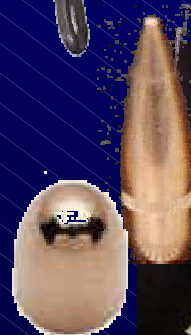


The Tekne Group, Inc.
Bosik Consultants Limited, Ottawa



Royal Canadian
Mounted Police

JOINT U.S. AND CANADIAN DEVELOPMENT OF TESTING PROCEDURES FOR EVALUATION OF PERSONAL BODY ARMOR PERFORMANCE AGAINST AUTOMATIC WEAPONS



Joint Services Small Arms Systems
Annual Conference
Little Rock, AR
August 2001

Steven L. Lightsey, The Tekne Group, Inc.
Anthony J. Bosik, Bosik Consultants Limited

Report Documentation Page

Report Date 13Aug2001	Report Type N/A	Dates Covered (from... to) -
Title and Subtitle Joint U.S. and Canadian Development of Testing Procedures for Evaluation of Personal Body Armor Performance Against Automatic Weapons	Contract Number	
	Grant Number	
	Program Element Number	
Author(s) Lightsey, Steven L.; Boskik, Anthony J.	Project Number	
	Task Number	
	Work Unit Number	
Performing Organization Name(s) and Address(es) The Tekne Group, Inc. Bosik Consultants Limited, Ottawa	Performing Organization Report Number	
Sponsoring/Monitoring Agency Name(s) and Address(es) NDIA (National Defense Industrial Association) 211 Wilson Blvd, STE. 400 Arlington, VA 22201-3061	Sponsor/Monitor's Acronym(s)	
	Sponsor/Monitor's Report Number(s)	
Distribution/Availability Statement Approved for public release, distribution unlimited		
Supplementary Notes Proceedings from the 2001 Joint Services Small Arms Symposium, Exhibition & Firing Demonstration 13-16 August 2001 Sponsored by NDIA, The original document contains color images.		
Abstract		
Subject Terms		
Report Classification unclassified	Classification of this page unclassified	
Classification of Abstract unclassified	Limitation of Abstract UU	
Number of Pages 12		

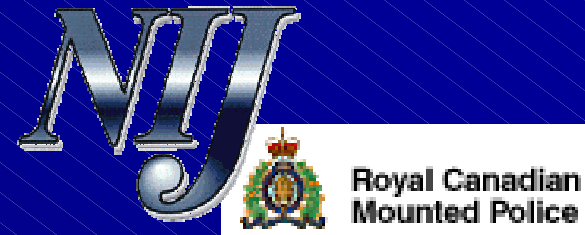
PROGRAM PARTICIPANTS



- **JOINT U.S. AND CANADIAN STANDARDS DEVELOPMENT**
 - **DOJ NATIONAL INSTITUTE OF JUSTICE (DOJ/NIJ)**
 - *OFFICE OF SCIENCE & TECHNOLOGY*
 - MS. WENDY HOWE, PM STANDARDS AND TESTING
 - *NIST OFFICE OF LAW ENFORCEMENT STANDARDS (OLES)*
 - MR. KIRK RICE
 - MR. STEVEN LIGHTSEY

 - **CANADIAN POLICE RESEARCH CENTER (CPRC) RCMP**
 - *DEFENCE RESEARCH ESTABLISHMENT VALCARTIER (DREV)*
 - MR. GILLES PAGEAU
 - *ROYAL MILITARY COLLEGE (RMC)*
 - JOSEE MAILLETTE
 - *BOSIK CONSULTANTS LIMITED (BCL)*
 - ANTHONY BOSIK

BODY ARMOR STANDARDS



➤ BACKGROUND

- **NIJ STANDARD-0101.04**
 - *25+ YEARS OLD*
 - *FIRST BODY ARMOR STANDARD FOR LAW ENFORCEMENT*
 - *SIX SINGLE HITS PER PANEL*

- **CANADIAN GENERAL STANDARDS BOARD (CGSB) 179.1**
 - *NEWLY ADOPTED IN 2001*
 - *BASED ON NIJ STANDARD*
 - *OPTIONAL MULTI-HIT PROCEDURE (SPACING AND PATTERN)*

