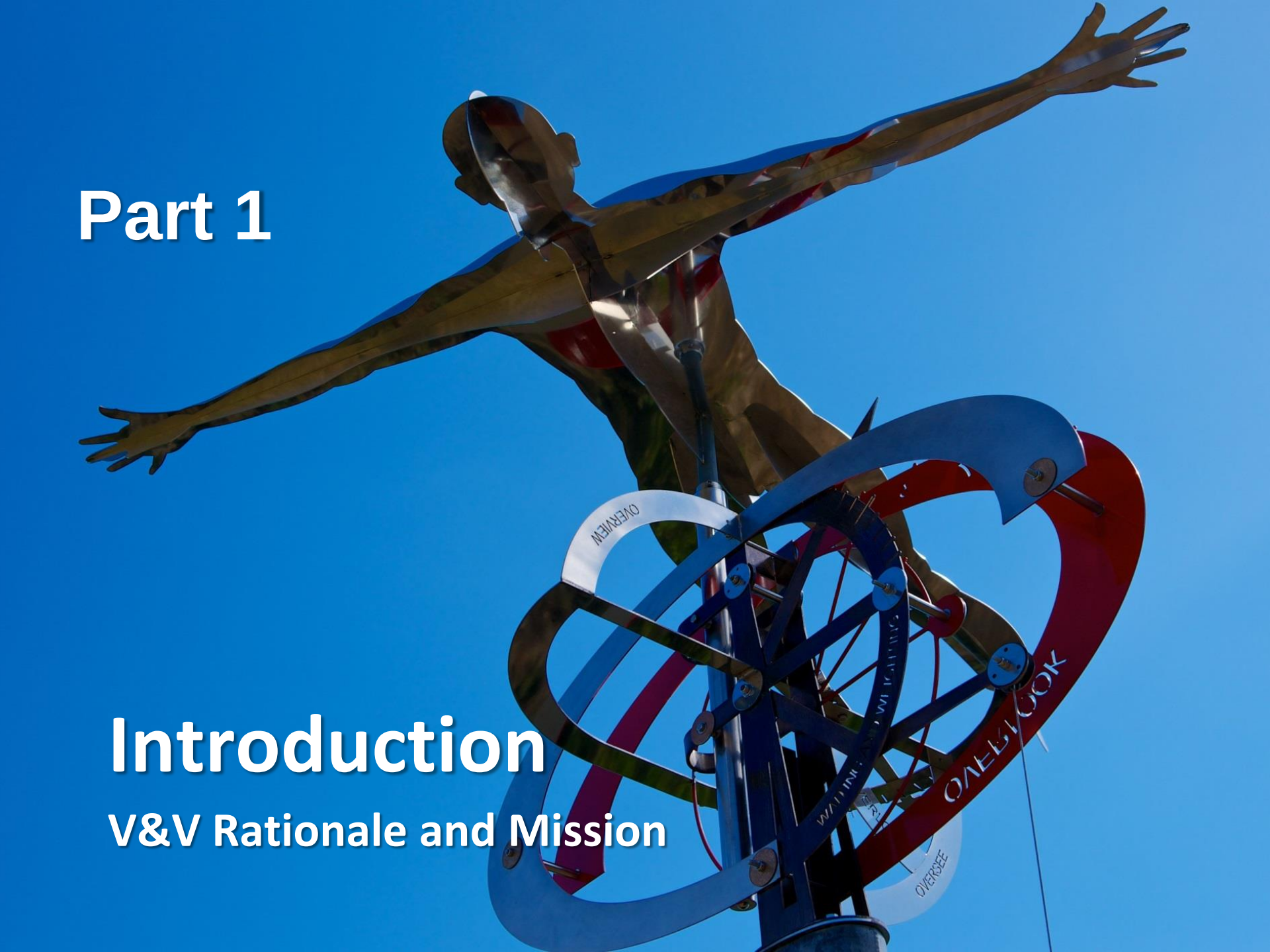
Qtility™
Verification and Validation Solutions
NLR
TNO
Verification & Validation Expertise Centre
for Models, Simulations and Serious Games
by Dr. ir. Manfred Roza

Who Am I?

What evil things I do to you!

"You can't escape your destiny,
You must face Darth V&V again!"

M&S Alliance


Part 1
Introduction
V&V Rationale and Mission

No worries its realistic,
I can tell .... ooh really? Great!

Ceci n'est pas une pipe.

Magritte

Δ δ
If there is none, its the real thing!
787

Uncertainty
We simply can’t measure or know it all!

“Too often a model of reality takes on a reality of its own ... users are likely eventually to adopt it as the truth.”
- Douglas W. Hubbard, Failure of Risk Management

Reality
Bites!
Inadequate
M&S Quality
can put you at
RISK

Inadequate M&S Quality Cost You Money!

