UCRL-JC-135079
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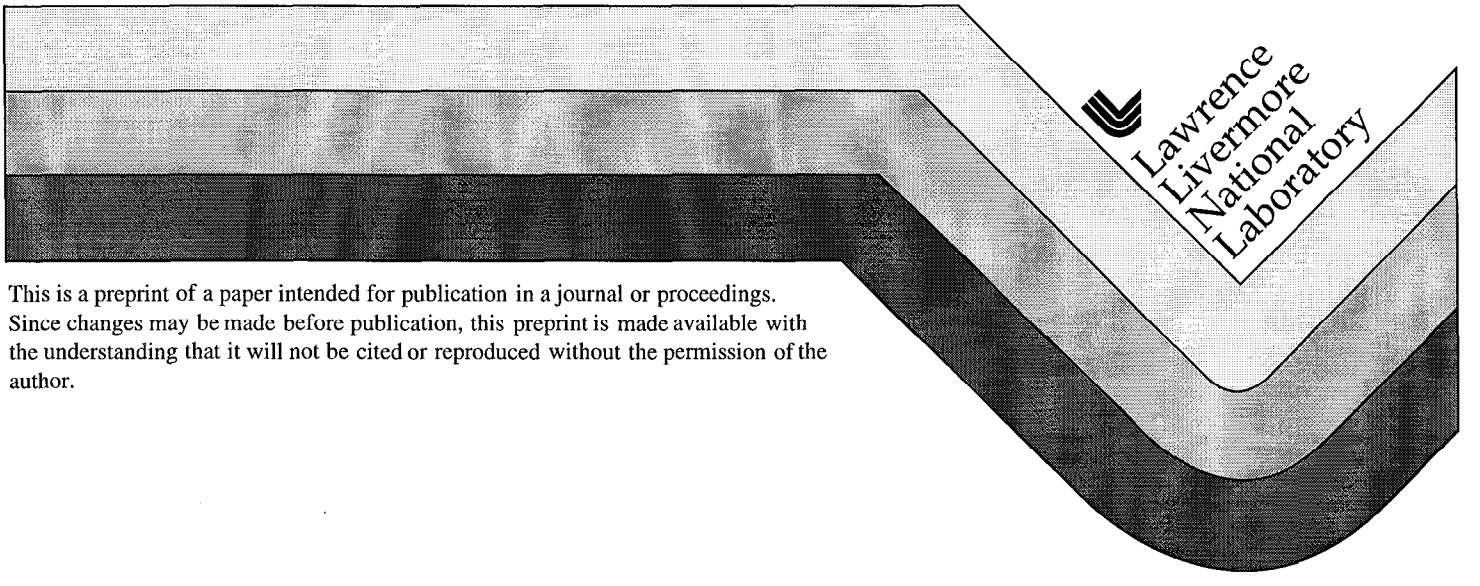
This paper was prepared for submittal to the
40th Annual Meeting, Institute of Nuclear Materials Management
Phoenix, Arizona
July 25 - 29, 1999

