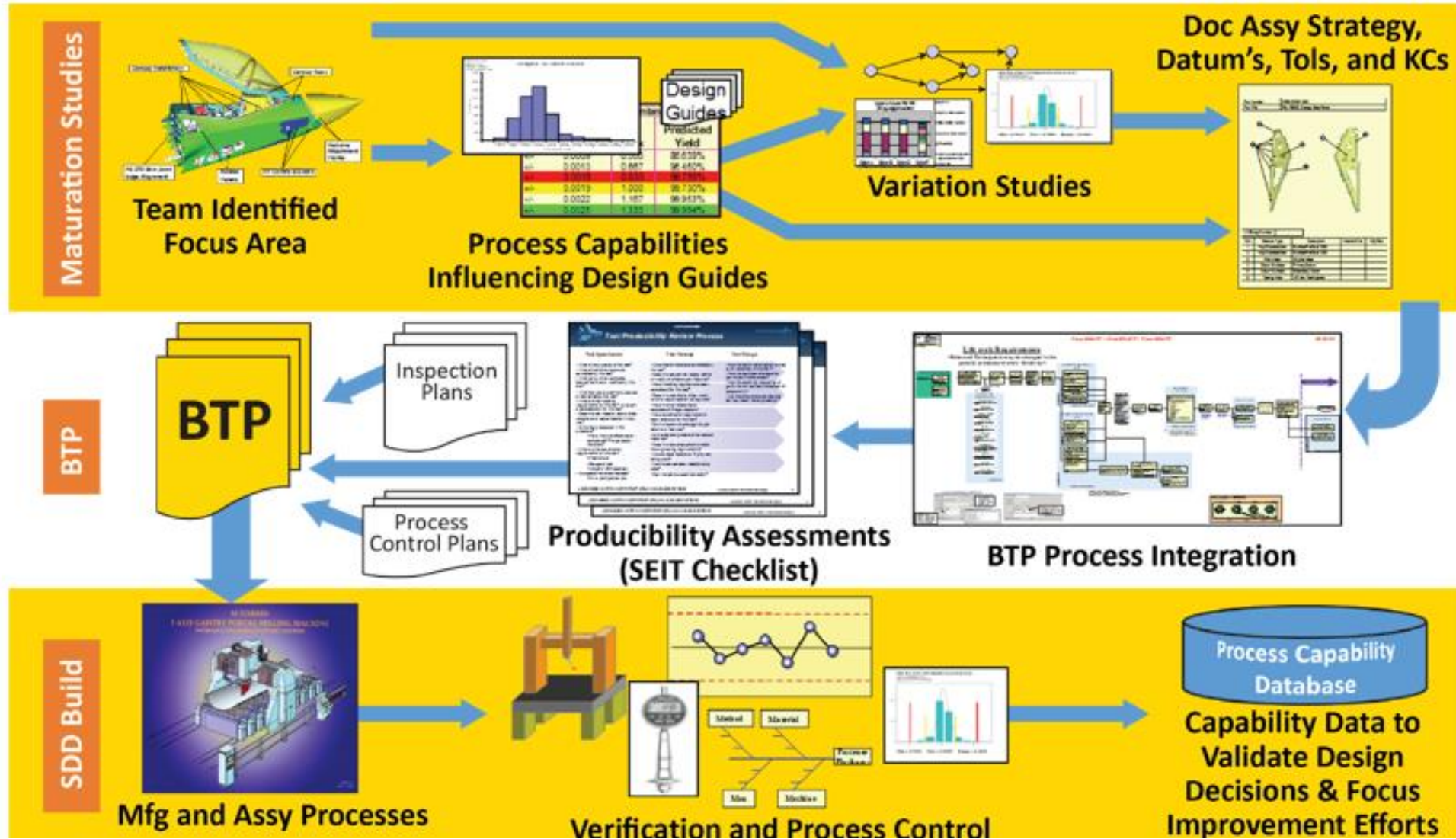
F-35 PRODUCTION RAMP



THE DIGITAL THREAD



PRODUCIBILITY AND KEY CHARACTERISTICS



AUTO-DRILLING



ROBOTIC COATINGS APPLICATIONS



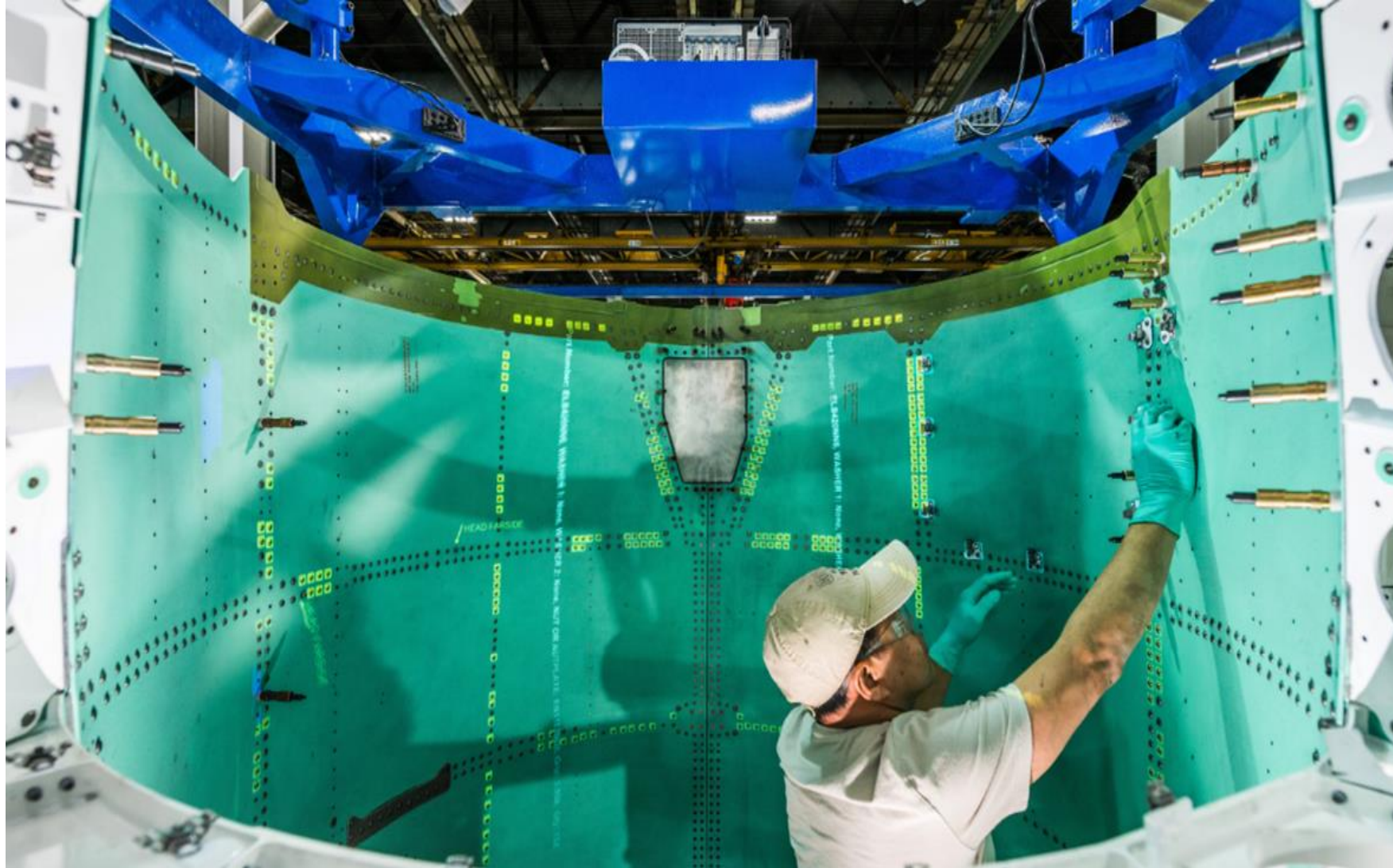
Aircraft Final Finishes (AFF)

In the AFF, robots are used for the application of stealth coatings to completed aircraft. Only automation can cost effectively control the process to the required engineering tolerances.

