LOCK RING WHEELS AND CARBON BRAKES FOR F-15C/D/E

Landing Systems | Troy, OH

Collins Aerospace
An RTX Business

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USAF WBSI OBJECTIVES

NEW F-15 Wheels and Brakes meet USAF REQUIREMENTS

RELIABILITY	SAFETY	LIFE CYCLE COST	PERFORMANCE
Extend useful life of wheels and brakes	Reduce brake fire and locked wheel potential	Decrease life cycle cost over life of aircraft	Improve energy capacity

COLLINS AWARDED F-15 WBSI

MEETS OR EXCEEDS USAF SAFETY & LIFE CYCLE COST REQUIREMENTS

Completed **USAF fleet retrofit**

Received Boeing **installation approval**

Selected to provide **F-15E wheels and brake for F-15EX production**

Collins F-15C/D and F-15E wheels and brakes **ready for international retrofit**

KEY FEATURES AND BENEFITS - WHEEL

New F-15 Lock-ring wheel

>80%

REDUCED TIRE CHANGE TIME

52 vs. 255 min. for current wheel decreasing maintenance time.

84%

PART COMMONALITY

between the F-15E and F-15C/D wheel reducing part count

16 X

LONGER FATIGUE LIFE

(25,000 vs. 1,500-mile life for current wheel) Fewer wheel replacements and increased operational usage.

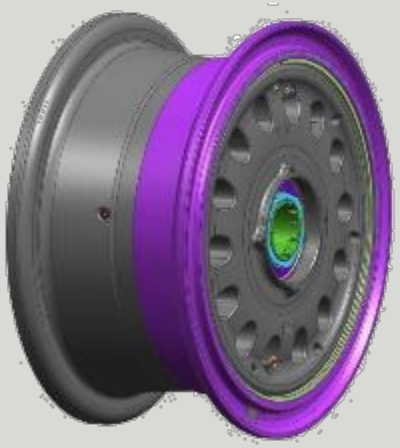
NEW

LOCK RING DESIGN

eliminates tie bolts, nuts, washers and non-destructive inspection of fasteners.

F-15 LOCK RING WHEEL

Three key components



Wheel Base

Lock Ring

Side Rim

NEW F-15 LOCK RING WHEEL

FEATURES & BENEFITS

Lock Ring Wheel Tire Change Demonstration

F-15 WHEEL AND TIRE MOUNTING

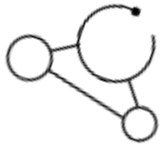
WHEEL FEATURE	LEGACY WHEEL	COLLINS WHEEL	COLLINS ADVANTAGE
Overinflation Plug	No	Yes	Safety improvement
Fuse Plugs	Small, frequent release	Larger, service-proven	Proven USAF reliability advantage
Scheduled NDI	5 years	10 years	Life cycle cost savings
Retaining Ring Lockwire	Yes	Not Needed	Maintenance time-savings
Hubcap O-ring	No	Yes	Improved wheel speed sensor protection
F-15C/D Wheel Bolts	Yes (16)	No	Maintenance and life cycle cost savings

On-site Observations – Wheel observations/feedback during tire mount and aircraft installation
The Collins wheel “felt lighter”, despite same weight requirement
The Collins wheel was easy to assemble, with little support from Collins
All support equipment, wheel jack and bearing can fixture worked with Collins wheel

KEY FEATURES AND BENEFITS - BRAKE

DURACARB® CARBON DISKS

Improve life & performance with service-proven oxidation protection.



90% PART COMMONALITY

between the F-15E and F-15C/D Brake

4 X LONGER LIFE

More landings per overhaul with 1,400 vs. 342 LPO current. Fewer brake replacements. Increased operational usage.

OPTIMIZED ROTOR DESIGN

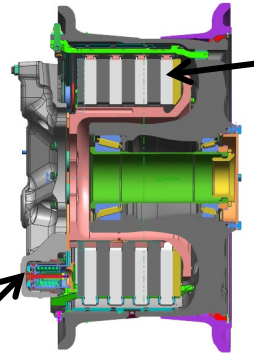
Lightweight, optimized for stopping performance and anti-skid compatibility.

TITANIUM TORQUE PLATE

Enhanced thermal properties, corrosion resistance, low maintenance.

