U.S. Department
of Transportation
**United States
Coast Guard**

MARINE CASUALTY REPORT

MV INCA TUPAC YUPANQUI,

TB PANAMA CITY, TUG CAPT. NORMAN;

COLLISION IN THE LOWER MISSISSIPPI RIVER

ON 30 AUGUST 1979 WITH LOSS OF LIFE

U.S. GOAST GUARD

MARINE BOARD OF INVESTIGATION REPORT

AND

COMMANDANT'S ACTION

REPORT NO. USCG 16732/01281

COLLISION OF THE PERUVIAN M/V INCA TUPAC YUPANQUI WITH THE MOORED TANK BARGE PANAMA CITY AND INVOLVING THE TUG CAPT. NORMAN ON 30 AUGUST 1979 WITH LOSS OF LIFE

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16. Abstract On 30 August 1979 at 0710 (all times CDT), the Peruvian Freighter, M/V INCA TUPAC YUPANQUI, while underway downbound in the lower Mississippi River collided with the moored T/B PANAMA CITY. The collision resulted in an explosion and fire which totally enveloped the INCA TUPAC YUPANQUI, the PANAMA CITY, the dock and the Tug CAPT NORMAN. The fire and explosions which followed the collision ignited the ship, the barge, the tug, the dock, and caused burning along the river bank. Twelve persons, ten crewmembers of the INCA TUPAC YUPANQUI and two crewmembers of the Tug CAPT NORMAN, died as a result of the casualty. In addition, thirteen persons were injured.

This report contains the U. S. Coast Guard Marine Board of Investigation Report and the Action taken by the Commandant to determine the proximate cause of the casualty and the recommendations to prevent recurrence.

The Commandant has concurred with the Marine Board that the proximate cause of the casualty was the loss of steering control from the bridge of the INCA TUPAC YUPANQUI, which prevented the rudder from turning to the right as the vessel entered a right turn in the Mississippi River. However, the exact cause of the loss of steering cannot be determined due to extensive fire damage.

17. Key Words	18. Distribution Statement
Freighter collision, tank barge, butane, lower Mississippi River, fire, steering system	This document is available to the public through the National Technical Information Service, Springfield, Virginia 22121

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16732 INCA TUPAC YUPANQUI

10 MAY 1983

Commandant's Action

on

The Marine Board of Investigation convened to investigate the collision of the Peruvian M/V INCA TUPAC YUPANQUI with the moored U. S. Tank Barge PANAMA CITY, and involving the Tug CAPT NORMAN, at General American Transport Corporation Terminal, Berth No. 4, at mile 121.2, ahead of passes, lower Mississippi River on 30 August 1979 with loss of life

The report of the Marine Board of Investigation convened to investigate the subject casualty has been reviewed; and the record, including the findings of fact, conclusions and recommendations, is approved subject to the following comments.

COMMENTS ON CONCLUSIONS

1. Conclusion 4: This conclusion is not concurred with. There was approximately a 2 minute time span from when the steering failure was discovered to when the collision occurred. It is doubtful that even a very experienced crew member stationed at the emergency steering station would have had sufficient time to diagnose the problem and take corrective action that could have prevented this casualty.

2. Conclusion 9: This conclusion is concurred with to the extent that the lack of an established anchor watch limited the pilot's ability to respond to the rudder failure. However, it is unlikely that in this incident an anchor watch could have prevented or mitigated the collision. Concerning the vessel's maneuvering characteristics (which are required to be posted on the bridge by 33 CFR 164.35(g)), it is unlikely that in this accident the knowledge of posted maneuvering data by the pilot would have prevented the collision.

3. Conclusions 11 and 12: These conclusions are concurred with. Presently, Coast Guard firefighting policy is outlined in Chapter 86-6 of the Marine Safety Manual (MSM), Volume VI. This guidance is being updated by Coast Guard Headquarters to reflect the concern that Coast Guard personnel are inadequately trained and equipped in firefighting situations. Specifically, the following three areas are being developed for further guidance:

a. Emphasize port contingency planning;
b. Establish required training standards; and
c. Establish protective clothing requirements.

4. Conclusion 18: This conclusion is not concurred with since the chief engineer apparently secured the emergency fuel oil valves after he and the second engineer had departed the machinery spaces due to the smoke. Securing the fuel oil valves would have been proper in this case.

5. Conclusion 19: This conclusion is concurred with to the extent some of the bridge crew did not respond properly to the emergency situation. The helmsman, for instance, did respond properly by reporting the steering failure to the chief mate. However, the chief mate did err by not immediately advising the pilot of the steering failure.

With regard to a lack of emergency situation training contributing to the bridge crew's improper actions, the 1978 Protocol to the Safety of Life at Sea Convention of 1974 (the 1978 Protocol to SOLAS 74) now requires emergency steering drill tests to be conducted every three months on all vessels that are subject to the convention. These requirements for all vessels that are 1600 gross tons or larger will be incorporated into 33 Code of Federal Regulations (CFR) 164 in the next revision.

ACTION CONCERNING THE RECOMMENDATIONS

1. Recommendation 1: This recommendation is concurred with. The Coast Guard has taken the initiative at the International Maritime Organization (IMO) (formerly the Intergovernmental Maritime Consultative Organization) on three separate occasions since 1975 regarding redundancy for steering systems on all vessels. The most recent work on amendments to the steering gear requirements in SOLAS 74 substantially improves redundancy requirments for all vessels subject to this convention. These new requirements are included in the Amendments to SOLAS 74, Resolution MSC.1 (XLV), and are expected to enter force on 1 September 1984.

2. Recommendation 2: This recommendation is concurred with. In developing the Amendments to SOLAS 74 at IMO, the concept of expanding rules for tankers (same as 33 CFR 164.39) to apply to all vessels was thoroughly explored. The requirements for new tankers in 33 CFR 164.39 will be applied to all other new vessels subject to SOLAS 74 by the Amendments to SOLAS 74. In addition, more stringent requirements for hydraulic systems have been adopted by IMO. It was agreed at IMO, however, that these requirements should not be applied to existing vessels other than tankers. The Coast Guard intends to modify applicable regulations for steering gear in a similar fashion.

3. Recommendation 3: This recommendation is not concurred with. The problems associated with the time frame for getting a man to the steering gear compartment and taking corrective action were discussed in developing the Amendments to SOLAS 74 at IMO. The alternatives of duplication and either automatic operation or operation from the bridge were preferred to manual operation in the steering gear compartment.

4. Recommendation 4: This recommendation is concurred with. Vessels subject to the 1978 Protocol to SOLAS 74 are currently required to permanently display on the navigating bridge "simple operating instructions with a block diagram showing the change-over procedures for remote steering gear control systems and steering gear power units." (Regulation 19-2(c)(i), Chapter V). There is a current regulatory project that will incorporate this requirement into 33 CFR 164.

5. Recommendation 5: This recommendation is concurred with. Title 33 CFR 126.16(b) requires warning alarms of the siren-type or the emergency rotating flashing light-type be installed at the waterside of a "facility of particular hazard." These alarms must be detected at a distance of at least one mile during normal facility working conditions. For instance, lights may be ineffective during poor visibility or when workers are engaged in activities where they cannot see the light. Sirens may be ineffective during unusually noisy conditions and/or workers may have poor hearing. A requirement for both sirens and lights is being developed.

6. Recommendation 6: This recommendation is not concurred with. Promulgation of such regulations would be onerous and would not be cost beneficial. Additional costs would be incurred from scheduling the placement of crews and towboats elsewhere during the period of time a vessel is usually moored to a facility for transfer of cargo.

7. Recommendation 7: This recommendation is concurred with. A copy of this report has been forwarded to the Government of Peru for its information.

