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SUMMARY				
<p>This document provides a detailed description of the modifications that were made to the ice monitoring system # 1 that was used for project number 42_836_16. The modifications were completed in 2003 at the Institute for Ocean Technology (IOT) in St. John's, Newfoundland.</p>				
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MARINE ICING SYSTEM MODIFICATIONS TO SYSTEM 1

LM-2005-07

Jody Farr

February 2006

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INTRODUCTION

This report describes the wiring modifications which were made to the first of two environmentally controlled dual still camera systems which were purchased through PERD Project 42_836_16 from a commercial vendor to study the accretion of ice on Marine Vessels or Structures.

The system consists of 2 still cameras enclosed in separate environmental housings, an embedded camera control PC and associated peripherals enclosed in an environmental enclosure, a power supply enclosure, and a commercial satellite phone with an environmental enclosure.

The system is meant to be deployed into the field for periods of 1 to 2 years. The still camera images are stored on 2 hard disk drives simultaneously for redundancy purposes and the images are taken at preprogrammed intervals. Images are transferred off the system by connecting an external laptop pc at the deployment site.

The purpose of the satellite phone is to periodically monitor the status of the system. The satellite phone data transfer rate is very slow and thus transfer of the high resolution images captured by this camera system in "real time" is not possible.

To enable greater flexibility in deploying this system in the field it was decided to add connector sets at each environmental enclosure so that each cable which enters or exits the enclosure can be disconnected. Because of the expected deployment environment, these connector sets were sealed against water / moisture ingress.

CIRCUIT BOARD MODIFICATIONS (COMPUTER ENCLOSURE)

The system as it was delivered had a small bug that may have caused complications in the field. This bug caused the wiper blades and pump for each camera enclosure to momentarily engage and do one complete wipe and spray. This may have caused problems in the field if the power was cycled for some reason and ice or snow had accumulated on the glass of the camera enclosure. Erdman video systems supplied us with a solution for this problem. Technically, the problem was with a switched power source being used instead of an unswitched source. The chip that was affected was U7, 75452. To remedy this problem, two pins on the 8-pin, U7 IC had to be removed from the current circuitry and then tied to an unswitched source. The following picture shows the modification that was performed.

