

The MRO Experience



Randy Thomas

Director, Customer Business, Commercial
and Planning



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Introduction



The MRO marketplace is dynamic consisting of a number of different sub-markets each with their own complexities

Aircraft

Engines

Components

Each of these can be broken into yet further markets

In TAESL's case we are in a large fan MRO market with engine thrust greater than 40,000 lbs





TAESL



Texas Aero Engine Services LLC "TAESL" is a 50/50 joint venture of American Airlines and Rolls-Royce

Operating out of a 450,000 square foot facility with test cell capabilities to test up to 130,000 lbs thrust





TAESL provides repair services for Rolls-Royce RB211-535E4 powering B757's, and Trent 800 powering B777's

1998

FAR Part 145 certification and began off-wing repair and maintenance on the Tay 650 and RB211-535E4B engines.

December 1999

TAESL received its first Trent 800 engine

Currently we have the capabilities of 180 engines a year

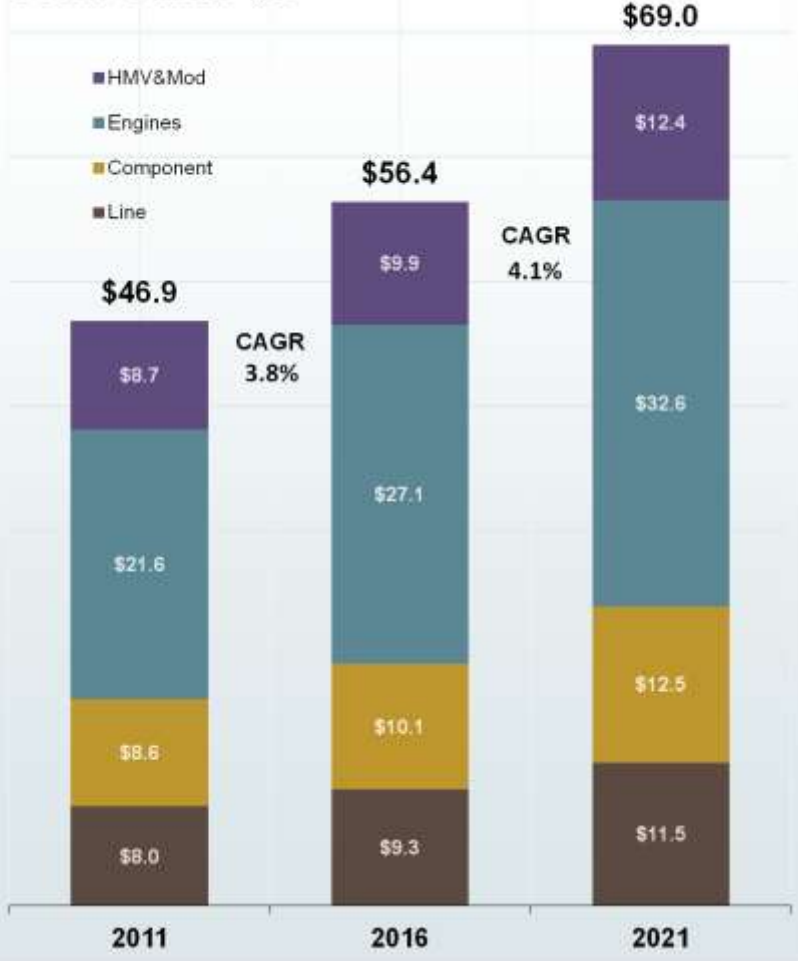
\$600 - \$700 million annual revenue stream