[redacted]

J. S. GRACEY
Admiral, U. S. Coast Guard
Commandant

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16732/M/V INCA TUPAC
YUPANQUI (Peru)
Barge PANAMA CITY

19 August 1980

From: Marine Board of Investigation
To : Commandant (G-MMI-1)

Subj: M/V INCA TUPAC YUPANQUI (Peru) Collision with the Moored Tank Barge PANAMA CITY (O.N. 262853) at General American Transport Corporation Terminal, Berth No. 4 at Mile 125.2 Above Head of Passes (AHP), Lower Mississippi River on 30 August 1979 with Loss of Life

1. FINDINGS OF FACT:

On 30 August 1979 at 0710 (all times CDT), the Peruvian Freighter, M/V INCA TUPAC YUPANQUI, while underway downbound in the lower Mississippi River collided with the moored T/B PANAMA CITY. The T/B PANAMA CITY was moored starboard side to the GATX Berth No. 4 at mile 125.2 AHP lower Mississippi River at the time of the collision. The collision resulted in an explosion and fire which totally enveloped the INCA TUPAC YUPANQUI, the PANAMA CITY, the dock and the Tug CAPT NORMAN. The fire and explosions which followed the collision ignited the ship, the barge, the tug, the dock, and caused burning along the river bank. Twelve persons, ten crewmembers of the INCA TUPAC YUPANQUI and two crewmembers of the Tug CAPT NORMAN, died as a result of the casualty. In addition, thirteen persons were injured.

2. DESCRIPTION OF VESSELS INVOLVED:

NAME:	INCA TUPAC YUPANQUI	PANAMA CITY	CAPT NORMAN
OFFICIALS NO:	N/A	262853	517274
RADIO CALL SIGN:	OAPG	N/A	WY5437
SERVICE:	Freight	Tank Barge	Tug
GROSS TONS:	9624	940	75
YEAR BUILT:	1968	1951	1968
LENGTH:	470 ft	210.1 ft	51.7 ft
BREADTH:	64.5 ft	44.1 ft	20.1 ft
DEPTH:	39.3 ft	10.1 ft	7.6 ft
PROPULSION:	Diesel	N/A	Diesel
HORSEPOWER:	9600 hp	N/A	600 hp
CARGO:	MISC	Butane Mix	N/A
HOME PORT:	Callao, Peru	Phila. Pa.	New Orleans,LA
OWNER:	Compania Peruana De Vapores Callao, Peru	Warren Petroleum Corp Box 1589 Tulsa, OK 74101	Frederick Towing Louisiana P.O. Box 173 St Rose,LA 70087
OPERATOR:	Owner	Owner	Owner
USCG Certificate of Inspection Issue Date:	N/A	24 October 1977	N/A

ISSUED BY:		USCG Marine Insp Ofc, New Orleans Louisiana	
MASTER/PERSON IN CHARGE:	[redacted] Master	Lucas Goar MMD [redacted] Tankerman Grade A & All Lower Grades & LFG	Charles H. Smith Lic #: [redacted] Issue #: 1-1 Issue Date: 9-12-73 SSN [redacted] Operator of Uninspected Towing Vessels Western Rivers. Inland Waterway of the United States
PILOT:	[redacted]	N/A	N/A

LICENSE: Lic. #[redacted]
Issue #2-2 Issue Date: 26 Mar 75
Authorized to serve as: First Class Pilot Steam and Motor Vessels of Any Gross Tons On the lower Mississippi River Between Baton Rouge, Louisiana Railroad and Highway Bridge (mile 234.0 AHP) and Mile 88.8 AHP; also Operator of Uninspected Towing Vessels upon Inland Waters of the United States and the Western Rivers; also Radar Observer.

MMD#: Z 1207542

SSN#: 434 64 0074

3. DECEASED AND INJURED:

a. Deceased crewmembers on the INCA TUPAC YUPANQUI:

(1) Name: Indalecio Aguerto Sanchez
Occupation: Quartermaster
Address: [redacted] Callao, Peru
Date of Death: 30 August 1979
Cause of Death: Drowning
NOK: [redacted]

(2) Name: Juan Santano Rodriguez
Occupation: Able Seaman
Address: [redacted] Callao, Peru
Date of Death: 7 September 1979
Cause of Death: Burns
NOK: [redacted]

(3) Name: Carlos Fspinoza Caceres
Occupation: Carpenter
Address: [redacted]
Lima, Peru
Date of Death: 6 September 1979
Cause of Death: Burns
NOK [redacted]

(4) Name: Asuncion Salazar Huertas
Occupation: Able Seaman
Address: [redacted] Zarate, Peru
Date of Death: 7 September 1979
Cause of Death: Burns
NOK: [redacted]

(5) Name: Andres Carrera Rodriguez
Occupation: Steward
Address: [redacted]
Lima, Peru
Date of Death: 30 August 1979
Cause of Death: Burns
NOK: [redacted]

(6) Name: Enrique Muchotrigo Carbonero
Occupation: Able Seaman
Address: [redacted], Condevilla, Peru
Date of Death: 30 August 1979
Cause of Death: Burns
NOK: [redacted]

(7) Name: Pablo Rodriguez Jimenez
Occupation: Boatswain
Address: [redacted]
Callao, Peru
Date of Death: 30 August 1979
Cause of Death: Burns
NOK: [redacted]

(8) Name: Carlos Geng Rios
Occupation: Third Mate
Address: [redacted]
Las Moras, San Luis
Date of Death: 30 August 1979

Cause of Death: Drowning
NOK: [redacted]

(9) Name: Fernando Ruiz Pino
Occupation: Able Seaman
Address: [redacted] Callao, Peru
Date of Death: 24 September 1979
Cause of Death: Burns
NOK: [redacted]

(10) Name: Rumaldo Tapia Caballero
Occupation: Able Seaman
Address: [redacted]
Date of Death: 14 September 1979
Cause of Death: Burns
NOK [redacted]

b. Injured crewmembers on INCA TUPAC YUPANQUI:

(1) Name: [redacted]
Occupation: Second Cook
Nature of Injury: Burns

(2) Name: [redacted]
Occupation: Master
Nature of Injury: Chipped bone in ankle

(3) Name: [redacted]
Occupation: Mess Boy
Nature of Injury: Burns

(4) Name: [redacted]
Occupation: 2nd Engineer
Nature of Injury: Burns

(5) Name: [redacted]
Occupation: Male Nurse
Nature of Injury Burns

(6) Name: [redacted]
Occupation: Radio Officer
Nature of Injury: Burns

(7) Name: [redacted]
Occupation: Quartermaster
Nature of Injury: Injured left shoulder

(8) Name: [redacted]
Occupation: 2nd Mate
Nature of Injury: Burns

(9) Name: [redacted]
Occupation: Chief Cook
Nature of Injury: Burns

(10) Name: [redacted]
Occupation: Mess Boy
Nature of Injury: Burns

c. Deceased crewmembers on CAPT NORMAN:

(1) Name: Charles Henry Smith
Occupation: Towing Vessel Operator
Address: [redacted] Milton, FL [redacted]
SSN:
Date of Death: 30 August 1979
Cause of Death: Drowning
NOK: [redacted]

(2) Name: Kenneth Lotz
Occupation: Deck Hand
Address: [redacted], Metairie, LA
SSN:
Date of Death: 3 September 1979
Cause of Death: Burns
NOK: [redacted]

d. Injured crewmenber on CAPT NORMAN:

(1) Name: [redacted]
Occupation: Deck Hand
Address: [redacted] Milton, FL [redacted]

e. Injured crewmember of PANAMA CITY:

(1) Name: [redacted]
Occupation: Tankerman
Address: [redacted] Metairie, LA.
MMD#

f. Dock personnel injured:

(1) Name: [redacted]
Occupation: Dock Master, GATX Corp.
Address: [redacted], Norco, LA. [redacted]

4. Weather and River Conditions:

The National Weather Service Station at Moisant Airport, New Orleans, Louisiana, recorded the weather as follows for 0751 CDT 30 August 1979:

Wind Direction: 070 Degrees True, Wind Speed: 5 knots
Air Temperature: 83 degrees Fahrenheit
Visibility: 7 miles
The stage of river at 0700, as observed by U. S. Army Corps of Engineers on 30 August 1979 at Carrollton Gage (river mile 102.8 AHP) was 4.9 feet.
Maximum Surface Velocity: 3.1 to 3.3 MPH
Mean Surface Velocity: 2.6 to 2.8 MPH
Average Velocity @ 60% Depth: 2.3 to 2.5 MPH

These conditions generally existed at the scene of the casualty.

