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Contrawl Project

Part II

Fishery Products International

Development Branch
Department of Fisheries and Oceans
Newfoundland Region
P.O. Box 5667
St. John;s, Newfoundland
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Fisheries and Oceans Pêches et Océans

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Canadian Industry Report of Fisheries and Aquatic Sciences

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Les numéros 1 à 91 de cette série ont été publiés à titre de rapports sur les travaux de la Direction du développement industriel, de rapports techniques de la Direction du développement industriel, et de rapports techniques de la Direction des services aux pêcheurs. Les numéros 92 à 110 sont parus à titre de rapports à l'industrie du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 111.

Les rapports à l'industrie sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par des agents commerciaux.

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DEPARTMENT OF FISHERIES AND OCEANS
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MARCH 1987

CONTRAWL PROJECT

BY

FISHERY PRODUCTS INTERNATIONAL LIMITED

FOR

FISHERIES DEVELOPMENT BRANCH
DEPARTMENT OF FISHERIES AND OCEANS
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INTRODUCTION

In recent years, Fishery Products International Limited has been searching for a method to land a higher quality raw material by its wetfish trawlers that would require less labour and permit a higher vessel discharge rate when in port. Contrawl Limited approached F.P.I.L. in 1980, presenting a concept to develop the in-hold portion of such a system, and requested support in Contrawl's application for the funding of a full scale prototype under the Enterprises Development Program (EDP). An agreement was reached and the prototype was subsequently fabricated and demonstrated at Colda Mechanical Limited in St. John's. At that time Contrawl Limited was successful in receiving funds under a second EDP program to develop a computerized control system for the prototype.

The prototype demonstration appeared to have much merit but its suitability under trawler operating conditions, and its capability to land an improved quality product, had to be proven. Contrawl Limited then requested F.P.I.L. to enter a joint project with Contrawl Limited and Fisheries and Oceans Canada to install a second generation system onboard one of its existing vessels and test the design under actual sea conditions. F.P.I.L. was to install a system supplied by Contrawl Limited and the installation cost was to be financed by Fisheries and Oceans Canada as per a contract between F.P.I.L. and D.F.O. Any lost contribution during the life of the project was to be absorbed by F.P.I.L.

F.P.I.L. agreed to this arrangement and in 1984 entered into a contract with D.F.O. valued at $211,998.00 to perform the installation

work. This figure was later amended to $311,260.00 and a second contract was finalized in 1985 for the amount of $57,675.00 to finance the operating and maintenance costs to the end of that fiscal year. A third contract was awarded in 1986 to cover the operating costs of an extended testing period up to June of 1986 and also the removal of the system from the vessel and restoration of the trawler to its original condition. That contract was valued at $169,000.00.

The scope of the project, as far as F.P.I.L. was concerned, was to install a fish-hold container storage and handling system onboard a trawler and operate the system for approximately six to eight months to determine if the idea was a workable concept. Problems associated with installing and operating the system were to be noted along with the quality of the landed product as it compared to that of a similar age and specie stored by the conventional penboard and stanchion method. High volume discharging and increased icing of fish were not considered for this project.

F.P.I.L. reviewed its trawler fleet and decided that a vessel from the Marystown fleet would best accommodate the new installation. The Atlantic Margaret was chosen and installation on the vessel was performed during the ship's refit period.

SECTION 1 - DESCRIPTION

The fish-hold of the Atlantic Margaret is divided into two compartments with a total storage capacity of 350,000 pounds of landed product by the penboard/stanchion method. A cross-sectional bulk head forms a forward fish-hold compartment of 70,000 pounds capacity and an

aft compartment of 280,000 pounds. It was decided to install the Contrawl system in the forward fish-hold and maintain the aft hold for conventional type storage. This arrangement would minimize the reduced productivity of the vessel due to volumetric loss of raw material landed and minimize the installation cost but also permit a true test of all components of the Contrawl system under sea conditions.

