

**NOT MEASUREMENT
SENSITIVE**

MIL-STD-3060
w/CHANGE 1
14 February 2019

SUPERSEDING
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DEPARTMENT OF DEFENSE
STANDARD PRACTICE
FOUNDATION GEOINT DIGITAL PRINT AND COLOR SEPARATION



AMSC N/A

AREA: GINT

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FORWARD

1. This standard defines the color separation requirement for print-ready georeferenced PDF print files (SPOT/CMYK/RGB) used in NGA's Print on Demand (PoD) database in accordance the Joint Requirements Oversight Council Memorandum (JROCM) 154-13, "Hardcopy and Media Transition DOTmLPF-P Change Recommendation," and the NGA-DLA Concept of Operations (CONOPS). This standard supersedes para. 5.7 "Printing Colors" of MIL-STD-2410 (DMA) Mapping, Charting, & Geodesy Reproduction and Printing, as well as the DoD, DMA, Standard Printing Color Catalog for Mapping, Charting, Geodetic Data and Related Products.
2. Map and chart products printed in compliance with this standard will consistently meet lowlight (red, blue, green) and night vision readability requirements as articulated in the various DoD standards, technical manuals, and requirements documents.
3. This approach allows users to obtain military specification maps and charts using print ready files pulled from the PoD directory by following the procedures in this document and using PoD-certified hardware/software and ink/paper combinations. The PoD process also reestablishes a common print standards between agencies, organizations, and nations from a final production perspective: the print ready georeferenced file (normally a high resolution raster spot georeferenced PDF, but can be CMYK, RGB, or vector PDF format). Data exchanges remain critical for the front end of the production process, but NGA, DLA, and co-producing partners have demonstrated time savings by using the PoD process.
4. This document makes no effort to categorize all variables possible in the modern digital print environment, but articulates the standards and combinations within the NGA/DLA PoD environment. Additional hardware/software/print combinations are routinely added as they are brought online and certified.
5. Comments, suggestions, or questions on this document should be addressed to the National Geospatial-Intelligence Agency (NGA) or e-mailed to STMProductionOffice@nga.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.

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6. Change log:

Page Number	Item - Section	MIL-STD-3060 Changes	Reason
4	3.13	Update print information to reflect standard screening techniques.	Clarifies that maintaining screen angles by feature is not necessary.
4	3.14	Update print information to reflect stochastic screening techniques.	Clarifies that maintaining screen angles by feature is not necessary.
6	5.3	Update hardware/software requirements to reflect print industry change to stochastic screening.	Clarifies that maintaining screen angles by feature is not necessary.
10	Appendix A	Update Table 1.1 to reflect changes to Aero Blue (46351/Pantone Blue 072) CMYK equivalency values.	More dense CMYK values create closer equivalency to spot color.
9-14	Appendix A	Update to Maximum Acceptable dE00 from 5 to 4 for Press, and 6 to 5 for Digital.	Further test and evaluation with DLA has demonstrated that tighter tolerances are achievable.
15	Appendix B-B.2	Revise the Topographic Map Specification information.	Provides the approved specification name.

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1. SCOPE

- 1.1 Scope. This standard identifies the standard practices required to print spec-quality maps and charts from georeferenced, print-ready files stored on NGA's Print on Demand (PoD) directory. It defines a certified set of printer, paper, and ink combinations for traditional lithographic offset press operations, as well as hardware/software and ink/paper combinations for the large format, high speed printers and plotters used in the PoD process.
- 1.2 Purpose. The purpose of this standard is to ensure printed Maps, Charts, & Geodesy (MC&G) and Safety of Navigation (SoN) products meet low light (Red, Blue, Green) and night vision readability requirements. Other uses will also achieve required print standards when in compliance with this standard, using calibrated printers and the PoD Standard Operating Procedures (SOP). The PoD SOP outlines paper, printer, Raster Image Processor (RIP) software, color management combinations and procedures tested and verified by NGA and DLA (other combinations are possible, but not validated).
- 1.3 Applicability. This standard applies to internal production, co-production, and contract production efforts by the National Geospatial-Intelligence Agency, and to all levels involved in the preparation and printing of MC&G products.
- 1.4 Security. This military Standard is UNCLASSIFIED. The technical specifications presented herein may be used for classified graphic products where appropriate security provisions are added.

2. APPLICABLE DOCUMENTS

- 2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this standard. This section does not include documents cited in other sections of this standard or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this standard, whether or not they are listed.
- 2.2 Government documents
- 2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

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- 2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

POD SOP Print on Demand Standard Operating Procedure

(Copies of these documents are available at <https://ghub.geoint.nga.mil/CDMWeb/>.)

