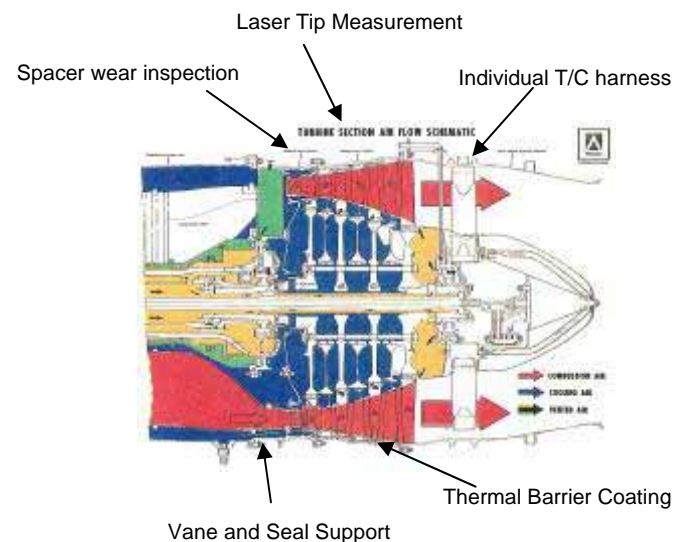
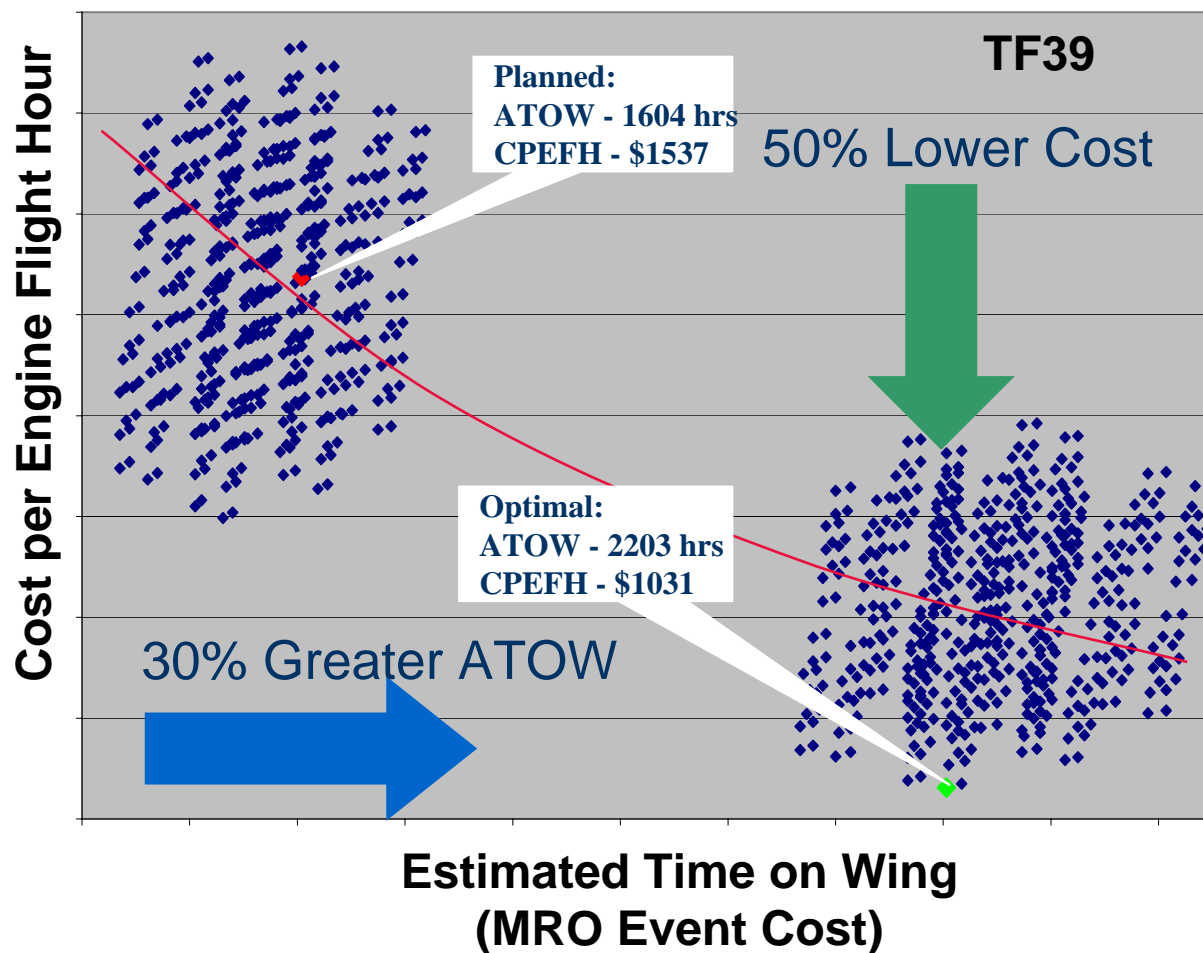


