



## A Refreshed view on firefighting

An evidence based approach in NL resulting in basic principles: simple and elegant

**Introduction: Netherlands**

Why Research? How ? 'UL-model'

Observations, considerations, developments.....

**Preview projects**

Smoke, explosions ?



**Research Projects**

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**A refreshed view on fire fighting**

23 25 42

1. Do we know where ?  
2. Can we reach it ?  
3. Do we have sufficient resources ?  
4. Can we extinguish it ?  
5. Can we prevent it ?

1 x NO = predictable outcome!



**IFIW conference 2018 Revinge**  
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the Netherlands Fire Service Academy

www.brandweernederland.nl

# Introduction: Netherlands

**Why Research?**

Turning point: "De Punt" 2008



**How ? 'UL-model'**

Combination of different research methods

Participative practical research



**Observations, considerations, developments.....**

Our point of view (now)...



Myths, beliefs, 'negative' facts, discussions and misunderstandings!



Why do we not apply our knowledge in practice?



# Turning point: "De Punt" 2008



- > This fire was not an incident - it was an example
- > The loss of our colleagues was avoidable but not culpable

**Conclusion: something is wrong in our system and we need a system approach to prevent incidents like this in the future**

## Quadrant model

### defensive exterior attack

goal:  
 1. prevent fire spread to adjacent buildings  
 2. reduce impact on environment

*new formula*

### offensive exterior attack

goal:  
 1. improve tenability  
 2. prevent fire spread  
 3. extinguish fire

*new*

### defensive interior attack

goal:  
 1. facilitate evacuation  
 2. prevent fire spread outside compartment

*houden new*

### offensive interior attack

goal:  
 1. rescue  
 2. prevent fire spread in compartment  
 3. extinguish fire in compartment

*new formula*

# How ? 'UL-model"

Combination of different research methods

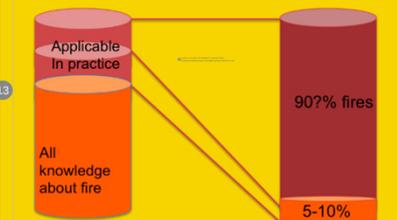


Participative practical research



# Observations, considerations, developments....

Our point of view (now)...



Why do we not apply our knowledge in practice?



- Hypotheses / observations:
- Human factors
    - adrenalin / time pressure -> Situational awareness imperfect
    - experience seems to replace knowledge (alle fires are like most fires)
  - Organisation / education
    - we offer correct theory - but: gap between theory and practice
    - our exercises are NOT realistic (and those in containers aren't either!)
- > SYSTEM APPROACH NECESSARY!

Myths, beliefs, 'forgotten' facts, discussions and misunderstandings



## Myths, beliefs, 'forgotten' facts, discussions and misunderstandings



Rescue or extinguish?  
discussion



Since the hose is in the door opening,  
we can leave the door open



never put in water from outside



We put out all fires using  
High Pressure (or CAFS)



venting  
a major fire  
to facilitate  
interior  
attack



internal attack =  
gas cooling  
  
gas cooling =  
unlimited





PPA and PPV  
can be applied easily

## Why do we not apply our knowledge in practice?




**Hypotheses / observations:**

- Human factors
  - adrenalin / time pressure --> Situational awareness imperfect
  - experience seems to replace knowledge (alle fires are like most fires)
- Organisation / education
  - we offer correct theory - but: gap between theory and practice
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--> SYSTEM APPROACH NECESSARY!