TAESL is the largest RB211 535E4 overhaul shop in the world

MRO Market



2011 Global MRO Forecast
Total Value \$B



In 2011, global MRO spend will be up 10.8% over 2010, to \$46.9B

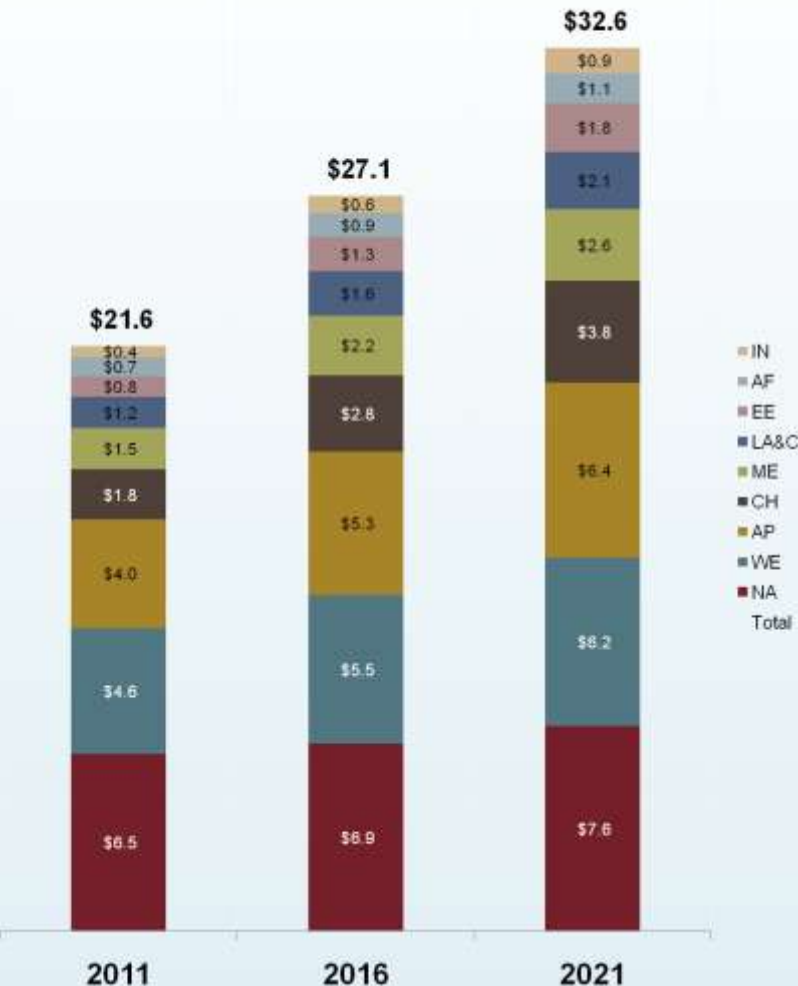
\$46.9B industry will grow to \$69.0B over 10-year forecast period

