

# BGT Fleet Longevity Presentation



## BGT LIMITED

One Stamford Plaza

263 Tresser Blvd. Suite 1000

Stamford, CT 06901-3216

TEL: 1-203-252-2700

FAX: 1-203-252-2410

EMAIL: [bgtgen@bgtct.com](mailto:bgtgen@bgtct.com)

WEBSITE: [www.bgtltd.com](http://www.bgtltd.com)

# Outline

- 1) Introduction of BGT fleet
- 2) Main refurbishment jobs relating to ship longevity conducted on BGT fleet prior to 2005
- 3) Targets of 2005 Longevity Study
- 4) Main items of 2005 Longevity Study conducted by Lloyd's Register
- 5) Outcome of 2005 study
- 6) Conclusion



# 1 ) Introduction of BGT fleet

## BGT fleet list (8 sister ships)

Vessel	Year Built	Trade
LNG Aquarius	1977	Ind.. – Korea
LNG Aries	1977	Qatar – Spain
LNG Capricorn	1978	Ind.. – Japan
LNG Gemini	1978	Ind.. – Japan
LNG Leo	1978	Ind.. – Japan
LNG Libra	1979	Ind.. – Japan
LNG Taurus	1979	Ind.. – Japan
LNG Virgo	1979	Ind.. – Japan

Main particulars	
Builder	General Dynamics
LOA	936.0FT (285.3M)
Breadth (MLD)	143.5FT (43.74M)
Depth (MLD)	82.9FT (24.99M)
Draft	36.0FT (10.97M)
Deadweight	71,400 tons
GRT	95,000 tons
NET	28,000 tons
Class	ABS
Cargo capa.	126,300M3
Tank design	MossRosenberg
Engine type	Steam Turbine
Horsepower	43,000 SHP
Service speed	19.5 knots

# 1 ) Introduction of BGT fleet

## History of Maintenance



1985-1989 : Water ballast tank recoating was conducted among the fleet;

1988 : Master Maintenance Plan was established to cover the maintenance program up to end of 1999;

1994 : Longevity Study conducted by Lloyd's Register to the fleet covering the period from 2000 to at least 2010;

1996-1999 : Refurbishment works were conducted based on the recommendations from the 1994 Longevity Study;

1999 : New Master Maintenance Plan was established to cover the maintenance program up to end of 2010;

2005 : Second Longevity Study was conducted on LNG Libra by Lloyd's Register as an indicator of the fleet to cover the period up to at least 2020.

## 2) Main refurbishment jobs relating to ship longevity conducted on BGT fleet during 1996 - 1999

1. Replacement of Cargo / Ballasting Consoles
2. Replacement of Liquid Header Insulation
  - Inspection of Stress Corrosion Cracks
3. Reinforcement in Water Ballast Tanks and Hold Spaces
  - Installation of brackets and stiffeners
4. Replacement of Rudder Carrier Bearings
5. Upgrading of Steering Gear Systems
6. Modification of Bow Thrusters
  - Oil pollution prevention
7. Repair of Cargo Dome Insulation

## 2) Main refurbishment jobs relating to ship longevity conducted on BGT fleet during 2002 - 2005

1. Replacement of Control Air Compressors
2. Upgrade of Main Switchboards
  - Engine Control Room
3. Replacement of Main Switchboard Breakers
4. Upgrading of Boiler Management Systems
5. Replacement of Insulation of Cool Down Lines
  - Inspection of Stress Corrosion Cracks
6. Replacement of Integrated Throttle Control Systems
7. Installation of Sacrificial Anode in Water Ballast Tanks

2) Main refurbishment jobs relating to ship longevity conducted on BGT fleet  
Water ballast tanks (1/2)



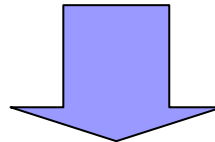
**<Specifications of recoating in 1985-1989>**

Surface preparation: full sand blasting (SA-2.5)

Painting: Epoxy Zinc Primer – one coat 30 micron/coat

Tar Epoxy Paint (under coat) – one coat 175 micron/coat

Tar Epoxy Paint (finish coat) – one coat 175 micron/coat



**About 110 days were consumed to complete the recoating**

2) Main refurbishment jobs relating to ship longevity conducted on BGT fleet Water ballast tanks (2/2)

