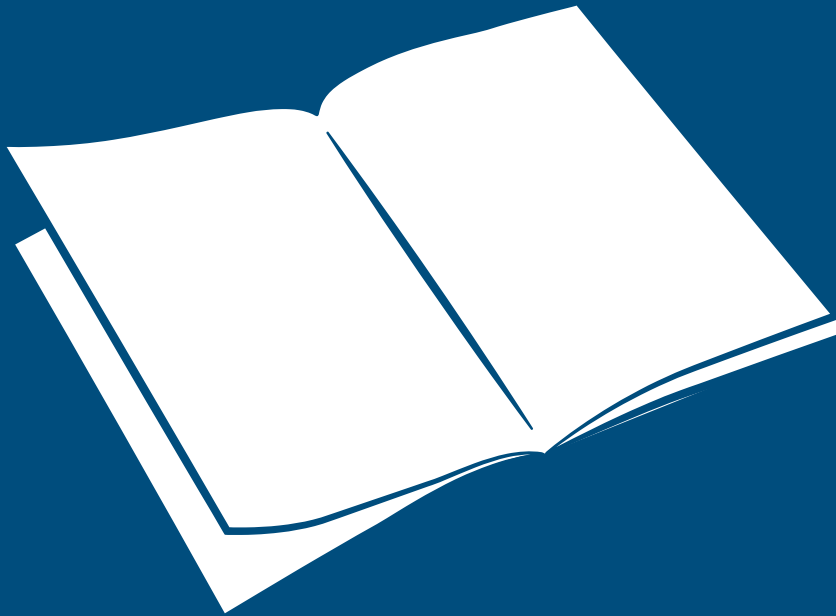


# SCOPE

## *Stories for Circular Orientation and Practice Exploration*



# Introduction

In this circular economy storybook, multiple **5 to 10-minute stories** can be found on what circularity and the circular economy is, in an aviation maintenance context. This booklet is part of a bigger vision to move maintenance towards a circular direction and has a focus on '**Sense-Making**'. This booklet is especially made for you, the **motivated explorer**. You are intrinsically motivated to contribute to sustainability, but often lack the right structure, shared language or support.

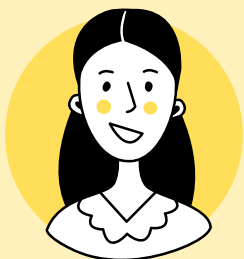
Sense-making means that around the topic of the circular economy, the focus is on creating **ownership**, a **simple and shared language** and a first **understanding of the added value** of the circular economy and its principles.

In this booklet you can find realistic stories, in which specific terms are used. It is almost like you learn while you do. Uhm read. It shows that **maintenance is a natural enabler** of the circular economy and that the circular economy principles can be helpful in **decision-making**. Especially since we want to work towards a **robust system** in the future.

# Meet the Four Faces of Circularity

Sustainability. Circularity. Regulation. Change. We all talk about them, but we don't all experience them the same way. At NLR, how we think about circularity often depends on our role, our mindset, and the questions we face in our daily work. Based on interviews and recurring patterns, four recognizable voices are identified. These aren't caricatures. They're honest portraits of people doing their best to navigate change. Let them introduce themselves, and see who you recognize in your own team, or in yourself.

## The Cautious Guardian



**Anna**

I find sustainability important, but only after safety and compliance have been fully secured.

*"If something isn't 100% safe, it will never be allowed in aviation, no matter how sustainable it is."*

## The Motivated Explorer



**Jeroen**

I am intrinsically motivated to contribute to sustainability, but I miss the right structures, shared language or support.

*"We're not overwhelmed with questions... we do what we can!"*

## The Business Realist

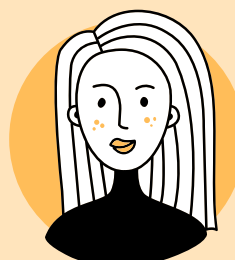


**Milan**

I embrace circularity as long as it saves money, time or offers a competitive edge.

