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# National Institute of Justice

S o l i c i t a t i o n

*Jeremy Travis, Director*

*July 1998*

Evaluation of Vehicle Stopping  
Electromagnetic Prototype Devices  
**Phase III - Engineering Field Testing**

**APPLICATION DEADLINE:**

21 September 1998

**U.S. Department of Justice**  
**Office of Justice Programs**  
810 Seventh Street N.W.  
Washington, DC 20531

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**Office of Justice Programs**  
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*<http://www.ojp.usdoj.gov>*

**National Institute of Justice**  
**World Wide Web Site:**  
*<http://www.ojp.usdoj.gov/nij>*

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# Evaluation of Vehicle Stopping Electromagnetic Prototype Devices Phase III - Engineering Field Testing

## Preface

The United States Department of Justice (DOJ) is responsible for implementing the Violent Crime Control and Law Enforcement Act of 1994 (the "Crime Act"), Public Law 103-322, 108 Statute 1796 (1994), codified as amended, 42 U.S.C. § 13701 et. seq.

The National Institute of Justice (NIJ) performs behavioral science research and physical science research and development for the DOJ. NIJ is responsible under the Crime Act to fund technology development projects that serve to enhance law enforcement, courts, and corrections operations at the State and local levels throughout the nation. In this regard, Crime Act funds will be applied in support of the efforts associated with this solicitation.

## Solicitation Purpose

The purpose of this solicitation is to request interested applicants offer their prototype electromagnetic (EM) devices for submission to NIJ's vehicle stopping Phase III testing (i.e., engineering field testing). Three types of EM devices will be considered for testing: electrostatic discharge, non-nuclear electromagnetic pulse, and high-power microwave or radio frequency energy. Upon the receipt of the applications submitted in response to this request, NIJ will determine those applicants who will be invited to participate in the NIJ vehicle stopping Phase III testing.

## Background

High-speed vehicle pursuits continues to be a very serious problem for State and local law enforcement officers throughout the United States. Although pursuits occur more frequently in some areas of the country than in others, no region or locality can be considered exempt from the occurrence of pursuits, or from the potential property damage and human injury or death resulting from them. Statistics indicate that high-speed pursuits result in the loss of more human lives per year than in any other police-related activity.

### Mission of NIJ

NIJ's mission involves the application of useful technology into the operations of state and local law enforcement agencies (LEA's), based on a thorough understanding of the LEA's technology needs and operations. The need to develop and deploy safe and effective technology for LEA's to stop vehicles has been validated by NIJ through the Law Enforcement and Corrections Technology Assessment Council (LECTAC), a body which links NIJ to the LEA community. LECTAC has recently placed the need for vehicle stopping technologies as their number two priority.

In recent years, NIJ has been involved in promoting the development of mechanical-type vehicle stopping technologies. These technologies have principally been tire-deflating technologies, some of which have matured and progressed into commercialization. However, other potentially useful technologies such as EM methods appear to offer promise for stopping vehicles as well, and NIJ intends to exploit their potential for application by LEA's.

## **NIJ's On-going Evaluation of EM Technologies**

NIJ is presently engaged in a four-phase, multi-year effort to investigate the feasibility of EM technology to stop vehicles. Phases I and II are completed. Phase I involved NIJ's solicitation of EM vehicle stopping technology inventors and developers to submit their devices or concepts to Phase II laboratory testing. From the EM devices that were proposed, NIJ selected those that were subjected to Phase II testing. Phase II involved the feasibility testing of the EM devices in a laboratory setting. In those tests, the EM devices were applied to targeted vehicles that were either idling or operating on a dynamometer with their engine and drive train engaged. The Phase II test results support the viewpoint that EM technologies have promise for eventual use in stopping vehicles.

However, EM technologies must undergo testing in a more realistic setting for their potential usefulness to be better assessed. NIJ's Phase III testing will be performed in a field setting, to better simulate a real vehicle stopping operational scenario. Some aspects of Phase II idling and dynamometer testing will be initially repeated, but Phase III will also include testing where targeted vehicles will be operated under their own power along a roadway.

Eventually, Phase IV will be conducted. In Phase IV, some of the EM devices that perform successfully in Phase III testing will be subjected to operational testing performed by law enforcement agencies.