Use Risks and Costs due to inadequate M&S Quality

Capital Loss of Unused M&S

Back to Use of More Costly Alternatives

Most Extreme Scenario Loss Lives and Equipment

Good and Defensible M&S Decisions

*"**Understanding** of the **limitations** in modeling and simulation **quality**, and the **implications** (cost, safety, time, effectiveness) for its users"*

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Verification and Validation Solutions

Verification and Validation of M&S defined

Mission Statement

"To demonstrate with ***sufficient confidence*** that an M&S system is of adequate Quality a.k.a. ***fits the intended use*** and doesn't pose ***unacceptable risks;*** to support well-informed ***decision*** making"

Delivers Right Evidence

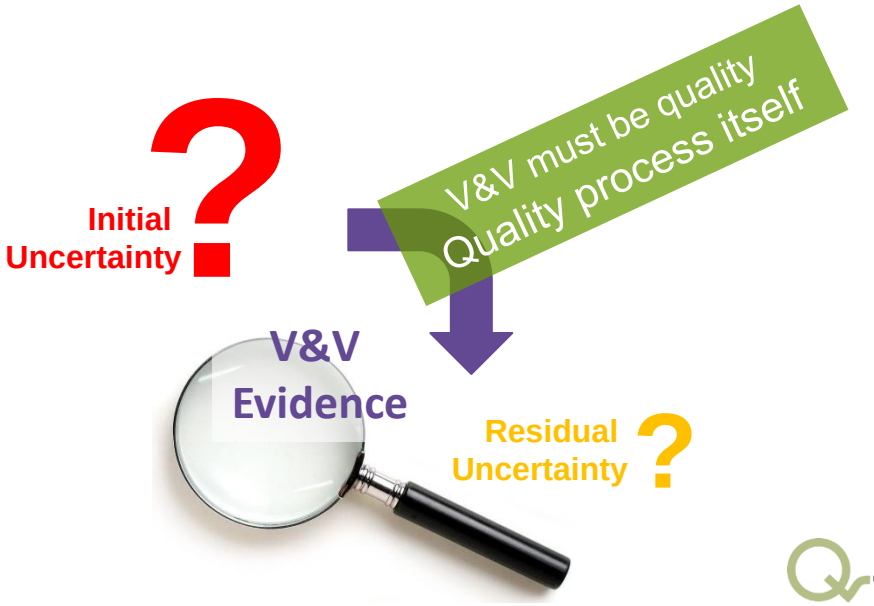
Credible

Useful

Accurate

Auditable

Traceable



Verification and Validation of M&S

comprises

Detection of defects – classic test engineering

Requirements, specifications, mathematical model, simulation hw/sw and data

Quantification and qualification

Utility level - Functional, operational and user

Fidelity level

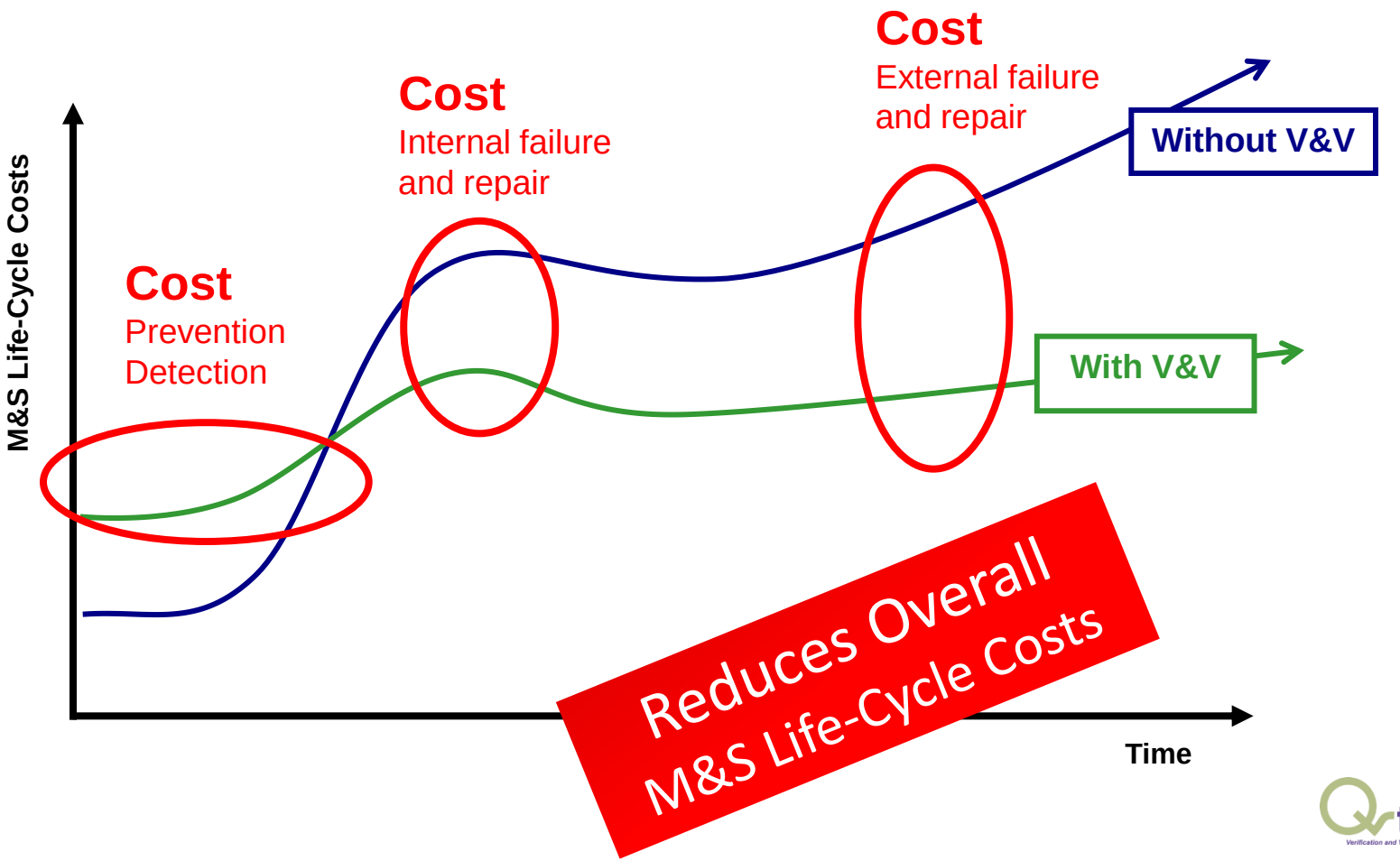
Referent data, replicative and predictive

