




  
**DEFENCE RD DÉFENSE**  
**Electronic and Software-side Solutions**  
**For LOCATES TDP**  
 (Formerly GLARES, BRILLIANT and LASSOS Projects)  
 by Philippe Bélanger, ing. M.Sc.A.  
 AEREX Avionics Inc. for DRDC-Valcartier  
 March 3<sup>rd</sup> 2009


**LOCATES**

- LTD and LBR Detection Heads (was from LASSOS for LTD)
  - Problem Description
  - Hardware-side Solution
  - Software-side Solution
  - Enhancements and Future Revisions
- Tracking Head LBR mechanism (was from BRILLIANT)
- Tracking Head Retro-reflection mechanism (was from GLARES)

Defence R&D Canada • R & D pour la défense Canada


**LTD and LBR Detection Heads (from LASSOS for LTD part)**

- Multiple sensors positioned to provide a complete view of the vessel's surroundings
- Reference sensor giving background noise threshold
- Sensor detection threshold level
- Sensor detection circuit gain control
- Precise recording of pulse events at given time and location

Defence R&D Canada • R & D pour la défense Canada

**LBR and LTD Detection Heads Solution: Brilliant Card Part**

GPS and Compass Data

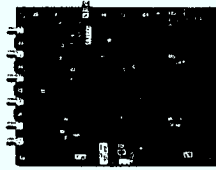
RS-232 link to PC software

Sensor Channel 1 → Sensor Circuit → Signal → Gain Control ADC Threshold

...

Sensor Channel 4 → Sensor Circuit → Signal → Gain Control ADC Threshold

Reference Sensor → Sensor Circuit → Signal → Gain Control ADC



100 MHz pulse acquisition to FPGA-based FIFO (Xilinx Spartan-3)

Pulse recording to on-board RAM (128 mb) and card configuration by Atmel microcontroller (ARM Thumb AT91RM9200, 200 MIPS at 180 MHz)

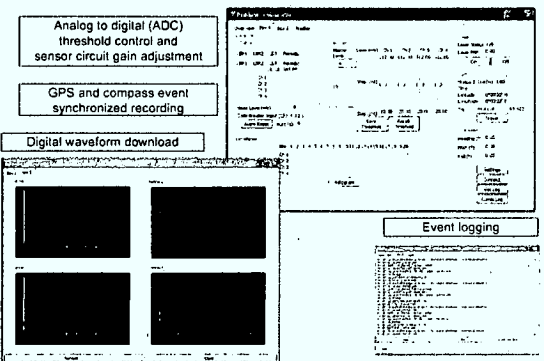
Defence R&D Canada • R & D pour la défense Canada

