

AUTHOR KIT INSTRUCTIONS AND MASTER CHECKLIST

UNCLASSIFIED POSTER SESSION



Instructions

This kit supplies instructions and necessary forms for submitting final manuscripts for the MILCOM 2002 Unclassified Poster Session. Three copies of final, camera-ready and electronic manuscripts, following the [Electronic Manuscript Submittal Instructions](#), are due no later than **June 3, 2002**. Please read the instructions carefully and submit all Mandatory and appropriate Optional forms with the final paper copies.

All presenters must register for the conference (see [Online Conference Registration and Registration Fees](#)). If you plan to attend any classified sessions, you must submit a completed [Security Clearance Form](#) no later than August 26, 2002. In addition, foreign nationals must submit a Request for Visit through their embassies to attend MILCOM 2002 classified sessions. Please allow 4 - 6 weeks for your security office to process the form.

MILCOM 2002 will not process any clearance forms at the conference.

Note: MILCOM 2002 requires both paper and electronic manuscript submission for the Unclassified Poster Session.

Master Checklist

- 1 Upload an electronic copy of manuscript by no later than **June 3, 2002**:
- [Electronic Manuscript Submittal Instructions](#)

- 2 Send 3 copies of Camera-ready manuscript to MILCOM 2002 Unclassified Poster Session by no later than **June 3, 2002**:
MILCOM 2002-Unclassified Poster Session

THE BOEING COMPANY

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Anaheim, CA 92803

See [Preparing FINAL Unclassified Papers](#)

Mandatory Forms

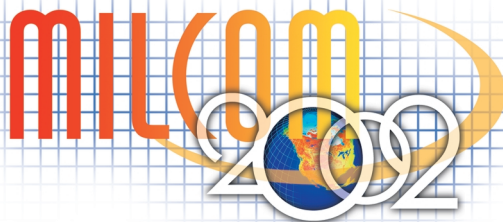
- [IEEE Copyright Form](#)
- Approval Endorsement Forms (Choose applicable)
 - US Authors (Except US Government Employees) [Endorsement Form A](#)
 - US Government Employee Authors [Endorsement Form B](#)
 - Foreign Nationals (Non-US Authors) [Endorsement Form C](#)
- [Speaker's Breakfast/Media Interview Form](#)

Optional Forms

- [Student Travel Support Application Form](#)

The following additional information can be found on-line at www.milcom.org/2002

- [Hotel Reservation Information](#)
- [MILCOM 2002 Special Events](#)
- [General Speaker Instructions](#)
- [IEEE Membership Information](#)
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General Information and Instructions

Please follow all instructions carefully. Omitting any step can jeopardize inclusion of your paper in the Conference Proceedings. Softcopy submission of your paper is required. You will upload a soft-copy of your draft paper to our MILCOM Paper Submission Application (MPSA) on the MILCOM 2002 Website. Page size will be 8 1/2 in. x 11 in. not to exceed five pages (including all illustrations).

Paper Format Specifications

- Prepare your paper using full size format 8 1/2 x 11 in. (21.6 cm x 27.9 cm). Image area is 7 1/2 x 9 1/2 in.
- Top margin is 1/2 in., bottom margin is 1 in.
- Right and left margins are 1/2 in.
- Layout is 2-column, 3-5/8 in. per column, justified
- Paper title is all caps, centered, 12 pt. Times Roman bold
- Headings are all caps, centered, 11 pt. Times Roman bold
- Text font is 11 point Times Roman, single space
- Position figure numbers and title below each figure; treat tables as figures
- Imbed all tables, charts, scans of photos and artwork within the text
- Page numbers are centered, 9 point Times Roman
- The first paragraph must be the abstract in 11 pt. Times Roman Italic
- See figure at right for sample layout

A NULLING ALGORITHM FOR MULTI-APERTURE MULTIPLE BEAM ANTENNAS

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Ann Q. Le

The Boeing Company
Signal Processing and Advanced Technology Department
Anaheim, CA

ABSTRACT

Several multi-aperture multiple beam antennas (MA-MBA) designs have been proposed for future military communications satellites to satisfy demands for increased nulling resolution against jammers. However, overall network performance can be severely degraded because of spurious nulls that are associated with MA-MBA antennas. In this paper, we propose and analyze a nulling algorithm that improves overall network performance by reducing potential performance degradation caused by MA-MBA antenna spurious nulls while providing high jamming resolution. This algorithm also provides wide area coverage for network users near a jammer in support of tactical scenarios. We show that optimized beam weights are a function of individual user optimum beam weights along with proper phase rotation for each beam. Computer simulated results are then provided illustrating performance of this proposed technique versus another nulling algorithm developed for Defense Satellite Communication System (DSCS) Super High Frequency (SHF) satellites.