**<Specifications of Sacrificial Anode Installation in 2002 - 2005>**

Type : LNZ-70A (16.1kg) x 1,326pcs

Surface protection: grand total 142,264 M2

Current density: 5mA/M2

Ballasting ratio: 50%

Sacrificial Anode life: 5 years

### 3) Targets of 2005 Longevity Study

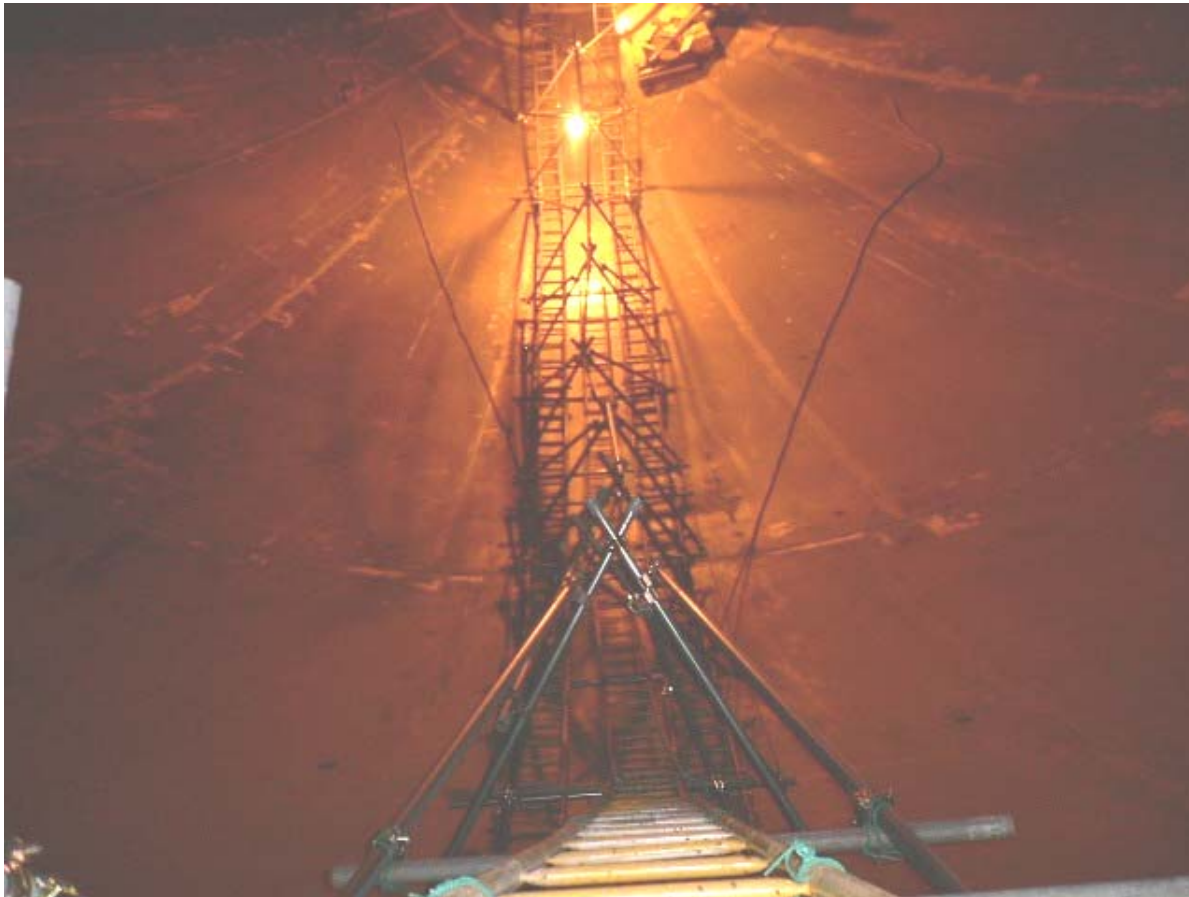
1. To compare the results between 1994 and 2005 Longevity Study;
2. To evaluate the outcome of past maintenance, repair and refurbishment records;
3. To obtain a third party recommendation for a future maintenance plan with the objective of maintaining the vessels in a sound condition up to at least 2020.

