

The following presentation was given at:

The SCAF 2015 Cost Estimating Challenge

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The SCAF 2015 Cost Estimating Challenge

Team FFI (Norwegian Defence Research Establishment)

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Bristol, 14th April 2015



Attacking the problem

– FFIs approach to long-term planning



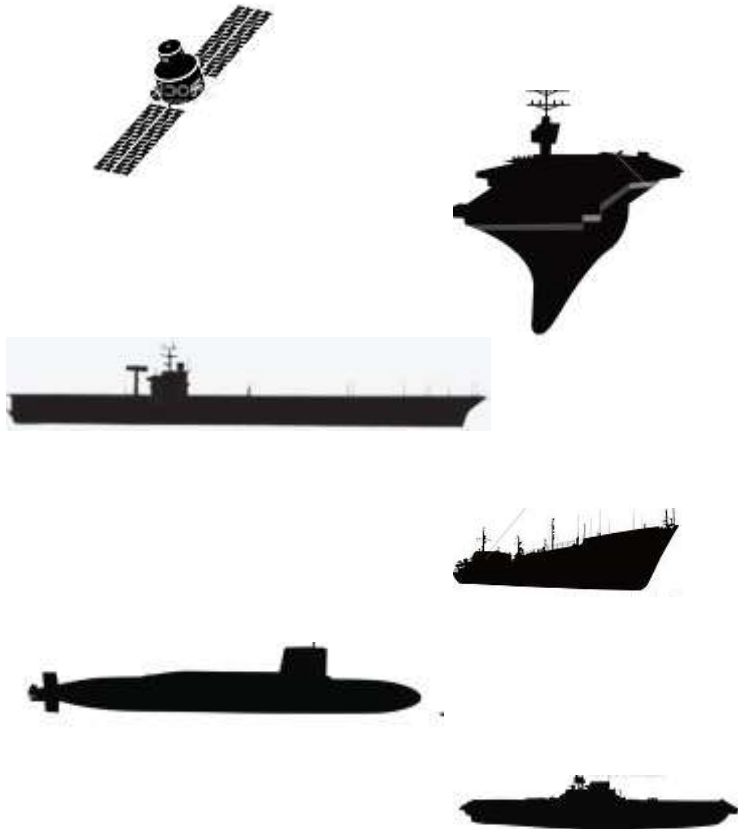
Mission

– 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?



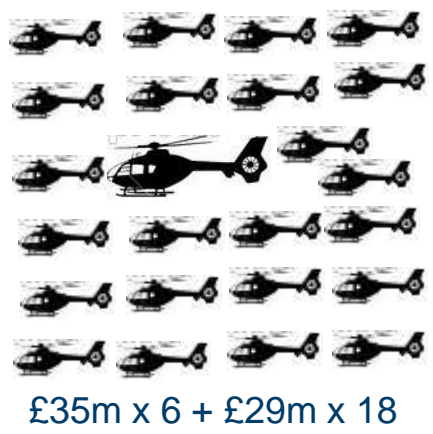
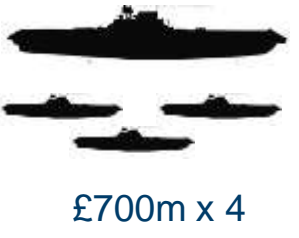
Force structure for transportation and protection