## **Permissible Uses Of NIJ Funding**

NIJ will evaluate applicant's proposals to determine the amount of funds that will be provided per applicant, for each purpose, on a case-by-case basis. NIJ will provide grant funds for the following purposes:

- Performance of reasonable development work to advance an applicant's EM device to the status of a field-testable prototype;
- Support for applicant technical personnel to attend field testing (i.e., reasonable labor, travel and per diem expenses).
- Shipment of the prototype device and associated ancillary support equipment to and from the Phase III test site.

Test facilities, instrumentation, target vehicles and their maintenance, and test engineering support staff will be provided by NIJ to assist applicants in subjecting their devices to Phase III testing. Applicants will be responsible for advising the engineering support staff as to the optimal manner for operating EM devices during testing.

Applicants are responsible for describing in their proposals the nature of their request for NIJ funds to develop their EM devices, as well as to have them shipped. NIJ will not provide funds for applicants to perform the development of concepts or ideas for stopping vehicles unless they are realized in the form of existing physical devices, albeit crude. Generally, NIJ will only provide funds to applicants who propose developmental efforts involving the advancement of their device from bread board or brass board maturity to field-testable prototype maturity.

EM device maturity is defined as follows: bread board maturity is characterized by a very crude device physical configuration - typically a result of a first attempt to produce such - which enables the initial observation or testing of the device's operability; brass board maturity is characterized by a more polished device physical configuration than the bread board version, the intent is to verify device operability given the advances made in component-level and system integration efforts to improve from the bread board level; and field testable prototype maturity is characterized by a device physical configuration that is

adequately assembled and packaged to permit the device to be deployed in field settings and operated in dynamic conditions.

Applicants should refer to the “How To Apply” section below under the sub-topics “Written Proposal: Technical Narrative” for more detailed information regarding what information is required in requesting funds for EM device development and field testing.

## **Criterion For NIJ’s Consideration Of Proposed EM Devices**

Responders to this solicitation should ensure that the EM device they propose for subjugation to NIJ’s Phase III testing satisfies the criterion described below. NIJ reserves the right to exclude an applicant’s proposed EM device from Phase III testing should NIJ be unable to determine that the device fully satisfies the criterion.

Applicants may propose more than one EM device for NIJ’s consideration for Phase III testing. However, a separate proposal must be submitted to NIJ for each different model, version, or type of EM device proposed by the applicant, regardless of the extent of the difference between the devices. Applicants must realize that NIJ reserves the right to limit the number of EM devices that are selected for Phase III testing. This limitation is necessary due to the funding available to NIJ for the Phase III effort. The number of EM devices that are selected for Phase III testing will be determined by NIJ following its review of the entirety of the proposals submitted by all applicants.

### **Applicable Types of Devices**

NIJ is seeking three different types of EM devices to be submitted to Phase III testing. The first are electrostatic discharge (ESD) devices, which produce a rapid, high-voltage transfer of charge to a targeted vehicle upon direct physical contact with the vehicle. The second type are

non-nuclear, ultra-wide band electromagnetic pulse (EMP) projected energy devices that radiate a solitary pulse of energy omnidirectionally through the atmosphere to a distant target vehicle. The third type are high-power microwave (HPM) or radio frequency (RF) projected energy devices that radiate continuous or repetitive-pulsed energy directionally through the atmosphere to a distant targeted vehicle.

### **Deployment Capability**

Phase III testing will be performed in a field environment to better simulate the realistic operational deployment of the EM devices by law enforcement agencies. An advantage of the field test environment, relative to the laboratory environment of Phase II testing, is an ability to assess EM device performance against vehicles that are moving along a roadway under their own motive power. The Phase III testing will require that the EM devices be deployed against vehicles that are operated in any or all of the following three test conditions: 1) stationary with the engine idling; 2) on a dynamometer with the engine and drive train self-powered; and 3) along a roadway or a paved surface at slow to moderately high speeds with the engine and drive train self-powered.

To be amenable to testing in each of these three conditions, applicant’s EM devices must be capable of being successfully deployed against both stationary and moving vehicles - the latter at speeds as high as 60 miles per hour. Successful deployment of ESD-type EM devices requires their ability to effectively function against target vehicles with the devices positioned on the roadway surface and in the path of oncoming target vehicles. Successful deployment of EMP- and HPM-type EM devices requires their ability to effectively function against moving target vehicles while the devices themselves are either: 1) positioned on the ground off to the side of the path of the target vehicles; or 2) placed on a moving test platform (i.e., a vehicle other than the

target vehicle) moving in front of, along side, or behind the target vehicle.

