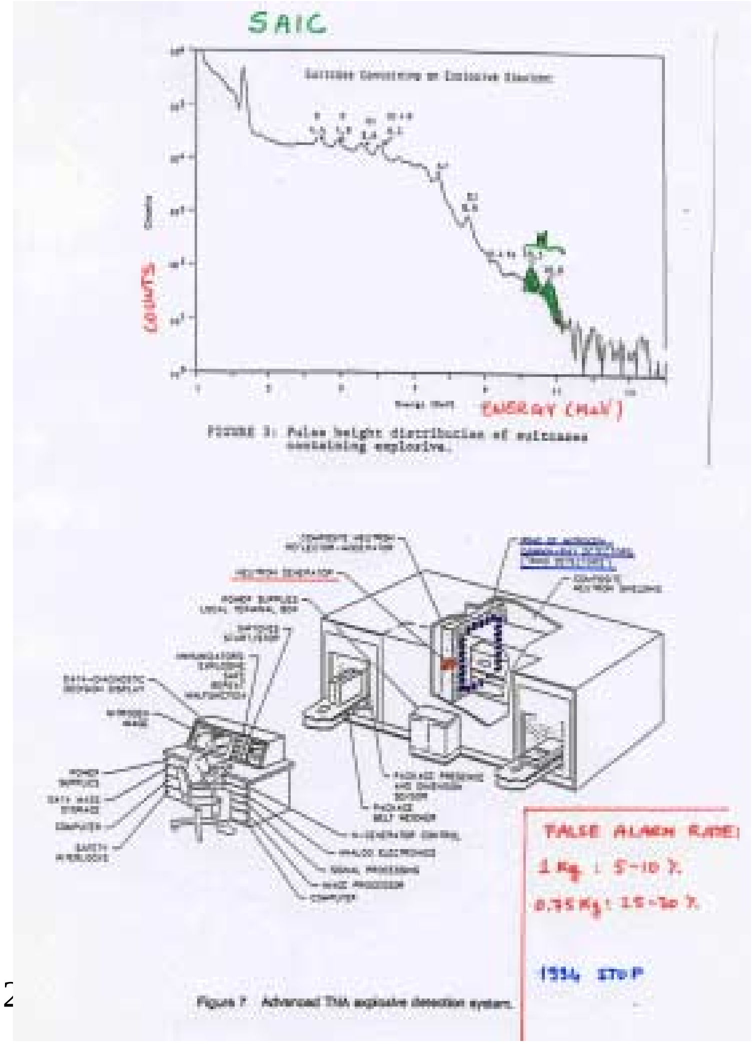
Sicurezza Aeroportuale

Sistema basato sulla cattura
Di neutroni termici in azoto
 utilizzato dalla SAIC
a scopo sperimentale in aeroporti
USA all’ inizio degli anni 90



Rivelazione di droghe

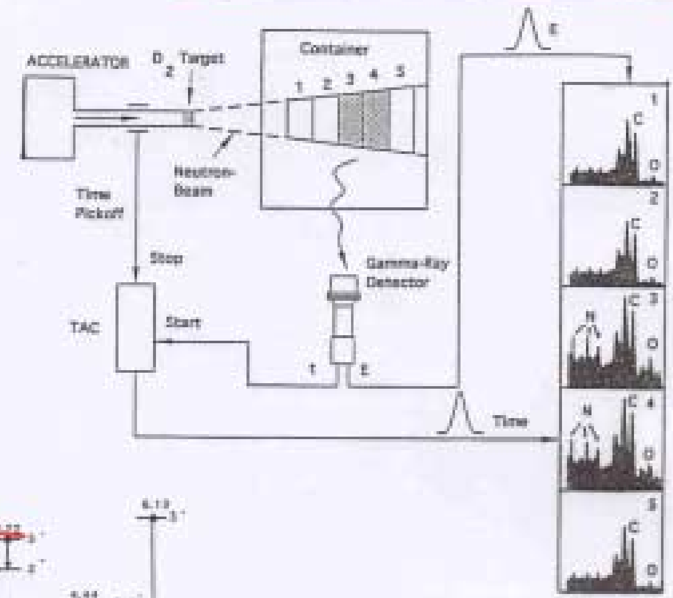
Method	Advantages	Disadvantages
	Analysis of vapors	
-using specially trained dogs	High sensitivity, long history of use	Expensive training, impossible to detect sealed or masked narcotics
-using electronic methods for vapor analysis	High sensitivity	Impossible to detect sealed narcotics, need to recover after series of measurements
	Nuclear methods	
-using nuclear magnetic resonance	Can detect sealed narcotics	Large size and weight of magnet, impossible to detect narcotics in metal coating
-irradiation with fast neutrons and registration of secondary gamma-rays	Can detect sealed narcotics, including those enclosed in metal coating	Need to use strong neutron sources to get required effect/background ratio

Narcotic	C	O	N	H
Heroine	68	22	4	6
Cocaine	67	21	5	7
Morphine	71	17	5	7
LSD	74	5	13	8

Pulsed Fast Neutron Analisys:
Z.P. Sawa NIM B99 (1995)

PFNA

Pulsed Fast Neutron Analysis



$E_n \leq 8$ MeV

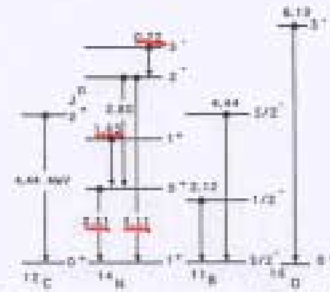


Fig. 2. The strong gamma-ray transitions in ^{12}C, ^{14}N, ^{11}B (due to the $^{14}N(n,\alpha\gamma)^{11}B$ reaction, and ^{16}O, induced by fast neutrons of $E_n \leq 8$ MeV.

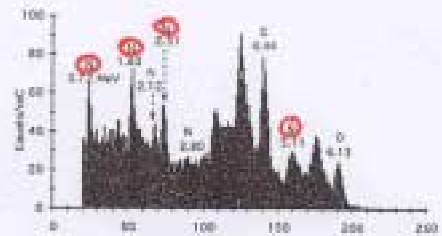


Fig. 3. The gamma-ray energy spectrum measured with a Ø 7.6 × 7.6 cm NaI(Tl) detector for a small sample of simulant of the C-4 explosive. The fingerprint lines of ^{16}O (6.13 MeV), ^{12}C (4.44 MeV), and ^{14}N (0.72, 1.63, 2.12, and 2.31 MeV) are indicated. Also indicated is the weak 2.80 MeV line associated with ^{14}N. The 5.11 MeV line of ^{14}N coalesces with the second escape peak of the 6.13 MeV ^{16}O-line.

