





Non-destructive damage prevention inspections

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There are risks and costs to a program of actions.

But they are far less than the long-range risks and costs of comfortable inaction.

John F. Kennedy (1917 – 1963)



Content

- Damage prevention history
- Present situation
- Non-destructive inspections
 - Why
 - How
 - Advantages
 - Disadvantages
- Conclusion



Damage prevention history

- In the 90's the “Damage Prevention Program” in the Dutch fishing industry
- Around 1995 Damnet was developed,
- Around 2002 the ERS was developed
- 2006 a new idea was developed

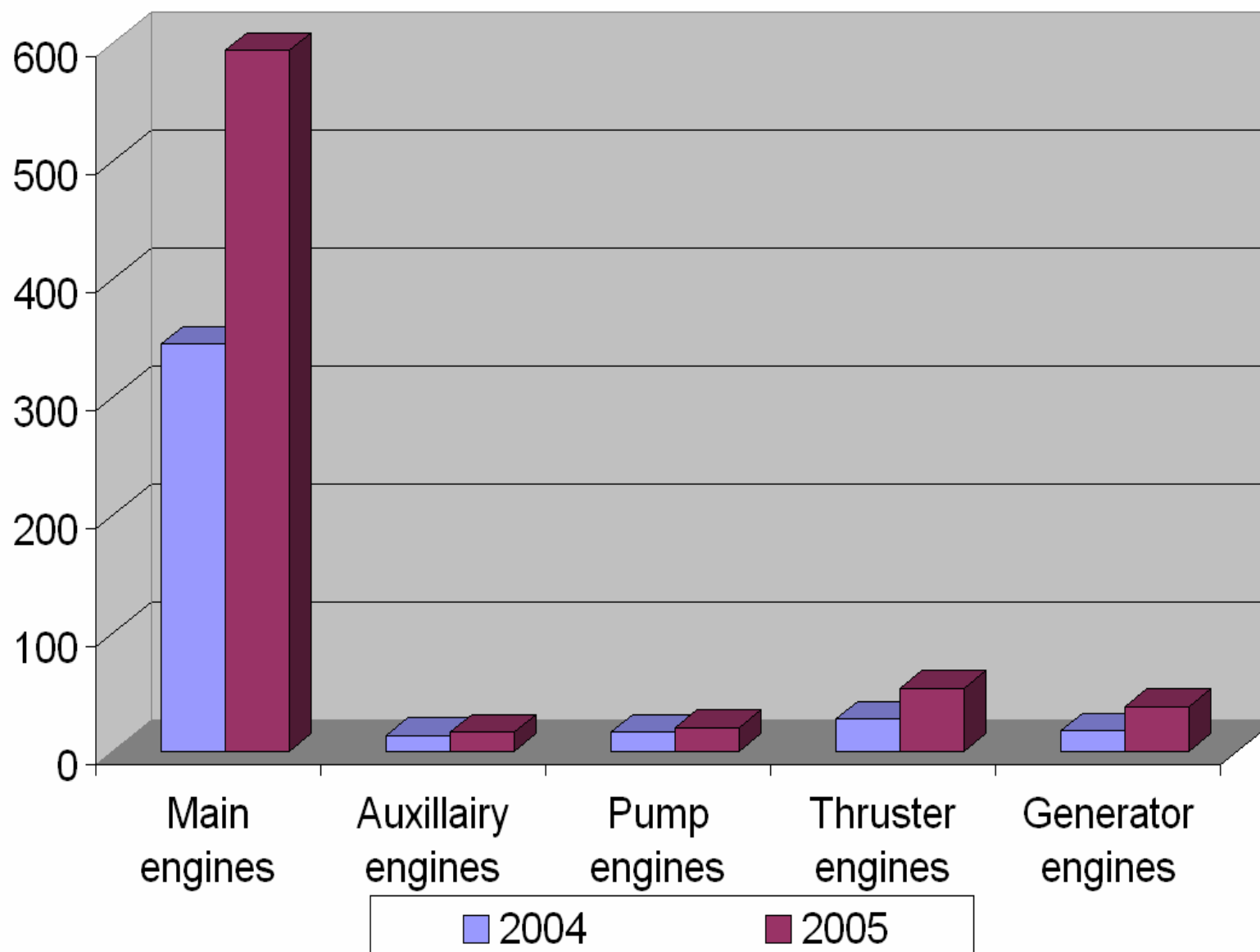


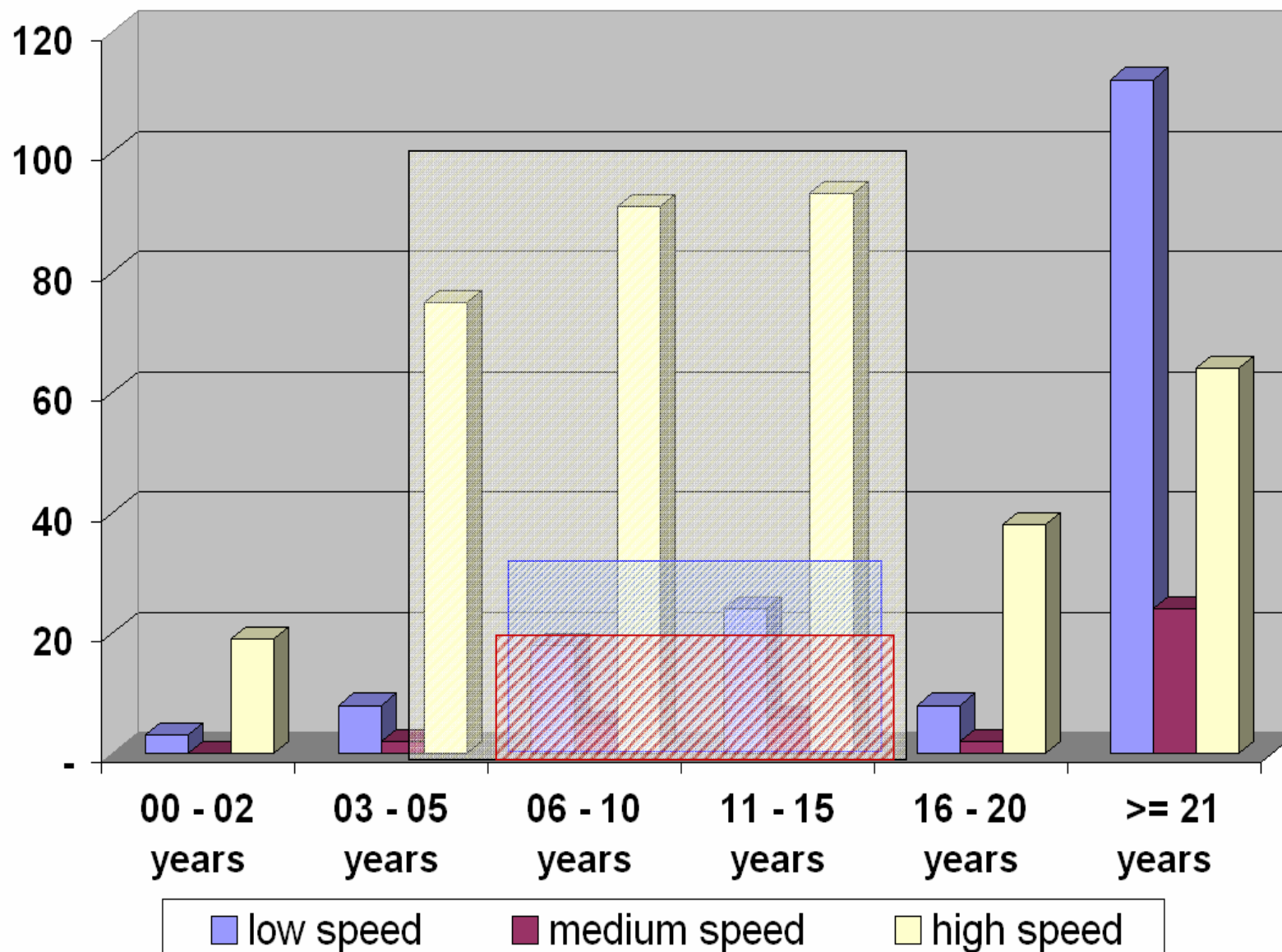
Present situation



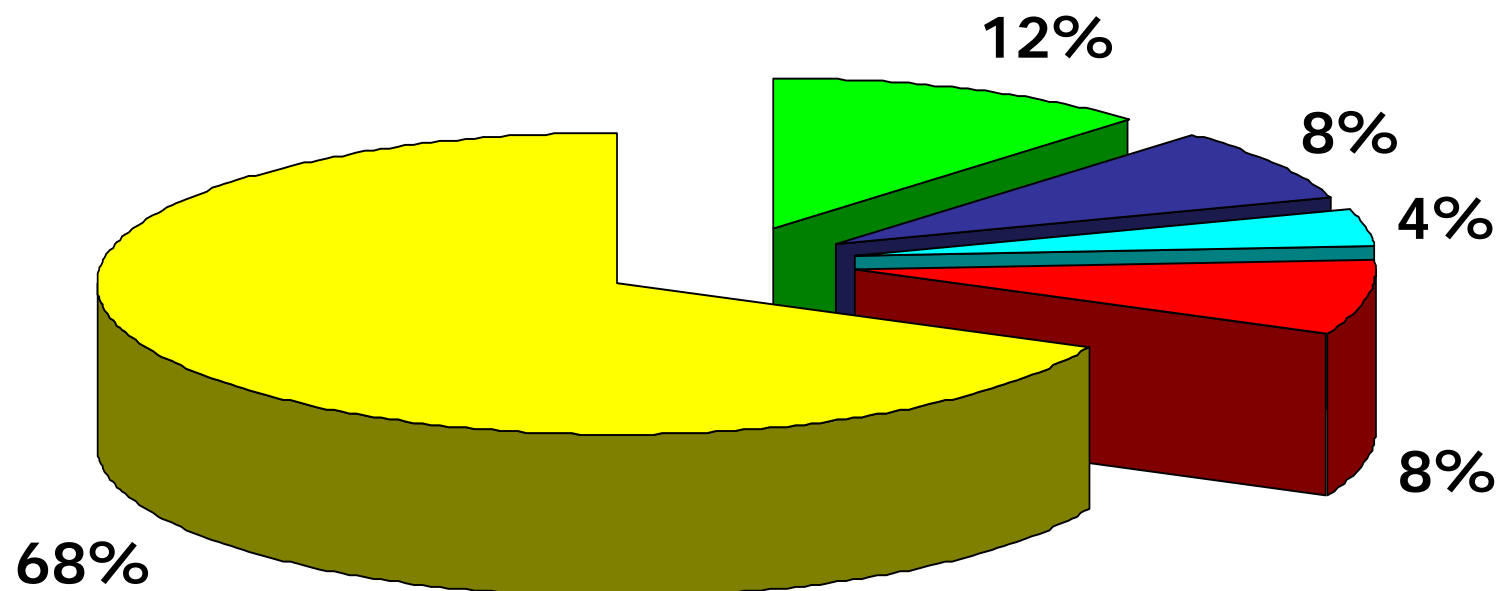
Some figures from Dutch inland shipping

(source: ERS)