- **prEN ISO 14876 PARTS 1 & 2**
 - *IN RATIFICATION PHASE*
 - *BASED ON NIJ STANDARD*

SINGLE VS MULTIPLE IMPACTS



➤ SINGLE HIT

▪ ISOLATED WITH RESPECT TO TIME BETWEEN IMPACTS

- *ONE ROUND PER TRIGGER PULL*
- *TIME INTERVALS BETWEEN IMPACTS - SECONDS OR LONGER*
- *INDIVIDUALLY AIMED*

▪ NIJ STANDARD, OTHERS, BASED ON SINGLE HIT, MULTIPLE TIMES

- *AUTOMATIC WEAPONS BECOMING MORE PREVALENT AS LE THREAT*
- *OFFICER WEAPONS AND ASSAILANT WEAPONS*
- *TACTICAL AND DUTY ENVIRONMENTS*

➤ MULTIPLE (MULTI) HIT

▪ GROUPED WITH RESPECT TO TIME BETWEEN IMPACTS

▪ CONTROLLED BURSTS OR FULL AUTOMATIC FIRE

- *TIME INTERVALS IN MILLISECONDS*
- *LESS CONTROLLED FOR AIM, THUS IMPACT SPACING/PATTERN*

RESEARCH PROGRAM

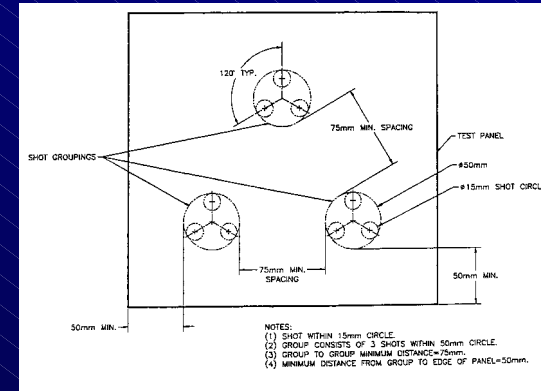
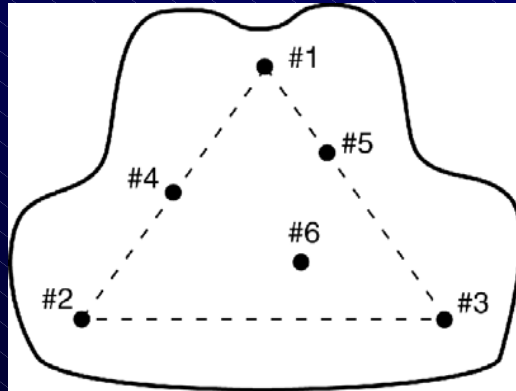


Royal Canadian
Mounted Police

➤ DEVELOP TEST METHODS AND PROCEDURES

▪ TRUE MULTI-HIT IMPACTS

- *TIME RESOLVED FOR AUTOMATIC RATES OF FIRE*
- *REPRESENTATIVE SHOT SPACING AND PATTERNS*



▪ STANDARDIZED LABORATORY METHODS AND EQUIPMENT

- *CONSISTENT, AFFORDABLE*
- *VALIDATED METHODS, EQUIPMENT, PROCEDURES*
- *POTENTIAL FOR INCLUSION IN FUTURE NIJ AND CGSB*

PROGRESS



➤ AUTOMATIC WEAPONS

▪ IDENTIFICATION AND SELECTION

- *RMC LED EFFORT*
 - DRAFT REPORT IN REVIEW – FINAL EXPECTED IN FALL 2001

▪ CLASSED BY BARREL LENGTH

- *APPROXIMATELY 6 IN. OR LESS (MACHINE PISTOLS)*
- *APPROXIMATELY 6 TO 12 IN. (SUBMACHINE GUNS)*
- *APPROXIMATELY 12 IN. OR LONGER (ASSAULT RIFLES)*

