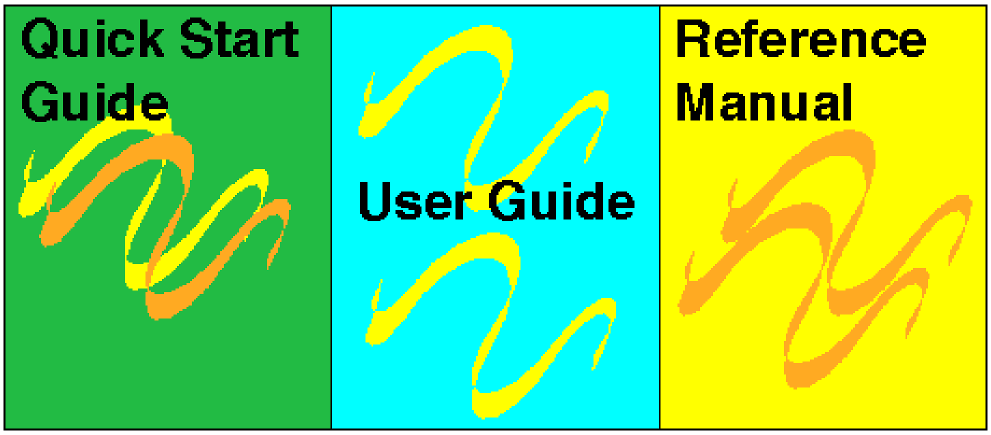
# Welcome to the interactive documentation for NCAR Graphics Version 4.1

This is the user documentation for NCAR Graphics Version 4.1.

You can access the three NCAR Graphics 4.1 hypertext user documents from here:




The Quick Start Guide explains all NCAR Graphics 4.1 examples and provides their source code.

The User Guide introduces NCAR Graphics 4.1 software functionality and key concepts.

The Reference Manual describes how the NCAR Graphics 4.1 software operates.

The User documentation for the traditional interface lists all the traditional documentation for the NCAR Graphics Low Level Utilities. This includes the programmer documents, user guide, and tutorials that give detailed descriptions for developing NCAR Graphics applications using the traditional interface.

The NCAR Graphics 4.1 preface and the NCAR Graphics 4.1 appendices provide other useful information about NCAR Graphics and its documentation.

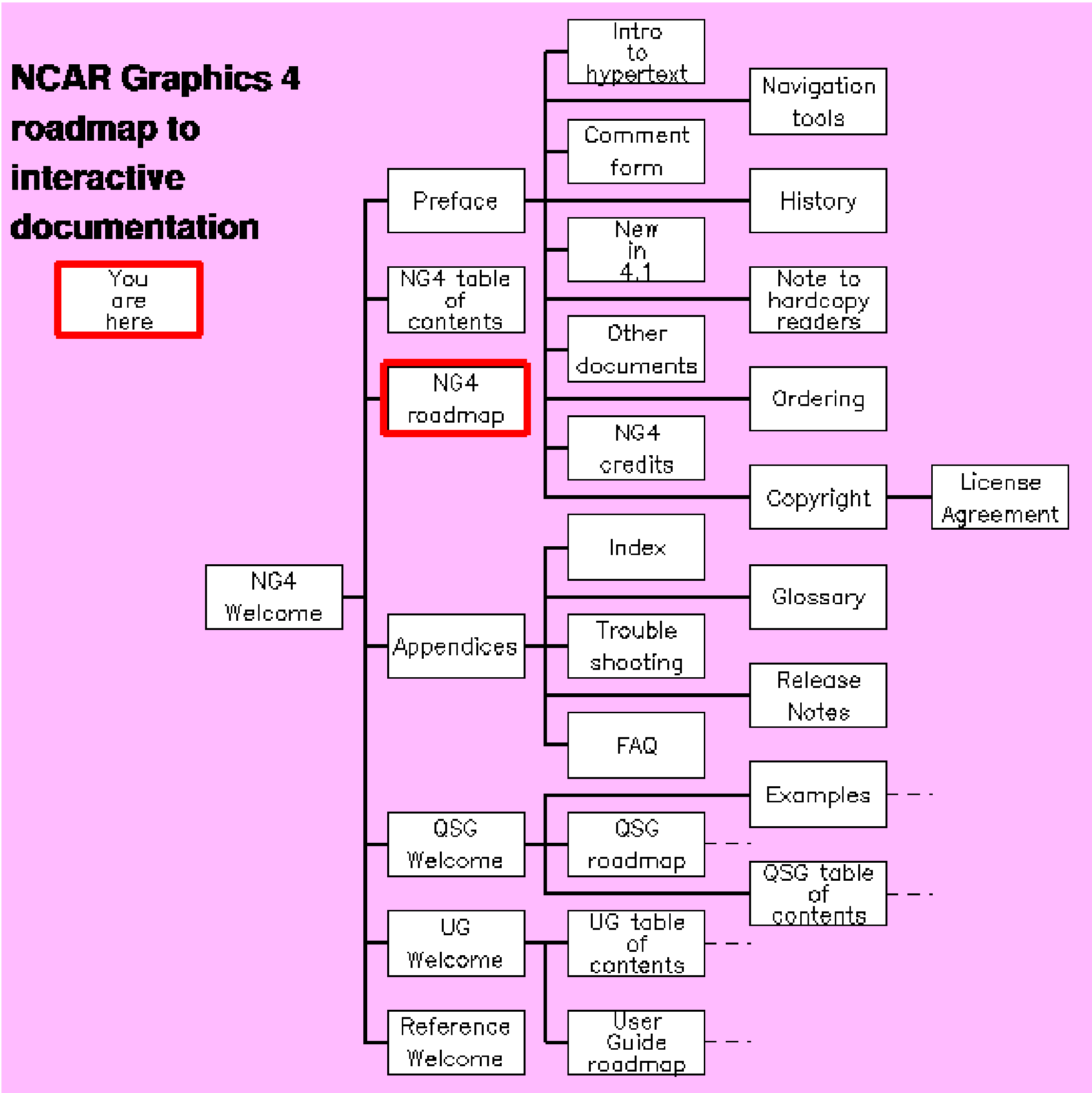


# NCAR Graphics 4.1 table of contents

---

## Table of contents

# NCAR Graphics 4 road map




# Preface

NCAR Graphics software is documented in the interactive hypertext information system you are now using. The following modules provide the type of information you would find in the preface of a hardcopy book:

- Table of contents
- Roadmap
- Introduction to hypertext documentation
- Introducing the navigation tools
- History of NCAR Graphics
- New features in Version 4.1
- A note to our hardcopy readers
- Other user documentation for NCAR Graphics software

- Ordering NCAR Graphics software
- NCAR Graphics credits

To continue on from this module, you can go to the:

- Quick Start Guide
- User Guide
- Reference Manual
- NG4.1 documentation appendix

# Introduction to this hypertext documentation

This module describes some of the key features of the NG4.1 hypertext user documentation. This module does not explain much about how your browser presents information to you because there are many significant differences between the various browsers and even between different versions of the same browser. For detailed information about using your browser, use your browser's help feature.

