

The following presentation was given at:

The SCAF 2015 Cost Estimating Challenge

*Tuesday 14th April 2015
BAWA Centre, Bristol*

Released for distribution by the Author
www.scaf.org.uk/library

The SCAF 2015 Cost Estimating Challenge

Team FFI (Norwegian Defence Research Establishment)

Ida Helene Berg, Ingrid Hognaland, Alexander Urnes Johnson and
Hallvar Gisnås

Bristol, 14th April 2015



Attacking the problem

– FFIs approach to long-term planning



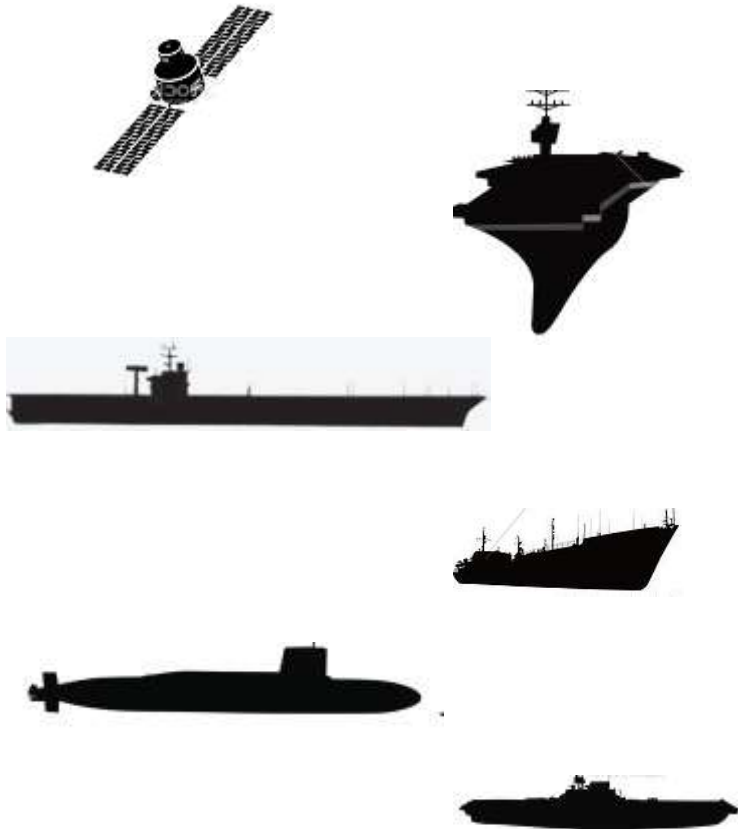
Mission

– understanding the problem space

- “Your team has been requested to plan and cost the offensive mission and conduct a BOI.”
- Three questions are answered in the presentation:
 - What force structure is needed to free Freedonia?
 - What is the cost of the offensive campaign?
 - What is the Whole Life Cost (WLC) of the force structure?



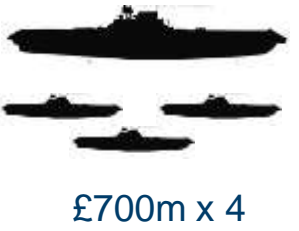
Force structure for transportation and protection