5. The vessel's radar and radio equipment was totally destroyed by fire. Due to the limited impact of this equipment on the casualty, information concerning this equipment was not developed.

6. The M/V INCA TUPAC YUPANQUI was built in 1968 in Bilbao, Spain. It is of typical freighter design with four cargo holds forward of the house and one aft. It has a sharp "V" bow with little flare. Cargo booms were rigged in the up position at the time of the collision with all cargo hatches closed. The exterior of the house is constructed of steel as is the engine room casing that passes through the house. All interior decks were steel as were all interior and exterior ladders. All interior bulkheads were constructed of plywood except for the galley, which was steel. All ladder ways were open with no means of closing them off to prevent spread of fire.

7. The INCA TUPAC YUPANQUI was scheduled to depart Baton Rouge, Louisiana bound for New Orleans, Louisiana at 2200 on 29 August 1979; however, due to cargo loading, sailing was delayed until 0030, 30 August 1979. The steering system was tested at 2030, 29 August 1979 by the Third Mate, Carlos Geng Rios, the Chief Engineer, [redacted] and the Chief Electrician, [redacted]. Steering tests were again conducted at approximately 2400 by the same people. Shortly before midnight, the Master checked the steering by himself, by turning the wheel right, then left and observing rudder angle indicator.

The tests made by the Third Mate, Chief Engineer, and Chief Electrician were conducted as follows: The Third Mate was on the bridge, the other two were in the steering gear room. The Chief Engineer stood aft of the steering motor observing the mechanical rudder angle indicator on the rudder post, while the Chief Electrician spoke via sound powered telephone to the Third Mate on the bridge. The Third Mate swung the rudder from midships to full left and back to midships and repeated the same procedure to full right and return. The Chief Engineer called out the rudder angle as the rudder swung and the Chief Electrician repeated this to the Third Mate who compared it to the electric rudder angle indicator on the bridge. The system checked out satisfactorily for all tests.

Between 0000 and 0015 on 30 August 1979, [redacted], a pilot commissioned by the State of Louisiana, boarded the vessel. He was met by the Chief Mate, [redacted], who took him to meet the Master. They spoke briefly and went to the bridge. The Pilot obtained information concerning vessel speeds through the water for various maneuvering conditions. The exchange was perfunctory and without remarkable content.

At 0030, INCA TUPAC YUPANQUI was maneuvered away from her berth in Baton Rouge, Louisiana. On the bridge was the Pilot, [redacted], the Master,

[redacted], a Watch Officer to oversee response to pilot orders, a Helmsman at the steering control, and the Second Electrician, [redacted], who was standing by on the bridge wing. Once the vessel was fair with the channel, Pilot [redacted] ordered full ahead maneuvering speed which is reported to be 100 RPM, 16.5 miles per hour. Pilot [redacted] used various speeds for the down river transit slowing when necessary for bends, traffic and at one point to permit the engineers to effect minor repairs to the main engine cooling system. The transit proceeded normally with the vessel responding to course and speed changes. Between 0030 and 0700, INCA TUPAC YUPANQUI travelled some 106 miles, averaging approximately 17.4 miles per hour. Pilot [redacted] reported no difficulty with the translation of his commands into Spanish by the Watch Officer. During the transit, Chief Mate [redacted] routinely relieved the Watch Officer and assumed the oversight of the bridge watch and [redacted] came on to relieve the Helmsman. The Master remained on the bridge or in the sea cabin immediately aft of the pilothouse where he was available, if needed.

INCA TUPAC YUPANQUI is equipped with an electric-hydraulic steering system which can be operated in two modes: automatic which responds to gyro input and non-follow-up which is controlled by a Helmsman. The Helmsman controlled mode is activated by a console mounted wheel which is turned through a small arc, closing contacts to direct rudder movement to port or starboard. The Helmsman has an alternate means of actuating the same mode by depressing push buttons immediately below the wheel, one for port and one for starboard movements. During the transit the Helmsman was using the wheel to respond to pilot commands, noting the rudder response on a rudder angle indicator mounted on the forward bulkhead above the steering console.

Shortly before 0700, INCA TUPAC YUPANQUI rounded the bend at mile 130 AHP favoring the right descending bank. Pilot [redacted] ordered the vessel speed to slow so that he could leave the bridge for a few minutes. When he returned to the bridge, the vessel was still favoring the right descending bank approaching the next bend at mile 125 AHP. Pilot [redacted] ordered half ahead and commenced a port turn to cross the river just above the Norco Docks at mile 126 AHP to allow him to take that next bend favoring the left descending bank. These maneuvers are consistent with the practice of down bound vessels following the sweep of the current through the bend.

Pilot [redacted] steadied on a heading which left him favoring the left descending bank. This was accomplished with a starboard rudder command after the crossing.

INCA TUPAC YUPANQUI approached the GATX facility holding a steady course with a speed reported by the Pilot to be half-ahead making good 13.5 miles per hour. Ships personnel testified that the engine order telegraph was at full ahead making 100 rpm.

As the ship passed GATX Dock #1, the Helmsman attempted to move the rudder to starboard. Although he moved the wheel to starboard, no movement could be detected on the rudder angle indicator. The Helmsman turned the wheel to port and observed a response on the rudder angle indicator. The Helmsman indicated he continued to turn the wheel starboard and port with no movement to starboard and a resultant five degree port rudder movement by the rudder angle indicator.

During the Helmsman's attempt to "free" the rudder he notified the Chief Mate that he had experienced a steering failure. The two crewmembers attempted to cause rudder movement to the right by use of the wheel and alternate button system. Realizing that the problem persisted, the Chief Mate turned to the telephone and called the Chief Electrician from the engine room to the bridge. After summoning the Chief Electrician, he called the Second Electrician from the port bridge wing and relieved the Helmsman at the wheel sending him to hurry the Chief Electrician to the bridge. After relieving the Helmsman, he continued his futile attempts by wheel and push button to bring the rudder right.

Pilot [redacted] became aware of an animated conversation between the Chief Mate and the Helmsman. He did not understand the conversation. As Pilot [redacted] attempted to comprehend the significance of this exchange, he noted the ship's head moving to port. Realizing that there may be a problem with the rudder command, he left his position on the starboard side of the bridge near the radar set.

As he moved toward the steering console he ordered "starboard, hard starboard." When he looked at the rudder angle indicator he saw approximately 10 degrees port rudder. Pilot [redacted] pulled the wheel to starboard in a futile attempt to answer his own command. Seeing no response, he pulled the engine order telegraph to stop. Shortly thereafter, seeing the INCA TUPAC YUPANQUI was bearing down on a "gas" barge, he commenced sounding the ship's whistle and ordered the engine full astern.

The Master, entering the bridge from his sea cabin in response to the commotion, observed the Chief Mate picking up the telephone to call the engineroom. The Master proceeded to the steering console where he attempted to move the rudder to starboard and on his own initiative, but simultaneous with Watson's order of full astern, rang up full astern on the engine order telegraph. Having done this, the Master then watched his vessel bear down on the barge PANAMA CITY.