## Information modules are brief

Most of the modules in the NG4.1 user documentation are brief to avoid user fatigue from scrolling through large online files. Most modules deal with just one topic, which also improves their usability. Redundant information is avoided wherever possible: hypertext links allow relevant information to be accessed from anywhere in the system. This precludes the need to duplicate information. Finally, the links provided in the text and graphics have been planned to be as useful as possible to you; an excessive number of links and/or irrelevant links can interfere with comprehension of the material.

## Orientation cues in color

The documentation for the three new interfaces to NCAR Graphics is divided into four parts. The NG4.1 preface files are visually coordinated for you with the color purple in the roadmap and in the control panels for each module. The Quick Start Guide is color-coded with green. The User Guide is color-coded with blue. The Reference Manual is color-coded with yellow. Through this color scheme, every module in the NG4.1 hypertext documentation provides cues to keep you oriented.

## Navigation tools in every module

Every module offers a control panel at its beginning and end. These control panels allow you to move efficiently from one area of the information system to another. While this is advantageous in many ways, you might also become confused about where you are and where you came from. To minimize such confusion, we have provided color cues and roadmaps. (These navigation tools are discussed in the preceding paragraph.)

## Navigation tools in your browser

You can also use the navigation tools available from your browser to help you move around the documentation. A "Back" button returns you to the module you were viewing prior to your currently displayed module. You can use this button repeatedly to retrace your path through the hypertext files. There is also a "Forward" button that becomes active after you use the Back button.

The Netscape browser has a "Go" menu that shows you a list of all the files you have visited; you can select a file directly from this list without having to repeatedly use the Back or Forward buttons. The Mosaic browser provides this same functionality in the "Navigate" menu, under "Window History."

An extremely useful tool provided by your browser is the "Bookmark" (Netscape) or the "Hotlist" (Mosaic). This feature allows you to record the location of any file with the click of a button: you can use this to keep track of modules that you will need to visit often. Netscape allows you to organize these locations under headings, and Mosaic records your selections chronologically (new locations are added to the bottom of the list).

> Of course, you can create your own HTML document--a personalized "home page"--in which you can organize your favorite locations in ways that are most useful to you. Many people "publish" their home pages on the World Wide Web (WWW) to publicly express their creativity and individuality. For more information about the World Wide Web, you might find value in the WWW Frequently Asked Questions document.

## Ongoing documentation updates

The NG4.1 documentation on the NCAR server is being continually updated. The files you are viewing on your local server were "frozen" at the time we wrote them onto the distribution medium (compact disk or magnetic tape). As of the 4.0 release, NCAR Graphics staff members were discussing ways to provide our customers with automatic updates of their local NG4.1 documentation files, but such a system has not been implemented as of the summer of 1995.

So if you want to check for a more up-to-date version of any file, add http://ngwww.ucar.edu/ngdoc/ng/ngdochome.html to the "Bookmarks" or "Hotlist" in your browser. Then visit our server for the most current documentation available.

## Printing hardcopy

If you find that you use certain modules frequently, you may decide that it is worthwhile to print those modules. You can print any module using the "Print" function in your browser's "File" menu. This approach can be more convenient that having a complete hardcopy manual at your desk, but your printed modules may become outdated as the NG4.1 user documentation evolves. You can also print a copy of the latest documentation from NCAR's server specified in the preceding paragraph.

PostScript copies of fully-assembled NG4.1 user documents have been provided on the NCAR Graphics distribution. These are not designed as hardcopy manuals; they are concatenated, in table-of-contents order, from the hypertext files.

# Introducing the navigation tools

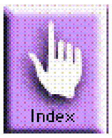
The NG4.1 navigation tools appear at the beginning and end of every information module.

# Control panels

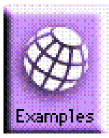
In the graphical control panel at the beginning of each module, and in the roadmaps that you can access from anywhere in the NG4.1 documentation, the background color serves as an orientation tool: it indicates your general location in the documentation:

- Purple for the home page, preface, and appendix
- Green for the Quick Start Guide
- Blue for the User Guide
- Yellow for the Reference Manual

**NG4.1 home** Click on this button to return to the NG4.1 home page.



**Index** Click on this button to open a new window that shows an index similar to the index you would expect at the end of a technical manual. Rather than listing page numbers, however, each entry in the index is a link to one location in the information system. Unlike the roadmap and contents tools, the index covers all three documents (User Guide, Quick Start Guide, and Reference Manual), not just the current document.

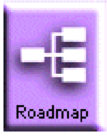


**Examples** Click on this button to open a new window that shows the utilities that have HLU, NCL, and/or GUI examples available. Click on one of these utilities to see images of all examples available for that utility. Click on one of the examples to see an explanation of how the code produces that example.

**Glossary** Click on this button to view the glossary of terms and acronyms used in NG4. Use your browser's "back" button to return to your previous location.

**Table of Contents** Click on this button to open a new window that shows the table of contents for the current document (either the User Guide, the Quick Start Guide, or the Reference Manual). Each table of contents shows all headings in the document, organized as they would be if this were a conventional printed book. Click on any heading in the contents to move to that module.

**Feedback** Click on this button to open a form that allows you to submit comments, questions, and requests about the documentation and the NG4.1 software.



**Roadmap** Click on this button to see a graphical representation of how the information modules in the current document are organized (either the User Guide, the Quick Start Guide, or the Reference Manual).

You can click on any module shown on the roadmap graphic to move to that module. The roadmaps have been subdivided to make them small enough for use on normal-sized workstation screens.

The highlighted box on the roadmap graphic indicates which module you were just viewing. The background color indicates your general location in the interactive documentation:

- Purple for the home page, preface, and appendix
- Green for the Quick Start Guide
- Blue for the User Guide
- Yellow for the Reference Manual

---

## Hypertext links

Throughout the text and graphics that make up the NG4.1 documentation modules, hypertext links are provided to lead you to additional useful information. These links are highlighted in a way that is determined by your browser (Netscape, Mosaic, Lynx, etc.) and the computer system on which it is running.

To avoid providing too many links (which quickly becomes distracting), we have made every effort to place links only where they will be relevant to what we believe you might need as you use the documentation.

# Send us your comments on NCAR Graphics documentation

*You can also use this form to make enhancement requests.*

---

Thank you for taking the time to send us your comments and suggestions.

We are interested in any feedback you care to send, but we are specifically concerned about correcting any factual errors and unclear passages in the documentation. Please type in your comments and/or requests here or send email directly to ng4doc@ncar.ucar.edu. Please include the module name if your comments are specific to a particular module:

Click here to edit and send us your comments.

**If you have usage or installation questions about NCAR Graphics, please do not use this feedback form**. Instead, contact your NCAR Graphics site representative (site representatives should refer to the "NCAR Graphics UNIX Installer's Guide" for support information). If you don't know who your site representative is, you can call (303)497-1201 or send email to ncarginf@ncar.ucar.edu.

# History of NCAR Graphics

The NCAR Graphics package has a long history and a bright future.

## Decades of development

The NCAR Graphics package has been evolving since its inception in the early 1960s as a collection of low-level Fortran routines for drawing simple graphical elements on the output devices of that era.

In the 1970s, NCAR scientists and Scientific Computing Division staff developed higher-level graphics utilities which were integrated into a package that could be distributed throughout the scientific community. Portability was enhanced as the utilities generated an output metafile to achieve device independence.