Force structure for operation



Total force structure



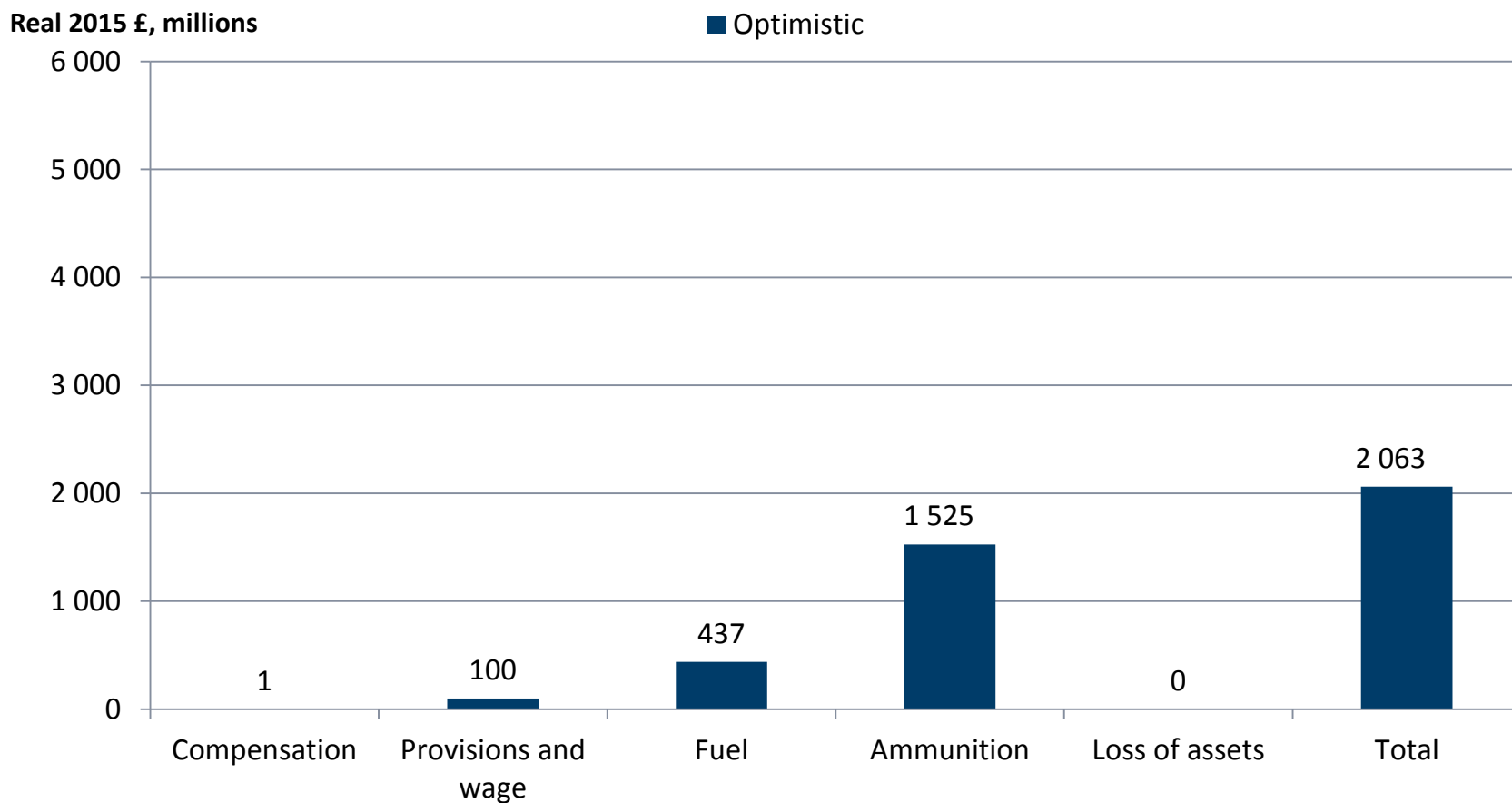
Cost of the campaign

- Campaign duration: 108 days (28 travel + 52 battle + 28 travel)
- Variable costs:
 - Fuel
 - Ammunition
 - Personnel
- Risk and uncertainty given the assumption of technological superiority and victory
 - Fuel prices
 - Underestimating the enemy