INTRODUCTION

Multiple beam antennas (MBA) are frequently used on military communications satellites especially to receive the uplink signal so that good gain patterns can be developed in the direction of user terminals while simultaneously providing nulls in the direction of uplink jammers. Recently, the use of additional apertures has been investigated as a means of improving the jammer nulling resolution of these MBAs. In addition to improving nulling resolution, the rapidly changing phase gradients across the field of view of these multi-aperture MBA(MA-MBA) can also provide spurious nulls in the gain pattern. These spurious can seriously degrade the overall gain pattern of these antennas especially for scenarios where a number of desired user terminals are in close proximity to the jammer.

Antenna gain patterns for MBAs, in general, are determined by the complex valued multiplication factors, called beam weights, applied to each beam. Many algorithms have been developed for determining these beams weights. These algorithm attempt to achieve good gain toward desired terminals while simultaneously providing nulls in the direction of jammer terminals. Unfortunately, many of these algorithms do not adequately address the problem of spurious nulls with the result that some user terminals may have lower gain than desired.

This paper presents a new algorithm for determining beam weights. This algorithm is especially well suited for MA-MBA designs since it uses a phase rotation technique which compensates for the large phase difference among individual beams resulting from these beam existing in different apertures. The next section provides an overview of the methodology. Next, the mathematics of the algorithm are presented. Finally, the performance of the new algorithm is evaluated for a particular scenario in comparison with another algorithm.

METHODOLOGY

Good antenna gain patterns must provide gain toward desired terminals while simultaneously exhibiting nulls in the direction of jammers. This later requirement can be considered a constraint on the beam weight vector and this constraint can be imposed simply by working in the null space of the antennas response to the jammer or jammers. Consequently the dimensionality of the problem is reduced and gains are determined while ensuring the jammers are null. The problem is further constrained such that the norm of the beam weight vector in unity. By appropriate normalization of the basis vectors for the null space, this unity norm constraint applies in both the null space and in the full beam weight space. The remaining problem is to find beam weights in the null space which provide good gains toward the desired user terminals.

The need for beam weight phase rotation can best be understood by first considering the special case of real beam weights and then extending the problem to include complex valued beam weights. Consider a two dimensional problem without a jammer as shown in Figure 1.

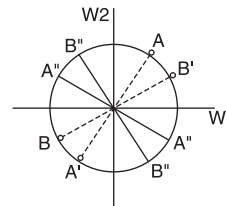
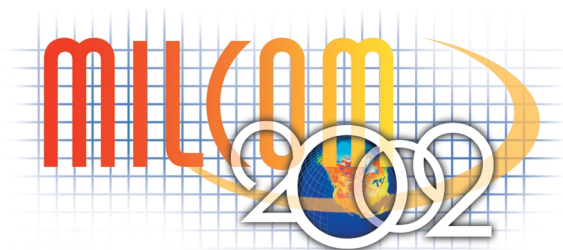


Figure 1. Two dimension Example with Real Weights

As shown in Figure 1, two weights must be selected, W1 and W2. Because there is a constraint on the norm of the



Examples

Follow these examples for Paper, Title with Multiple Authors, and Artwork.

Paper Title

Wideband On-The-Move Satellite Communications Ground Terminal

Frank S. Sutton
The Boeing Company
Phantom Works
Seattle, WA

Paper Title with Multiple Authors

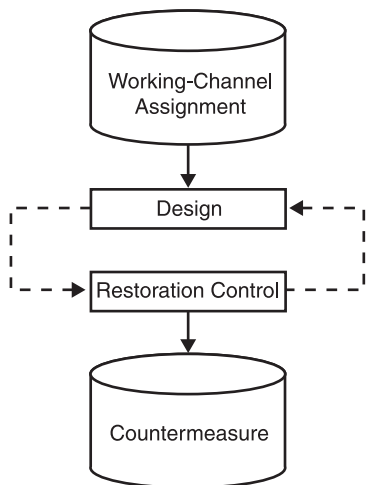
Demonstration of Static Network Mobile Router for Mobile Platforms

Jae H. Kim
The Boeing Company
Phantom Works
Seattle, WA
and
Kent Leung, Kevin Echols, Dan Shell, and Mark Denny
Cisco Systems
San Jose, CA