In the 1980s, still more functionality was added, and the whole package was brought into conformance with the graphics and programming language standards that emerged at that time. In late 1986, the updated set of the NCAR Graphics utilities was converted to Fortran 77, the metafile was based upon a private encoding of the Computer Graphics Metafile (CGM) standard instead of the early home-grown metafile format, and the utilities were moved to the Graphical Kernel System (GKS) standard. This standards-conforming package has been distributed to about 1000 sites worldwide.

In the 1990s, the functionality of NCAR Graphics has been growing, both from the expanded power provided by GKS and from the addition of new utilities. With the release of NCAR Graphics Version 3.2 in 1993, a second programmatic interface was added: C program bindings were included for all calls to all utilities. NCAR Graphics is widely viewed as a mature two-dimensional visualization package.

## New interfaces for the future

The traditional Fortran interface to NCAR Graphics can be difficult to use because it does not have a consistent user interface. This is because the various utilities were developed by numerous people through many years. Its components have been collected into one package, but new users of the package are often confused by the differences in the Fortran calls needed to control the various utilities.

The package is robust, it is widely used in the scientific community, and it provides a wide range of 2-D visualization capabilities. Rather than pursuing more 2-D or 3-D functionality, the NCAR Graphics Group is now focusing its efforts on improving the user interface.

This is why *three* new interfaces are being developed: High Level Utilities (HLUs), NCAR Command Language (NCL), and Graphical User Interface (GUI). When all three are fully implemented, NCAR Graphics will offer five user interfaces to all of its functionality.

The functionality in NCAR Graphics Version 4.1 is almost identical to that of Version 3.2, that is, the Fortran and C programmatic interfaces have not changed much.

The significant difference is that two new interfaces are partially implemented for a subset of the NCAR Graphics functionality. The High Level Utilities (HLUs) and the NCAR Command Language (NCL) are the beginnings of a consistent visualization model for all of NCAR Graphics.

In future releases, all NCAR Graphics functionality will be accessible through all three new interfaces.

NCAR Graphics developers have always strived to maintain compatibility between the many versions and releases of the NCAR Graphics package. It is our intention to keep supporting--for as long as possible--older user programs that were written for earlier versions of the package.

At Version 4.**x**, you should find that your existing Fortran and C programs that call routines in the NCAR Graphics libraries will continue to function as they always have.

If you notice functional discrepancies in the way your existing codes perform, you should contact your local site representative, and your site rep will determine if NCAR Graphics or SCD Consulting staff needs to be notified.

You might also consider joining an e-mail group of NCAR Graphics users and developers where a wide variety of usage issues are discussed and resolved. This group is called "ncarg-talk", and you can join by sending an e-mail message to Majordomo@UCAR.EDU with `subscribe ncarg-talk` in the *body* of the message (not the subject line). You can also contact a human by sending e-mail to ncarg-talk-approval@UCAR.EDU.

# A note to our hardcopy readers

The NCAR Graphics Version 4.1 documentation was designed as an online hypertext information system to be read using a hypertext browser like Netscape or Mosaic. We recommend viewing the documentation using a hypertext browser rather than reading the documentation in a hardcopy form. Depending on the browser you use, you can conveniently navigate through the documentation by just clicking on highlighted text and/or using the control panel tools that appear at the top and bottom of every module.

## Forced to use hardcopy?

However, if you are unable to use a hypertext browser, you will be constrained to using the PostScript versions of the User Guide, the Quick Start Guide, and the Reference Manual. You will lose many of the hypertext advantages offered by the interactive documentation, and you may have to wait for new software releases to obtain documentation updates.

We've placed PostScript copies of the hypertext user documentation in the ngdoc/ng/nggenrl/psdocs directory. Note that some of the .ps files have been compressed with the UNIX compress command, making them .ps.Z files. However, the installer at your site may have elected not install these large files on your local system because they require so much storage space. If the links in the following paragraph do not work for you, and if you must have the hardcopy versions of this interactive documentation, then you need to seek the assistance of your system administrator.

The PostScript versions of the NG4.1 preface files, User Guide, Quick Start Guide, and Reference Manual may not be installed on your system. The PostScript files of the manuals for the traditional NCAR Graphics Fortran and C interfaces, *NCAR Graphics Fundamentals*, *NCAR Graphics Contouring and Mapping Tutorial*, and *User's Guide for NCAR GKS-0A Graphics*, may likewise be missing from your local computer.

The programmer documents covering each of the utilities for the traditional programmatic interfaces are now available in HTML.

## How to obtain a hypertext browser

If you are using a graphics workstation, we recommend using a full-screen hypertext browser like Netscape or Mosaic. These browsers are currently free, however, we cannot distribute them with the NCAR Graphics software. If your workstation does not support graphics, then we recommend using a line mode browser like Lynx.

## Feedback helps everyone

If you have any difficulty with the documentation, please send your comments and suggestions using the Feedback button on the control panels at the beginning and end of every module, or contact us at one of the following addresses:


ng4doc@ncar.ucar.edu - Email address

(303) 497-1201 - NCAR Graphics Information Line

SCD/NCAR Graphics Documentation
University Corporation for Atmospheric Research
P.O. Box 3000
Boulder, CO 80307-3000 (USA)


# User documentation for NCAR Graphics Low

# Level Utilities

To use traditional NCAR Graphics (the Low Level Utilities), you write a Fortran or C program to call NCAR Graphics routines that produce visual representations of your data. Traditional NCAR Graphics is thoroughly documented in:

- The introductory user guide to the Ngmath library
- The introductory user guide *NCAR Graphics Fundamentals*
- The training manual *NCAR Graphics Contouring and Mapping Tutorial*
- The NCAR Graphics GKS manual *User's Guide for NCAR GKS-0A Graphics*
- The full set of NCAR Graphics man pages
- Examples that show NCAR Graphics capabilities and help you to understand and use the code that produces the examples
- Programmer documents for each Low Level Utility, written by the software developers. Note: some of these programmer documents are currently only available in PostScript format.
  - Areas, A Package that Solves Certain Practical Problems in Topology
  - Autograph, A Package of Routines to Draw X/Y Plots
  - CGM, Graphcap, and Fontcap Supplement
  - Conpack, A Contouring Package
  - Dashpack, A Software Package for Drawing Dashed Lines
  - Ezmap, A Map-Drawing Package
  - Gflash, A Graphics Instruction Manipulation Package
  - Gridal, A Package to Draw Backgrounds for X/Y Plots
  - Isosurface, A Package of Routines used to Draw Isosurfaces
  - Labelbar, A Package of Routines to Draw Labelled Bars
  - Plotchar, A Character-Plotting Package
  - Polypack, A Package of Routines to Manipulate Polygons
  - Stitle, A Package to Create Scrolled Movie Titles
  - Seter, A Centralized Error-Handling Package for NCAR Graphics
  - Softfill, A Software Fill Package
  - Streamlines, A Field Flow Visualization Utility
  - Tdpack, A Three-Dimensional Plotting Utility
  - Vectors, A Vector Field Plotting Utility
  - Wmap, A Package for Producing Daily Weather Maps and Plotting Station Model Data

The Ngmath library is a collection of mathematical procedures for which there are equivalent Fortran, C, and NCL entries. These procedures are generally not available in other libraries local to the NCAR Scientific Computing Division.