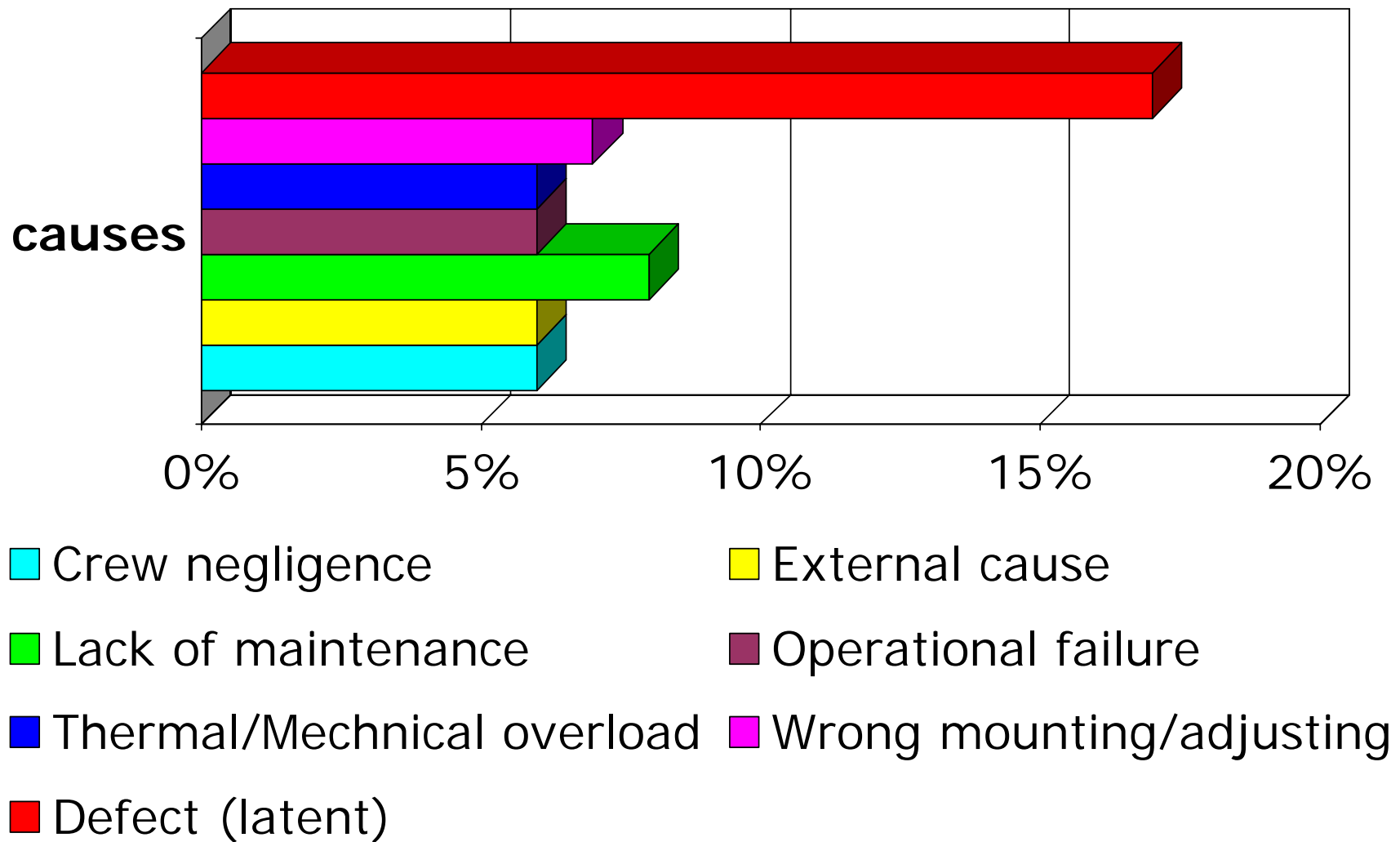
Engine damage basic causes



- Cooling failure
- Misalignment
- Component failure

- Lubrication failure
- Thermal overload

Engine damages

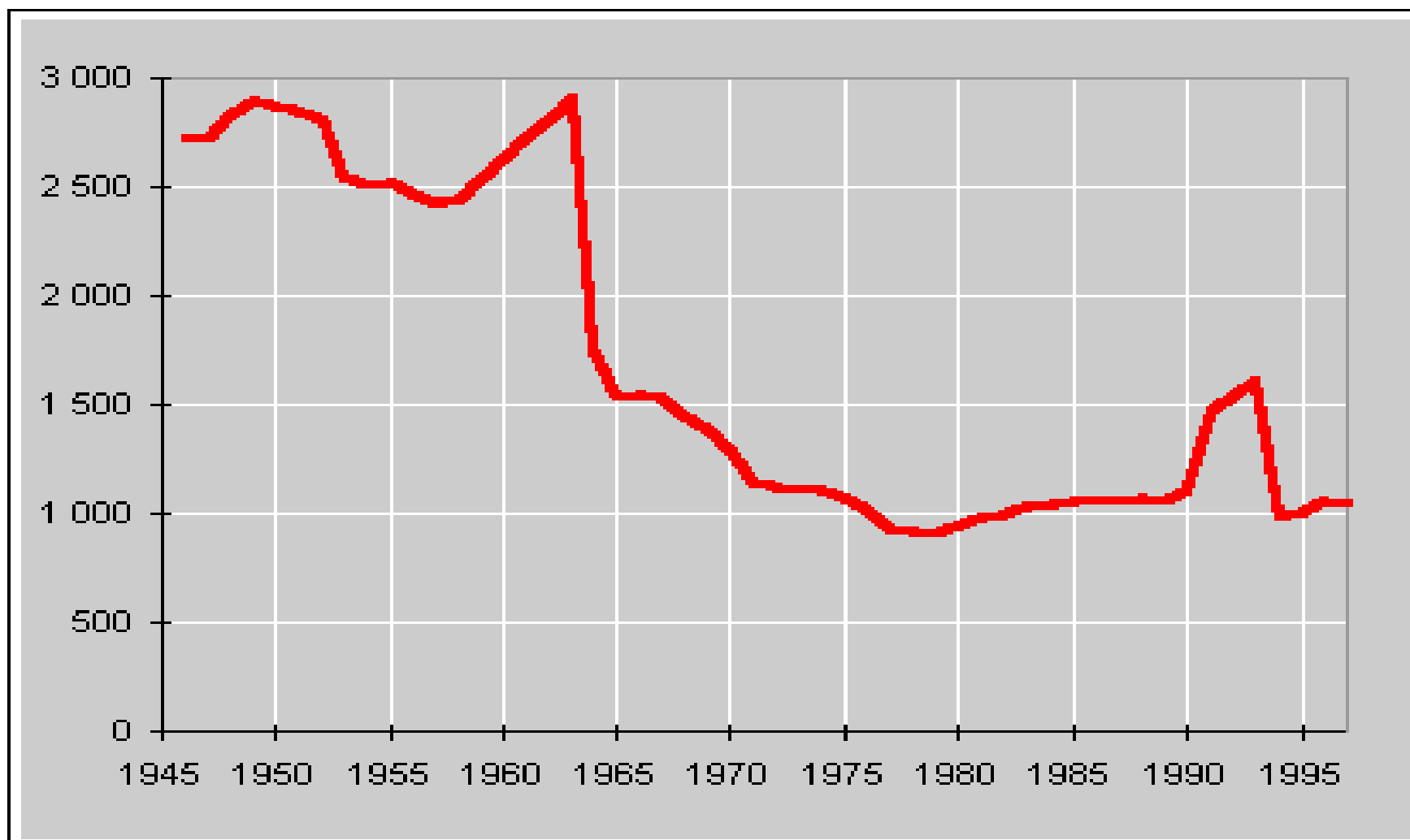




