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QUARTERLY TECHNICAL PROGRESS REPORT

1 November 1970 - 31 January 1971

Technical progress in this period was as follows:

- 1) Acquisition and review of applicable reports and data,
- 2) Preliminary organization of a systematic approach to the problem of personnel incapacitation, and
- 3) Two ad hoc evaluations of proposed incapacitation systems.

1. Thirty-eight unclassified and twenty-five classified documents are now on hand, covering a wide range of electrical, chemical, sensory and physical means of restraint or behavior control. Each of these documents has been screened by one or more staff members.

2. On 18 November 1970, a report on an [] flashblindness simulation proposal was forwarded to [] It was concluded that it might not be possible to extrapolate the proposed simulation results to levels of flash intensity that would be useful operationally. The risk of permanent eye damage at high light levels, furthermore, would not be clarified by the tests. The performance tasks proposed were not detailed sufficiently to determine their relevance to real situations. Several operational drawbacks of the flash blindness technique itself were pointed out, for example, the critical positioning of flares with respect to the subject by reason of the inverse square law, and the limited usefulness during the daytime, and the conspicuity of the technique at night. The short time of effectiveness makes this technique more useful as an adjunct system than as a primary behavioral control technique. Primate studies were suggested as a means of establishing damage thresholds and performance decrements under actual (rather than simulated) flash conditions.

3. On 31 December 1970 a memorandum on the [] non-lethal electrified net system was forwarded to [] Unfortunately, the data provided by the manufacturer are not completely explicit. Based on certain assumptions

about the device, it was concluded that a) under some conditions the [redacted] could cause partial incapacitation by paralyzing the subject's arms; and that b) it would be unlikely to kill healthy people. Disadvantages of the system stem from the extreme variability of the skin resistance factor -- depending on surface contact area, humidity, body sweat, etc., the likelihood of the net shorting itself out, the ineffectiveness against fully clothed subjects (who might even be wearing gloves), and the probability that the subject, even though his arms were immobilized, could still run and free himself from the net. The effectiveness of the [redacted] therefore, is open to question. A rough circuit diagram of a device which fulfills the specifications of the [redacted] was prepared.

4. Consideration has been given to a systematic approach to the incapacitation problem. There is a spectrum of situations or scenarios in which immobilization or restraint systems would be desirable. These range from a situation in which there is a single assailant (such as a hijacker) who must be subdued in the presence of a large number of innocent bystanders, to a one-to-one confrontation between individuals, to an individual (such as a diplomat) or small group surrounded by a large hostile crowd, to a full-scale riot situation. Each of these situations has different technical requirements for an optimum system.

Incapacitation systems can be categorized in several other ways. They may be grouped according to the general method used:

- Psychological
- Impact
- Chemical
- Sensory
- Restraining
- Electrical

or they may be categorized according to the agent employed

- Projectiles
- Bases
- Sound

Light
Shock wave
Nets
Bolas
Polymers
Drugs, etc.

Regardless of what type of device is used, certain attributes of each system need to be considered, as they apply to different scenarios:

Degree of incapacitation
Delivery System
Length of incapacitation
Speed of action
Requirement for antidote
Residual effects
Lethality risk
Risk of system failure/countermeasures
Range
Covertness
Suitable for individual (or group)
Safety of user
Size and weight
Environmental requirements
Shelf life
Training requirements

Plans for future work

Definitive work on a systematic evaluation of known and promising personnel incapacitation techniques awaits a conference with [redacted] tentatively scheduled for March, 1971.

The following steps will be taken in the meantime:

1) Literature search will be carried out as follows:

[redacted] Document Collection

Document Library (computer search)

Medical Library

Library and

Medical School Library

- 2) Schematics for a [] type device will be forwarded *
- 3) An evaluation of a patent of an electrified projectile will be forwarded *

* These reports are enclosed

QUARTERLY TECHNICAL PROGRESS REPORT

1 February 1971 - 30 April 1971

Technical progress in this period was as follows:

- 1) Submission of possible schematics for a _____ type device.
- 2) Evaluation of a patent of an electrified projectile.
- 3) Completion of literature search of the following libraries:

Document collection
Document Library
Medical Library
Library

Medical Library
Police Academy Library

- 4) Presentation of a group of status reports to the Project Monitor during his visit _____ on 20 April 1971. The items presented were:
 - a) a general outline of the Behavioral Control Support programs to date.
 - b) a summary of the Behavioral Control literature review
 - c) Brief descriptions of several real-life situations and possible incapacitating agents applicable to each (preliminary only)
 - d) Suggestions for future activities under Behavioral Control Support Project.

