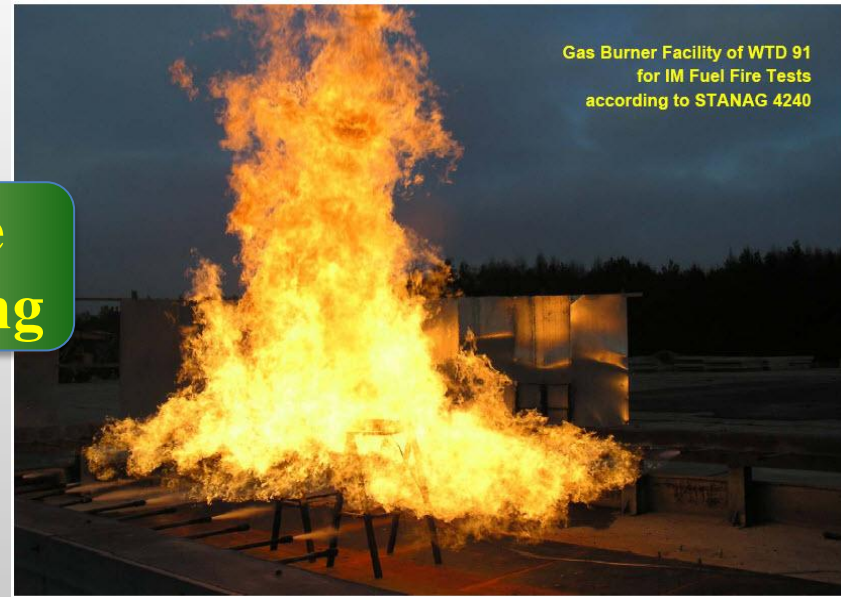


# Session 3B: Testing 1 – Thermal Emphasis



Full Scale  
FCO Testing

Fuel Pool Fires



Propane Fires



Small Scale  
FCO Testing



# Why Study the Fire Threat?

**Problem: Munitions tend to react badly when exposed to fire.**

**Example: The US Navy experienced several violent reactions of munitions aboard ship, due to fire, causing loss of life and major materiel damage.**

**Estimates for three ship board accidents approach 2 billion dollars and loss of functionality.**

# Carrier Accidents - USS Forrestal

- A ZUNI rocket was fired accidentally from an aircraft being readied for a mission on July 29, 1967. The rocket screamed across the flight deck, struck another aircraft and ignited a fuel fire. The initial fire could have been contained, but 90 seconds after the fire started a bomb detonated, killing or seriously wounding most of the fire fighters.
- The detonation ruptured the flight deck, and burning fuel spilled into the lower levels of the ship.
- Bombs, warheads, and rocket motors exploded with varying degrees of intensity in the fire, killing 134 and wounding 161 men. Twenty-one aircraft were destroyed.



Raging fire

# Example: USS Forrestal - Fuel Fire



# From a Survivor...

**“Fuel tanks became incendiary bombs,  
ejector seats blasted from burning planes,  
a superheated machine gun opened fire  
spontaneously, missiles detonated.  
It was pure hell -- just ungodly!”**

**Chief Warrant Officer Bob Henderson**

# USS Forrestal Incident



Hole in deck

# Addressing the Threat

**Because of this sensitivity to fire, testing was needed to estimate the response of munitions, and to evaluate the effectiveness of mitigation solutions.**

**Today, we have presentations from several nations that quantitatively examine the characteristics of various fires used for fast cookoff testing.**

# Agenda – Session 3B

<b>Time</b>	<b>Speaker</b>	<b>Title</b>
<b>1:20 PM</b>	<b>Mr. Manfred Becker</b>	<b>Fuel Fire Experts Work on Propane as an Alternate Heating Source for the Fast Heating Test</b>
<b>1:40 PM</b>	<b>Mr. Gert H. Scholtes</b>	<b>The Development of a Clean Fast Cookoff Test in the Netherlands</b>
<b>2:00 PM</b>	<b>Dr. Jon J. Yagla</b>	<b>Experimental Development of a Propane Burner for Fast Cookoff Testing</b>
<b>2:20 PM</b>	<b>Dr. Fabien Chassagne</b>	<b>Low Cost Heat Flux and Flame Temperature Characterization of NATO Standard Kerosene Pool Fires</b>
<b>2:40</b>	<b>Mr. Jon Toreheim</b>	<b>The Sand Bed Burner and the Adiabatic Surface Temperature Probe – The Future Equipment for Fast Cookoff Testing</b>