The forward fish-hold was completely stripped down to the structural steel of the hull, deck head, double bottom tank tops and bulk head. All stanchions, aluminum sheeting, insulation and timber materials were removed and a steel frame was installed to provide support and guidance for the new containers.

The Contrawl installation permitted forty-eight containers to be stored in the forward fish-hold. The system was three containers long and five storage bays wide. The three center bays stored four tiers of containers and the two outside bays stored containers two tiers deep. An extra tier of containers over all five bays and totalling fifteen in number, could have been accommodated if stored elsewhere until filling time. Temporary storage on the factory deck would have been necessary for these containers in order to provide maneuvering space inside the fish-hold when filling the others. The Atlantic Margaret did not lend itself to factory deck container storage.

A bridgeless crane was secured to the deck head of the fish-hold. The crane consisted of two end truck assemblies each rolling on a set of channel irons positioned transversely in the fish-hold. One set of channel irons was located immediately aft of the containers and the other was positioned immediately forward. The trucks were powered by a roller chain driven by a motorized shaft on the factory deck above. The lifter

frame could be lowered onto a row of containers and electrically powered lugs, installed in the lifter frame, would subsequently engage them. The containers could then be lifted and moved to any part of the hold by maneuvering the lifter frame.

The hatchway in the forward fish-hold had to be lengthened. This was necessary because it had to allow three containers, arranged end to end, to pass through simultaneously.

A motorized retractable angle iron was installed in each side of the hatchway. They were installed such that when in the retracted position, a row of containers could pass through the opening and when in the extended position, could be supported by them.

Mounted to the deck head of the factory deck an don centre with the fish-hold hatchway, was a second lifter frame. It too, was suspended on cables and could be lowered to the bottom of the fish-hold. The movement of this lifter frame was also controlled by motorized winches on the factory deck.

The factory deck lifter frame was mounted at the deck head to a retractable frame. The frame was on rollers and could be moved to the starboard side. This was necessary to allow access to a hatchway in the deck head directly over the fish hold hatchway. Containers were transferred between the fish hold of the trawler and the dock through these two hatchways.

A hydraulic crane was mounted on the forecastle deck. The crane was used to load and discharge the containers when the vessel was in port.

A mechanical and electrical room was constructed on the factory deck over the forward fish-hold and to the extreme starboard side. This compartment housed the drive units for the lifter frames and the

bridgeless crane, and most of the electrical switches and control panels.

The operation of the in-hold equipment and the factory deck lifter frame was controlled by an operator using a control console. The console was mounted on the factory deck at the forward end of the fish-hold hatchway. This location gave the operator a good view into the hold.

The console was designed for two modes of operation designated as manual and automatic. When in the manual position, the operator directed each individual equipment movement as he desired. It was important for the operator to have a good view into the fish-hold to see things as they happened. The only feedback that the console displayed was an indication as to when the in-hold travelling bridge was on centre of a storage bay, thus signifying that the in-hold lifter frame was in position for lowering. When the console control was switched to the automatic mode, the system was programmed to perform the proper sequence of movements automatically for storing filled containers and bringing up empties.

The control system utilized a series of sensor switches positioned throughout the fish-hold and factory deck. The sensors fed information to the control panel and provided an interlock system. The interlocks increased the possibility of safe operation and was necessary for automatic control.

SECTION 2 - INSTALLATION

The installation of the Contrawl system was performed at the F.P.I. Limited vessel refit centre in Burin by qualified trades people. The Atlantic Margaret arrived at Burin in January of 1985 and was ready for sea trials in October of that year. In conjunction with the Contrawl

installation, a refit of the vessel took place which included engine work and propulsion system alignment. During the summer period, work was discontinued on the Contrawl system for four weeks when the vessel was moved to a shipyard for underwater work.

It was decided to do the installation at the Burin refit facility for economic reasons. The estimated cost to perform the work at Burin was substantially less than quotations received from shipyards. In addition, the design package for installation was very general which meant that much of the detail had to be worked out in the field. This is probably not uncommon for a project of this nature, but it would be very difficult to control extra job costs if a contract had been awarded to an outside contractor.