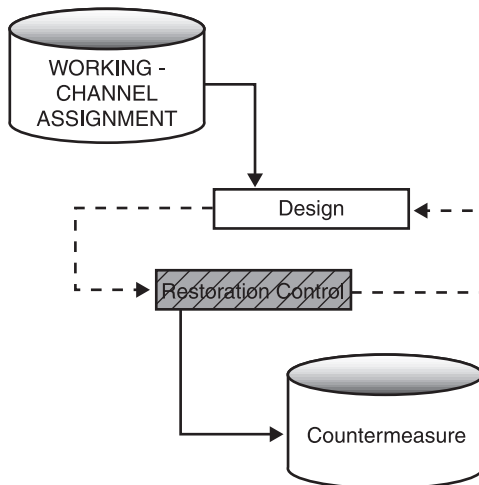
Artwork

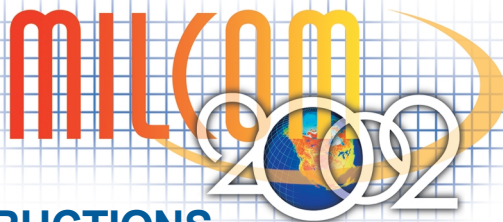
Artwork will reproduce well in the Unclassified Proceedings if these guidelines are followed: Line selection should be simple (a number 1 line with a number 2 line used for emphasis). Shading should be kept at a minimum: Use only to show emphasis or flow. Text should be sans serif (Helvetica, Arial, etc.), black: Do not use color or shadow text. Do not submit any hand drawn artwork or text. Good and Poor art examples are shown below.

Good Artwork



Poor Artwork





ELECTRONIC MANUSCRIPT SUBMITTAL INSTRUCTIONS

Author Instruction

The following instructions are for the electronic manuscript submittal. Please read the detailed instructions that follow before you start, taking particular note of preferred fonts, formats, and uploading the file. The quality of the finished product is very dependent upon receiving your help at this stage of the publication process.

Producing Your Paper

Acceptable Formats

Papers must be submitted electronically in one or more of the following formats, listed in order of preference.

- Portable Document Format (.pdf)
- PostScript (Level I, II) (.PS)

Generating PostScript and PDF Files

The submission of your document as a PDF file is the preferred method. PDF files are more likely to preserve your intended layout than other formats.

Almost all applications/systems can produce a suitable PostScript file, which can then be converted to PDF. PS files may be generated in a wide variety of ways. In all cases, the quality of your PostScript file will have a direct impact on the quality of the converted file. A high quality PS file is one that reliably produces pages with the desired look, as efficiently as possible.

Please review the following suggestions for producing your PostScript file. This will ensure it is usable and presented in the manner you wish.

- Use only base fonts (see Fonts). If you use ANY OTHER font(s), you must embed those fonts in the PostScript file. If using a Windows system, select the "Use Printer Fonts for all TrueType Fonts" option in the "Advanced Options" dialog box for the PostScript printer driver.
- Embed all images and figures.
- Make sure that your submitted paper prints correctly to a PostScript printer. Files that cannot be printed usually can not be converted. Select the following printer for PostScript output:

Windows 3.1, 3.11- PostScript Printer driver

Windows '95- Adobe PS 4.1 (available from www.adobe.com) OR any Linotronic printer driver

Window NT- any Linotronic printer driver

Mac OS - Laser Writer 8.x driver
OS/2 - any Apple LaserWriter with PostScript driver

- Always use the latest version of your PostScript driver and select PostScript Level 2 if available.
- If you design your document using color, select a color PostScript printer to create your PostScript file. Note that many applications create color data only when printing to a color printer and will create a grayscale document unless a color PostScript printer is selected.
- Do not use custom halftones (photo-graphs) and pattern fills. Instead use solid-color or gray scale fills to produce a more readable document on-screen that will also load and print significantly faster.
- Do not select "Smooth Graphics". This option often produces extremely large files that will take a long time to display and print. The Smooth Graphics option is usually found in the Page Setup Dialog box in Macintosh applications and some Windows applications.

Converting Word Files

You will need either the PDF Writer or any PostScript printer driver installed to create a PDF from a Word document.