V

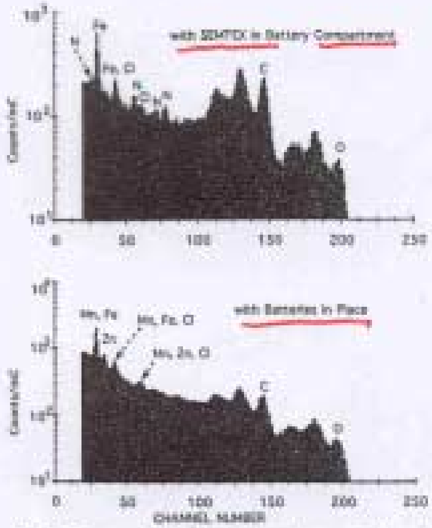


Fig. 5. The gamma-ray energy spectra for a portable radio receiver with tape recorder. In the upper spectrum, the battery compartment of the radio receiver was partially filled with a simulant of Semtex. In the lower spectrum, the batteries were reinstalled. Note the fingerprints of the batteries: the lines of Mn, Zn (and Cl).

Simulazione di attentato: esplosivo SEMTEX nel comparto batterie di una radio

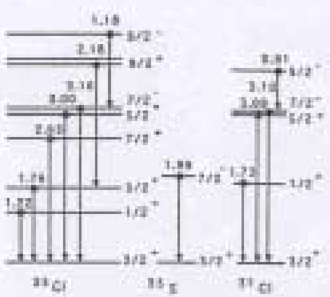


Fig. 6. The strong gamma-ray transitions in ^{35}Cl (75%), ^{35}S (due to the $^{35}Cl(n,p\gamma)^{35}S$), and ^{37}Cl (25%).

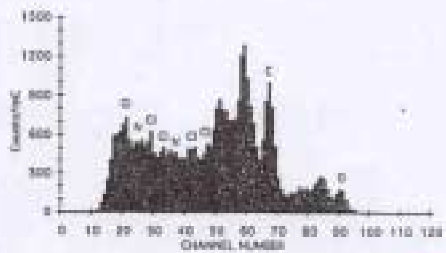


Fig. 7. The gamma-ray energy spectrum for ~600 g of cocaine hydrochloride measured with a Ø 7.6×7.6 cm NaI(Tl) detector.

Spettro gamma di un campione di cocaina

Sistema di scanning
per containers da utilizzarsi
in ambito aeroportuale

D.R. Brown, T. Gozani / Nucl. Instr. and Meth. in Phys. Res. B 99 (1995) 753–756

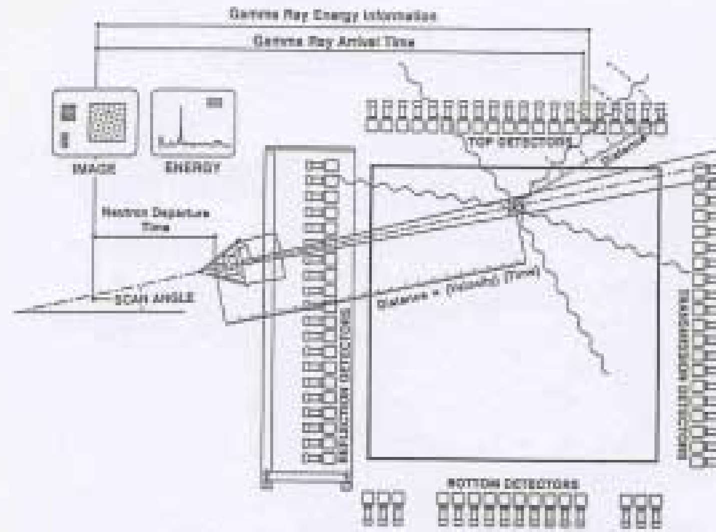


Fig. 1. Schematic view of the cargo inspection system based on PFNA.