RCM Workscope Optimization

- ▶ Typical worksopes focus on LLPs and published technical data only:
 - Short term focus
 - Lack of real world feedback
- ▶ Difficult to manage workscope(s) over entire life of engine:
 - Huge number of variables
 - *typically 16,000 choices*
 - Opportunistic maintenance - hundreds of options
 - Very complex problem
- ▶ Reliability and cost modeling has created realistic optimization capability - RCM:
 - Accumulate and scrub actual operating data
 - Use model to calculate cost per hr and average time on wing (ATOW) for each possible workscope scenario
 - Select workscope with lowest cost per engine flying hour (CPEFH)



RCM determines the workscope required to give highest Average Time on Wing (ATOW) for lowest Cost Per Engine Flight Hour (CPEFH)



- ▶ Workscope optimization is not intuitive due to large number of options (2^{13})
- ▶ Algorithm developed to find optima
- ▶ Significant cost and ATOW gains
- ▶ In use today on certain USAF engines

Engineered Workscope Optimization Highlights Potential Benefits



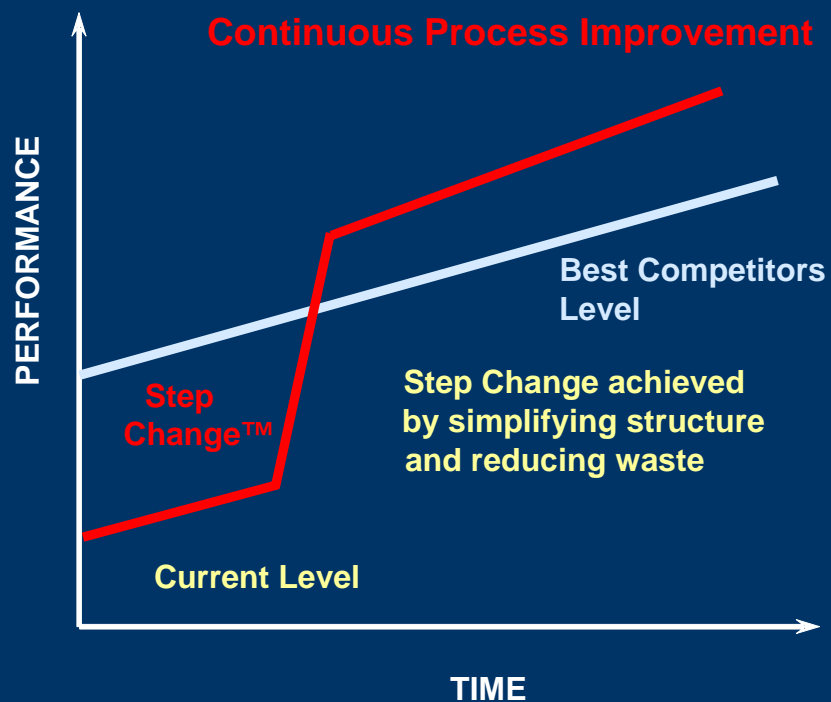
So...we can use RCM to generate a unique workscope, specifically for optimum readiness value...