- 2.3 Non-Government publications. This section is not applicable to this standard.
- 2.4 Order of Precedence. Unless otherwise noted herein, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. DEFINITIONS

- 3.1. Spot Color PDF. NGA's preferred georeferenced print ready format. A .pdf file whose color space can be Grayscale, CMYK, or Spot Color – depending on the mission requirements for the product – and be able to be output to a plotter and lithographic press. For all products which require Red, Blue, and/or Green light readability, the .pdf must be in Spot Color. The .pdf must also allow for transparency. Image data can be 8-bit or 16-bit; however, 16-bit images are still rarely used and may cause issues with several RIPs and workflows. The use of layers is allowed. All fonts must be embedded in the file. Embedding open type fonts is allowed. Low resolution version of an existing image is not allowed. All image data must be embedded. Compliant files cannot contain music, movies, or non-printable annotations. The file should not contain forms or Javascript code. Only a limited number of compression algorithms are supported, JPEG 2000 being one of them. Encryption cannot be used. Transfer curves cannot be used. Spot geo.pdf files are used to generate printed maps from the PoD directory, as well as generate several digital display and storage product lines: Mr Sid, jpg, CADRG, ECRG, and reduced resolution/vector geo.pdfs used for display, print, and storage. Currently, these capabilities are only possible for files generated by production software that embeds a tag called a third party plug-in, which provides users with a colored or grayscale view with continuous MGRS and geodetic coordinates display.
- 3.2. Spot Color Printing. Files derived from Spot Colors can be output both on a lithographic press and a plotter. Each spot color has an embedded CMYK or CIE-LAB equivalent that allows it to be translated to CMYK via the RIP on the plotter. If output on a press, then the spot colors within the files are used to create plates via the RIP software at the

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press. Spot Colors have unique qualities such that, depending on the mission requirements of the product, the Spot Colors used allow for the printed product to be low-light (Red, Blue, Green) readable.

- 3.3. CMYK. Cyan, Magenta, Yellow, and Black (CMYK) is a four color printing process where a color image is separated into four different color values, called a color separation, by the use of filters and screens. The result is a color separation of four images that – when transferred to printing plates and sequentially printed on a printing press – reproduces the original image. Most of the entire color spectrum is reproduced with just the four process ink colors. CMYK process printing uses the same four standardized base colors all the time, small dots of the three colors are printed at different angles to create the printed image, and it is the most widely used and cost effective color system in commercial printing.
- 3.4. RGB. Red, Green, Blue (RGB) files are those whose color space resides within the additive color spectrum, where red, green, and blue are the primary colors of light. Because RGB is within the additive color spectrum, and CMYK is within the subtractive color spectrum, RGB must be converted to CMYK or Spot Color to be accurately output on a plotter or lithographic press. Because each output device may have different output settings, this will produce inconsistency in output quality when produced on different/various plotters. RGB files should only be accepted into the PoD database in order to conserve resources/time and bolster NGA's holdings when color correcting those files would be too manually intensive.
- 3.5. Area Pattern. Analog: a photographic negative or positive containing repetitively arranged small feature symbols, which have been designed to present a visual portrayal of a graphic feature (i.e., swamp, sand, etc.).

Digital: tile-able vector or raster patterns composed of feature-specific symbology.

- 3.6. Line Pattern. Analog: photographic negative containing parallel lines of equal-sized widths, which are equally spaced. Line patterns are used for printing tones of color or to present a pattern of coverage for a graphic feature.

Digital: tile-able vector or raster patterns composed of lines of varying widths, angles, etc.

- 3.7. Dot Pattern. Analog: a photographic negative or positive containing repetitively dots, which have been designed to present a visual portrayal of a specific ink or color density.

Digital: tile-able vector or raster patterns composed of dots of varying scale, diameter, etc.

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- 3.8 Lithography. A planographic method of printing based on the chemical repulsion between grease and water to separate the printing from the non-printing areas.
- 3.9 Mask. Analog: to block out an area by means of actinically opaque material, to prevent exposure in the part blocked out.

Digital: to block out an area with vector or raster elements within a digital file.

- 3.10 Moiré. An interference pattern resulting from the overlaying or overprinting or halftones of tints whose screen angles are not sufficiently separated to make the pattern inconspicuous or to preclude pattern accuracy.
- 3.11 Process Color Printing. A technique for the reproduction of a graphic in full color rendition, by combining tones of the subtractive primary colors: yellow, magenta, cyan and black.
- 3.12 Register. The correct position of one component of a composite graphic image in relation to the other components, at each stage of reproduction.
- 3.13 Screen Angle (printing). The angle which rows of halftone dots make with the vertical when right-reading. The angle is measured clockwise with 0 degrees at 12 o'clock.

Example:



- 3.14 Stochastic/Frequency Modulation (FM) Screen (printing). Halftone dots distributed on a pseudo-random basis by which the frequency of dots affects the density of color.

