

Cyber Grand Challenge

Technical Paper Guidelines

May 29, 2014



Defense Advanced Research Projects Agency
Information Innovation Office
675 North Randolph Street
Arlington, VA 22203-2114



Document Change Summary

[illegible]

1. Introduction

To receive an invitation to the Cyber Grand Challenge (CGC) Final Event (CFE), a team must submit an acceptable CGC Qualifying Event (CQE) technical paper to DARPA describing their Cyber Reasoning System (CRS). CQE technical papers will be evaluated and approved according to the CGC Technical Paper Guidelines outlined below.

DARPA will review each technical paper and communicate acceptance of papers to each team leader.

CQE Technical Papers are due Thursday, March 5, 2015.

2. Required Technical Content

The DARPA Cyber Grand Challenge is intended to catalyze research in areas automated Computer Network Defense (CND). The goal of the teams' technical papers should be to inform DARPA about advances made in the state of the art; communicate potential risks, encumbrances, limitations and weaknesses; and apprise about lessons learned. The technical papers are required to describe the overall architecture of the CRS, the CRS' approach to the Areas of Excellence (AoE), and the strategies the CRS will employ in competition.

	Areas of Excellence (AoE)	CGC Qualification Event (CQE)	CGC Final Event (CFE)
AoE 1	Autonomous Analysis: The automated comprehension of computer software (e.g., CBs) provided through a Competition Framework.	✓	✓
AoE 2	Autonomous Patching: The automatic patching of security flaws in CBs provided through a Competition Framework.	✓	✓
AoE 3	Autonomous Vulnerability Scanning: The ability to construct input which when transmitted over a network provides proof of the existence of flaws in CBs operated by competitors. These inputs shall be regarded as Proofs of Vulnerability.	✓	✓
AoE 4	Autonomous Service Resiliency: The ability to maintain the availability and intended function of CBs provided through a Competition Framework.	✓	✓
AoE 5	Autonomous Network Defense: The ability to discover and mitigate security flaws in CBs from the vantage point of a network security device.		✓

3. CQE Technical Paper Formatting Requirements:

The United States Government uses ANSI NISO Z39.18 as a guide for most of its technical reports. CGC will use this subset of the ANSI standard to highlight important guidance addressed in the ANSI standard as outlined below. Full component descriptions are available in the ANSI NISO Z39.18.

COMPONENTS OF A TECHNICAL REPORT

	POC	Inclusion Status
Front Matter – numbered sequentially with Roman numerals beginning with Table of Contents		
Cover or Title	Report Author	Required
Table of Contents	Report Author	Required
List(s) of Figures and Tables	Report Author	Conditional (include when there are more than 5 figures and/or tables)
Foreword	Report Author	Optional
Preface	Report Author	Optional
Acknowledgements	Report Author	Optional

Body – numbered sequentially beginning with the Arabic numeral 1		
Summary	Report Author	Required
Introduction	Report Author	Required
Methods, Assumptions, and Procedures	Report Author	Required
Results and Discussion	Report Author	Required
Conclusions	Report Author	Required
Recommendations	Report Author	Conditional (include when purpose of report is to suggest a course of action)

References	Report Author	Conditional (use if references are provided)
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Back Matter – numbering continues sequentially from body of report		
Appendices	Report Author	Conditional (Include when needed to supplement Results and Discussion)
Bibliography	Report Author	Conditional
List of Symbols, Abbreviations, and Acronyms	Report Author	Conditional (include if used in any other component of the report)
Glossary of Terminology	Report Author	Conditional (Include if report incorporates terms unfamiliar to the intended audience)
Index	Report Author	Optional

FORMAT REQUIREMENTS:

1.0 TYPE (FONT) AND HEADS (CHAPTER TITLES)

The preferred type (font) is 12-point Times New Roman or Arial. The following is an example (format and spacing) of heads:

1.0 FIRST-ORDER HEAD IS ALL CAPS, FLUSH LEFT AND BOLDED

1.1 Second-Order Head is Bolded, Same Font Size as Text, Caps and Lower Case, Flush with left Margin

Insert one blank line between head and text then begin copy.