1. This report was submitted on 12 February 1971. The possible schematics for the _____ are essentially:

- a) an auto ignition system and
- b) a DC to DC converter

An output voltage of only 4000 volts is specified in the postulated system (as opposed to 20 Kv for the _____ system) because of the extremely short battery

life and arcing problems that would exist with the higher voltage system.

2. U.S. Patent 3,523,538 describes an electrical shock-producing projectile. The projectile would be incapable of producing the "false epilepsy," as claimed by the inventor, would have a limited range, and besides being ineffective it could possibly harm the victim.

3. A description of the literature search is given under 4(B).

4. The status reports presented to the Project Monitor will be found in attachments A, B, C and D.

BEHAVIORAL CONTROL SUPPORT

General Outline of Program

1. Review Literature
 - a) Police and criminology
 - b) Medical and scientific
 - c) Military
 - d) International
 - e) Patents and proposals
 - f) Science fiction, comics, etc.
 - g) Other

2. Describe the factors which constitute the generalized conflict/control situations of interest:
 - a) number of antagonists
 - b) number of protagonists
 - c) intensity range of hostilities (actual or predicted)
 - d) time scale
 - e) location/mobility/environmental factors
 - f) availability of additional support
 - g) effects desired
 - i) offensive (calm, disperse, arrest, subdue, incapacitate, immobilize)
 - ii) defensive (avoid hostilities, self-protection, escape/flight)

3. Prepare brief, representative real-life situations to serve as examples and help generate ideas:
 - a) Surrounded automobile
 - b) Lone individual
 - d) The snatch
 - e) the crowd
 - f) Pursuit
 - g) Protection of individuals and property

4. Study available and proposed weapons/devices and strategies in light of desired effects and user-criteria dictated by various situations.

5. Compile lists of as yet undeveloped devices/weapons and recommend design and bench testing of those judged most valuable. Some possible examples:
 - a) [or similar agent for rapid, transcutaneous administration of drugs
 - b) Synchronized strobe lights and sound stimuli at critical frequencies
 - c) Various undetectable (or subthreshold) physiological insults
 - d) Low-velocity, high-mass, low psi projectiles: "jet-propelled medicine ball"
 - e) _____

6. Respond to ad hoc requests for evaluation of concepts, proposals, patents, etc.
 - a) _____
 - b) _____
 - c) Japanese patent
 - d) Others

BEHAVIORAL CONTROL LITERATURE REVIEW

To date, our search for behavioral control literature has included the following local libraries, all of which yielded some information:

Department

- document library
 - medical library

- general library
 - medical library

} Police Academy

The original 50 documents received at the start of the contract have been thoroughly reviewed by Drs. | Those publications, by nature of their pre-selection, pertinence and variety, are still the core of our incapacitation literature. Several of them were used in a pilot run in order to devise the evaluation form, shown in Attachment A. This form will be used later to provide quick reference to factors from selected proposals and techniques.

In February 1971, all the literature then in our possession was screened for bibliographic references to other works. A master list was made, from which library searches were conducted. By March it had become obvious which material was not available locally, and those items remaining on the list were then ordered through the |(28 unclassified documents) or through Washington (26 classified items). As of April 19, sixteen unclassified documents were still on order, along with the classified material.

The library work also included a search of card catalogs and indices of ~~abstracts for 30-40 pertinent topics~~, as well as a search of recent volumes of approximately 15 journals. All of the locally available literature has been procured, cross-indexed, screened and filed (the cross-index categories are given in Attachment B). The collection consists of 135 items at this time.