Example:



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- 3.15 Digital Printer. Digital printers are large-format printing devices (typically using inkjet, laser, or electrostatic methods), which share many similarities to common office laser and inkjet printers. Laser printers use electro-photographic imaging to transfer text and images to paper much like a photocopier. Inkjet printers spray tiny drops of ink onto paper.
- 3.16 ASG. Allied System for Geospatial-Intelligence. The Allied System for Geospatial Intelligence (ASG) represents the geospatial intelligence relationship among the "five-eyes" community: Australia, Canada, New Zealand, United Kingdom, and United States.
- 3.17 NSG. National System for Geospatial-Intelligence. The National System for Geospatial Intelligence (NSG) is the Enterprise comprised of National, International, Commercial, and Academic contributors and consumers of Geospatial Intelligence (GEOINT).

4. GENERAL REQUIREMENTS

- 4.1 Requirements for digital print. NGA and SoN Hardcopy Print products shall meet approved NSG standards, as delineated in the various documents listed in Appendix B tables B.1 and B.2. This shall include requirements for correct paper weights, as well as red light and low light readability, unless specifically waived by customers during the product ordering process.
- 4.2 Intended use for reproduction and printing standards. MC&G graphic products fall into the following five categories: planning, navigation, target identification, direct fire support, and target positioning. Users of these products shall require, unless specifically identified otherwise, these standards be met to assure mission goals are achieved. This standard is intended to ensure that the printing of all standard Mapping, Charting, and Geodesy (MC&G) products is uniform and consistent across lithographic and digital printing devices.

5. DETAILED REQUIREMENTS

- 5.1 Paper. The Joint Committee on Printing (JCP) sets standards for paper that is produced by or for the U.S. Government. Three basic types of paper shall be used for printing most MC&G graphic products. They are as follows:
- a. High Wet Strength Lithographic Map (JCP E-50) – shall be used for all nautical graphic products including Littoral Planning Charts.
 - b. Offset Book Map, Lithographic Finish (JCP E-30) – shall be used for aeronautical graphic products, City Graphics, and most book type graphic publications, such as catalogs and trig lists.

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- c. Chemical Wood Map, Lithographic Finish (JCP E-40) – shall be used for all topographic products such as the 1:50,000, 1:100,000, Joint Operations Graphic (Ground and Air).
 - d. Digital printing devices shall use paper of equivalent color, thickness, folding endurance, etc. to ensure that the final, printed product best matches the requirements of the end customer. Any deviation from the JCP set of paper – either on lithographic press or digital printer – shall require authorization from NGA.
 - e. There are various other types of paper used for specific products. These shall be identified in the assignment instructions when required. If a specified paper is not available in the needed size or quantity, substitutions of an appropriate quality paper shall be made by the local authority.
- 5.2 Color Management. NGA PoD files are high quality commercial print industry standard PDF files built upon NGA military specifications and therefore are referred to as Military Specification PDF (MS-PDF). These files are output in the PDF-X4 format, allowing for printing on multiple devices (i.e. desktop printers, large format plotters, inkjet web presses, and sheet fed lithographic presses) on a global scale while maintaining color fidelity.
- a. The sixteen (16) approved standard colors are listed in Appendix A “PoD Color Specification Guide.”
 - b. The PoD Color Specification Guide is also located in the Informational Documents section of the PoD site, if you click on the "MIL SPEC Color Specifications Guide" button. It provides a visual reference for all NGA Spot Color gradations and their associated CMYK equivalents, as well as a color spectrum to ensure that the digital printing device used to output NGA standard products is within the correct tolerances.
- 5.3 Printing Hardware and Software. Along with traditional lithographic printing presses, NGA print files may be output on multiple print devices using different viewing software, different RIP software, different Operating Systems (OS), and/or different web browsers. Links to recommended PoD digital printing hardware and software are listed in NGA’s “PoD Standard Operating Procedures.” Because lithographic printing has numerous facets and inputs, any printing hardware and software that maintains industry standards, and outputs products meeting NGA’s print specifications, are accepted. Because screening techniques have evolved, there is no longer the need for files to maintain set screen angles for different features and colors, as RIP software automatically sets screening stochastically (as noted in Sections 3.14).