Uncertainty level

Sources, lack of knowledge and randomness

Verification and Validation of M&S

Return on Investment



Verification and Validation

Learns you what you are up to!

Mitigate risks and save on costs

Part 2

Overview

Generic Methodology for Verification & Validation

Background

Global Trend

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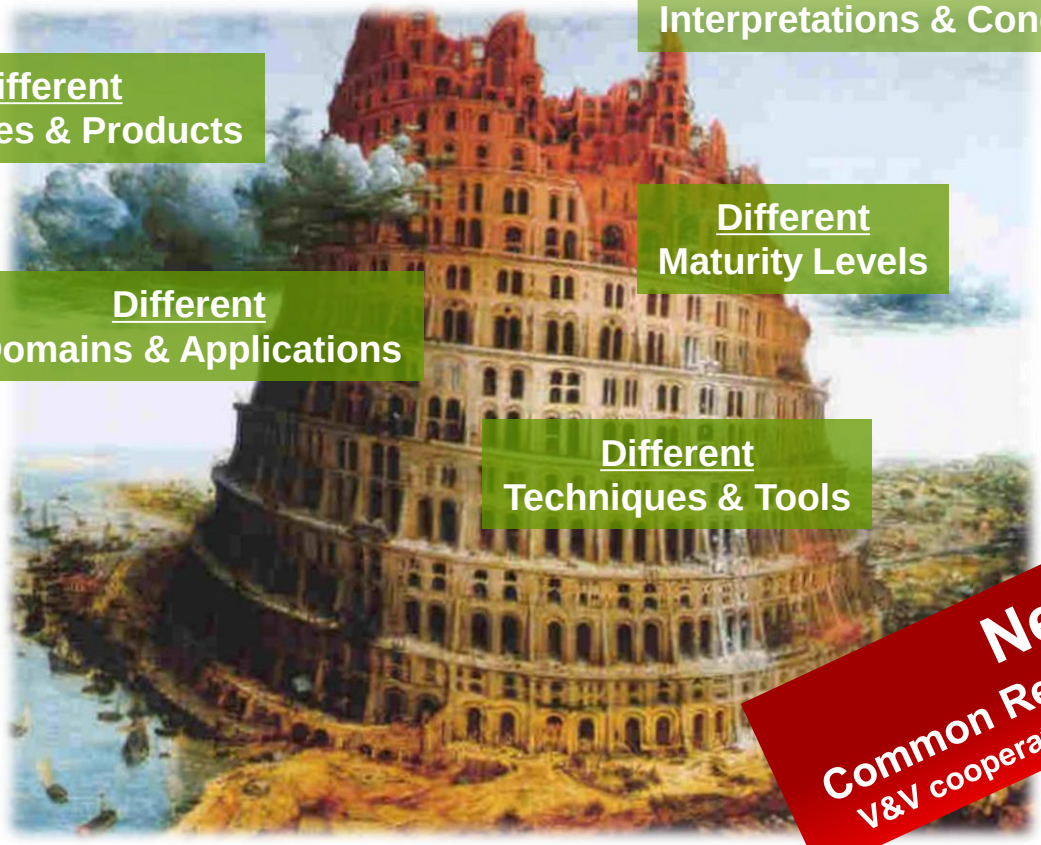
Background

Driving V&V Issues



Different
Interpretations & Concepts

Different
Processes & Products

Different
Maturity Levels

Different
Domains & Applications

Different
Techniques & Tools

Need
Common Reference & Basis
V&V cooperation & interoperability

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Generic Methodology for Verification and Validation

Initiated and Support by

WEAG REVVA projects as the basis; evolved into NATO-STO MSG-073

Key Objectives

Methodology for V&V that embraces a wide variety of M&S technology and uses

Common basis for V&V cooperation, information sharing and tools

Standardization

Simulation Interoperability Standards Organization
"Simulation Interoperability & Reuse through Standards"

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Generic Methodology for Verification and Validation