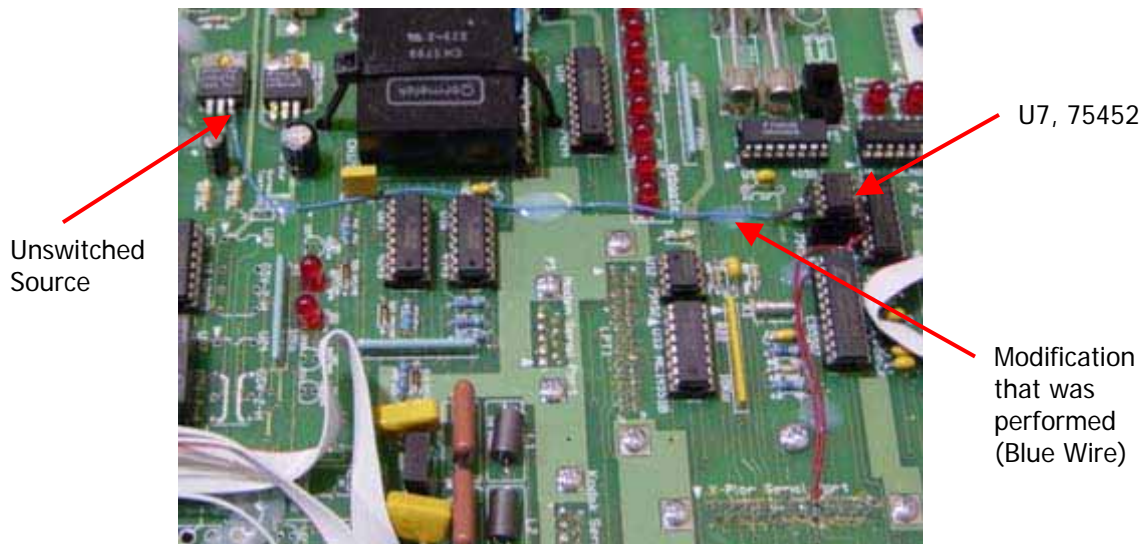


Figure 1. Board modifications

ENCLOSURE MODIFICATIONS

As the next section describes, a number of modifications needed to be made to the cables. Because of these modifications the enclosures had to be repaired/modified. Since some of the glands that were included with the system were replaced, the holes where the glands were located had to be covered/water-proofed. A piece of aluminum was cut to appropriately cover each hole that was left behind by the removed glands. The aluminum was attached to the enclosure in a way that will not permit moisture to enter the enclosures through the holes that were used for the glands. A 'gasket' of Loctite 5900 was applied around the perimeter of each piece of aluminum so as to provide a good seal.

CABLE MODIFICATIONS

There are a number of connections that are made between the components of the video system that were unacceptable as it was delivered to us. These connections had to be modified in such a way that permitted easy connectivity of each component.

The system arrived with the cables connecting each component running through glands. It is not the use of glands that was questionable, but the amount of cables going through each gland. For a gland to provide a proper seal only one cable of an acceptable diameter should be run through it. These glands will not provide a good seal for a harsh environment. The glands have been replaced with box and cable mounted connectors, as well as some smaller glands in certain instances.

The following tables explain the color code for connectors, connection descriptions, and the type of connector or gland used for each connection.

CONNECTOR DESCRIPTIONS

CONNECTION	DESCRIPTION	CONNECTOR
1	AC Power connection on the power enclosure.	97-3102A-22-2P
		97-3106A-22-2S
2	Connection between the power enclosure and the computer enclosure. This connection is located at the power enclosure.	97-3102A-18-8P
		97-3106A-18-8S
3	Connection between the power enclosure and the computer enclosure. This connection is located at the computer enclosure.	97-3102A-18-8P
		97-3106A-18-8S
4	Connection between the computer enclosure and the telephone enclosure. This connection is located at the computer enclosure.	97-3102A-12S-3P
		97-3106A-12S-3S
5	Connection between the computer enclosure and the camera (1) enclosure. This connection is located at the computer enclosure.	97-3102A-18-1P
		97-3106A-18-1S
6	Connection between the computer enclosure and the camera (2) enclosure. This connection is located at the computer enclosure.	97-3102A-18-1P
		97-3106A-18-1S
7	Connection between the computer enclosure and the telephone enclosure. This connection is located at the telephone enclosure.	97-3102A-12S-3P
		97-3106A-12S-3S
8	Connection between the computer enclosure and the camera (1) enclosure. This connection is located at the camera (1) enclosure. *	97-3101A-20-7P
		97-3101A-20-7S
9	Connection between the camera (1) enclosure and the pump/reservoir (1) enclosure. This connection is located at the camera (1) enclosure. *	97-3101A-14S-1P
		97-3101A-14S-1S
10	Connection between the computer enclosure and the camera (2) enclosure. This connection is located at the camera (2) enclosure. *	97-3101A-20-7P
		97-3101A-20-7S
11	Connection between the camera (2) enclosure and the pump/reservoir (2) enclosure. This connection is located at the camera (2) enclosure. *	97-3101A-14S-1P
		97-3101A-14S-1S
12	Connection between the computer enclosure and the telephone enclosure. This connection is located at the computer enclosure.	97-3102A-18-1P
		97-3106A-18-1S
13	Connection between the computer enclosure and the telephone enclosure. This connection is located at the telephone enclosure.	97-3102A-18-1P
		97-3106A-18-1S

Table 1. Connection Descriptions

Note: Each connection requires two connectors. Either, one for the enclosure and one for the cable, or both are cable connectors.

* Indicates that both connectors are cable mounted connectors.