1.1.1 Third-Order Head is Flush Left, Boldface, Caps and Lower Case Letters, Followed by a Period. Then continue the copy.

2.0 SPACING

Final reports should be single spaced. It is not necessary to double-space between paragraphs if the first line of each paragraph is indented.

3.0 MARGINS

Leave **one-inch left, right, and top margins**. *Page number should be centered and located one-half inch (1/2") from bottom of page.* This is accomplished in page setup, Margins - bottom - 1", Layout – Footer .7". Leave enough room at the bottom of each page to include applicable restrictive statements.

4.0 NUMBERING

Page numbers are centered at bottom of page. Figure numbers are centered **below** Figure, with caption centered either on the line below Figure number or on the same line as Figure number. Table numbers are centered **above** Table on the same line as Table caption, and Equations are numbered on right margin across from Equation.

Number Pages, Figures, Tables, and Equations sequentially, not by section.

5.0 PRESENTATION STYLES

5.1 All figures, tables, equations, and line drawings shall be crisp and easy to read. Figure letters and numbers (callouts) should be in at least an 8-point type (handwriting on figures is not acceptable). Figures and tables in the table of contents are numbered, worded, spelled and punctuated exactly as they are in the report.

5.2 Style for Equations:

$$E = mc^2 \quad (1)$$

$$\phi_{\text{det}} = L_e \times \Omega_{\text{det}} \times v n(D, \hat{i}) \cdot \pi D^2 dD \quad (2)$$

5.3 Style for Figure Captions

Callouts (labels) should be in Upper and Lower case type, not all caps, bolded, no periods.

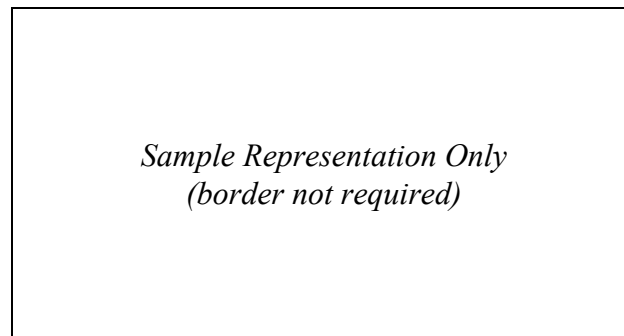


Figure 1. Figure Caption May be on Same Line as Figure Number

5.3.1 The figure caption describes the content without giving background information, results, or comments about the figure. Reference to Figures and Tables must appear in text ***before*** actual Figure or Table appears in report. Where possible, integrate Figures and Tables into text and place Figure/Table as soon after the first mention of it as possible, before beginning a new subject. There should be two blank lines between Figures or Tables and text.

5.4 Style for **Table Captions** (authors should use the style listed in para 5.3 above)

Table 1. Title Line and Number All in One Line, Centered or Flush Left, Bolded, (No Periods)

<i>Sample Representation Only (border not required)</i>

6.0 FRONT MATTER

The **Cover Page** is always the first page of the report. Then there should be the three sections (with page numbers listed in lower-case Roman numerals, beginning with Roman numeral i), **Table of Contents, followed by List of Figures, and List of Tables.**

6.1 Table of Contents

Start pagination of Table of Contents with lower-case Roman numeral i. Start listing contents that are in front matter, e.g. List of Figures, List of Tables, Foreword, Preface, then body of text, then back matter. Appendices should be numbered sequentially from the last page of the report. If there's only one Appendix, just call it an Appendix. Example (border not required):

TABLE OF CONTENTS	
Section	Page
List of Figures.....	iv
List of Tables.....	v
1.0 SUMMARY.....	1
2.0 INTRODUCTION.....	3
3.0 METHODS, ASSUMPTIONS, AND PROCEDURES.....	4
3.1 High Symmetry Hypervalent Structures (OF ₆).....	7
3.2 Azide-like Structures.....	9
3.2.1 N(N ₃) ₃ , HN(N ₃) ₂ , N(N ₃) ₂ [−] and N(N ₃) ₄ ⁺	12
4.0 RESULTS AND DISCUSSION.....	15
5.0 CONCLUSIONS.....	35
6.0 REFERENCES.....	37
APPENDIX A – Publications and Presentations.....	40
APPENDIX B – Abstracts.....	51
LIST OF SYMBOLS, ABBREVIATIONS, AND ACRONYMS.....	59