Force structure for operation



Total force structure



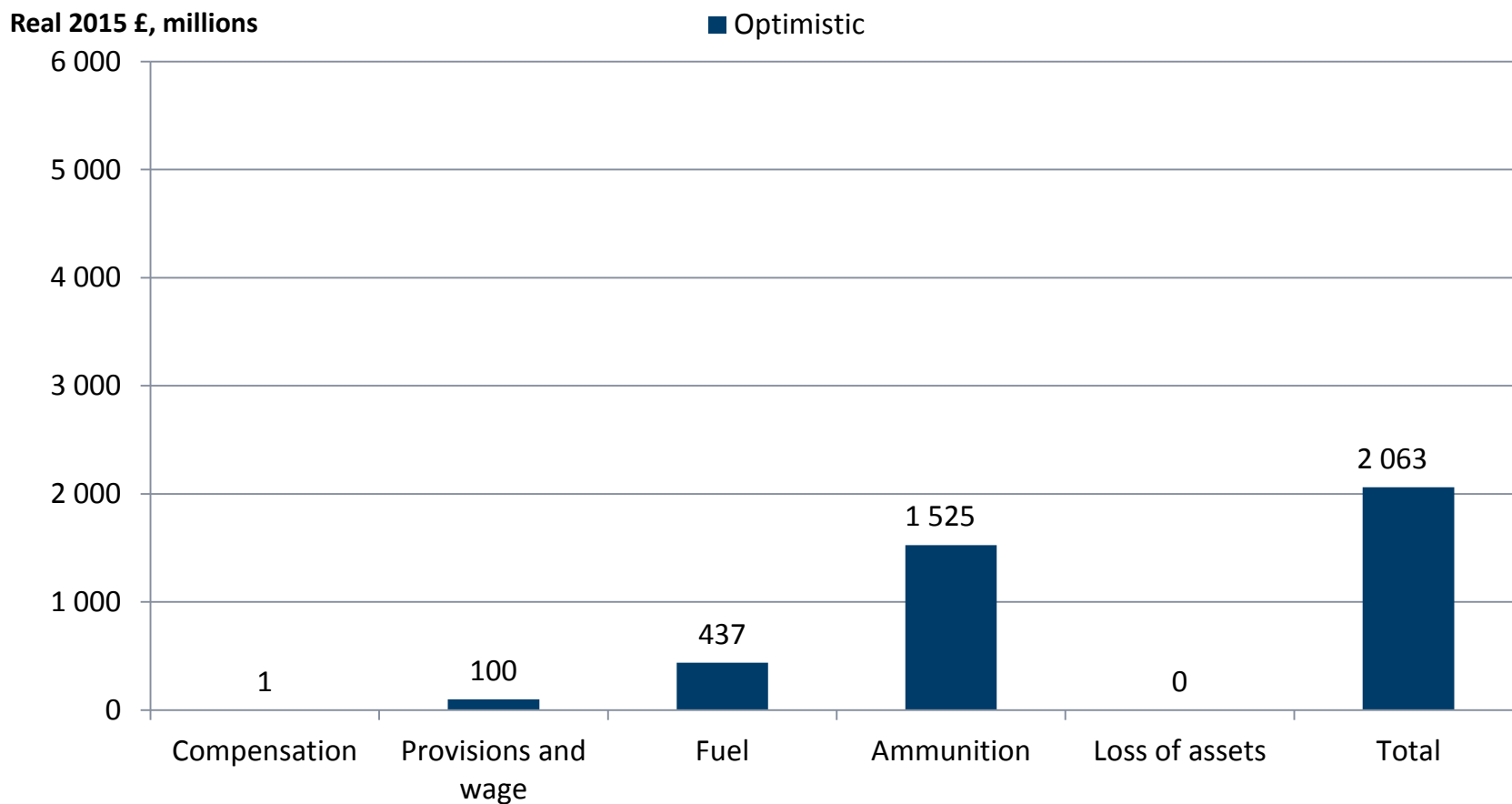
Cost of the campaign

- 