The Second Electrician, in response to the Chief Mate's summons, entered the bridge, checked the steering motor run lights on the steering console, and observed that both lights were lit. As he checked the condition, he noted that the Master, Chief Mate and Pilot were clustered about the steering stand with Watson sounding the whistle. In an attempt to visually check the steering components, the Second Electrician started to remove the cover on the steering stand. He only managed to remove one screw.

The Chief Electrician, in response to the call from the bridge, left the engine room where he had been maintaining the bell book. As he left the engine room, he heard the stop bell and during his race to the pilothouse, felt the vibration as the screw turned full astern. He arrived on the bridge about 20 seconds before impact and had time only to push the starboard button. He observed no response.

All persons watched as the INCA TUPAC YUPANQUI came down on the moored PANAMA CITY. Collision occurred at approximately 0710, some two minutes after the steering failure was first discovered. As the ship penetrated the barge, a large cloud of butane engulfed the ship. The subsequent explosion knocked the bridge personnel to the deck.

The Second Engineer first realized there was a problem when the engine orders "STOP" then immediately "FULL ASTERN" were rung down on the engine order telegraph. The vessel was proceeding at manuevering speed at that time, and due to the rapidity of the orders, he took the situation to be an emergency. He took no more than 8 or 10 seconds to reverse the engine and bring it to full speed astern. One and a half to two minutes later, a slight movement of the vessel was felt, followed a few seconds later by smoke entering the engine room ventilation ducts. The Second Engineer remained at his position until he received a "STOP" engine order. This order came approximately three minutes after the "FULL ASTERN" order.

After the engine room filled with smoke, the Chief Engineer was temporarily blinded by smoke in his eyes and departed the space. The Second Engineer, after receiving the last "STOP" order, heard the #2 and #3 generator low lube oil alarms sound. He then proceeded to shut down both generators. He left the engine room and obtained a breathing apparatus from the Chief Mate. The Second Engineer then returned to the engine room and started #1 ship's service generator and attempted to start the fire pump. However, due to smoke, heat, and his decreasing oxygen supply, he was forced to leave the engine room.

During the above course of events, shortly after smoke entered the engine room, the quarters air conditioning system was secured, however, engine room ventilation was not secured until the Second Engineer secured #2 and #3 generators.

After the Chief Engineer left the engine room he assisted several shipmates and then went to the second deck and closed the emergency fuel oil shut-off valves.

The Second Engineer was not able to explain why the low lube oil alarms sounded for #2 and #3 ship's service generators; however, he was quite positive that the alarm did sound. The #2 and #3 generators were the only generators operating at the time of the casualty, the remaining generator (#1) was started after the casualty. The above described events occurred in a rapid sequence. Figure #1 illustrates the board's determination of when and in what order these events occurred.

8. GATX Berth #4

GATX Berth #4 is a standard "T" shaped dock extending at a near right angle 550 feet from the center of the levee into the Mississippi River. The dock has two levels and contains numerous pipelines for various petroleum products. The dock was built in 1975-76 by Lane & Company in accordance with the U. S. Army Corps of Engineers permit number LMNOD-SP (Mississippi River) 801. In 1978, an additional pipeline was added to Dock #4. This pipeline ran from Good Hope Refinery through the GATX refinery to Dock #4. There are no stop valves located in the GATX facility. All valves are located either in the Good Hope Facility or on Dock #4. The new pipeline was built by Good Hope Refinery on an agreement with GATX that would allow Good Hope to utilize GATX's dock facilities. The new line was designed to carry butane and propane. An emergency rotating flashing light was installed in accordance with 33 Code of Federal Regulations, Part 126.16(b). This light was not activated prior to, or during this casualty.

9. T/B PANAMA CITY

The tank barge PANAMA CITY is certificated to carry liquified flammable gases in six cargo tanks. The barge is of open hopper construction with a transverse bulkhead dividing the hopper into two nearly equal halves with three tanks located in each half. The tanks are cylindrical, set three abreast and are numbered as follows:

Forward Starboard Tank is #1, Forward Center #2, Port Forward #3, After Starboard #4, After Center #5, and After Port #6.

In addition, there are forward and after rake compartments.

Each tank is equipped with 7 four-inch relief valves. There are two pipelines running transversely across the barge. They are located directly above the transverse hopper bulkhead with valves at either end of each line. The valves are at the port and starboard loading stations. One pipeline is a liquid line, the other a vapor line, six pipelines run fore and aft from each transverse line, one to each cargo tank. The two pipelines penetrate the after end of each of the forward three tanks and the forward end of each of the after three tanks. The vapor pipelines extend only a short distance into each tank while the liquid lines extend to the bottom of each tank and terminate near the after end of each tank. There are manual valves on each pipeline located external to the tank. There are spring loaded hydraulic valves on each pipeline located inside the tanks. The hydraulic valves are opened by a manual pump and are designed to close if hydraulic pressure is released.

The Tank Barge, PANAMA CITY arrived at GATX Berth #4 at 1330 on 29 August 1979 to load a cargo of butane mix. [redacted], employed by Fryoux Tankerman Service, who was employed by Warren Petroleum, was acting Tankerman. [redacted] had arrived at 1400 and cargo loading commenced at that time.

Shortly before 0700, [redacted] relieved as Dockman at Berth #4. There was no transfer going on at the time, as transfer had been shutdown since 0540 by the Goodhope Refinery. When the cargo transfer was stopped, the PANAMA CITY was loaded in the following manner:

#1 Tank - 60% full
#2 Tank - 90% full
#3 Tank - 90% full
#4 Tank - 65 to 70% full
#5 Tank - 65 to 70% full
#6 Tank - 75% full

This loading would indicate approximately 6500 to 7000 barrels butane mix on board prior to the collision.

At approximately 0710, [redacted] left the barge to talk to the dockman and find out why there was a delay in loading. He heard a ship's whistle and saw a ship coming at the barge. He hollered at [redacted] to run. Both ran approximately 600 to 700 feet and then were knocked down twice in succession

by two explosions. Both made their way to a highway and flagged a passing car which took them to a nearby service station. [redacted] was taken from there by ambulance to a hospital where he received medical attention for burns, strains and bruises.

[redacted] called his wife who picked him up and took him to the Emergency Room at a local hospital where he was treated and released.

10. The M/V CAPT NORMAN was a tug of typical small pusher design with a messing area on the main deck and the berthing area on the 01 deck below the bridge. The CAPT NORMAN was tied up starboard side to the dock at the downstream dolphin of berth #4 at GATX on 30 August 1979. The Captain, Charles Henry Smith, and [redacted] a Deckhand were in the messing area. The other Deckhand, Kenneth Lotz, was asleep in the berthing area. Shortly after 0700, [redacted] and Smith heard whistle signals, both moved to the port side and saw a ship heading directly at the barge PANAMA CITY. Both men ran through the dining area to the starboard side through the door and then aft. Both jumped from the fantail into the river just prior to the explosion. [redacted] lost sight of Smith shortly after entering the water. [redacted] swam downstream to a mooring bouy, swimming under water at times to avoid the flames. While holding to the mooring bouy, he observed Lotz in the water holding on to the side of the CAPT NORMAN which was on fire and drifting down the river. [redacted] told Lotz to swim over to the bouy, which he did. The Tug LADY LEONTINE came to their aid. Lotz was transferred to shore immediately because of severity of his burns and [redacted] was taken to the Foot Ferry Landing located just above Norco. [redacted] was taken by helicopter to a hospital. [redacted] suffered minor burns to the head, face, arms and back. In addition to the burns, he also suffered a broken bone in his right hand. He was released from the hospital on 4 September 1979. Charles Smith's body was recovered on 1 September 1979 at mile 119 AHP of the lower Mississippi River. The M/V CAPT NORMAN was declared a constructive total loss.

