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High-Speed Ship/Agile Port Concept

Alternate Power Generating Systems for High-Speed Commercial Ship Propulsion

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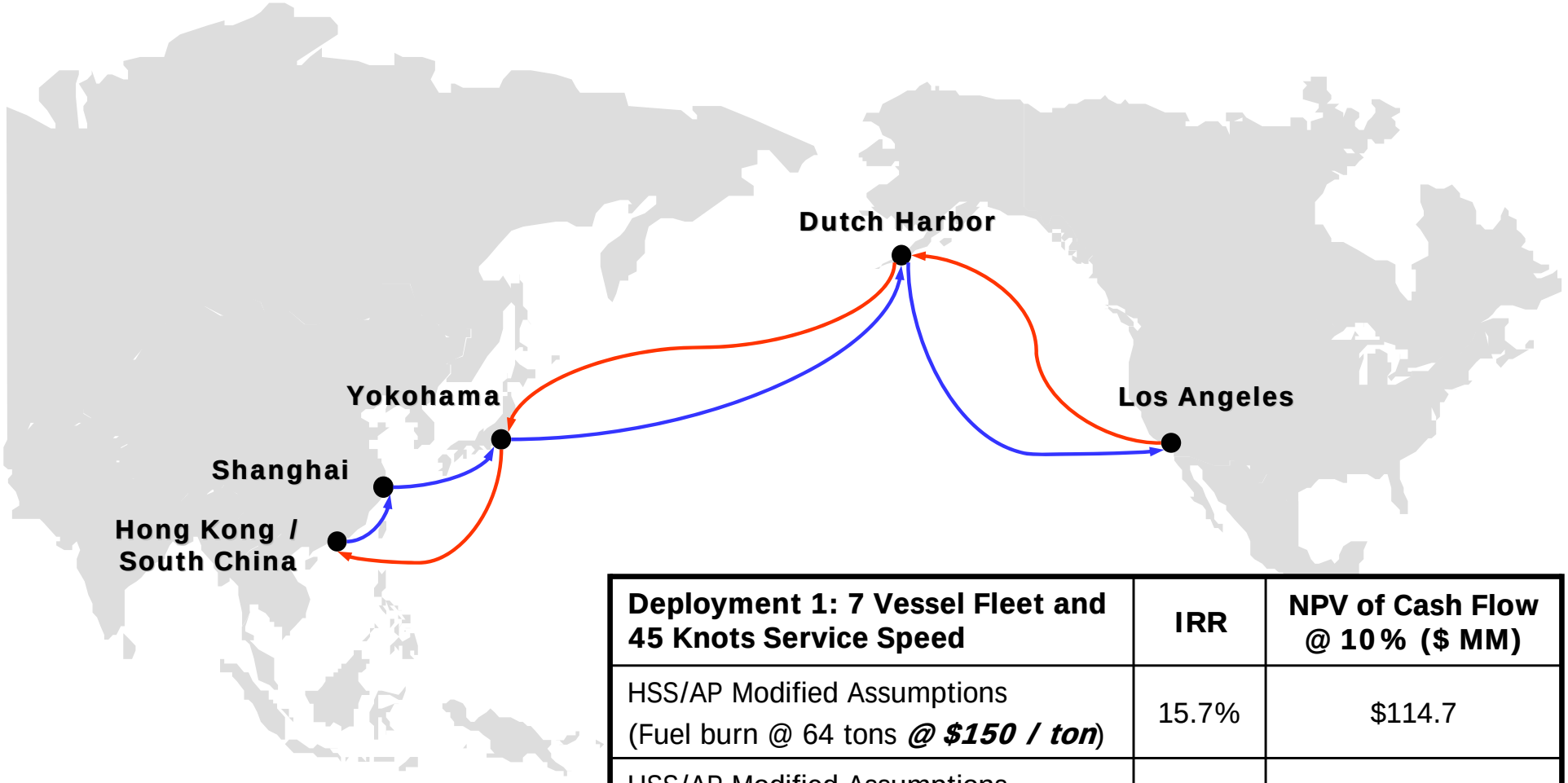
BACKGROUND

