Diversions in (Radio) Engineering

or

Murphy's Law exemplified

by

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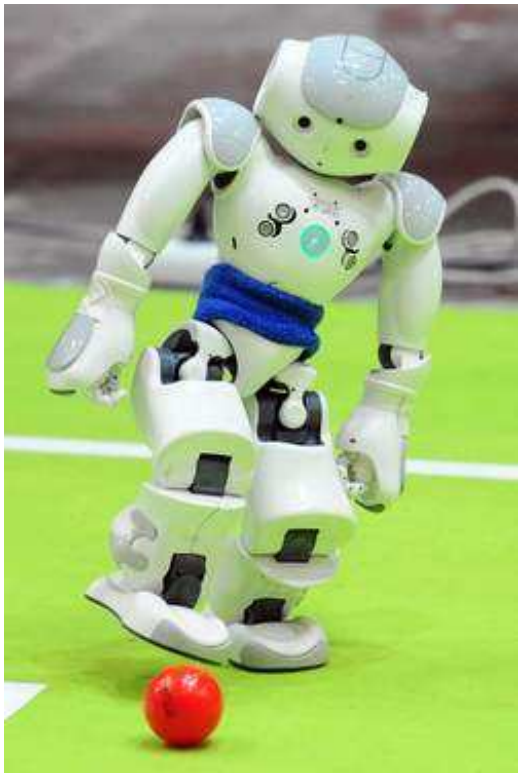
Presentation given at: Rotary Club Rotterdam, the Netherlands, 2011 July 27



From 'android' to 'humanoid'

Soccer Robot in action

RADAR – Some early history in the Netherlands

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RADAR

RAdio Detection And Ranging

Some early history in the Netherlands

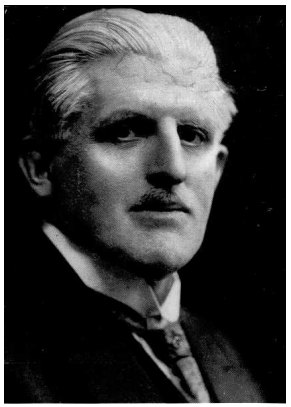
1924 – Newspaper article 'Lethal radio ray operational in Germany'

1924 – Dutch Ministry of Warfare installs 'Committee for Physical Weaponry'

('Commissie voor Physische Strijdmiddelen' $\Longrightarrow$

Physisch Laboratorium RVO –TNO $\Longrightarrow$

TNO – Defence, Security and Safety)



Chairperson: jhr. dr. G. J. Elias

Professor of Electromagnetic field theory

Delft University of Technology

1927 – **ULTRA SECRET** Location: Waalsdorpervlakte

('Measurement building','~~LABORATORY~~') **NOT ON ANY**

PUBLICLY AVAILABLE MAP **BUT** $\Longrightarrow$

Committee for physical weaponry

1936 – King (peppermint) Atlas Nederland voor School en Toerisme

SHOWS FULL COORDINATES OF LOCATION !

Location secret?

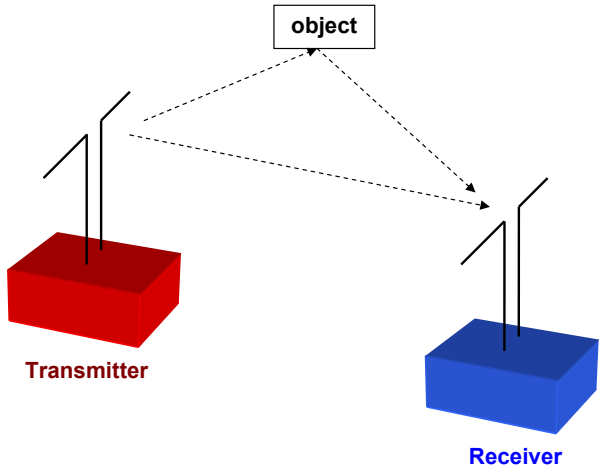
1927 – Director: ir. J. L. van Soest

– Ir. S. Gratama joins the staff

1934 – Jhr. ir. J. L. W. C. von Weiler joins the staff

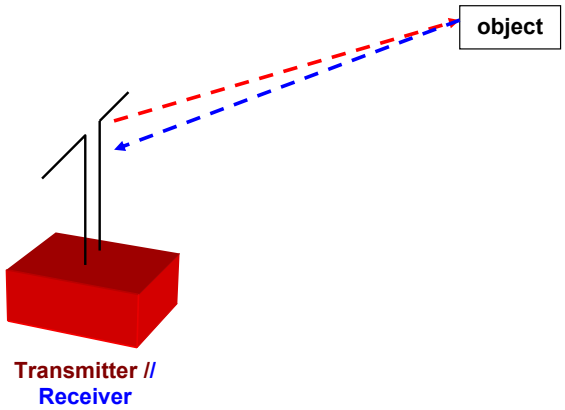
1936 – Principle of Radar established (Gratama & Von Weiler)