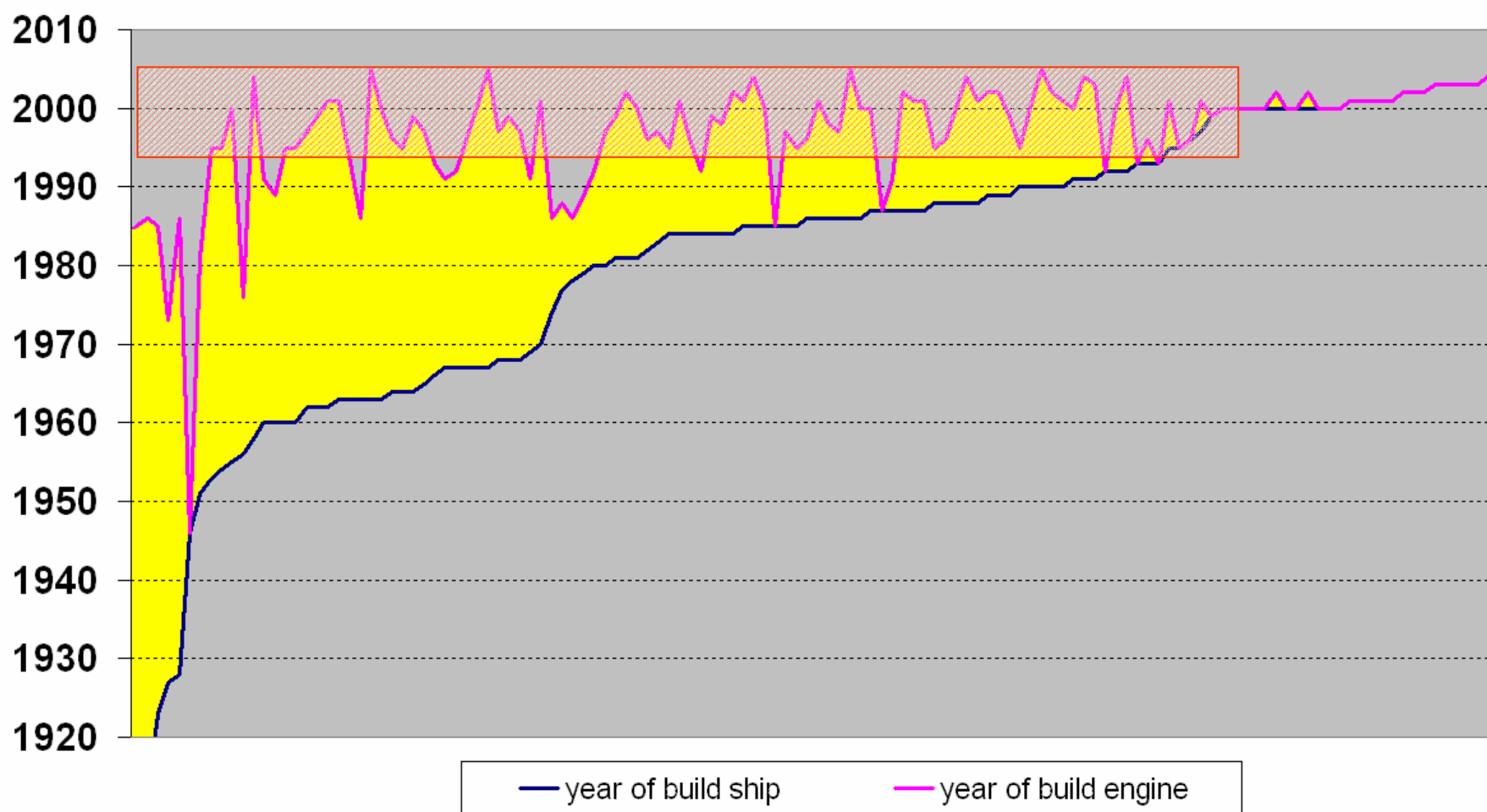
Some figures from Dutch fishing vessels

(source: Central Bureau of Statistics)

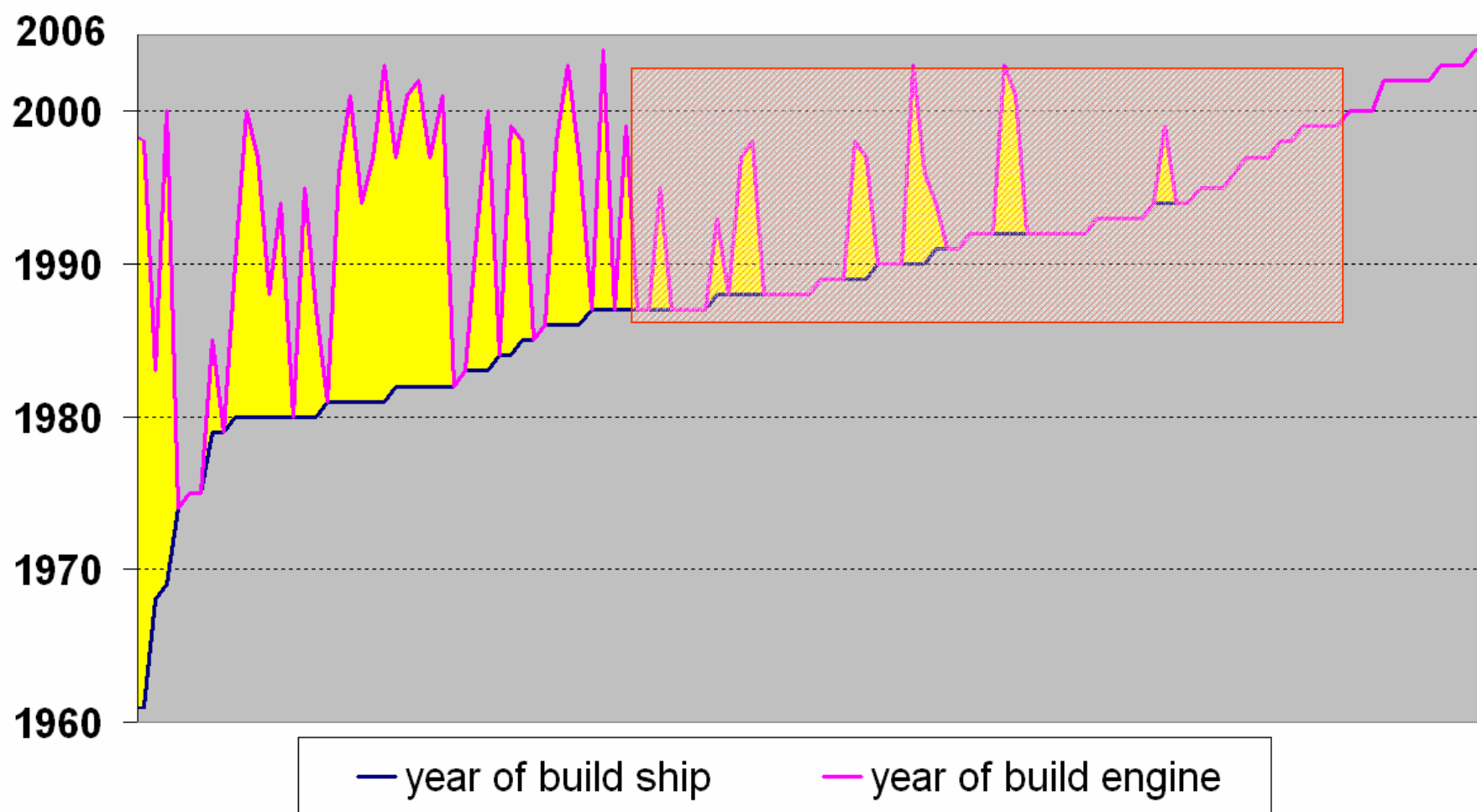
Development number of vessels Dutch fishing fleet