*NCAR Graphics Fundamentals* contains important information for all users of traditional NCAR Graphics: a glossary of terms, explanation of the structure of NCAR Graphics programs, strategies for learning to use NCAR Graphics, instructions for compiling, linking, and running programs, instructions for producing and editing output from NCAR Graphics programs, and guidelines for using the utilities. It introduces the Fortran interface to all of the traditional NCAR Graphics utilities except for Areas, Ezmap, and Conpack, which are explained in full detail in the hardcopy manual *NCAR Graphics Contouring and Mapping Tutorial*.

The *NCAR Graphics Contouring and Mapping Tutorial* is a learning tool for beginning and intermediate users of the Fortran interface to NCAR Graphics. It gives examples and describes how to use all routines in the Areas, Ezmap, and Conpack utilities. Users combine these routines to prepare NCAR Graphics programs that fill areas, draw maps, and contour data fields.

The online man pages provide concise reference information for all user entry points, user-modifiable internal routines, parameters used in all utilities, and NCAR Graphics commands such as **ncargex**. The overview man page **ncargintro** introduces all utilities in the package, and overview man pages for each utility introduce all routines in that utility. The man pages should be installed on all systems that runNCAR Graphics software.

Programmer documents are the software developers' reference notes; they are provided for users who want to explore the information that developers use to maintain a utility's source code. They can also be very helpful to users.

The **ncargex** command allows you to access more than 250 examples, and all of them are internally documented with comments. A brief introduction to **ncargex** is provided in the *Tutorial* module Intro 1.2 "Details about how information is presented in this manual,"and procedures for using **ncargex** appear in the *Fundamentals* " Chapter 2: Five quick steps for creating and viewing your plot." A pictorial index to all NCAR graphics examples is provided as Appendix D of *Fundamentals*; this pictorial index appears only in the hardcopy version of the manual, and the hardcopy manual is likely to become unavailable sometime during 1995. While supplies of the printed manuals last, one copy each of *Fundamentals* and *Tutorial* is shipped to sites that order any version of NCAR Graphics at Version 3.2 or later.

Additional special-purpose user documents are available via anonymous FTP to ftp.ucar.edu; see the **ncarg** directory. These documents include guides to producing films and videos using NCAR facilities and a reference guide to the NCAR CGM format. The complete list of these special-purpose documents appears in the online NCAR Graphics order form

Cannot open ../../../info/order.html: No such file or directory

# NG4.1 documentation credits

## Acknowledgments

**Authors**: Ethan Alpert, Brian Bevirt, Jeff Boote, Dave Brown, Fred Clare, Quindi Franco, Mary Haley, Lynn Hermanson, Dave Kennison, Bob Lackman, Jacque Marshall, Tom Parker, Tim Scheitlin, Ed Stautler

**Editor**: Brian Bevirt

**Production**: Jacque Marshall

## Copyright

## Trademarks



## Published by

National Center for Atmospheric Research, Scientific Computing Division, P.O. Box 3000, Boulder, CO 80307-3000. The National Center for Atmospheric Research is operated by the University Corporation for Atmospheric Research and is sponsored by the National Science Foundation. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the National Science Foundation.

# Copyright notice

CONSEQUENTIAL DAMAGES OR ANY DAMAGES WHATSOEVER, INCLUDING BUT NOT LIMITED TO CLAIMS ASSOCIATED WITH THE LOSS OF DATA OR PROFITS, WHICH MAY RESULT FROM AN ACTION IN CONTRACT, NEGLIGENCE OR OTHER TORTIOUS CLAIM THAT ARISES OUT OF OR IN CONNECTION WITH THE ACCESS, USE OR PERFORMANCE OF THIS DOCUMENTATION.

# License Agreement

---

## IMPORTANT: READ IMMEDIATELY

## NCAR GRAPHICS SOFTWARE LIMITED USE LICENSE AGREEMENT

THIS SOFTWARE AND DOCUMENTATION IS LICENSED NOT SOLD TO YOU UNDER THIS AGREEMENT. THIS AGREEMENT SPECIFIES THE TERMS AND CONDITIONS UNDER WHICH YOU, THE "USER," MAY ACCESS, INSTALL AND/OR USE ("USE") THE SOFTWARE (SOURCE AND/OR OBJECT CODE) AND/OR RELATED DOCUMENTATION. YOUR USE OF THE SOFTWARE AND/OR DOCUMENTATION CONSTITUTES YOUR ACCEPTANCE OF THE TERMS OF THIS AGREEMENT BETWEEN YOU AND THE UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH FOUNDATION ("UCARF"). IF YOU DO NOT AGREE TO THE TERMS AND CONDITIONS OF THIS AGREEMENT AND DO NOT WANT YOUR ACT OF USING THE SOFTWARE AND/OR DOCUMENTATION TO INDICATE YOUR ACCEPTANCE OF THE AGREEMENT, PROMPTLY RETURN THE SOFTWARE AND/OR DOCUMENTATION AND PROOF OF PAYMENT TO UCARF FOR A FULL REFUND.

**SITE** A "Site" is defined as a single facility and/or physical User location (i.e., university campus, building, facility or department, as appropriate). Computer equipment on which the Software is used must be located at the Site. YOU, THE USER, ARE OBLIGATED TO INFORM ALL USERS AT THE SITE THAT THE SOFTWARE AND/OR DOCUMENTATION IS LICENSED.

**GRANT** UCARF grants the User a personal, non-exclusive, non-transferable right to use at the Site the Software and Documentation for internal data processing needs and requirements subject to the terms and conditions of this Agreement.

YOU MAY ONLY AT YOUR SITE

- Use the Software on a single-user computer, on a workstation/terminal of a multi-user computer, and/or on workstations/terminals of a local area network.
- Copy and create derivative works (provided all copyright or other proprietary notices remain intact), modify, merge or alter the Software Source code, which is provided to you.
- Copy and create derivative works (provided all copyright or other proprietary notices remain intact) of the Software Object code which is provided to you.
- Make and use multiple copies of the Documentation provided you reproduce all copyright or other

proprietary notices.

YOU MAY NOT

- Alter, modify or remove any copyright or other proprietary notices included in the Software or Documentation, including derivative works thereof, or any copies thereof.
- Rent, lease, license or otherwise transfer, distribute or disseminate the Software or derivative works thereof, or Documentation to any person or entity, outside the Site without the express written consent of UCARF.
- Reverse engineer, decompile, translate, disassemble or reduce the Software Object code to human readable form.

**SUPPORT** See your Site installer or Site representative if you encounter installation or technical problems with the Software. Other general questions may be directed to NCAR Graphics Information at 1-303-497-1201, between 8:00 am and 5:00 pm, as available, Mountain Standard time.

**RELEASES/MODIFICATIONS** The User shall not be entitled to receive any new releases, versions, updates, modifications, bug fixes or enhancements ("Updates") of the Software hereunder, and UCARF shall not be obligated to notify the User of any such Updates. In the event the User receives any Updates, the terms and conditions of this Agreement shall govern the use thereof.

**LIMITED WARRANTY** UCARF warrants to the original User only that the media upon which the Software is recorded shall be free from defects in materials and workmanship under normal use and service for a period of thirty (30) days following the date of payment of the Software ("Warranty Period").