*"It uses 20% less energy. That's great for the environment, but mostly because it's cheaper."*

## The Technically-Driven Doer



**Farah**

Circularity is about smart engineering and effective maintenance, not ideology.

*"Maintenance is what enables circularity." & "A good maintenance concept needs to be built into the design phase."*

# Story 1

10R

CE Terminology and Definitions

Jargon

## Wait.. Does refurbish mean the same as overhaul?



The morning sun filtered through the glass walls of the NLR project room. Sanne placed two coffees on the table and dropped into a chair opposite Bram. Between them lay a freshly printed document: "10R Strategies for Circular Economy."

Bram raised an eyebrow. "Ten of them? I thought there were maybe three."

Sanne smiled. "Apparently, there are levels. Like a ladder—from smartest to least ideal."

He leaned in, finger following the words as he read aloud: "Refuse, Rethink, Reduce, Reuse, Repair, Refurbish, Remanufacture, Repurpose, Recycle, Recover."

"Catchy," he said. "Still sounds a bit... abstract."

"Let's see," said Sanne, "Shall we just walk through it together?"

### Refuse

Bram frowned. "So we just say no to buying stuff?"

"In aviation?" Sanne shrugged. "Maybe more like: don't accept default assumptions. Like, why replace that part every six months if failure data doesn't support it?"

"Fair point," he nodded. "It's more strategic refusal."

### Rethink

"This one's familiar," Sanne said. "Remember our digital job card project last year? That was rethink. Changing how we plan inspections—not just digitizing paper."

"Yeah," Bram agreed. "We turned four steps into one. Less handling, fewer errors. Rethink isn't about throwing things out—it's about seeing them differently."

### Reduce

"Material use?" Bram guessed. "Or reducing interventions?"

"Both," said Sanne. "If you only open up what's needed, and do it at the right time—you're not just saving effort. You're avoiding wear-and-tear from over-maintenance."

He smiled. "That sounds like something you'd say in a report."

### Reuse

"Now this one's trickier," Sanne admitted. "When do we trust a part enough to reuse it?"

"If the history's rock solid," Bram said. "And if we've scanned it, checked it, logged everything... then sure. But it needs transparency."

They both glanced at the RFID tags lying in a tray on the table.

### Repair

"Bread and butter," Bram said. "We live here."

Sanne grinned. "Yes, but repair has become undervalued. Everyone wants new—because it's safer? Faster? But if we structure the repair process better, it can be both circular and reliable."

### Refurbish

They paused.

"Okay," said Bram, "this is the one I always stumble on."

"Me too," said Sanne. "Is refurbish just a fancy word for overhaul?"

"Could be," he said. "In our world, overhaul means full teardown, clean-up, replacing wear parts—signed off and certified again."

"But refurbish might not go that far," she mused. "Maybe it's less about function, more about appearance. Or just restoring usability."

"So overhaul is... somewhere between refurbish and remanufacture?"

She nodded. "Possibly. But I'd love a side-by-side chart."

### Remanufacture

"Now we're talking rebuild," Bram said. "New life. Same bones."

"With improvements," Sanne added. "Think: design tweaks, upgraded materials. Still certified, still safe, but smarter."

### Repurpose

"Creative territory," she smiled. "Not easy in aviation."

"Still," said Bram, "I've seen decommissioned engine parts turned into training tools. That counts, right?"

"It does. We're just not used to calling it that."

### Recycle

"Material recovery," Bram said. "Better than landfill. But honestly, if it reaches this point, we missed an opportunity earlier."

Sanne nodded. "It's the 'too late' option."

### Recover

"Energy from waste," she read.

He frowned. "Do we even...?"

"Not really. But it's useful to know where the ladder ends."

They sat back, letting it sink in.

"It's funny," Sanne said. "We've been doing circular work for years. Just never called it that."

"And never saw the whole system," Bram added. "I used to think circularity was about recycling bins and green logos."



“But now it’s about smarter choices,” she said. “It’s maintenance thinking—with a long-term lens.” He held up the page. “So next time someone asks me about circularity, I can say: we already do it—we’re just getting better at naming it.”

