Presentation of the Joint Research Project

Resource-Efficient Maintenance Logistics

(Ressourceneffiziente Instandhaltungslogistik – ResIH)

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Project overview

Resource-Efficient Maintenance Logistics

Motivation

In industry, resources are often unnecessarily wasted

- **Maintenance** and **logistics** are main functions to **reduce** or **avoid consumption of resources**
- It is important to define and evaluate **measures** which can help to **save resources** and **use them more efficiently**

Project partner

XERVON®

InfraServ KNAPSACK

Fraunhofer IML

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Project overview

Resource-Efficient Maintenance Logistics

Targets & products

- Intra-/Logistics
- Maintenance
- Resource efficiency

Reduction of unnecessarily wasted resources in industries

- **Identification** of **waste of resources**
- **Evaluation** of **waste**
- **Definition** of **improvement activities**

- Decision supporting system **RESOPT**: spare parts management optimization considering carbon-criteria
- Decision supporting system **RESTTRAT**: analysis of (optimal) replacement of constructions and components considering carbon-criteria
- **Condition monitoring technologies** for intra-/ logistics systems
- New **services**: e.g. spare part-pooling, maintenance strategies for intra-/logistics systems

Results & benefits

- Less consumption of resources
- Low carbon intra-/logistics
- Lower lifecycle costs

- **Economical** and **ecological optimization** of maintenance logistics
- **Higher performance availability** for i**ntra-/logistics systems**

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Areas of work

Resource efficiency in **maintenance** and **spare parts management**

Resource efficiency in **maintenance** and **logistics services**

Resource efficiency in **maintenance** and **intralogistics**

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Results, innovations and products

Current results and actual work:

Packages of measures and concepts to visualize and optimize the consumption of resources

AP 1: Stock-taking

AP 2: Development of criteria to select reference objects

AP 3: Identification of suitable reference objects

AP 4: Generation of a measures package

AP 5: Development of a tool to visualize and optimize the consumption of resources

Definition of **measures** and **strategies** to **identify** and **optimize** the **consumption of resources** in terms of the **reference objects**

Concept development of new decision supporting systems **RESOPT** und **RESSTRAT**

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Results, innovations and products

Current results:

Package of measures to optimize the consumption of resources in maintenance and spare parts management





Target: avoidance of unnecessarily produced spare parts

Premise: Taking stock of the actual spare parts situation

1) **Self-production or refurbishment of spare parts**
   reaction time, utilization
2) **Warehousemanagement concepts and strategies within a network**
   lower stock of spare sparts
3) **Identification of critical equipment**
   spare parts availability
4) **Utilization of condition monitoring technologies**
   determination of remaining lifetime

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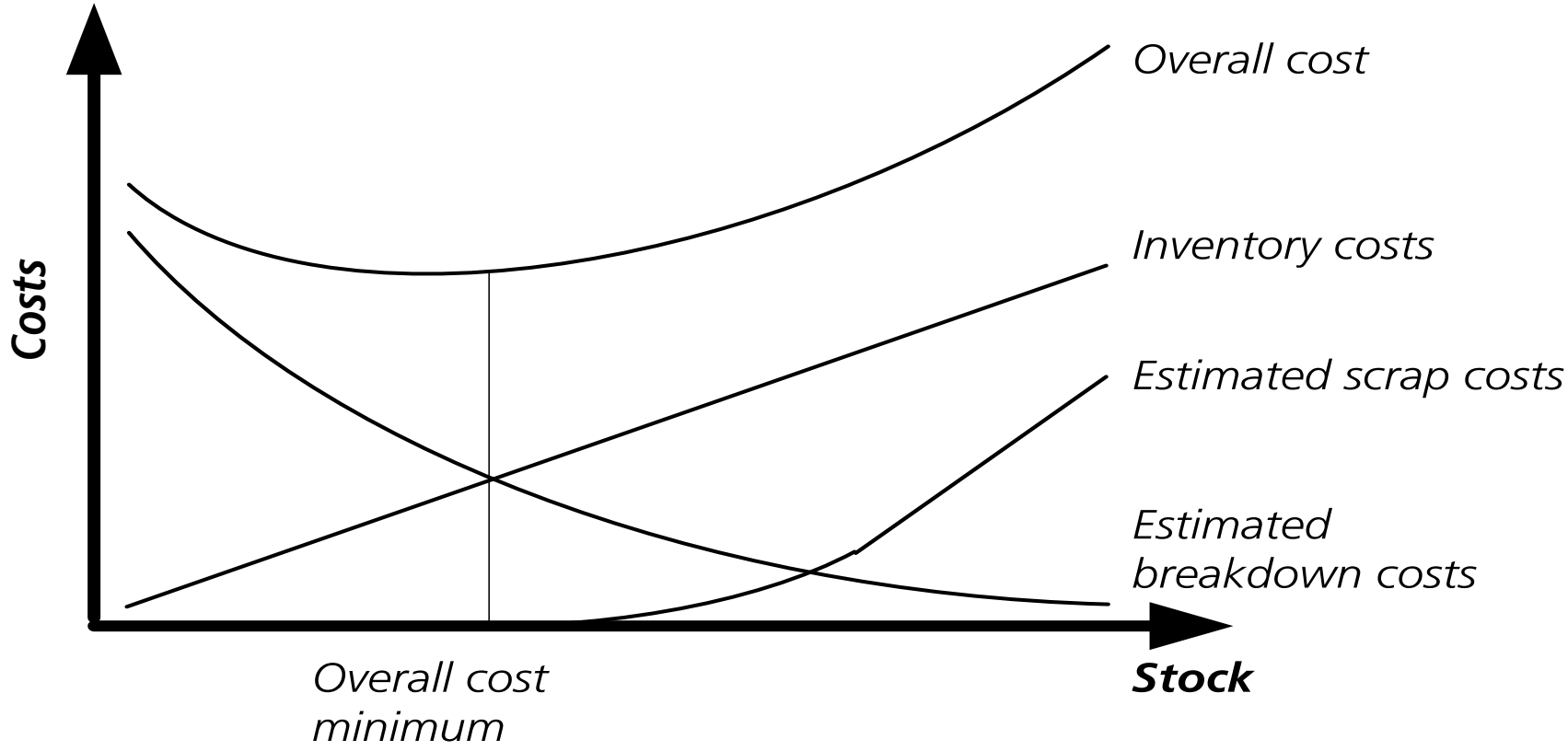
Results, innovations and products