# Mr. Manfred Becker

- **Manfred Becker has over 25 years of experience in the US Navy laboratory environments working on research, development, testing, qualification, production and failure investigations of conventional ordnance.**
- **He was the project lead for the team that developed the IM improvements for the US Air Force and Navy General Purpose bombs.**
- **Fred was Chairman for the Blast and Fragmentation Warhead group within the Joint Insensitive Munitions Technology Program. This DOD program develops and matures science and technology to be transitioned into critical programs for the improvement of munition safety.**
- **Since the fall of 2011, he is the Warhead Technology Specialist Officer at the Munitions Safety Information Analysis Center (MSIAC) at NATO HQ, Brussels Belgium.**

# Manfred Becker

His paper today is “Fuel Fire Experts  
Work on Propane as an Alternate  
Heating Source for the Fast Heating  
Test”

# Mr. Gert H. Scholtes

- **J.H.G. Scholtes M.Sc. Senior Scientist and Consultant in the field of Safety, Functioning and IM aspects of Munitions for TNO (Netherlands Organisation for Applied Scientific Research TNO).**
- **He started in 1990 at the thermal Initiation section at TNO, setting up the research on Cook-off (Heating of explosives), developing an instrumented cook-off test, theory and a computer code using ABAQUS (FEM).**
- **Over the years he has continued to broaden knowledge/experience in the other areas of IM such as bullet and fragment impact, etc.**
- **He has been manager of numerous defense programs involving munitions safety.**
- **He is TNO POC in the Data Exchange agreement with the US (DEA-N-02-NE-4822, Combustion & Detonation Phenomena in Rocket Motors and Warheads) on Cook-off and was one of the foreign members in the US cook-off community.**
- **He operates as a consultant and teacher in the fields of energetic materials, safety and functioning and IM aspects of munitions.**

# Mr. Gert H. Scholtes

His paper today is “The Development of a Clean Fast Cookoff Test in the Netherlands”

# Dr. Jon J. Yagla

- **Dr Jon Yagla has degrees in Engineering Mechanics and Aerospace and Mechanical Engineering.**
- **He was formerly Principal Weapons Systems Engineer in the Weapons Systems Department, Naval Surface Warfare Center, Dahlgren Division, Dahlgren, Virginia.**
- **He is the Inventor and designer of missile components and missile launching systems. Developed numerous unique and pioneering experimental and analytical methods for solving complex problems in compressible flow, shock, vibration, mechanical and thermal design, electronics, and numerical methods. Inventor of the Concentric Canister Missile Launcher and Water Piercing Missile Launcher.**
- **Author of over 120 technical papers, journal articles and reports, including international symposiums in Great Britain, France, Italy, Germany, Australia, and China.**

# Dr. Jon J. Yagla

**His paper today is “Experimental Development of a Propane Burner for Fast Cookoff Testing”**

# Dr. Fabien Chassagne

- **Munitions Safety Expert at DGA Missiles Testing Center (French MoD).**
- **He produces technical reports about missiles and munitions safety for French authorities, dealing with IM test results and modeling.**
- **He is a member of the French MURAT (IM) commission that is in charge of MURAT (IM) signature assessment of the French munitions**
- **He has participated in the NATO Fuel Fire Experts Meetings that held in 2010 and 2012, respectively in Germany and France. He will assist with the next workshop that is planned in Netherlands in September 2013.**

# Dr. Fabien Chassagne

His paper today is “Low Cost Heat Flux and Flame Temperature Characterization of NATO Standard Kerosene Pool Fires”



# Mr. Jon Toreheim

- Jon Toreheim has been working in the defence industry with explosives in general and Insensitive Munitions in particular since 2005.
- Since 2010 he works at Bofors Test Center in Sweden as Marketing and Sales Manager for IM testing.
- When he is not working Jon likes to spend his time together with his wife Hà and their four years old daughter Julia. They all love to go hunting and fishing together but skiing and snowmobile driving is also of interest.
- Yes; he is a Swedish hillbilly!

# Mr. Jon Toreheim

His paper today is “The Sand Bed Burner and the Adiabatic Surface Temperature Probe – The Future Equipment for Fast Cookoff Testing