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



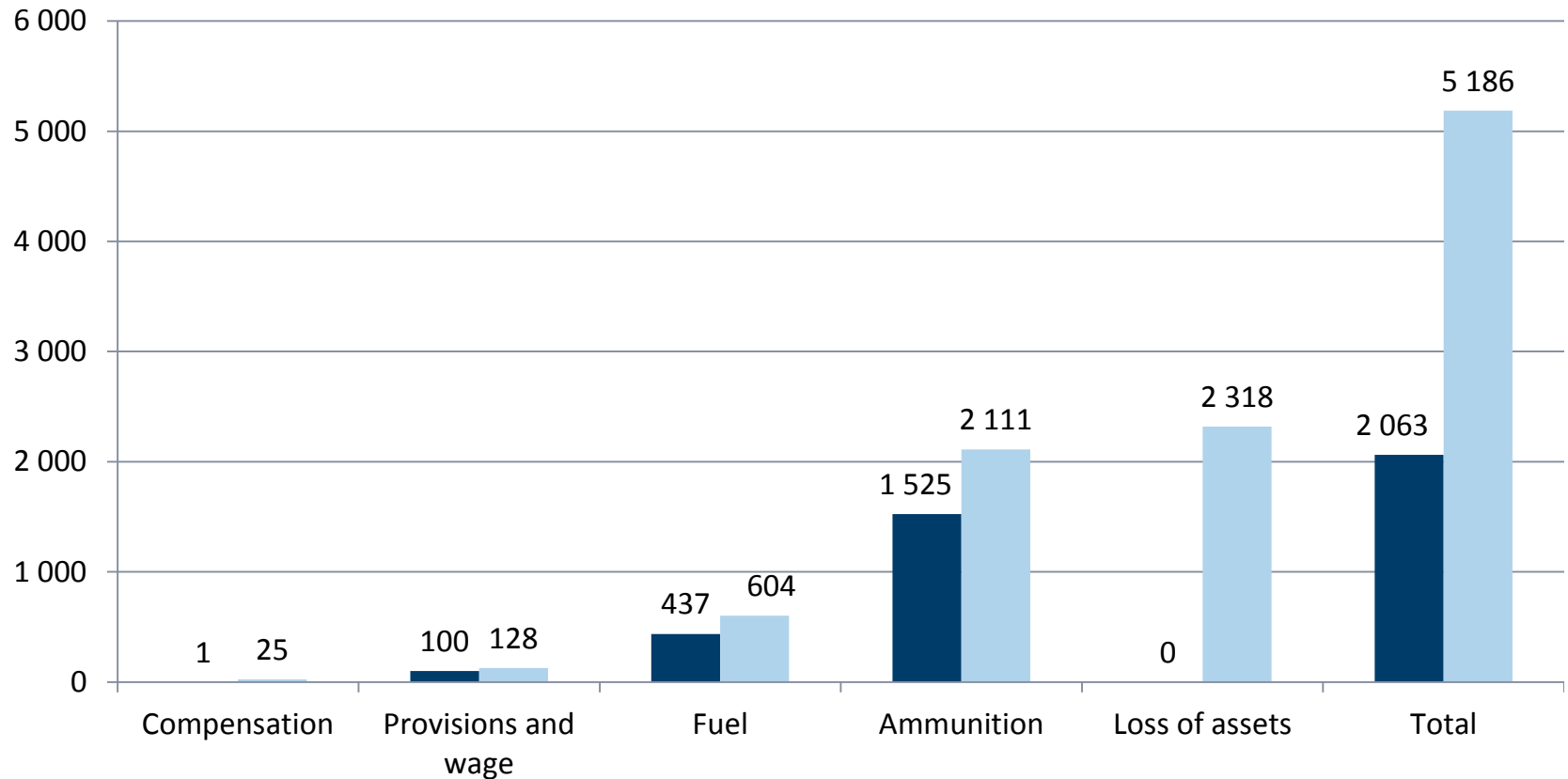
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Cost of the campaign