**LBR and LTD Detection Heads Solution: PC Software-side**


Analogue to digital (ADC) threshold control and sensor circuit gain adjustment

GPS and compass event synchronized recording

Digital waveform download



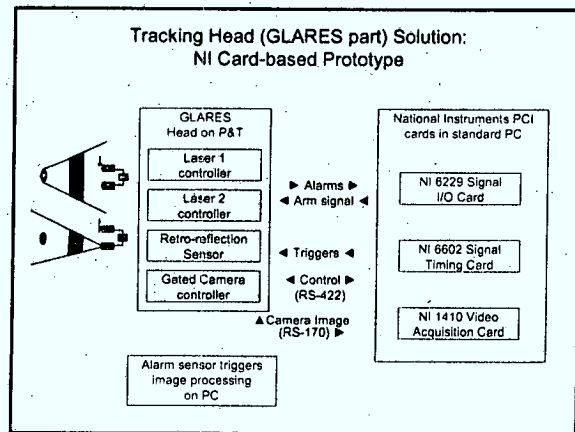
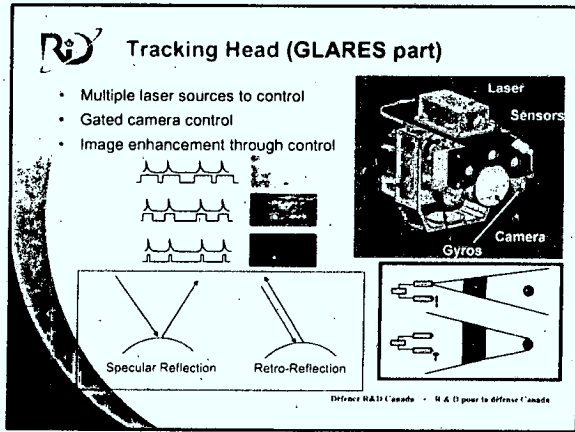
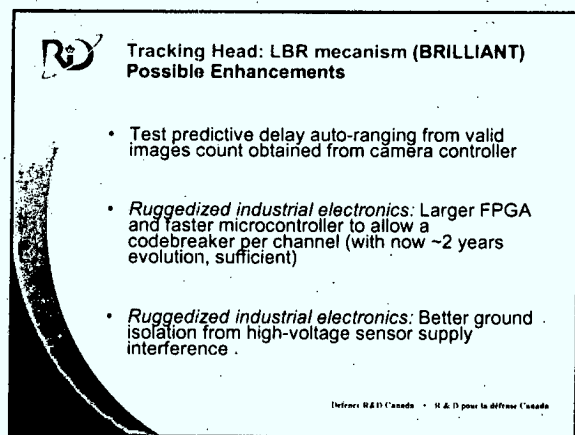
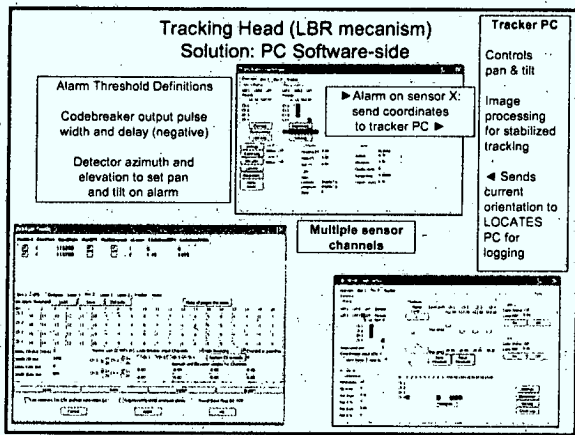
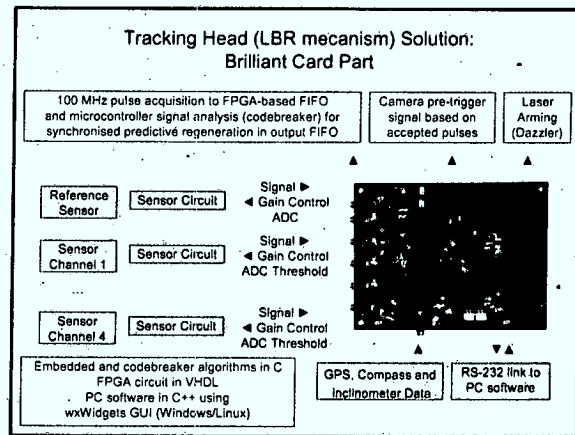
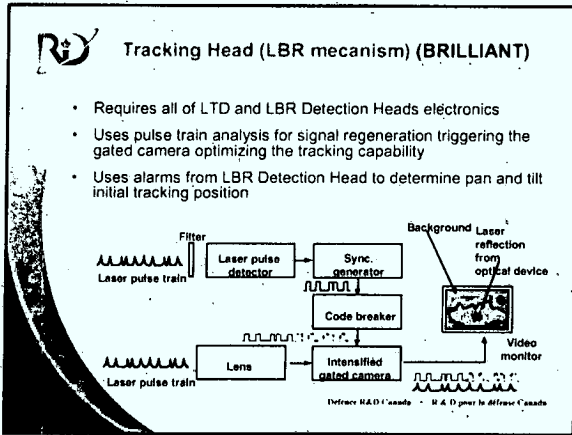
Defence R&D Canada • R & D pour la défense Canada

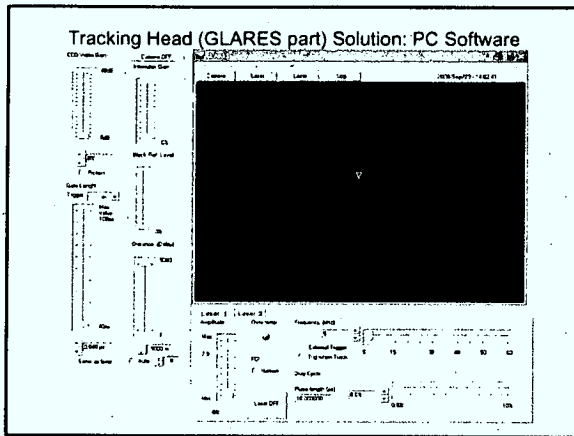

**LTD and LBR Detection Heads (vs LASSOS for LTD) Enhancements**

- Support for different type of sensors
- Opto-coupler configuration optimization to avoid detector circuit perturbation when controlling gain
- *Ruggedized industrial system* would have detector gain on same electronic board instead of additional circuits

Defence R&D Canada • R & D pour la défense Canada

# 531907





**Tracking Head: Retro-reflection mechanism (GLARES part) Enhancements**

- Automatic scene enhancement using region auto-selection and parameter optimization iterations
  - Distance ranging for optimal camera gate delay
  - Gate width based on laser gate width and background noise accepted
  - Maximal camera gains (CCD and intensifier) acceptable for good signal/noise ratio
  - Laser pulse repetition frequency for current target

Defence R&D Canada • R & D pour le défense Canada

**Tracking Head: Retro-reflection mechanism (GLARES) 2<sup>nd</sup> Revision**

*Ruggedized industrial electronic cards: FPGA-based reconfigurable timers and triggers for maximum integration.*

Requires only simple I/O routing to replace NI prototype. PC software shall then send messages to BRILLIANT PC application which will be rerouted to the LOCATES card.

Defence R&D Canada • R & D pour le défense Canada

**Conclusion : LOCATES Prototype Implementation - Work in Progress**

- LTD and LBR Detection Heads (LANSON)
  - Work mostly on sensor selection, support and optimization
- Tracking Head: LBR mechanism (BRILLIANT)
  - Mature
  - More integration with revised industrial electronics
- Tracking Head: Retro-reflection mechanism (GLARES)
  - Image processing and optimization work

**AEREX**  
Defence R&D Canada • R & D pour le défense Canada