Provides

Framework of Generic V&V products, processes and organizational components

Application guidance by example, tools and techniques catalog

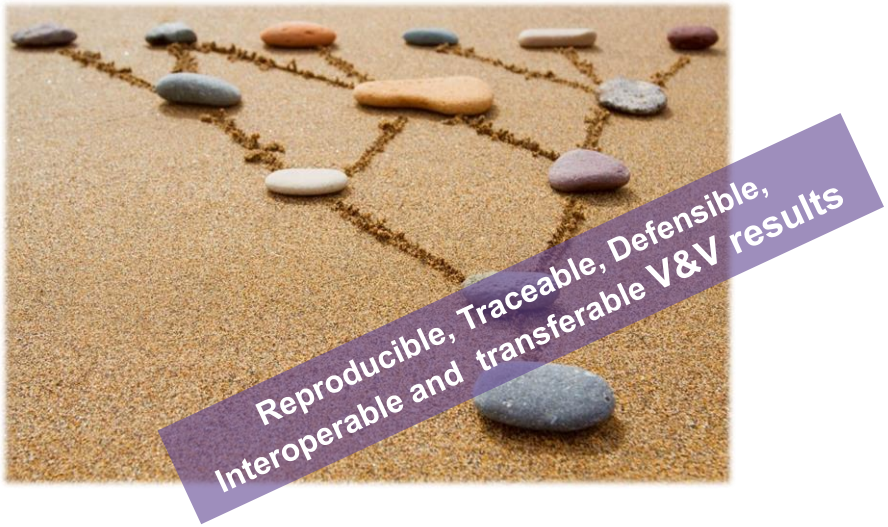
Tailorable

Structured

Risk-driven

Argumentation

Evidence-based



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Technical Framework Overview

Conceptual Framework

Underpins

Implementation Framework

Generic V&V components

Tailoring Framework

Produces

V&V Method Instances
M&S Projects and Organizations

M&S Project or Organization

- ✓ Needs
- ✓ Budget
- ✓ Schedule
- ✓ Resources
- ✓ Risks
- ✓ Skills
- ✓ ...

Drives

Related M&S Domain

- ✓ Standards
- ✓ Policies
- ✓ Patterns
- ✓ Tools
- ✓ Techniques
- ✓ Knowledge
- ✓ ...

Uses

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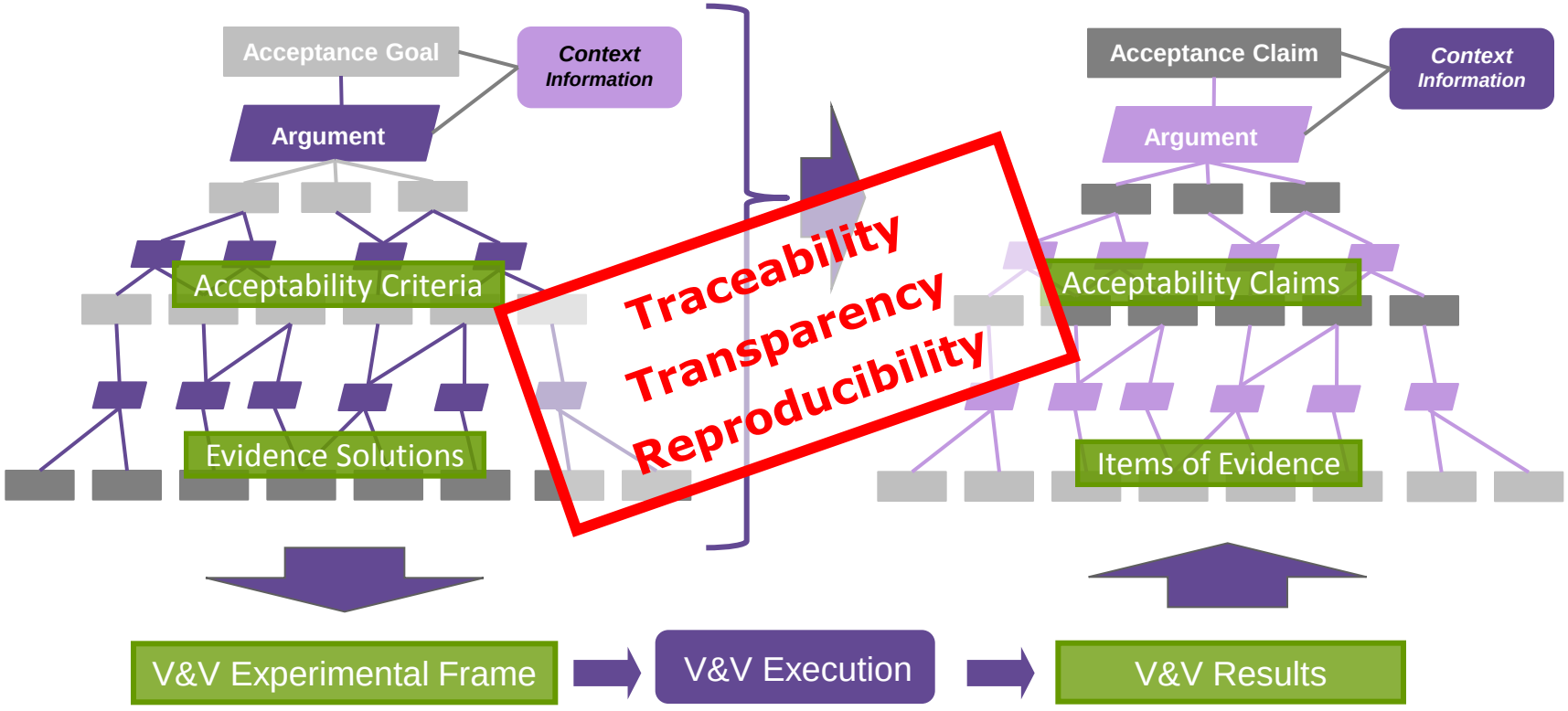
Argumentation Approach



