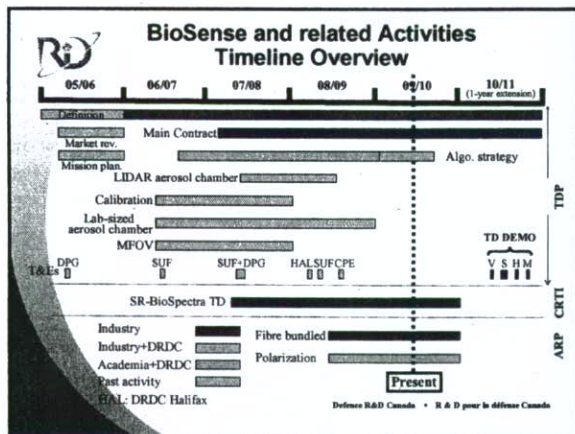


Plan of the Presentation

- Overall Schedule Overview
- BioSense updates
 - ✓ Objectives review and Milestones
 - ✓ Main contract
 - ✓ Lab-size bioaerosol chamber
 - ✓ TD performance indicators
 - ✓ TD demonstrations schedule
 - ✓ Special request for a participation to a JBSDS trial
- SR-BioSpectra updates
 - ✓ Objectives and Schedule
 - ✓ Alpha T&E results
 - ✓ Beta T&E preparation

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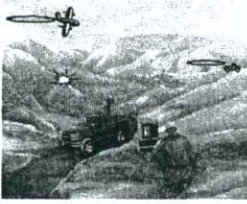


TD Program

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BioSense TDP

- Lidar Cloud mapping (NIR) followed by spectral LIF confirmation (UV)
- Wide area/low concentration Autonomous surveillance;
- DTED based user mission planning;
- Manual investigation of externally triggered events;
- >75 km² monitored by single unit (5 km maximum range);



Identified performance parameters (in brief):

- Sensitivity: < 20 ACPLA at 1 km (4σ, BG, 3 μm, 10 m);
- False Alarm rate: < 1 False Alarm per week;
- Ease of deployment in complex terrain;

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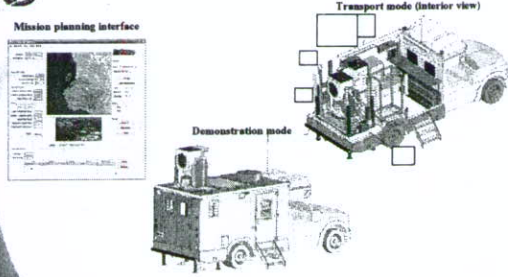
Milestones (BioSense TDP)

Milestones	Event	Completion Date
1	Project definition begin	May 2005
2	Project implementation begins	Apr 2006
3	Main contract begins	May 2007
4	Critical Prototype Evaluation	24-28 Nov08
5	System delivered	Jul 2010
6	System evaluation completed	Dec 2010
7	Project completed	Mar 2011

CF Sponsors: Director of CBRN Defence Development

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BioSense System



Mission planning interface

Transport mode (interior view)

Demonstration mode

• BioSense System developed under single main contract (MDA with INO/Davtair subcontractors)

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Main contract

Objective:

- Construct the BioSense System;

Status:


- Contract awarded on May 23, 2007;
- IPR (June07), PDR (Sept07) and CDR (Apr08) held with success;
- Overruns (25%) has required a contract stop work order (Oct08) that has created a 10-month delay in the contracted work progression schedule;
- Contract amendment negotiated, awaiting HQ green light for announcement and continue contract work (expect contract restart mid-September).

Highlights:

- Important fraction of overruns results of JP Innovations, LLC failure to deliver BioSense main laser;
- Other fraction of overruns results from underestimated efforts in purchasing/integrating lidar optics and the scanner construction.

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Lab Size volume LIF aerosol chamber



Objectives:

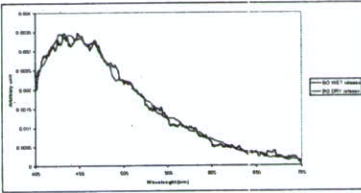
- Better understanding aerosol LIF spectral properties;
- Demonstrate spectrometric correlation between laboratory chamber and open-air results;
- Accelerate and reduce cost of spectral fluorescing library build-up.