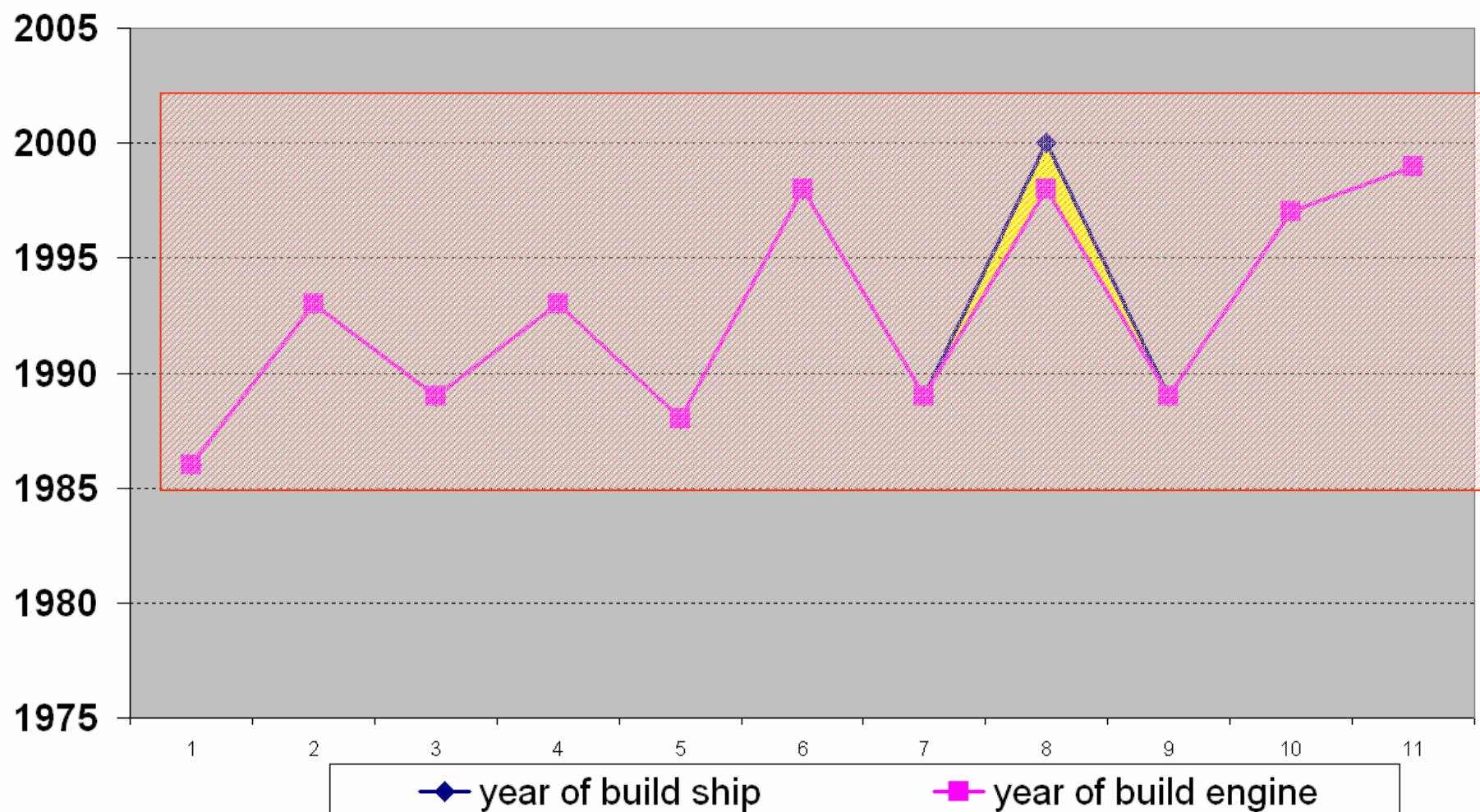
Year of build ship / engine up to 300 hp (approx. 130 vessels)



Year of build ship / engine 400-4000hp (approx. 120 vessels)



Year of build ship / engine - Dutch stern trawlers



General conclusions

- Below 300 hp almost all relatively new propulsion installations
- In the Dutch beam trawler fleet only incidentally new engines installed.
- Dutch beam trawler propulsion installations majority more than 10 years old!
- Majority part of the stern trawlers propulsion installation are all more than 10 years old!



- Most of the time not
- In the small details

The question is..... how to find them?

Non-destructive inspections

Why ?

- Propulsion installations are becoming older than 10 years
- Dismantling for inspections is costly
- Dismantling for inspections is time consuming
- Visual inspection does not cover it all
- Visual inspection leaves room for interpretation
- Many claims occur due to failing alarms, relays and non-visible wear

Non-destructive inspections

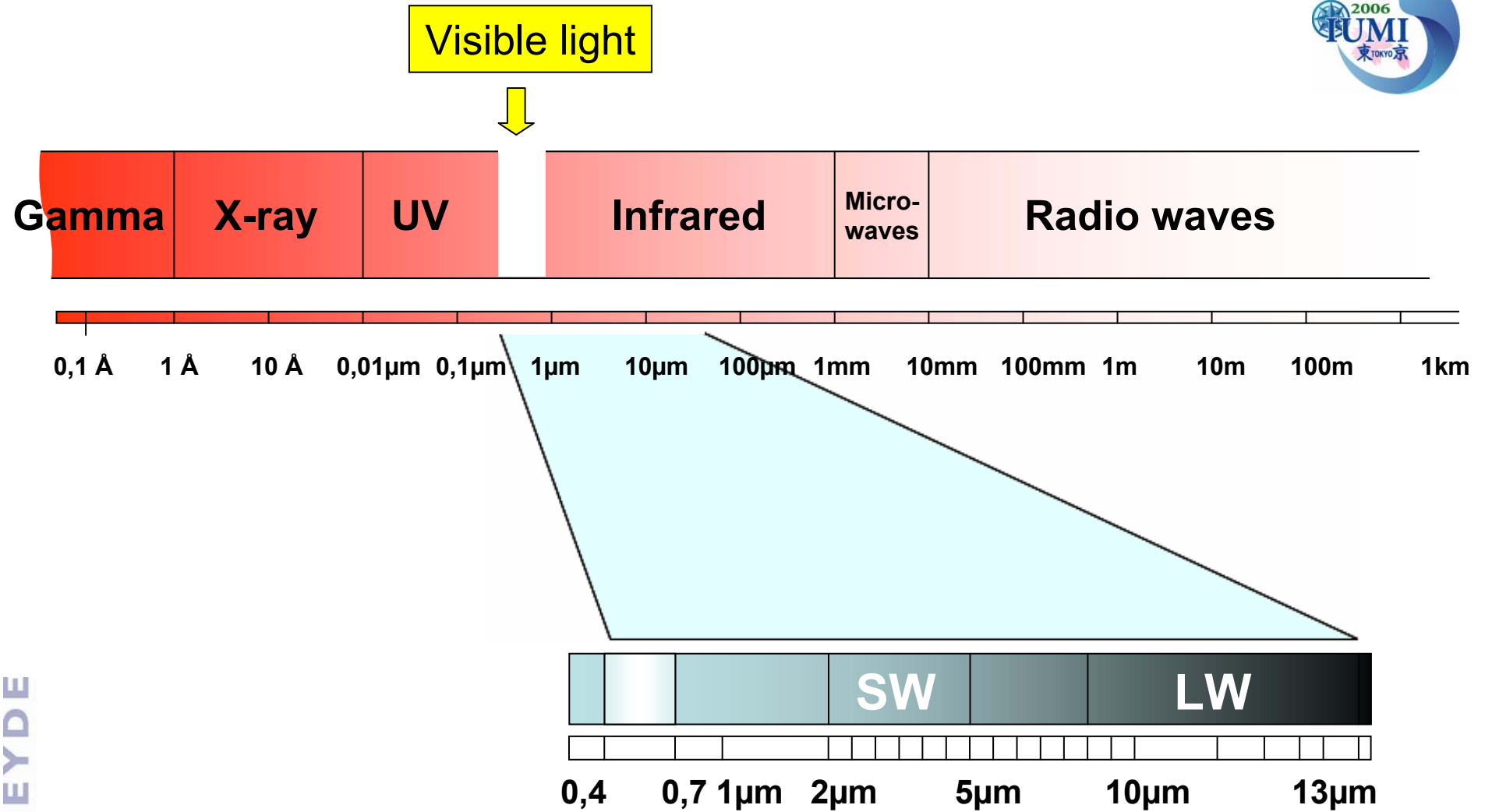
How ?