Cost of the campaign

– Uncertainty analysis



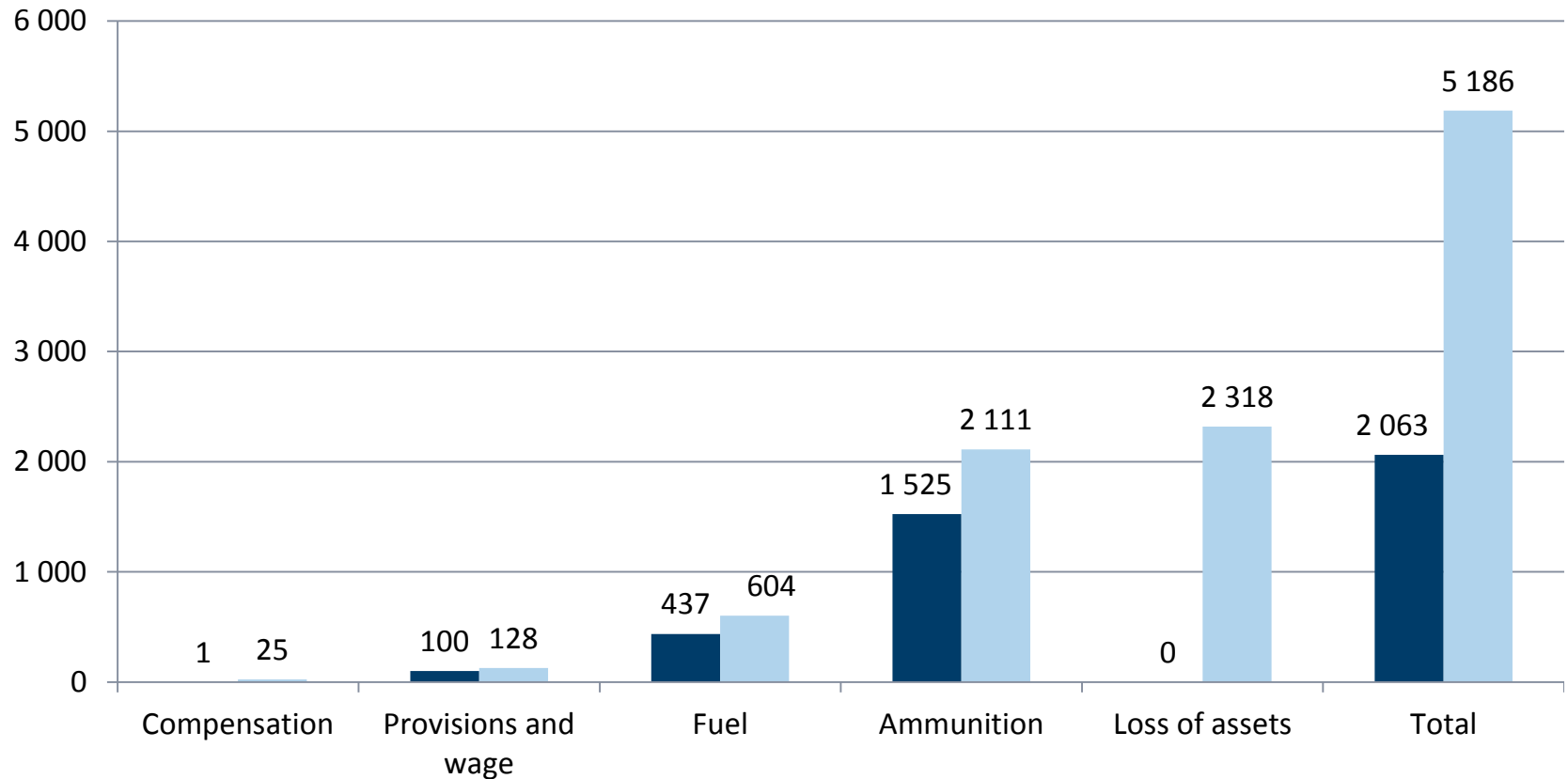
© Forsvarets forskningsinstitutt

Cost of the campaign

– Uncertainty analysis

Real 2015 £, millions

■ Optimistic ■ Pessimistic



© Forsvarets forskningsinstitutt

Cost of the campaign

– Uncertainty analysis

Variables

Personnel travel

Personnel battle

Fuel journey