## **Physical & Functional Maturity**

To qualify for selection by NIJ for Phase III testing, an applicant's EM device must (minimally) be at a breadboard stage of physical maturity at the time of the applicant's proposal submission, and the device must be fully functional. It is highly advised that applicants provide evidence of such in their proposal by way of a description of testing performed on the device, or by providing the results obtained in testing of their device. NIJ will not select design concepts or ideas proposed by applicants in lieu of tangible, functional EM devices.

At the time of proposal submission to NIJ, some applicants may possess tangible, functional EM devices, but they may not be conducive to field testing (breadboard maturity devices are an obvious example). As indicated above, however, funds will be provided to NIJ-selected applicants to perform reasonable developmental work to advance the physical and functional maturity of the EM device (refer to the above section entitled "Permissible Uses Of NIJ Funding"). NIJ's intent in this regard is solely to render those applicant's devices suitable for submission to Phase III field testing.

## **Test Operation of Devices**

Applicants who participate in Phase III testing will be responsible for preparing, deploying, operating, maintaining, repairing, and stowing their own EM devices before, during, and after Phase III testing. NIJ will arrange test engineering support services to be provided at the test site to execute the test plan as well as to assist applicants as necessary. Test engineering support personnel will be responsible for conducting the test trials, including the operation of the test vehicles (i.e., the target vehicles and any device-bearing vehicles). The test engineering support personnel will not operate

the applicant's device unless such is requested by the applicant.

Participating applicants will be responsible for specifying their needs for any test engineering support assistance to NIJ, so that NIJ can assure those needs will be addressed. Shortly after the time of award, NIJ will provide a copy of a Phase III test plan to selected applicants for their reference and use in making test preparations.

## **NIJ's Proposal Selection Criteria**

NIJ will determine those applicant's devices which will participate in the Phase III field test. NIJ's determination will be based on the findings of a peer panel following the panel's review of the entire field of proposals. The panel will consist of members having technical and operational expertise and knowledge pertinent to the subject matter of this solicitation.

Individual EM device proposals will be evaluated using the following criteria.

### **OPERATIONAL/FUNCTIONAL:**

- Anticipated effectiveness of the technologies employed within the applicant's device;
- Anticipated effectiveness of the applicant's device against the population of commercial ground vehicles (i.e., automobiles and trucks);
- Intended operational deployment of the applicant's device:
  - soundness of the concept;
  - ease and practicality of deployment;
- Potential undesired effects associated with deploying the applicant's device on:
  - human safety;
  - vehicles other than that targeted;
  - nearby communication systems; and
- Documented, demonstrated test performance of the applicant's proposed EM device.

## PROGRAMMATIC:

- Soundness of applicant's proposed technical approach for performing device development work, if applicable, to render the device a field-testable prototype device; and
- Justification of applicant's proposed scope of work (including a task plan and the proposed time involved) to perform device development work, if applicable.

## COST:

- Justification of applicant's proposed cost associated with work to perform device developmental work, if applicable;
- Projected production cost of the applicant's EM device, given for quantities of 5, 10, and 20.

## Deliverable Items

Applicants who are supported by NIJ funds as a consequence of this solicitation will be required to submit a final report to NIJ at the conclusion of the Phase III test effort. The final report will include written descriptions of: 1) the configuration and manner of functioning of the applicant's EM device, 2) a summary of the technical effort undertaken to advance the applicant's EM device to a field-testable prototype device, if applicable, and 3) test data, results, conclusions and recommendations obtained or derived from Phase III testing of the device.

## How To Apply

Interested applicants must submit a proposal package to be considered for participation in NIJ Phase III testing. The proposal package will consist of the following documentation:

- An assortment of forms;
- A written abstract;
- A device technical characteristics fact sheet; and
- A written technical narrative.

These documents are described in the following paragraphs.

Applicants need be aware that the volume and complexity of proposals received by NIJ pose an administrative and logistical workload burden that precludes NIJ staff from editing submitted material and/or contacting applicants to make corrections. An applicant's omission of a form, submission of unsigned forms, or submission of forms not collated in specified order are among the reasons for which an application can be rejected by NIJ for administrative reasons, without further consideration for applicant appeal. Proposals that are incomplete or that are hand-written will be judged as they are submitted, or, at NIJ's discretion, they may be returned to the applicant without an extension in proposal submission deadline. No subsequent additions of material to an applicant's original proposal submission will be allowed.