- Large Commercial Cargo Ships Today Require ~80 -100,000 SHP To Provide 25-28 Knot Service Speed
- Military Cargo Ships To Support Seabasing And Other Littoral Support Issues Are Considering Ship Speeds In The 40-45 Knot Range
- Large High Speed Ships Will Require 250,000 To 350,000 SHP To Sustain Service Speeds Of 40+ Knots
- The Escalation In Marine Fuel Costs Suggests That A Nuclear Power Generation System (As Used On Large Naval Ships) May Be An Alternative Option
- Results Of Earlier (2003) Assessment As To A High-speed Pacific Service Will Serve As A Baseline

Major Base Case Ship Assumptions Under HSS/AP Nuclear and Non-Nuclear Propulsion

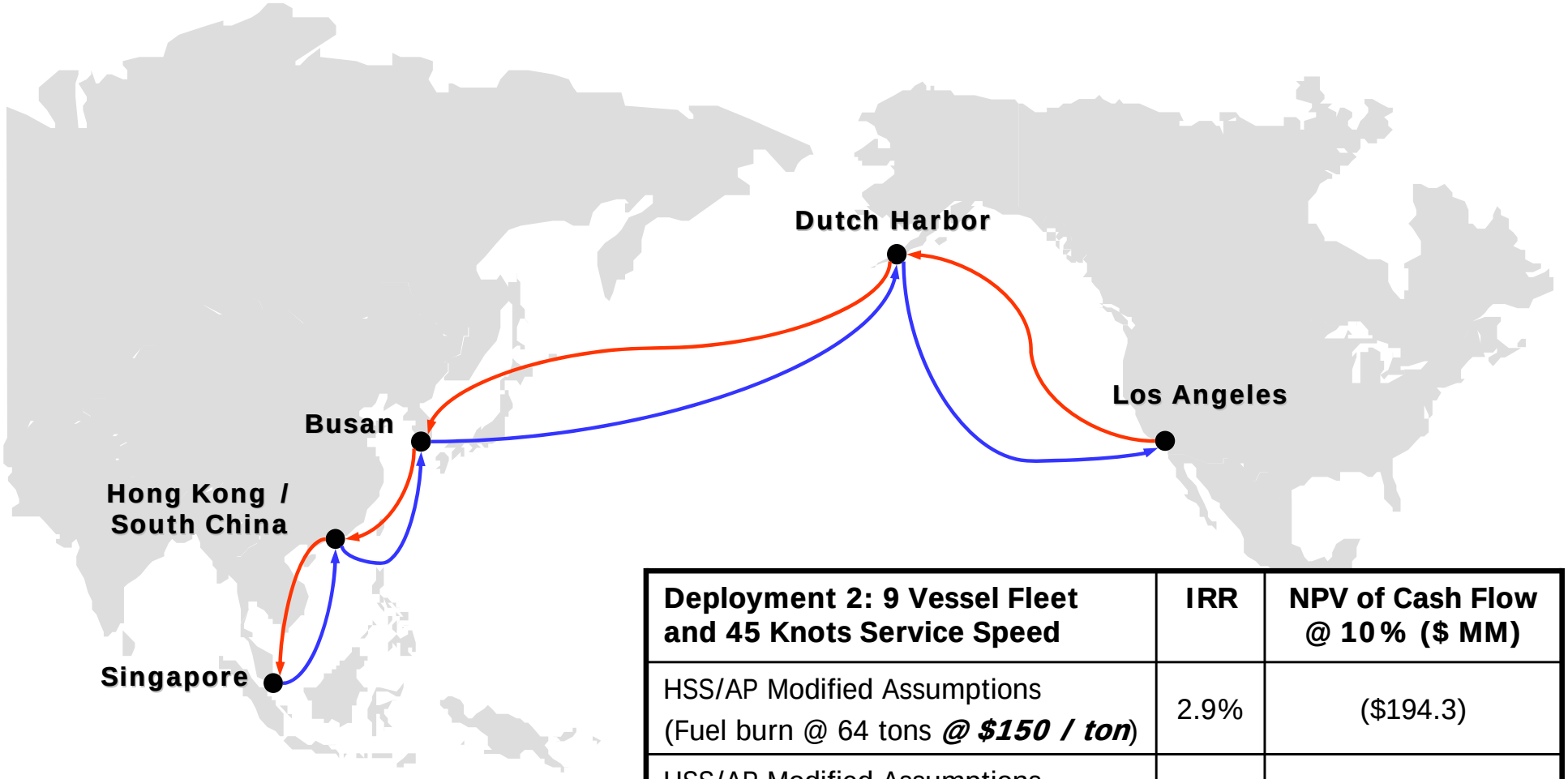
Category	HSS/AP Nuclear Propulsion	HSS/AP Non-Nuclear Propulsion
Operating Life	25 years	25 years
Newbuild Cost	$400 million per ship	$180 million per ship
Cargo Capacity	2,300 TEU (Eastbound)	1,700 TEU (Eastbound)
Average Service Speed	45 knots	45 knots
Operating Range	Unrestricted	3,500 nautical miles
Manning	Ships Crew – 15 @ $8,000 per day Reactor Crew – 12 @ $8,000 per day	Ships Crew – 15 @ $8,000 per day
Refueling	• Every 5 Years; 2 months to complete • Fuel cost of $45 million per reactor • Fuel disposal cost of $36 million per reactor	Refueling undertaken at Dutch Harbor eastbound and westbound
Reactor Maintenance	$5.6 million per reactor per year	Not applicable
Insurance	2% of newbuild price	~1% of newbuild price
Reactor Decommissioning	$31.25 million per reactor	Not applicable