Conclusions

Our literature search has been comprehensive enough to draw the following conclusions:

1. As expected, the open literature does not mention any innovative hardware which could be easily adapted to our purposes.
2. The greatest concentration of published material has been in the categories of light (flashblindness), sound (all frequencies), electricity (shock, electronarcosis, electromagnetic radiation) and chemicals (drugs and gases). Very little open literature is available on biological weapons, odor, temperature, vibration or applicable psychological methods of incapacitation.
3. It appears that certain gaps in the literature can be filled only by obtaining classified documents through Washington.
4. The police literature is mainly concerned with riot control. The police appear to be the recipients rather than the initiators of research into new techniques of behavioral control.
5. Our group now has a broad and general conception of current incapacitation devices and techniques. The most profitable course for further search of the literature would be to narrow our fields of interest (as proposed in the program for the coming months), and collect information in those specialized areas.
6. An ongoing, general survey of published material concerning personnel incapacitation will be maintained ~~regardless of the focus or direction taken in our future program.~~ *regardless of the focus or direction*

Reviewed by: _____ Serial No. PI- Doc. No. _____

Date: _____ Title _____

Techniques: _____

Incapacitation
degree of _____

length of _____

Speed of Action _____

Residual Effects _____

Lethality Risk _____

Dependability _____

Countermeasures _____

Range _____

Delivery System _____

Size/Weight _____

Covertness _____

Shelf Life _____

Safety/Training
of User _____

Individual vs.
Group _____

Environmental
Dependence _____

Public Image _____

Remarks:

Scenarios:

CROSS-INDEX CATEGORIES

- AD number
- Authors
- Bibliography
- Biological
- Central Nervous System
- Chemical
 - drugs
 - gases
- Electrical
- Facilities
- History
- Impact
- PI- number
- Proposal
- Psychological
- Restraining
- Sensory
 - light
 - odor -
 - pressure
 - shock
 - sound
 - temperature
 - vibration
- Theory -
- Titles
- Tolerance/Antidote

REAL-LIFE SITUATIONS

Surrounded Automobile

(Diplomat; Police; Stop and Search)

This situation entails one or two individuals inside their car, surrounded and outnumbered by a hostile group, in a potentially unfriendly environment such as a foreign country, riot area or inspection checkpoint. The confined space of the automobile can be an asset and must not become a trap. Pre-installed incapacitation equipment can be utilized providing the individuals remain in their own car, otherwise portable equipment would be required. The least amount of force needed, either to calm the hostile group or to make a "getaway," would be highly desirable from the standpoint of good will; trying to calm the group can be expected to consume more time than getting away by car from a group which is on foot. Safety for innocent bystanders may be of limited concern.

Incapacitators

persuasion (loudhailer)
lures (hand-outs etc.)
dyes
stench
tear gas;
aerosols; skin penetrants
car-top sprinkler
fire extinguisher
blown sand, heat or smoke
marshmallow barrage
extendable booms: with oil, foam,
~~bubbles, chemicals, smoke~~
~~extendable rotating sticks~~
car-top light
loud sound
insects (released outside car)
slick ground surface
electrified car

Protection *

bullet proofing
ear defenders
electric ground
gas mask
goggles
independent air supply
sealed car

* Protection is for the operators; some items listed could also be used by antagonists as countermeasures.

Lone Individual

Perhaps the most vulnerable situation is that of a single person who may have numerical odds against him, with no vehicle nor any other source of aid, who must protect himself outdoors. His immediate need is for small, unobtrusive equipment (and possibly protective gear) which he can instantly utilize and rely on for complete incapacitation of his-assailant(s). If the general environment is unfriendly, he may need to re-use the equipment in order to reach safety.

Incapacitators

stench
smoke screen
combined smoke and gas
tear gas
aerosols; skin irritants
|
impact balls that break:
 smoke, stench, Mace
darts with drugs
marshmallow barrage
taffy pellets
night stick/baton
shock
karate/judo
stun gun
big net
adhesives
bolas
slick foam (sprayed or hurled)
heat-seeking device to trip, tackle
load SOUND
light
instant barrier
radio-controlled barrier

Protection

bullet-proof vest
car defenders
gas mask
goggles
inflatable plastic helmet
inflatable plastic shield
pocket bicycle

The Snatch

In this situation the advantage is with several persons who wish to incapacitate one or two others, in an outdoor environment such as a war zone. Because the operation must be swift and perhaps surreptitious, it may well be nocturnal. Protection of bystanders or property is probably unnecessary. Incapacitation techniques must be fast-acting, may require protection for the operators, and should leave the victim in a subdued but moveable condition. Any devices used should be portable or -- if the location is known beforehand -- deployable.