CONNECTOR WIRING DIAGRAM

CONNECTION (AS PER PREVIOUS TABLE)	WIRE COLOR	PIN NUMBER
1	BLACK	A
	WHITE	B
	GREEN	C
2	YELLOW	A
	BLUE	B
	WHITE	C
	BROWN	D
	BLACK	E
	GREEN	F
	RED	G
3	YELLOW	A
	BLUE	B
	WHITE	C
	BROWN	D
	BLACK	E
	GREEN	F
	RED	G
4	BLACK	A
	WHITE	B
5	BLUE	A
	YELLOW	B
	WHITE	C
	BLACK	D
	RED	E
	GREEN	F
	BROWN	G
	ORANGE	H
6	BLUE	A
	YELLOW	B
	WHITE	C
	BLACK	D
	RED	E
	GREEN	F
	BROWN	G
	ORANGE	H
7	BLACK	A
	WHITE	B
8	BLUE	A
	YELLOW	B
	WHITE	C
	BLACK	D
	RED	E
	GREEN	F
	BROWN	G
	ORANGE	H
9	BLACK	A
	WHITE	B

	GREEN	C
10	BLUE	A
	YELLOW	B
	WHITE	C
	BLACK	D
	RED	E
	GREEN	F
	BROWN	G
	ORANGE	H
11	BLACK	A
	WHITE	B
	GREEN	C
12	BROWN	A
	RED	B
	ORANGE	C
	WHITE	D
	PURPLE	E
	YELLOW	F
	PINK	G
	LIGHT PINK	H
13	BROWN	A
	RED	B
	ORANGE	C
	WHITE	D
	PURPLE	E
	YELLOW	F
	PINK	G
	LIGHT PINK	H

Table 2. Connector Wiring Diagram

GLANDS

GLAND	DESCRIPTION
A	Exterior temperature sensor connection located at the computer enclosure.
B	Satellite phone antenna cable connection located at the telephone enclosure.
C	Camera 2 network connection located at the computer enclosure.
D	Camera 2 network connection located at the camera 2 enclosure.
E	Camera 1 network connection located at the computer enclosure.
F	Camera 1 network connection located at the camera 1 enclosure.

Table 3. Glands

DEPLOYMENT INSTRUCTIONS/PRECAUTIONS

Cable/Connector Labeling

While performing the wiring and enclosure modifications, steps were taken to insure that deployment would be as easy as possible. All cables and the respective enclosure connections and glands are clearly labeled. It is basically as easy as choosing a wire, viewing the label and then finding the corresponding connection. Figure 2 illustrates all the connections and the corresponding number/ letter labels. Table 1 also gives a description of each connection and Table 3 provides a list of glands.

Special Connectors

Network cables are used to transport data to and from the cameras. These network cables have fragile connectors on each end, which may easily be broken. Great care should be taken when handling these. These cables also required the use of larger glands so as to permit the connector to pass through. Because of this, a small area of the cable's diameter has been built up. This will allow the gland to more snugly tighten down over the cable. It is important to be sure that the built up area of the cable is actually in the gland before tightening the gland down. Gland connections A, C, D, E, and F are affected in this way. A list of glands is provided in Table 3.

There is also an external temperature sensor that connects to the interior board of the computer enclosure. The cable used for this sensor is like the network cables in that the diameter of the cable had to be built up to accommodate the larger gland size and it also has a similar connector (telephone wire plug). This connector is also fragile and should be treated with the same care as the network cable connectors.

It is recommended to wrap all of these types of connectors with electrical tape to avoid damaging the 'key' until they are ready to be inserted into the proper jacks.

Special Connections

Connections 8, 9, 10, and 11 also require special attention when setting up the system in the field. These connections are not located directly at the enclosures but are located approximately 18" away, on the cable itself. These connections should be weatherproofed after they are made. To do this it is recommended to tightly wrap the connection in vulcanizing tape after it has been completed.