6.3 List of Figures

Continue pagination with lower-case Roman numerals. List all Figures found in text (not Figs. in Appendix, if any, those will be listed separately in front of the Appendix). Example (border not required):

LIST OF FIGURES		
Figure		Page
1	Overall View of Propulsion Vehicle.....	3
2	Motor Configuration.....	6
3	Apparatus Used to Make Nozzle Tubes.....	7

6.4 List of Tables

Continue pagination with lower-case Roman numerals. List all Tables found in text (not Tables in Appendix, if any, those will be listed separately in front of the Appendix). Example (border not required):

LIST OF TABLES		
Table		Page
1	Some of the Upper-Stage Propulsion Options.....	3
2	Results of Test Firing #1.....	6
3	Results of Test Firing #2.....	7

7.0 BODY

Next, start body of text with **Summary** and begin pagination with Page 1 (Arabic numerals). This may be accomplished by inserting a Section Break and start the pagination with 1. Follow with **Introduction, Methods, Assumptions, and Procedures, Results and Discussion, Conclusions**, then **References**, to be followed by the appropriate **Back Matter**.

7.1 References

References should be listed numerically, in the order they appear in the text. The Reference page should be at the end of the report (not at the end of each section).

For works that are generally referred to throughout the report, without citing specific references from the work, create a Bibliography (in alphabetical order). Personal communications, unpublished speeches, or any other information not available for reference by the reader should not be included in the References – footnote your citation instead. References must be available to readers of the report.

References are prepared according to the accepted practice of the discipline of the primary author/creator of the report. The examples below are a suggested format.

7.1.1 Papers / Journal Articles / Conference Presentations or Proceedings

Author's last name, then first

Titles of papers are in quotation marks

Journal names or Conference names are in *italics*

Volume is **bolded**

Date follows comma (not within parenthesis)

Page numbers (pp.) are last.

Examples:

Author(s), "Title of Article," *Journal Name (italics)*, **19**, 628, Jun 1993 pp. _-_.
Chidambaram, N., Dash, S., and Kenzakowski, D., "Scalar Variance Transport in the

Turbulence Modeling of Propulsive Jets," *Journal of Propulsion and Power*, Vol. 17, No. 1, pp. 79-84, 2001.

Author(s), "Title of Article," Paper No. (if AIAA or CPIA paper, etc.), *Name of Conference*, Location, Date.

Chai, A.H., Cao, Z.T., Chen, H. P., "Monte Carlo Method Study of Terahertz Pulse Propagation in Biological Tissue," *Proceedings of the 2005 IEEE, EMBS 27th Annual Conference*, Shanghai China, (2005).

7.1.2 URLs The URL or other path information appears instead of the volume and number cited for a conventional journal. It is frequently useful to the reader to know the date when the material was accessed. In such cases, "Accessed [date]" would be appropriate wording.

Virillio, Paul, "Speed and Information: Cyberspace Alarm!" CTHEORY, URL:
<http://www.freedonia.com/ctheory/>, last modified September 19, 1995. Accessed
November 17, 1999.

7.1.3 Technical Reports

Author's last name, then first

Titles of reports are in *italics*

Next is report number

Name and address of performing agency/organization

Date is last.

Example:

Author(s), *Title*, AFRL-PR-ED-TR-20XX-XXXX, Company, Inc., City, ST, Jan 2006.

Gaitonde, Datta, *Advances in High-Fidelity Multiphysics Simulation*, AFRL-RB-WP-TR-2008-3019, Wright-Patterson AFB: AFRL Air Vehicles Directorate, 2008.

Gaitonde, Datta, *Advances in High-Fidelity Multiphysics Simulation*, AFRL-RB-WP-TR-2008-3019; ADB123456, Wright-Patterson AFB: AFRL Air Vehicles Directorate, 2008.