11. ANN GLADDERS

[redacted] was standing on deck of his tug ANN GLADDERS which was moored starboard side to the dock at the GATX Berth #3, which is located approximately 900 feet upstream from Berth #4. He noticed a freight vessel up stream of him which he perceived to be out of place in the channel. He noticed the vessel's rudder gradually move to the left as the vessel passed his position. The vessel was swinging slowly at first and then more rapidly to port. The rudder remained left. He watched as the vessel hit and passed completely through or over the barge. A white cloud of gas was released from the barge as the bow of the ship passed through the barge. As the bow contacted the dock, a large explosion occurred and the ship was surrounded by a hugh ball of fire.

[redacted] saw a tug tied off to the downstream end of the barge prior to the collision. He observed two people jump from the tug and one from the ship prior to the ship's hitting the barge.

12. SYDALISE FREDEMAN

Mr. [redacted] Operator of the tug SYDALISE FREDEMAN which was moored to GATX Berth #2, was in the wheelhouse of the tug at 0710 on 30 August

1979. He saw a ship coming downstream and out of shape in the river. He thought the vessel was going to run aground between GATX Berths #3 and #4. He grabbed his camera, a Vivitar 110 Instamatic, which he normally kept in the wheelhouse and proceeded down one deck and aft. When he reached the bottom step he saw the ship ram a barge moored at Berth #4, and commenced taking pictures at that point. The first showing a ship buried in a large white cloud and the second picture showing a large fire ball. He continued the sequence for a total of 64 pictures which gave a dramatic photographic record of the events after the collision. His cook confirmed the time of the collision as 0710 as she had just placed bread in the oven.

13. GATX Perth #2

Mr. [redacted], a Maintenanceman with GATX, was on Berth #2 with the Dockman when he saw a ship coming downstream. The ship caught his attention because it seemed out of control. The ship sounded the danger signal as it passed Berth #3 and then turned left into the barge at Berth #4. When he saw that collision was imminent, he told the Dockman to call Berth #4 and tell the people there to get out. The call was made but not completed. When the bow of the ship hit the barge, a large cloud of white gas was released. [redacted] observed the ship pass completely through the barge and at the moment he saw the ship's bow make contact with the dock, a large explosion occurred.

14. INCA TUPAC YUPANQUI - Post Collision

Prior to the collision, one crew member jumped from the INCA TUPAC YUPANQUI into the river. After the collision, the Pilot, [redacted] jumped from the stern into the river and at some point in the confusion after the explosion, a third man entered the river.

The first man to jump is believed to have been the Third Mate, Carlos Geng Rios. His body was recovered at mile 123 AHP of the lower Mississippi River at 0900 on 2 September 1979. The third man to enter the river is believed to have been a Quartermaster, Indalecio Agurto Sanchez. His body was recovered from the lower Mississippi River at mile 123 AHP at 0230 on 1 September 1979.

All persons on the bridge were thrown to the after bulkhead of the bridge by the force of the explosion. The Pilot left the bridge as soon as the flames died down, ran aft and jumped into the river from the starboard quarter. The vessel had sternway on when he jumped and the propeller was turning in the astern direction. He swam away from the vessel and against the current until he was rescued by the Tug NATIONAL FLAG. He was then tranferrred to a crew boat which took him to the Foot Ferry Landing above the Narco Docks. He suffered no injuries.

The vessel was left at full astern and backed away from the dock, swinging hard left and backing upstream. It eventually came to rest with its port stern against the left descending bank of the river and its port side resting against the upstream dolphin of GATX Berth #4. The rudder was observed and photographed at hard left after the vessel came to rest against the bank.

The Master left the bridge after the initial flare-up of fire died down, found the Pilot's walkie talkie laying on the deck and broadcast a request for help. The Chief Mate left the bridge with the Captain, and returned to the

bridge a short time later to stop the main engines. He then attempted to organize fire fighting teams. First attempts were made to put out the deck fires utilizing portable fire extinguishers which were soon expended.

Just prior to and shortly after the collision, several tugs and small boats got underway and proceeded toward the stricken vessels. Mr. [redacted] got his tug, ANN ~~GLADDERS, underway and first aided the NATIONAL FLAG in its~~ rescue of the Pilot. After this, he moved his tug in against the stern of the INCA TUPAC YUPANQUI and assisted the Tug ASHLEY, operated by [redacted], in removing five critically injured crew members from the INCA TUPAC YUPANQUI. The injured were them transported by helicopter to local hospitals. A Louisiana State Trooper, [redacted], boarded the INCA TUPAC YUPANQUI.

All crewmembers on the INCA TUPAC YUPANQUI either then fled or had already fled to the stern of the vessel. Fires were burning on the main deck and in various locations in the deck house.

After the vessel reached her final position, ropes were lowered over the stern and several crew members were able to lower themselves over the side and wade ashore. The more seriously injured were taken onboard the Tug ASHLEY and transferred to helicopters. Most of those who were critically injured were in the deck department.

The deck department had been called on deck at 0700 to commence their normal day's work and were on deck when the collison and explosion occurred. All except one of these men died as a result of the casualty. The survivor, [redacted], an Able Seaman, heard the danger signal and ran from his main deck location near the starboard side of #4 hold, into the crews quarters areas of the main deck. His only explanation for his action was that he knew the whistle meant danger. Juan Santana Rodriguez was with [redacted] at #4 hold. The Boatswain, Pablo Rodriguez Jimenez, Able Seaman, Fernando Peno, Able Seaman, Enrique Muchotrigo Carbonero, Able Seaman, Asuncion Salazar Hertas, and Able Seaman, Rumaldo Tapia Caballero were at #2 hold. In addition to the above, the Ship's Carpenter, Carlos Espinoza Caceres and Andres Carrera Rodriguez, Steward, received burns during the explosions or fires that followed the collision. Their location at the time of the collision and explosion was not determined. All eight men were transported to local hospitals where they subsequently died.

15. Rescue Operations

Several commercial tugs, along with crew boats from the Crescent Ship Service Launch Company, and numerous other vessels were assisting in the search for missing personnel or in firefighting efforts throughout the day. First reports of the collision were received by the Coast Guard Vessel Traffic System, New Orleans, at 0713 on 30 August 1979 from the M/V DOMAR COMMANDER. The Coast Guard Group Commander New Orleans received notification at 0714 from the M/V JOHNNY.

The first Coast Guard unit on scene was the helicopter CG 1496, which arrived at 0747. This unit evacuated two injured personnel from INCA TUPAC YUPANQUI. One was taken to an ambulance that was standing by onshore, the other to the West Jefferson Hospital.

Air Log 49, a privately owned helicopter, was on scene at 0721, and delivered at least three INCA TUPAC YUPANQUI crew members to the West Jefferson Hospital by 0732. Two additional Coast Guard helicopters arrived on scene between 0800 and 0830 and spent a total 5.3 hours searching the river for missing personnel. The first shore-side fire fighting unit on scene was the GATX refinery fire team lead by the Safety Director, [redacted].

The GATX team responded immediately after hearing the explosion. Mr. [redacted] kept his team off the dock until he first examined it himself, insuring that all cargo valves were secured and that the burning remains of the Tank Barge PANAMA CITY had drifted a safe distance from the dock. He observed that the barge had been cut in half with three tanks remaining in the after section, one tank floating free and 2 tanks in the forward section. All three sections were on fire. When he felt it safe, [redacted] brought his fire crew onto the dock. It took approximately 30 to 45 minutes to put out the dock fires utilizing water and Purple K fire extinguishers.

After the dock fires were out, the GATX team, which has been joined by 5 or 6 TPC employees (a contracting firm employed by Good Hope Refinery), boarded the vessel and commenced fighting fires on the fore deck and in the house.

