

# MERIT Seminar

Energy Efficiency through Innovation in Cruise Ship Design & Operations



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**Eniram**



Helsinki  
2015 November 12

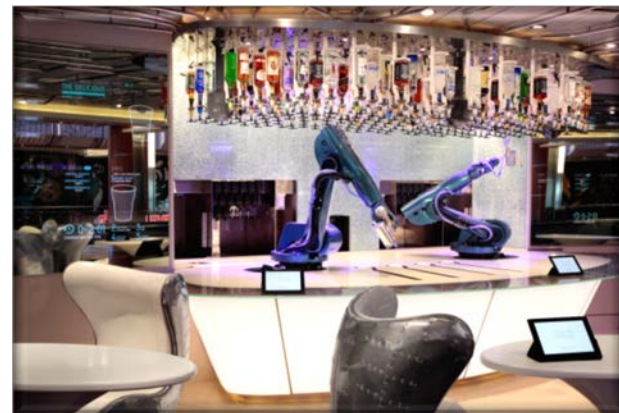
# Evolution and Success of the Cruise Industry

## ➤ Global Mature Industry Today

- Song of Norway 1970 - 18,000 GRT
- Today 300+ cruise ships, 19M GRT
- 23 million guests annually
- Average newbuilding size - 180K GRT
- 40+ ships currently on order

## ➤ What the cruise industry delivers that no other can

- ✓ High guest satisfaction
- ✓ Value for money
- ✓ Convenience
- ✓ Innovative product
- ✓ Broad itineraries and destinations
- ✓ Experience you can't get on land



# Royal Caribbean Cruises Ltd.



- Second Largest Cruise Company
- 44 ships - 102,000 guests - 60 000 employees
- 11 Newbuilds
- Extensive AEP / Scrubber Retrofit Program
- Extensive Revitalization Program
- Global operation - 480 Destinations
- Six Strong Brands