7.1.4 Books

Author's last name, then first

Title of book can be **Bolded** or Underlined

Publisher's name and address

Date of publication

Page numbers last

Example:

Author(s), **Book Title**, Harper & Rowe, New York, NY, 1993, pp. 36-38, 77, 98-101.

Wylie, C.R., **Advanced Engineering Mathematics**, 7th ed, New York: McGraw-Hill, 2005.

8.0 BACK MATTER

Pagination continues from the body. Include conditional and optional back matter in the order listed in the components table on page 2: Appendices, Bibliography, List of Symbols, Abbreviations, and Acronyms, Glossary, and Index.

8.1 Appendices

If there is only one appendix, titled Appendix, all tables and figures in that appendix are prefixed with A-, the “A” representing the word, Appendix.

Each appendix should be referred to in the body text. Any references cited in an appendix must be listed as the last page of the appendix. Appendix page numbering is a sequential continuation of the Arabic text page numbering.

Number figures, tables, equations, and references in an appendix with the letter of the appendix, followed by a hyphen and a sequential number, starting at 1, e.g., Figure A-1. An Appendix Figure; Table A-1. An Appendix Table; and for reference citations, [A-1].

8.2 Symbols, Abbreviations and Acronyms

When first introduced in the report (title or text), completely write out abbreviations and acronyms, followed by the abbreviation or acronym in parentheses, and subsequently use only the acronym/abbreviation in the body text ; i.e. Small Business Innovation Research (SBIR).

Create an acronym list that lists and defines all acronyms and symbols that appear in your report. List all terms alphabetically, beginning with those starting with capital letters, followed by lower case (e.g., H₂, HEDM, hcp). Follow alphabetical entries with Greek or special symbols. Capitalize definitions only if they are proper names (e.g. Department of Defense).

Example (border not required):

LIST OF SYMBOLS, ABBREVIATIONS AND ACRONYMS	
CAT	computerized axial tomography
COMSAT	Communication Satellites
DMP-128	a Polaroid™ photopolymer
DoD	Department of Defense
dcg	dichromated gelatin
H ₂	hydrogen
HEDM	High Energy Density Matter
∇	angle of attack

The words “Figure,” “Reference,” and “Equation” should be written out in text, but abbreviated when used within parentheses. Months are abbreviated to three letters without punctuation (e.g., Jun, Jul, Aug). Units of measurement are abbreviated (e.g., 12 cm, 50 l, 20 lb, 1 atm, 30 sec, 200 psig) without punctuation – except for “in.” (inches), which may be followed by a period to distinguish it from the preposition – and are generally singular.

For a complete list of abbreviations, see Chapter 9 of the *GPO Style Manual*
<http://www.gpoaccess.gov/stylemanual/browse.html>.

9.0 INSTRUCTIONS FOR SUBMITTAL

For Open Track teams, those not under contract for the Cyber Grand Challenge, deliver a copy of the final technical report via email to CyberGrandChallenge@darpa.mil in such a form that it may be evaluated by the government and Cyber Grand Challenge support contractors.

For Proposal Track teams under contract follow your Contract Data Requirements List (CDRL) for submission instructions. If your CDRL requires delivery of the final technical report on CD-ROM, ensure it is marked as follows:

CD-ROMs shall have the following items legibly printed on top of the disk:

1. Contract Number and Program Name.
2. CDRL numbers referenced and Title of Data Items.
3. Date.
4. Company Logo/ Nomenclature.
5. Distribution Statement, export control warning notice (when applicable).

4. Appendix A: Template

Cover Page: *(Requires only the following information):*

Title
Subtitle (if any)

Date

Author(s)

Organization Name and Address

Body of Report: *(A checklist at the end of this section has been provided for additional guideline purposes)*