– Uncertainty analysis

Real 2015 £, millions

■ Optimistic ■ Pessimistic



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Cost of the campaign

– Uncertainty analysis

Variables

Personnel travel

Personnel battle

Fuel journey

Fuel battle

Loss of assets

Casualties

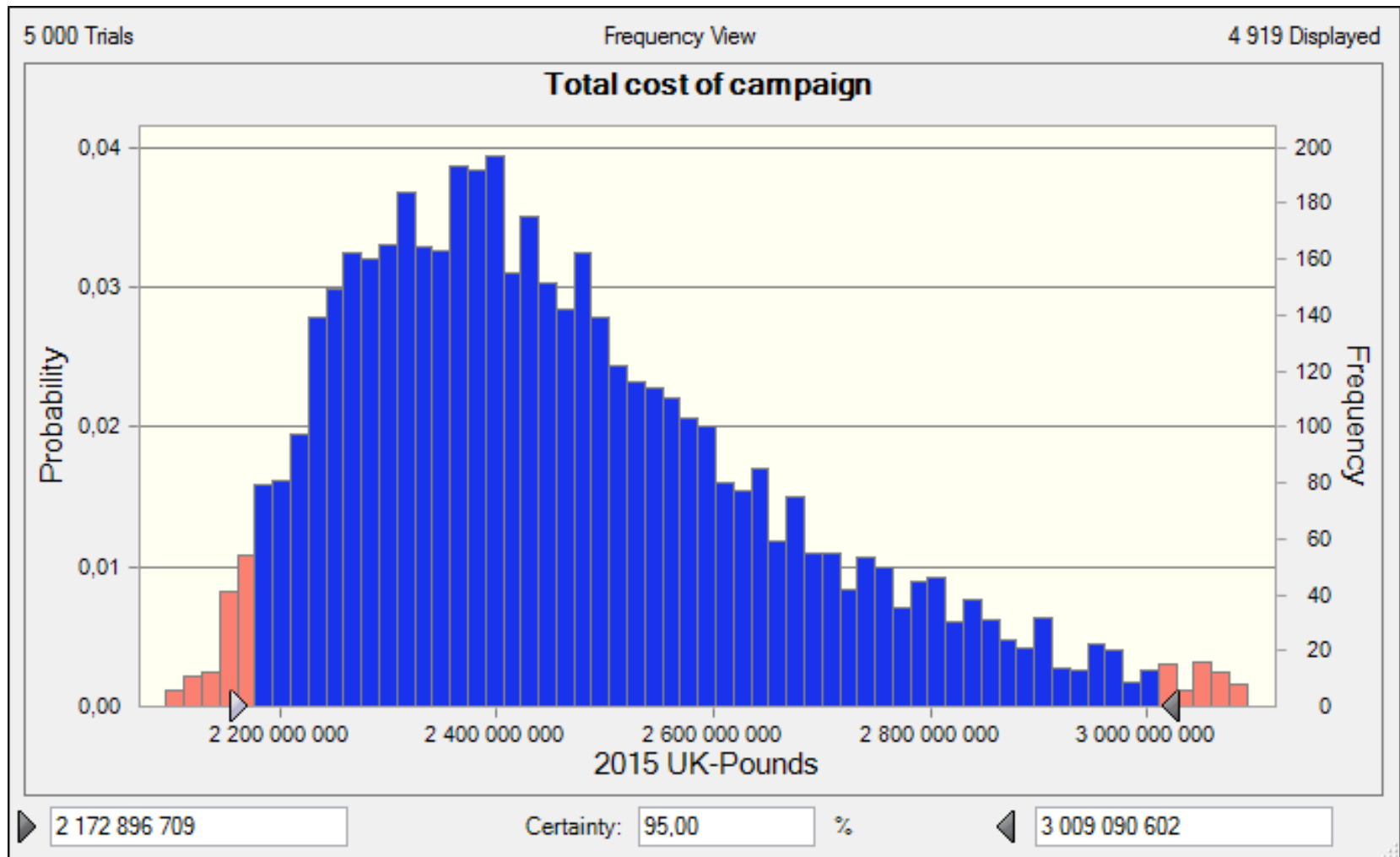
Ammunition



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.