**EXCLUSIVE REMEDY** UCARF’s entire liability and the User’s exclusive remedy shall be, at UCARF’s option, either (a) the repair or replacement of the Software or Documentation that does not meet UCARF’s Limited Warranty and which is returned to UCARF with proof of payment; or (b) a refund of the price which the User paid for the Software as substantiated with proof of payment. TO MAKE A WARRANTY CLAIM, PLEASE RETURN THE SOFTWARE AND DOCUMENTATION TOGETHER WITH YOUR PROOF OF PAYMENT TO UCARF DURING THE WARRANTY PERIOD. This Limited Warranty is void if the failure of the media upon which the Software and/or Documentation is recorded has resulted from accident, abuse, or misapplication. Any replacement Software and/or Documentation will be warranted for the remainder of the original Warranty Period or thirty (30) days following initial use of the replacement Software, whichever is longer.

**DISCLAIMER** THE SOFTWARE AND/OR DOCUMENTATION ARE PROVIDED "AS IS" AND UCARF DISCLAIMS ALL OTHER WARRANTIES, OTHER THAN THE ABOVE LIMITED WARRANTY, EITHER EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. UCARF DOES NOT WARRANT THAT THE SOFTWARE WILL MEET THE USER’S REQUIREMENTS OR THAT THE OPERATION OF THE SOFTWARE WILL BE UNINTERRUPTED OR ERROR FREE. THE USER IS ADVISED TO BACK UP ITS DATA PERIODICALLY.

**LIMITATIONS ON DAMAGES** UCARF WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH OR ARISING FROM THE

PROVISION OF, THE PERFORMANCE OF OR USE OF THE SOFTWARE, SOFTWARE MEDIA OR THE DOCUMENTATION; AND UCARF SHALL IN NO EVENT BE LIABLE FOR ANY DAMAGES WHATSOEVER (INCLUDING WITHOUT LIMITATION, DAMAGES FOR LOSS OF PROFITS, BUSINESS INTERRUPTION, LOSS OF DATA/INFORMATION, OR OTHER PECUNIARY LOSS) ARISING OUT OF THE USE OF OR INABILITY TO USE THE SOFTWARE AND/OR DOCUMENTATION, EVEN IF UCARF HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT SHALL UCARF'S LIABILITY FOR ANY REASON EXCEED THE ACTUAL PRICE PAID BY THE USER TO USE THE SOFTWARE AND/OR DOCUMENTATION.

**TITLE** UCARF represents that it has the right to grant the rights and privileges to the Software and/or Documentation recited herein. The Software and Documentation are protected by United States copyright laws and international treaties, and other proprietary, statutory or otherwise, interests. All rights not expressly granted herein are reserved by UCARF. UCARF shall be entitled to pursue any legal and/or equitable action against the User with regard to infringement of its copyright on the Software and /or Documentation or any other proprietary interests therein. Furthermore, UCARF shall be entitled to pursue all appropriate legal and/or equitable actions for any breach by the User of the terms and conditions recited herein.

**SEVERABILITY** If any of the provisions of this Agreement are declared to be invalid, such provisions shall be severed from this Agreement and the other provisions hereof shall remain in full force and effect.

**ENTIRE AGREEMENT** This Agreement embodies the entire understanding of the parties and supersedes previous or contemporaneous licenses, communications, representations, or undertakings, written or oral, between the parties relating to the Software and/or Documentation. This Agreement is governed by the laws of the State of Colorado and of the United States of America.

**TAXES/SHIPPING COSTS** The User shall pay all necessary and appropriate taxes and shipping costs.

**TERMINATION** UCARF may terminate this Agreement if the User violates any proprietary interest, statutory or otherwise, on the Software and/or Documentation or any of the terms and conditions recited herein. The User may, at any time, terminate this Agreement by destroying the Software and Documentation. Upon any termination, the User shall destroy all copies of the Software and Documentation.

**U.S. GOVERNMENT RESTRICTED RIGHTS** The Software and Documentation are provided with RESTRICTED RIGHTS. Use, duplication, or disclosure by the Government is subject to restrictions set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013. Contractor is University Corporation for Atmospheric Research Foundation/3300 Mitchell Lane/Boulder, CO 80307-3000.

**EXPORT ADMINISTRATION** The User shall adhere to U.S. Export Administration Laws and Regulations.

# NG4.1 documentation appendix

The following modules provide the type of information you would find in the appendix of a hardcopy book:

- Troubleshooting NG4.1 usage problems:
  - General
  - HLU
  - NCL
- Glossary
- Index
- 4.1 Release Notes
- 4.1 FAQ

# Glossary of NCAR Graphics terms

Definitions that are specific to a particular part of the package are prefaced accordingly. For example, definitions that apply only to NCL are prefaced with **NCL:** .

**A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z**

## A

---

**annotation**
: A viewable object whose location and usually size are set relative to the viewport or data coordinate space of a base plot. There are three kinds of annotations: intrinsic annotations, embedded annotations, and external annotations.

**annotation functions**
: The functions used to add and remove annotations to and from plot objects. Specifically, these functions are NhlAddAnnotation and NhlRemoveAnnotation for the C and Fortran interfaces.

**annotation plot**
: An annotation that is a plot object and not simply a viewable object. An annotation plot is a subordinate base plot.

**ANSI**
: The American National Standards Institute, an independent non-profit organization that creates and publishes U.S. national standards (such as Fortran, C, CGM, and so forth) taking input from all sectors of the technical community and the public at large. ANSI also works in collaboration with other standards organizations such as ISO (the International Standards Organization) and IEEE (the Institute of Electrical and Electronics Engineers).

**API**
: Application Programming Interface.

**application**
: A program written in C, Fortran, or NCL that utilizes any of the functionality of NCAR Graphics.

**application class**
: Refers specifically to the class App. Objects that are instances of this class are used to keep track of resource databases. Every application must create at least one App object (this will be done

automatically for you if you use NhlOpen).

**Application Programming Interface**

The programming interfaces (C, Fortran, and NCL) to the NCAR Graphics package. These interfaces provide access to the support functions defined in the classes as well as provide additional useful functionality.

**application resource file**

A resource file that is specific to a particular application. There are two application-specific resource files: a system application-specific resource file and a user application-specific resource file. The user can specify what directories the application-specific resource files are in. By default, the user application-specific resource file is in the local current directory and the system application-specific resource file is in the directory specified by the setting of the environment variable NCARG_SYSAPPRES. Resources defined in the user application-specific resource file will override resources defined in the system application resource file.

**area fill pattern**

A pattern to use for filling a polygonal area. The patterns are selected by using an integer fill index into a table of patterns.

**ASCII**

Stands for "American Standard Code for Information Interchange." This is an ANSI Standard specifying a set of 128 characters with their associated coded integer representations.

**ASCII file**

**NCL:** A data file that contains integers or floating point data values in ASCII format.

**aspect ratio**

Specifies the height-to-width ratio of a plot. This term is also applied to characters. For example, characters with an aspect ratio of 2.0 are twice as tall as they are wide.

**associative operator**

A binary operator that obeys the law of associativity: i.e. a binary operator "R" such that (aRb)Rc = aR(bRc) for all legal operands a, b, and c.