Actual work:

Decision supporting system RESOPT for optimal cross-location storage quantity of spare parts



Results, innovations and products

Current results:

Package of measures to optimize consumption of resources in maintenance and logistics services

Kriterium/ Objekt	Titan	Holz	GfK	Kunststoffe	RIF	Abrollcontainer
	Material					Bauart
Beeinflussbarkeit	√	√	√	√	√	√
Verfügbarkeitserhöhung	~	~	~	~	~	~
Kostenanteil	√	√	√	√	~	√
Kostenreduzierung	~	~	~	~	~	~
Reduzierung Ressource	~	~	~	~	~	~
Durchführbarkeit	√	~	~	~	√	√
Multiplikatorischer Nutzen	√	√	√	√	√	X
ENTSCHEIDUNG	√	√	√	√	√	√

Definitionen	
Beeinflussbarkeit	Wieviel Einfluss hat dieLogistik der InfraServ Knapsack auf diese Maßnahme
Verfügbarkeitserhöhung	Erhöht die Maßnahme die Verfügbarkeit der Ressource
Kostenanteile	Wie hoch ist der Kostenanteil der verifizierten Maßnahme an dem Gesamtprodukt
Kostenreduzierung	Kann durch die Maßnahme die TCO reduziert werden
Reduzierung Ressource	Werden durch diese Maßnahme Ressourcen reduziert
Durchführbarkeit	Wie leicht kann die Maßnahme durchgeführt werden
Muliplikatorischer Nutzen	Hat die Maßnahme weitern Nutzen innerhalb der Infraserv oder sogar für andere Unterneh

Material | Entwässerung | Bauart | Sonstiges | Zusammenfassung | Entscheidung

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Results, innovations and products

Actual work:

Decision supporting system RESSTRAT to analyze the replacement of materials & vehicles based on carbon criteria

Current Situation				New Situation			
Material 1	Copper	Weight	4 kg	**Material 1**	GRP	Weight	2 kg
Material 2	Iron	Weight	0.4 kg	**Material 2**	Titanium	Weight	2.3 kg
Material 3	Plastic	Weight	12 kg	**Material 3**	Steel	Weight	5.7 kg
X **Fuel consumption (optional)**							
Fuel	Gasoline	Amount	10 274 litres	**Fuel**	Diesel	Amount	8 722 litres
Total carbon emissions	**329.4 kg**			**Total carbon emissions**	**269.7 kg**		
Durability of object	**2 years**			**Durability of object**	**2.5 years**		
Change of carbon emission situation	**59.7 kg**			**Replacement reasonable**	**Yes**		

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Results, innovations and products

Current results and actual work:

Package of measures to optimize consumption of resources in maintenance and intralogistics

Condition monitoring technologies:

- Acoustic Emission Testing
- Ultrasonic Testing
- Electromagnetical Testing
- Electrical Inspection
- Laser Inspection
- Leak Testing
- Magnetic Particle Testing
- Penetrant Testing
- Radiographic Testing
- Stress Wave Analysis
- Thermal Inspection
- Tribological Testing
- Vibration Analysis
- Visual / Optical Inspection
- Etc.

