

BEYOND THE HANGAR: SUSTAINMENT LESSONS FROM OTHER INDUSTRIES



**Robot
Toolworx**



Universal Challenge: Aviation is not alone!

WORKFORCE ENVIRONMENT

- **Workers retiring at increasing rates**
- **Massive shortage of interest**
- **Pipeline problems**
- **Retention challenges**

AGING ASSETS

- **Extending service life beyond design criteria**
- **Retrofitting older systems with new technology**
- **Tribal Knowledge retention**

COST PRESSURES

- **Longer Turn around times**
- **Higher competition for new hires**
- **Extended AOG, Out of Service Status**

CROSS-INDUSTRY PROBLEM

Severe mechanic shortage runs boaters, dealers aground

Overhauls for the US NAVY frequently took 30% to 100% longer than these final planned schedules.

News

Diesel technician shortage could mean longer waits for RV repairs

BUSINESS

Ford CEO Jim Farley laments he can't fill 5,000 mechanic jobs paying \$120K per year: 'We are in trouble in our country'

Nearly 20% of diesel mechanic positions are unfilled in 2025, ATRI research shows

50% of the oil and gas workforce is over the age of 50

'Fleets Turn to Military Veterans to Fill Technician Roles: Shortage of Technicians Persists'

Shipping safety hangs in the balance as ageing fleet accelerates problems

Tankers

Machinery damage increasingly taking toll on 'silver tsunami' of older ships

Your Navy

How a sailor shortage is crippling ship maintenance at sea

Farm Futures

Search for ag technicians goes outside of farming

AGING WORKFORCE

Sector	Avg / Median Age	% Near Retirement (55+)	New Hire Ability
Aviation MRO Technicians	51–54 years	Moderate/High (35% aged 55–60)	High
Oil & Gas	~56 years	41%+ over 50	Moderate
Maritime (Officers/Engineers)	45–50+ (Rising)	Significant (64% aged 40–61)	Low (officer shortfall)
Mining	45-55 (Rising)	High	Low
Heavy Equipment / Diesel / Trucking	41–43 years	Moderate	High (apprenticeships)
Space (Ground Support / Launch Technicians)	30-45 years	Low	High
Automotive Service	~40 years	Moderate	High
Farm / Agricultural	40–45 years	Moderate (higher in developed regions)	Moderate

HIRING MORE YOUNG PEOPLE

Sector	Entry-Level Hiring Success	Turnover Rates - First 1–3 Years	Turnover Before Journeyman/Certified/Mid-Level
Aviation MRO Technicians	High – FAA certificates surged 2024–2025; strong school/apprenticeship outreach	Very high – most common exit window Year 1–3	Majority don't make it past Year 3
Oil & Gas	Moderate – targeted early-career hires but lags demand	Very high – burnout, consolidation of roles, volatility	High among young engineers; many leave early
Maritime (Officers/Engineers/Cadets)	Moderate – cadet programs and targeted recruitment	High for juniors – sea-time demands, paperwork burden	Many leave before Chief Officer level
Mining	VERY Low	High - Harsh environments	High, 65% do not complete apprenticeship
Heavy Equipment / Diesel / Trucking	High via apprenticeships & school programs	High - spikes in first 3 years	High without structure; many drop out early
Space (Ground Support / Launch Technicians)	High interest & hiring spikes (industry growth 18% 2019–2024)	High – competition, burnout, rapid pace	Shortage of mid-level talent despite early interest
Automotive Service Technicians	High – strong post-pandemic school/apprenticeship push	High – spikes in first 3 years	50% attrition in first 3 years; many leave before master tech
Agriculture / Farm Mechanics	Moderate – rural youth programs exist but low interest	Moderate–High – youth exodus to urban jobs	Significant rural-to-urban migration before full career