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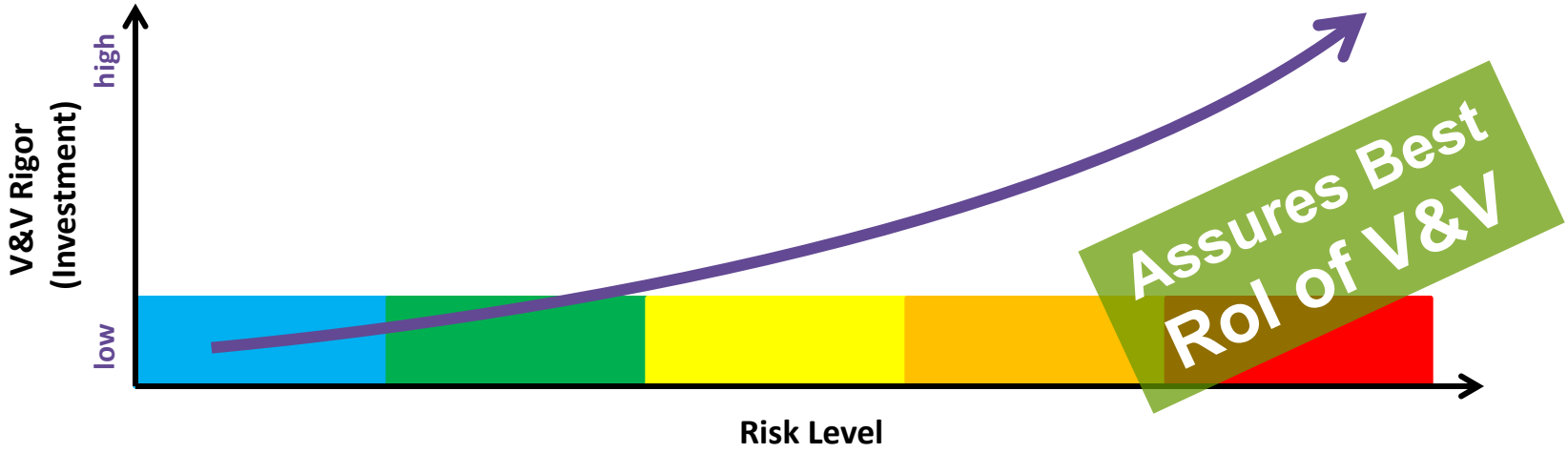
Risk-Based Tailoring and Optimization Approach