F.P.I.L. installed major equipment items as supplied by Contrawl Ltd. This included:

1. electrical control panels
2. electrical sensor switches
3. factory deck lifter frame and retractable beam units
4. in-hold travelling bridge system and lifter frames
5. motorized winch units and spring loaded blocks
6. containers

F.P.I.L. supplied all other materials which included:

1. all plate, structural steel and miscellaneous metals
2. common electrical switches, lighting and wiring
3. small motors and gear boxes
4. miscellaneous materials such as plexiglass, cable, wood, fasteners, paint, etc.

Materials were selected in a cost conscious manner and for

relatively short term application. For this reason, steel was used as the primary fabrication metal for the in-hold container guide system, overhead travelling bridge and lifter frames. In an installation for long-term use, steel would have to be substituted for a non-corrosive metal.

Before installation began, F.P.I.L. inquired about the suitability of certain design components related to the electrical controls system. Contrawl intended on using lever and push button activated sensor switches as part of this installation with magnetic relay switches in the control panels. F.P.I.L. had little faith in these components for such a severe working environment. At that point, however, the components had already been purchased and extra cost would have been associated with replacing them, so it was decided not to make a change. Later in the project, these items proved to be a constant source of problems. It was the desire of F.P.I.L. to use proximity limit switches and programmable logic controllers for these applications.

SECTION 3 - OPERATION

When at sea, the on-deck lifter was secured in place over the fish-hold hatchway. To load containers, the operator at the console maneuvered the in-hold bridge and lifter frame to pick up a set of three containers and deposit them in the center bay directly under the hatchway. The in-hold bridge and lifter frame was then moved to the side and the on-deck unit lowered down to engage the containers. The lifter frame nestled down between the raised side walls of the containers and the motorized lugs installed in the lifter frame were actuated. The lugs extended out

through slotted holes formed in the raised sides of the containers, thereby taking the weight of the containers when the lifter frame was raised. The containers were then raised up through the factory deck hatch coaming and the motorized angle brackets moved into position out into the open hatchway. The three containers were then lowered to rest on the angle brackets and the lifter frame disengaged and raised up tight to the deck head.

At that point, the containers were positioned partially through the hatchway and such that the tops of the containers were several inches below the belt of the factory deck conveyor which ran parallel beside the hatchway and carried fish. Fish was directed from the conveyor through one of three gates and down a short chute into the containers.

When the containers were loaded on board the vessel in port, 50 pound bags of ice were placed in each container. Before fish was directed into the containers, crew members removed the bags of ice. A layer of ice was spread over the floor of each container, ice was mixed evenly through the fish as the containers were filled and a top layer of ice was spread over the fish. The containers were then stored and another three positioned for filling.

When the vessel was in port, the hydraulic crane mounted on the forecastle deck was used to transport containers between the fish hold and the wharf. An operator using controls mounted near the base of the crane handled one container at a time.

SECTION 4 - OPERATING RESULTS

The Atlantic Margaret went back into service on October 20, 1985. Five fishing trips were made before the Christmas tie-up and then an additional fourteen trips in the new year up to June of 1986. During the vessel's first five trips, a number of problems were experienced. A list was prepared in an effort to rectify them when the vessel was in port during the Christmas break. Deficiencies identified during that period were as follows:

(a) The containers had warped and bulged out of shape considerably after little usage, such that it was very difficult for the lifter frames to engage properly without the help of crew members using pry bars. It was concluded that a stronger container, manufactured to closer tolerances, would be required. The lifter frames needed to be tapered to secure proper alignment. As an interim measure, before better containers could be provided, aluminum brackets had to be fabricated. These would be used to hold the containers in line during the lifter frame engagement process.

(b) There were not enough drainage ports in the containers to drain ice melt water when at sea.

(c) Outside corners of containers were being damaged during the lowering into the storage bay structural guides. A number of factors could have contributed to this problem.