Staff 'Measurement Building' Physical Weaponry



RAdio Detection And Ranging

1936 experiment



RAdio Detection And Ranging

Operational setup

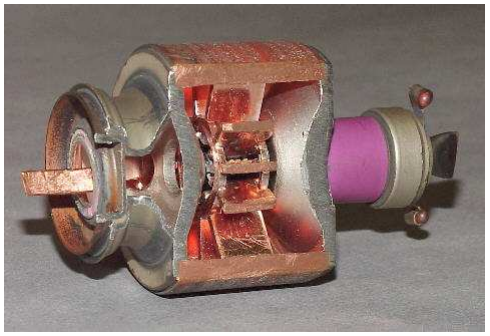
Principle of Radar (1936 experiment & Operational setup)

1940
- 4 Prototypes operational (a.o., Malieveld, The Hague)
- 2 destroyed; 2 dismantled $\Longrightarrow$ UK (with Von Weiler)
- Von Weiler: Hook of Holland $\Longrightarrow$ UK (H.M.S. Malcolm) $\Longrightarrow$ Royal Netherlands Navy

30 Jan 1943
- Churchill gives (after 6 months hold-up) permission to install (magnetron-operated) H2S radar on board UK Stirling Pathfinder Elite Squadron (with detonation button for destroying it prior to crashing)

02/03 Feb 1943
- Pathfinder shot down near Rotterdam with H2S **INTACT** German physicists & engineers: **MAGNETRON???**

RAF Stirling Pathfinder



Magnetron

'If there is a possibility of several things going wrong, the one that will cause the most damage will be the one to go wrong'

Delft University of Technology

DelFly Micro: mass = 3 g:

a crow's prey

'Mother Nature is a Bitch'

The NASA/ESA Cassini – Huygens mission

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National Aeronautics and Space Administration /

European Space Agency

CASSINI (Saturn) – HUYGENS (Titan) mission

All that went wrong

1625 – 1712 : Giovanni Domenico Cassini, Italian/French astronomer

(4 Saturn moons)

1629 – 1695 : Christiaan Huygens, Dutch mathematician,

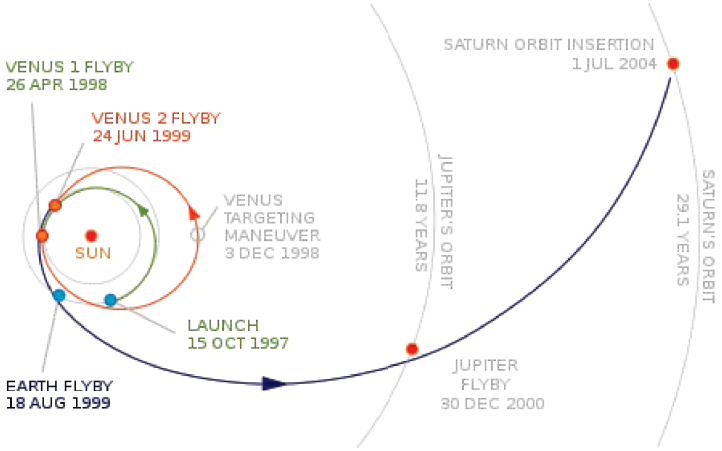
astronomer, physicist, horologist

(Saturn rings, Saturn moon Titan)

15 Oct 1997 – Saturn explorer **Cassini** and Titan landing probe **Huygens** launched

– trajectory (energy build-up):

Venus – Venus – Earth – Jupiter – Saturn



– costs: **300 000 000 USD**

early 2000 – Boris Smeds (1944 – . . .)  Radio Engineer, ESA Darmstadt

– Critical flaw in design of (Italian brand) receiver $\Longrightarrow$
SCRAMBLES ALL PHOTO'S

– not detected due to skipping a full-up high-fidelity test of the radio link prior to launching (NO BUDGET!)

Sep 2000 – Tests at NASA CA, USA, with the communication links of Cassini (two-way signal travel time 48 min) $\Longrightarrow$ Smeds is right

– **ERROR**: Digital-signal Doppler shift overlooked! (De Hoop 2009)

– Cassini's trajectory diverted

Jul 2004 – Cassini in orbit around Saturn

14 Jan 2005 – Huygens probe lands on Titan (50 % of the photo's saved!)

Boris Smeds: 'There is something very wrong'

Huygens probe on Titan

'If anything just cannot go wrong, it will anyway'

and

'If everything seems to be going well, you have obviously overlooked something'

Murphy's law

'Murphy was an optimist'

THANK YOU