Fuel battle

Loss of assets

Casualties

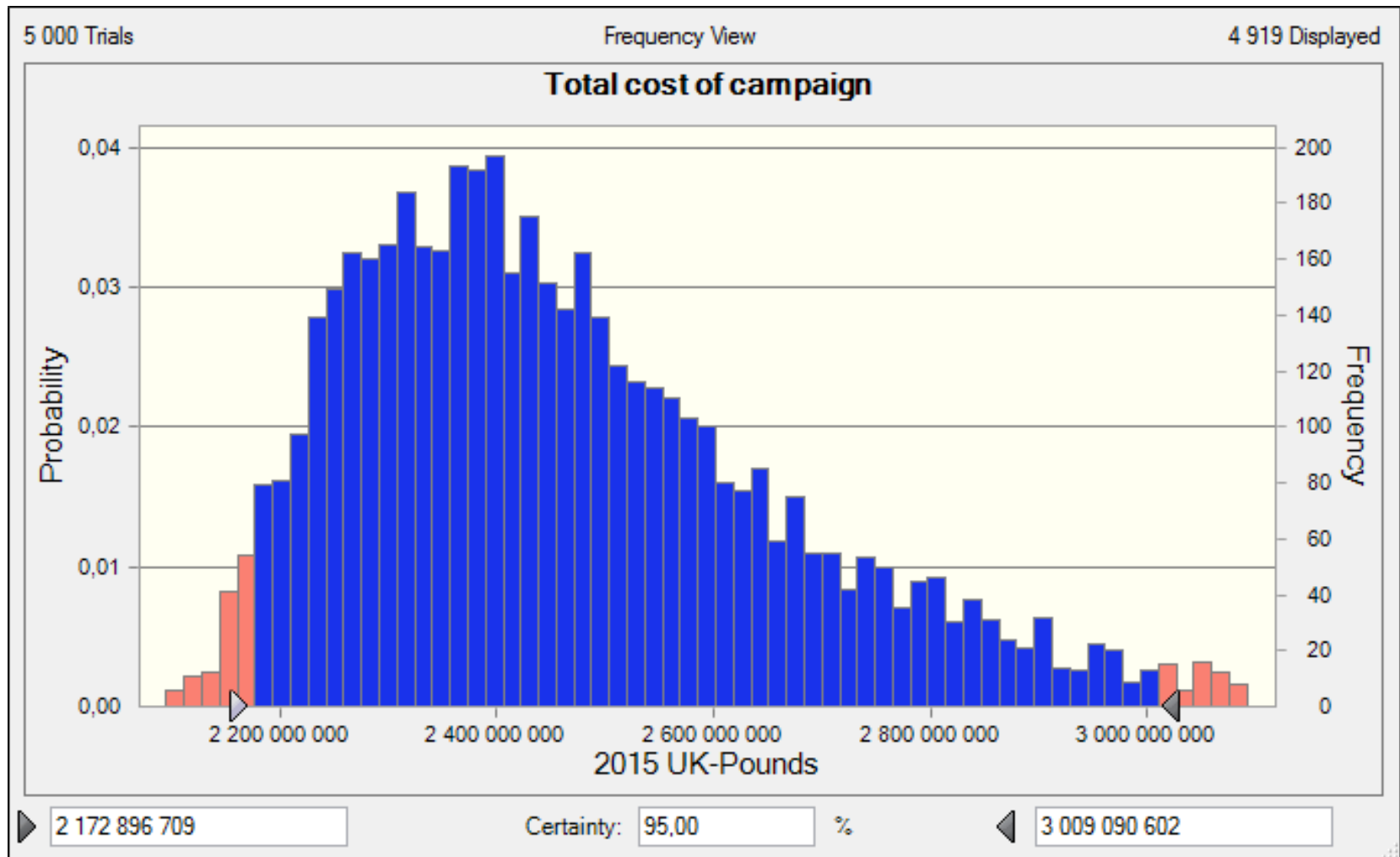
Ammunition



Monte-Carlo
Simulation

Cost of the campaign

– Uncertainty analysis



WLC of the force structure

– Methodological approach

- WLC estimated for the expected lifetime of the aircraft carrier.
- Replacement of force elements reaching end of expected lifetime.