Incapacitators

instant barrier fence
radio-controlled barrier with heat,
light, smoke, stench
plastic cocoon
taffy pellets
nets, snares, adhesives
darts with drugs
water hose
karate/judo
dogs
night stick/baton
dyes (including infrared)
chemicals/smoke
tear gas
Mace
aerosols
blown sand, dust
swarm of insects
sound
~~light~~

Protection

beekeeper's suits
camouflage suits
ear defenders
gas masks
goggles

The Crowd

Behavioral control of a crowd is probably the most complex situation to be considered. Many individuals, potentially hostile as a "mob", must be controlled but not particularly harmed. In addition, fringe participants and adjacent property should be protected. A primary method of control is through dispersal of the crowd, which means they must retain their mobility to some degree. Techniques of control which allow gradations of intensity of action and an expandable time frame are recommended. Methods of control are more limited if the crowd is gathered indoors. Devices should be portable although their deployment beforehand may, in some cases, be possible, and pre-installed devices on official vehicles may be available. Overt techniques have positive and negative aspects: they may intimidate the crowd or they may become targets for the crowd's hostility. Selective incapacitation of the crowd's leaders is an effective technique. The operators in this situation often consist of a large, trained group such as the police; in any case, safety of the operators may depend on their protective gear.

Incapacitators

lures (spectacle elsewhere etc.)
rumor control/oratory
loudhailer (persuasion - drowning
noise - synchronized sound)
synchronized strobe + sound, pulses
robot rovers that emit flashes, heat,
chemicals, smoke, stench, or
~~broadcast~~
extendable booms that emit same
light
foam; foam grenades
bubbles
slick surface/oil
stench
dye
smoke
chemicals: tear gas, Mace
balls that break, emitting chemical
aerosols
drug darts for ring leaders
car-top sprinkler
night sticks/batons

marshmallow barrage
nets/snare
barricades
dogs/horses
insects

Protection

beekeeper's helmet
ear defenders
earphones
gas masks
goggles
rubber boots

Pursuit

This situation may follow that of the "Surrounded Automobile:" one or two persons in a car are being pursued by the occupants of another car, in what must be considered an unfriendly environment. The advantages to be exploited are: maneuverability of the vehicle (to utilize wind direction, for example); pre-installation of devices; protection afforded by the car's own shielding. Devices should be covert when not in use, quick acting because the pursuers may have lethal weapons, and capable of stopping the chase. This may be accomplished by: incapacitating the following driver, immobilizing the pursuit car, obscuring its path, barring its path, or disguising the operators' car or occupants. Re-use of the chosen techniques may be required if more than one vehicle joins the pursuit.

Incapacitators

license-plate change
external change in car's color, etc.
pop-up people in lead car
smoke screen
blown sand
paint on windshield
foam (on road or windshield)
oil slick
light beam (nighttime)
instant barrier
wire across road, about 48" high
extendable boom (if close behind)
pop-up deterrent shapes
tetrahedrons
nails strewn on road
rolling shapes strewn on road
rolling barrier attached by wires
to lead car
explosion under car
gas grenade

Protection

bullet proofing
goggles

Protection of Individuals and Property

A preventive and defensive situation occurs when the locale of a person (public speaker) or a piece of property (store subject to looting) must be protected. Assailants can approach from any direction but the protected object remains stationary. One or more "bodyguards" provide the defense against one or more assailants. A reasonably friendly environment can be supposed, which limits the useable techniques to those which will not seriously affect bystanders (nor the operators, the protected individual or the property). The devices should be aimed directly at the offenders only, and should reliably incapacitate them. The degree of incapacitation can depend on the severity of the attackers' intended crime. In all cases it seems desirable that the devices be quick-acting, portable and covert, so that they can be used in a variety of "stay-put" circumstances.