The Norco Volunteer Fire Department joined the GATX team at approximately 0800, followed by units from East St. Charles Parish Volunteer Fire Department. The fire truck from St. John the Baptist Volunteer Fire Department was placed on the LULING-DESTREHAN Ferry and brought along the starboard side of the vessel. First Coast Guard personnel from Captain of the Port, New Orleans, arrived at 0830 by truck. The first Coast Guard Vessel, CG 32332, arrived at 0935 followed by the Coast Guard Cutters WEDGE and PAMLICO at 1200 and 1230. The Port of New Orleans Commission's Fire Boat DELUGE arrived at 1130. Personnel from the Coast Guard Gulf Strike Team arrived at 1200. Also on scene was the CG 41457 which was joined later by the CG 55104.

Fire fighting efforts by all the above mentioned units continued until approximately 1100 when the GATX team departed, followed at 1300 by the LULING-DESTREHAN Ferry. The remaining civilian units with the exception of the DELUGE, departed at approximately 1530 after several severe flare ups. The volunteer units did continue to provide pumpers for water pressure but did not provide personnel assistance until two hours later, when the Good Hope Refinery fire team boarded and began to assist. The fire was extinguished at 1900 with intermittent flareups until 2400. Coast Guard personnel remained on scene until 1300 on 31 August 1979. The M/V INCA TUPAC YUPANQUI was removed to New Orleans, Louisiana on 1 September 1979. The vessel suffered extensive damage in the house area. All interior wooden bulkheads were burned out. The bridge and its equipment were extensively damaged.

All interior decks in the house were heavily distorted as were several steel bulkheads. All wiring runs through the house were totally destroyed. The exterior paint on all above water areas was scorched by fire. The vessel is currently being repaired and will return to service. The engine room, steering gear room and cargo holds were undamaged.

The tank barge, PANAMA CITY, was cut in two between the forward and after cargo tanks at the hopper bulkhead. The after half of the barge drifted free and was beached on the right descending bank at mile 123 AHP and all fires

were extinguished. Number 4 and 5 tanks were fractured with all cargo burned out. Number 6 tank was intact and was partially full of butane mix. All external piping was burned away. Two cargo tanks drifted free of the forward section of the barge and were eventually grounded on the right descending bank at mile 124 AHP where they burned out. Both tanks were fractured. Number three tank was located in the sunken forward half of the barge in 60 feet of water on left descending side of the river approximately 500 feet downstream from the down river dolphin of GATX Berth #4. The barge is a total loss.

GATX Berth #4 suffered extensive structural damage above the lower platform. All cargo piping was distorted and broken and all electrical equipment and fixtures were destroyed. The dock is being repaired and returned to service.

16. The INCA TUPAC YUPANQUI Steering System

In the steering gear room, a hydraulic rotary actuator is mounted on top of the rudder post. On the port and starboard side of the rotary actuator are located similar hydraulic pumps each driven by a 40 horsepower electric motor. Each pump has its own self-contained reservior. On top of each hydraulic pump is an electric solenoid-operated pilot valve. Mounted below the solenoid-operated pilot valve is a split spool, four (4) way directional control valve which directs the fluid to and from the rotary actuator. Each pump unit has a relief value. Each solenoid pilot valve has a plunger which can manually operate the pilot valve. Amidships forward of the actuator is located a manually operated hand pump, with its own reservior for emergency steering. On the aft bulkhead is a hydraulic oil expansion tank with a line that runs to each hydraulic pump reservior. The hydraulic system is fitted with appropriate piping and isolation valves. The hydraulic system was manufactured by A/S Frydenbo Mek Verksted of Bergen, Norway. The rotary actuator is divided into three compartments by 3 vanes. There are 6 hydraulic lines to the actuator, two from each of the two electrically driven pump and two from the hand powered emergency steering pump. The solenoid valves on top of the two electrically driven hydraulic pumps control the flow of the hydraulic fluid into the pipes connected to the actuator. A right rudder command would cause the fluid to flow one direction, a port command would reverse the flow. The rotary actuator is mounted on top of and connected directly to the rudder post. The rudder turns exactly the same number of degrees as the actuator turns. At full rudder, the rotary vanes attached to the rudder post come up against the actuator fixed casing vanes, thereby providing mechanical stops. Over pressurization at full rotation is prevented by a series of relief valves located in the rotary casing vanes.

A mechanical linkage attached to the top of the rudder post turns with the rudder post and provides input to a single Robertson Rudder angle indicator transmitter. Rudder angle indicators are located on the bridge and in the steering gear room. Prior to the casualty, the steering gear room Rudder Angle Indicator had been disconnected and removed from its mounting.

A similar mechanical linkage to the rudder post drives a transmitter which provides feedback input to the auto pilot steering system (Gyro Pilot). Separate motor controllers for each of the hydraulic pump drive motors are located in the engine room. Each controller receives electrical power through separate circuit breakers located in the main switch board. A start-stop

switch is located in each controller and a remote start-stop switch for each is located in the steering gear room. Run-stop check indicator lights are located on each motor controller, each remote switch and also on the navigation bridge. An audio alarm sounds on the bridge and in the engine room in the event of an overload or loss of power to the electric steering motor.

The rudder angle indicator system has its own power supply circuit breaker and is independent from the steering system.

The steering controls in the pilothouse are located in a console on the forward bulkhead. In the center of the console is a wheel and on either side of the wheel are push buttons. On the console top is a combination gyro repeator and auto pilot for steering control. To the left is a mode selector switch with four positions: Off, Auto-1, Non-Follow-Up, and Auto-2. Also on top of the console are various push buttons, lights, and alarms for the steering gear. The console was built by Gobasco in Spain.

Steering control from the bridge may be provided for either of two basic systems. First is an autopilot steering control system manufactured by C. Plath of Germany. This system provides steering control from the gyro compass and follows preset courses. The mode selector switch can be set for Auto-1 or Auto-2 which utilizes the port and starboard steering units, respectively. The autopilot steering is designed for single steering unit operation only. The auto steering system was not energized at or prior to this casualty and detailed information on the system was not developed.

The second steering control system on the bridge, the non-follow-up system, consists of two sets of mechanically operated normally open contacts of which one set is activated by turning the ship's steering wheel and the second set which is activated by push buttons. Each set of contacts has one contact for a right rudder order and one for a left rudder order. A right rudder contact may be activated by either turning the wheel to the right or by pushing the right push button. Left rudder contacts operate similarly by turning the wheel left or pushing the left button. Activation of any of the contacts closes an electrical circuit on a relay panel located inside the bridge steering console. The wheel and button contacts receive power in any mode. The relay contacts receive power only when the mode selector switch is in the non-follow-up position.

On the relay panel are four (4) relays. The two upper relays are activated in parallel by an order for right rudder, one relay sending to the port steering unit solenoid and the other to the starboard. Likewise, the lower two relays are activated in parallel by a left rudder order and one sends to the port steering unit solenoid and the other to the starboard unit.

The relay panel operates on 24 to 29 volts direct current obtained through a transformer and rectifier located on the relay board. The transformer receives 240 volt power through circuit "C-55." C-55 also provides power to the radar and gyro compass, and is protected by a circuit breaker located in the engine room. The transformer is protected by a 2 amp fuse on its primary side.

The non-follow-up steering control was designed to operate with both the port and starboard steering units in operation, but is capable of operating with either unit secured.

Simply stated, the non-follow-up steering control operates as follows: an order for right or left rudder is initiated by the Helmsman turning the wheel in the direction ordered or depressing the appropriate push button. A contact closed by this action would activate the same two direction relays on the relay panel, each sending a signal to open its respective port or starboard hydraulic steering pump solenoid valve in a manner to permit the rotary actuator to turn the rudder stock in the desired direction.