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- 5.4 Printer Installation and Calibration. It is highly recommended that a certified technician (G7 or similar) install and calibrate printers. For digital printers, this ensures that the RIP and device are properly linearized, that the print drivers are properly installed, and that the RIP interfaces accurately with the printer. For lithographic printers, this ensures that all aspects of printing result in accurate, consistent, and quality product output, in accordance with industry standards and NGA's print specifications.
- 5.5 Printer Certification Criteria. The below criteria must be met in order for a printing device to be certified. Any uncertified printing of standard maps and charts shall not be sanctioned, by NGA, for use in red, blue, green, and low light conditions, and will also be suspect to other quality issues. Certification shall be vetted and maintain through NGA's STM Production Office.
- 5.5.1 Registration. The maximum amount that the colors or inks may be out of register is 0.15mm or 0.006 inches. For example, if the magenta is 0.11mm out of register to the left of the black, and the cyan is 0.12mm out of register to the right of the black, then the total distance of mis-registration is 0.23mm – which is 0.08mm more than the maximum. Because mis-registration will cause blurry, illegible features and text, it directly and negatively impacts red, green, and blue light readability, as well as standard, daylight readability. If registration is not maintained to within 0.15mm or 0.006 inches, then the device must be recalibrated.
- 5.5.2 Color Accuracy. Nearly all colors present within standard maps and charts are present on the NGA Color Target (NRN: NGAXCOLTRGT, NSN: 7643016701923), located on the PoD website or available in the DLA Catalog. To validate a lithographic press or digital printer's color output, print the NGA Color Target, measure all ten gradations of the sixteen spot color swatches, and perform a ΔE_{00} color comparison with the tabulated values in Appendix A. If the measured ΔE_{00} values exceed the maximums established in Appendix A, then the printing device must be further calibrated to meet this criteria.
- 5.5.3 Required and Suggested Equipment. To accurately assess the color output from a lithographic press or digital printer, a spectrophotometer or spectrodensitometer, which returns CIE-LAB values and utilizes ΔE_{00} , is required. To accurately assess the registration on a map or chart, it is highly recommended that a loupe with a minimum magnification of 10x and integrated ruler be used. For routine, visual inspections of color, it is highly recommended that a light booth with D50, 5000°K lighting be used.
- 5.5.4 Mechanical Accuracy and Consistency. Any printed products, either lithographic or digitally printed, shall be free of the following: moiré, striations, resizing,

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mechanical chatter marks, ink smudging, ink smearing, excessive dot gain, paper tearing, paper wrinkling, and any other mechanically-induced issue that impacts the quality and consistency of the printed product.

- 5.6 Lithographic and Digital Printing Quality Control Procedures. Once a printer has been certified, all criteria for certification must be maintained for all products that are printed from that device. NGA may require that certified sites send samples – according to an agreed-upon timeframe and sample quantity – in order to verify that all criteria are consistently met. Should certification criteria not be met, then certification testing must be conducted again before printed products will be sanctioned by NGA.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory)

6.1 Supersession data.

- a. Clause 5.7 “Printing Colors” of MIL-STD-2410 (DMA) Mapping, Charting, & Geodesy Reproduction and Printing, 31 January 1995.
- b. DMA, Standard Printing Color Catalog for Mapping, Charting, Geodetic Data and Related Products (January 1987).

6.2 Subject term (key word) listing.

chart
color management
digital display
graphic product
lithographic
map
print ready

- 6.3 Changes from previous issue. The margins of this standard are marked with vertical lines to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the previous issue.

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APPENDIX A

PRINT ON DEMAND (PoD) COLOR SPECIFICATION GUIDE

A.1 SCOPE

This Appendix is a mandatory part of the standard. The information contained herein is intended for compliance. Sections A.2-A.5 delineate the key aspects and data within the below table.

A.2 RGB Values

The RGB values in the below table were derived from the CIE-LAB values using the sRGB ICC profile.

A.3 CMYK Values

The CMYK values in the below table were derived from the Pantone Uncoated Library's spot color to CMYK equivalency.

A.4 CIE-LAB Values

The CIE-LAB values in the below table were cataloged using an X-rite I1 Pro spectrophotometer utilizing D50 as the standard illuminant setting.

A.5 Maximum Acceptable ΔE_{00} Values

The Maximum Acceptable ΔE_{00} values in the below table account for variations in paper, inks (both digital and press), and minor environmental differences. The ΔE_{00} for press is lower than digital due to the fact that the color specifications are derived from Pantone Spot Colors, which are a press-based ink set. Also, the ΔE_{00} for 46351 (i.e. Aero Blue or Pantone Blue 072 U) is set higher due to the fact that emulating all gradations of rich, vibrant colors – on uncoated or matte paper – extends beyond the typical gamut for most digital printers.









