## Proposal Package Description

**Forms.** All of the following forms must be completed by the applicant and signed and dated by a responsible officer of the applicant's organization. The applicant shall submit them in the order they appear below. Blank copies of these forms are included at the end of this document. Information on how to complete the forms is provided below in the section entitled "Guidance on Proposal Preparation".

- Standard Form 424 - Application for Federal Assistance;
- Budget Information (Standard Form 424A);
- Budget Detail Worksheet (OJP Form 7150/1);
- A Budget Narrative Description,
- Assurances Form (OJP Form 4000/3);
- Certifications Regarding Lobbying, Debarment, Suspension and Other Responsibility Matters; and Drug-Free Workplace Requirements (OJP Form 4061/6);
- Disclosure of Lobbying Activities;

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- Negotiated indirect rate agreement, if appropriate; and a
- Privacy certificate.

**Written Abstract.** The abstract is meant to serve as a succinct and accurate summarization of: 1) the nature and capabilities of the applicant's EM device, and 2) any developmental work being proposed by the applicant to advance the device to a field-testable, functional prototype. Applicants must concisely describe the development maturity of their device, the technology(ies) employed within the device, the device's manner of operation, and the work (if any) which is desired to advance the maturity of the device to a field-testable functional prototype. The abstract length is not to exceed 400 words. Proprietary, privacy-confidential, and classified security information is not to be included within the abstract.

### **Device Technical Characteristics Fact Sheet.**

Applicants shall provide a one-page fact sheet that specifies the technical characteristics of their EM device. The fact sheet shall include the following information:

- a) The identity (i.e., a descriptive title) of the applicant's EM device, the applicant's name and organization, and the title of this solicitation;
- b) The device's actual physical size, weight, and configuration (at the time of the applicant's proposal submission per this solicitation), and its anticipated size, weight, and configuration at the onset of Phase III testing;
- c) The estimated time required to re-deploy the device between test trials and between test platforms (i.e., a vehicle (truck) and the ground, and vice versa) during Phase III testing;
- d) A safety statement which identifies any hazardous materials contained within the device (i.e., explosive, corrosive, or combustible materials), or hazards associated with operating the device (other than the emission of radio frequency energy);

- e) The estimated device prototype cost (per unit) based on the configuration and capabilities of the device at the onset of Phase III testing;
- f) The estimated device production cost (assume 5, 10, and 20 units); and
- g) The operating frequency(ies), duty cycle, pulse train duration, pulse width and repetition frequency, pulse rise time, minimum and maximum energy density estimates, rough description of the expected energy distribution versus range (i.e., transmitting antenna pattern), discharge voltage and current levels, (etc), as produced by the operation of the device.

The figures specified by the applicant for device size, weight, and configuration in items a) and b) above are to include contributions made by any of the following: microwave/RF source, power supply (battery and/or portable electric generator), horns, wave guides, support structures and bases, and control electronics. Information in item g) will be useful for computing device compliance with allowable human exposure safety standards; it will also be useful for obtaining frequency approval from the FAA for device use at the Phase III test site.

**Written Technical Narrative.** The applicant's written technical narrative shall include the following items and shall present them in the order given below:

- A title sheet giving the proposal title and the name of the principal investigator(s), their title, organizational affiliation, address, telephone and facsimile (fax) numbers;
- A technical narrative main body, which is described below;
- Appendices including the following:
  - Names and affiliation of all key persons, including personnel in the applicant's organization as well as those in subcontractor and consultant organizations;
  - Resumés of key persons to be involved in EM device developmental work, if

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- applicable, including resumés for contract and consultant personnel;
- Letters of cooperation from organizations who will collaborate with the applicant's organization in the Phase III testing effort, if applicable;
- References, if applicable; and
- Previous NIJ awards received by the applicant's organization, if applicable.

The technical narrative main body shall address the topical areas given below.