Engines remain the largest segment with the highest growth rate

Engine MRO Market



2011 Global Engine MRO Forecast
Total Value \$B



Engine growth is expected to maintain a 4.2% CAGR through 2021

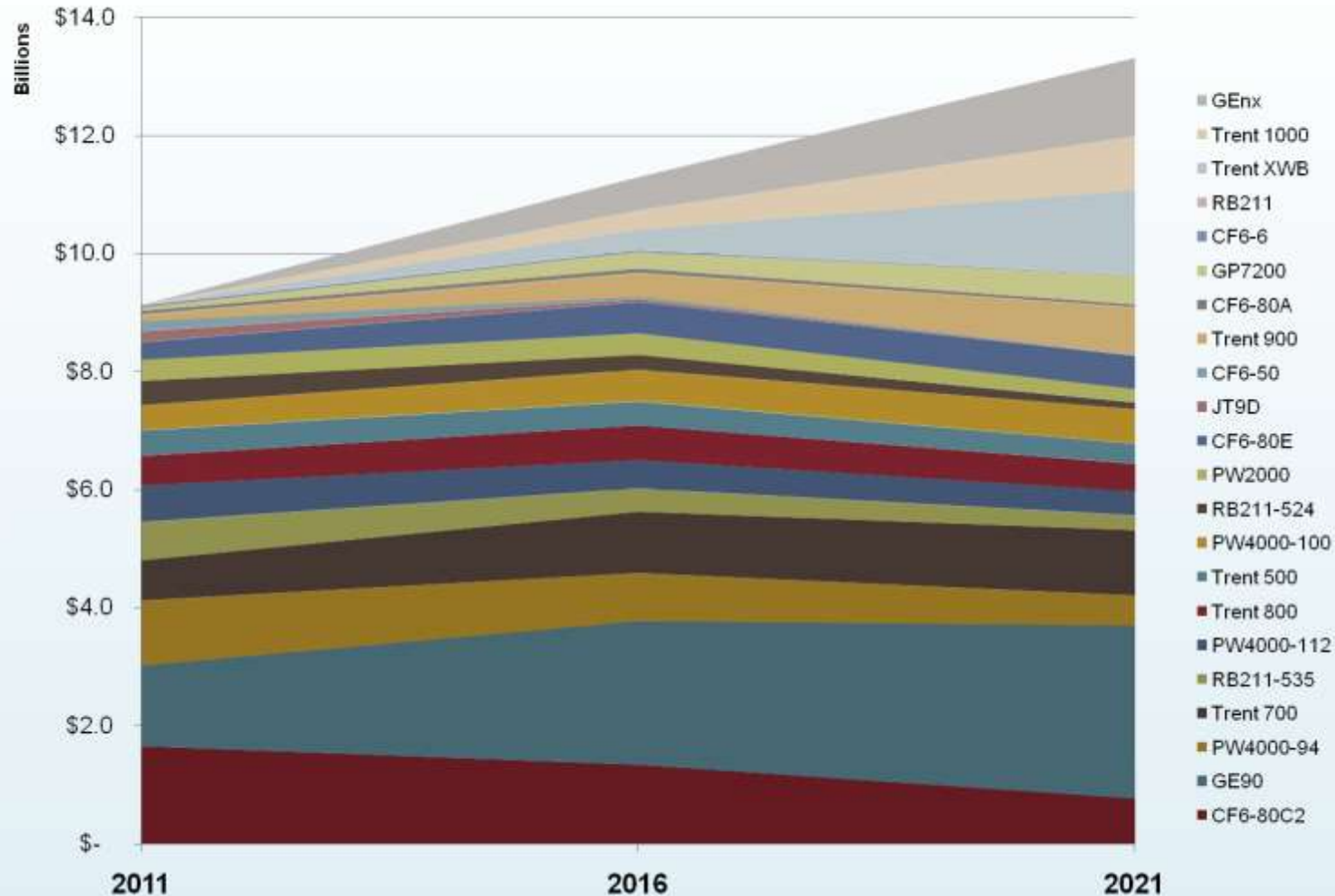
Eastern Europe leads the growth, followed by India and China

North America and Western Europe are expected to lose share as emerging regions' share increases

Large Engine MRO Market

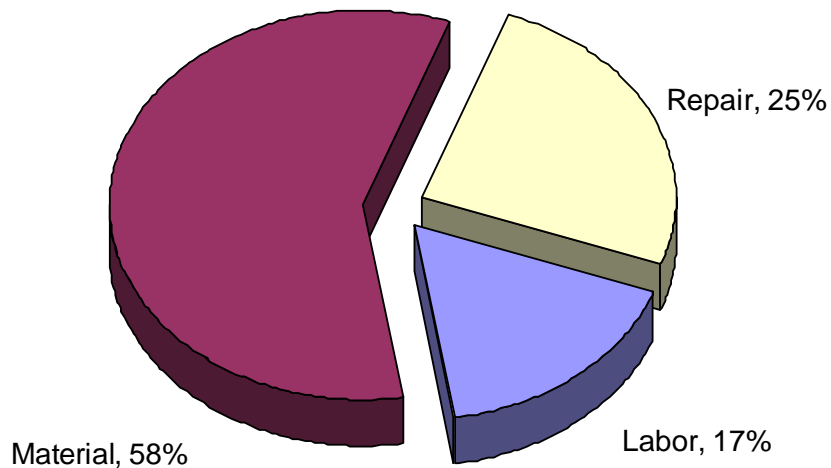


Large Engine (>40000 lbs SLTS) MRO Forecast



Large Engine MRO Market

Distribution of Costs



Materials constitute the largest share of the engine MRO market value

Repairs and labor follow parts

MROs have very little input on OEM parts and Outside Repairs

Competing in the MRO Market



With 80% plus of the cost inputs similar across competitors competition focuses on more than cost

International shipping of an RB211 535E4 is not a factor

It is truly a world wide competitive market driven by:

Relationship

Quality

Cost



Competing in the MRO Market



Large engines are expensive to own or lease

The Customers rely on the MRO to provide advice that can be trusted, provide a quality service and do so “relatively” quickly in order to hold the fewest required spares

Our approach is to partner with the Customer to balance long term gains with short term wins



Technical Expertise

Comparing the benefits and potential problems of check and repair vs overhaul

Check and Repair vs Overhaul

Technical risk

When workscoping the engine for a check and repair instead of an overhaul you need to be thinking “By not overhauling the engine what **risk** am I accepting?”