**July 1999**



# MPC&A Enhancements for the Murmansk Shipping Company Icebreaker Fleet

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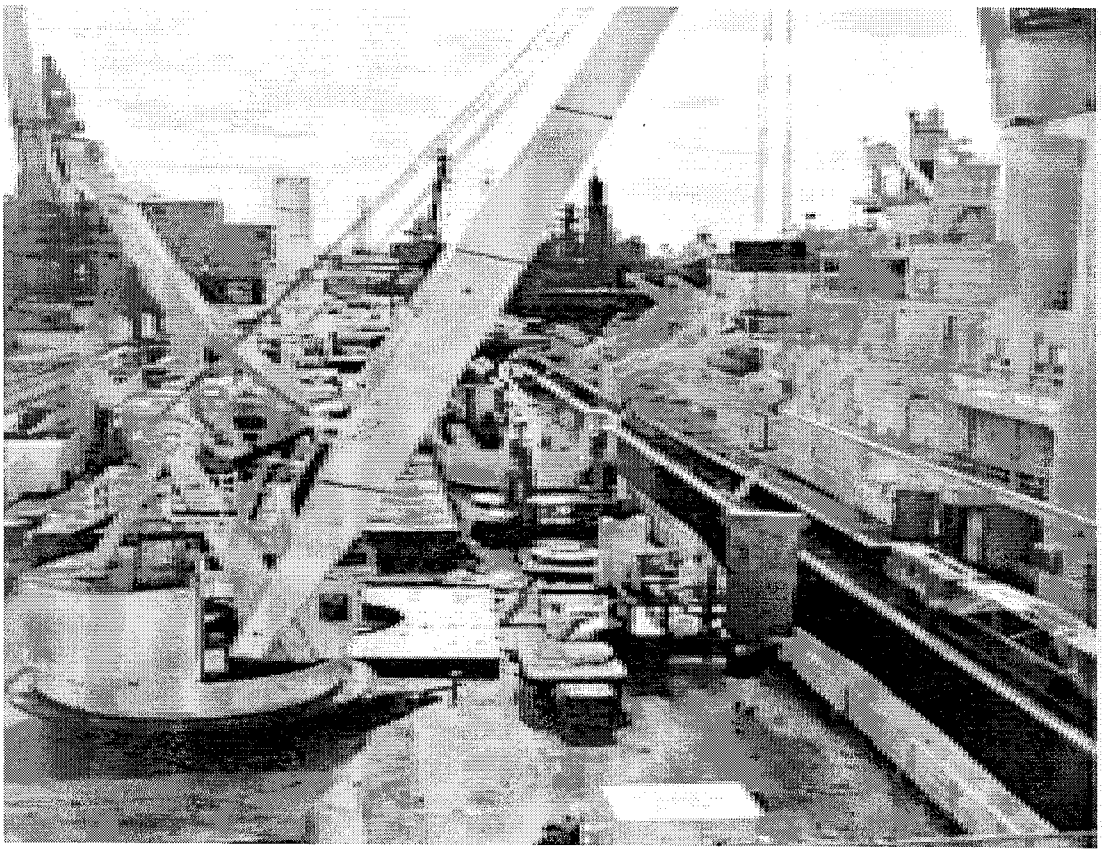
## Abstract

The United States and the Russian Federation entered into a cooperative agreement in 1994 that resulted in a nuclear weapons non-proliferation program within the United States (US) Department of Energy (DOE) currently known as the Russia/Newly Independent States (NIS) Nuclear Material Security Task Force. In 1996, a project was initiated with the Murmansk Shipping Company to enhance material protection, control, and accounting of highly enriched nuclear fuel assemblies used for the Icebreaker Fleet. The commissioning ceremony for this project is scheduled for August 1999.

This paper describes the physical protection, material control, and accounting measures implemented for the Icebreaker Fleet.

## Introduction

Background As mentioned, the Icebreaker Fleet Project began in 1996. The timing of the first visit proved to be a good omen as did the professional interactions that followed. The first visit, in July 1996, occurred at a time when the Icebreaker Tymyr was being refueled by the ship Imandra, as seen in Figure 1.



The visit afforded the experts from Lawrence Livermore and Sandia National Laboratories, and the Kurchatov Institute, a first hand look at the problem at hand; the security of fresh nuclear reactor fuel. Lengthy discussions of the fuel cycle and reloading process followed a tour of the ships. It was immediately agreed to conduct a joint vulnerability assessment to identify the necessary MPC&A upgrades. This assessment was followed by a joint meeting to develop a conceptual design. A preliminary design was developed and the firm Escort Center added to the team to prepare the remaining designs and implement our joint work.

As the Escort Center has been implementing the work, the Murmansk Shipping Company and Atomflot have been revising the applicable operating procedures to match the new protection technologies and practices. The Murmansk Shipping has also been revising MC&A procedures to reflect new operating procedures in the area of material control and accounting. With all the changes occurring, training was necessary. The Russian team has also been working together to train all personnel. A fruitful and professional partnership has developed on the Russian side as well as with the US partners from Lawrence Livermore, Sandia, Oak Ridge and Los Alamos National Laboratories.