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APPENDIX A

NGA SPC Number	Pantone Equivalent	Product Lines	General Description	Low-Light Readability			Color Swatches	Screen %	RGB Equivalent Values			Hexadecimal Values	CMYK Equivalent Values				CIE-LAB Values			Maximum Acceptable ΔE_{00}	
				Red	Green	Blue			R	G	B		C	M	Y	K	L	A	B	Press	Digital
46351	Blue 072 U	JOGA LPC MDG NAVPLAN TLM TM	Common name: "Aero Blue." Assigned to features such as Vertical Obstructions, Runways, Aerodromes, etc.	Yes	Yes	Yes		100%	56	70	157	#38469D	92	70	0	0	33.4	22.5	-48.7	4 0	8.0
								91%	54	72	160	#3648A0	84	64	0	0	33.9	22.6	-50.1		
								79%	67	83	167	#4353A7	73	55	0	0	38.2	20.1	-47.3		
								67%	74	94	177	#4A5EB1	62	47	0	0	42.1	18.2	-46.8		
								54%	97	113	187	#6171BB	50	38	0	0	49.5	14.3	-40.8		
								42%	121	135	200	#7987C8	39	29	0	0	57.5	11.2	-35.3		
								31%	140	153	209	#8C99D1	29	22	0	0	64.1	8.8	-30.2		
								21%	165	175	220	#A5AFDC	19	15	0	0	72.0	6.4	-24.1		
								12%	192	199	233	#C0C7E9	11	8	0	0	80.8	4.4	-17.3		
								7%	208	213	240	#D0D5F0	6	5	0	0	85.6	3.4	-13.7		
46961	2665 U	MDG MIM TLM TM	Common name: "Blue Light Readable Blue." Typically replaces 48253 (Cyan) for drainage/water features on products requiring Blue/Green Light Readability.	Yes	Yes	Yes		100%	119	103	194	#7767C2	48	55	0	0	48.9	27.9	-45.6	4 0	5.0
								91%	122	106	197	#7A6AC5	44	50	0	0	50.1	27.6	-45.4		
								79%	125	110	200	#7D6EC8	38	43	0	0	51.5	26.9	-44.7		
								67%	132	118	203	#8476CB	32	37	0	0	54.2	25.0	-42.4		
								54%	142	130	211	#8E82D3	26	30	0	0	58.3	23.2	-40.3		
								42%	158	148	219	#9E94DB	20	23	0	0	64.7	19.3	-34.9		
								31%	173	165	227	#ADA5E3	15	17	0	0	70.4	15.9	-30.1		
								21%	190	184	233	#BEB8E9	10	12	0	0	76.8	11.9	-23.8		
								12%	208	204	240	#D0CCF0	6	7	0	0	83.4	8.2	-17.4		
								7%	218	216	245	#DAD8F5	3	4	0	0	87.2	6.1	-13.5		
47651	285 U	BNPC TLM	Legacy color used in TLM products for drainage/water features.	Yes	No	No		100%	60	152	220	#3C98DC	70	30	0	0	60.3	-4.8	-42.3	4 0	5.0
								91%	68	155	221	#449BDD	64	27	0	0	61.5	-4.9	-41.2		
								79%	86	163	224	#56A3E0	55	24	0	0	64.5	-5.1	-38.3		
								67%	102	169	227	#66A9E3	47	20	0	0	67.1	-4.9	-35.5		
								54%	125	180	231	#7DB4E7	38	16	0	0	71.4	-4.4	-31.3		
								42%	148	192	236	#94C0EC	29	13	0	0	76.2	-4.0	-26.4		
								31%	168	202	239	#A8CAEF	22	9	0	0	80.2	-3.0	-21.9		
								21%	188	213	242	#BCD5F2	15	6	0	0	84.2	-2.1	-17.0		
								12%	208	223	245	#D0DFF5	8	4	0	0	88.4	-0.9	-12.4		
								7%	219	230	248	#DBE6F8	5	2	0	0	90.9	-0.1	-10.0		









