▪ COMPARISONS MADE BY

- *CALIBER*
- *NOMINAL VELOCITY AND KINETIC ENERGY*
- *RATE OF FIRE*
- *ORIGIN, FIRING DESIGN/MECHANISM NEGLECTED*



**Royal Military
College of Canada**

WEAPONS SELECTION



Royal Canadian
Mounted Police

- ACQUISITION OF WEAPONS FOR STUDY (RMC)
 - AVAILABILITY BASED – CANADIAN SOURCES



*Skorpion Model 61
Ingram MAC-10*



*Beretta 38A
H&K MP-5
Sterling
SMG*



*M4
Carbine
C7A1
AK-47
C2*

WEAPONS CHARACTERIZATION



Royal Canadian
Mounted Police

➤ ATTRIBUTES MEASURED

▪ BALLISTICS

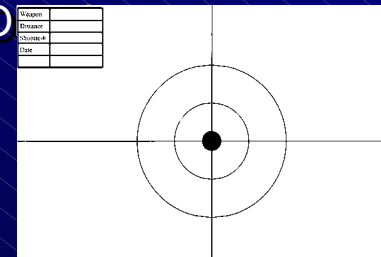
- *VELOCITY*
- *RATE OF FIRE*
- *BURST AND FULL AUTOMAT*

▪ IMPACT BALLISTICS

- *AIMED BURST IMPACTS (3 SHOT BURSTS)*
- *SNAP FIRED BURST IMPACTS (3 AND 9 SHOT BURSTS)*
 - *SHOULDER, AIM, FIRE IN LESS THAN 2 SECO*
- *5 METER (16.4 FT) RANGE*



Name	
Address	
Station	
Date	



SHOOTER INFLUENCES



- TYPED USING PRESCRIBED PROTOCOL
 - FAMILIARIZATION – 3 BURSTS OF 3 SHOTS AT 5 M
 - AIMED BURSTS – 3 SHOT BURST AT 5 M
 - SNAP BURSTS – 3 AND 9 SHOT BURSTS AT 5 M