Infrared

- What is infrared
- How does it work
- What are the criteria
- Some examples



What is infrared?



Visible light ranges from 0,4 μm (violet) to 0,7 μm (red)



How does it work?



Infrared measuring is;

not

measuring heat,

but

measuring ***radiation!!***.

There are 2 forms of radiation involved:

Incident radiation =

all the radiation that strikes an object from its surroundings

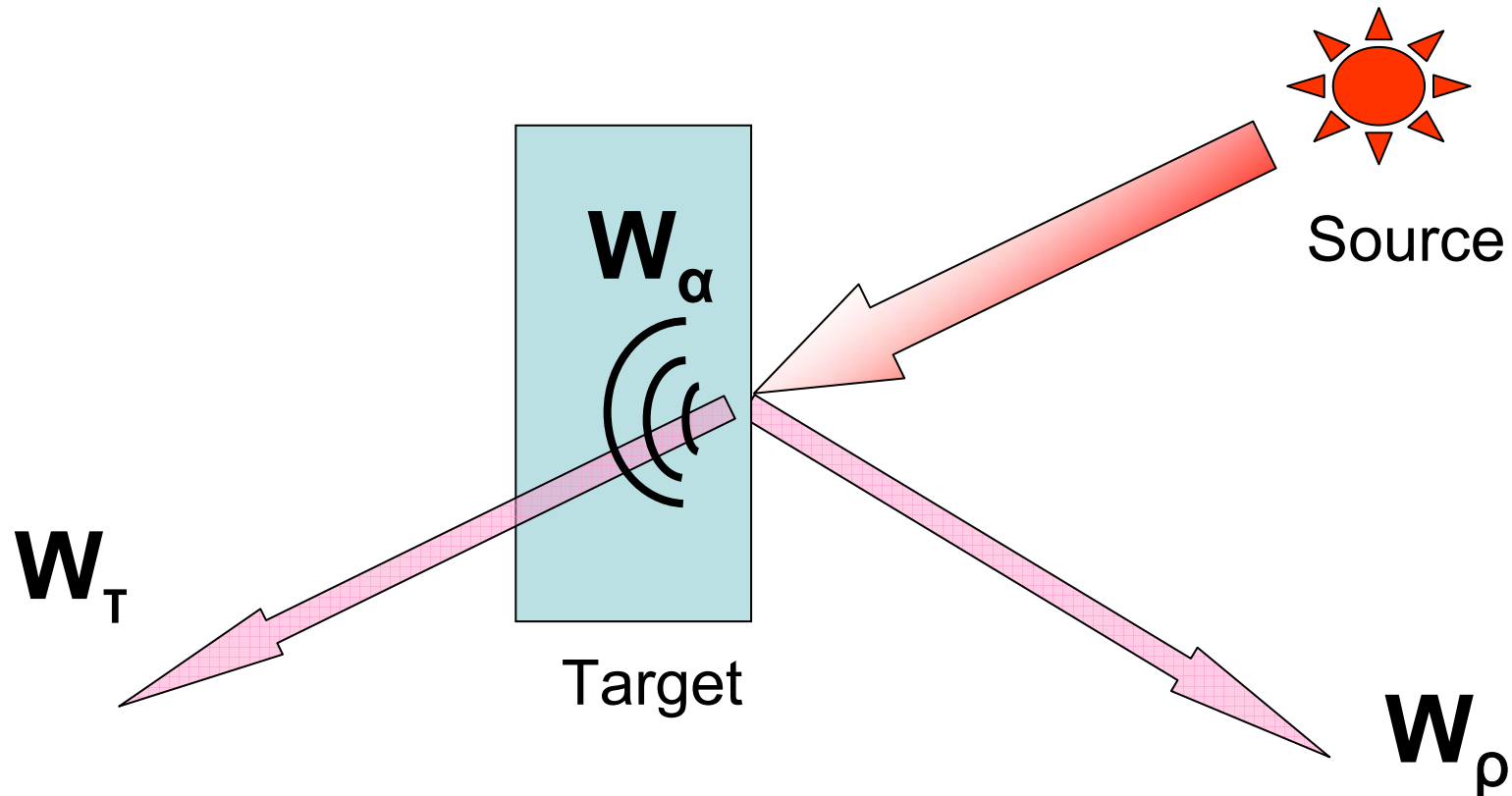
Exitant radiation =

All the radiation that leaves the surface of an object, regardless of its original source

Incident radiation

An object will have certain capacity or ability to:

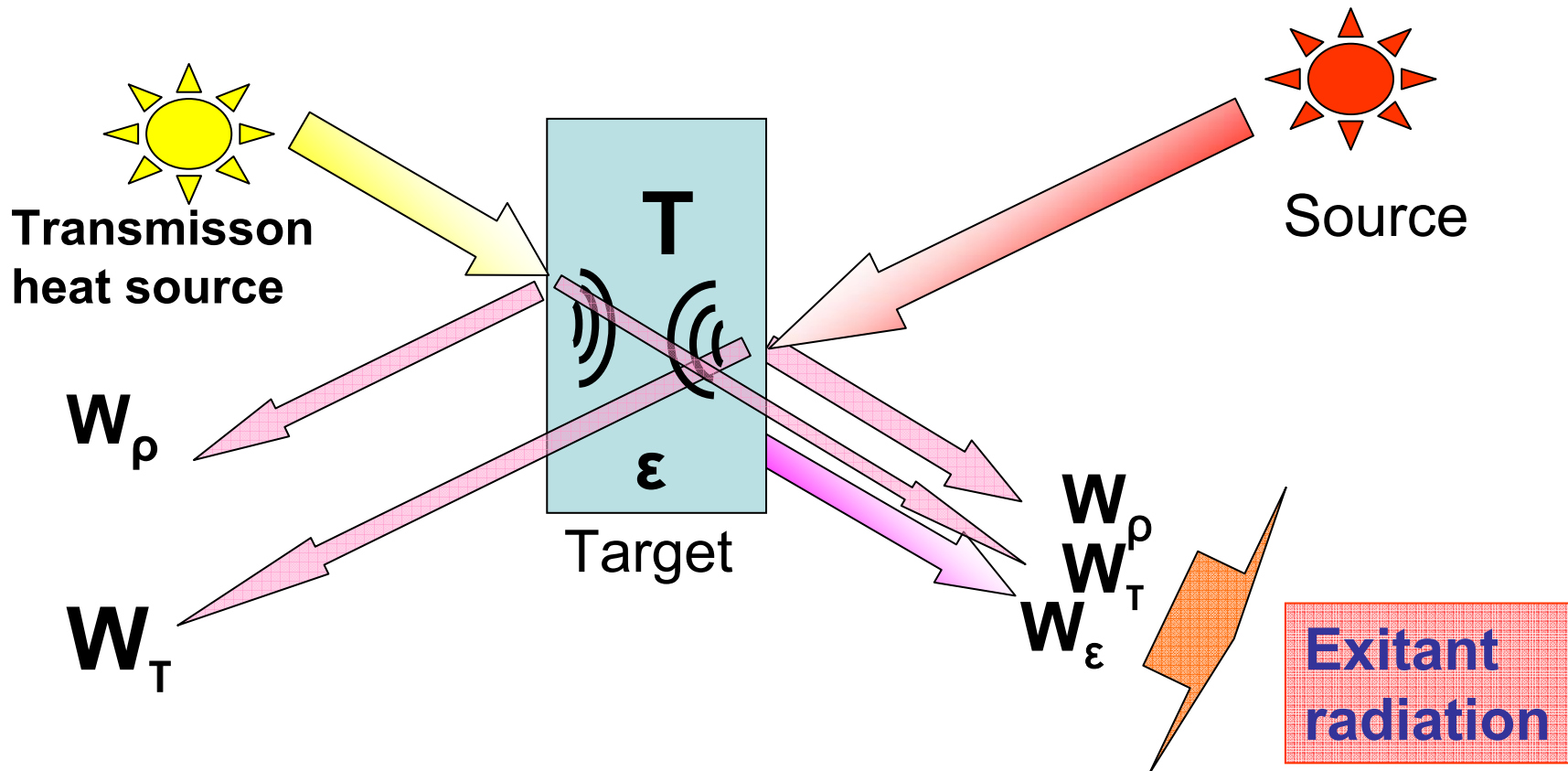
- **Absorb** – called Absorptivity = α (alpha)
- **Reflect** – called Reflectivity = ρ (rho)
- **Transmit** – called Transmissivity = τ (tau)