Provides a balance between

"Risk level and tolerances" **AND** ***"Costs and available resources"***



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Documentation set

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Part 3

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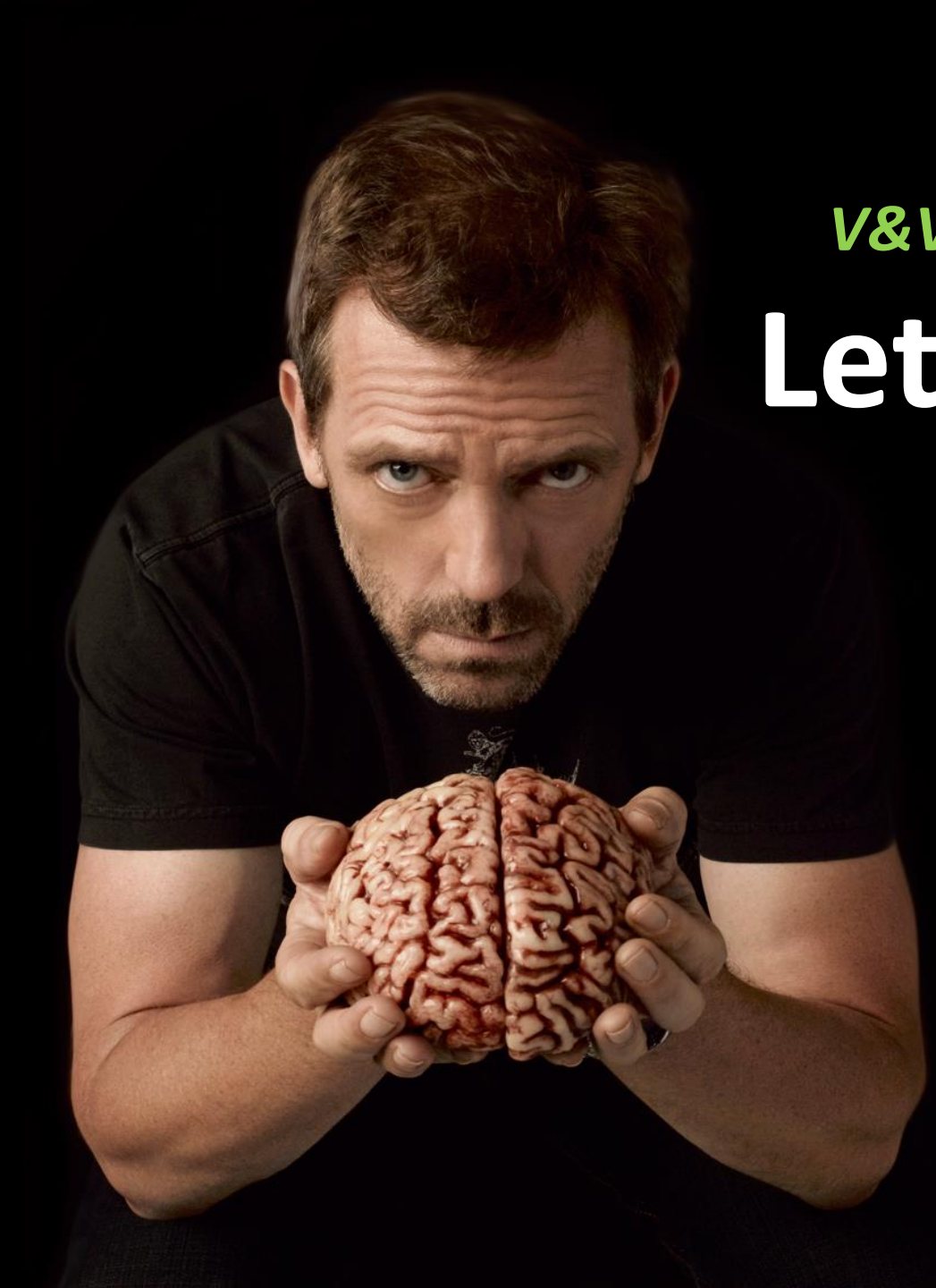
Dutch V&V Expertise Centre