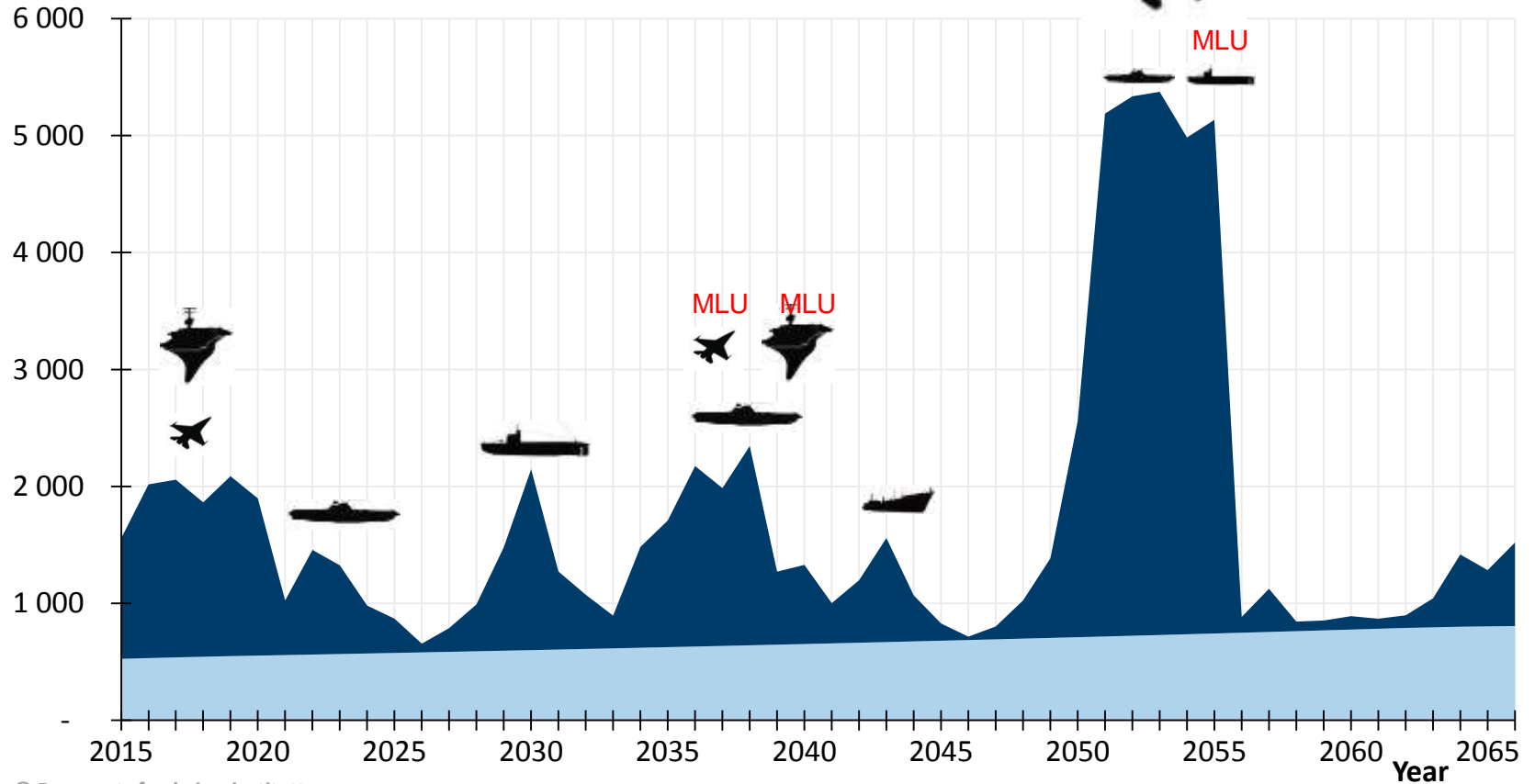
Examples of assets with information necessary for WLC estimation:

	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



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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.