HSS/AP Non-Nuclear Propulsion Deployment 1



Deployment 1: 7 Vessel Fleet and 45 Knots Service Speed	IRR	NPV of Cash Flow @ 10% ($ MM)
HSS/AP Modified Assumptions (Fuel burn @ 64 tons ***@ $150 / ton***)	15.7%	$114.7
HSS/AP Modified Assumptions (Fuel burn @ 64 tons ***@ $300 / ton***)	NA	($3,465.9)

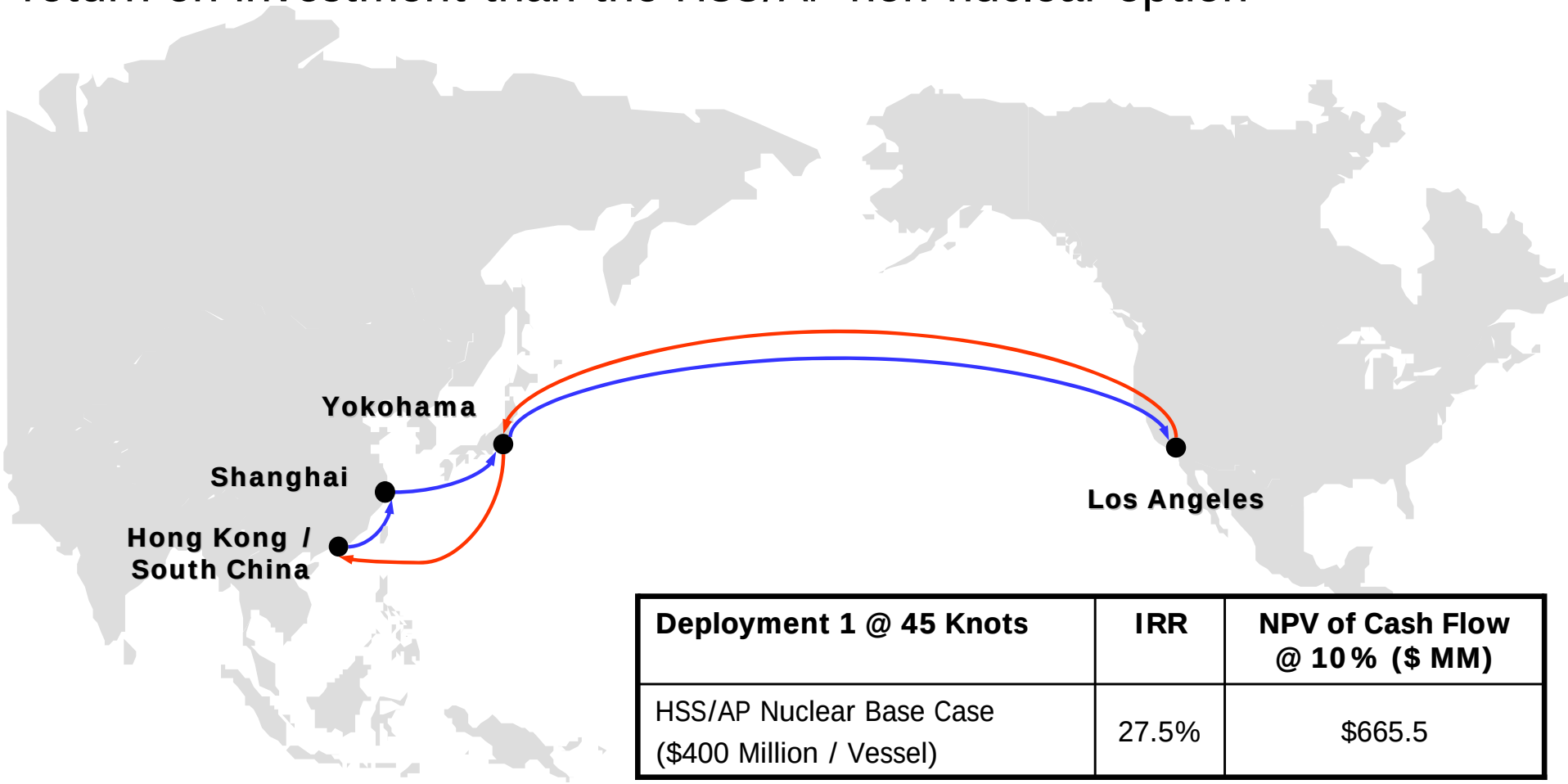
HSS/AP Non-Nuclear Propulsion Deployment 2