To generate a PDF file from a Word document

Generating a PDF directly from Word requires the PDF Writer driver. All default settings for this driver should be kept except the following if you use any fonts other than the base fonts (see Fonts):

1. Select File /Print
2. Under Printer Name select the Acrobat PDF Writer driver
3. Click Properties button to the right of the Printer Name text box
4. Click Compression
5. Under the Compatibility drop-down list, choose Acrobat 3.0 or higher
6. Click OK
7. Click Fonts
8. Check the "Embed All Fonts" option in the upper left corner, or check the "Always Embed List" option and add all fonts used in your paper to the list (you may opt to embed only those fonts that are not base fonts)
9. Deselect any subsetting options (IMPORTANT)
10. Click OK twice, then either click Close to complete the configuration, or OK to create the PDF.

After the properties are set, you may also create a PDF by choosing **File/Create Adobe PDF /Print via PDF Writer**.

If you have used only base fonts (see Fonts) you need not embed any fonts. You must, however, change the compatibility setting as instructed above.

To generate a PostScript file from a Word document

If you have a PostScript driver you will need to create the PostScript file first, then convert it to PDF:

1. Select file /Print
2. Under the Printer Name, choose the PostScript printer
3. Check the Print to File checkbox
4. Click OK to output a PostScript file. The extension of this file will be either *.ps or *.prn. Both of these files are recognized as PostScript files.

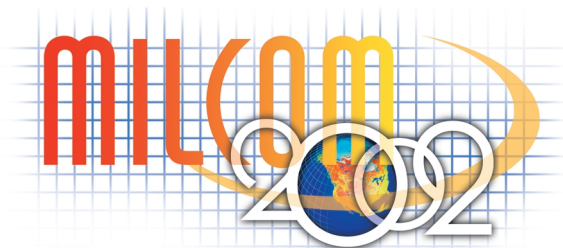
Please include a second format if possible (i.e., PDF and the original preferred application, Microsoft Word document) to assist if there is trouble during the conversion process.

Fonts

The following fonts are considered **base fonts**, and you are encouraged to limit your font selections to this list. These fonts are automatically installed with the viewing software and made available to all papers included on the published CD without having to be included within individual PDF files. Please note that Times is the preferred font.

- Arial
- Courier
- Courier-Bold
- Courier-Italic
- Courier-Bold Italic
- Helvetica
- Helvetica-Bold
- Helvetica- Italic
- Helvetica-Bold Italic
- Symbol
- Times/Times New Roman
- Times-Bold
- Times-Bold Italic
- Zapf Dingbats

Using these fonts will reduce the size of your converted paper as well as speed up the display and printing of your paper for the readers. Additionally, using only the specified fonts provides a consistent look across to all material on the published CD. If you decide to use fonts other than "base fonts" you must submit your paper as a PostScript or PDF file with embedded fonts. The embedded fonts will be preserved during the conversion process.



Including Graphics/ Images

The type of graphics you include will affect the quality and size of your paper on the electronic document disc. In general the use of vector graphics such as those produced by most presentation and drawing packages (i.e., MS PowerPoint) can be used without concern and is encouraged.

The use of bitmap images such as those produced when a photograph is scanned require significant storage space and must be used with care. Bitmap graphics store an image as a series of numbers that represent the color of each dot in the image. Increasing the size, resolution (dots per inch), or number of colors in an image will dramatically increase the size of the image.

If your paper contains many large images they will be down-sampled to reduce their size during the conversion process. However, the automated process used will not always produce the best image, and you are encouraged to perform this yourself on a image-by-image basis.

Suggestions for improving the quality of bitmap graphics include the following:

- In general, bitmap images should be limited to no more than 256 (8 bit) color/gray scale, 150 dpi, and should be kept as small as possible.
- Reduce the number of display colors before making screen shots. The majority of computer applications use less than 16 colors for their menus, dialogs, etc.
- Select higher resolutions only for images that a reader will magnify. Image resolution does not increase when readers zoom in on an image.

All images must be embedded into your document.

File Size Limits

File size should be reasonable – not more than 5 MB.

Compressing Your Submission

Submitting your material is quicker and easier if all of the files are collected into a single archive using one of the following formats:

- Pkzip (.zip)
- Stuffit (.sit)

Naming Convention

Use your Abstract ID Paper Tracking No. as your file name, followed by the appropriate file extension. For example, if your paper tracking Number is 134, file name will be 134.doc.

Uploading your file(s) is a two-step process.

- 1) Launch your Internet browser and go to the MILCOM 2002 website. Once there, click on the Submit Paper link, and follow the instructions given.

Frequently Asked Questions

Q. How will I know if my paper was received?

- A. You will receive a confirmation email when your paper is detected.