TABLE OF CONTENTS

NOTE: An electronically linked TOC is preferred

Section	Page
List of Figures.....	[]
List of Tables.....	[]
<p>NOTE: The categories above are conditional (include when there are more than 5 figures/tables), page numbers should be sequential in lower-case Roman numerals beginning w/ the Table of Contents (Arabic numerals begin with the SUMMARY); DELETE any or all of the above if not required</p>	
Foreword.....	[]
Preface.....	[]
Acknowledgements.....	[]
<p>NOTE: The above 3 categories are optional, page numbers should be lower-case Roman numerals; DELETE any or all of the above if not including</p>	
1.0 SUMMARY.....	[]
1.1 [Second-Order Head, Caps and Lower Case].....	[]
<p>NOTE: <u>Insert additional order heads as needed</u> in caps and lower case, numbered as 1.1, 1.2, 4.1, 4.2, etc. as the First-Order Head number of each category dictates, ONLY first, second, and third order heads need to be listed in the TOC; DELETE Second-Order Head 1.1 if not needed</p>	
2.0 INTRODUCTION.....	[]
3.0 METHODS, ASSUMPTIONS, AND PROCEDURES.....	[]
4.0 RESULTS AND DISCUSSIONS.....	[]
5.0 CONCLUSIONS.....	[]
<p>NOTE: The above 5 categories are required, page numbers should be Arabic numerals beginning w/ Page 1 and all following pages in sequence</p>	
6.0 RECCOMENDATIONS.....	[]
<p>NOTE: Conditional (include when purpose of report is to suggest a course of action)</p>	
7.0 REFERENCES.....	[]
<p>NOTE: Conditional (use if references are provided)</p>	
APPENDIX – [Title in Caps and Lower Case].....	[]
<p>NOTE: Conditional (include when needed to supplement Results and Discussion); If more than one appendix</p>	

is needed, list as APPENDIX A, APPENDIX B (all caps) etc., followed by the title as formatted above

BIBLIOGRAPHY.....	[]
NOTE: Conditional	
LIST OF SYMBOLS, ABBREVIATIONS, AND ACRONYMS.....	[]
NOTE: Conditional (include if used in any other component of the report)	
GLOSSARY OF TERMINOLOGY.....	[]
NOTE: Conditional (include if report incorporates terms unfamiliar to intended audience)	
INDEX.....	[]
NOTE: Optional, DELETE if not including	

REMEMBER – DELETE all notes and all category lines you are not using, make sure the PAGE NUMBERS ARE CORRECT

LIST OF FIGURES

Figure		Page
1	[Title – Caps and Lower Case].....	[]
2	[Title – Caps and Lower Case].....	[]
3	[Title – Caps and Lower Case].....	[]
4	[Title – Caps and Lower Case].....	[]
5	[Title – Caps and Lower Case].....	[]

NOTE: Conditional (include when there are more than 5 figures), add additional figures by following the format above; **make sure your page numbers are correct; DELETE** if not required

SAMPLE: Format figures in report as follows:

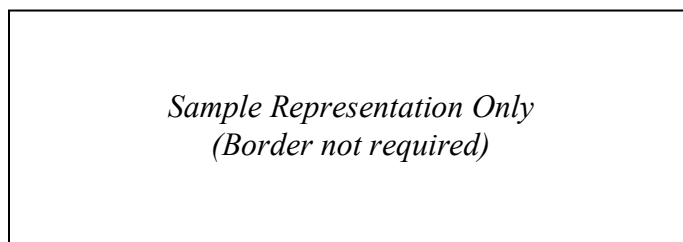


Figure []. [Caption (short and concise) – Centered, Bold, Caps and Lower Case, No Periods]

NOTE: Caption font should be no smaller than 8pt; there should be 2 blank lines between figures/tables and text; figure captions must go BELOW the figure; **DELETE this sample before submitting**

LIST OF TABLES

Table	Page
1 [Title – Caps and Lower Case].....	[]
2 [Title – Caps and Lower Case].....	[]
3 [Title – Caps and Lower Case].....	[]
4 [Title – Caps and Lower Case].....	[]
5 [Title – Caps and Lower Case].....	[]

NOTE: Conditional (include when there are more than 5 tables), add additional tables by following the format above; **make sure your page numbers are correct; DELETE** if not required

SAMPLE: Format tables in report as follows:

Table []. [Caption – Centered, Bold, Caps and Lower Case, No Periods]

<i>Sample Representation Only (border not required)</i>

NOTE: Caption font should be no smaller than 8pt; there should be **2 blank lines between figures/tables and text**; table captions must go ABOVE the table; **DELETE this sample before submitting**