## 4) Main items of 2005 Longevity Study conducted by Lloyd's

1. Examination of the classification records  
*⇒ to identify recurring defects from historical records*
2. Examination of the vessel & onboard operational records  
*⇒ to inspect on board records of machinery failure, record keeping procedures and condition of machinery equipment during sailing*
3. Condition Assessment Program ("CAP")  
*⇒ to analyze the current condition of the vessel*
4. Structural integrity analysis  
*⇒ to evaluate the life of the hull structure (Ultrasonic thickness gauging / Steel coatings)*
5. Machinery maintenance management study  
*⇒ to provide a regime & identify strengths and weaknesses of the current maintenance system, in order to indicate that current maintenance management is suitable to control related risks during the life extension period up to at least 2020*

#### 4) Main items of 2005 Longevity Study conducted by Lloyd's

Sample picture of investigation work: In-cargo tank inspection (equator zone to the tank bottom)



# 5) Outcome of 2005 study

## Comparison between 1994 and 2005

### Longevity Study (main items) 1/2

Items	Hull structure	Water ballast tank coating	Duct keel
1994 Study	Steel renewal is not required due to diminution of materials but certain areas required future inspection and maintenance planning. (mainly connection areas)	Steel work and detailed inspection and maintenance program was recommended.	Coatings were in satisfactory condition.
1994-2005 M&R	The recommended areas were refurbished.	Steel work was conducted , regular maintenance, sacrificial anodes were installed.	Regular maintenance
2005 Study	Free from major defects. Recommend to continue regular inspection and maintenance.	Paint condition to be good albeit with minor places of paint breakdown (rust ratio approx. 1%).	Spot corrosion has been active and renovation work was conducted.

# 5) Outcome of 2005 study

## Comparison between 1994 and 2005

### Longevity Study (main items) 2/2

Items	Machinery	Main Gearing	Gas Header Insulation	Cargo Tank Insulation
1994 Study	Recommended to continue and upgrade the Master Maintenance Plan to form an essential ingredient in the operation of the fleet.	The pitting of the main wheel ahead flank and secondary pinion mesh was carefully investigated.	No recommendations to inspect.	Renewing the insulation along with the fitting of an effective vapor barrier was recommended.
1994-2005 M&R	In 1999 New Master Maintenance Plan was established.	The pitting appeared to be static and kept under observation.	No maintenance.	Sealing arrangement to all tank flanges were modified and silicon sealing was installed.
2005 Study	Satisfactory condition. Effectiveness of the Master Maintenance Plan can be seen from the machinery conditions.	Periodical and close up examination at each DD using carbon tape records.	Recommendation to inspect critical areas by removing the insulation.	No deterioration in figures of BOG rate.

## 5) Outcome of 2005 study

Item	Summary
Hull Structure	<p><b>2005 CAP rating: 2</b></p> <p>The structure of the vessel is in good condition although some areas have experienced corrosion that requires attention or renewal. Continuous and periodical inspection to the paint condition should be maintained. Minor cracks in Water ballast tank should be monitored.</p>
Machinery	<p><b>2005 CAP rating: 1</b></p> <p>The main and auxiliary machinery was found in satisfactory condition. Vibration inspections at sea were generally good and satisfactory. Obsolescence of spare parts requires attention.</p>
Electrical	<p>Inspection of all equipment was carried out. Thermo graphic inspection found that all circuits and connections were found to be in good condition.</p>
Cargo System	<p><b>2005 CAP rating: 2</b></p> <p>Full inspection was conducted and found to be satisfactory. Cold spot inspection revealed several areas of frost on each tank. However the BOG rate has not deteriorated and remains stable. Stress Corrosion Crack on gas piping requires attention.</p>

## 6) Conclusion



A proper long term maintenance program will result in maintaining the vessels in a sound condition.

### *Our primary target:*

To plan and continually update a proper Master Maintenance Plan taking the Lloyd's recommendations and suggestions into consideration to cover the period up to at least 2020.

# 6) Conclusion

## Fleet life expectancy



1977 - 1979 → 2000

Delivery

*Maintenance programs*

1994 → 2010

1<sup>st</sup> Longevity study conducted

*Refurbishment works and Maintenance programs*

2005 → 2020

2<sup>nd</sup> Longevity study conducted

*Refurbishment works and Maintenance programs are planned*

**2015**

3<sup>rd</sup> Longevity study expected