- CLASSIFIED BY RESULTS AS
 - EXPERT
 - EXPERIENCED
 - INEXPERIENCED

- CHARACTERIZATION
 - EACH WEAPON
 - EACH CLASS OF SHOOTER

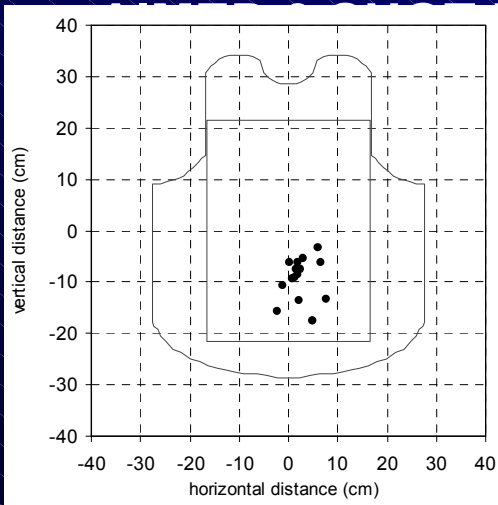


SAMPLE IMPACT BALLISTICS

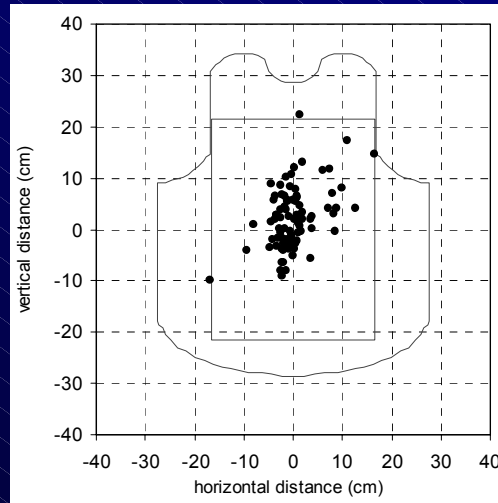


➤ COMPOSITE IMPACT LOCATIONS OF ALL SHOOTERS

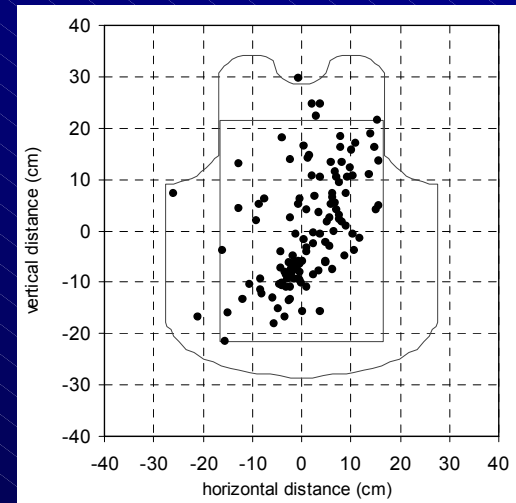
BURSTS AT 5 M



SKORPION



MP 5



AK-47

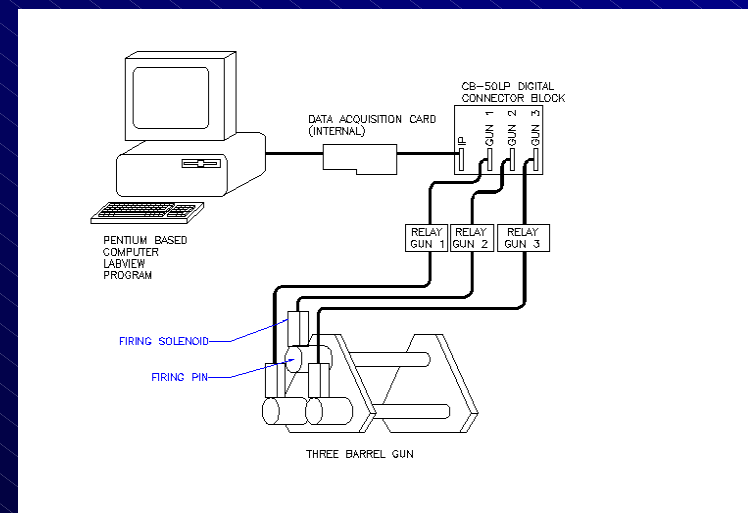
LABORATORY SIMULATION



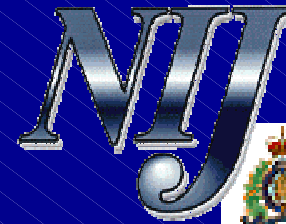
Royal Canadian
Mounted Police

➤ BCL 3-BARREL TEST FIXTURE

- DEVELOPED FOR CGSB 3 SHOT IMPACT GROUP
- TEST BARRELS – SELECTION OF CALIBERS, LENGTHS, TWISTS
- SHOT SPACING AND PATTERN CONTROLLED
- RATE OF FIRE CONTROLLED BY PC/SOFTWARE



CONCLUSION



Royal Canadian
Mounted Police

➤ PRELIMINARY RESULTS SHOW

▪ SHOT SPACING MAY BE CLOSER THAN USED IN CURRENT TESTS

- *EQUILATERAL VERSUS ASYMMETRIC SPACINGS*

▪ SHOT PATTERNS IN GENERAL REFLECT

- *TRIANGULAR SHAPES (EQUILATERAL AND ASYMMETRIC)*
- *STRAIGHT LINE EQUAL AND VARIABLE DISTANCES*

▪ TIME BETWEEN IMPACTS CRUCIAL WITH RESPECT TO

- *ARMOR RESTRAINT ON TEST FIXTURE*
- *BACKING MATERIAL ELASTIC RESPONSE*



➤ FINAL WEAPONS SELECTION

▪ MP5 SUBMACHINE GUN (9 X 19 mm Parabellum)

▪ INGRAM MAC 10 MACHINE PISTOL (.45 caliber ACP)

▪ BASED ON RATE OF FIRE, ACCURACY, CALIBER/ENERGY

- *CONSERVATIVE CHOICES WITH RESPECT TO SEVERITY OF THREAT TO ARMOR*