Q. I uploaded my paper to the MILCOM 2002 website, but when I went back later to see if it was there, it was gone. What happened to it?

- A. Once your submission is detected on our site, we move it inside our firewall to a location where our Production Team can access it. It will no longer be visible on our website.

Q. I have uploaded two different versions of my paper. How do you know which one to use?

- A. Each version of your submission is automatically date/time stamped, so that we know which one is the most current.

Q. My system keeps timing out when I try to upload my file. What should I do?

- A. You can try two things. If your file is large, you may want to compress it before uploading it (zip, sit, tar, etc.). If you have already done this, you should wait a little while and then try to upload your file again. Sometimes your specific Internet route may experience heavy Internet traffic, slowing down your connection and resulting in time-outs and/or painfully slow transmissions.

Q. If I have a technical problem uploading my file, who can I contact?

- A. E-mail: dfrey@afcea.org The subject line of your message must be "MILCOM Papers".

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UNCLASSIFIED POSTER SESSION

Applicability

Part I must be completed for all papers submitted by US Authors (excluding US Government Employees). Additionally, either Column A or Column B of Part II must be completed. If Part II Column B is completed, then Part III is required.

Title of Paper

Paper Tracking No. (Required)

Part I - Author and Company or University First Endorsement

Signature in Part I certifies that author and coauthor(s), if any, have received all required company or university approvals.

Author (Print or type)

Author's Phone

Fax

Company/University Name

Mailing Address

City, State, Zip

Author's Signature

Date

Note:

For jointly authored papers, only one signature is required, but all coauthors need to be advised of the above terms (i.e., they also need to have received all required approvals prior to signature) and agree with the column selected/signed in Part II.

Part II - Author and Company or University Second Endorsement

Column A

By signing below, author certifies that all information used in preparing this paper was derived from unclassified/open sources and that no information was used from work performed or derived under a US Government contract or US Government grant. (Part III is not required when author signs Part II, Column A).

Author's Signature

Date

Column B

For work performed or derived under a US Government contract or grant, complete the following.

Contract or Grant Number

US Government Agency Awarding Contract or Grant

Author's Signature

Date

Part III - US Government Public Affairs Office Endorsement

Part III is required for unclassified papers to be presented in an unclassified (open) MILCOM 2002 session when Part II, Column B is signed. Part III is to be completed by a US Government individual authorized to release and clear information for open publication or public disclosure (e.g., security review officer).

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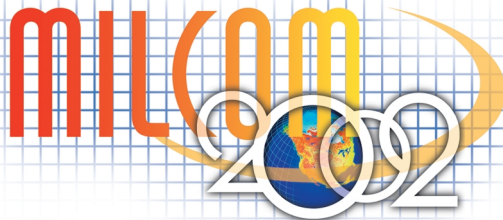
Releasing Official's Signature

Date

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APPROVAL ENDORSEMENTS: U.S. GOVERNMENT EMPLOYEE AUTHORS FORM B - MANDATORY

UNCLASSIFIED POSTER SESSION



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This form is to be used only by US Government Employee Authors (military and civilian). Complete Parts I and II for all papers.

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Author's Phone

Fax

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Mailing Address

City, State, Zip

Author (Print or type)

Date

Author's Signature

Date

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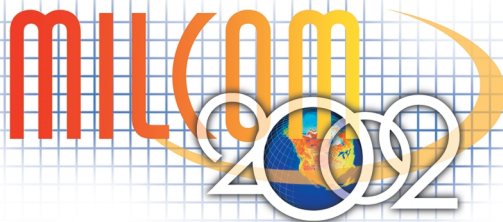
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APPROVAL ENDORSEMENTS: FOREIGN NATIONALS (NON- U.S. AUTHORS) FORM C - MANDATORY

UNCLASSIFIED POSTER SESSION



Applicability

This form is to be used only by non-US citizen authors. Complete Parts I and II for all papers. If the paper is coauthored with a US citizen, the applicable author form A or B is also required.

Title of Paper

Paper Tracking No. (Required)

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Author (Print or type)

Author's Phone

Fax

Company/University Name

Mailing Address

City, State, Zip

Author's Signature

Date

Part II - Endorsement

Part II is required for papers to be presented in an unclassified (open) MILCOM 2002 session. Part II is to be completed by an official authorized to release and clear information for open publication or public disclosure (e.g., public affairs officer or security review officer). If no agency/government approvals are required, the author must sign Part II.