Deployment 2: 9 Vessel Fleet and 45 Knots Service Speed	IRR	NPV of Cash Flow @ 10% ($ MM)
HSS/AP Modified Assumptions (Fuel burn @ 64 tons ***@ $150 / ton***)	2.9%	($194.3)
HSS/AP Modified Assumptions (Fuel burn @ 64 tons ***@ $300 / ton***)	NA	($4,903.0)

HSS/AP Nuclear Propulsion Deployment 1

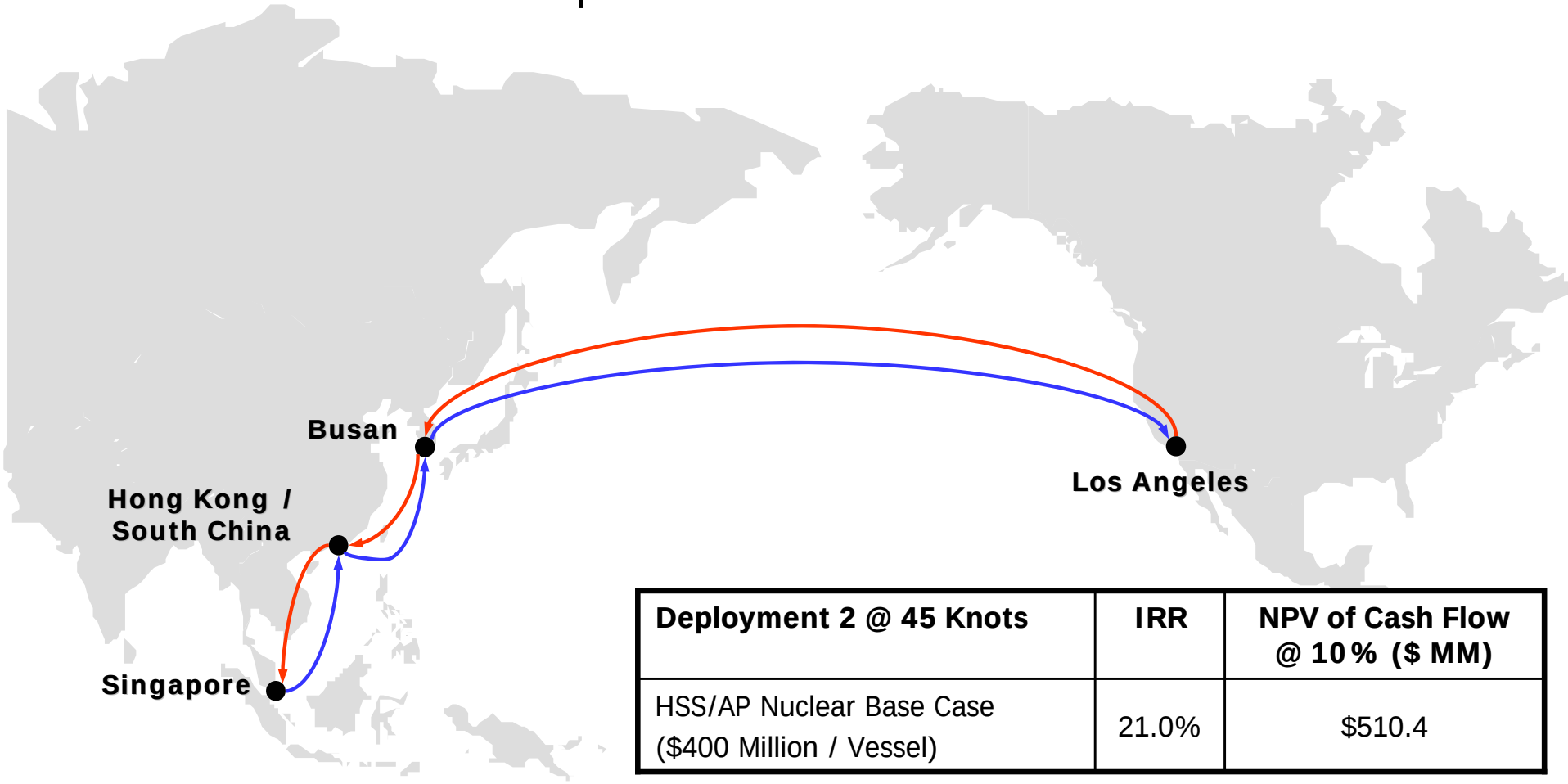
Deployment 1 Base Case is economically viable and generates a higher return on investment than the HSS/AP non-nuclear option