FOREWARD

[Begin text here, font must be 12pt Times New Roman]

NOTE: Optional, **DELETE** if not including

PREFACE

[Begin text here, font must be 12pt Times New Roman]

NOTE: Optional, **DELETE** if not using

ACKNOWLEDGEMENTS

[Begin text here, font must be 12pt Times New Roman]

NOTE: Optional, **DELETE** if not using

1.0 SUMMARY

[Begin text here, font must be 12pt Times New Roman]

1.1 [Second-Order Head, Bold Caps and Lower Case]

[Begin text here, font must be 12pt Times New Roman]

NOTE: Insert additional order heads as needed in caps and lower case, numbered as 1.1, 1.2, 4.1, 4.2, etc. as the First-Order Head number of each category dictates; **DELETE Second-Order Head 1.1 if not needed**

2.0 INTRODUCTION

[Begin text here, font must be 12pt Times New Roman]

3.0 METHODS, ASSUMPTIONS, AND PROCEDURES

[Begin text here, font must be 12pt Times New Roman]

4.0 RESULTS AND DISCUSSIONS

[Begin text here, font must be 12pt Times New Roman]

5.0 CONCLUSIONS

[Begin text here, font must be 12pt Times New Roman]

6.0 RECCOMENDATIONS

[Begin text here, font must be 12pt Times New Roman]

NOTE: Conditional (include when purpose of report is to suggest a course of action); **DELETE** if not required

7.0 REFERENCES

[Begin text here, font must be 12pt Times New Roman]

NOTE: Conditional (use if references are required), see sections 7.1-7.4 of the CGC Technical Paper Guidelines for complete instructions on how to properly list references; **DELETE** if not required

APPENDIX – [Title in Caps and Lower Case]

[Begin text here, font must be 12pt Times New Roman]

NOTE: Conditional (include when needed to supplement Results and Discussion); if more than one appendix is needed list as APPENDIX A, APPENDIX B (all caps) etc., followed by the title as formatted above. **DELETE** if not required

BIBLIOGRAPHY

[Begin text here, font must be 12pt Times New Roman]

NOTE: Conditional, **DELETE** if not required

LIST OF SYMBOLS, ABBREVIATIONS, AND ACRONYMS

[Begin text here, font must be 12pt Times New Roman]

NOTE: Conditional (include if used in any other component of the report), see section 8.2 in the CGC Technical Paper Guidelines for complete instructions on how to properly list symbols, abbreviations and acronyms; **DELETE** if not required

GLOSSARY OF TERMINOLOGY

[Begin text here, font must be 12pt Times New Roman]

NOTE: Conditional (include if report incorporates terms unfamiliar to intended audience), **DELETE** if not required

INDEX

[Begin text here, font must be 12pt Times New Roman]

NOTE: Optional, **DELETE** if not including

DELETE all categories not being used from the TOC and body

DELETE all NOTES and instructions from the TOC and body

5. Appendix B: CHECKLIST

- ___ Cover/Title Page is complete
- ___ Page numbers listed in the Table of Contents (TOC) are correct
- ___ All categories not being used have been DELETED from the TOC
- ___ All NOTES and instructions have been DELETED from the TOC
- ___ Page numbers listed in the List of Figures and List of Tables are correct (if applicable)
- ___ Tables and Figures have been inserted as needed, follow the sample formatting and are correctly numbered (sequentially)
- ___ Figure captions are short and concise (if applicable)
- ___ All NOTES and instructions have been DELETED from the body
- ___ All categories not included or required have been DELETED from the body
- ___ There is one blank line between all Order Heads and text
- ___ Second-Order Heads have been inserted as needed, follow the sample formatting and are correctly numbered
- ___ All REQUIRED categories have been included
- ___ References have been listed in accordance with sections 7.1-7.4 of the CGC Technical Paper Guidelines
- ___ Symbols, Abbreviations and Acronyms have been listed in accordance with section 8.2 of the CGC Technical Paper Guidelines
- ___ All acronyms are spelled out the first time used, followed by the acronym in parenthesis
- ___ This checklist page has been **DELETED** before submitting