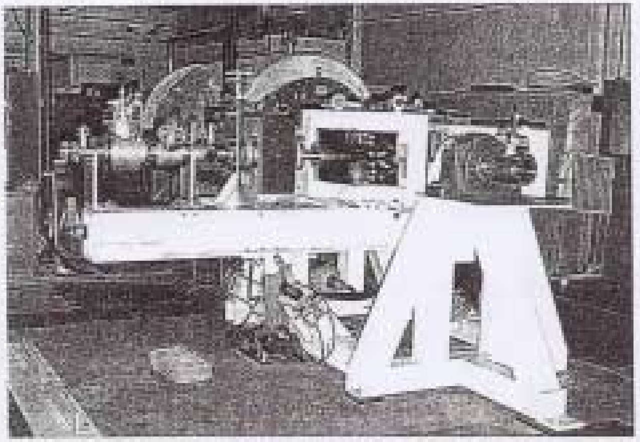


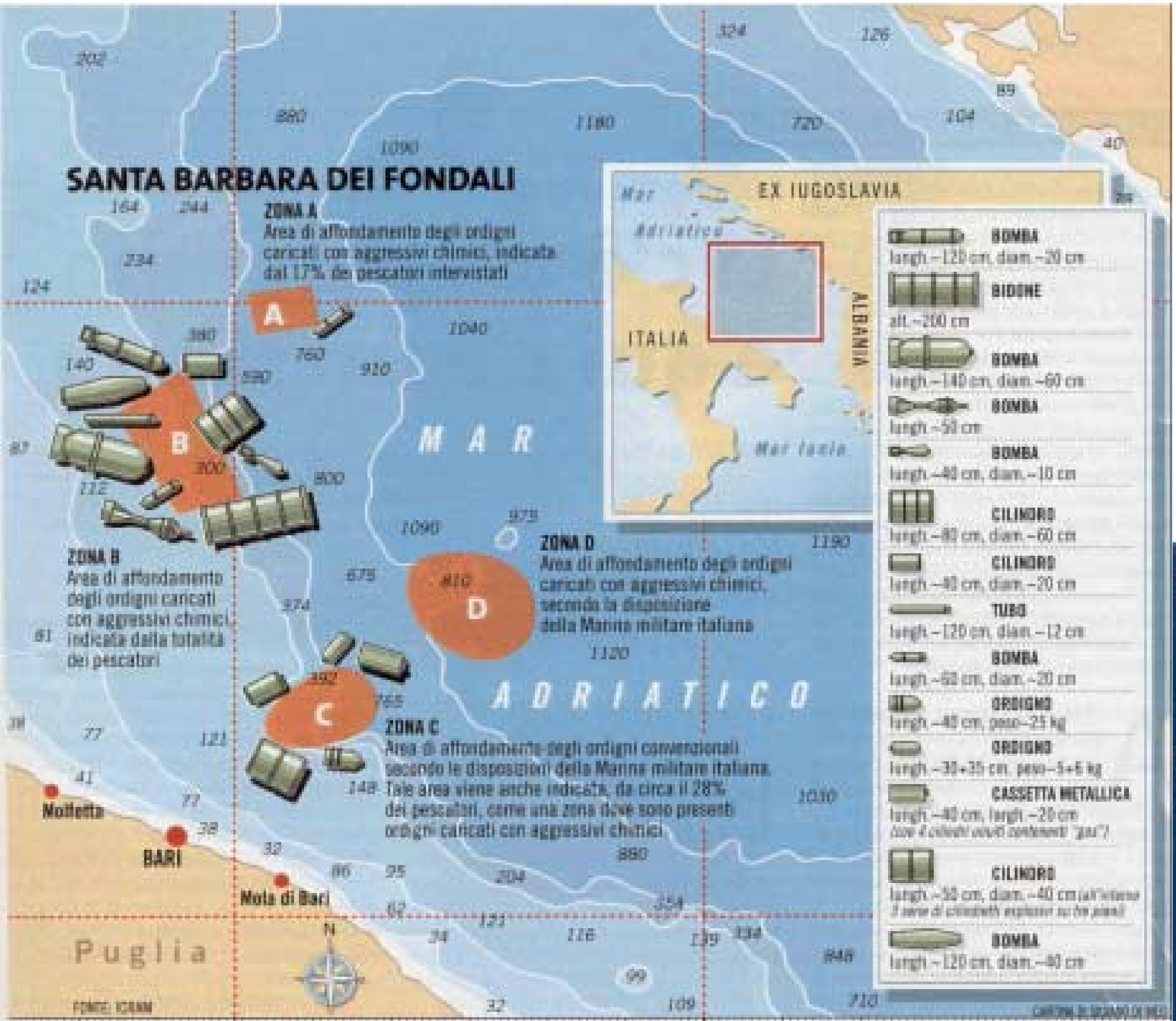
Fig. 2. PFNA scan arm which rotates beam line and neutron production target through ± 27° from horizontal. Two positions of the variable collimator are shown.

SISTEMA PFNA SAIC : FINANZIAMENTI DOD: 21 M$ DAL 1991

COSTO PREVISTO SISTEMA FINALE:

5 ML$ 5 CONTAINERS - ORA

L' Espresso 1 Febbraio 2001 p.40
Un Mare di Armi chimiche



Armi Chimiche

Composizione elementare (numero di atomi per molecola) di alcune armi chimiche ed esplosivi.

Materiale	Massa Molare	Cl	P	As	S	F	O	N	C	H
Mustard Gas (HD)	159	2			1				4	8
Nitrogen Yperite(HN3)	203	3						1	6	12
Lewisite (L1)	207	3		1					2	2
Tabun (GA)	162		1				2	2	5	11
Sarin (GB)	140		1			1	2		4	10
Amiton (VX)	267		1		1		2	1	11	26
Pentrite	316						12	4	5	8
Hexogen	296						8	8	4	8
Ammonium Nitrate	80						3	2		4

Armi Chimiche II

Tabella: Transizioni gamma pronte e ritardate utili per identificazione delle armi chimiche. Le energie sono in keV. (Adattato da P. Bach NIM B79 (1993) 605)

$E_{neutroni}$	Tipo Reazione	Cl	P	F	S	As	N	O	H
14 MeV	Pronta	1763 2645	1266 2230	197	2230	279	5106 2313	5129	
14 MeV	Attivazione ($t_{1/2}$)	3103 (5 m)	1779 (2.2 m)	6129 (7 s)	2127 (12 s)	265 (1.4 h)	511 (10 m)	6129 (7 s)	
Termica	Cattura (n,γ)	6110 1959 1951	3900 6785	3589 2452	5420 3220 2931	165	10830 5269		2223
Termica	Attivazione ($t_{1/2}$)	2168 1642 (37 m)		1634 (11 s)	3103 (5 m)	657 559 (26 h)			

Problemi: 1) Fondo di gamma dovuti al contenitore esterno.
2) Interferenza di transizioni gamma con energia simile in piu' nuclei.
3) Stessi nuclei possono essere il prodotto di reazioni diverse, ad es. $^{16}O(n,p)^{16}N$ e $^{19}F(n,\alpha)^{16}O$

NON-STOCKPILE CHEMICAL MATERIEL PROGRAM (NSCMP)

Overview / Issues

for the

Interstate Technology

Regulatory Cooperation

(ITRC) Work Group

PMCD

Program Manager for Chemical Demilitarization

12 May 1998

Presented by:
COL Edmund W. Libby
Project Manager, Non-Stockpile Chemical Materiel

NS901-1-5/11/98

RANGE OF MUNITIONS / CONTAINERS

Known:

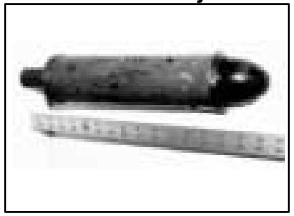
Projectiles
75mm, 105mm, 155mm

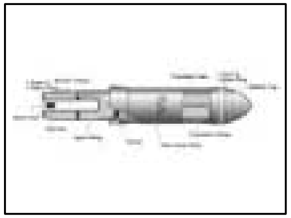
Cartridges
4.2 in Mortar
Stokes Mortar
Livens Projector