### "Experience: can we trust on it?"

#### Amount of experience

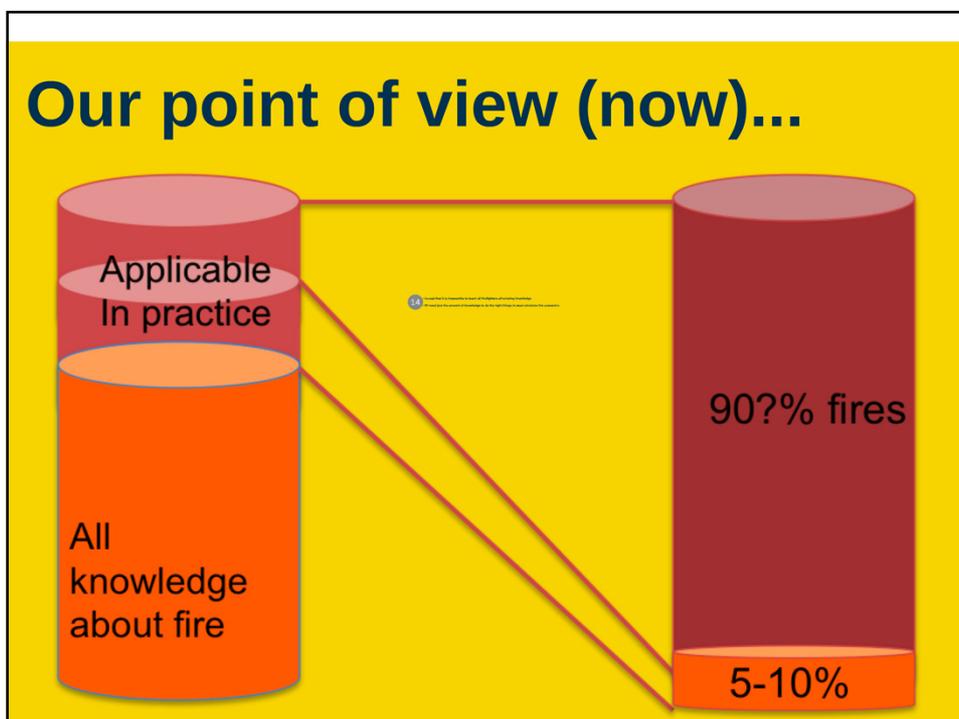
AANTAL GEBOUWBRANDEN PER POST IN EEN JAAR		
	PER POST	SCHATTING SERIEUZE BRAND PER PERSOON
Groningen	10	2
Friesland	8	1
Drenthe	11	1
Overijssel	10	1
Gelderland	10	1
Utrecht	10	1
Noord-Holland	36	5
Zuid-Holland	5	1
Zeeland	5	1
Noord-brabant	14	2
Limburg	12	2
Flevoland	13	2
Gemiddeld	13	2

#### Valuability of experience



brain fools us

## Experience is only experience (knowledge) when understood!

- Accept that it is impossible to teach all firefighters all existing knowledge
- FF need just the amount of knowledge to do the right things in most structure fire scenario's

## Research Projects

Case studies: underventilated fires & elderly in home fires

Fire Engineering

fire behaviour: escape and tenability in single family dwellings

DATA

International Research

Incident command

We are not perfect

TAKE TIME!

Quadrant model

<p>defensive exterior attack</p> <p>goal</p> <ol style="list-style-type: none"> <li>1. prevent the spread to adjacent buildings</li> <li>2. reduce impact on environment</li> </ol> <p>new formula</p>	<p>defensive interior attack</p> <p>goal</p> <ol style="list-style-type: none"> <li>1. improve survivability</li> <li>2. prevent the spread</li> <li>3. extinguish fire</li> </ol> <p>new</p>
<p>defensive interior attack</p> <p>goal</p> <ol style="list-style-type: none"> <li>1. facilitate evacuation</li> <li>2. prevent the spread outside compartment</li> <li>3. extinguish fire in compartment</li> </ol> <p>new</p>	<p>defensive exterior attack</p> <p>goal</p> <ol style="list-style-type: none"> <li>1. rescue</li> <li>2. prevent the spread to compartment</li> <li>3. extinguish fire in compartment</li> </ol> <p>new formula</p>

• effect depends more on location of attack than on technique → site specific → design → using research → feasibility not much better