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NGA SPC Number	Pantone Equivalent	Product Lines	General Description	Low-Light Readability			Color Swatches	Screen %	RGB Equivalent Values			Hexadecimal Values	CMYK Equivalent Values				CIE-LAB Values			Maximum Acceptable ΔE_{00}	
				Red	Green	Blue			R	G	B		C	M	Y	K	L	A	B	Press	Digital
48253	Process Cyan U	BNPC City Graphic HITS ICM JOGA LPC MDG NAVPLAN OPAREA SNC TLM TM	Common name: "Cyan." Used for drainage/water features in topographic and aeronautical products. Used for near-shore tints in hydrographic products.	Yes	No	No		100%	0	160	223	#00A0DF	100	0	0	0	59.5	-26.0	-45.6	4 0	5 0
								91%	0	163	224	#00A3E0	91	0	0	0	61.1	-25.3	-43.5		
								79%	0	174	228	#00AEE4	79	0	0	0	65.8	-21.4	-38.5		
								67%	30	180	231	#1EB4E7	67	0	0	0	68.7	-19.5	-35.4		
								54%	89	190	234	#59BEEA	54	0	0	0	72.9	-16.7	-30.4		
								42%	132	202	238	#84CAEE	42	0	0	0	78.0	-12.4	-24.9		
								31%	158	210	241	#9ED2F1	31	0	0	0	81.7	-9.3	-20.6		
								21%	187	221	244	#BBD4F4	21	0	0	0	86.3	-6.0	-15.1		
								12%	206	228	246	#CEE4F6	12	0	0	0	89.4	-3.4	-11.5		
								7%	217	232	247	#D9E8F7	7	0	0	0	91.3	-1.9	-8.9		
49733	3258 U	BNPC OPAREA SNC	Common name: "Hydro Green." Typically used for sector lights, buoys, drag zones, etc. in hydrographic products.	Yes	No	No		100%	71	188	174	#47BCAE	55	0	33	0	69.8	-36.0	-2.6	4 0	5 0
								91%	80	191	178	#50BF82	50	0	30	0	71.0	-34.6	-2.9		
								79%	93	194	182	#5DC2B6	43	0	26	0	72.5	-32.2	-3.1		
								67%	106	200	190	#6AC8BE	37	0	22	0	74.8	-30.2	-3.6		
								54%	128	206	199	#80CEC7	30	0	18	0	77.8	-25.5	-4.2		
								42%	144	211	207	#90D3CF	23	0	14	0	80.3	-22.2	-4.5		
								31%	167	218	217	#A7DAD9	17	0	10	0	83.7	-16.7	-4.7		
								21%	188	224	226	#BCE0E2	12	0	7	0	86.8	-11.6	-4.7		
								12%	207	230	235	#CFE6EB	7	0	4	0	89.8	-6.8	-5.0		
								7%	219	234	241	#DBEAF1	4	0	2	0	91.9	-3.6	-5.1		
51022	355 U	MDG MIM TLM TM	Common name: "Green Light Readable Green." Typically replaces 52813 (Topo Green) for maps requiring Blue/Green Light Readability. Used for vegetation features in topographic maps. Used for vegetation and zoning features in MIMs.	Yes	Yes	Yes		100%	3	152	89	#039859	82	0	92	0	55.2	-49.0	23.6	4 0	5 0
								91%	35	155	96	#239B60	75	0	84	0	56.6	-46.1	22.0		
								79%	41	159	100	#299F64	65	0	73	0	58.2	-46.1	22.0		
								67%	52	165	106	#34A56A	55	0	62	0	60.6	-45.5	21.7		
								54%	77	178	122	#4DB27A	44	0	50	0	65.6	-42.6	20.1		
								42%	104	189	141	#68BD8D	34	0	39	0	70.5	-37.0	16.8		
								31%	134	201	163	#86C9A3	25	0	29	0	75.8	-29.4	12.4		
								21%	161	211	185	#A1D3B9	17	0	19	0	80.6	-21.8	7.9		
								12%	189	223	209	#BDDFD1	10	0	11	0	86.1	-13.8	3.3		
								7%	203	229	220	#CBE5DC	6	0	6	0	88.8	-10.0	1.2		
52813	346 U	LPC MDG TLM TM	Common name: "Topo Green." Used for vegetation features in topographic maps and littoral charts.	Yes	No	No		100%	23	158	106	#179E6A	55	0	51	0	57.8	-46.5	17.6	4 0	5 0
								91%	23	161	109	#17A16D	50	0	46	0	58.9	-47.2	17.9		
								79%	53	167	118	#35A776	43	0	40	0	61.5	-43.6	16.4		
								67%	76	177	131	#4CB183	37	0	34	0	65.5	-40.6	14.9		
								54%	101	183	144	#65B790	30	0	28	0	68.6	-34.2	12.1		
								42%	131	194	164	#83C2A4	23	0	21	0	73.7	-27.0	8.9		
								31%	154	205	181	#9ACDB5	17	0	16	0	78.3	-21.2	6.3		
								21%	176	214	199	#B0D6C7	12	0	11	0	82.5	-15.2	3.2		
								12%	200	224	217	#C8E0D9	7	0	6	0	87.2	-9.2	0.4		
								7%	212	229	227	#D4E5E3	4	0	4	0	89.6	-5.8	-0.9		