When the rudder had moved the desired amount, the contact is released by the Helmsman and the relays and solenoids would return to their neutral position causing the rudder to stop in its position until another order for further movement in the same direction or opposite direction was initiated.

In the fire following the collision the vessels steering system received significant damage and the vessel's plans and documents relative to the steering system were lost.

Information on the steering system was obtained by the following procedures:

A panel of steering gear experts examined the remains of the system, conducted tests, and made diagrams of the system, as found. When possible, plans were obtained from the manufacturer on the various components. Also, members of the panel obtained information from the M/V INCA CAPAC YUPANQUI, a sister vessel to the M/V INCA TUPAC YUPANQUI, by operational tests of her steering system, reviewing her plans, and discussions with her crew.

During inspections and tests on the INCA TUPAC YUPANQUI, the following observations were made by members of the panel of experts:

(1) A circuit breaker identified as C-55 was tripped. This circuit breaker is located in the main switchboard and provides power to the gyro, radar, and the transformer on the relay panel in the bridge steering console.

(2) The 0.8 amp fuse in the bridge control relay panel was found to be blown. An analysis on this fuse indicated that it had blown due to over current. This fuse is located between the rectifier on the panel and the panel relay circuitry.

(3) On the main electrical switch board, the circuit breaker for the port (#1) steering pump motor was in the tripped position, and the circuit breaker for the starboard steering pump motor was in the open (off) position.

(4) Two fuses were blown in the port steering motor controller. One fuse was a 4 amp fuse located in 440 volt A.C. power line to the steering motor.

The other was a 1.5 amp fuse in a control circuit between the transformer and rectifier which provides power for operation of the solenoid value on the port steering pump.

(5) A transformer, located immediately below the port motor controllor and electrically connected thereto, had exploded. This transformer provides power to the alarm circuits on the bridge and in the engine room for the port steering unit.

(6) Flectrical wiring between the engine room and the steering gear room for the port steering unit was destroyed by fire. Similar wiring for the starboard unit was intact.

(7) All wiring between the engine room and the bridge was totally destroyed.

(8) The bridge steering console's exterior received extensive fire damage. The hookup and connection wire in the console had severe fire damage. However, the relay panel and contacts located inside were intact.

(9) On the relay panel, the contacts for the upper left hand relay were found to be out of adjustment in that they did not make electrical contact when the coil was energized. The relay coils were tested and all four (4) were electrically operable.

(10) One leg of the 24 volt rectifier on the relay panel was open. This made the output of the rectifier approximately one half (1/2) of its designed value. Tests conducted indicated that this was insufficient voltage to cause the relay coils to pull their contacts into a closed position.

(11) The hydraulic portion of the steering gear system was found to be in good condition.

(12) Members of the panel of experts concluded that the blowing of the 0.8 amp fuse in the relay panel would have resulted in complete loss of steering control from the bridge in the non-follow-up mode.

(13) On 7 September 1979, there was no fluid in the emergency steering column sight glass. The fluid level was noted to be at the hub of the pump. This is an axial fixed displacement rotary pump. Upon addition of oil to the hand pump reservior, purging air from the system, then closing the hand valves between the pump and the rotary actuator and closing the hand valves to the electric driven pumps; the hand pump satisfactorily turned the rudder one (1) degree per six (6) revolutions of the wheel. The hand pump responded the same with the valves to the electric pumps open.

(14) No electrical discontinuities were noted in the electrical components located in the steering gear room.

(15) Using shore power from a shipyard, the steering pumps and motors were tested and found to operate satisfactorily. The rudder turned to hard over

in 29 seconds using the starboard pump unit, 25 seconds using the port unit, and in 15 seconds using 2 pump units. With 24 volts from a battery bank placed on the pump solenoid valves, the solenoid functioned properly. The hydraulic steering system also functioned satisfactorily by use of the manual plunger on the solenoid valves.

(16) Numerous electric cables came through the pilothouse deck into the steering control console. These include wires for the horn, bridge lighting systems and other bridge functions as well as steering control. All were fire damaged.

(17) In the right hand center section of the bridge steering console, mounted vertically, was a relay board. The relay board was a steel plate with the following mounted on it: 4 relays, a 440 to 29 volt transformer, a rectifier and two fuses. The panel was identified "C. PLATH."

(18) The transformer in the relay panel and its 2 amp fuse were in good condition.

(19) Loss of steering was the most likely cause of the casualty.

Tests and inspections conducted on the M/V INCA CAPAC YUPANQUI revealed the following:

1. The steering systems on the M/V INCA CAPAC YUPANQUI and the M/V INCA TUPAC YUPANQUI were generally similar.

2. When simultaneous orders for both right and left rudder movement from the bridge console were initiated, no response was obtained.

3. After a right or left rudder order was made by closing either the wheel or push button contacts, an order for opposite direction movement would have no effect while the original order contact remained closed.

4. With power to the radar and gyroscope circuit breaker secured, the relays on the relay panel would not operate.

5. With the fuse located in the secondary circuit between the rectifier and the relays on the relay board removed, the relays on the board would not operate.

6. On the relay board a starboard command activated the two top relays and a port command activated the bottom two.

A drawing on the non-follow-up control system provided by C. PLATH showed the push buttons to be connected directly to one of the steering pump motor's solenoid valves. In this drawing, the push buttons do not connect to the relay panel.

The Frydenbo drawing shows a 110 volt circuit having a separate fuse and switch providing power for the alarms. Actual installation had this 110 volt

alarm circuit leading from a 440 volt to 110 volt transformer on the load side of the 440 volt switch.

A letter from C. PLATH states that the relay board was installed on 29 September 1971.

17. Activities of Board Members

On 5 September 1979, the board made an orientation overflight of the scene of the collision and fire. The board observed landmarks, configuration of the river, dock location, and damage. At the time of the overflight, the tug and vessel had been removed. The after-half of the barge PANAMA CITY was moored at a fleeting area on the right descending bank at mile 123.8 AHP. Three tanks were in place on the barge. Two additional tanks were tied off to the right descending bank immediately upstream from the barge. The remainder of the barge, one tank and the hull, were missing.

18. At 1630 on the same date, the board made a walk throughout the fire damaged INCA TUPAC YUPANQUI, which was moored at Beinville Street Wharf in New Orleans, Louisiana. This was done in company with attorneys of designated parties of interest and attorneys representing other interested parties. On 8 November 1979, the Recorder made a familiarization voyage on the AMOCO VOYAGER from mile 138 AHP to New Orleans, Louisiana.

19. Captain Jack A. Howell, USCG, was assigned as Chairman of this Marine Board of Investigation and acted in that capacity until his retirement from active duty on 1 February 1980. Although he is not signatory to this report, he participated fully in the drafting of and the deliberation leading to this final report.

CONCLUSIONS:

1. The cause of the casualty was the loss of steering control from the bridge of the INCA TUPAC YUPANQUI, which prevented the rudder from turning to the right from a position of 5 degrees to 10 degrees left rudder as the vessel approached and entered a right turn of the Mississippi River. The exact cause of the loss of steering cannot be determined due to the extensive fire damage to the bridge steering controls, wiring and systems, the unavailability of as built drawings and the unfamiliarity of the vessel's crew with technical details of the steering system.

2. Several possible causes of loss of steering control exist and are as follows:

a. The 0.8 amp fuse in the relay panel located on the bridge opened due to over-current at a time when the rudder was at 5° to 10° left. When the fuse opened all power was lost to the relay board, thus denying steering control for both the wheel and push buttons in non-follow-up steering mode.

b. The failure of the rectifier in the relay panel located on the bridge which would have caused a reduction of current to the relay coils. This lower

current was insufficient to cause the relay coils to operate, thereby causing a complete loss of bridge steering control in the non-follow-up modes.

c. A short circuit in the port steering pump solenoid circuits which resulted in a partial or total loss of steering control from the bridge.

d. The inoperative contact in the bridge relay panel most likely controlled the starboard movement of the starboard steering motor. This would mean that the starboard steering motor could cause only port rudder movement and could not direct the rudder to starboard. The failure of the 1.5 amp fuse in the engine room motor controller for the port steering motor caused a complete loss of power in the control circuits for the port steering motor. This, coupled with the mechanical failure of the relay in the bridge, could have created a situation whereby the port steering motor soleniod was totally inoperative and could only respond to a left rudder command.