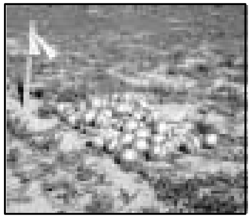
Rockets
German Traktor

Bombs / Bomblets
M125, M139

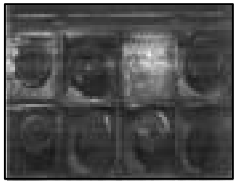
Ampoules
Miscellaneous



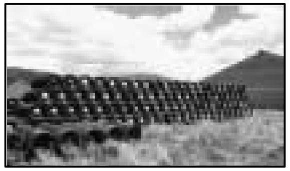




DOT Containers / Bottles



Ton Containers



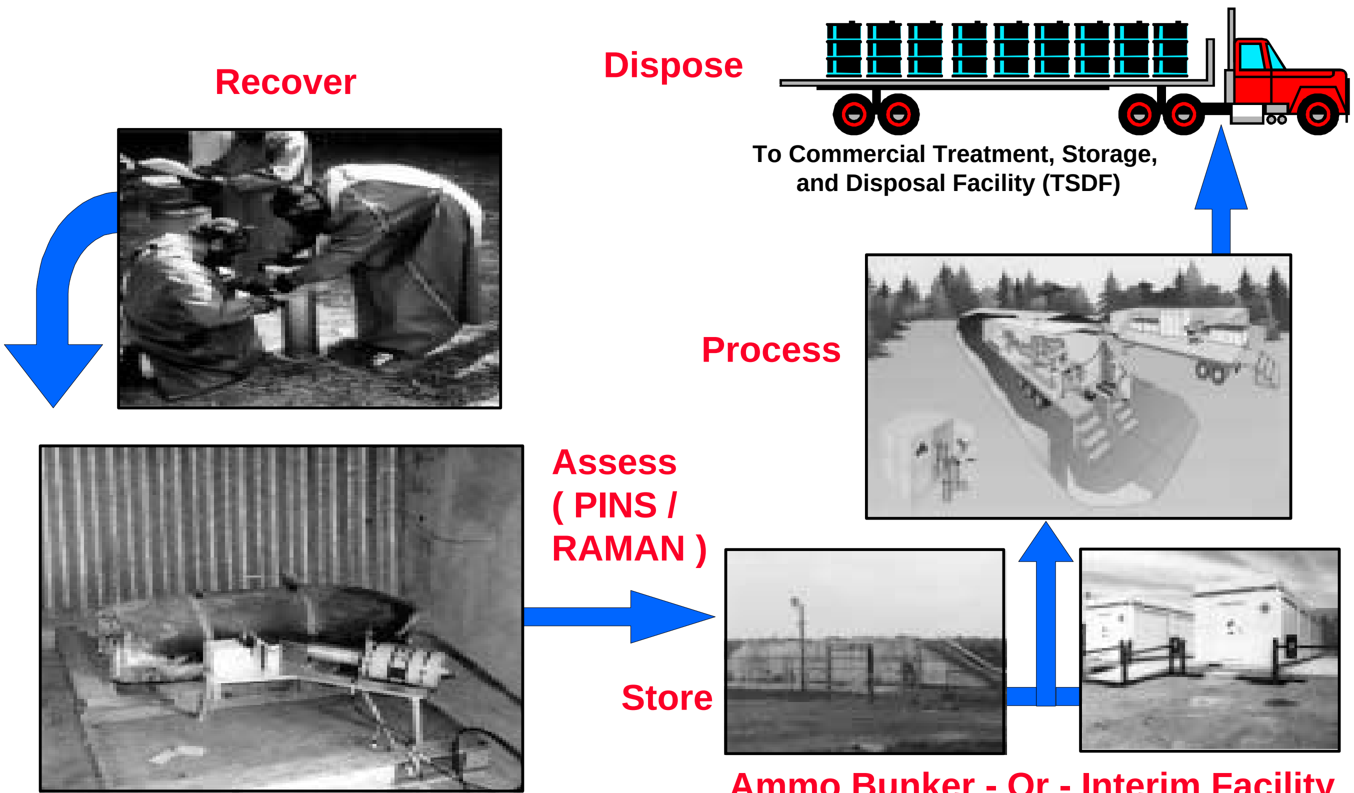
Potential:

US Bombs: M34, M47, M69, M70, M74
German Bombs: 250 / 500 kg
Mines: M23
Rockets: M55
Projectiles: 175mm, 8 in
Drums: 30 - 55 Gallon

Agents: **Nerve - GA, GB, GD, VX**
Blister - H, HD, HN, HT, L, HL
Industrial - CG (Choking) / AC, CK (Blood) / DM (Vomiting) / PS, CN, CS (Tear) / Others

NS901-6-5/11/98

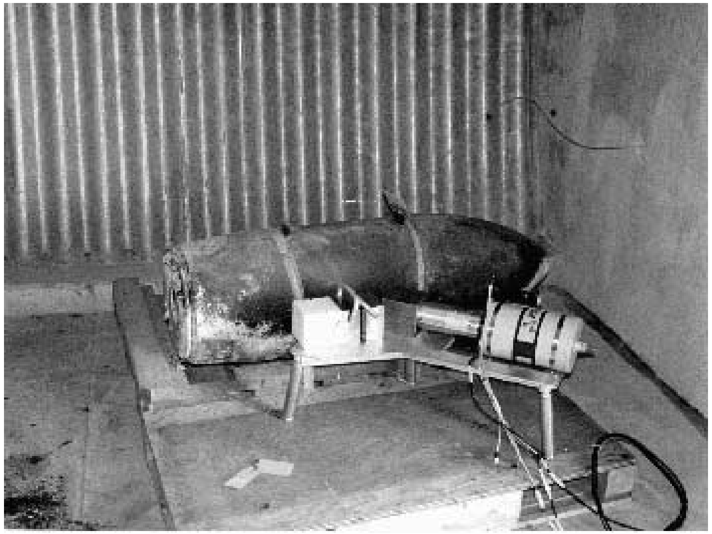
RECOVERED CWM
OPERATIONAL SCHEME



NS901-8-5/11/98

PORTABLE ISOTOPIC NEUTRON SPECTROSCOPY (PINS) CHEMICAL ASSAY SYSTEM

PINS: Key Component of the
Mobile Munitions Assessment System (MMAS)



Test Results To Date*

Munition Type**	Correct ID	Total	%
75mm	7	25	28
105mm	10	10	100
4.2″ Mortar Proj.	21	22	95
Livens Projector	6	6	100
155mm	11	12	92
175mm	17	17	100
Miscellaneous	37	37	100
Total	109	129	84
Total Less 75mm	102	104	98

**** PINS assay, as confirmed by chemical analysis***

****** Includes CW Agent Fills (41/41), Empty (12/12), Explosive (0/9), Simulant (35/35), Smoke (15/15), and Other (6/17)

- PINS Assessment: Only One Part of the Munitions Assessment Review Board (MARB) Process
- MARB Assesses Munition Contents and Actions To Be Taken
  - X-Ray, Historical Records Reviews Also Key

NS901-9-5/11/98

Submitted to IEEE Transactions on Nuclear Science

Chemical Warfare Agent and High Explosive Identification by Spectroscopy of Neutron-Induced Gamma Rays.

A.J. Caffrey, J.D. Cole, R.J. Gehrke, and R.C. Greenwood

Idaho National Engineering Laboratory
P.O. Box 1625, Idaho Falls, ID 83415

Abstract

A non-destructive assay method to identify chemical warfare (CW) agents and high explosive (HE) munitions was tested with actual chemical agents and explosives at the Tooele Army Depot, Tooele, Utah, from 22 April 1991 through 3 May 1991. The assay method exploits the gamma radiation produced by neutron interactions inside a container or munition to identify the elemental composition of its contents.