Analog and Legacy Systems



Designed Lifespan: ~25 years
Avg Age Today: ~30-40 years



Designed Lifespan: ~25 years
Avg Age Today: ~40-50 years



Designed Lifespan: ~15 years
Avg Age Today: 12-22 years



Designed Lifespan: ~20 years
Avg Age Today: ~20-25 years



Designed Lifespan: ~10-20 years
Avg Age Today: 12 years



Designed Lifespan: ~20 years
Avg Age Today: ~25-35 years

AVIATION



**Critical
Workforce Issue**



Extended TAT



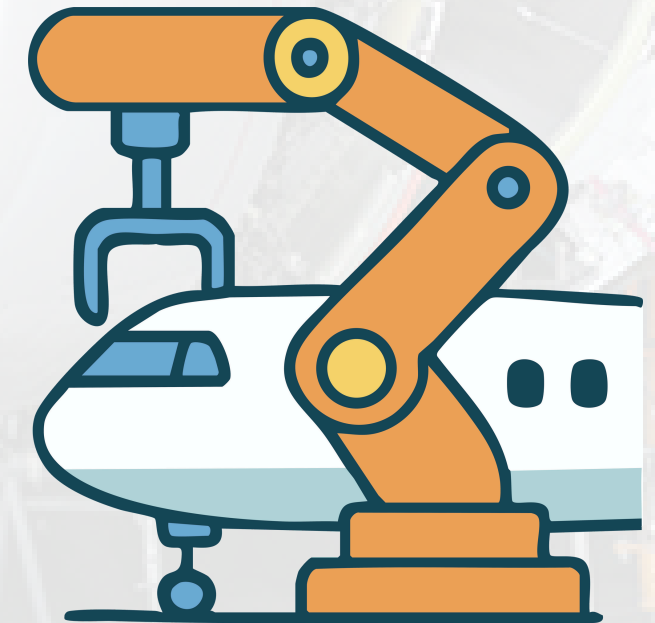
Increase AOG



Skilled Labor Gap



**Data and Process
Inefficiencies**



Increase of Complexity

Lessons Learned

- Workforce Challenges are real
- Young workers want consolidated digital data, not fragmented legacy sources
- Need to capture tribal knowledge from retiring experts before they retire
- Reduce downtime/turnaround time via better tools (safety + efficiency gains)
- Cross-pollination works: Ideas from one sector (digital logbooks, critical procedures) inspire others.

Digital Models for MRO will be the foundation for the future enabling:



Significant gains in human labor efficiency

Reduction in overall cost structure and time to repair

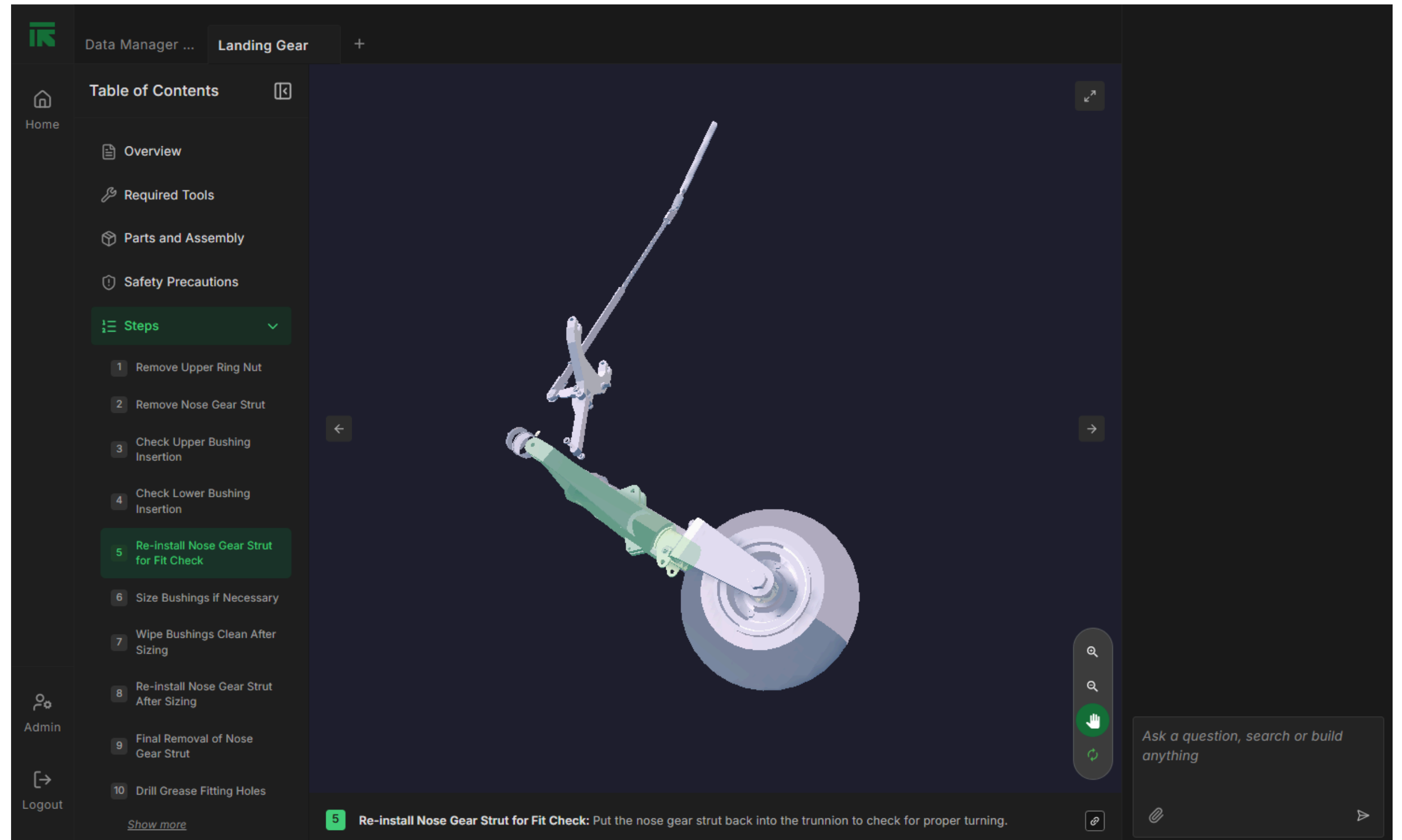
Dramatically improve quality and consistency

LEVERAGING AI & 3D MODELING, OUR PLATFORM REDEFINES MRO PROCEDURES


Automatically Transform EXISTING data and procedures into Digital Procedure Models (DPM, our World Model)


Translate these DPM data sets into 3D Visualizable Digital Procedures for technicians to use