AUTOMATION AT BAE – ROBOTIC COUNTERSINKING



OPTICAL PROJECTION OF WORK INSTRUCTIONS



3D PRINTED TOOLING



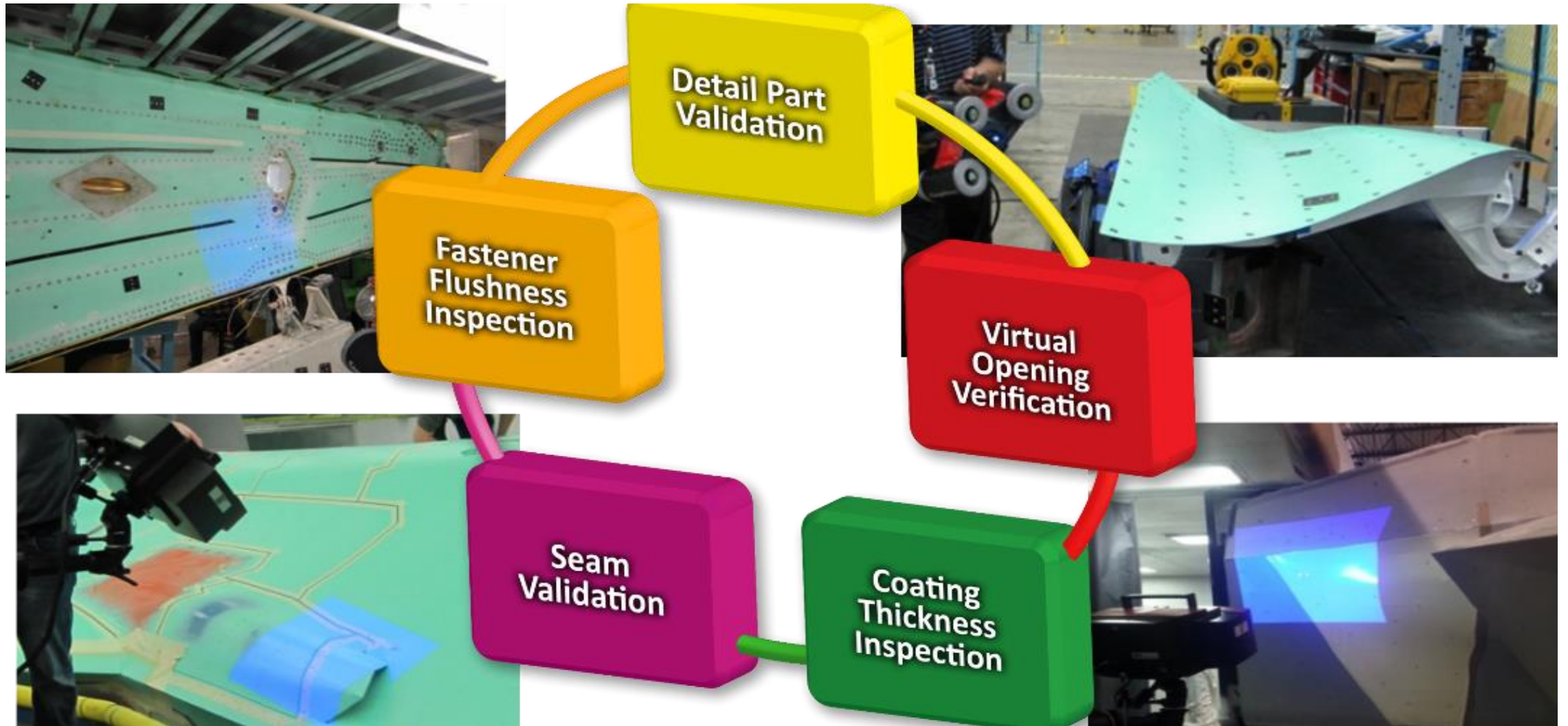
NON-CONTACT METROLOGY – TYING THE KNOT IN THE DIGITAL THREAD



Non-Contact Metrology

Non-contact Metrology systems use structured light to measure the "as-built" configuration of the part or assembly. These images can then be directly compared to the engineering 3D model for validation.