SISTEMA
PINS
Portable
Isotopic
Neutron
Spectroscopy
EGG-ORTEC

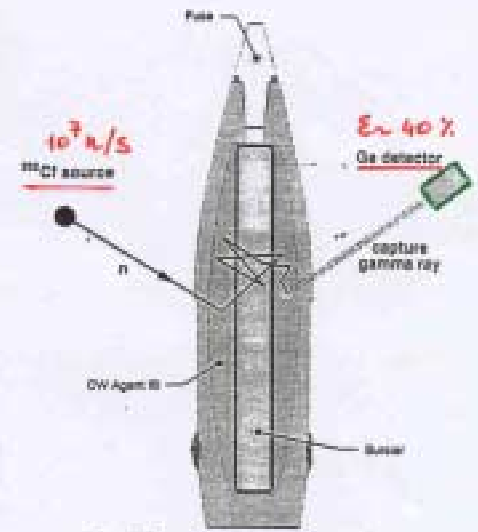
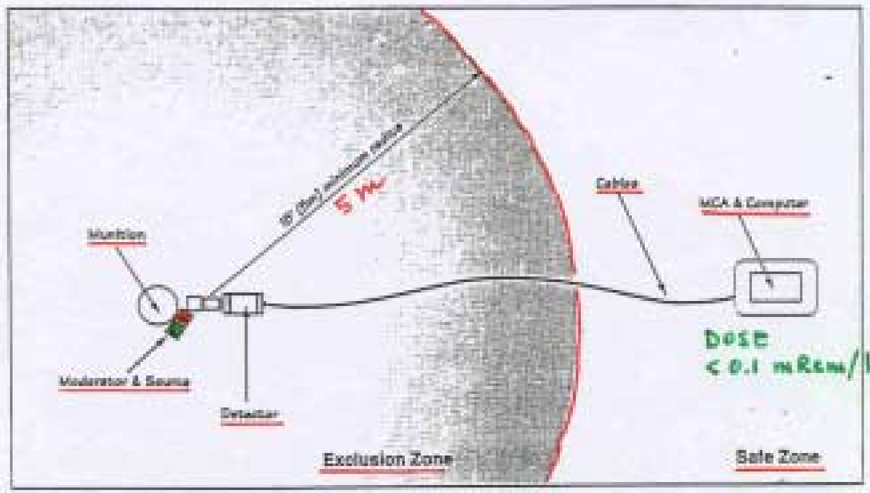


Fig. 1 Schematic neutron capture reaction



Villa

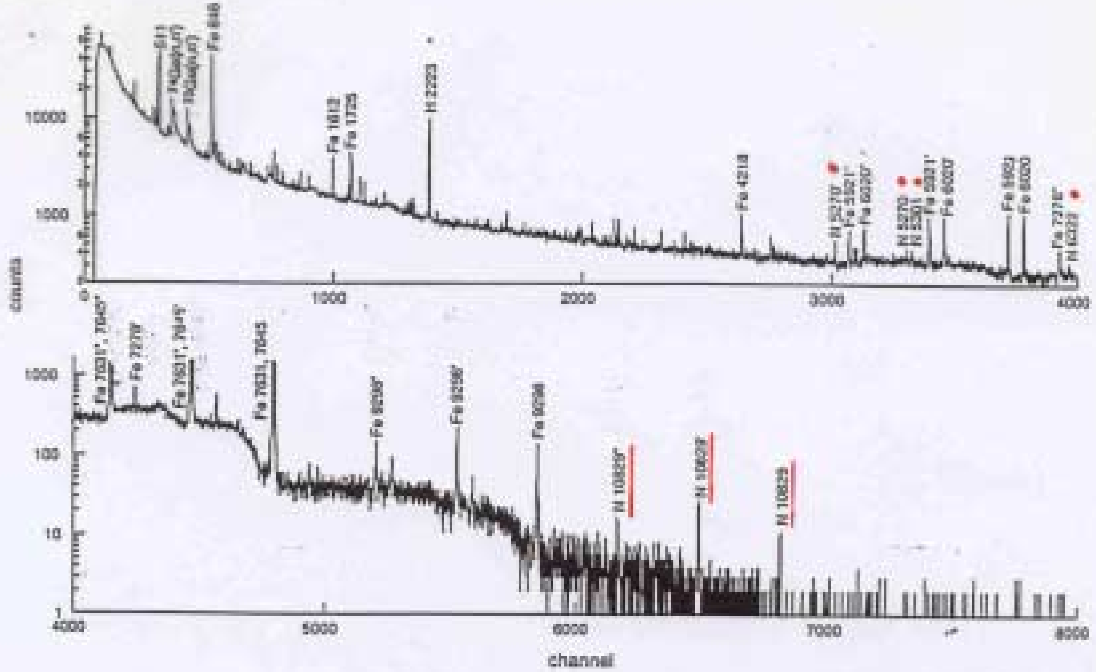


Fig. 3. High explosive gamma-ray spectrum

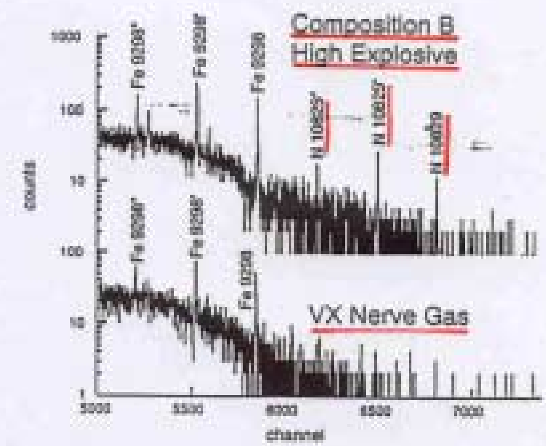


Fig. 4: Comparison of HE and VX gamma-ray spectra.