HOW DO WE IMPLEMENT THIS IN A REAL WORLD MRO ENVIRONMENT?

A Lean / Cellular™ Maintenance Facility Transformation can make it possible ...

A Systems Engineering Approach to MRO Transformation™

PLAN FOR A STEP CHANGE



EXECUTE COORDINATED CHANGE



Over 15 Years of Transformation Experience
Over 160 cell redesigns to date around the world

Because Key Elements of Lean / Cellular™ MRO drive process ownership up...

Visual Factory for Lean / Cellular MRO

Visual Control Systems

Any Wall Must Have Windows

Employees Clean their workspace

Perform own Preventive Maintenance

Lighting - 2X Industry Standard

Management & Support co-located with the shop

Cellular "U" shaped flow

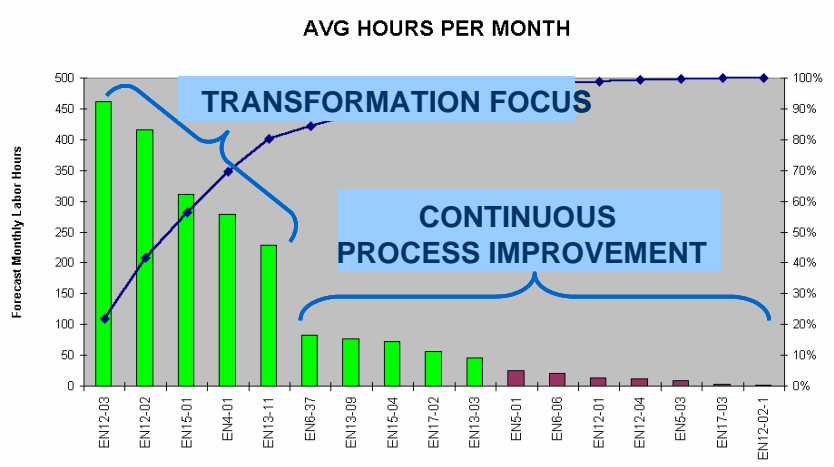
Multi-Skills and Comprehensive Training

TOPIC, SKILL, TASK	EMPLOYEE														DATE OF NEXT EMPLOYEE DEVELOPMENT PLAN						
	Bench	EDM	Welding	Quality Project	Grinding	Lathe	Manual Plasma	Plasma Prep	# 2's	Soft Mill	Stress Relief	Conventional Mill	Steam Welding	Chasing		O.L.T Training	F.A.I	Management Training	Back-up Cell Leader	Material Handler	Planner
Norm																					June-00
Mitch																					June-00
Nick																					June-00
John																					June-00
Rick																					June-00
Jeff																					June-00
Todd																					June-00
Travis																					June-00
Diana																					June-00
Brian																					June-00
Rick																					June-00
Blaine																					June-00
Geoff																					June-00
ACTUAL	7	1	2	1	2	2	2	3	0	8	2	3	1	9	2	5	3	1	1	0	
REQUIRED	7	1	2	1	3	2	2	3	1	8	2	3	2	9	7	5	3	1	1	1	
TO BE TRAINED	0	0	0	0	1	0	0	0	1	0	0	0	1	0	5	0	0	0	0	1	

Identified for training
 Presently being trained
 Requires experience
 Fully experienced
 Able to train / supervise