F-15 CARBON BRAKE

F-15E

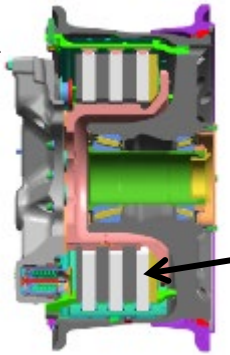


Four Rotor Design

Five Pistons

Titanium Torque Plate

F-15C/D



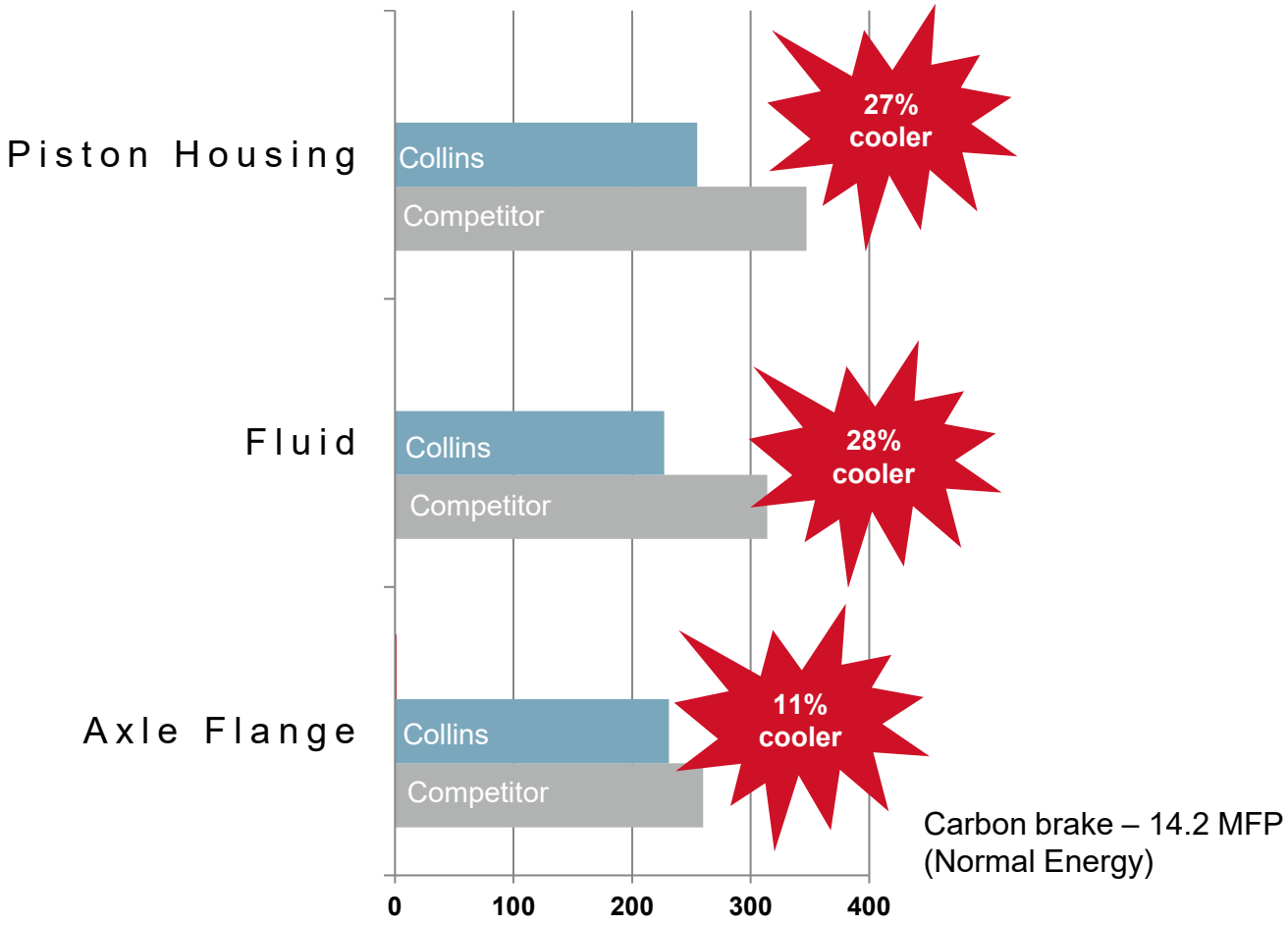
Three Rotor Design

COLLINS VS COMPETITOR

OPERATING TEMPERATURE COMPARISON

Meets all requirements

Improved thermal management, increases product safety margin.