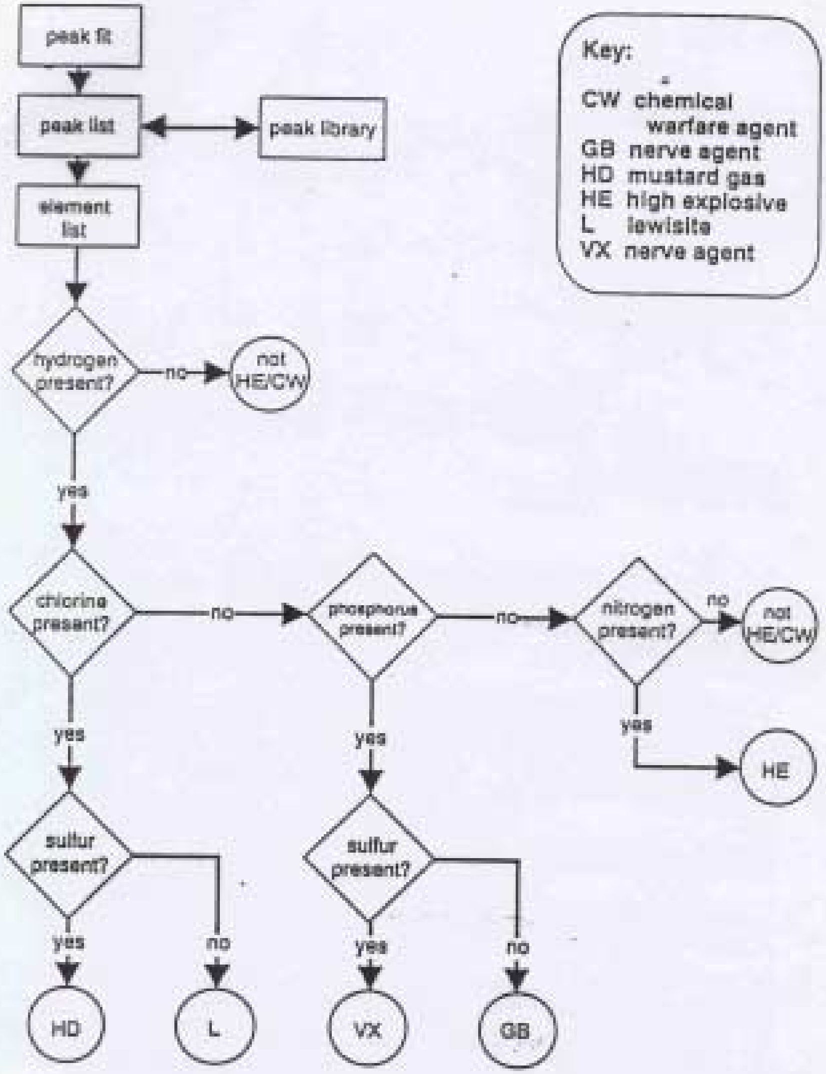


Fig.7: Identification algorithm

Table 3A: Recommended Assay Lengths

Agent to be verified	Container	Element(s) to be observed	Confidence level* expected	Recommended Live Time
H (mustard)	Ton container	H Cl	1 1	500 seconds
H (mustard)	155mm or 105mm projectile or 4.2" mortar	H Cl S	1 1 .25 or .5	1000 seconds
VX	155mm projectile	H S P N	1 .5 or .75 .25 or .5 .25	1000 seconds
VX	8" projectile	H S P N	1 .75 .5 .25	1000 seconds
VX	spray tank	H S P N	1 .75 .5 .25	1000 seconds
VX	M55 rocket	H S P N	1 .75 .25 or .5 —	1000 seconds
GB	105mm projectile	H P	1 .5	2000 seconds
GB	155mm projectile, M55 rocket	H P	1 .5	1000 seconds
GB	ton container or large bomb	H P	1 .25 or .5	1000 seconds**
WP	155mm projectile or 4.2" mortar	P	1	500 seconds
HE	155mm projectile	H N	1 .75 or 1	2000 seconds ~30 m
L	ton container	H Cl As	1 1 1	500 seconds
Unknown	155mm or 8" projectile			1000 to 2000 seconds
Unknown	MC-1 bomb or ton container	Count at least 1000 seconds or until two or more elements (in addition to H) are observed with a confidence level of .5 or more. If only N_2 or P are observed, the fill is high explosive or white phosphorus, respectively.		

* *If confidence levels shown here are not equalled in the Analysis program results, extend the count for an additional live time without disturbing the equipment set-up.*

** *Length of count determined by anticipated concentration (purity) of agent and agent type.*

Villa Gualino 2001

Digital Radiography and computed tomography of chemical munitions: development and implementation of field inspection systems. T. D. Roney et al. INEEL

rate, continuously collecting data ... time. The scan may proceed either from bot
bottom of the object. In the field-portable digital radiography and computed t
source and detector actually share a common vertical carriage so synchronizatio
detector vertical alignment does not vary as the translation occurs. Other sys
source and detector requiring additional real time monitoring and adjustment of
insure vertical alignment.

The bottom diagram in figure 1 demonstrates that data acquisition mode for comp
data for a single 2D slice, the vertical position of source and detector remains statio
data is continuously collected. To acquire data for 3D volume images, the source and detector move v
the object is rotated and data is acquired continuously. This method of data ac
scanning.

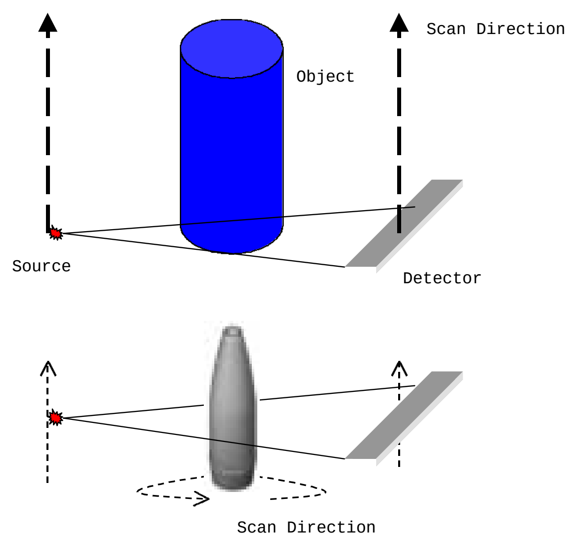


Figure 1. Scanning motions for the field portable DRCT scanner. The top
single projection radiograph. The bottom shows the motion for either single-
tomography with (object) rotate only, or volume 3D imaging, with simultaneous
(source/detector) motions for spiral CT.

Digital Radiography and computed tomography of chemical munitions: development and implementation of field inspection systems. T. D. Roney et al. INEEL

Figure 2. Field Portable Digital Radiography and Computed Tomography Syst

Digital Radiography and computed tomography of chemical munitions: development and implementation of field inspection systems. T. D. Roney et al. INEEL