1. The need for sensor switch adjustment.

2. The in-hold guide columns were not installed perpendicular to the main longitudinal girders of the ship as directed by the consultant. This alignment produced extra scrubbing on the areas of the containers in contact with the aft columns.

3. Roughness of cut on the tee sections fastened to the main columns.

4. The need for a better guide system in the transition phase of lowering the containers from the on-deck guides to the in-hold guides.

(d) The speed of the bridgeless crane and lifter frames needed to be increased.

(e) A footrest and handrail was required on the factory deck along the fish hold hatch coaming to aid crew members.

(f) The lever and push button switches were corroded and seizing up. They needed to be replaced by proximity devices.

(g) Some switches needed to be adjusted and one relocated to a more protected location.

(h) The Automatic operation mode was not working.

(i) The trolley car system supporting the electric power supply to thin-hold lifter was binding and damaged.

(j) The two winches on the factory deck controlling the lifter frame movements each needed a guide-on mechanism. Without it, improper wire wrap on the drums was common and resulted in lifter frame malfunctions.

(k) Sheaves and bushings on the in-hold bridge and lifting frame were seizing up and no provision for lubrication existed. The system had to be disassembled, grease nipples installed and lubricated.

(l) Holding pins for securing the on-deck lifter could be easily damaged with the existing method of moving the frame from port to starboard.

(m) Electrical relay fell out of position.

(n) Intermittent control board malfunctions which appeared to be caused by ship vibration and possibly moisture contamination.

Most of the above problems were addressed during the Christmas tie-up. The intermittent electrical problems, however, which were inherent in the control system, were not rectified; the containers could not be replaced with better ones and guide-on units could not be installed on the winches.

In the early trips of 1986, the Contrawl system was operated continuously but was constantly plagued with the problems associated with those things that could not be corrected during Christmas. Contrawl Ltd. contracted its supplier to have a better container manufactured and also directed its controls designer to assemble a new electronic board. The new board was intended to eliminate the intermittent electric problems in the control panel and also make the system operable in a semi-automatic mode. In addition, proximity switches were installed to replace the push-button and lever type devices.

The new containers, proximity switches and electronics board all proved very effective in reducing the frequency of the problems but did not eliminate them completely. Operation of the system in any mode other than manual was never realized.

Operating the contrawl system was a new experience for F.P.I.L. operations personnel, different in many ways from their normal duties. The transfer of containers between the wharf and the fish hold required

the services of five people at the vessel and a forklift operator to transport containers between the vessels and the dockside. A man was required inside the fish hold to attach the lifting bracket of the loading crane to containers. A second person was required to operate the factory deck control panel. Two people were necessary on the forecastle deck, one as the crane operator and the other to ensure proper container alignment when a container was passing through the hatchway. A fifth person was required on the dock to align containers properly on a pallet and manipulate the lifting bracket of the loading crane.

Initially, it took four hours to load the containers on board the vessel but this improved to 2½ hours when the workers became more familiar with the system. The discharge time was initially three hours but it was eventually improved to two.

When at sea, two crew members were required to work the system. One was required to operate the control console and a second to fill the containers with fish and ice. In a penboard/stanchion system, one may only is used under normal circumstances. He works in the fishhold.

When a continuous supply of fish is available, it took an average 9½ minutes to load a set of three containers with fish and ice. It took an average of 11 minutes to search out a set of containers and position them for filling and about 4½ minutes to store filled containers.

These time studies were performed before the Christmas tie-up. The installation of the larger drums on the winches reduced the maneuvering time for containers by approximately one third (4mm to search out and position containers in the hatchway for filling).

Under the normal method of operation, a vessel such as the Atlantic Margaret has the ability to store approximately 6,500 pounds of head-on and gutted cod per hour. This figure varies with size of catch and time

of year.

The ice-to-fish mixture in the Contrawl containers, for most of the test period, was maintained at the conventional standard of 2/3 fish and 1/3 ice. Approximately 200 pounds of ice was loaded into each container in port and approximately 525 pounds of head-on and gutted cod was landed per container. Later in the project, the amount of ice stored in each container was reduced to 150 pounds. This had no noticeable effect on landed quality but increased the volume of raw material landed proportionately.