Powering Up The System

Once all the connections have been made it is safe to turn the system on. Please follow these steps to insure a trouble free power up:

Check all connections to insure that they are done correctly. It would be advisable to take a photocopy of Figure 2 to use as a checklist for connections. Check the position of the main power switch on the computer enclosure and make sure it is in the off position.

Plug in the AC power plug. If it is necessary to use an extension, please insure that it is exterior grade. After the connection to the extension is properly made use vulcanizing tape to weatherproof it.

Turn the main computer power switch on the computer enclosure to the ON position.

After a few minutes the system will be powered up and acquiring images. To check the system's functionality on-site, connect a laptop to the computer enclosure's exterior network connection using a crossover cable. Then you may connect to the system using PC Anywhere.

CONNECTION DIAGRAM

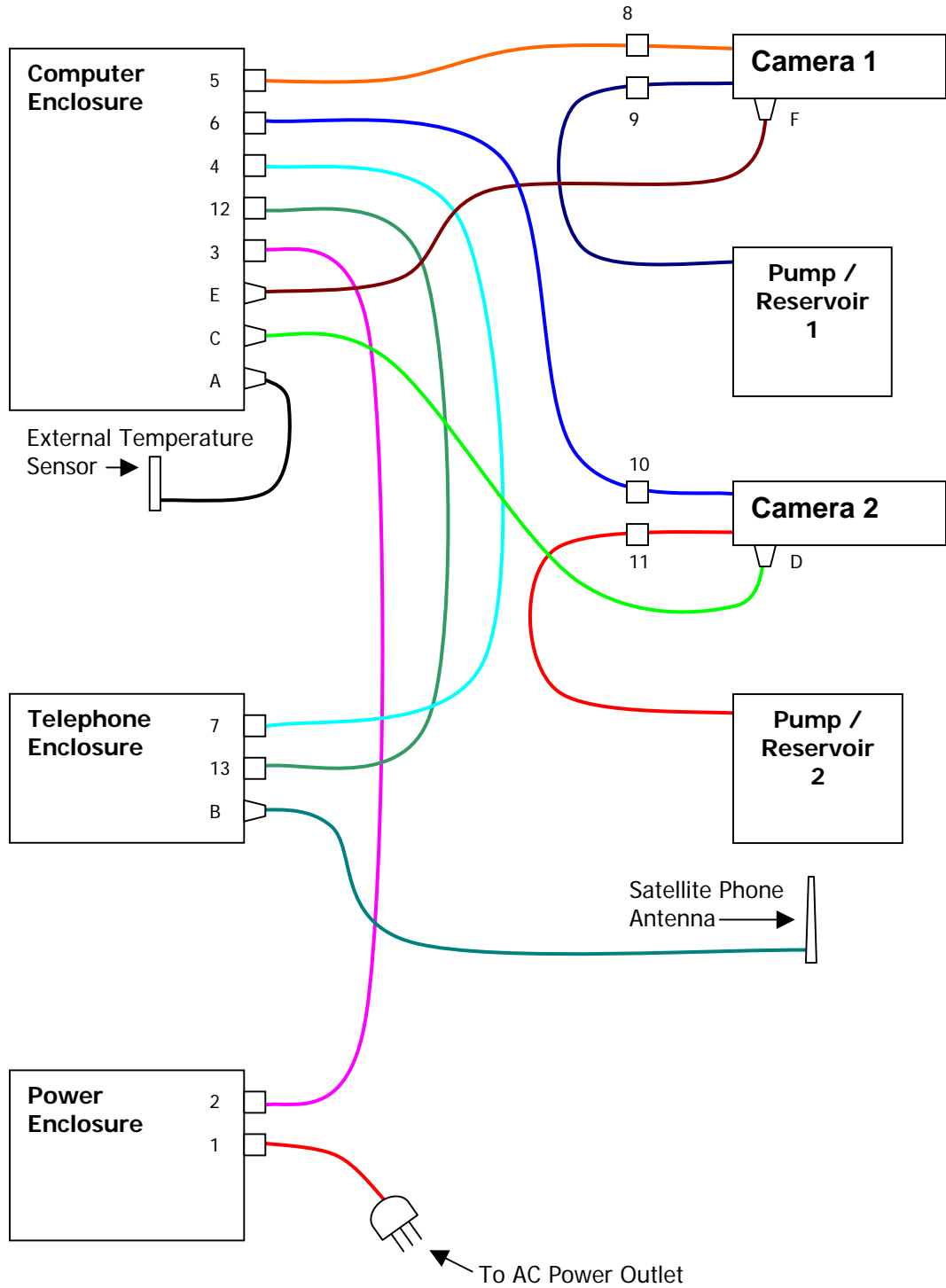


Figure 2. Connection Diagram

COMPLETED SYSTEM PICTURES



Figure 3. Computer Enclosure Exterior

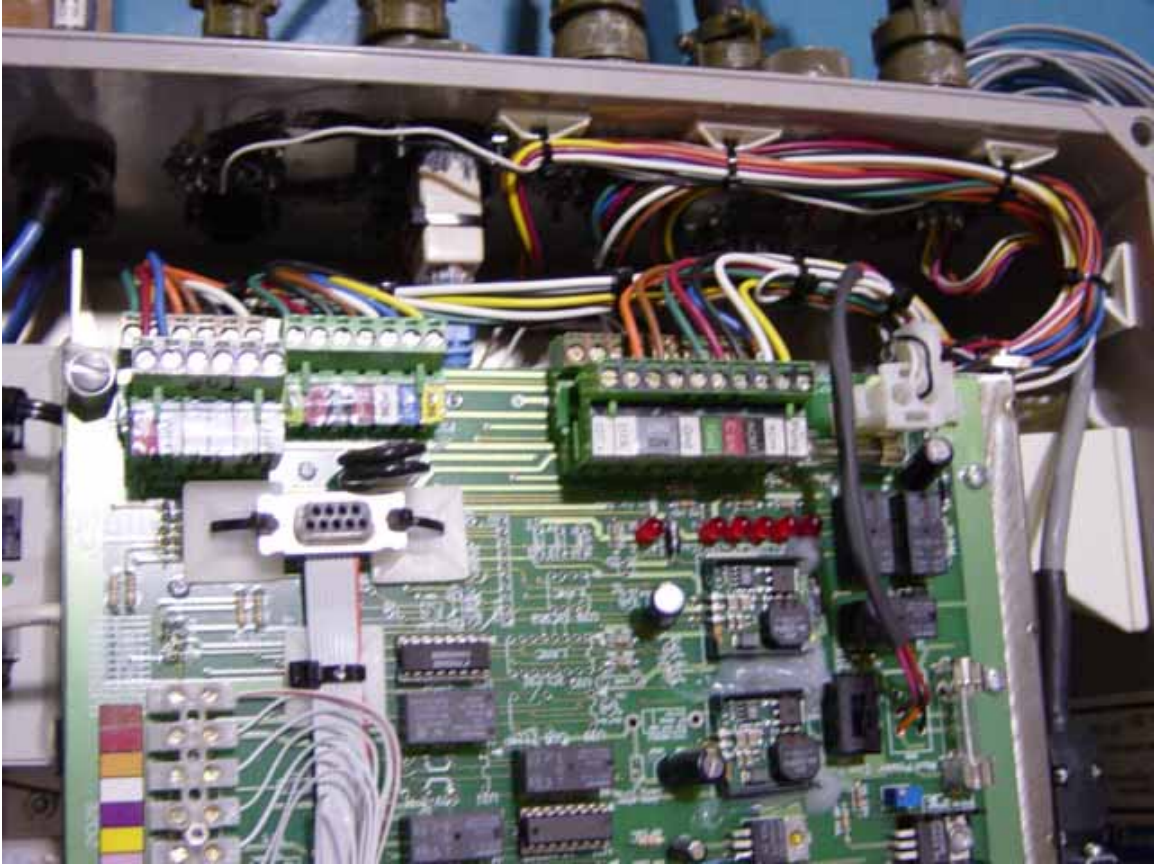


Figure 4. Computer Enclosure Interior



Figure 5. Power Enclosure Exterior



Figure 6. Power Enclosure Interior



Figure 7. Telephone Enclosure Exterior



Figure 8. Telephone Enclosure Interior

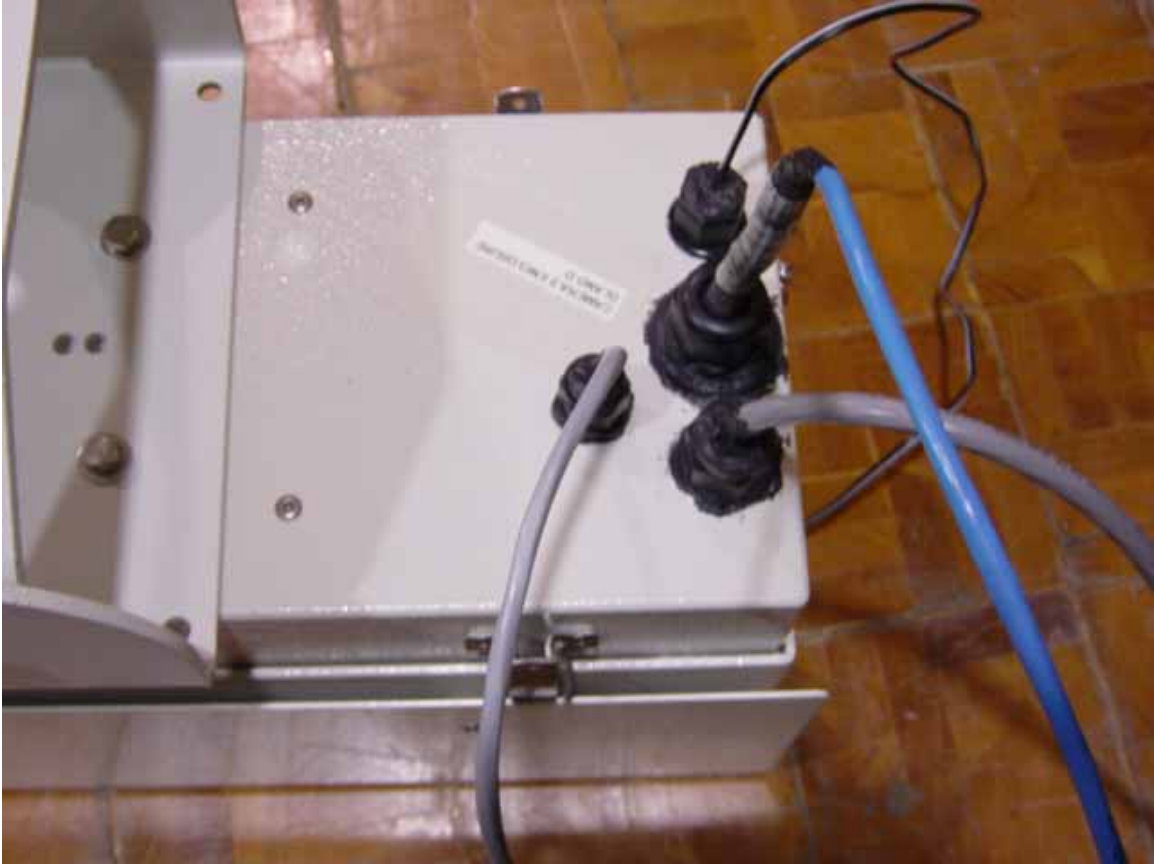


Figure 9. Camera Enclosure Exterior



Figure. 10 Camera Enclosure Interior