AS-DESIGNED TO AS-BUILT VALIDATION



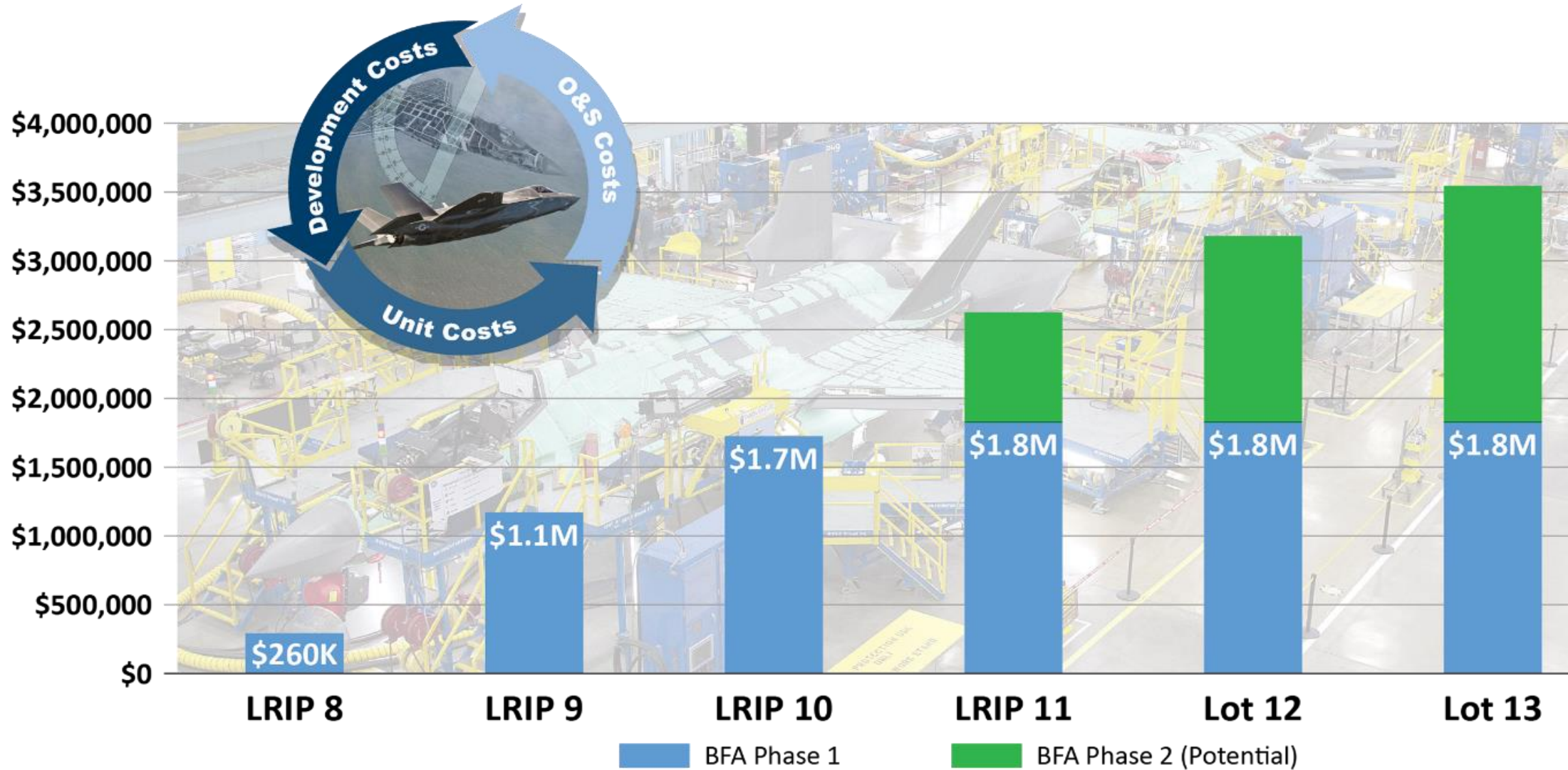
LEAN MANUFACTURING PRINCIPLES



Overhead Rail System

The F-35 program uses a flow-to-takt, lean manufacturing system that incorporates an overhead rail to move components from station to station at the same rate as rollout. This factory flow, automotive-like rhythm is designed to drive standard work in each position, reducing span and cost.

