



Protection of Radionuclide Thermoelectric Generators



U.S./Russian-Installed Alarm Systems

Presented to:

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Contact Expert Group

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Objectives

- **Deploy communications and alarm device**
 - provide a basic level of protection
 - RTGs located remotely
 - While they await removal
 - Small
 - Simple
 - Cost effective
 - Timely notification of tampering
 - Temporary



Approach

- **Study communications to support protection**
 - While RTGs are in the field
 - During transportation
 - While RTGs are in storage
- **Use existing systems**
- **ID best communications channel**
- **Take advantage of RTG characteristics**
- **Develop Response Plan**
- **3 – 5 years required**
- **Test the water with Pilot Project**



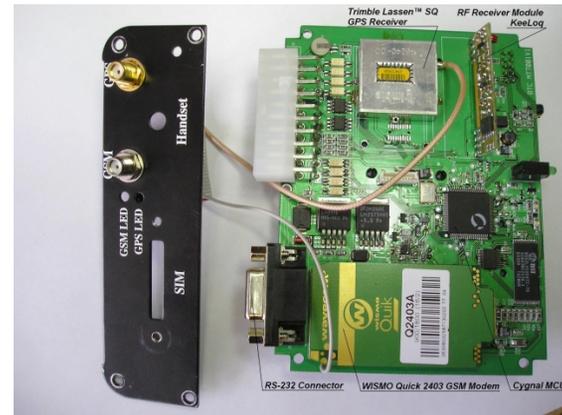
Basic requirements

- Mount to the RTG
- Extended unattended operation
- Harsh environment
- Low power consumption
- Periodic status updates
- Backup power
- Location information
- Additional alarm points



ISSUES

- Lo-jack devices are common, but not in harsh arctic environments
- RTGs are:
 - Remote
 - Harsh environments
 - Rough terrain
 - Heavy
 - Hot
 - Radioactive



Typical lo-jack device

Issues

Radiation Shielding

- Low power device » CMOS
- CMOS » radiation sensitive (total dose)
- RTGs are radioactive
 - 200 mR/h at the surface
 - 10 mR/h at one meter
- Shielding is required
- Accumulators may double as shielding