Carbon brake – 14.2 MFP
(Normal Energy)

F-15 BRAKE

BRAKE FEATURE	LEGACY BRAKE	COLLINS BRAKE	COLLINS ADVANTAGE
Number of rotors and stators	5	4	Parts reduction
Piston Pucks	Thin steel	Carbon puck with double insulator and heat shield	Improved thermal management
Rotor Clips	Thin with oxidation shields	Robust, service proven	No oxidation shields needed
Torque Plate Backleg	Individual, steel	Solid, titanium	Rigid modern design

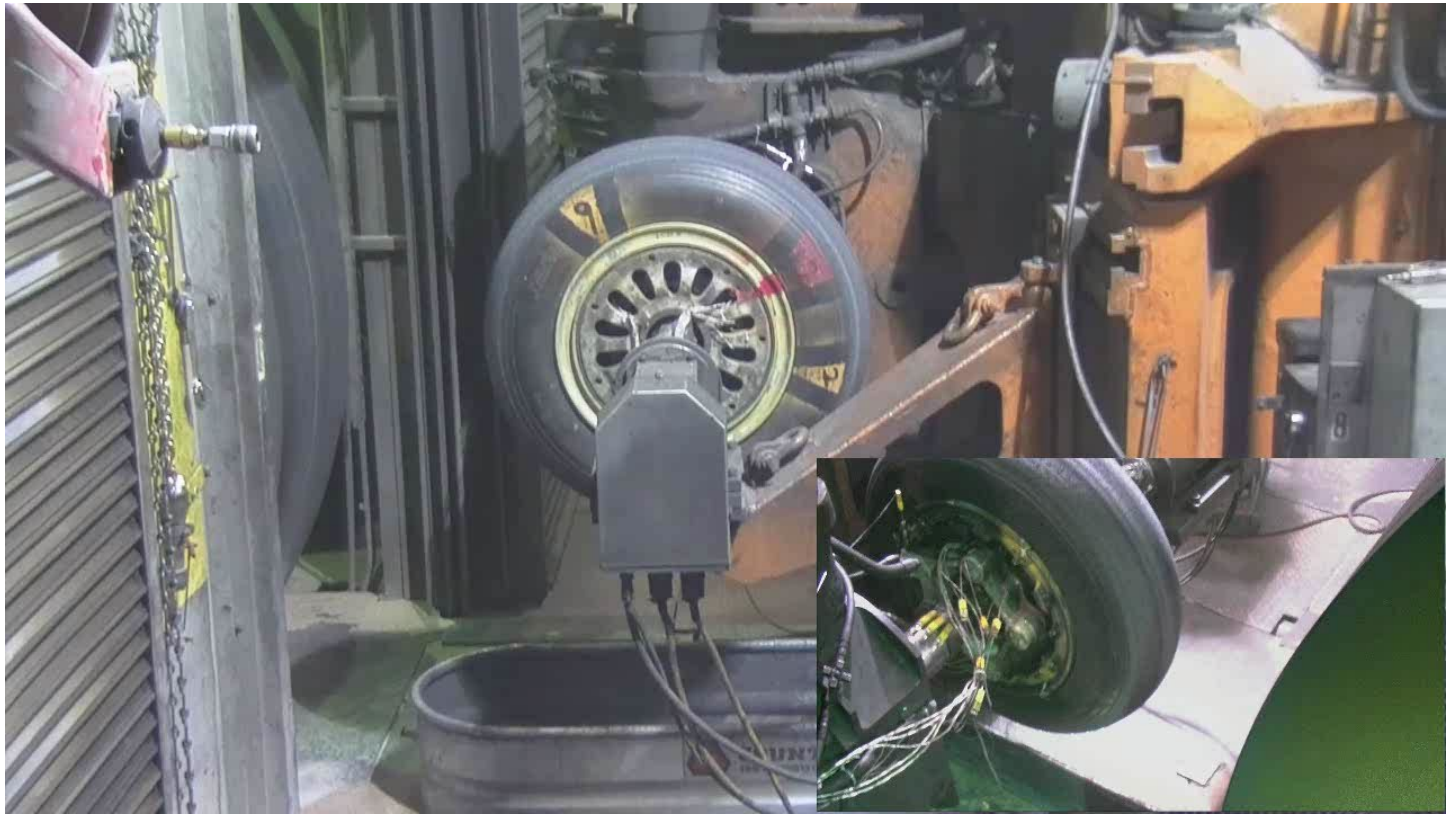
No hydraulic shop visit was needed. The brake was taken directly to the aircraft.