**attribute**

**NCL:** A singly-dimensioned datum of any type that is assigned to a variable using the ' @ ' operator. An attribute of a variable contains descriptive information about the variable.

# B

---

**background color**

The color that will be used as a background color for the entire viewable surface of a physical workstation when plots are drawn on it.

**base plot**

A plot object responsible for setting the viewport of zero or more plot members relative to its own viewport. There are two kinds of base plot: primary base plots and subordinate base plots. At creation, any plot object is a primary base plot. A plot object ceases to be a base plot when added to another plot object as an overlay. When added as an annotation a plot object becomes a subordinate base plot. A plot object must be a primary base plot for users to draw it or change its workstation.

**binary file**

**NCL:** A data file that contains integer or floating point data stored in a format not supported by

NCL.

**bounding box**

For View class objects, the bounding box for such objects is the smallest rectangle in NDC space that contains all of the marks that would appear on an output workstation if the object were drawn.

# C

---

**CGM**

Computer Graphics Metafile.

**child**

A relationship that holds between *objects*. If "A" and "B" are objects, then B is a child of A provided that when B was created, A was specified as being its parent (either in the fourth argument of an NhlCreate call, or in a NCL create expression), or B was made a child of A by using the NhlChangeWorkstation function. If B is a child of A, then the following conditions apply:

1. B inherits the resource database of A. If viewable, B will display to the same workstation as A; if A is a workstation, then B will draw to A.
2. Destroying A will destroy B.
3. Resources can be specified in resource files as: {App obj name} . {parent of A} . {Name of A} . {Name of B} . {resource of B} : {value}.

A child can have only one parent. See also parent.

**child/parent hierarchy**

The tree structure determined by the child/parent relationship existing among all current objects in an application. A child can have only a single parent, but a parent may have many children. The child/parent hierarchy should not be confused with the class hierarchy. See also class hierarchy.

**class**

A template for defining objects that specifies variables, and procedures that operate on those variables. In the context of the NCAR HLU library, the class variables are called resources and the class procedures are called support functions. Objects are members, or instances, of a class formed by assigning specific values to the variables in the class.

**class hierarchy**

Each class, except the base class, is derived from some other class. The tree structure determined by the derived-class/superclass relationships among all of the classes is called the class hierarchy. The class hierarchy should not be confused with the child/parent hierarchy.

**color index**

See color table.

**color map**

Same as color table.

**color table**

A table that associates integer values (called color indices) with RGB color values. In NCAR Graphics, color tables contain up to a maximum of 256 colors (including the background color).

**command**

**NCL:** Same as an NCL statement.

**composite class**
A class that combines the resources of other classes with its own. A composite class inherits resources and functions from its superclass and it shares the resources from its composite members by the process of resource forwarding. If the composite class members have support functions, these functions do not apply to the composite class.

**composite class member**
A class used as part of the functionality of a composite class.

**composite class resource**
A resource available to a composite class by way of resource forwarding from a member class of the composite class.

**Computer Graphics Metafile**
A graphics metafile is a file that contains encoded vector graphics elements such as lines, colors, dash patterns, markers, and so forth. The Computer Graphics Metafile (CGM) is a precisely-defined formatting for a graphics metafile as defined and standardized by ANSI. NCAR Graphics produces a version of the CGM that is called a *conforming private encoding* that can easily be converted to and from standard CGM by using the filters ncgm2cgm and cgm2ncgm. The NCAR private encoding is also called NCAR CGM, or NCGM.

**coordinate variable**
**NCL:** A value associated with a named dimension of a variable or file variable that contains numerical coordinate information for each index of the dimension. Coordinate variables must be singly- dimensioned values. Warnings are produced if the array of values assigned is not monotonically increasing or decreasing.

**ctrans**
The NCGM interpreter distributed with NCAR graphics.

# D

---

**dash pattern**
A pattern (such as "solid", "dotted", and so forth) to use as a line style when lines are plotted using the draw function. Dash patterns are selected by using an integer index into a table of dash patterns.

**data classes**
Any of the classes that are used to provide user input data to any of the objects that utilize such data. These classes are the CoordArrays class, the CoordArrTable class, and the ScalarField class.

**data conversion**
The process of converting data stored in one format to another format, such as converting data stored as integers to data stored as floating point numbers. Some objects, such as ScalarField, perform automatic data conversions.

**data coordinate space**
The coordinate space that is appropriate to input data. Transformations can be effected between data coordinate space and NDC (see Normalized Device Coordinates).

**data specific resource**
A resource of a particular class, such as the XyPlot class, that can be used to modify the attributes of data supplied via a DataSpec object. Data specific resources can be used to control attributes such as curve colors, dash patterns, marker sizes, marker colors, and so forth.

**data transformation**
A process that transforms data from one coordinate space to another, such as transforming data in logarithmic space to data in linear space.
**data type**
**NCL:** A data type is a representation of data that defines a size and valid range for numerical data or provides a reference to a file or HLU graphical object.
**derived class**
See subclass.
**drawable object**
See viewable object.
**draw function**
Specifically, either the NhlDraw function of the C or Fortran interfaces, or the draw function of NCL, that is invoked to plot a View object.

# E

---

**embedded annotation**
An annotation that may be incorporated as part of the functionality of subclasses of the Transform class. It is managed internally by the controlling PlotManager.
**Encapsulated PostScript**
Encapsulated PostScript (EPS) is a subset of regular PostScript. The restrictions placed on EPS files are for making it an appropriate format for importing into applications that import PostScript.
**Encapsulated PostScript Interchange Format**
Encapsulated PostScript Interchange Format (EPSI) files are Encapsulated PostScript files that have a "preview bitmap" that represents the PostScript image contained in the file. The bitmap (and it is a bitmap and not a color map) can be used by an importing application to quickly display a picture of the imported file.
**EPS**
see Encapsulated PostScript
**EPSI**
see Encapsulated PostScript Interchange Format
**error class**
A class that is used to configure the error reporting module of the HLU library. For any application, there is precisely one error object created, and it is created automatically for you. The error class defines several resources for controlling error reporting.
**expression**
**NCL:** Any sequence of NCL operators and operands that results in the computation of a value. In particular, any literal value is an expression and any variable is an expression. Also, arrays are expressions as well as functions. Operators applied to expressions are expressions.
**external annotation**
An annotation consisting of an arbitrary user-created viewable object added to a plot object. The user controls the location and size relative to the base plot by manipulating the resources of a user-accessible AnnoManager object.

# F

**file**

**NCL:** A data file residing external to NCL in one of NCL's supported data formats.

**file variable**

**NCL:** A variable, created by the NCL addfile function, that contains a reference to a file.

**fill value**

**NCL:** Same as missing value.

**fontcap**

A file that contains detailed information used to plot characters. Fontcaps have a human-readable ASCII form and a binary form that is readable by ctrans.

**foreground color**

The color associated with color index 1. This is used as the default color in drawing viewable objects.

**function**

**HLU:** Any member of the HLU API.

**NCL:** An identifier with a list of parameters separated by commas and enclosed in parentheses. Functions return values when called. A function is defined by NCL source unlike the NCL intrinsic function.

# G

---

**GIF**

A file format used for the storage and on-line retrieval of bitmapped graphical data. GIF stands for "Graphical Interchange Format"; it was created by the CompuServe Corporation in 1987.