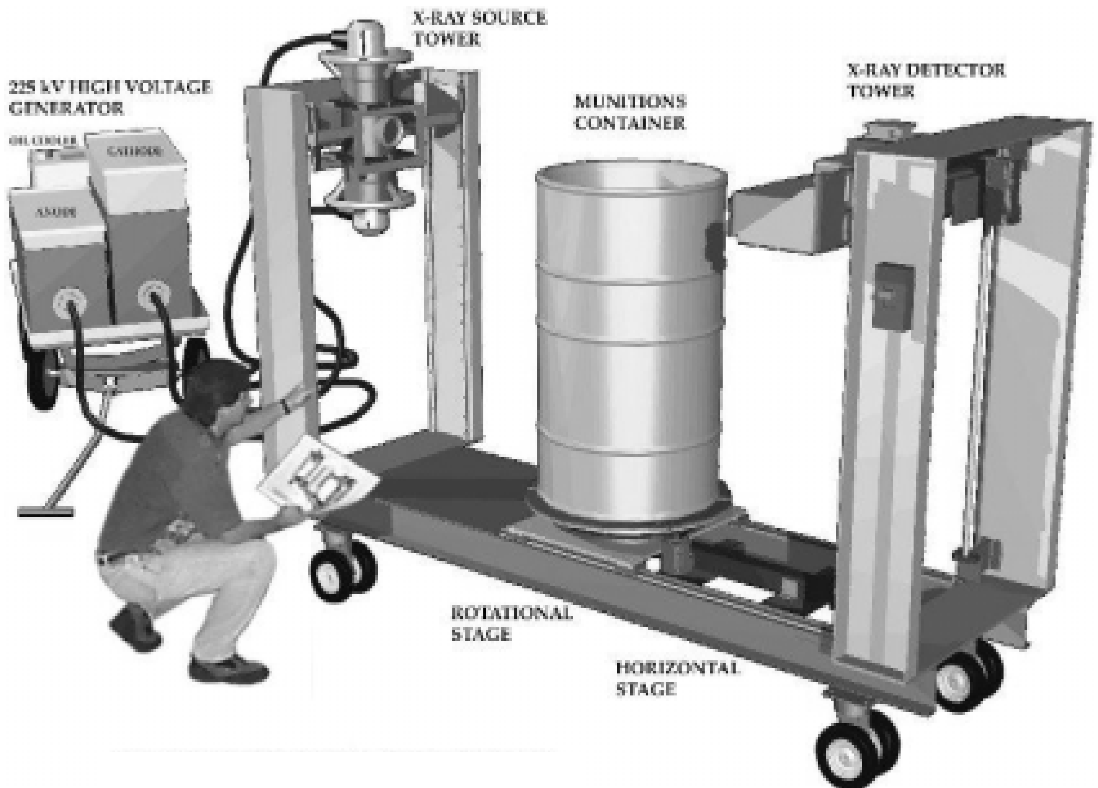
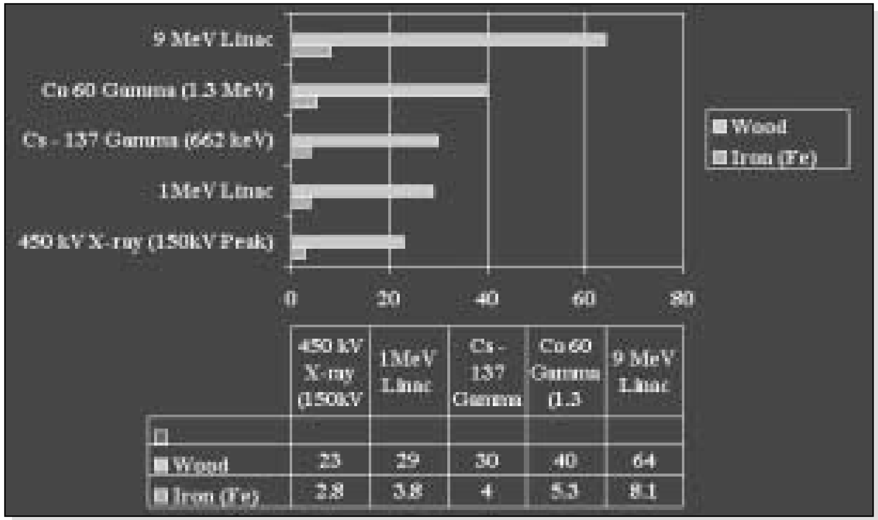


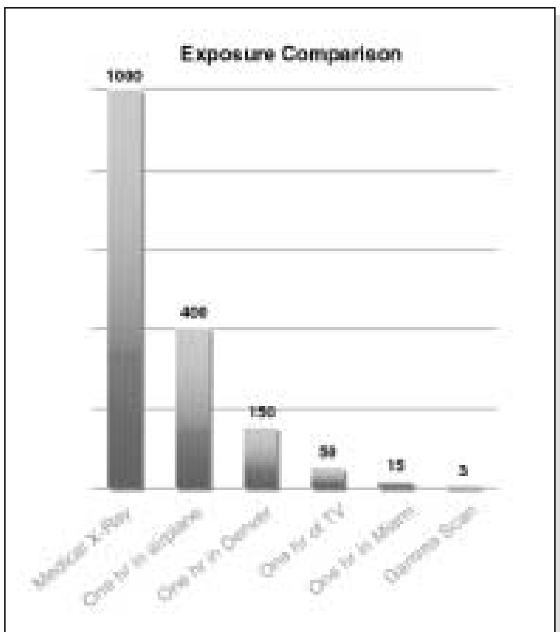
Figure 7. Transportable large object x-ray imaging system.



	450 kV X-ray (150kV	1MeV Linac	Cs - 137 Gamma	Cu 60 Gamma (1.3	9 MeV Linac
Wood	23	29	30	40	64
Iron (Fe)	2.8	3.8	4	5.3	8.1

Figure 2 (above)
Comparison of penetration distances in wood and steel for gamma-rays and x-rays

Figure 3 (right)
Exposure levels from various common sources of radiation

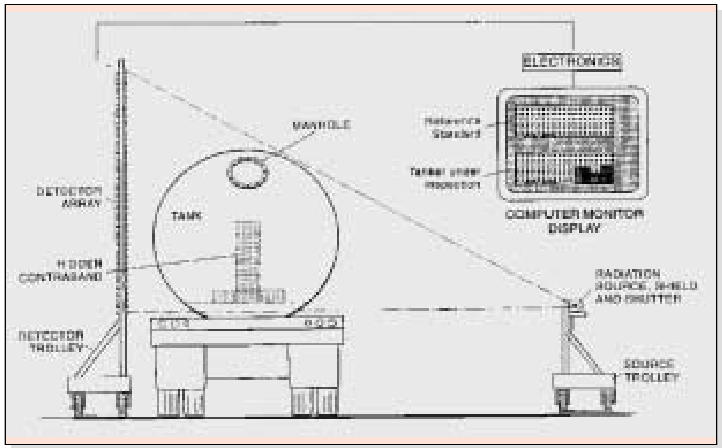


VACIS: Vehicle and Cargo Inspection System

(M.P. Snell Gamma-ray technology: the practical container inspection alternative)

VACIS: Vehicle and Cargo Inspection System

(M.P. Snell Gamma-ray technology: the practical container inspection alternative)