**The End**

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## **Summary Explanation Box** Circular Economy Terminology

In this story you read about ...

# Story 2

Responsibility

Decision-Making

Regulations

Internalizing Risks

## Is That Really Our Responsibility?



Back in the project room, Nina reopened the draft report. It was solid, data-rich and technically watertight. But it was also clinical. It said nothing about circularity, nothing about the broader implications of automating inspections.

She glanced at a recent published article on cockpit on important sustainability regulations in aviation.

- 2025 – CSRD: Full ESG disclosure begins. All tooling and services must show environmental and social impact.
- 2026 – EU ETS: Aviation loses free emissions allowances. Carbon costs will directly affect maintenance economics.
- 2025 – CRMA: Raw material use must be documented, traceable, and justified — including for inspection equipment.
- ReFuelEU Aviation: Mandates SAF usage, but requires full chain transparency — from aircraft to tools that determine aircraft status.

Nina sat back. “We’ve been building GERDA for productivity. But in this context, not reporting on its impact could be seen as a blind spot. Or worse — a missed responsibility.”

Daan nodded. “Imagine a shop reusing more parts because GERDA catches repairable damage early enough. Or imagine inspection data supporting reuse certification — something KLM can actually report under CSRD.”

“And the tooling itself,” she added. “What sensors we use, where they come from — CRMA will demand we know that. Even the robot’s materials could be questioned.”

“And if GERDA allows airlines to reduce unscheduled removals,” Daan continued, “that’s fewer maintenance-related emissions. That’s EU ETS compliance support, indirectly.”

They looked at each other.

“We never planned for this,” he said. “But maybe we should start.”

They sat in silence for a moment. Outside, someone was powering down the adjacent test bench. The lights flickered, then stilled.

“I think we’ve been framing this the wrong way,” Nina said. “We always ask: what does the regulation require from us? But maybe we should ask: what kind of organisation do we want to be in this landscape?”

“You mean... taking responsibility before it’s assigned?”

“Yes,” she said. “Because when KLM submits their CSRD report in 2028, they’ll need to explain not just their emissions, but their entire supply chain logic—including the tools and decisions they base their maintenance strategy on.”

“And that includes us.”

She nodded. “We don’t manufacture airplanes. We don’t fly them. But we shape the systems that others rely on to prove they’re sustainable.”

Daan stood up, drained the last of his coffee, and smiled.

“You know,” he said, “I used to think this was someone else’s job. Like—let compliance deal with it.”

Nina smiled back. “I used to think the same.”

He paused at the door. “Should we add a section to the report? About circularity potential?”

“I already started,” she said, clicking open a new page.

GERDA continued scanning in the background — quiet, precise, and now, part of something larger than just efficiency.

**The End**

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## **Summary Explanation Box** Regulations and Responsibilities

In this story you read about ...