Issues to consider:

- Current life of engine
- Required engine life / Profile of engine
- Cost of check and repair against predicted engine life

Check and Repair vs Overhaul

Commercial risk

Understanding the life cycle of the engine in order to see how different strategies will affect the life cycle cost plays a role in the decision

Spending a significant amount on a check and repair now may not give the life benefit required



What can be done during a shop visit?

The Swiss watch approach – “blue printing”

Replace with new

A better way?



The Swiss watch approach



Benefits

Matching components within the engine

Individual rework of each engine

Every engine is as good as it can be.

Low cost of new parts, old parts are reworked and then match machined



Replace with new?

Benefits

Performance and reliability components replaced with new every overhaul

Mostly Hot end items

OEM recommended

Standardized workscope

Known life from components



Replace with new?

The Down side

High Cost

Unused life



A Better Way?

Using new and serviceable used parts in a strategic way to produce an engine that meets the mission requirements for the most value for money

Only use New material in areas that need it

Gets the most life and therefore the most value for money out of all components

Does not affect reliability

Does not affect performance



A Better Way?

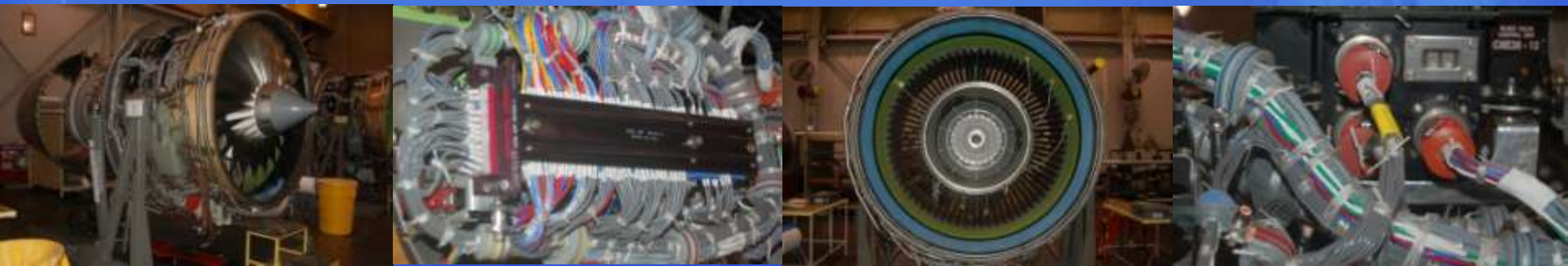


To do this well the MRO needs both the experience of engine/fleet performance and trust of the Customer that the MRO has their best interest in mind