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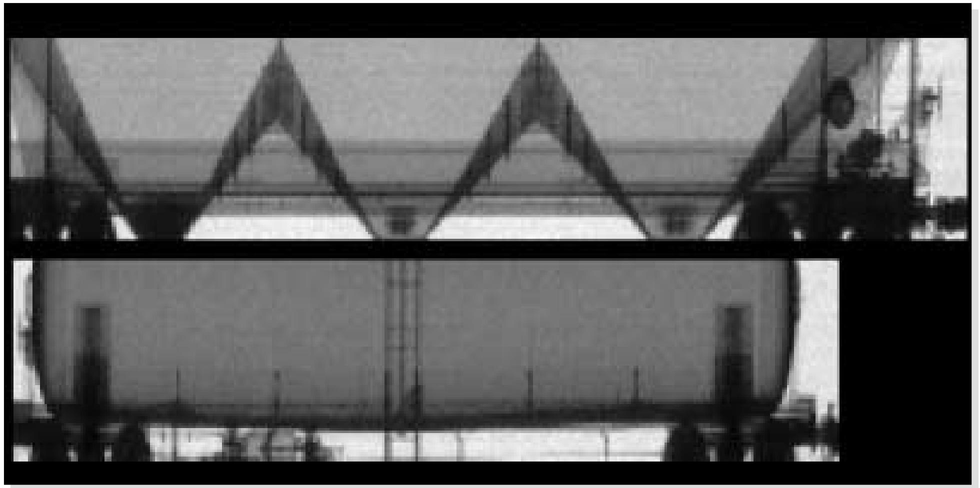

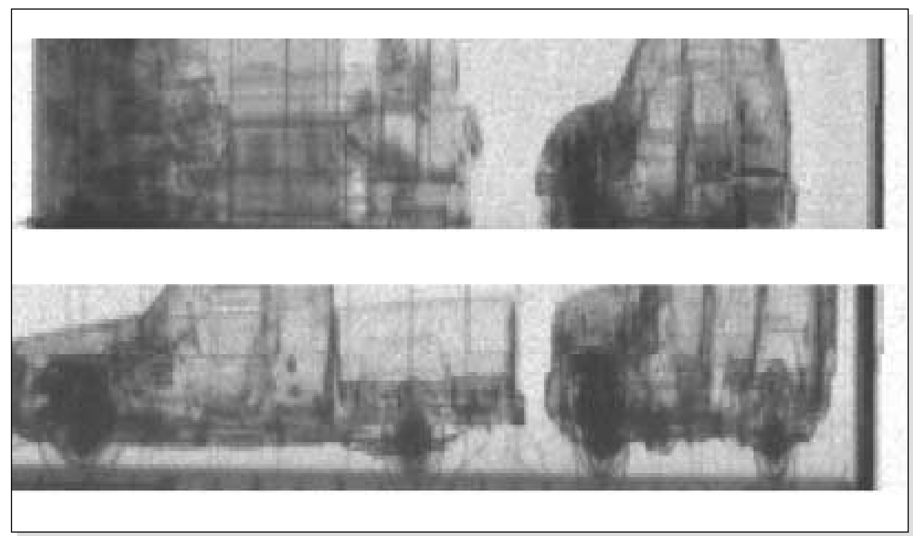

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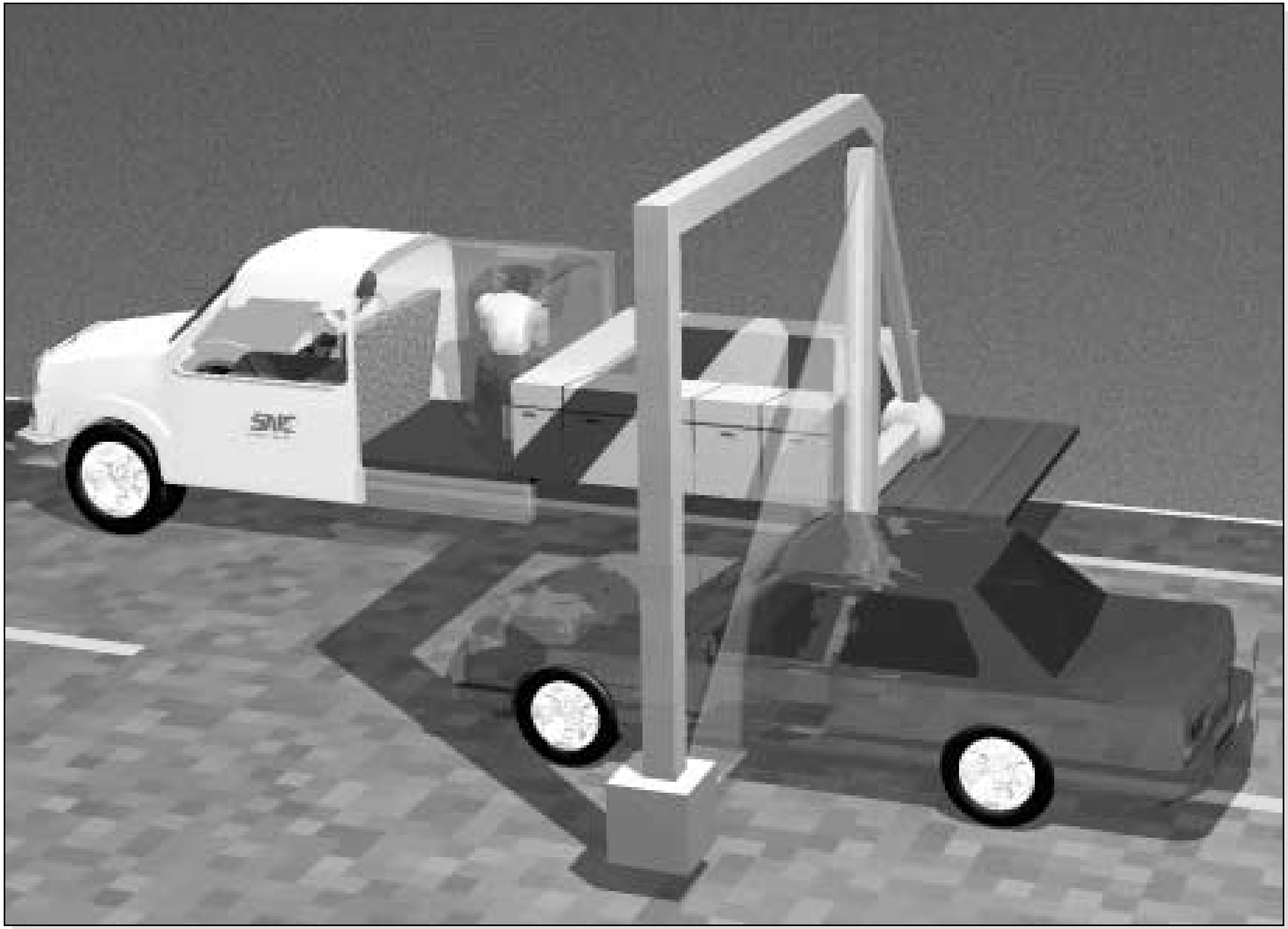

Villa Gualino 2001