• feasibility (if depends) fire development (if depends) site conditions (if depends)

fire behaviour, escape and tenability in single family dwellings

# Incident command

We are not perfect

Decision making under pressure

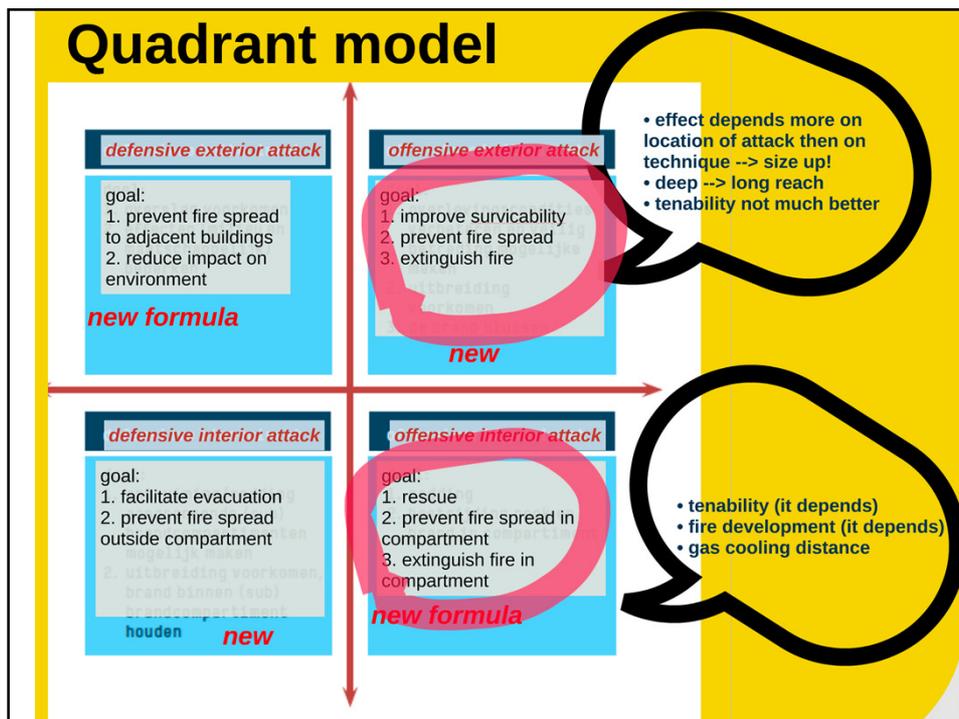
Safety net

HUMAN FACTORS

OH WOW! PARADIGM SHIFT!

INNOVATION OVERLOAD

TAKE TIME!



## International Research




**Wetenschappelijk onderzoek naar de ontwikkeling van effectievere tactieken**  
Governors Island-experimenten  
Jul 2012

**NIST**

**Positive Pressure Attack**



**UL FSRJ Launches Dutch version of Governors Island Online Training Program**

Suppression tactics  
Training  
Ventilation  
vertical  
ventilation  
Wall Fire

**wind driven fire**



**ventilate?**



**transitional attack**



**MYTHS**

**FACTS**

**Comparison of Room Furnishings**

Legacy Room      Modern Room

Flashover 2:25      Flashover 3:40

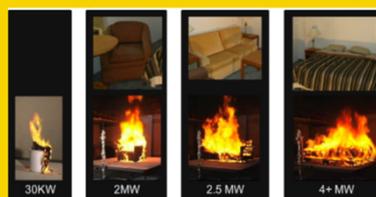


# Fire Engineering

## Cooling capacity



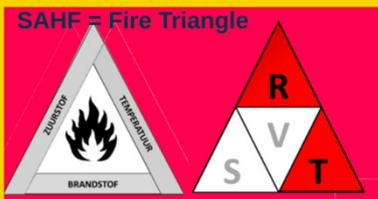
## Potential Heat Release Rate



per m2 opening -> 1,5-3 MW fire

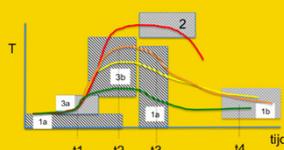
Sofa ± 2,5 MW -  
home: 0,25 MW/m2 -- industrial: 0,5 MW/m2