On-site Observations – Brake observations/feedback during aircraft installation
The Collins brake “felt lighter”, despite same weight requirement
Less lockwire required. The Collins brake does not require lockwire on shuttle valve bolts, and requires less lockwire on bleed ports

NEW F-15 CARBON BRAKE

MEETS ALL PERFORMANCE & THERMAL REQUIREMENTS

F-15E Dynamometer Test - 100% Worn, Maximum Energy RTO



F-15 WHEELS & BRAKE

MEETS ALL REQUIREMENTS - SUCCESSFUL COMPLETION OF FLIGHT TEST

F-15D Flight Test – Worn Brake RTO

USAF RETROFIT PROGRAM COMPLETE

USAF F-15 OPERATION – MEETS ALL REQUIREMENTS

Collins F-15 wheels and brakes **installed on over 450 USAF aircraft for more than 7 years**

Collins F-15 wheels and brakes **meeting or exceeding requirement for 1,400 landings per overhaul**

Collins **meeting or exceeding USAF life cycle cost savings objective**

The USAF has been operating Collins wheels and brakes since 2017

BOEING INSTALLATION APPROVAL

COLLABORATION BETWEEN BOEING AND COLLINS – MEETS ALL REQUIREMENTS

Qualification requirements reviews

Specification gap testing

Gap testing report reviews

OEM procurement drawing updates

OEM installation approval for F-15C/D and F-15E

Boeing approved F-15 aircraft installation of Collins wheels & brakes

INTERNATIONAL OPERATOR STATUS

INTERNATIONAL RETROFITS

South Korea (ROKAF):
F-15K Retrofit (Boeing PBL)