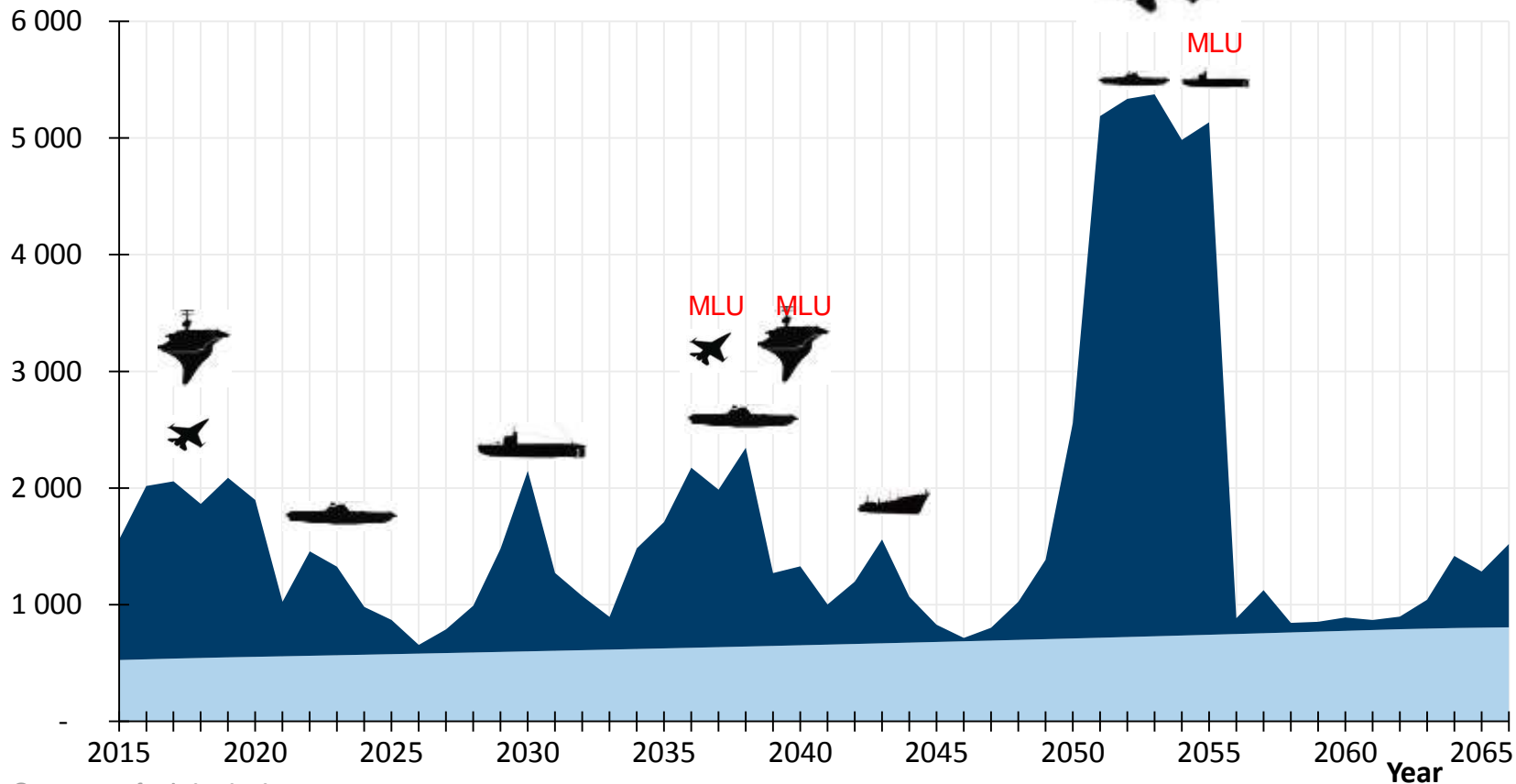
Examples of assets with information necessary for WLC estimation:

| | Aircraft carrier | Fighter aircraft | Submarine |
|----------------------------------|------------------|------------------|-----------|
| Investment cost | £3100m | £100m | £1300m |
| Operating costs | £10m | £2m | £7m |
| Investment cost escalation (ICE) | 2% | 4% | 2% |
| Operating cost escalation (OCE) | 1.5% | 1.5% | 1.5% |
| Acquisition years | 2013–2019 | 2016–2020 | 1987–1993 |
| Expected lifetime | 50 | 35 | 40 |
| Midlife update | £930m | £40m | £520m |

WLC of the force structure

Real 2015 £, millions

■ Operating costs ■ Investment costs



© Forsvarets forskningsinstitutt

WLC of the force structure

– Uncertainty analysis

- Long term cost analysis highly dependent on cost escalation factors.
 - Estimating WLC with different ICE and OCE factors reveals the degree of estimation uncertainty.

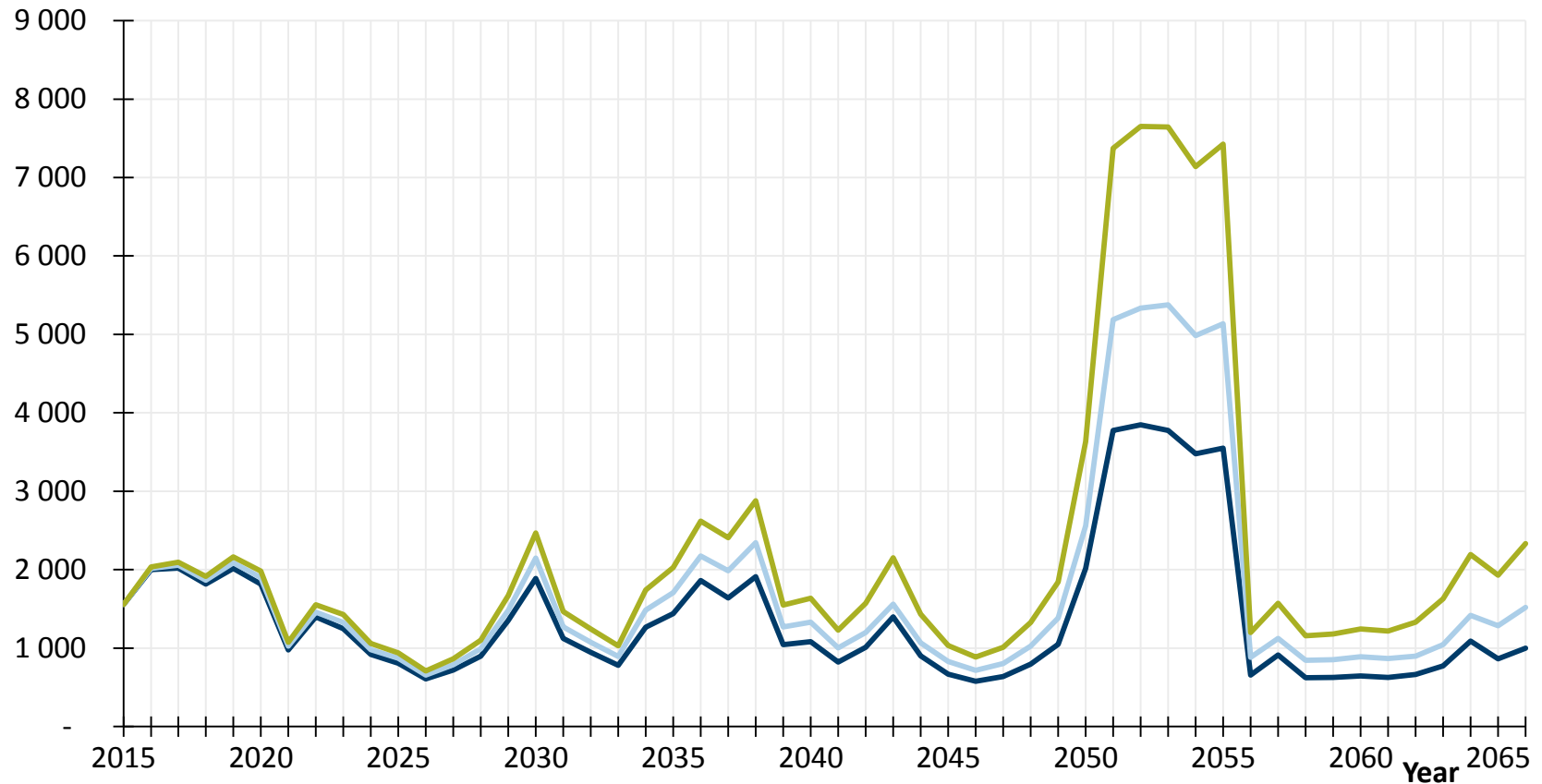
| Asset / Force element | ICE | | | OCE | | |
|--|-----|------|------|------|-------|------|
| | Low | Base | High | Low | Base | High |
| Personnel | | | | 0% | 0.5% | 1% |
| Satellite, Logistic ships, Vehicles | 0% | 0% | 1% | 0.5% | 1.5 % | 2.5% |
| Destroyer, Frigate, Helicopters | 0% | 1% | 2% | 0.5% | 1.5% | 2.5% |
| Aircraft Carrier, MALE UAV, Submarine, Amphibious assault ship, LCVP, Missiles | 1% | 2% | 3% | 0.5% | 1.5% | 2.5% |
| Fighter aircraft | 3% | 4% | 5% | 0.5% | 1.5% | 2.5% |