Focused Data Driven Analysis

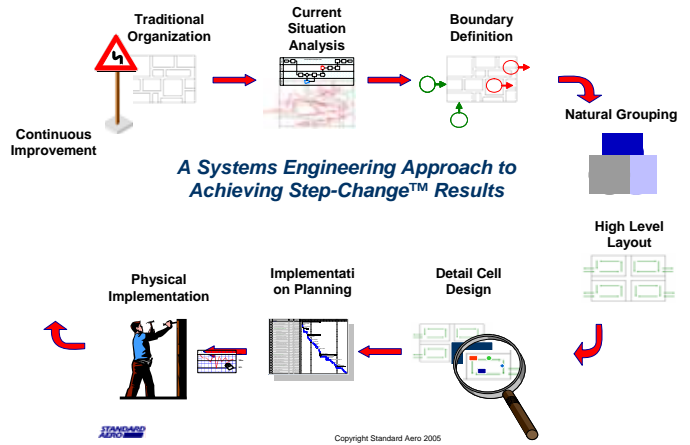


Hands On and Computer Simulation



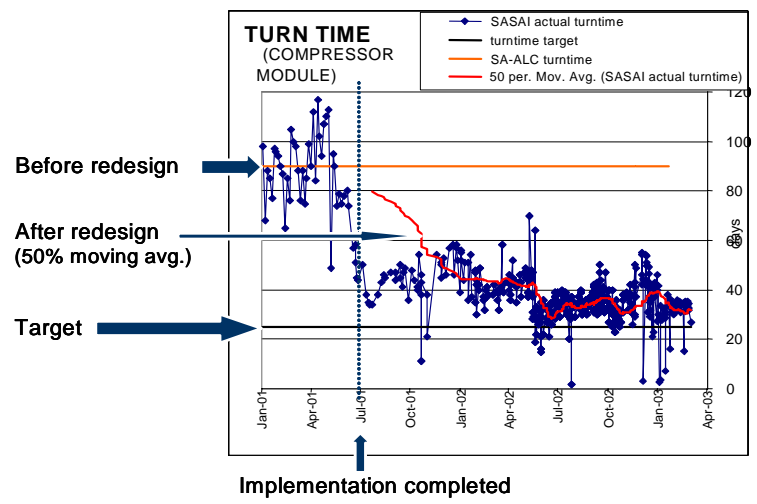
And vastly increase the speed and degree to which changes to work scoping can be made