Deployment 1 @ 45 Knots	IRR	NPV of Cash Flow @ 10% ($ MM)
HSS/AP Nuclear Base Case ($400 Million / Vessel)	27.5%	$665.5

HSS/AP Nuclear Propulsion Deployment 2

Deployment 2 Base Case generates a higher return on investment than the HSS/AP non-nuclear option



Deployment 2 @ 45 Knots	IRR	NPV of Cash Flow @ 10% ($ MM)
HSS/AP Nuclear Base Case ($400 Million / Vessel)	21.0%	$510.4

FINDINGS AND CONCLUSIONS

- Under HSS/AP Base Case Deployments ($400 Million Vessel Price @ 45 Knots Service Speed), Nuclear Propulsion Is Economically Viable And Generates Investment Returns Better Than Non-nuclear Propulsion
  - Greater Cargo Carrying Capacity Due To Elimination Of Bunker Fuel
  - Extended Service Range
  - Favorable Cost Of Fuel, Particularly In The Current Environment
- As Vessel Service Speed Falls Or The Refueling Cycle Shortens, The Economic Viability Declines And Some Vessel Price Subsidy Would Be Needed To Provide Attractive Investment Return
- Elimination Of Direct Port Calls In Japan (Deployment 1) And China (Deployment 2) Due To Environmental/Political Concerns Has A Detrimental Impact On Economic Viability And A Significant Vessel Price Subsidy Would Be Required To Generate Strong Returns On Investment

REVIEW OF ALTERNATIVE SHIP POWERING SYSTEMS

- Emergent Need for High Speed (>40K Ships – Military & Commercial
- Small Team of Experts Engaged to Investigate Applications to:
  - Evaluate Highly Advanced Conventional & Nuclear Propulsion in Powering Conventional & Advanced Ship Designs,
  - Review Technical and Economic Feasibility of Each Alternative,
  - Focus on Dual Usage & Long Distance Trans-Pacific Routings,
  - Conduct Sensitivity Analyses of Major Elements Affecting Economics
- Study Will Evaluate "New" (Changed) Technical & Market Environment Influencing Feasibility (Speed, Market Availability, Energy Costs)
- Study Will Include Major Non-Economic Issues, Such as Safety, Refueling, Manning & Training-- And The Current Political Acceptance Climate