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				Red	Green	Blue			R	G	B		C	M	Y	K	L	A	B	Press	Digital
57377	Process Yellow U	ICM JOGA LPC MIM NAVPLAN SNC	Common name: "Yellow." Used for numbered features in ICMs, hypsometric tints in JOGA/NAVPLAN products, sector lights in SNCs, grid numbers in MIMs, and land tint in LPCs.	No	No	Yes		100%	255	221	22	#FFDD16	0	0	100	0	88.9	-2.9	86.6	4 0	5 0
								91%	255	220	48	#FFDC30	0	0	91	0	88.6	-2.8	81.1		
								79%	255	224	74	#FFE04A	0	0	79	0	89.8	-3.5	74.0		
								67%	255	225	91	#FFE15B	0	0	67	0	90.0	-3.8	67.5		
								54%	255	228	122	#FFE47A	0	0	54	0	90.7	-3.7	54.6		
								42%	253	230	145	#FDE691	0	0	42	0	91.4	-3.4	44.1		
								31%	248	230	168	#F8E6A8	0	0	31	0	91.5	-2.8	32.8		
								21%	247	234	194	#F7EAC2	0	0	21	0	92.9	-1.9	21.3		
								12%	245	236	214	#F5ECD6	0	0	12	0	93.6	-0.8	11.6		
								7%	243	237	226	#F3EDE2	0	0	7	0	94.0	-0.1	6.0		
58422	7504 U	BNPC HITS MIM OPAREA	Common name: "Brown." Used for boundaries and Aviation Routes in MIMs.	Yes	Yes	Yes		100%	159	136	123	#9F887B	15	27	46	37	58.5	6.3	10.4	4 0	5 0
								91%	163	141	128	#A38D80	14	25	42	34	60.3	6.2	10.3		
								79%	161	141	129	#A18D81	12	21	36	29	60.0	5.8	9.2		
								67%	171	151	140	#AB978C	10	18	31	25	63.9	5.6	8.6		
								54%	180	163	154	#B4A39A	8	15	25	20	68.1	5.0	6.7		
								42%	191	177	171	#BFB1AB	6	11	19	16	73.2	4.3	4.6		
								31%	201	190	187	#C9BEBB	5	8	14	11	77.7	3.7	2.9		
								21%	212	204	204	#D4CCCC	3	6	10	8	82.6	3.1	0.8		
								12%	220	214	217	#DCD6D9	2	3	6	4	86.3	2.6	-0.7		
								7%	227	222	226	#E3DEE2	1	2	3	3	89.0	2.2	-1.5		
58600	Process Black U	BNPC City Graphic HITS ICM JOGA LPC MDG MIM NAVPLAN SNC TLM TM	Common name: "Black." Typically used for text, grids, and culture features in all products lines.	Yes	Yes	Yes		100%	75	75	75	#4B4B4B	0	0	0	100	31.9	1.6	1.5	4 0	5 0
								91%	92	92	92	#5C5C5C	0	0	0	91	39.1	1.4	0.5		
								79%	100	100	100	#646464	0	0	0	79	42.5	1.2	-0.2		
								67%	121	121	121	#797979	0	0	0	67	50.8	1.1	-1.2		
								54%	139	139	139	#8B8B8B	0	0	0	54	57.7	1.1	-1.7		
								42%	158	158	158	#9E9E9E	0	0	0	42	64.6	1.1	-2.2		
								31%	174	174	174	#AEAEAE	0	0	0	31	70.7	1.1	-2.9		
								21%	194	194	194	#C2C2C2	0	0	0	21	77.5	1.2	-3.7		
								12%	211	211	211	#D3D3D3	0	0	0	12	83.8	1.4	-4.2		
								7%	224	224	224	#E0E0E0	0	0	0	7	87.8	1.5	-4.3		
59062	7413 U	City Graphic MIM	Common name: "Yellow-Brown." Typically used for culture features in City Graphics and Aviation Routes in MIMs.	No	Yes	Yes		100%	225	154	102	#E19A66	0	44	81	2	69.6	21.2	37.7	4 0	5 0
								91%	227	157	107	#E39D6B	0	40	74	2	70.5	20.4	36.6		
								79%	228	164	119	#E4A477	0	35	64	2	72.6	18.3	32.8		
								67%	229	171	129	#E5AB81	0	29	54	1	74.4	16.4	29.7		
								54%	231	179	142	#E7B38E	0	24	44	1	76.8	14.4	26.4		
								42%	234	188	157	#EABC9D	0	18	34	1	79.6	12.0	22.0		
								31%	235	199	176	#EBC7B0	0	14	25	1	82.7	9.3	16.5		
								21%	236	208	191	#ECD0BF	0	9	17	0	85.5	7.1	12.1		
								12%	237	219	210	#EDDBD2	0	5	10	0	88.6	4.8	6.6		
								7%	238	226	222	#EE2DE	0	3	6	0	90.8	3.1	3.5		