Comprehensive Systems Engineering Approach to Step-Change™ & Sustainment

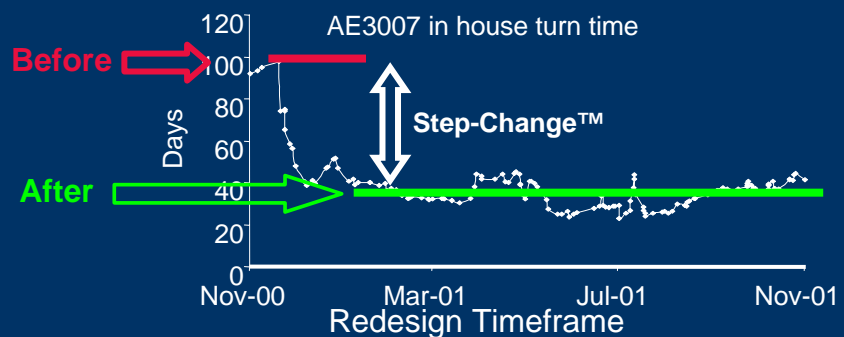


Typical Process Shop Ownership 25-40%
Lean / Cellular MRO Cell Ownership >85%

C-130 / P-3 Powerplant – USAF T56 San Antonio, TX From 100 Days to 30 Days



Regional Airline Fan – AE3007 Knoxville From 100 Days to Sub 30 Days

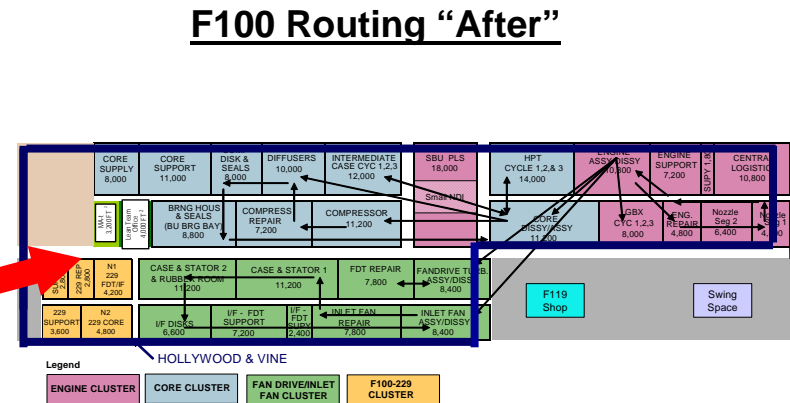
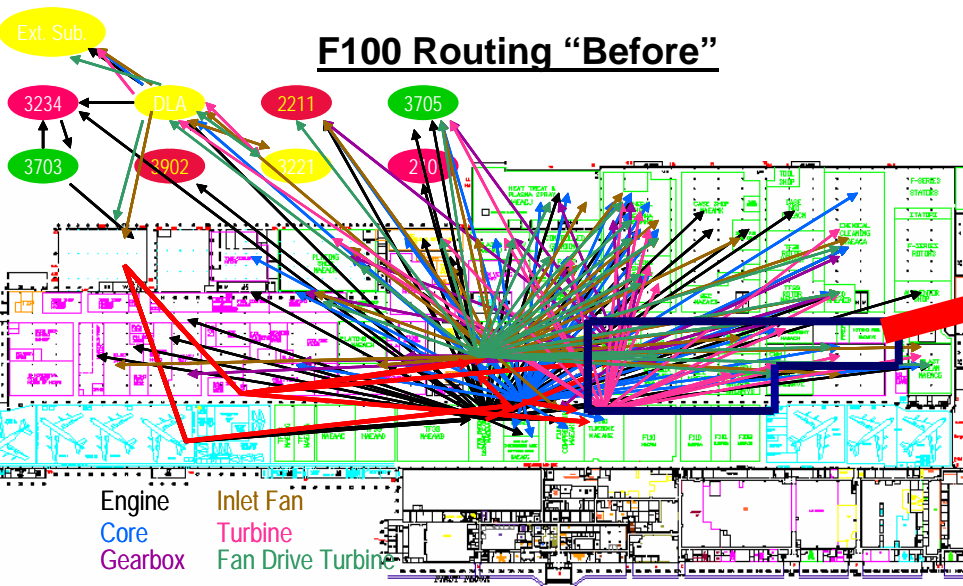


Performance Measure	Before (1999)	After (2001)
Turn around time	90 + days	< 30 days
1 st pass fill rate	50%	>90% +
Back order days	15-25 days	<5 days
ENMCS	Red	Green
War Ready Engines	Red	Green
Water reuse	0%	85%

Typical “legacy” MRO operations can make workscope changes difficult...

OC-ALC Initiatives

<i>F100 Engine</i>	<i>Today</i>	<i>After Redesign</i>
Rear Gearbox housing	15.0 miles travel	2.3 miles travel
1st stage Fan Assembly	48 ownership changes	3 ownership changes
Forklifts required	24	3
Material handling carts required	256	5
Core Engine Turn Time	113 days	35 days