AZAMARA  
CLUB CRUISES



TUI Cruises

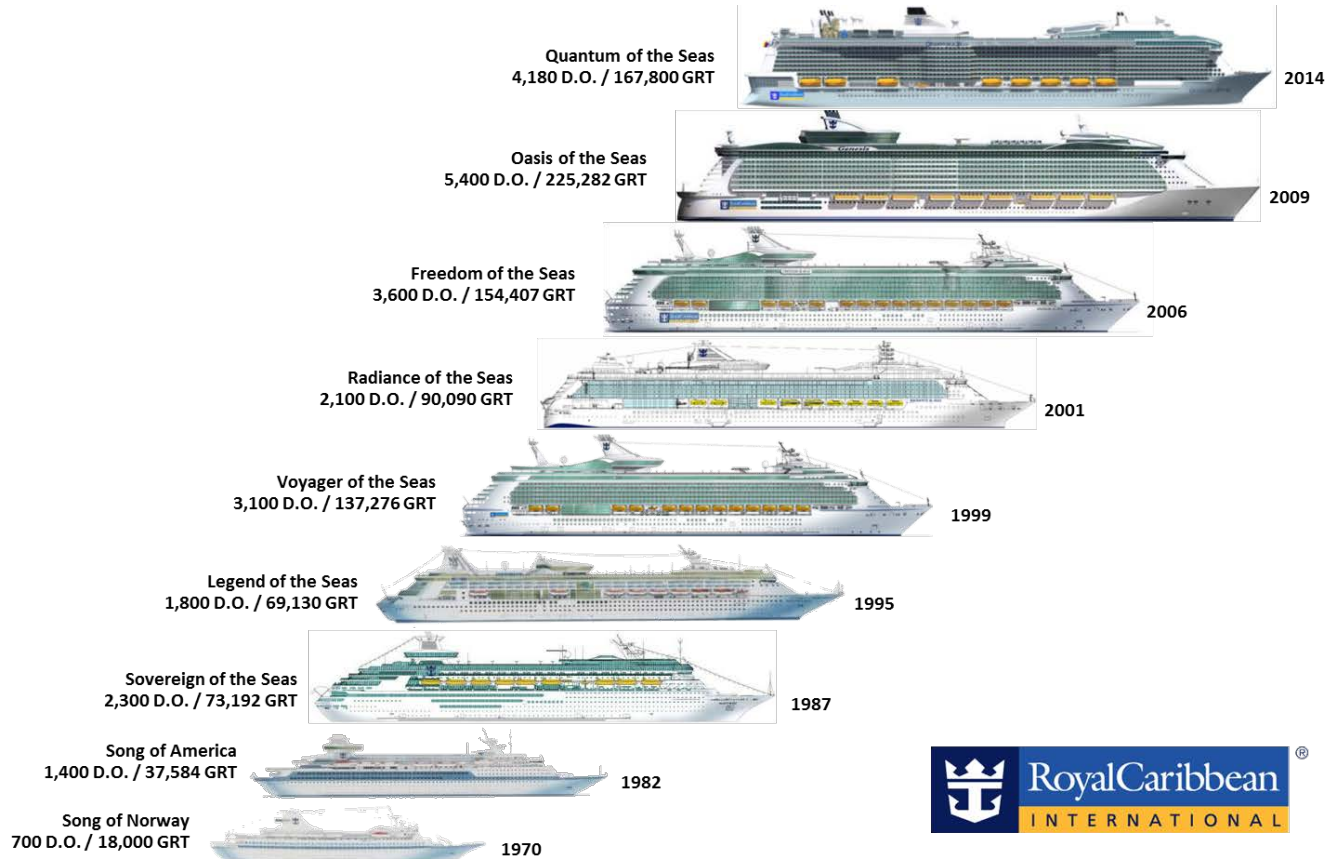


# Culture of Innovation and Safety

## Fleet Evolution



ROYAL CARIBBEAN CRUISES LTD.



# Innovation and Continuous Improvement

Imbedded in our DNA

- Never-ending quest to provide the best vacation to our guests
- Based on consumer demands and feedback
- Economies of scale provide cost advantages and opportunities
- Building upon our innovative mind-set with a strong focus on:
  - ✓ *Safety*
  - ✓ *Guest Experience*
  - ✓ *Environment*
  - ✓ *Energy efficiency*
  - ✓ *Lifecycle*



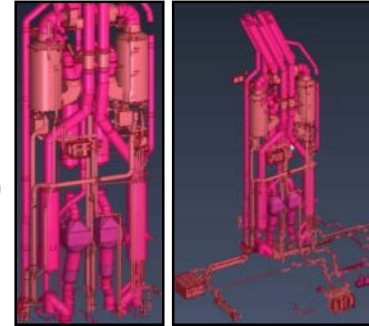
***There is no silver bullet; it's all about culture and process***

# Environment



ROYAL CARIBBEAN CRUISES LTD.

- **Consistent emphasis on advancing environmental solutions with suppliers**
- **Technical qualification & fit for purpose integral part of development**
  - ✓ Industry leader on Advanced Wastewater Purification (All waste treated in AWP)
  - ✓ Proactive working on Advanced Emission Purification (AEP) – SOx
  - ✓ Ballast Water Treatment
  - ✓ 19 ship AEP program with 42 units being installed
  - ✓ Selective Catalytic Reduction (SCR) – Nox
  - ✓ Waste Oil and oily Sludge collected in tanks and landed to be treated onshore
  - ✓ Introduced Save the Waves program in 1992
  - ✓ Sustainable design and selection of materials



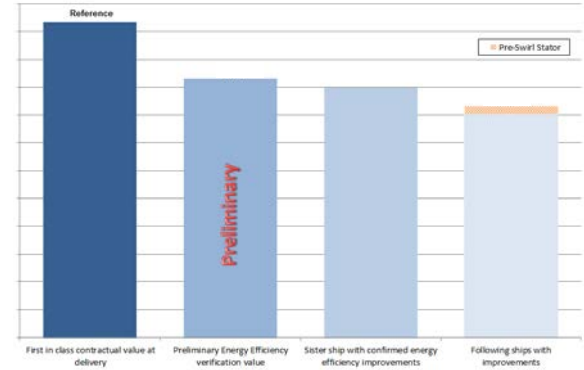
***Engineer workable solutions that are heading toward acceptable emissions***

# Energy Efficiency

## A central focus for each new class of ships with ambitious goals to reduce environmental impact

- Set a goal in early 2000 to improve fuel efficiency
- Every class is 20-25% more efficient than predecessors
- 3-5% improvement for existing vessels every year
- Well structured and focused process with hundreds of initiatives