Name of Releasing Official (Print or type)

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Date

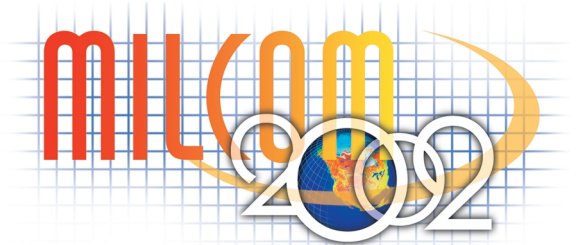
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SPEAKER'S BREAKFAST MEDIA INTERVIEW - MANDATORY

UNCLASSIFIED POSTER SESSION



Speaker's General Information

Speaker's Name: _____ Date: _____

Title of Paper: _____

Business Phone: _____ Fax Number: _____ E-Mail: _____

Signature: _____

Speaker's Breakfast

* Each speaker is entitled to a complimentary breakfast on the day of his/her presentation.

I will attend the Speaker's Breakfast Yes No

Media Interview Availability

Journalists from the general news media and trade press will be invited to attend all unclassified sessions at MILCOM 2002. They may report anything said or shown at these open sessions. Your presentations and artwork must be planned and cleared accordingly. If your presentation generates media interest, will you be available for an interview? Yes No

MILCOM's publicity committee will handle arrangements for media requests. The interview can be conducted in the hotel's media center, if you desire.

Interviewees and their companies or organizations are solely responsible for the following:

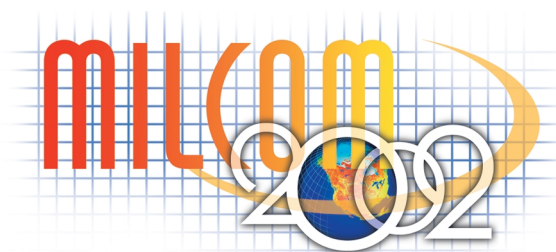
- The decision to be interviewed
- The interview's content
- All security and media relations aspects connected with the information released

We recommend that you coordinate your actions with the public relations or public affairs function within your company or organization. If you have any questions call **MILCOM 2002 Communications Chair:**

Felicia A. Cambell (562) 797-4303, or felicia.a.cambell@boeing.com

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STUDENT TRAVEL SUPPORT APPLICATION REGISTRATION ADDITIONAL FORM (IF APPLICABLE)



UNCLASSIFIED POSTER SESSION

Applicability

Travel grants are intended to provide partial reimbursement of travel costs for full-time students attending MILCOM 2002 and making technical presentations based on research conducted as part of graduate-level university degree program in engineering or science. Although the primary goal is to provide partial or full reimbursement of transportation costs, the MILCOM 2002 Conference Board does not wish to rule out the reimbursement of hotel, registration, or other expenses in certain instances.

Student Name: Last First Middle Initial

Student IEEE Number Student SSN

University

University Address

City, State, Zip

Advisor's Name Advisor's Phone

Title of Paper Paper Tracking No.

Student Signature: I am a full-time student at the university listed above

Advisor's Signature: I confirm the above information and verify that alternate travel support for this student does not exist

Guidelines for MILCOM 2002 Graduate Student Travel Grants

The guidelines provide some degree of uniformity in the selection of MILCOM Student Travel Grant recipients from year to year. However, these are guidelines, not restrictions. The final authority in awarding travel grants lies with the Technical Program Chair.

Eligibility Guidelines

- Eligibility is limited to full-time university students who are enrolled in a graduate program and are making satisfactory progress toward a graduate-level engineering or science degree, as certified by the student's graduate thesis advisor.
- The student must be the author or a coauthor of a technical paper that has been accepted for presentation at MILCOM 2002. The paper must be based on the student's graduate research, as certified by the student's thesis advisor.
- The student must submit this completed application form, the copy of the camera-ready manuscript, and a copy of the appropriate MILCOM 2002 approval form indicating that the paper has been approved for release and publication in the MILCOM 2002 Conference Proceedings. The student's university affiliation must be displayed on the paper, and no company affiliations may be given.
- The student must be a member or student member of IEEE.

Grant Awards

All recipients of a Student Travel Grant will receive a Grant Award Letter from the Technical Program Chair specifying the amount of the award.

Grant Reimbursement

After the paper is presented, the student should contact the MILCOM 2002 Registration Supervisor to receive the grant award. The student must present a copy of the Grant Award Letter signed by the Technical Program Chair and a photo ID.

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