Incapacitators

rhetoric
electrical shield
light beam
taffy pellets
hurled foam, smoke
Mace
dart with drug
jet-propelled medicine ball
bola
karate/judo
night stick/baton
stun gun
balance disruption

Protection

instant plastic shield

5. Conduct feasibility studies of promising new approaches. For example, one potentially fruitful research area, probably worth evaluating, involves chemicals such as [redacted] which rapidly penetrate the skin and may serve as carrier vehicles for chemical agents for behavioral control. The control agent (e. g., irritant, anesthetic, synaptic blocker, etc) could be mixed with the skin penetrant and delivered in liquid, gel or aerosol form via projectiles, for accurate delivery to individuals, or via sprayers, for group administration. Other techniques, such as [redacted] could also be evaluated.

6. Exploratory animal studies. Brief, preliminary studies with promising chemical or physical techniques may be attempted if time permits and conditions justify such an effort.

QUARTERLY TECHNICAL PROGRESS REPORT

1 May - 31 July 1971

Technical work during this period was directed primarily towards collection, cataloging, review and appraisal of documents related to all aspects of personnel incapacitation. More than 160 documents have been so processed and many others have been screened. While there are dozens of good libraries throughout the country which have not been visited, the diminishing returns from our literature search suggest that we are in touch with the largest bulk of thought on this subject. Further intensive literature review would appear to add little, other than detail, to the information already at hand.

A great effort has also been made to conceive of "new" approaches to the problem of non-lethal behavioral control. Discussions between project members and unclassified exchanges with others have been initiated. Very little thought which could be described as "new" has resulted from this. So far, only two possible techniques, not reported in the available literature, would appear to warrant further consideration.

1)

2)

A further review will be carried out to determine whether either or both of the above techniques are actually feasible.

A course of action has been formulated for presentation to the project monitor in August. Briefly, the remaining contract effort will be directed as follows:

1. Literature review: A continued effort will be made to acquire and review new documents and other material related to personnel incapacitation. It is expected that no more than 10% of the remaining effort will be spent in this activity.

2. Evaluation of "new" methods of personnel behavioral control: An effort will be made to determine the feasibility of using agents such as _____ for incapacitation of humans. This research would be preliminary, being limited to theoretical considerations. No "bench" testing or animal testing is envisaged at this time. If possible, other new concepts will also be generated and examined. Approximately 30% of the remaining effort will be spent on "new" techniques.

3. A state-of-the-art review will be prepared using a system approach to the incapacitation problem. Each group or family of techniques will be considered separately. Some of the major categories are as follows:

Missiles, ballistics/impact
Light, electromagnetic radiation
Sound
Electric currents
Drugs, chemicals
Physical restraint

Psychology, verbal persuasion
Miscellaneous (odor, slippery foam, etc)

Various aspects of each group of techniques will be reviewed, for example:

Physical aspects of the agent
Delivery system
Physiological, biochemical or psychological mechanisms;
medical considerations
Results or effects, type and degree of performance decrement
Operational factors (portability, reliability, etc)
Possible applications and limitations
Recommendations

Descriptions of any new techniques which appear feasible will be included in the report.

Administrative Aspects

1. [redacted] an analyst who has done much of the literature research on this project will be terminating [redacted] (employment as of 1 October 1971. [redacted] a physicist and research analyst, will continue [redacted] work. [redacted] holds current TOP SECRET and Special Clearances with [redacted] M.D., who also holds TOP SECRET and Special Clearances, will work on the medical and clinical aspects of this project.

2. As of 31 July 1971, only 23.3% of the available funds had been spent (compared with a projected 75%). Accordingly, work on the project is considerably behind schedule and it will be necessary to request an extension of time, without additional funds, to complete the work. A six-months no-cost extension to 30 April 1972 is therefore requested.

QUARTERLY TECHNICAL PROGRESS REPORT

1 November 1971 - 31 January 1972

During this quarter, our main emphasis has been on the preparation of a series of reports, based on a systems approach to several groups or families of techniques for incapacitation. Rather than to re-review superficially every possible type of incapacitation technique, our effort has been concentrated in areas 1) where a medical or physiological evaluation (as opposed to ballistics, pyrotechnics, etc.) would offer a useful contribution; 2) where there appeared to be some promise of usefulness of the technique, and 3) where a technique appeared to be new or insufficiently studied.