Selected and used technologies:

- Vibration Analysis
- Torsional Moment Analysis
- Thermal Inspection
- Leak Testing
- Electrical Testing
- Current Consumption Analysis
- PLC – Monitoring

Experimental field for condition monitoring

Motivation

- Intralogistics systems are often build too robust
- Little wear after end-of-life time and possibility for further use

Waste of resources

Ambition

- Practical testing of condition monitoring technologies in intralogistics
- Determination of components status and remaining life span
- Further development of predictive maintenance

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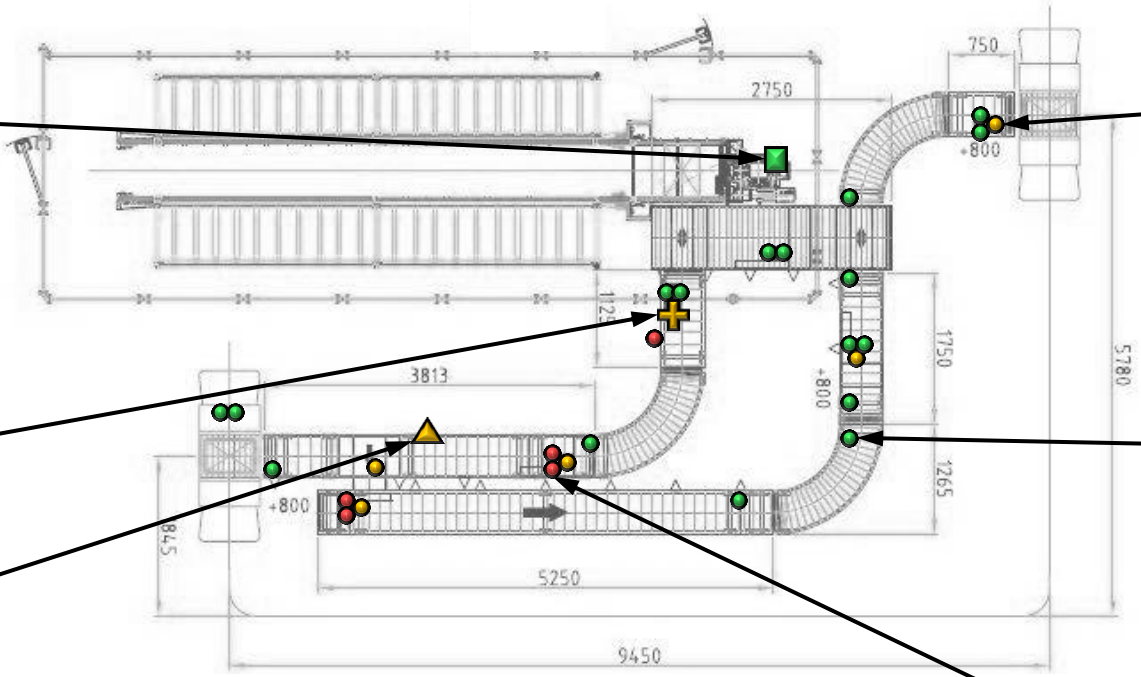
Experimental field for condition monitoring

Layout and Sensors

Torque Monitoring

Temperatur Sensor

Compressed Air Sensor



Sensor:
- Vibration
- Torque
- Temperature
- Compressed Air

Producer:
- Producer 1
- Producer 2
- Producer 3

Vibration Sensors:

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Conclusion

Resource-Efficient Maintenance Logistics


Less consumption of resources


Resource consumption calculator


Condition monitoring technologies


Design requirements


New services


Low carbon intra-/logistics


Lower lifecycle costs

Innovations, technology- and leading trends in logistics through …

- … utilization of condition monitoring and conditionoriented maintenance in intra-/logistics systems based on reliable information about the objects remaining lifetime
- … decision supporting system to analyze the replacement of constructions and components considering carbon-emissions (RESSTRAT)
- … decision supporting system to determine the optimal storage quantity of spare parts considering carbon-emissions (RESOPT)
- … testing, evaluation and utilization of alternative materials in intra-/logistics systems considering ecological aspects

Strengthening of the competitive position of the project partners and the clusterregion through …

- … new services in cross location spare parts management
- … avoidance or delay of investments in constructions, components and means of transport
- … increasing the performance driven availability of (project)focused constructions, components and means of transport

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Outlook

Objectives for the future:

- Finishing work at decision supporting system RESOPT and implementation – going live
- Finishing work at decision supporting system RESSTRAT and implementation – going live
- Analysis of condition monitoring research results
- Invention of marketing concepts

Thank you for your attention!

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