**graphcap**

A file that contains detailed information used to define the capabilities of a specific plotting device. Graphcaps have a human-readable ASCII form or a binary form that is readable by ctrans.

**graphical object**

**NCL:** An NCL value of type graphic. A graphical object is an identifier for an HLU object.

**Graphical User Interface**

A non-programmatic, graphical, interface to the functionality of NCAR Graphics. Such an interface is sometimes referred to as a "point-and-click" interface, since that is how the interaction is accomplished.

**GUI**

Graphical User Interface.

# H

---

**HDF**

HDF (Hierarchical Data Format) is a multi-object file format, developed at NCSA, that facilitates the transfer of various types of data between machines and operating systems.

**High Level Utilities**

Objects, like XyPlot objects, Contour objects, TextItem objects, and so forth, that can be created and manipulated by a set of library functions, callable from either a C program, a Fortran program, the NCAR Command Language, or a GUI. High Level Utilities are also referred to as HLUs and are to be distinguished from the Low Level Utilities, or LLUs.

**HLU resource string**

A character string identifying a particular resource of a class. These are the resources listed in the descriptions of the classes.

**HLUs**

High Level Utilities.

# I

---

**identifier**

**NCL:** A name of a variable, or a function, or a procedure.

**immediate mode**

A mode used by certain API functions that produces immediate drawing without invoking a draw function.

**instance**

When specific values are assigned to all the resources defined in a class, the result is an instance of that class. Any instance of any class is called an object. Default values exist for all resources; before creating an object, users may override any default value.

**instance hierarchy**

Same as child/parent hierarchy.

**inheritance**

A class is said to inherit resources or support functions from its superclasses, since those functions and resources are available to the subclass. See superclass, *and* composite class.

**intrinsic annotation**

An annotation available as composite class member of the PlotManager class. Intrinsic annotations are available to any class of plot object and include TickMark, Title, LabelBar, and Legend annotations. The PlotManager manages these annotations internally.

**intrinsic function**

**NCL:** An identifier with a list of parameters, the parameters being separated by commas enclosed and in parentheses. Intrinsic functions return values when called. An intrinsic function is not defined by NCL source; it is a C or Fortran routine that has been added to the NCL function set. Intrinsic functions often perform operations that NCL source does not support.

**ISO**

The International Standards Organization that publishes international standards. (see ANSI).

**intrinsic procedure**

**NCL:** An identifier with a list of parameters, the parameters being separated by commas enclosed in parentheses. An intrinsic procedure is not defined by NCL source; it is a C or Fortran routine that has been added to the NCL procedure set. Intrinsic procedures often perform operations that NCL source does not support.

# J

---

# K

---

**keyword**
: **NCL:** A word reserved by NCL that not allowed to be used as a variable or function name.

# L

---

**lazy evaluation**
: **NCL:** The process whereby relational expressions are assigned a value as soon as it is possible to do so, without necessarily evaluating all of the components in the expression. For example, the expression (1 .lt. 3) .or. (2 .lt. 1) can be assigned the value True immediately after evaluating (1 .lt. 3) without having to evaluate (2 .lt. 1).

**literal array**
: **NCL:** An array of values specified using literal values, these values being separated by commas and enclosed in ' (/ ' and ' /) ' .

**literal value**
: **NCL:** A single scalar value expressed by its actual string value (i.e. not referenced by a variable). For example, 1, 1.414 and "string" are literal values.

**LLUs**
: Low Level Utilities.

**local resources**,
: Resources defined in a particular class that are not inherited from another class.

**Low Level Utilities**
: Traditional NCAR Graphics as it existed before Version 4.0. It is a package of about 500 graphics routines. User entries have both C and Fortran interfaces. These entries continue to be supported in 4.0.

# M

---

**marker**
: See polymarker.

**member class**
: One of the class components of a composite class.

**metadata**
: **NCL:** Information used to describe data, such as dimension names, variable attributes, valid

ranges, and so forth.

**metafile**

A file containing encoded graphical elements. Metafiles are used for storing and transporting graphics images. In the context of NCAR Graphics "metafile" is generally synonymous with NCGM.

**missing value**

**NCL:** A special value for a variable or array element indicating that no legal data has been specified for that quantity. See the section on missing data in the evaluation of expressions in the NCL User Guide module on NCL expressions and operators for details on how these missing values are handled.

**monotone**

A sequence of numeric values is monotone (or monotonic) if either: each element in the sequence is larger than (or equal to) its predecessor, or each element in the sequence is smaller than (or equal to) its predecessor. A sequence is monotonically increasing if each element in the sequence is larger than its predecessor; a sequence is monotonically decreasing if each element in the sequence is smaller than its predecessor. A sequence is monotonically non-decreasing if each element in the sequence is larger than, or equal to, its predecessor. A sequence is monotonically non-increasing if each element in the sequence is smaller than, or equal to, its predecessor.

# N

---

**named dimension**

**NCL:** A dimension of a variable or file variable that has been assigned a name using the '!' operator.

**NCAR Command Language**

A language written for the purpose of interactive data manipulation and display. NCL has a command line interface and will accept netCDF, HDF, Grib, or ASCII input files. NCL also provides an easy interface to the HLUs.

**NCAR Computer Graphics Metafile**

The NCAR private binary encoding of a Computer Graphics Metafile.

**NCGM**

NCAR Computer Graphics Metafile.

**NCL**

NCAR Command Language.

**NCL resource list**

**NCL:** An NCL resource list is a list of HLU resource strings followed by a " : " followed by a valid NCL expression.

**NDC**

Normalized Device Coordinates. A coordinate system that describes positions on a virtual plotting device. The lower left corner corresponds to (0,0), and the upper right corner corresponds to (1,1). NDC space will be mapped onto the largest square which will fit on an actual plotting device. PostScript output is centered on the page by default, but options exist for positioning PostScript output anywhere on the page. See the PSWorkstation for details.

**netCDF**

netCDF (network Common Data Form) is an interface for scientific data access and a library that provides an implementation of the interface.

**numeric**

**NCL:** Any data type that represents a numerical value. The numeric data types are: double, float, long, integer, short, and byte.

# O

---

**object**

An object is created from a class by assigning specific values for the class resources. See class *and* instance.

**overlay**

A transform overlaid on a base plot using the add overlay function. The base plot sets the viewport of the overlay to match its own and transforms the coordinate data of the overlay into its own coordinate space. Only that portion of the overlay's coordinate space that intersects the coordinate space of the managing plot will be visible in the plot output. If the overlay is a plot object, it gives up its base plot status. The base plot to which the overlay is added assumes responsibility for managing the overlay's plot members.

**overlay functions**

The functions used to add and remove overlays to and from plot objects. Specifically, these functions are NhlAddOverlay and NhlRemoveOverlay for the C and Fortran interfaces.

**overlay plot**

An overlay created from a plot object rather than from a simple transform.

**overlay sequence**

The ordering of the transforms in a plot or subplot that contains overlays. The base plot is always first, followed by each overlay in an order that may be manipulated through the overlay functions. The overlay sequence determines the basic drawing order of the plot. The base plot is drawn first; each succeeding overlay is drawn on top of the preceeding transforms. Annotations are not affected by the overlay sequence; they always drawn after all the transforms.