- Aerosol chamber development in partnership with Laval University (DRDC co-directed PhD student);
- Chamber delivered at Valcartier by April 09;
- Activity conducted by Dr. Christian Laflamme/Dr. Jean-Robert Simard
- PostDoc fellow (microbiologist) has joined DRDC Valcartier (Dec08) to pursue lab chamber work for up to 3 years in collaboration with Laval Hospital;

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Lab-size aerosol chamber: Preliminary results

Example of signature comparison of *Bacillus globigii* (BG) : Wet vs Dry release



- Spectra smoothed and normalized (results from a few minutes integration)
- Aerosol mean size distribution around 1 µm (wet and dry)
- Equivalent wet and dry BG signatures (within measurement noise uncertainty)
- Confirmed previous observations of BG (Dry and Wet) obtained in open-air trial

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Lab-size aerosol chamber: Questions of interest (next activities)

- **What are the effects of culture media and washing on the spectral LIF signature ?**
 - ✓ Signatures of BG growth with Nutrient broth (NB), Tryptic soy broth (TSB), Brain and heart infusion (BHI), ...
- **Does the physiological state of the bacteria have an influence on the spectral LIF signature ?**
 - ✓ Spore vs vegetative cells;
 - ✓ Comparison between BG spore, log (vegetative), post-log (vegetative-a few days old).

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TDP Performance Parameters

- Sensitivity**
 - <20 ACPLA at a range of 1 km (4σ, BG, 3 µm, 10 m)
 - Characterized with Lidar adapted bioaerosol chamber
- False Alarm Rate**
 - <1 FA per week (vs sensitivity)
 - Based on background clutter acquisitions (resulting from extensive background monitoring)
 - Derive ROC (Receiver Operating Characteristics);
- Ease of Deployment/Surveillance in Diverse Terrains**
 - User efficiency to plan mission (with user's mission planning program);
 - Deployment performance (vs time/adequacy);
 - Surveillance mapping/staring stability vs time;
 - Human manual intervention/investigation efficiency
- Performance vs specific operational scenarios**
 - Blind aerosol releases (to evaluate the probability of detection);
 - Combined standoff and point biodetector dynamics (TBC);
 - Battlefield related scenarios (moving platforms, explosions,...);

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Tentative T&E Trial Sites and Durations

- Hilly environments (2 weeks)**
 - DRDC Valcartier (tentatively: July 2010);
 - Anticipated Tasks:** early debugging, background clutter characterization, ease of mission planning/deployment/surveillance, human manual interventions, blind releases, battlefield related scenarios.
- Plain environments (4 weeks)**
 - DRDC Suffield (tentatively: Aug/Sep 2010);
 - Anticipated Tasks:** main sponsor demonstration - VIP day, sensitivity, background clutter characterization, ease of mission planning/ deployment/surveillance, human manual interventions, blind releases, battlefield related scenarios.
- Maritime environments (2 weeks)**
 - NESTRA range, Osborn Head, NS (tentatively: Oct 2010);
 - Anticipated Tasks:** background clutter characterization, ease of mission planning/deployment/surveillance, human manual interventions, blind releases, battlefield related scenarios.
- Urban environments (2 weeks)**
 - CFB Longue Pointe, Montreal (tentatively: Nov 2010);
 - Anticipated Tasks:** Background clutter characterization, ease of mission planning/deployment/surveillance, human manual interventions.

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Trial Opportunity Requests

Mandate:

- Evaluate BioSense System under Afghanistan like weather;
- Special request from Chair/CAN TD Program.

Requests:

- Initiate discussion with US SBWG national leader;
- Identify possible trial opportunity;
- Obtain authorisation to participate/contribute to the selected trial;
- Provide logistic information for the trial preparation.

Challenge:

- Identify a JBSDS trial that is compatible with BioSense Development /Evaluation schedule;


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SR-BioSpectra Public Security effort (CRTI TD)

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Objectives

Detect/classify bioaerosol events in enclosed, semi-enclosed and wide open spaces

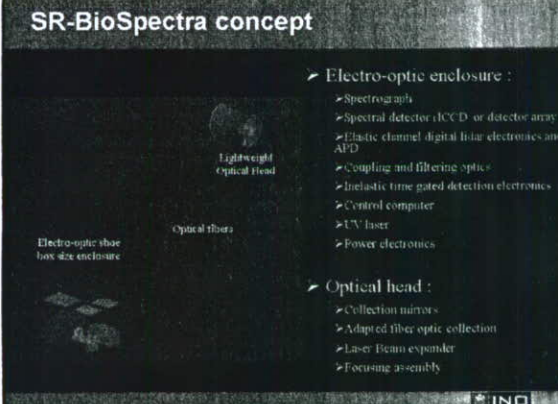


- Targeted infrastructures: stadium, subway, airport,...
- Limited cloud mapping (multiple air volumes probing)
- Several sensors networked under same C2 unit
- Below 1000 ACPLA sensitivity up to 100 metres
- Shoe-box size device / <\$50k
- Duration: 2 years

Partners: DRDC Valcartier, DRDC Suffield, INO, MDA, Telops;
First Responders: 'Comité Aviseur de la Ville de Montréal (CAAM)', Workplace Health and Public Safety Programme, 'Sûreté du Québec'.