Integrate, Update, Maintain, Version, Collaborate and Deploy DPMs



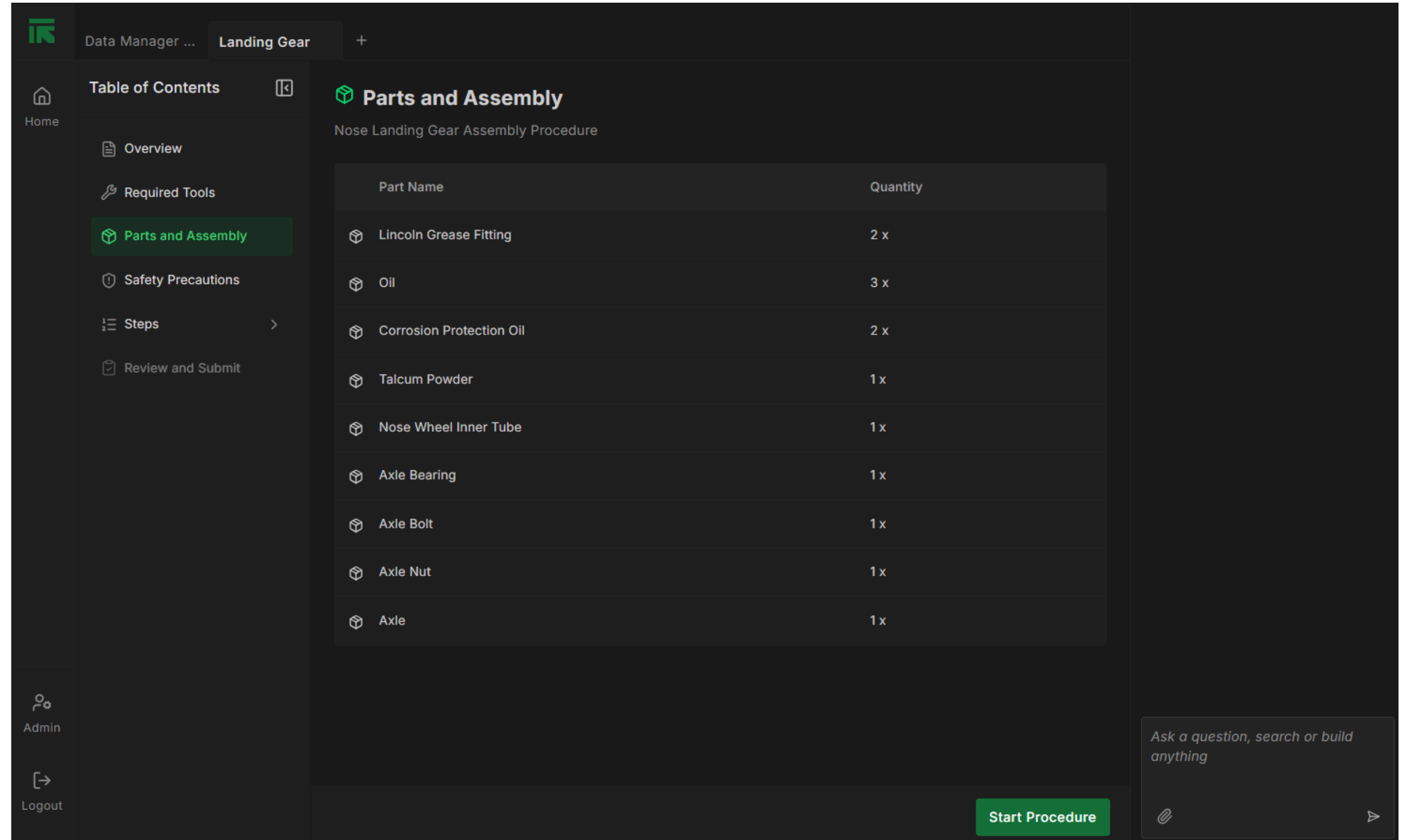
DPMS CHANGE EVERYTHING

 DPMS give complete control to authoritative sources

 Integrate procedures, parts, technical specs, tooling, digital log books, etc

 Version and change control for product variants & personnel roles

 Collaboration enables a broad network effect



The screenshot displays a software interface for a Digital Product Management System (DPMS). The main content area shows a table titled 'Parts and Assembly' for the 'Nose Landing Gear Assembly Procedure'. The table lists various parts and their quantities:

Part Name	Quantity
Lincoln Grease Fitting	2 x
Oil	3 x
Corrosion Protection Oil	2 x
Talcum Powder	1 x
Nose Wheel Inner Tube	1 x
Axle Bearing	1 x
Axle Bolt	1 x
Axle Nut	1 x
Axle	1 x

The interface includes a sidebar with navigation options: Home, Overview, Required Tools, **Parts and Assembly** (highlighted), Safety Precautions, Steps, and Review and Submit. At the bottom, there are links for Admin and Logout, a 'Start Procedure' button, and a search bar with the placeholder text 'Ask a question, search or build anything'.



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