## SAHF = Fire Triangle



## Possible scenario's...

1. "nothing showing"  
Open door shortly  
(Ventilation)
2. Working outside fire  
Transitional attack
3. Smoke pushing out
4. Smoke coming out



## A refreshed view on fire fighting

Elegant to explain and simple to apply

( for fire prevention and for fire suppression)

**1** • Take time!

- We have more time than we think!
- all closed = pause, open = speed up!

**2** THINK OUTSIDE  
approach from outside > exterior size up

Basis: **3**

1. Do we know where the fire is?
2. Can we reach it ?
3. Do we have sufficient cooling capacity?

--- > Put it out!

**5** Sofa: ca 2,5 MW --> HD (125l/min)= ca 2,5 MW  
 Apartment 40 m2: ca 10MW --> LD (400 l/min) = ca 10 MW  
 industrial building / warehouse 1000 m2: ca 500 MW --> ??

**4** maybe go inside

1. "nothing showing" Open door shortly (Ventilation)
2. Working outside fire (Transitional attack)
3. Smoke pushing out
4. Smoke coming out

1 x NO = predictable outcome!

→ defensive strategy

a. Door control

b. Fast action; water on the fire

c. Gas cooling distance!

d. Cooling capacity

1. "nothing showing" Open door shortly (Ventilation)
2. Working outside fire Transitional attack
3. Smoke pushing out
4. Smoke coming out

## Air, Fire and water



Little air --> small fire --> little water  
 lot of air --> big fire --> lots of water



**HÉ DOE DE DEUR DICHT!**

Test jezelf op verkleinik.ansgoud.nl

**CLISE**  
BEFORE YOU DOZE

cliseproject.org

## Preview projects

### Case studies: trends to learn from

Casustiek uit brandonderzoek

**TRENDS OM VAN TE LEREN**

39  
41

### Gas cooling (3D) - or not?

Questions?

27  
32  
31

**For now:**

- keep oxygen away (door control)
- water on fire if possible is the best
- gas cooling when approach a fire --> keep distance:  $\leq 70 \text{ m}^2 / 4 \text{ m}$

### Smoke explosions / Fire explosions

33  
35



### Consequences - educational system

40  
46



bron: RTV Rijnmond

## Gas cooling (3D) - or not?

### Questions?



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- To which extent is gas cooling effective? What are limits?
- Is it only cooling? (maybe also asphyxiation or inertization)?
- What about cold smoke gases? They can still ignite! How to prevent ignition?
- Do we really need 3D gas cooling techniques?



Literatuuronderzoek rookgaskoeling

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- focus on cooling
- no research on other effects
- inertize and dilution: definitions not clear
- different opinions on applicability

### For now:

- keep oxygen away (door control)
- water on fire if possible is the best
- gas cooling when approach a fire --> keep distance:  $\leq 70 \text{ m}^2 / 4\text{m}$

compare US and EU style attack







# Smoke explosions / Fire gas explosions





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Harmelen 2016



Helmond 2015



Schiedam 2016

What we know:

- 2014: 2x
- 2015: 2x (industrial)
- 2016: 5x (1 x house, 4x industrial)
- 2017: 3x
- 2018: 1x until now



IJmuiden 2016



Obdam 2015



Leiden 2005



De Punt 2008



Den Haag 2011



Woerden 2016

# Case studies: trends to learn from

Casuïstiek uit brandonderzoek

## TRENDS OM VAN TE LEREN

- 1. Smoke spread through building
- 2. Risk prevention
- 3. Resilience / zelfredzaamheid
- 4. Rescue first? Redden of blussen?
- 5. Contra-Intuitive brandontwikkeling / fire development
- 6. Brandbestrijding

Refreshed view as reference