System Implementation The primary components of any good physical protection system include detection, response, delay, and assessment. This is the formula used in the Icebreaker project. After adversary pathways to the target were analyzed, systems were identified to reduce the risk from both the insider and outsider threats with the emphasis on protection at the target location.

Detection The purpose of this system is to detect adversaries in time to allow the response force to interrupt, engage, and neutralize them. Protecting material on board a ship poses some unique problems. Not the least of which is getting the numerous approvals to modify a ship. The intent of our work was to implement the correct sensor coverage to detect adversaries along credible pathways. This was accomplished and has been tested.

Response The purpose of response is absolutely to stop the adversary! If an adequate response does not exist then no system will be successful. In this project the response is handled by the MVD. In order to enhance their command and control capability, a radio communication system was implemented. The system is installed, has been tested and is operational.

Delay The purpose of this system, as its name implies, is to delay the adversaries once detection has occurred for a sufficient enough time to allow the response force time to contain them. In this project we employed some very unique systems as reflected in Figures 2 and 3 which show the fuel rack and the barrier system placed over the fuel racks. The system was identified as a rapid upgrade for the project and has been in place since 1998.

Figure 2

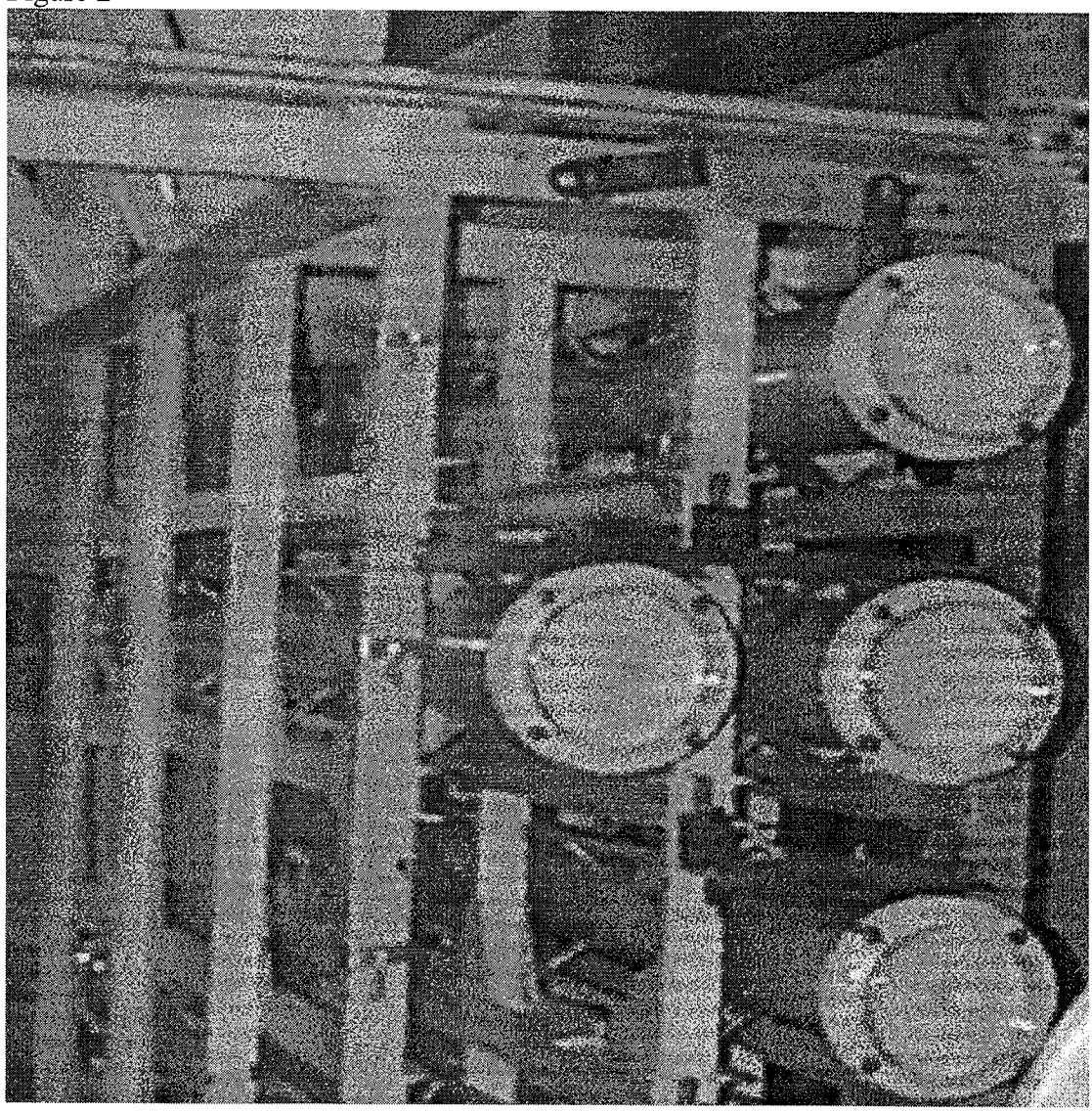
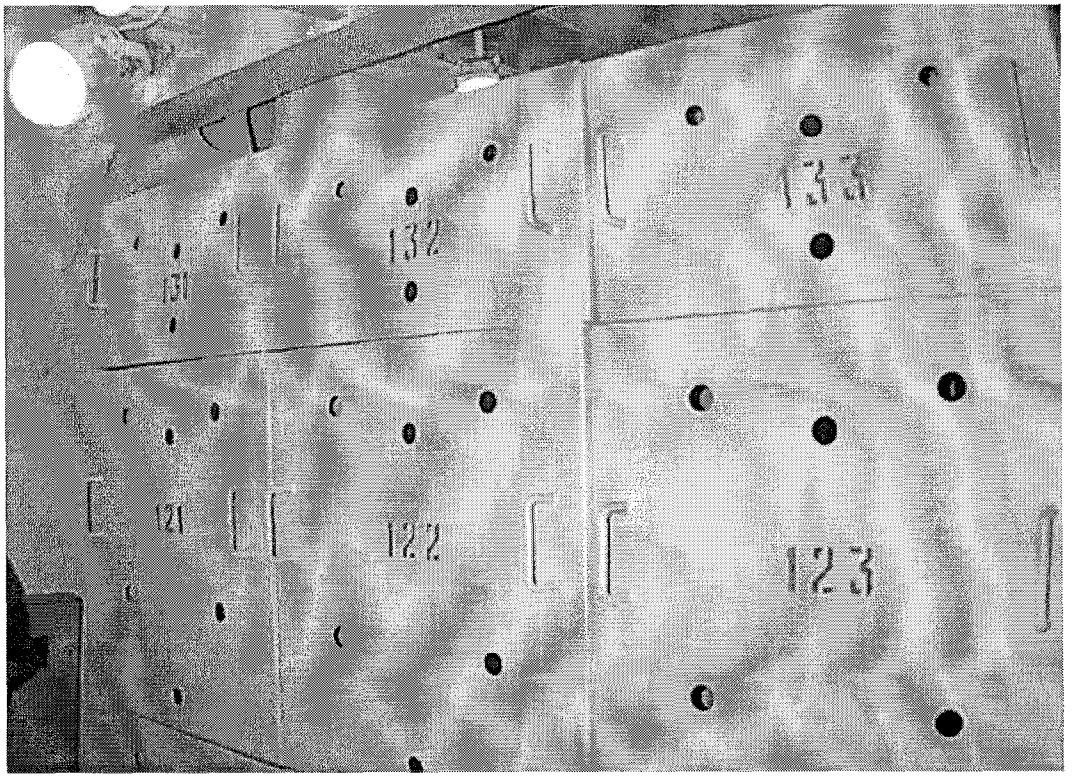
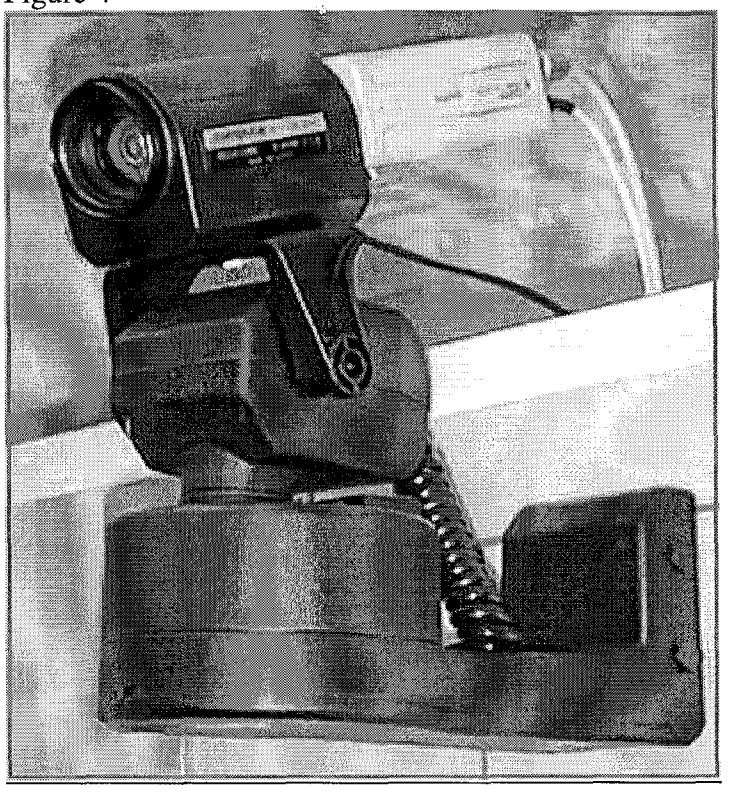