During the test period, it was necessary to have a maintenance person in attendance at all times when the system was being operated. This was required both when the vessel was at sea and in port. The maintenance person was required to resolve system malfunctions that could not be corrected without the installation of new equipment pieces and the incurrence of considerable downtime.

The Atlantic Margaret often encountered very heavy seas in storm conditions during the test period. The system proved to be structurally sound and was not impeded by heavy seas any more than other conventional methods of in-hold fish handling and storage. It was operable for the entire test period in that it did not have to be taken out of service. It would, however, have been impossible to use the system without the full-time services of a maintenance man and the extra efforts of the ship's crew in assisting with misalignment problems.

SECTION 5 - PRODUCTION RESULTS

The Contrawl system was used for a total of 19 trips beginning in October 1985 and ending in June 1986. Production results (yields, labour

costs, packout, etc) were compared between penned and containerized fish. These comparisons may contain minor anomalies when production of a vessel's catch occurs over a two day period. To eliminate these possible anomalies, strictly controlled tests were performed for Contrawl trips number 2, 3, 31 and 15. For these trips, the Production system was altered to ensure that containerized fish and penned fish were produced in a strictly confined area using the same production lines, cutters, etc. The conclusions are as follows (all results are for cod only):

Yields - Cod

	Contrawl	Pens	Variance
Wetfish Yields	38.6%	36.9%	1.7%
Freezer Yields	37.3%	35.7%	1.6%

The average count of the containerized fish was 32 versus a count of 33 for the penned fish. This minor difference would not affect yields.

"Frozen Yield" figures should be used in analyzing results. These results indicate that a catch of 300,000 lbs. in a containerized vessel would result in 111,900 lbs. of finished product versus 107,100 lbs. from a penned vessel.

On an annual basis, assuming the average ice-strengthened vessel lands 6 million lbs., containerized fish will result in an extra 96,000 lbs. of finished product. The market information needed to analyze the affect this has on corporate profit is outlined in the next section ("Packout"). Note that the raw material costs of this extra production is effectively nil since, naturally, there is no increase in the purchase cost of the raw material as a result of this increased output. This fact

merely confirms the significant effect that increased yields have on corporate profitability.

Prices

The purchase price of trawler cod is based on a transfer system whereby the vessel "sells" the fish to the Production Department at a breakeven price. The cost of landings include crew costs (shares, per diems, benefits, etc.) and operating costs (gear, maintenance, fuel, etc.). It does not include fixed costs (refit, depreciation, interest, dockings, etc.). An industry average should be used to determine raw material costs.

A. Packout

Containerized fish resulted in a greatly improved pack split between fillet and block production, i.e.

	Block Production
Contrawl	48.8%
Penned	65.7%
Variance	16.9%

Block production as a percentage of total cod production varies widely, especially on a seasonal basis. The reasons for this are well documented. The percentage of block production stated above (65.7%) is not necessarily indicative of F.P.I.L's annual results. The variance, however, would be expected to remain relatively consistent and it is this variance that is important for purposes of analysis.

Increased Revenue Resulting from Increased Fillet Production

Present market conditions are such that in many cases the production of block will yield higher returns to processors than will the production of fillet packs. The existing (24/9/86) block price of $1.50 U.S. - as per the Boston Bluesheet - combined with lower production prices of block tends to minimize or negate the comparative profitability of fillet production. This situation is misleading in that it neither reflects long-term price trends nor reflects the industry's objective of maximizing fillet production while at the same time maximizing the quality of cod blocks.

Historic price differentials vary greatly. Blocks and premiums 5's have varied by 35 - 65 cents/lb. in the last five years. It would appear that any analysis of fillet vs. block production should be based on this price variance.