Needs a transparent culture and business model

Access to serviceable used material

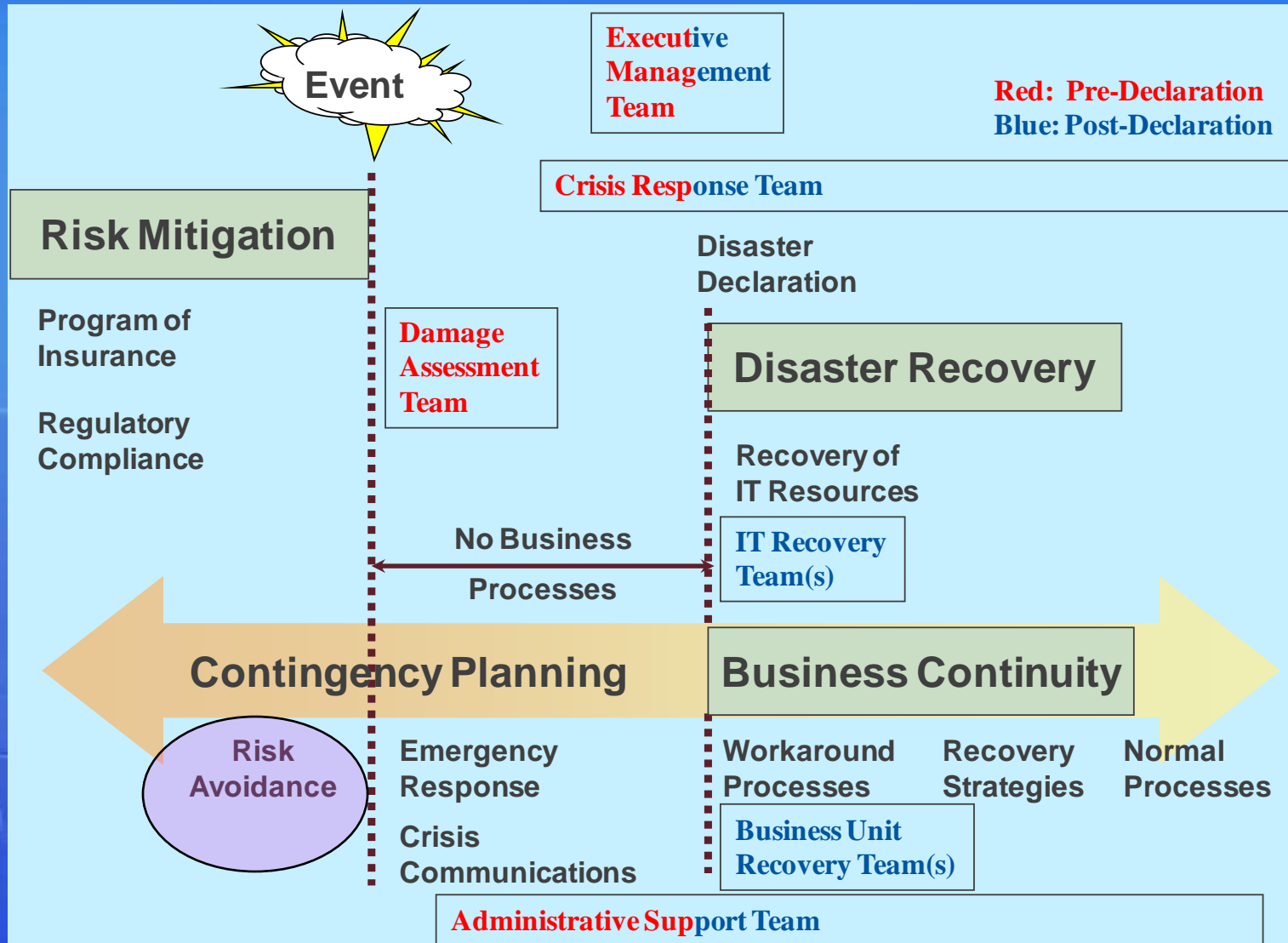
Early engine removal results if you get it wrong



Business Risk and Quality Management

The most important part of the relationship is producing a safe engine when we say it will be done

Business Risk Management



Quality Transformation Process



"Ben Hurt" Safety Report

"Wise Owl" Training Report



SCONQ Report Measures Cost

"Inspector Budget" Audit Perf

SAFETY & QUALITY KPI Charts

Data driven decisions

Quality driven by Processes and Procedures

Baldrige Criteria to measure our business

Partnering with Risk, Safety and QA

SAP implementaion along with supporting procedures (AS 9110)

Benchmarking to ensure world class operation

Kitting verification as a means to maintain quality with minimum deviation

Implementation of TI
Customer validation as a step towards customization of products

Customer focused Risk Sharing

Implementation of automated NCR process as new integral procedures

Implementation of SQ1, as means of partnering with the business

Completion of 5 S process in QA visual, includes revamping of QA area

QA EI meetings to solve QA issues and to support our partners

Employee Safety



Straighten
Sweep
Sort
Standardize
Sustain



Boroscope reporting process as means of standardization

Human Factors training

QRB process as a Visual / Interactive Quality/Safety tool

Consistent Customer and FAA audit performance

Incorporation Of MEDA process

SB verification process

Regulatory Compliance Approach

Audits conducted by QA as an isolated and independent group

Meaningful QEMS process

SQ-1

Inspection of quality to the OPM

All quality issues assigned to QA

Reactive

Structured Reactive

Proactive

Systematic

World Class