- Background or statement of the problem;
- Statement of the proposal objective(s);
- Description of the EM device:
  - Physical configuration (drawings and/or photographs are recommended);
  - Manner of functioning, including a description of the technology(ies) employed;
  - Intended operational deployment scenario;
  - Developmental maturity of the EM device at the time of the applicant's response to this solicitation (describe in terms of the device physical configuration and function); and
  - Any data or results obtained from testing the EM device.
- Description of the proposed developmental effort to advance the EM device to a field-testable prototype, if applicable:
  - Technical objective(s) and approach;
  - Programmatic approach:
    - Task Plan (i.e., list all pertinent tasks which must be performed);
    - Project milestones (a Gantt chart); and
    - Estimated costs as follows:
      - To perform the development effort, if applicable, (cost estimates must be given for each identified task);

- To ship the EM device and ancillary support equipment to and from the Phase III test site;
- To produce 5, 10, and 20 EM devices that are of field-testable maturity; and
- Test site support required by the applicant during the Phase III tests (i.e., electrical power, fuel, hardware, tools, communications equipment, fork lift, etc.).

**Written Proposal Format.** The documents of the written proposal shall be assembled together in the following order of appearance:

- Cover sheet including the following:
  - Title of proposal;
  - Name(s) of proposal author(s);
  - Identity of applicant-affiliated organization(s);
  - Date of submission; and the
  - NIJ solicitation number.
- Assorted forms, in the same order as specified above under the title "Forms";
- Written abstract;
- Device technical characteristics fact sheet;
- Table of contents and, if applicable, a list of figures or illustrations; and a
- Written technical narrative, beginning with the title sheet giving the proposal title and principal investigator information.

The number of pages in the technical narrative part of the proposal must not exceed 30 double-spaced pages, excluding the one-page device technical characteristics fact sheet, any tables or figures (i.e., graphic images), and any appendices. Use of graphical images is recommended but is not required for NIJ's consideration of an applicant's proposal. Applicants are asked to exercise prudent judgement regarding the extent to which graphical images are provided in the written proposal.

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The written proposal, which includes the Written Technical Narrative, must be submitted on 8 1/2" by 11" paper. If applications are bound, which is preferable, the binding should be of the spiral type so that the proposal's pages lie flat when it is opened. Do not use loose-leaf 3-ring binders.

## **Proposal Submission to NIJ:**

Proposals submitted by facsimile (fax) will not be accepted by NIJ. **Ten copies of completed application materials and proposals must be received at the National Institute of Justice by the close of business on 21 September 1998.** This deadline will not be extended.

### **Send completed forms to:**

Evaluation of Vehicle Stopping EM Devices  
Phase III Field Testing  
National Institute of Justice  
Office of Science and Technology  
810 Seventh Street N.W.  
Washington, DC 20531

NOTE: When using overnight delivery services such as United Parcel Service and Federal Express, use a 20001 zip code instead of the 20531 zip code given above.

## **Guidance On Proposal Preparation**

Proposal preparation information is available to applicants who intend to submit a proposal in response to this solicitation. Guidelines for preparing proposals may be obtained from NIJ via the following sources. The two web sites offer NIJ forms and proposal preparation guidelines in the form of electronic files that may be downloaded to a personal computer.

- The Justice Information Center at <http://www.ncjrs.org/fedgrant.htm#NIJ>;
- The NIJ web site at <http://www.ojp.usdoj.gov/NIJ/funding.htm>;
- The National Criminal Justice Reference Service (by telephone) at 800-851-3420, or from the Department of Justice Response Center (by telephone) at 800-421-6770, or at 202-307-1480 from the Washington D.C. metropolitan area); and
- The National Criminal Justice Referral Service (by fax) at 800-851-3420. When calling, initially select option 1, then select option 1 a second time for NIJ. When prompted for a code, enter the following: 1023.

## **Anticipated Number Of Awards**

NIJ anticipates making up to (4) awards under this solicitation to address ESD devices, EMP devices, and/or HPM devices. The actual amounts of the awards will be made on a case-by-case basis.

## **Technical Point Of Contact**

Applicants are encouraged to contact NIJ to discuss topic viability and proposal content before submitting proposals. Applicants may write to Mr. Amon Young, Program Manager, at the NIJ address given above, or may contact him at 202-514-4338 with technical questions between the hours of 7AM and 4 PM Eastern time, Monday through Friday. Please direct queries of an administrative nature to the sources identified above.

**To find out more information about the National Institute of Justice, please contact:**

**National Criminal Justice Reference Service  
Box 6000  
Rockville, MD 20849-6000  
800-851-3420  
e-mail: askncjrs@ncjrs.org**

**To obtain an electronic version of this document, access  
the NIJ web site (<http://www.ojp.usdoj.gov/nij>).**

**If you have any questions, call or e-mail NCJRS.**