Figure 3




Assessment The purpose of this system is two-fold. Not only are cameras and lighting employed to aid the response force in command and control activities during an adversary engagement but also as a material surveillance system as part of the MC&A program. The difference is merely the types and locations of cameras. The system offers protection for both insider and outsider adversaries. Figure 4 shows one type of camera used in the project.

Figure 4



These are but a few of the features implemented in this project. All systems require the appropriate infrastructure and operating system to make it effective. This project was no exception. The Operand system, developed by Escort Center, was chosen for this purpose.

The entire system is operated by a primary and secondary alarm control and display unit, located within hardened positions, and equipped with emergency power supply capability. Each individual sub-system is supported by smaller emergency power supplies as well. Access control was also employed with special attention to the needs within the ship Imandra. The pedestrian, rail, and vehicle portal barriers were also enhanced. And finally, a new relationship was developed with the MVD and an enhanced response capability developed. This agreement alone was quite an achievement!

Overall, the project employed a comprehensive approach to enhancing the pathways to the target material including both interior and exterior detection, delay, and assessment on the ship Imandra and Atomflot resulting in increased system effectiveness and risk reduction. This is complimented by enhanced MC&A and enhanced response force capability.

Sustainability It would appear that the work is done. But this is not true. We must sustain the system and continue its effective operation. We are currently identifying the appropriate means to test and maintain the system on a continuing basis. This effort will be a continuation of the partnership with Murmansk Shipping Company, Atomflot, Kurchatov Institute, Escort Center and the Department of Energy Lawrence Livermore National Laboratory. But, in thinking of the future, we should keep in mind that there are also other materials, such as highly enriched spent fuel, which warrant consideration for protection. Increased effort in this area is urged. The current Russian team is ready and equipped to work with the current US team in this regard.

Conclusion In closing, it should be said that the experience of the last three years has been very rewarding for all participants. The professionalism and positive relationships have been key to the success. As the completion of the project for securing the fresh fuel grows near, it is clear that the foundation for continued cooperation in non-proliferation and Material Protection Control & Accounting has been laid.

This work was performed under the auspices of the U. S. Department of Energy by Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.