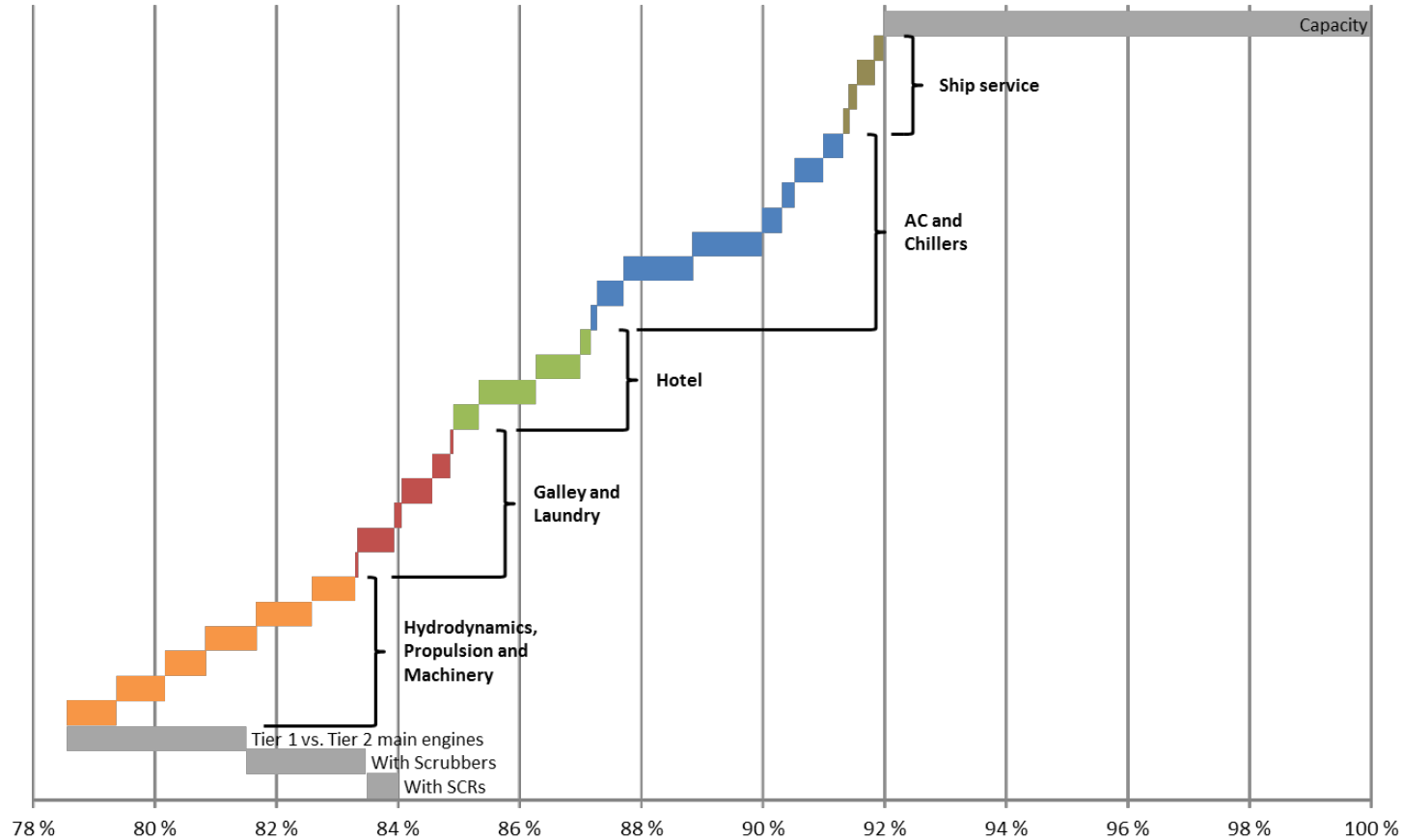
***Reduce consumption and emissions by burning less fuel***



# Energy Efficiency Waterfall Diagram



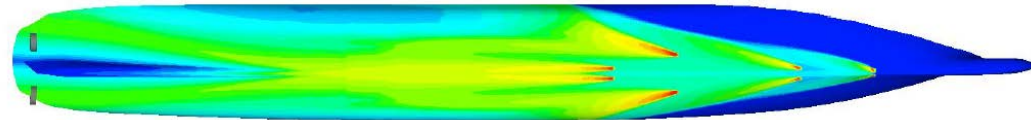
ROYAL CARIBBEAN CRUISES LTD.