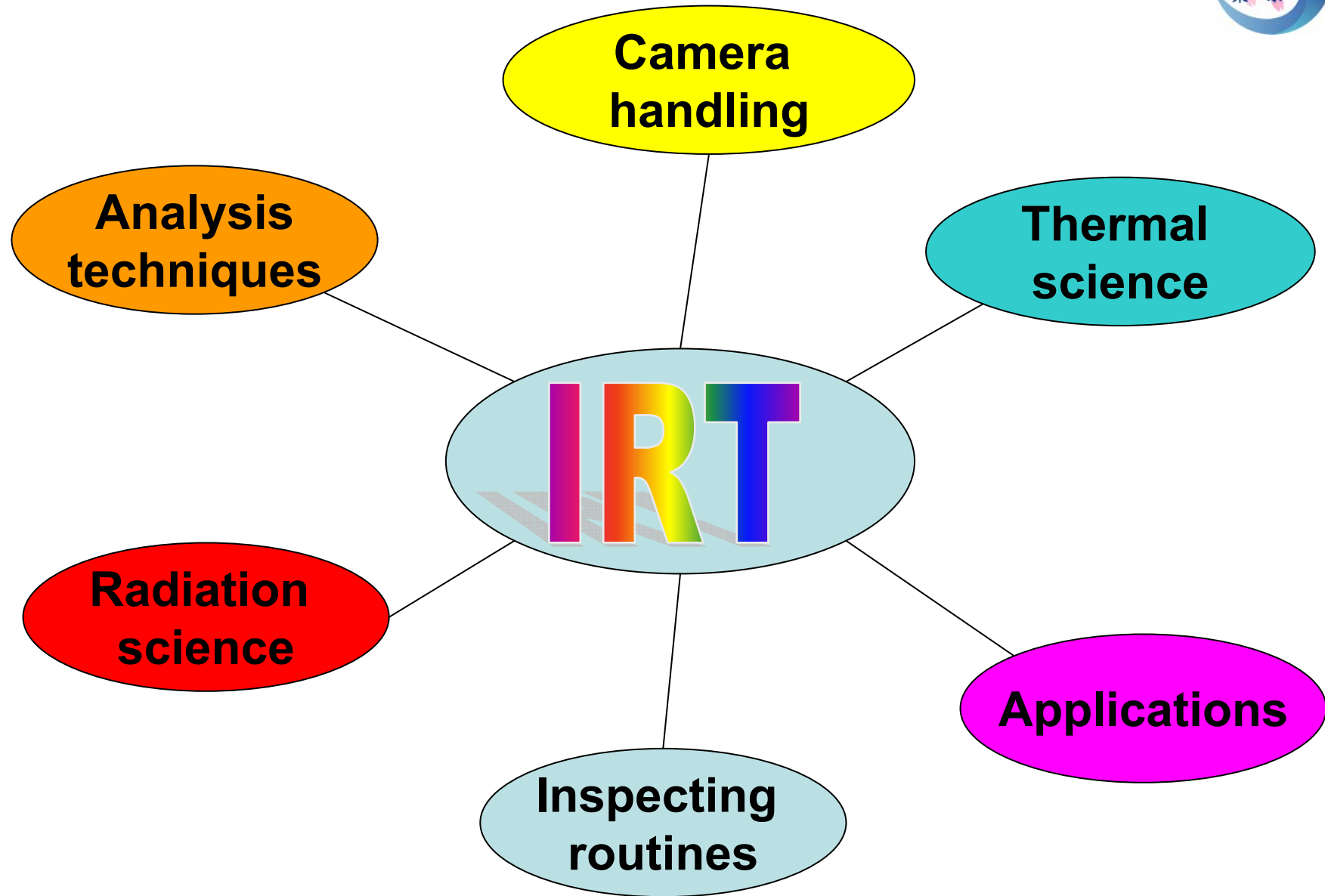


Exitant radiation

Exitant radiation comes from 3 different sources:

- **Emit** – called Emissivity = ε (epsilon)
- **Reflect** – called Reflectivity = ρ (rho)
- **Transmit** – called Transmissivity = τ (tau)







What are the criteria?

Two different principles for analysing:

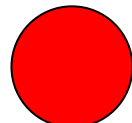
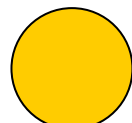
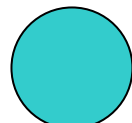
Qualitative =

Qualitative IRT relies on analysis of thermal patterns to reveal the existence and locate the position of anomalies, and evaluate them

Quantitative =

Quantitative IRT uses temperature measurement as a criterion to determine the seriousness of an anomaly, in order to establish repair priorities.

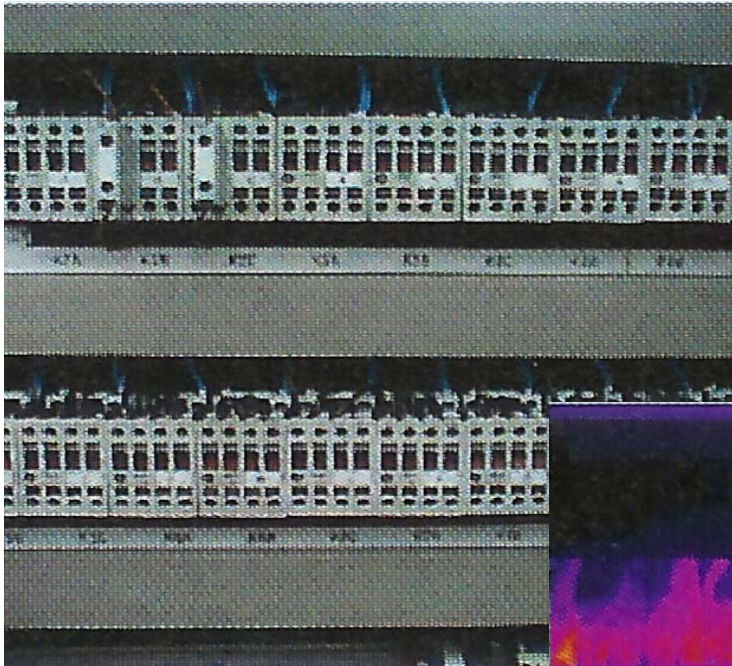
Classification criteria

-  = Class “A” – A very serious anomaly that requires immediate attention.
Example: Absolute temperature > 80°C, or delta T > 30K
-  = Class “B” – A serious anomaly that requires attention as soon as possible.
Example: Delta T between 5-30K
-  = Class “C” – An anomaly that requires monitoring and a check-up at the earliest convenient time possible.
Example: Delta T up to 5K



