

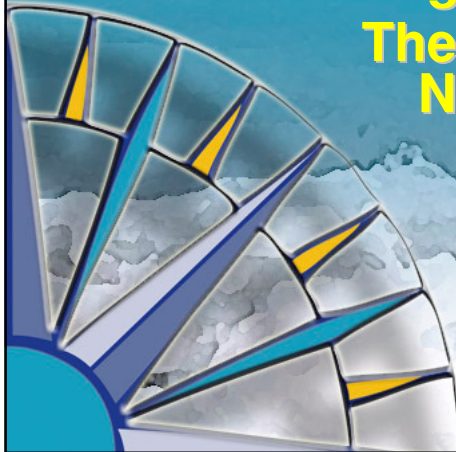
PIANC Workshop  
13-14th September 2011



## Design for Maintenance The Experience of the New Panama Locks

(Cheryl George)  
Rogelio Gordon  
Juan (Johnny) Wong  
Panama Canal Authority

**PIANC**  
Setting the course

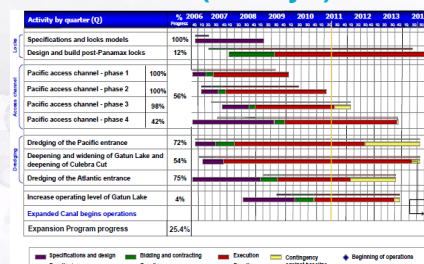


## Project chronology

- 1998-2005 Studies and Master Plan (dream?)
- 2006-2009 Referendum and Contracting
- 2009-2011 Design, set up, excavation
- 2012-2014 Construction
- 2015-2017 Operation and maintenance (reality?)



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## Project set-up

- Build the team
  - ACP expertise, Technical Experts and Project Management
- Benchmarking
  - USACE and European Post-Panamax locks (Germany, Netherlands, Belgium, France, Great Britain)
- PIANC



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## Procurement process

- Design-build contract
  - Performance specifications
- FIDIC yellow book
- Meeting with Consortia
  - Amendments
- Bid best value
  - Technical 55% and Financial 45%



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## Top level decisions

- Post-panamax size vessel and locks
- Tugs vs locomotives
- Life cycle cost: initial, operations and maintenance costs

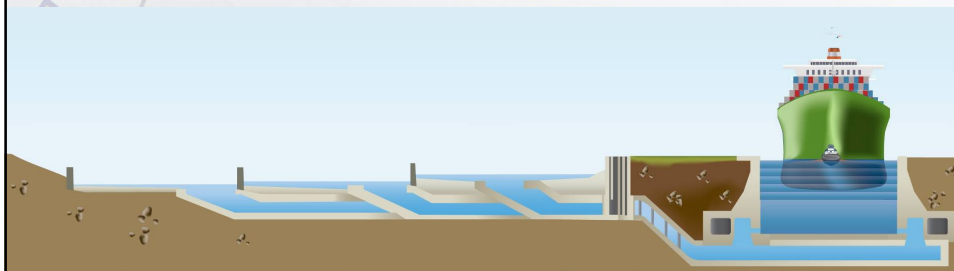


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## Top level decisions (2)

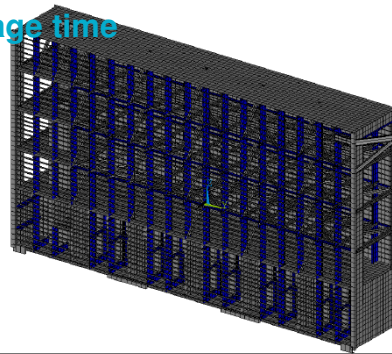
- Three lift locks
  - Water, environmental, technical
- Water saving basins
  - Proven technology German locks barge traffic
  - Numerical & physical models





## Rolling gates

- Gate size and weight
  - Double set of gates for safety and reliability
  - Standardized middle gates
- Able to dry dock and maintain in place
  - Bulkheads, pumps, outage time
- Operating cycles
- Replacement of buggies
- Corrosion
- Traffic gates



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## Civil and structural

- Seismic
  - Different levels of damage to structures
  - Fit for purpose
- Durability (100 years)
  - Concrete strength and permeability
  - Culvert water velocities



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## Reliability

- Third set of locks requires very high reliability
  - Fault tree analysis
  - Redundancy
  - Reduced outage times



## Filling and Emptying

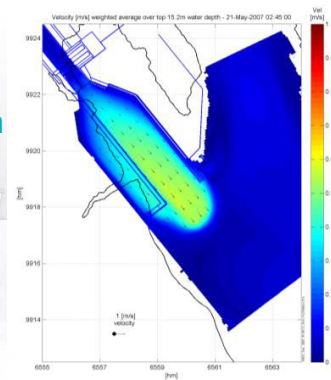
- Side F-E system
- F-E times and hawser forces
- Limit max water velocity
- Water velocity approach channels
- Valves main and conduit
  - Standard
  - Bulkheads to isolate repair and maintenance



Figure 3-20 Pacific Lock Structures

## Electrical, mechanical, control

- Reliability feed two loops
- Crossunders and cable trays/raceways
- Standard off-the-shelf parts
- Current technology
- Three years maintenance option



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## Gracias



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