Quality Results

Quality grading is based on four criteria: texture, bruising, blood clots and odour. The lowest rating in any one of these criteria determines the overall rating of any sample. Since texture is the only criteria affected by containerization, quality grading results can be misleading if used in analyzing the Contrawl project. A more meaningful analysis is to isolate improvements in the texture component only. Results of the Contrawl experiment with regards to texture improvement are as follows:

	Contrawl	Penned
Grade A*	66	40
Grade B	33	56
Grade C	1	4
Reject	--	--

*Contrawl results varied from 48 - 90% Grade A. Penned fish varied from 22 - 66%.

Labour Costs

There are four main cost centers/components in the production of groundfish within F.P.I.L., i.e.:

Receiving Cost Centre: discharge and related functions

Round Fish Cost Centre: cutting and related functions

Special Preparation Cost Centre: trimming and related functions

Fillet Cost Centre: packing and related functions

Results of the Contrawl experiment are as follows (cents/lbs.):

	Contrawl	Penned	Variance
RCC	2.0	.9	(1.1)
RFCC	12.6	14.8	2.2
SPCC	5.5	5.9	.4
FCC	3.8	3.9	.1
Benefit/O.T	5.5	5.6	.1
Total	29.4	31.1	1.7

Comments

A. RCC

Extra workers (signalman, forklift operator, etc.) were required. Refinements to the Contrawl system may result in the reduction in discharge related costs (increased overhead?).

B. RFCC

The filleting process also includes pin-bone removal and skinning. Improved texture therefore would have the greatest affect on this cost centre.

While this report evaluates only cod production, it should be noted that results of boxed flounder production at Catalina have shown that labour costs are lower for boxed flounder than penned. A similar result would be expected for containerized fish.

C. SPCC

Improved texture results in lower labour costs. A recent memo from D.F.O. requests the effect that containerized fish has on work content. For purposes of terminology clarification, texture is not a factor in establishing "work content" under the F.P.I.L. system although it obviously does affect labour costs.

D. FCC

The cost centre is not affected by texture.

Production Results - Conclusion

Improved production results through the use of a Contrawl system are evident as stated in the preceding paragraphs. The Contrawl experiment at Marystown has quantified a previously known fact - containerized fish results in lower production costs and higher quality finished product than does the traditional penned fish. In the final analysis, however, a comparison must be made between containerized fish and boxed fish.

Since the Contrawl was first proposed, F.P.I.L. has boxed 13 of its penned vessels and is rapidly moving towards a fully boxed fleet especially since the results of boxed flounder production have proven very favourable. The next section of this report addresses the comparison between boxing and containerization.

B. Boxing vs. Contrawl

Marystown does not have any boxed vessels and consequently there were no controlled tests to compare the Contrawl results with boxed fish. The production related improvements attributable to boxing are well documented within F.P.I.L. so that it is possible to make a general comparison between the two systems. The Contrawl results were reviewed with Production/Incentive Staff at Catalina and the following conclusions were made:

1. Yields

An overall cod yield increase of 1.6% is readily attainable with boxed fish. Yield improvements vary depending on seasonally, areas, etc. but the overall result is that yields from boxed fish are at least as good as those from Contrawl.

2. Packout

The increase in premium pack production was much better than expected. A thorough review of results from boxed vessels indicates that similar results are attainable with boxed fish.

3. Labour Costs

A. Discharge

The cost of discharging boxed vessels is 4½ cents/lb. vs. 2 cents for containers. Any comparison, however, should take into account the fact that the existing method of discharging boxed fish is temporary and will be made more efficient when the proper infrastructure is implemented.

It is possible to accurately compare labour costs. One reason for this is that v-cuts at Catalina are often performed in the special preparation cost center. The Incentive Manager at Catalina has confirmed, however, that the overall cost reduction realized from containerized fish is readily attainable with boxed fish.

Conclusion

Containerized cod does not result in better production costs when compared with boxed fish. For this reason, the deciding factor in

determining whether or not Contrawl is preferred over boxed fish will probably be based on potential improvements in vessel turnaround. This topic is discussed in the next section.