BLUE PRINT FOR AFFORDABILITY

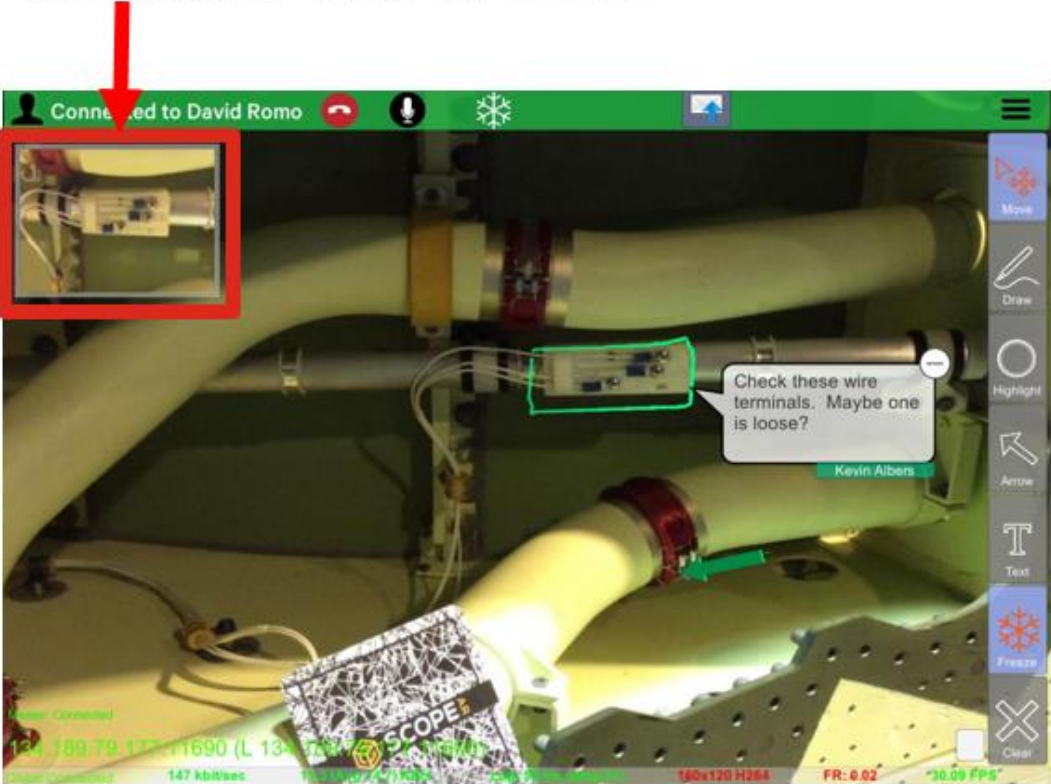


FUTURE DIGITAL THREAD TECHNOLOGIES



REMOTE AUGMENTED REALITY

“Technician” view on Tablet



“Expert” view at Desktop Computer

“Technician” view on Tablet

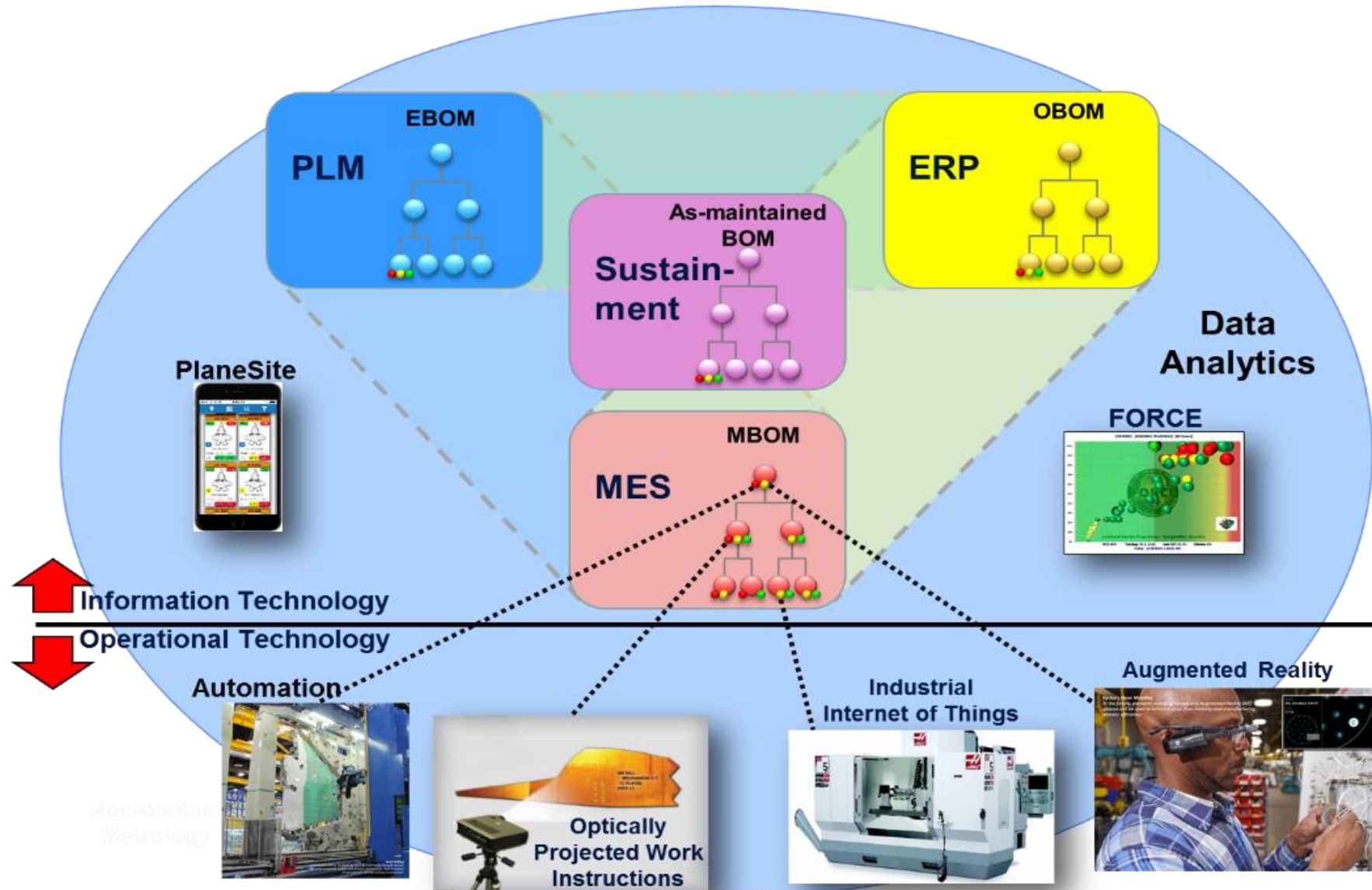


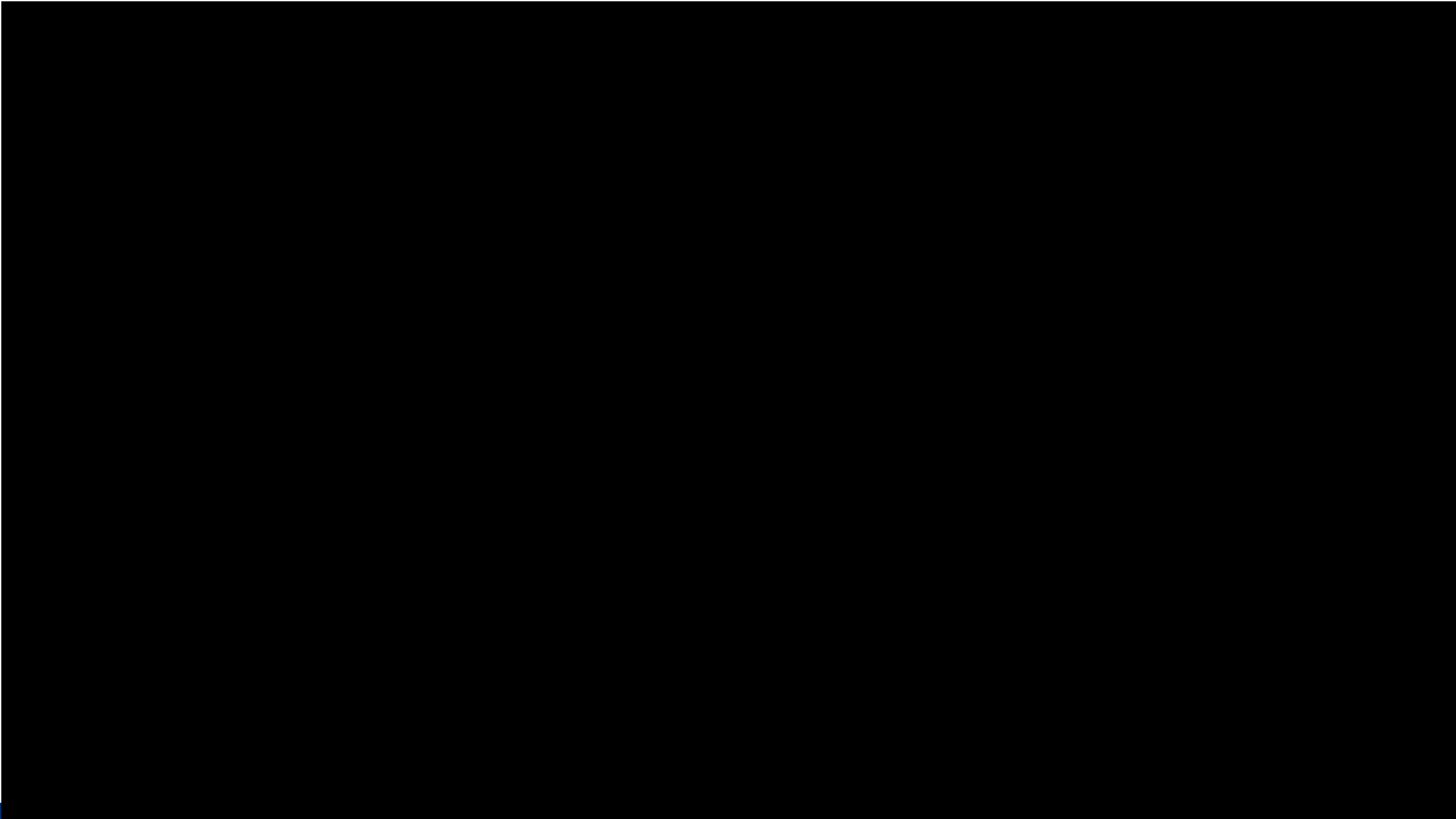
“Expert” view at Desktop Computer

CRYOGENIC MACHINING FOR SUPPLIER COST SAVINGS



INDUSTRY 4.0 – THE 4TH INDUSTRIAL REVOLUTION





SUMMARY

- The F-35 Program has utilized the digital thread to support design, manufacturing, and sustainment development and the implementation of advanced manufacturing technologies such as autodrilling, robotic coatings, optical projection, additive manufacturing, and noncontact metrology.
- The F-35 is in a unique position, with the long term production forecast, to continue to develop and apply advanced manufacturing technologies for quality improvements and cost reduction.
- Many of the advanced manufacturing technologies have applications to the sustainment of the aircraft.
- Industry 4.0, the next industrial revolution, is coming. Data integration and data automation will bring improved system visibility and allow descriptive, predictive, and prescriptive data analytics to improve overall system performance.

QUESTIONS?