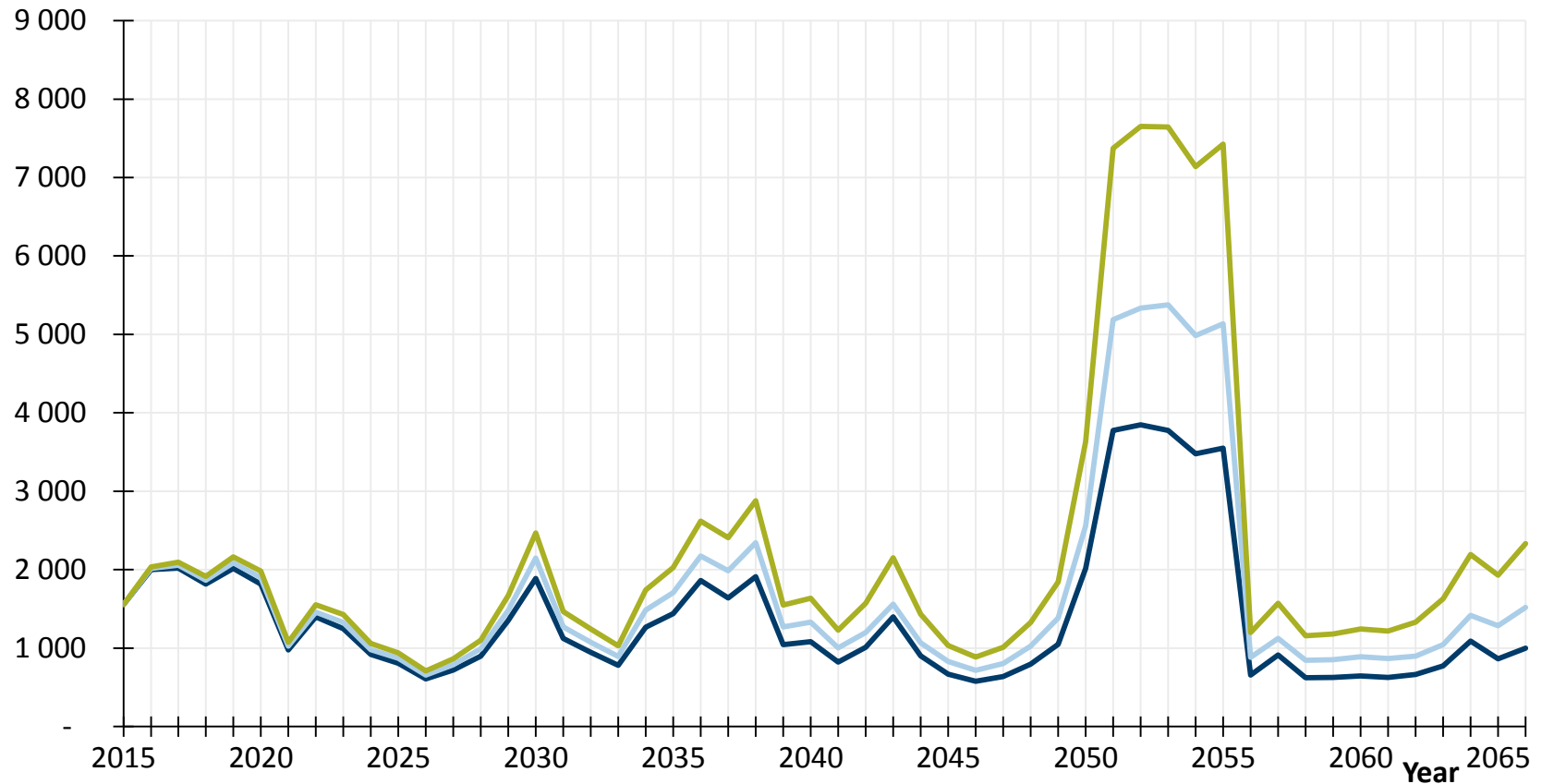
Asset / Force element	ICE			OCE		
	Low	Base	High	Low	Base	High
Personnel				0%	0.5%	1%
Satellite, Logistic ships, Vehicles	0%	0%	1%	0.5%	1.5 %	2.5%
Destroyer, Frigate, Helicopters	0%	1%	2%	0.5%	1.5%	2.5%
Aircraft Carrier, MALE UAV, Submarine, Amphibious assault ship, LCVP, Missiles	1%	2%	3%	0.5%	1.5%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



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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 ?