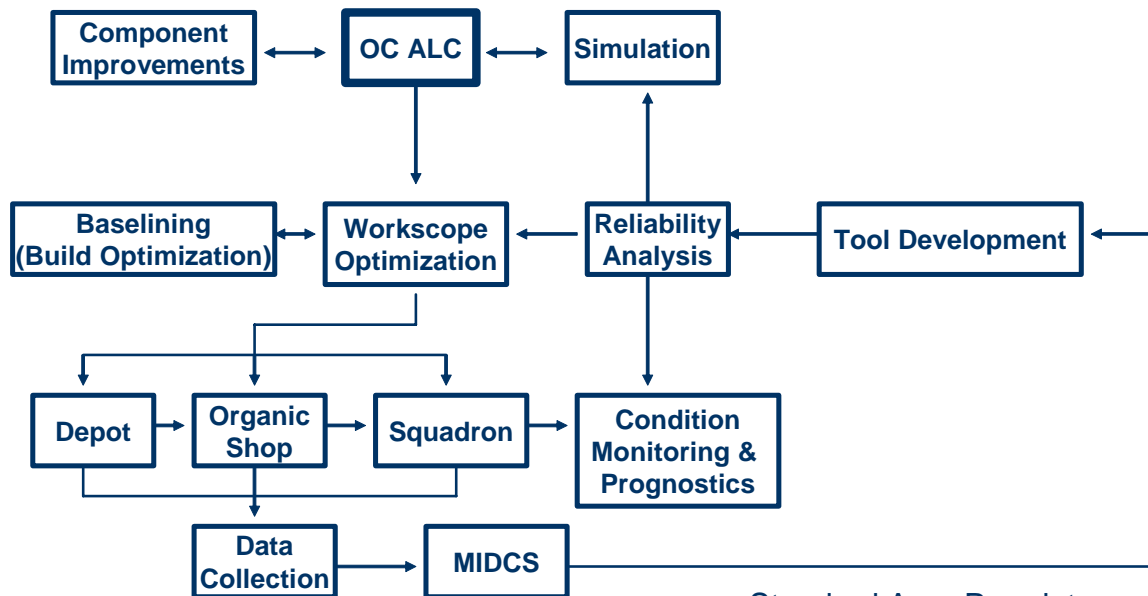
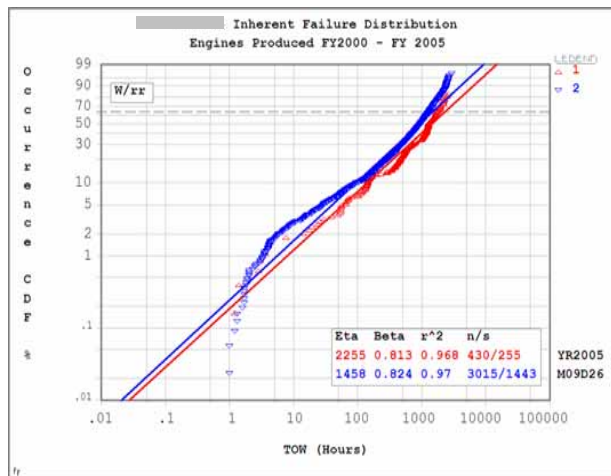


Footprint Reduced to Single 320K SF Area, 25 Production, 5 Supply, 4 Support Lean Cells

Combining RCM and Lean/Cellular MRO Integration makes substantial improvement possible

Inherent Reliability (ATOW)					
	Type/Model "X/1" USAF		Type/Model "X/2" USAF		Type X/1 Other Customer
	Standard Aero	Organic	Standard Aero	Organic	Standard Aero
ATOW	2,159	1,363	2,526	1,618	2,246

Weibull analysis: Standard Aero Workscoped Engines have 50% higher Inherent ATOW than organically produced engines



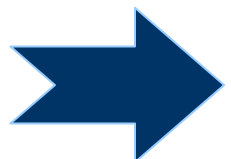
Source & Analysis: CEMS Report E314. Suspensions from E314 and current times from E118 reports. Filtering: Engines installed after FY00; < 4 hours per day; negative TOWs eliminated

Standard Aero Proprietary

Providing Best Value Readiness for the WARFIGHTER!



Systems Engineering RCM + **Enterprise Lean / Cellular MRO**



Total Cost ↓
↑ **Time on Wing**