# P

---

**parent**

A relationship that exists between *objects*. If A and B are objects, then A is a parent of B if and only if B is a child of A. See child for more information.

**polymarker**

An array of coordinates specifying positions where certain specified symmetric symbols (markers) such as circles, dots, and so forth will be plotted.

**plot**

Depending on context, the word *plot* may be used to mean:

1. A plot object.
2. A primary base plot and all its plot members.
3. The output resulting from drawing a primary base plot and all its plot members.
4. The output resulting from drawing any arbitrary collection of viewable objects.

**plot_class**
: **NCL:** The plot_class in NCL is the same as the HLU class pointer used in the HLU API to specify what type of object to create. The NCL plot_class identifier is spelled the same as the HLU class pointer.

**plot member**
: A viewable object managed by a base plot. If the base plot is a subordinate base plot then the object is indirectly a plot member of the complete plot managed by the primary base plot. Drawing the primary base plot causes all its plot members to be drawn. A plot member is either an overlay or an annotation. Although an annotation can be any arbitrary view , an overlay must be a view belonging to the Transform class. A plot member must belong to the same Workstation as its base plot and cannot be drawn independently. A view cannot belong as a plot member to more than one base plot at a time.

**plot object**
: A Transform object instantiated with an active PlotManager. In general, unless otherwise restricted by their specific class, plot objects have the ability both to manage other viewable objects as plot members and to be managed as plot members themselves. A plot object that manages plot members is called a base plot. If the managing plot object is itself managed as a plot member, it is a subordinate base plot. If it manages itself (i.e. is *not* a plot member) it is a primary base plot. At creation, all plot objects are primary base plots.

**PostScript**
: A general-purpose programming language that contains a rich set of graphics operators. PostScript is produced by many popular word processing and graphics packages and can be displayed on a wide variety of printers, plotters, and workstation screens.

**primary base plot**
: A self-managing plot object. A base plot that directly manages any number of plot members, consisting of overlays and annotations, but is not itself a plot member. At creation all plot objects are primary base plots. A plot object must be a primary base plot for the user to draw it or change its workstation.

**procedure**
: **NCL:** An identifier with a list of parameters, these parameters being separated by commas and enclosed in parentheses. Procedures do not return values when called.

**PS**
: see PostScript

# Q

---

# R

---

**resource**
: A variable defined as part of the definition of a class. Resource values in *objects* can be set by using a Create function or a SetValues function. Resource values can be retrieved using a GetValues function.

**resource file**

A file that can be used to set values for resources. There are four different resource files. See system resource file *and* user resource file.

**resource forwarding**

A technique that makes the resources of member classes available to a composite class.

**RGB**

Stands for the *red, green, blue color space* where colors are specified as triples of floating point numbers between 0. and 1. inclusive. The number triple gives the intensities for the red, green, and blue components of a color. The triple <1,.0.,0.> would indicate red, for example.

# S

---

**scalar**

**NCL:** A single element of data of any type is referred to as a scalar value.

**scalar_logical_expression**

**NCL:** A single element value of the logical data type with no missing values.

**scope**

**NCL:** The range or area within a program in which an identifier is meaningful.

**subordinate base plot**

A plot member that is an annotation plot. A subordinate base plot sets the viewport of the plot members it controls, while its own viewport is set by the base plot that controls it. Unlike a primary base plot, the user cannot directly draw or change the workstation of a subordinate base plot. A subordinate base plot and the plot members it manages are known collectively as a subplot.

**simple overlay**

An overlay created from a simple transform.

**simple transform**

A transform object created without an active PlotManager. Unlike a plot object, a simple transform cannot manage any plot members, either as annotations or as overlays. Therefore, the only elements that appear when a simple transform is drawn are those implemented within the object itself. However, unless restricted by its particular class, a simple transform may itself become an annotation or an overlay of a base plot. Since a plot object has all the capabilities of a simple transform and none of the limitations, the main reason for creating a simple transform would be to conserve system resources when PlotManager capabilities are not required.

**statement list**

**NCL:** A sequence of statements separated by a carriage returns (\n).

**statement**

**NCL:** A single language construct within NCL that performs a specific task.

**subclass**

A class B is a subclass of A if B has in it all of the resources and support functions of A (B may have additional resources and support functions as well). If B is a class derived from A, then B is said to *inherit* its resources and support functions from A. If B is derived from A, then it is also said that B is a subclass of A.

**subplot**

The portion of a plot that is managed by a subordinate base plot.

**superclass**

A class A is a superclass of class B if A is on the same branch of the class hierarchy tree and A is higher on that branch.

**superclass resource**

A resource that one class inherits from a superclass.

**support function**

A function defined as part of a class definition.

**system resource file**

There are four files where resources can be set - two of these files are system resource files and the other two are user resource files. The name of one of the system resource files is specified by the setting of the environment variable NCARG_SYSRESFILE; the other system resource file is specified in an application-specific manner. See application resource file.

# T

**transform**

A Transform object.

**Transform class**

The Transform class is a subclass of the View class that supports transformations from data coordinate space into the NDC space occupied by the Transform class instance's viewport. Transform subclasses may include the PlotManager class as a composite class member. The Transform class provides a resource for activating or deactivating the PlotManager when a Transform instance is created. In addition, the Transform class provides support functions for converting between data coordinate space and NDC space, for drawing immediate mode graphics primitives, and for adding and removing overlays and annotations from plot objects.

**Transform object**

An object that is an instance of the Transform class. Transform objects become plot objects when created with an active PlotManager instance. A Transform object created without an active PlotManager is called a simple transform.

# U

**user resource file**

There are four files where resources can be set - two of these files are user resource files and the other two are system resource files. The name of one of the user resource files is specified by the setting of the environment variable NCARG_USRRESFILE; the other user resource file is specified in an application-specific manner. See application resource file.

# V

**variable**

**NCL:** A name that can contain a singly-dimensioned or multi-dimensioned data array, dimension names, coordinate variables, attributes, and so forth.

**view**
: A viewable object.

**viewable object**
: An object that is an instance of the View class.

**View class**
: An object can be drawn only if it is an instance of the View class. The View class provides resources for sizing and positioning objects on an output device (workstation). The View class also provides a support function for determining the bounding box of a given object in the class. A View class object must have a Workstation class parent.

**View object**
: A viewable object.

**viewport**
: For View objects, the viewport is a rectangular subregion of NDC space that specifies where the View object will be placed when drawn. The precise meaning of the viewport depends on the View object. For example, for XyPlot objects, the viewport specifies where the grid containing the curves will be placed, and the labeling (if any) will be drawn outside of the viewport. On the other hand, for TextItem objects, the viewport will be a rectangle surrounding the text string.

**visualization block**
: **NCL:** A group of NCL resources specified in either an NCL create, setvalues, or getvalues statement. Visualization blocks are used to create, modify, or inquire about the values of resources of objects.

## W

---

**workstation**
: Used in NCAR Graphics Version 4 terminology to mean a valid output device such as an X Window System display, a PostScript file, or an NCGM.

**workstation class**
: A class that provides interfaces to specific output devices.

## X

---

## Y

---

## Z

---

# General troubleshooting

This troubleshooting module will be implemented in a later release of NCAR Graphics. For now, you might find help in the HLU troubleshooting module or the NCL troubleshooting module.