## Continues to improve savings since introduction on Celebrity Reflection and has become standard on most newbuilds

- One fourth implementation showed savings 1-3%
- Full scale deliveries on current newbuilds expected to reach savings in range of 3% to 7%
- Air bubble layer will reduce propeller induced noise
- Further development of propeller design can potentially lead to 10% savings
- Retrofitting full or partial ALS is also planned for the existing fleet



# Overcoming Complexities Our Approach

- Strong in-house design and project management capability
- Partner and review with industry leaders, designers and consultants
- Rigorous risk assessment process, risk centrality
- Utilization of state of the art technical and design technology
- Continuous improvement and feedback loop



***...one team, one goal, one vision...***

# Future Trends in Cruise Ship Design & Operations

- **Average cruise ship size will grow, maximum size stable**
- **Novelty in architectural design solutions (open spaces, atriums, indoor-outdoor areas)**
- **Strong focus on safety and the environment**
  - ✓ Holistic risk-based approach and lifecycle (design, operation, emergencies)
  - ✓ Advanced emission purification systems
  - ✓ Improved efficiencies with focus on alternative fuels
- **Technology an integral part of design and ship features**



# What has Enabled us to Achieve This?



ROYAL CARIBBEAN CRUISES LTD.

- Innovation sown into corporate values
- Competence and knowledge - People!
- Partnerships and collaboration
- Investing in research and its outcomes
- Elevate knowledge with computing capability and tools
- Develop/implement ahead of legislation
- Opportunity always there, journey still underway



***SAFETY – ENVIRONMENT – ENERGY – LIFECYCLE***



## DATA

### ONBOARD:

- SENSORS
- SYSTEMS

### ONSHORE:

- FORECASTS
- KNOWLEDGE BASES



## INSIGHT

STATISTICAL MODELLING  
MACHINE LEARNING  
SIMULATION  
PREDICTION  
OPTIMIZATION  
DATA ENRICHMENT



## ACTIONS

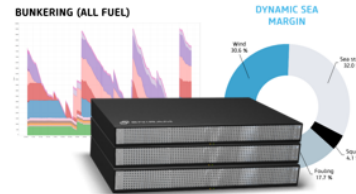
### OPTIMIZED:

- TRIM
- HULL FOULING
- SPEED & ENGINE
- ROUTE
- OPERATIONS

Gather accurate real time data



Gain insight with advanced modelling and analytics



Provide guidance to improve performance





# Savings Case on Royal Caribbean Cruises Ltd.



<b>ELEMENT</b>	<b>STARTED</b>	<b>SAVINGS TO DATE</b>
Trim optimization	2009	2 %
Hull & Fouling	2010	1 %
Speed & Engine	2012	1 %
Route optimization	2015	
Operations	2016	
<b>TOTAL</b>		<b>4 %</b> USD 16 M per year



# Savings Case on Royal Caribbean Cruises Ltd.



ELEMENT	STARTED	SAVINGS TO DATE	TARGET SAVINGS
Trim optimization	2009	2 %	2 %
Hull & Fouling	2010	1 %	3 %
Speed & Engine	2012	1 %	3 %
Route optimization	2015		3 %
Operations	2016		3 %
<b>TOTAL</b>		<b>4 %</b> USD 16 M per year	<b>Additional 10 %</b> USD 40 M per year