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SR-BioSpectra concept



Electro-optic enclosure :

- Spectrographs
- Spectral detector (CCD or detector array)
- Elastic channel digital filter electronics and A/D
- Coupling and filtering optics
- Inelastic time gated detection electronics
- Control computer
- UV laser
- Power electronics

Optical head :

- Collection mirrors
- Adapted fiber optic collection
- Laser Beam expander
- Focusing assembly

INO

Milestones (2-year TD)

Event	Completion Date
Project Approval-in-principle	June 15 2007
Project Charter and Signatures Completed	21 September 2007
PWGSC Contract Awarded	26 February 2008
Project Implementation Begins	26 February 2008
Project Kick-off	18 March 2008
System requirements and architecture	18 June 2008
Alpha design review	18 June 2008
Alpha prototype	November 2008
Alpha T&E	15 December 2008
Beta design review	7 April 2009
Beta prototype	August 2009
Beta T&E	28 Sep - 9 Oct 2009
Project Close Out Report	March 2010
Project Complete	March 2010

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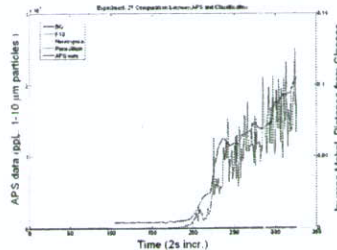
Alpha T&E Results: Final (1/2)

- Current analysis is not using spectral information for separating BG spectra from background spectra. Only the derivation of sensitivity limits (worst cases) is targeted.
- Current analysis for anthrax simulant "BG", 1 µm size particles, dry release.
 - 992 and 1144 ppL at 100 m (Goal <1000 ppL)
- For BG of 3 µm size as is usual for wet releases, signal will be 9 times higher for the same number of particles and the sensitivity requirement will easily be met.
- Stray light in the spectrometer is increasing the background level. Sensitivity can be further improved for the Beta prototype.
 - Two solutions have been identified and have been implemented



Alpha T&E Results: Final (2/2)

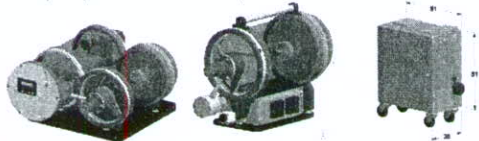
- Large number of detection channels and spectral exploitation algorithm allow classification of bioagents
- Classification can be an efficient way of reducing the false alarm rate



Progress of the Beta prototype

- Beta prototype improvements:
 - Optical head is 60% of original volume (64cm x 30cm x 40cm)
 - Optical head is 71% of original weight (25 kg)
 - Enclosure is 23% of original volume (51cm x 51cm x 28cm)
 - Sensitivity improved by optimizing the spectrometer
 - Sensitivity improved by using a different PMT

Alpha optical head Beta optical head Beta enclosure



Preliminary Beta T&E (Valcartier)

- Dissemination performed with the DRDC Valcartier Environment Chamber (3-4 August 2009)
- Objectives
 - ✓ Beta prototype first outdoor trial in preparation of Beta main T&E at DRDC Suffield
 - ✓ Initial experimental evaluation of Beta prototype projected sensitivity
- Referee Sensors: APS and quantitative volumetric analyses
- Trial plan:
 - ✓ Release wet/dry BG (sensitivity reference)
 - ✓ 100 m range
 - ✓ Deploy a small eye-safe cloud mapping lidar to evaluate disseminated cloud spatial homogeneity (may be deployed at Suffield).



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Beta T&E (Suffield) : Test Plan

- When: Sept. 28 to Oct. 9 2009 (10 nights)
- Objectives:
 - ✓ Demonstrate 1000 ACPLA sensitivity (BG, 4µ) at a range of 100 m;
 - ✓ Populate spectral library with simulants of biological agents.
- Referee Sensors: APS, Slit Samplers array, C-FLAPS, High volume liquid impinger.
- VIP day during second week of trial (US and UK invited):

Schedule

Date	Release Type	Distance	Source	Source	Release Level	Method	Max number of Releases
28-Sep (Sat)	Chamber	30m	F18	1802	1700-2100	BG	12
29-Sep	Chamber	30m	F20	1808	1700-2100	BG	12
30-Sep	Chamber	100m	F21	1803	1700-2100	BG	12
01-Oct	Chamber	100m	F22	1800	1700-2100	BG	12
02-Oct	Chamber	100m	F26	1854	1400-2200	BG	12
Small Test - Observers and First Referee Test							
03-Oct	Chamber	30m	F20	1801	1700-2100	BG	12
04-Oct	Chamber	30m	F21	1800	1700-2100	MEI	12
07-Oct	Chamber	30m	F20	1847	1700-2100	OV	12
08-Oct	Chamber	100m	F24	1845	1700-2100	BG	12
09-Oct (Sun. VIP)	Chamber	100m	F26	1843	1400-2200	MEI	12

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Questions ?

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