C. Vessel Turnaround

Previous Contrawl reports have created several misconceptions regarding F.P.I.L's vessel turnaround. The 1983 report by Wayne Follett correctly stated that the existing average in-port time was 96 hours. This statement, however, implies that there is significant potential to reduce this time to 28 hours through improved discharging of Contawl fish. The following breakdown of average 1986 turnaround indicates that avoidable delays account for 102 hours per trip.

	DOWNTIME/TRIP To August 8th, 1986	
	Hours	Days
Fishing Hours	170.5	7.1
In/Out Hours	45.5	1.9
In-Port Hours	48.0	2.9
Operating Hours	264.0	11.0
DELAYS		
Discharge	3.4	.14
Icing	1.7	.07
Landed Early	5.1	.21
Avoidable Delays	10.2	.42
Maintenance	1.6	.07
Maintenance - Unusual	18.2*	.76
Other Unavoidable	11.2	.47
	31.0	1.30
Sub-Total: Delays	41.2	1.72
EXTRAORDINARY		
Tied-up	17.1	.71
Refit	16.2	.68
Docking	5.4	.23

* Excluding Ramea: 13.0

	DOWNTIME/TRIP To August 8th, 1986 Hours	Days
EXTRAORDINARY (continued)		
Christmas	7.3	.30
Ice-Strengthening	5.6	.23
	51.6	2.15
Total Delays	92.8	3.87
Total	356.8	14.87

As this analysis demonstrates, only 10.2 hours per trip are "avoidable" and therefore subject to improvement. However, reduced maintenance downtime is being achieved through the installation of preventative maintenance programs and the replacement of older vessels with new constructions, therefore, the contribution of a system that enables quick vessel turnaround will be significant.

As well, as 36-hour turnaround pilot project has been negotiated with our Union for the port of Marystown and if successful, will be applied throughout the fleet. Hence, the need for a system to effectively provide F.P.I.L. with a consistently efficient turnaround operation. Even without reduced downtime hours and a 36 hour contractual obligation we can still realize 46.4 additional trips annually if the 10.2 hours are recovered. This is the equivalent of two vessels' operations. The cost of constructing a new ship in 1987 as per F.P.I.L. requirements is $8.5 million.

CONCLUSIONS

The Contrawl prototype is structurally sound and has proven to be a workable concept under sea conditions. Just as importantly, the system (containers) can deliver a high quality raw material. However, it is not refined enough in its present form to be considered as a permanent installation onboard a trawler. If Contrawl Ltd. can provide a second generation system that meets industry requirements, then it could serve as a basis on which to design a new ship. It does not appear to be feasible for use on existing F.P.I.L. trawlers. For a full system to be incorporated into an existing vessel, it is anticipated that very extensive and costly modifications would be required and volumetric reduction factors would be too extreme.

The Contrawl system, as it exists today, appears to require more design refinement. It is believed that more involvement by machine design people and industrial control specialists would significantly enhance the product.

When evaluating a new product for service, other factors have to be considered besides the capability of a piece of equipment to perform its specific function. It has to interface with existing facilities and in the case of the Contrawl fish-hold container handling system, its compatibility with present day onshore handling and storage facilities has to be considered. Questions need to be answered regarding the general arrangement of a containerized vessel and what equipment would be needed to handle the existing and projected flow rates of raw materials at sea and in port during the discharge operations. These questions need to be addressed in some detail with consideration for proper icing and

personnel requirements.

F.P.I.L. has demonstrated its commitment to the development of an automatic containerized handling system that delivers a high quality raw material to processing facilities and provides the user with a very efficient unloading system that generates increased sea time.

F.P.I.L., as is most of the fishing world, is still committed to projects related to improved handling of seafood. Fishing vessels are becoming very expensive to build and operate. Improved productivity through increased sea time and greater landings is required if we are to remain competitive.

The existing system can be significantly improved upon with direction and commitment from professional groups with experience in their respective fields. Therefore, F.P.I.L. would seriously consider further participation in this project so long as the proper expertise is applied and financial commitment is given from other project participants.