CONFIDENTIAL



▼ QUANTUM CLASS

- Quantum of the Seas
- Anthem of the Seas

▼ OASIS CLASS

- Oasis of the Seas
- Allure of the Seas

\*\*\* FREEDOM CLASS

\*\*\* RADIANCE CLASS

\*\*\* VOYAGER CLASS

\*\*\* VISION CLASS

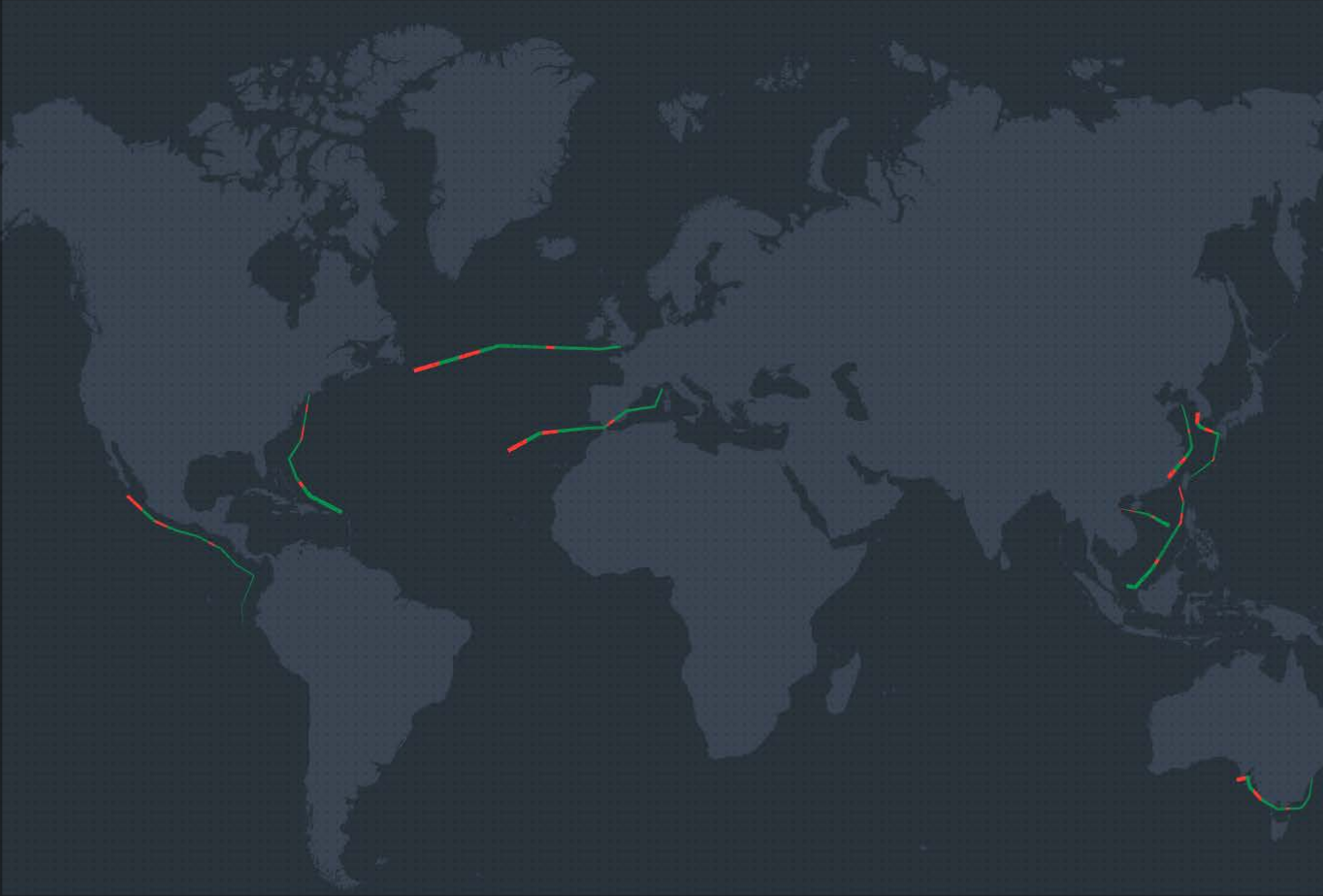
■ SOVEREIGN CLASS



▼ MILLENNIUM CLASS

- Celebrity Millennium
- Celebrity Infinity
- Celebrity Summit
- Celebrity Constellation

\*\*\* SOLSTICE CLASS



CREW | ANTHEM OF THE SEAS

DANIEL WILLIAMSON  
CAPTAIN

PRIYA YADAV  
STAFF CAPTAIN

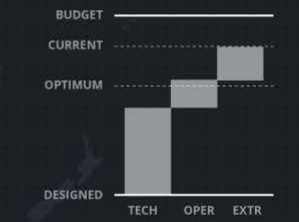
KEVIN MICHAELSON  
CHIEF OFFICER



CONNECTED TO DANIEL WILLIAMSON

WRITE YOUR MESSAGE

SEND



AUG 01

SEP 01

FLEET ENERGY EFFICIENCY / DAY

OCT 01

NOV 01





5 NEWS

FOX

Share a Coke with Sabrina

Text Coke your name to 41411 to see it here.

Panasonic

FIRST TIME \$

Yahoo!

New York Police

Coca-Cola

# 1

TOOLS



# 2

SUPPORT



# 3

FOLLOW-UP



# 4

TRANSPARENCY





**Thank You**