Dutch MoD DR&D

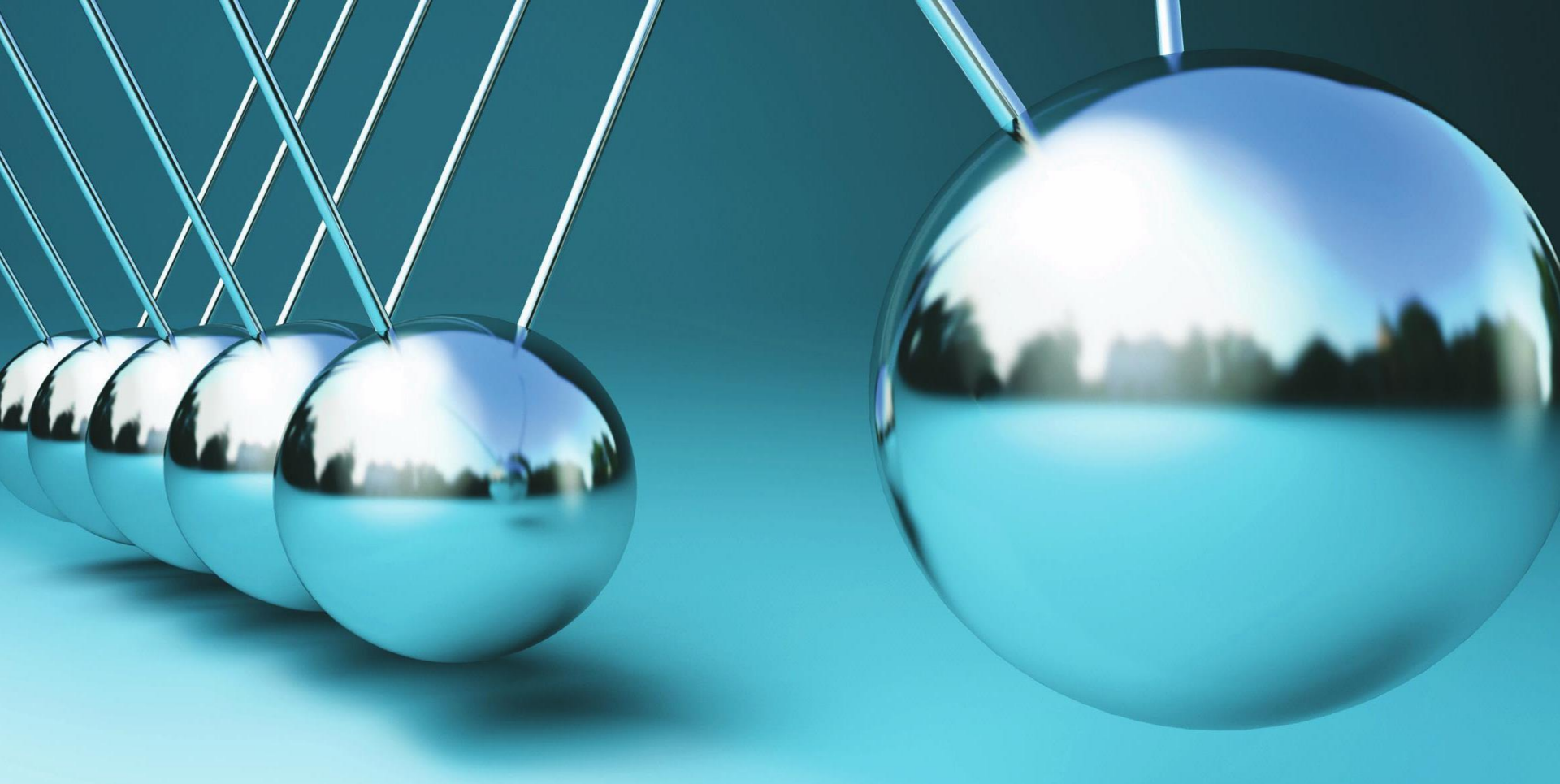
V&V Knowledge Investments

Lets exploit it!

for our own and other's benefits

NLR

TNO



V&V Expertise Centre

External organization *not* Dutch MoD

Independency, Specialist s, Domain Knowledge and other Markets

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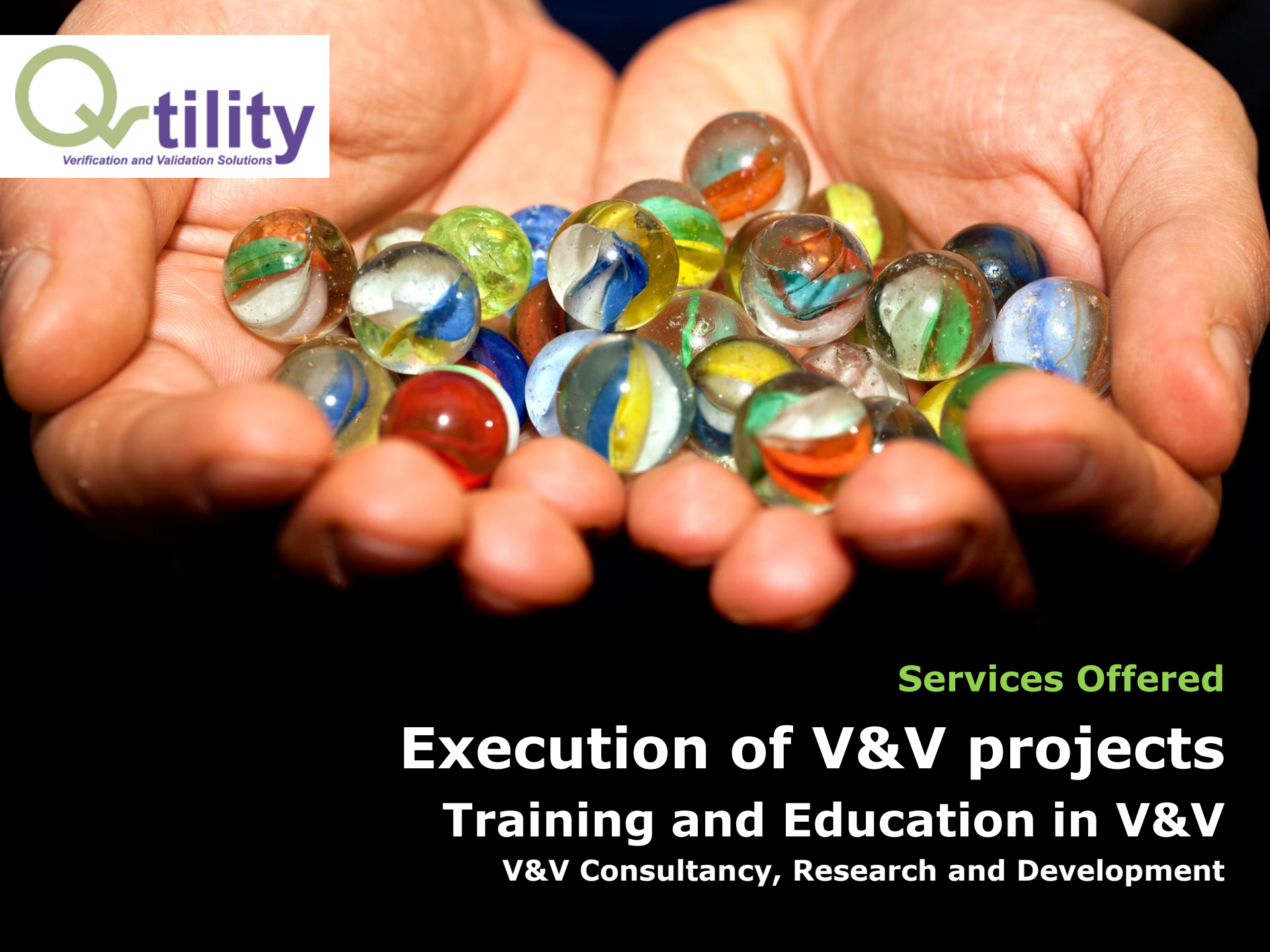
V&V Expertise Centre