Each of the above scenarios deals with electrical faults and failures found after the collision and fire. There is insufficient evidence to prove or disprove that any of these faults found later could have been caused by short circuiting that resulted from the collision and fire. However, the board concludes that one or more of these faults or failures did occur at the approximate time that bridge steering control was lost.

3. There is no evidence to indicate that the casualty was caused or contributed to by a failure within the hydraulic components of the steering system.

4. This casualty may have been avoided if the crew of the INCA TUPAC YUPANQUI had taken immediate steps to regain steering control by utilization of either of the two means available in the steering gear room. That is by use of the manual plunger to operate the soleniod pilot valves or by use of the manually operated hand pump. No crewmember was specifically directed to go to the steering room to assume steering control in this instance.

5. The connection of the circuits from both the wheel and button methods of steering to the relay panel created a common link betwen these two methods of steering control. Had the button contacts been wired directly to the soleniod valves as shown in the C PLATH drawing, the loss of bridge control may not have occurred.

6. Ten crewmembers of the M/V INCA TUPAC YUPANUI and two crewmembers of the Tug CAPT NORMAN died as a direct result of this casualty. Ten crewmembers of the M/V INCA TUPAC YUPANQUI, one crewmember of the Tug CAPT NORMAN, one crewmember of the T/B PANAMA CITY, and one employee of the GATX Corporation, suffered reportable injuries as a direct result of this casualty.

7. The sounding of the danger signal on the ship's whistle by the Pilot, [redacted], was instrumental in saving at least four lives, i.e., Able

Seaman [redacted] of the M/V INCA TUPAC YUPANQUI, Deckhand, [redacted] of the Tug CAPT NORMAN, [redacted], Tankerman on the T/B PANAMA CITY, and [redacted], Dockmaster, at Berth #4

8. The sounding of a facility alarm could possibly have reduced the loss of life on the Tug CAPT NORMAN. The CAPT NORMAN's Operator and Deckhand ~~responded casually to the~~ M/V INCA TUPAC YUPANQUI's danger signal. Had there been an audible facility alarm, they could have been warned of imminent peril to persons on or near the dock and may have responded in a more immediate and concerned manner.

9. The Pilot, [redacted], severaly limited his ability to correct, mitigate or respond to an emergency situation by failing to establish an anchor watch and by failing to obtain detailed information concerning the vessel's manuevering characteristics.

10. The Tank Barge PANAMA CITY, the Tug CAPT NORMAN, and the GATX Berth #4, did not contribute to the cause of the casualty. There is no evidence to indicate that the safety devices on the T/B PANAMA CITY failed to perform their intended functions.

11. The response of the GATX fire departments and local volunteer fire departments was timely. The efforts of the various firefighting groups were at times uncoordinated, due primarily to lack of formal contingency planning for emergency situations.

12. Coast Guard response to the incident was timely and adequately coordinated internally. Coast Guard efforts, along with those of the Fire Boat, DFLUGE, were instrumental in securing the fires. A lack of coordination between the Coast Guard and the volunteer units existed; however, this did not add to the seriousness of the incident or increase deaths, injuries, or material damage. The fire was out of control when the first firefighting units arrived; however, even though it remained out of control for a considerable length of time, it was effectively isolated to the superstructure.

13. The massive release of butane mix from the T/B PANAMA CITY was caused by the bow of the INCA TUPAC YUPANQUI rupturing #3 cargo tank and all cargo piping systems. The subsequent gas cloud enveloped the INCA TUPAC YUPANQUI, the T/B PANAMA CITY, the Tug CAPT NORMAN , and GATX Berth #4. The source of ignition could not be determined; however, the most likely source is the heat and/or sparks generated by the bow of the M/V INCA TUPAC YUPANQUI passing through the T/B PANAMA CITY and contacting GATX Berth #4.

14. There exists a large discrepency between testimony of the pilot and that of the ship's crew concerning the speed of the vessel. The pilot testified that the vessel was at half ahead, the crew all stated full ahead. Computed times and distances provided by the pilot and the crew indicate the vessel's speed was consistent with half ahead.

15. The firefighting effort by the ship's crew was severely hampered by the necessary abandonment of the engine room due to excessive smoke. The induction of smoke into the engine room was caused by the failure of the Chief Engineer and the Second Engineer to secure the engine room ventilation.

Subsequently, due to the heavy smoke, the Second Engineer was unable to place the fire pump in operation, thereby limiting available ships firefighting equipment to portable fire extinguishers.

16. The large amount of wood utilized in the interior of the superstructure ~~of the INCA TUPAC YUPANQUI,~~ combined with the lack of fire doors, was a major factor in the rapid spread of the fire. This also increased the severity of the fire and the increased material damage to the vessel.

17. The cause of the low lube oil pressure alarms sounding on #2 and #3 generators could not be determined.

18. The Chief Engineer's securing the emergency fuel oil valves in the passage way had the potential of being counter productive, had the Second Engineer been able to start the fire pump.

19. The actions of the bridge crew of the M/V INCA TUPAC YUPANQUI, after being made aware of the emergency situation, were indicative of a lack of training in dealing with emergency steering situations.

20. There is no evidence of actionable misconduct, inattention to duty, negligence or willful violation of law or regulation on the part of licensed or certificated persons; nor evidence of failure of inspected material or equipment; nor evidence that any personnel of the Coast Guard or any other government agency or any other person contributed to the cause of this casualty.

RECOMMENDATIONS

1. The Coast Guard should take the initiative on the international front through the International Maritime Consultive Organization (IMCO) to amend Safety of Life at Sea (SOLAS) regulations to require complete redundancy in all steering systems.

2. The Commandant consider expanding the application of the steering gear regulations under 33 CFR part 164, which currently apply to only those tank vessels over 10,000 gross tons, to apply to all vessels over 1600 gross tons, regardless of the vessel's design, service, or employment.

3. The Commandant consider amending the Navigation Safety Regulations under 33 CFR part 164, to require continuous supervision of the steering gear room when navigating confined navigable waters of the United States.

4. Of a more immediate nature, the Commandant should consider requiring that all vessels entering U. S. waters be required to have posted on the bridge in a conspicuous location near the steering station an instruction which clearly and concisely delineates all steps necessary to switch from the primary to the secondary means of steering and to any other alternative means of steering which may be available on the bridge.

5. The Commandant should consider requiring an audible alarm at all waterfront facilities handling petroleum or other hazardous commodities in bulk. This alarm should be distinctive to such facilities and be of sufficient loudness to alert personnel in potential danger zones to impending danger.

6. The Commandant should consider regulations which would permit tug boats to be moored alongside petroleum and hazardous bulk transfer facilities only when actually engaged in picking up or dropping off a vessel. Lengthy moorings by such vessels at such waterfront facilities pose an avoidable risk to towing vessel personnel.

7. It is further recommended that a copy of this report be forwarded to the Peruvian Government.

8. It is further recommended that this casualty investigation be closed.

[redacted]

Peter C. F. LAURIDSEN, JR.
Commander, U. S. Coast Guard
Chairman

[redacted]

John W. KLOTZ
Commander, U. S. Coast Guard
Member

[redacted]

Stanley J. SPURGEON
Lieutenant Commander, U. S. Coast Guard
Member and Recorder