Issues Construction

- **Disassembly**

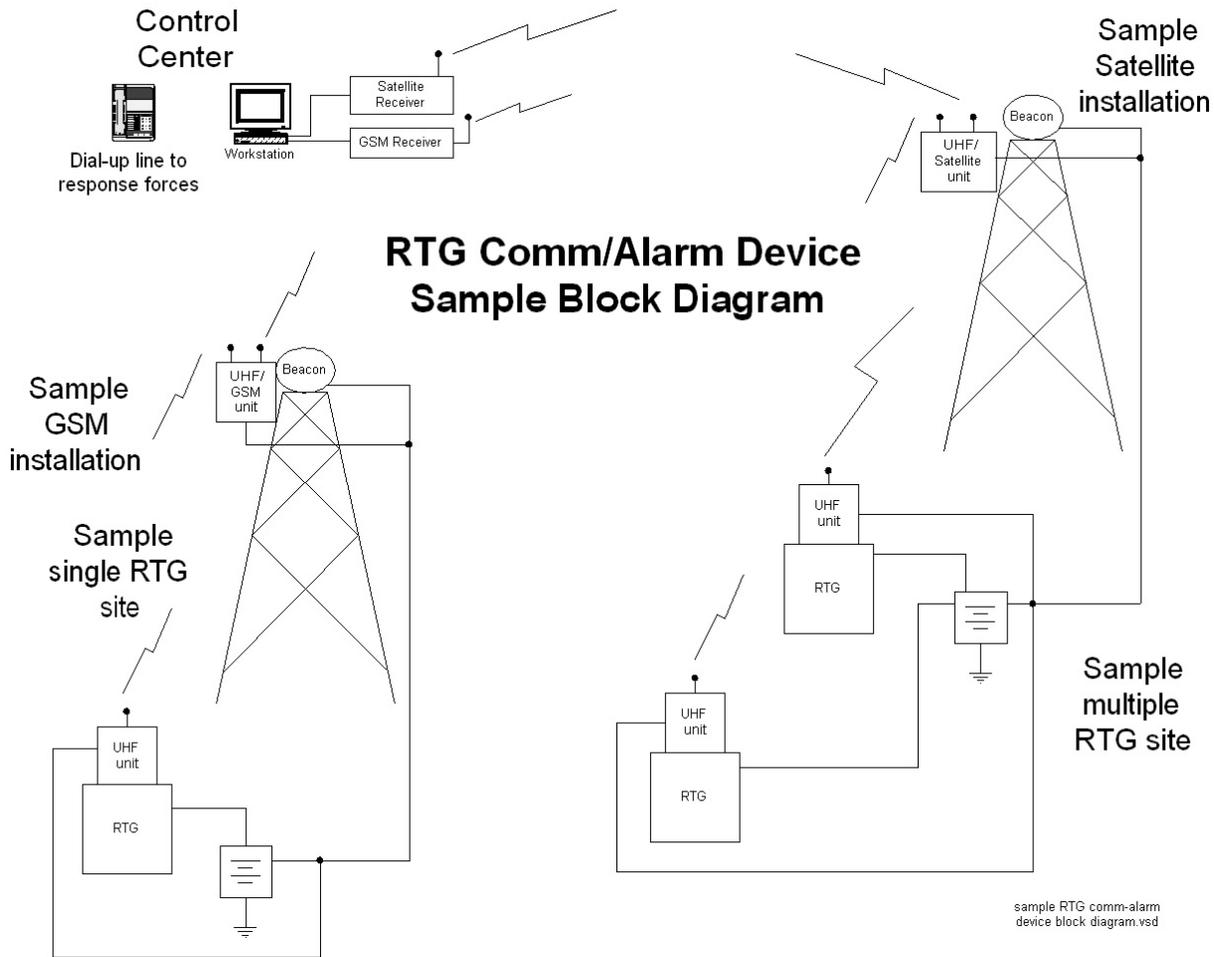
- Hard
- Medium
- Easy

- **Weight**

- Beta M, 560Kg
- IEU-1, 2500 Kg



System Architecture

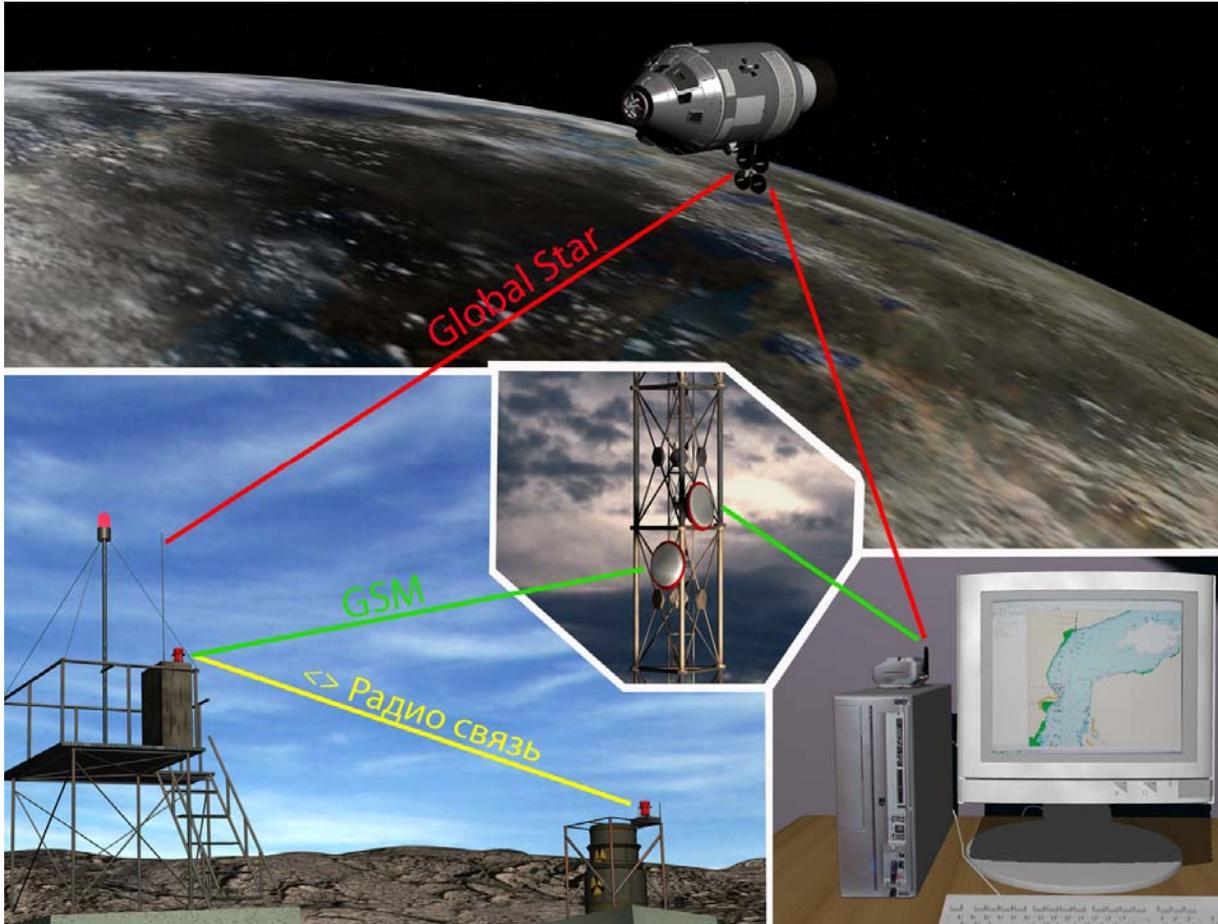


System Architecture Components

- RTG unit
 - UHF
- Tower unit
 - GSM
 - Satellite
- Control center
 - RF Modems
 - Display



System Architecture Artists Rendering



Control Centers and Response

- Alarm response are new
- Remote locations
- Large coverage area





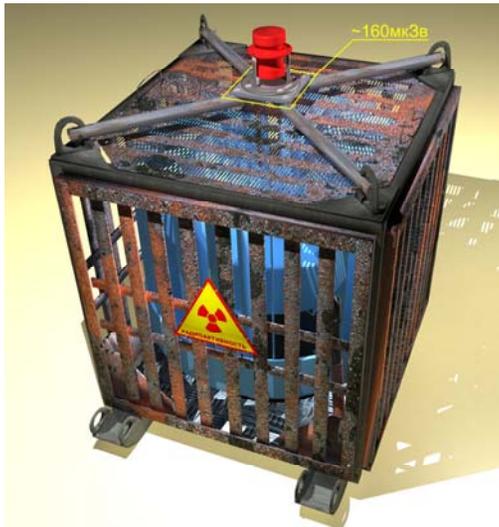
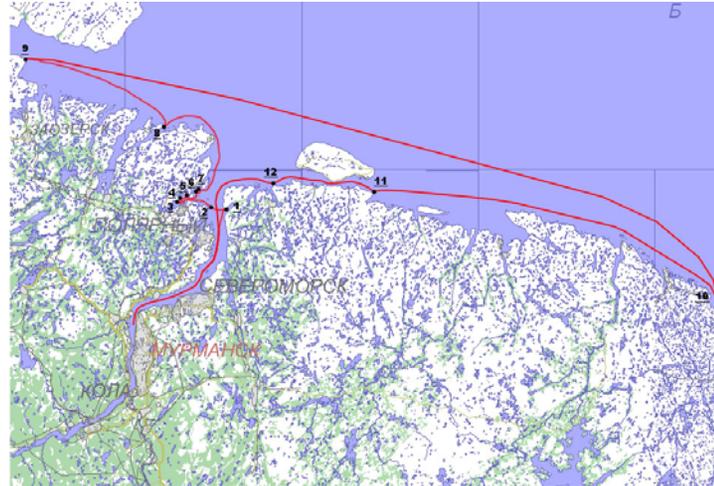
Alarms Defined

- Loss of input power
 - Lack of signal between units
 - Lack of status beacon
 - Tilt, vibration
 - Violation of alarm unit casing
 - Excessive radiation level
 - Excessive temperature change
 - Demounting from RTG
 - Change in location
-
- Combine alarms to minimize false alarms



Installation Issues

- Travel to sites
- Condition of sites
- Difference in units





Status



- **Pilot Project underway**
- **Results to date**



Conclusions

- It is possible to provide a basic level of protection to RTGs located in remote locations and improve response times from weeks or months to hours for a nominal cost.



Questions