WLC of the force structure

– Total costs with different cost escalation factors

Real 2015 £, millions

— Low — Baseline — High



© Forsvarets forskningsinstitutt

WLC of the force structure

– Total costs with different cost escalation factors

| | Low | Base | High |
|--|------------------|------|------------------|
| Total operating costs (£ bn) (Per cent deviation from base) | 28.7 (-16.4%) | 34.4 | 41.7 (21.4%) |
| Total investments (£ bn) (Per cent deviation from base) | 43.2 (-20.2%) | 54.1 | 71.8 (32.6%) |
| Total costs (£ bn) (Per cent deviation from base) | 71.9 (-18.7%) | 88.5 | 113.5 (28.3%) |
| | | | |
| Average annual operating costs (£ m) | 553 | 661 | 803 |
| Average annual investments (£ m) | 830 | 1041 | 1381 |
| Average annual costs (£ m) | 1383 | 1702 | 2184 |

Summary

| | 2015 £, in billions | Share of UK defence budget |
|-------------------|---------------------|----------------------------|
| Cost of campaign | 2.4 | 6.9 % |
| Annual WLC (base) | 1.7 | 4.9 % |
| Sum | 4.1 | 11.7 % |

"the cost to the defense budget up to the end of September was an estimated £700 m," or \$1.19bn.
(NY Times, 1982)

≈ **£2.4bn in 2015**

Lessons learned

- The challenge requires interdisciplinary skills.
 - Insufficient with only cost estimating skills.
- High uncertainty in long term cost analysis (50 years +).
 - Cost escalation factors particularly important.
- Norway cannot afford aircraft carriers and Freedomia campaigns.

Questions ?