Some examples

Low voltage switchboard



Bad low voltage connection

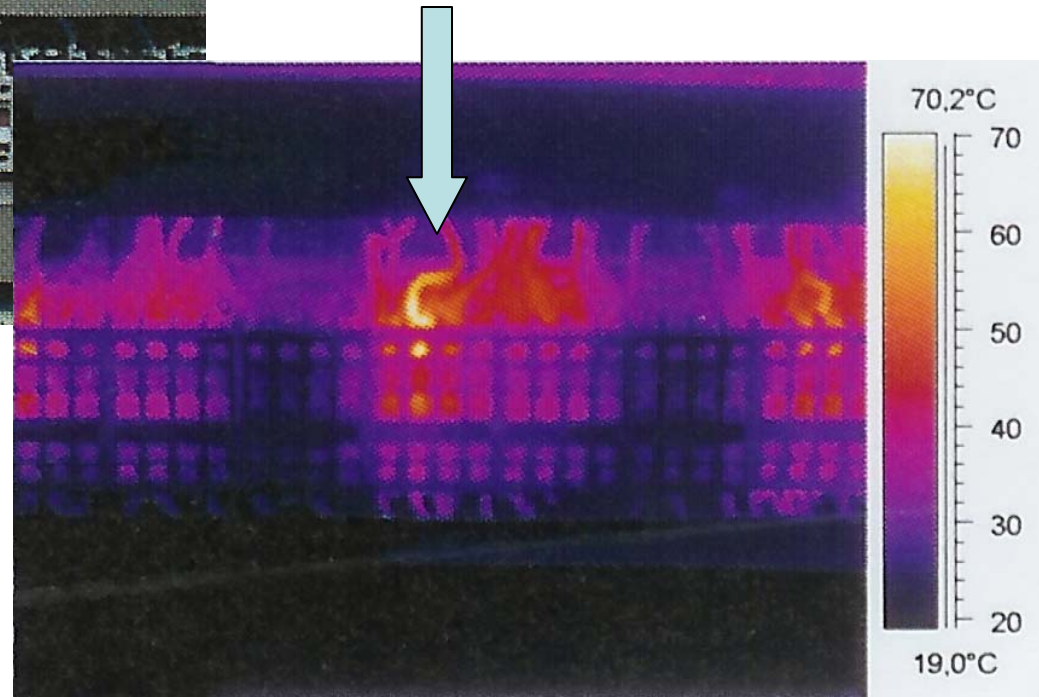
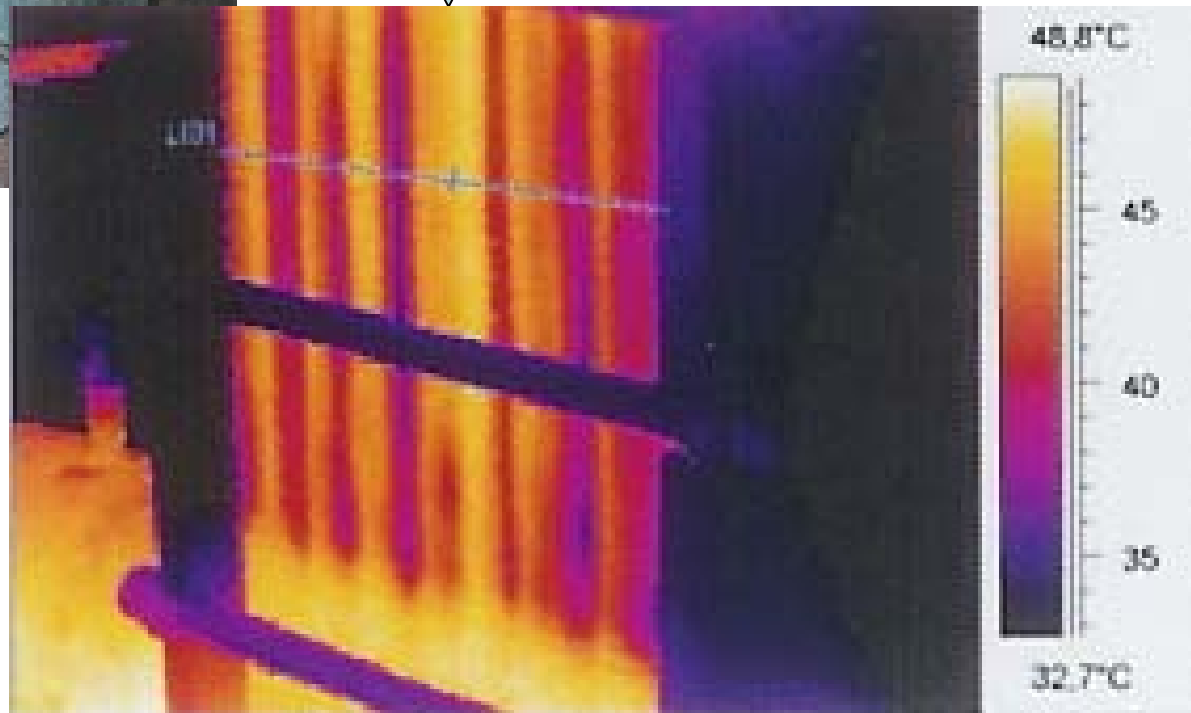