# Story 3

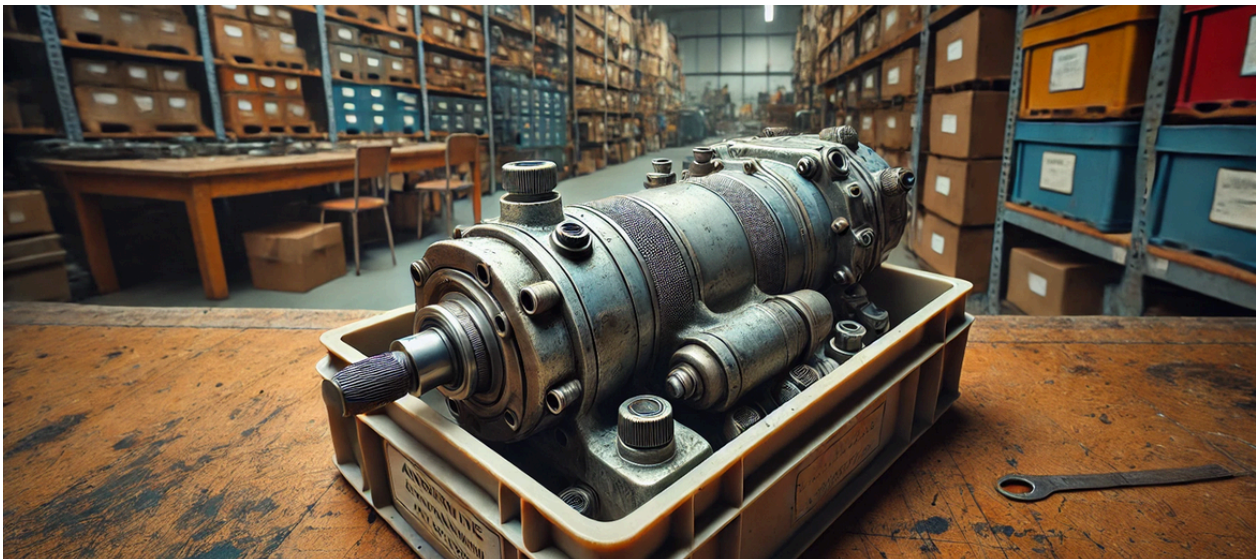
Ministry of Defence

System &amp; Process

Measurability

Component Level

## The Last of Its Kind



*A story told by a retired actuator*

They pulled me out on a Wednesday. I remember the chill of the hangar floor, the hiss of hydraulic fluid, and the quiet muttering of the tech who tagged me.

"Out of spec," he said. "End of life."

That's what the red tag means: your mission's over. You don't go back in. You don't get repaired. You get stored, stripped, or scrapped.

For thirty-seven years I did my job. Left flap, outer actuator. You wouldn't notice me unless I failed — which I didn't. I extended. I retracted. I hissed. I held. I flew.

Then, the thresholds changed. Not because I broke, but because the rules moved. And suddenly, I was obsolete.

I was shelved.

Crate 28, Section G, under a retired fuel pump and a disassembled radome scanner. I listened to stories from parts that had seen wars, monsoons, desert heat. We swapped tales like old pilots in a bar. And we waited.

But I wasn't ready to be forgotten.

One day, someone opened the crate. She wore a navy-blue jacket with a patch that said NLR. Her name was Eva.

She ran her scanner over my serial. Frowned. Checked the tag. Frowned again.

"Still under fatigue threshold," she said.

"But no traceability after 2012," said the technician.

"Doesn't mean it's useless," Eva replied.  
Interesting. Most people see red tags and walk away. But she didn't. She saw potential.

The next day, I was on a bench. Cleaned, scanned, tested. They didn't just check if I moved. They looked at how I moved. The delay, the smoothness, the thermal response. They used lasers. I felt important again.

Then came Tom — a Defence guy. Broad shoulders. Greasy gloves. He looked at me like I was part of the family.

"Actuator like this?" he said. "They don't make 'em like this anymore."

He and Eva talked. A lot. About reuse protocols. Field certification. Something called the Circular Readiness Framework.

"It's not about the part," Eva said. "It's about the process."

"We need systems," she added, "not heroic fixes."

Still, I liked Tom. He wasn't afraid of heroic fixes.

They didn't throw me away.

Instead, they made me part of a pilot. Not a flight test, but a test of something bigger: could we build a process where parts like me don't get wasted just because the system isn't flexible enough?

I got a second tag — blue this time. I was recertified for limited use in non-critical systems. I would fly again — maybe not at 35,000 feet, but in a simulator rig, or a test bench. Still moving. Still useful.

And this time, every move would be logged.

I'm still just an actuator. I extend. I retract.

But now, I'm also a symbol. Not because I'm special — but because I'm not. I'm ordinary. Replaceable.

And still — I was worth saving.

### **Epilogue (from Eva's notes)**

The pilot showed that legacy components, when properly tested and certified, can extend asset life and reduce waste. This isn't about nostalgia. It's about designing systems that recognize value — even when it comes from the past.

## **The End**

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### **Summary Explanation Box** Second Life of Components

In this story you read about ...