A report entitled, [redacted] "As a Vehicle For Incapacitating Agents," was completed in December and forwarded to [redacted] does not appear to be a promising vehicle for administration of incapacitating agents, principally because of the long time required for "carried" substances to reach peak blood concentrations. Any dosage large enough to provide rapid incapacitation would be dangerously large, if not fatal, at the time of maximum blood concentration. Besides being slow, too many variables affect the absorption of [redacted] agent combinations and the fact that the technique cannot be used surreptitiously offers several possibilities for countermeasures. A second, informal report on the "Possible Interaction Between [redacted]" was submitted in January.

The report on non-penetrating impact, completed in late January was scheduled for submission early in February, 1972. In spite of the widespread use of billy clubs, special ordnance rounds and other impact devices, useful incapacitation by means of impact remains either unreliable (at the "safe" extreme) or hazardous at levels which will reliably incapacitate the subject. Blows to the genitalia in males and high-velocity, low-mass impacts appear to be the only truly safe methods of incapacitation. The latter is of only limited effectiveness.

The next two activities will be brief reviews of [redacted] as a possible

incapacitating agent and of the [redacted] electric shock system.

Administrative Aspects

Expenditures to date:

	<u>Quarter Amount</u>	<u>% of Total</u>	<u>Cumulative Amount</u>	<u>% of Total</u>
Nov 1970-Jan 1971	\$	1.2	\$	1.2
Feb - Apr 1971		14.4		15.6
May-Jul 1971		7.7		23.3
Aug-Oct 1971		22.3		45.6
Nov 1971-Jan 1972		31.1		76.6

FINAL TECHNICAL PROGRESS REPORT

1 February 1972 - 30 April 1972

During the final quarter the last Systems-oriented report was prepared and submitted: [redacted] as an Incapacitating Agent

While [redacted] is a relatively safe incapacitating agent, variations in individual susceptibility, possible delayed effectiveness due to breath-holding and difficulty in rapid, surreptitious delivery -- especially in a large room that is not reasonably airtight -- limit its usefulness as an incapacitating agent.

Major emphasis during this quarter was also placed on providing, in a readily available form, the maximum amount of practically useful information from previous reports. To this end, unclassified versions of the reports on electric shock and non-penetrating impact were submitted: Incapacitation of Criminals by Non-Penetrating Impact and Incapacitation of Criminals by Electric Current.

Of all the specific incapacitation systems examined, the [redacted] device appears to be the most promising. Dr. [redacted] cardiologist, Dr. [redacted] visited [redacted] and submitted a special report on their device, with recommendations for animal studies which would help validate the physiological safety of this incapacitation technique.

The final activity undertaken under this project was a brief ad hoc review of the Soviet technique known as Kirlian photography. Biological materials, when placed along with photographic film in a high-voltage radio frequency field produce a picture which shows details of the object not visible under ordinary light. With the help of [redacted] on the subject, a simple instrument was developed and satisfactory Kirlian-type photographs were obtained in both color and black-and-white.

Summary of reports, letter reports and substantive reviews submitted under
Project

Letter report on U. S. Patent 3, 523, 538

Letter report on [redacted] with circuit diagram

30 April 1971 Status reports:

General Program Outline
Behavior Control Literature Review
Real Life Situations
Program for Continuation of Work

Report: Electric Current as an Agent for Personnel Incapacitation

Report: [redacted] as a Vehicle for Incapacitating Agents

Report: Non-Penetrating Impact as an Agent for Personnel Incapacitation

Report: [redacted] as an Incapacitating Agent

Letter report: Possible Interactions Between [redacted]

Letter report: Trip Report "Visit to [redacted]"

Report: Incapacitation of Criminals by Non-Penetrating Impact

Report: Incapacitation of Criminals by Electric Current

Ad Hoc Report: Investigation of Kirlian Photography

6 Quarterly Technical Progress Reports, which includes the Final
Technical Progress Report and,

16 Monthly Contract Status Reports, which includes the final monthly
report.

Administrative Aspects

Expenditures to date:

	<u>Quarter Amount</u>	<u>% of Total</u>	<u>Cumulative Amount</u>	<u>% of Total</u>
Nov 70 - Jan 71	\$	1.2	\$	1.2
Feb - Apr 71		14.4		15.6
May-Jul 71		7.7		23.3
Aug - Oct 71		22.3		45.6
Nov 71 - Jan 72		31.1		76.6
Feb 72 - Apr 72		23.4		100.0