Plate cooler

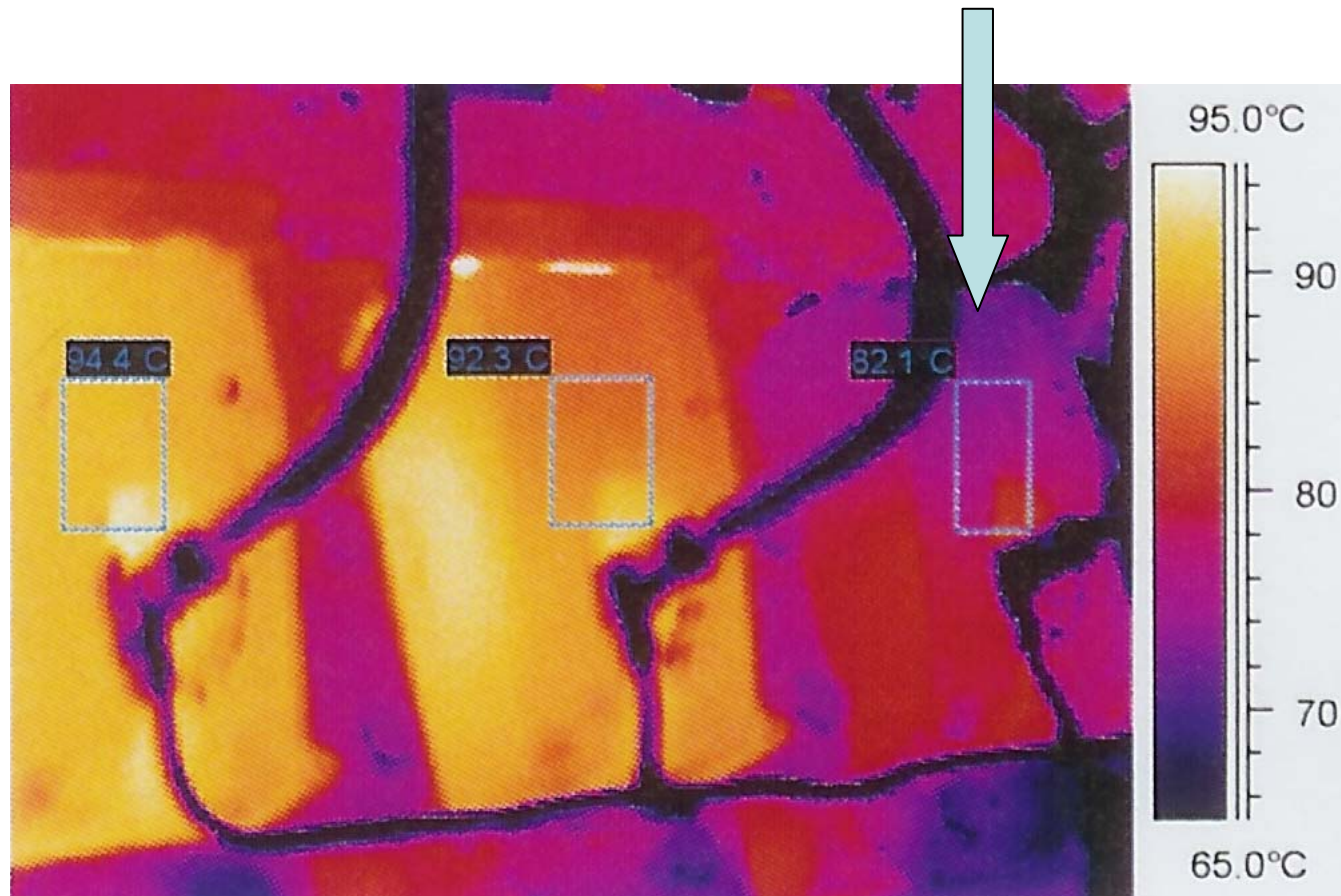


Blocked heat exchanger pipe

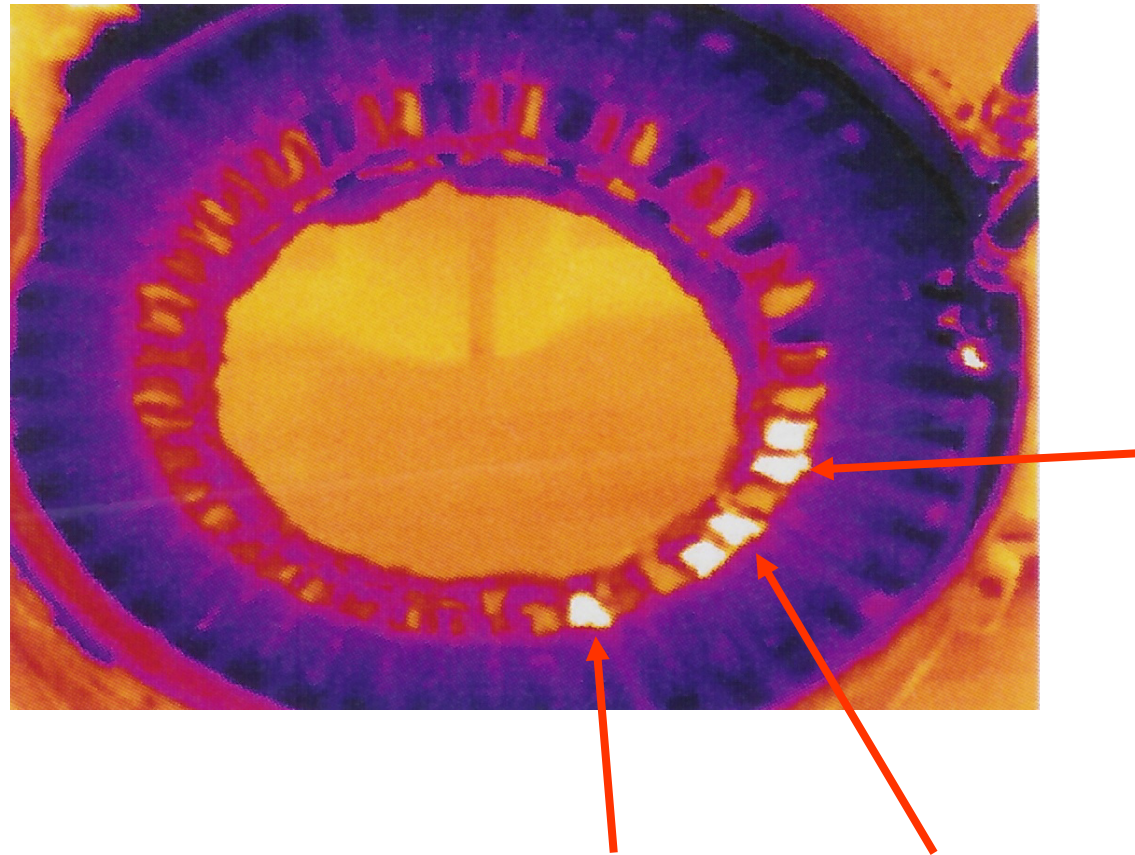


Three cylinder covers in row of a V-8 engine

One cylinder not firing



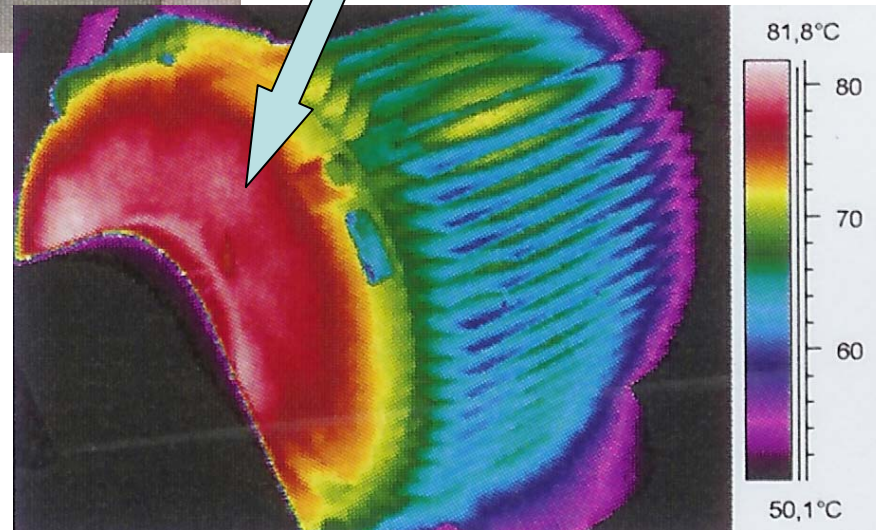
Short circuit in stator coils



Electric motor of cooling water pump



**Overheated
electric motor
bearing**



Difficult to reach isolated piping system



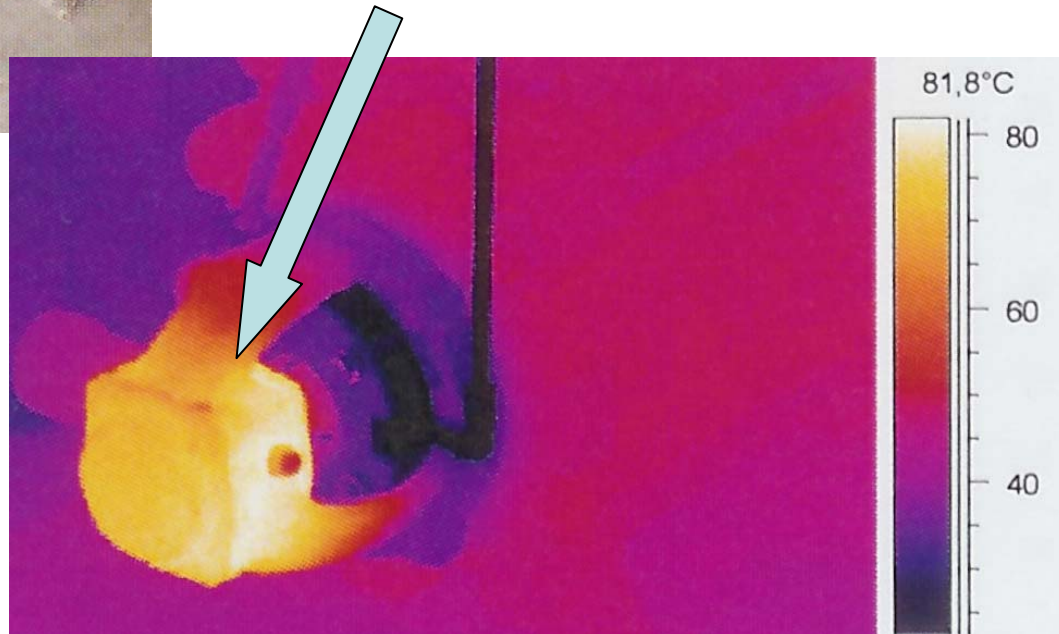
Pipe isolation failure



Cooling water pump



Pump bearing to be replaced





Non-destructive inspections

Advantages

Advantages

- Non-destructive
- Condition monitoring
 - Optimizes maintenance
 - No business interruption
 - Reduces maintenance costs
 - Reduces damage risk
- Not too expensive

Disadvantages

- Requires certified IRT inspectors
- Requires wide range of technical knowledge
 - Machinery
 - Electronics
 - Processes
- Requires inspections to be carried under load conditions (whilst fishing and hauling)
- Requires classification criteria
- Too many charlatans around



Conclusions

- IRT is a good tool to find anomalies in a relatively easy non-destructive way
- It can reduce / prevent damages
- It's feasible
- Not too expensive
- It has to be done at regular intervals



There are risks and costs to a program of actions.

But they are far less than the long-range risks and costs of comfortable inaction.

John F. Kennedy (1917 - 1963)



Thank you
for
your attention