Strategic Cooperation

Dutch R&D Institutes - NLR and TNO

Working from a **Common V&V knowledge basis** with
Complementary M&S application **domain knowledge**



Services Offered

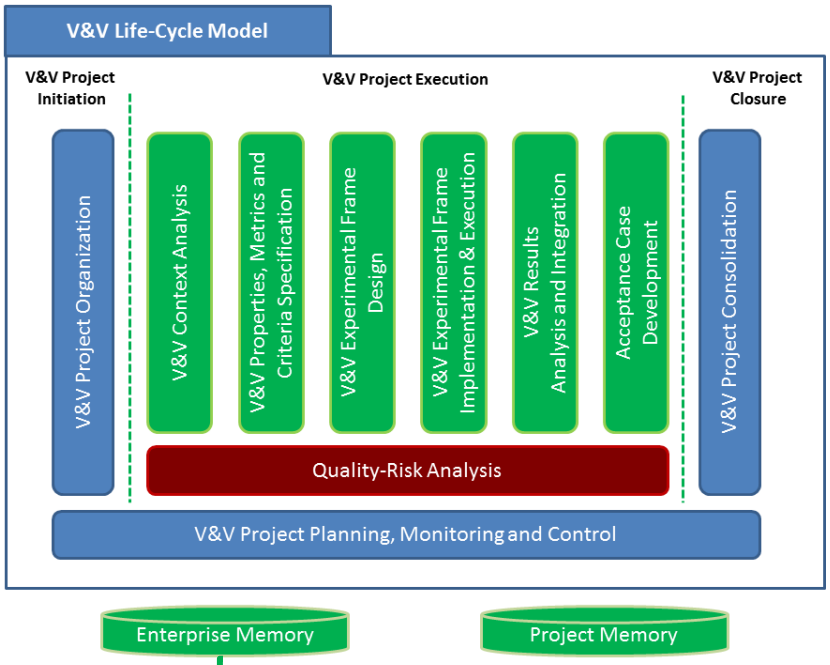
Execution of V&V projects

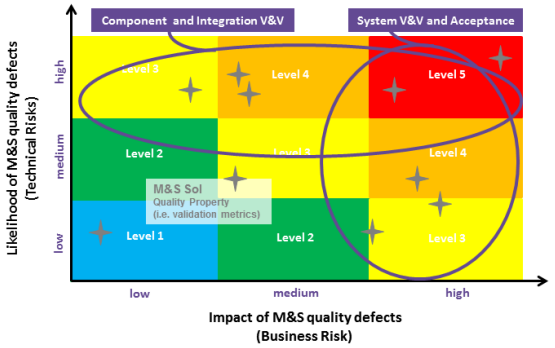
Training and Education in V&V

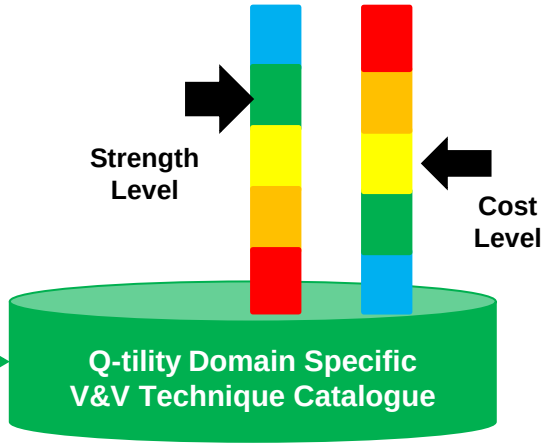
V&V Consultancy, Research and Development

V&V project execution GM-VV

tailored compliant and proven cost-effective







Military Public Order Management

Serious Game Verification and Validation

Utility of Games in Training?

Optimal M&S introduction through V&V

Maximum value from M&S technology innovations!

V&V Study for the Dutch Royal Netherlands Military Police - KMAR

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Fighter Controller F16 Familiarization

Distributed Training Simulation Verification and Validation

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Valid Concept for live F16 training?

V&V is a Smart Buyer and Specifier Enabler

Best Simulation Acquisition Return on Investments!

V&V Study for the Dutch Royal Netherlands Air-Force - AOCS

SPIKE Medium Range Anti Tank

Indoor and Team Training Simulator Verification and Validation

M&S Capabilities and Quality?

V&V pushes the boundaries of M&S usage

Maximum Training Effectiveness and Efficiency!

V&V Study for the Dutch Royal Netherlands Army and Navy – CLAS/CZSK

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Next Generation Fighter Aircraft Systems

Engineering Models Verification and Validation

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Reliable Simulation Based

Design, Development and Operation

V&V assures the Safety of Future Aviation!

A Dutch MoD R&D Program in cooperation with USAF

Want to Learn More?

A *Free* 2-Day Lecture Series on V&V

April - Stockholm, May - Ottawa and September – Rome

***www.cso.nato.int* or *www.q-tility.nl* for details**

Let the V&V Force
be with you!
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More Information?
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