ACTIVE HARDWARE TRIALS

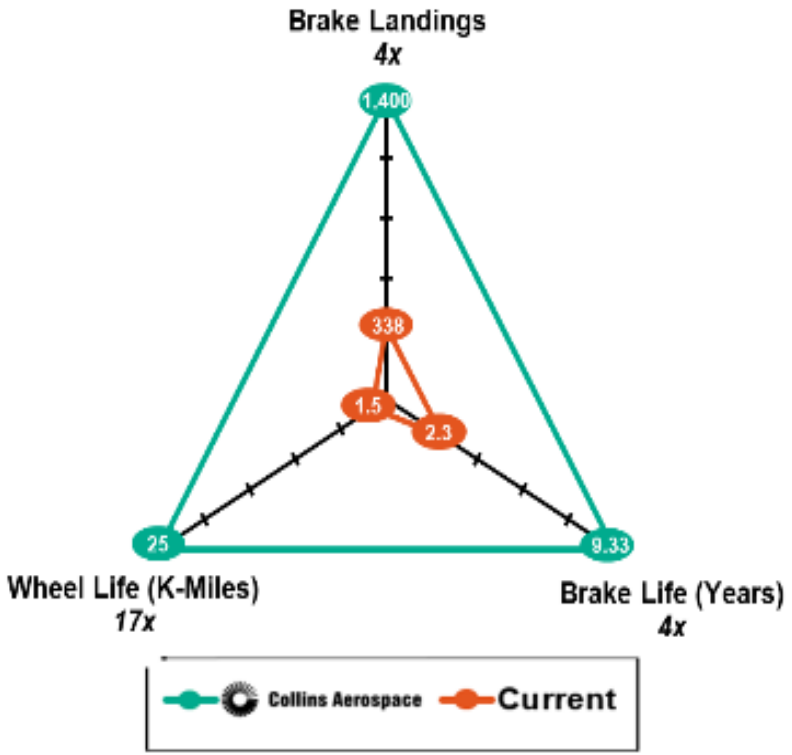
Japan (JASDF):
F-15J/DJ Trial

Israel (IAF):
F-15C/D and F-15I Trial

Collins F-15C/D and F-15E wheels and brakes ready for international retrofit

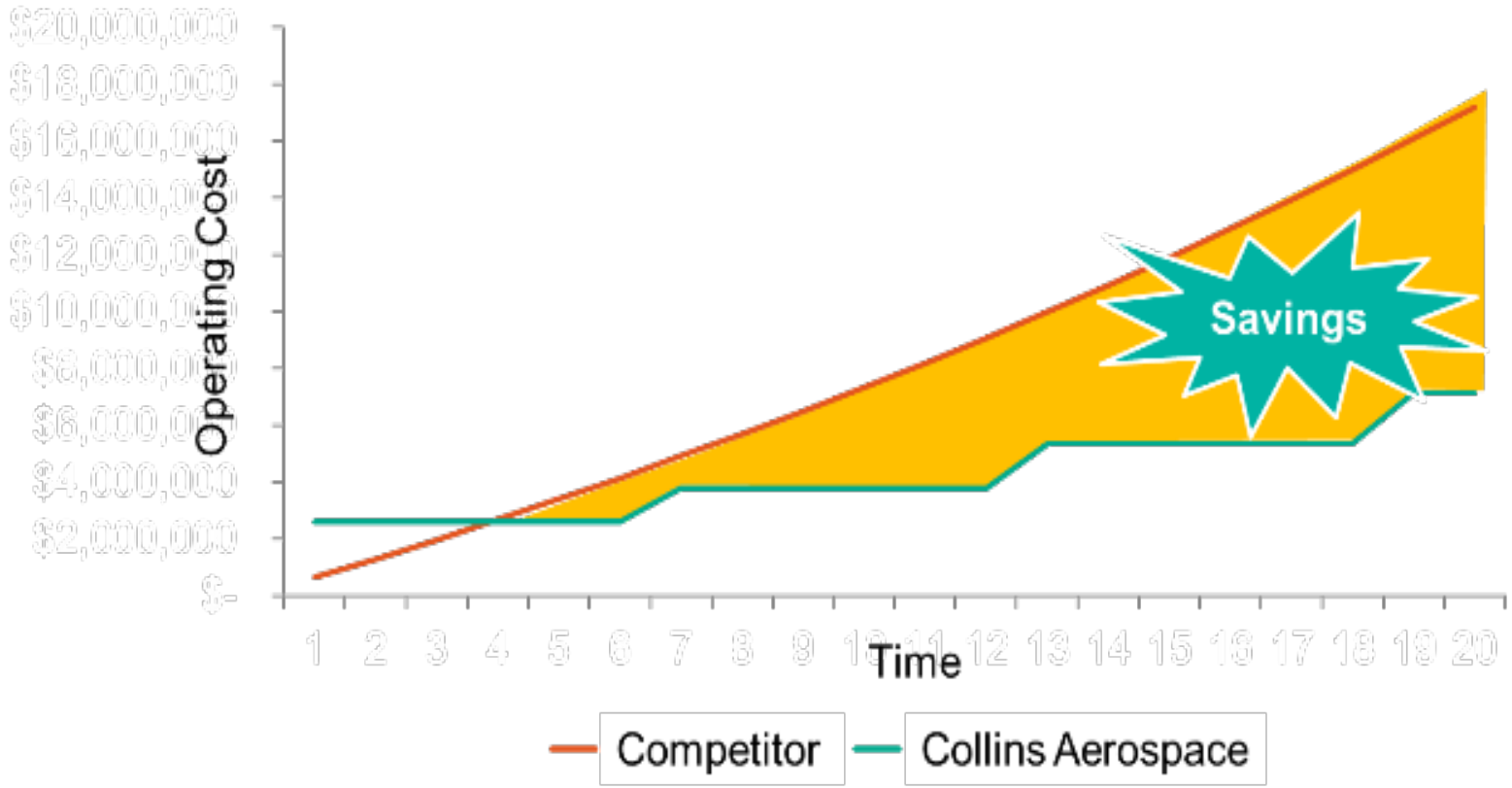
NEW F-15 WHEELS & BRAKES

Summary of features - life



Collins wheels and brakes stay on-wing longer and provide more up-time

LIFE CYCLE COST COMPARISON



The life cycle cost analysis yields a significant return on investment for the operator

THANK YOU