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NGA SPC Number	Pantone Equivalent	Product Lines	General Description	Low-Light Readability			Color Swatches	Screen %	RGB Equivalent Values			Hexadecimal Values	CMYK Equivalent Values				CIE-LAB Values			Maximum Acceptable ΔE_{00}	
				Red	Green	Blue			R	G	B		C	M	Y	K	L	A	B	Press	Digital
60862	485 U	City Graphic MIM	Common name: "Red." Typically used for numbered features in City Graphics and Aviation Routes in MIMs.	No	Yes	Yes		100%	232	95	80	#E85F50	0	73	92	1	57.9	52.1	35.4	4 0	5 0
								91%	231	98	83	#E76253	0	66	84	1	58.4	50.8	34.4		
								79%	234	113	100	#EA7164	0	58	73	1	61.9	45.5	29.2		
								67%	235	123	112	#EB7B70	0	49	62	1	64.2	41.8	25.6		
								54%	235	140	132	#EB8C84	0	39	50	1	68.2	35.5	20.2		
								42%	237	158	153	#ED9E99	0	31	39	0	72.8	28.6	14.8		
								31%	238	172	170	#EEACAA	0	23	29	0	76.5	23.5	10.9		
								21%	238	191	191	#EEBFBF	0	15	19	0	81.4	17.0	6.4		
								12%	238	208	211	#EED0D3	0	9	11	0	86.0	11.2	2.3		
								7%	238	217	222	#EED9DE	0	5	6	0	88.6	8.0	0.5		
61121	202 U	BNPC HITS ICM JOGA LPC MDG MIM TLM TM	Common name: "Dark-Brown." Typically used for boundaries in HITS and MIMs; roads in ICMs; hypsometric features in JOGAs, LPCs, MDGs, MIMs, TLMs, and TMs.	Yes	Yes	Yes		100%	149	80	88	#955058	12	88	67	34	42.4	29.9	7.8	4 0	5 0
								91%	154	83	94	#9A535E	11	80	61	31	44.0	30.6	7.0		
								79%	161	94	105	#A15E69	9	70	53	27	47.8	28.5	5.5		
								67%	170	108	121	#AA6C79	8	59	45	23	52.7	26.3	3.3		
								54%	180	127	140	#B47F8C	6	48	36	18	58.7	22.7	1.3		
								42%	194	151	165	#C297A5	5	37	28	14	66.8	17.9	-1.0		
								31%	203	169	183	#CBA9B7	4	27	21	11	72.6	14.4	-2.4		
								21%	212	187	201	#D4BBC9	3	18	14	7	78.4	11.3	-3.5		
								12%	222	206	219	#DECEDB	1	11	8	4	84.4	7.9	-4.4		
								7%	229	217	230	#E5D9E6	1	6	5	2	88.0	6.1	-4.8		
90342	Process Magenta U	ICM JOGA NAVPLAN	Common name: "Magenta." Typically used as part of color imagery in ICMs and hypsometric tints in JOGAs and NAVPLAN charts.	No	Yes	Yes		100%	239	84	144	#EF5490	0	100	0	0	58.7	64.1	0.0	4 0	5 0
								91%	226	87	143	#E2578F	0	91	0	0	57.0	59.1	-2.6		
								79%	227	106	155	#E36A9B	0	79	0	0	60.8	52.1	-3.9		
								67%	229	126	169	#E57EA9	0	67	0	0	65.2	44.9	-5.3		
								54%	230	141	180	#E68DB4	0	54	0	0	68.9	38.7	-6.0		
								42%	231	158	191	#E79EBF	0	42	0	0	73.0	32.3	-6.2		
								31%	233	175	204	#E9AFCC	0	31	0	0	77.5	25.5	-6.5		
								21%	235	194	218	#EBC2DA	0	21	0	0	82.6	18.5	-6.6		
								12%	237	211	230	#EDD3E6	0	12	0	0	87.0	12.3	-6.1		
								7%	237	221	237	#EDDDED	0	7	0	0	89.7	8.4	-5.8		
91021	688 U	SNC	Legacy color used in SNCs. Replaced by 96532.	Yes	No	No		100%	175	119	149	#AF7795	34	64	19	1	56.6	26.3	-7.0	4 0	5 0
								91%	177	122	151	#B17A97	31	58	17	1	57.5	25.8	-6.9		
								79%	183	128	157	#B7809D	27	51	15	1	59.9	25.7	-7.1		
								67%	189	140	167	#BD8CA7	23	43	13	1	63.6	23.0	-7.1		
								54%	196	152	177	#C498B1	18	35	10	1	67.5	20.6	-6.8		
								42%	206	168	192	#CEA8C0	14	27	8	0	72.8	18.1	-6.8		
								31%	211	178	200	#D3B2C8	11	20	6	0	75.9	15.7	-6.8		
								21%	221	196	215	#DDC4D7	7	13	4	0	81.7	11.8	-6.2		
								12%	228	212	228	#E4D4E4	4	8	2	0	86.5	8.3	-5.9		
								7%	233	221	236	#E9DDEC	2	4	1	0	89.5	6.4	-5.5		

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NGA SPC Number	Pantone Equivalent	Product Lines	General Description	Low-Light Readability			Color Swatches	Screen %	RGB Equivalent Values			Hexadecimal Values	CMYK Equivalent Values				CIE-LAB Values			Maximum Acceptable ΔE_{00}	
				Red	Green	Blue			R	G	B		C	M	Y	K	L	A	B	Press	Digital
96532	2577 U	BNPC HITS LPC OPAREA SNC	Common name: "Hydro Purple." Used for hydrographic features, sector lights, buoys, grids (LPCs), and zoning areas in charts.	Yes	No	No		100%	150	123	191	#967B8F	32	43	0	0	56.4	24.6	-31.7	4 0	5 0
								91%	152	125	192	#987DC0	29	39	0	0	57.3	24.1	-31.3		
								79%	157	130	197	#9D82C5	25	34	0	0	59.2	23.9	-31.0		
								67%	162	135	202	#A287CA	21	29	0	0	61.0	23.5	-30.7		
								54%	171	146	210	#AB92D2	17	23	0	0	64.8	22.3	-29.5		
								42%	182	159	218	#B69FDA	13	18	0	0	69.2	20.1	-27.0		
								31%	191	171	224	#BFABE0	10	13	0	0	73.3	17.3	-23.9		
								21%	202	187	230	#CABBE6	7	9	0	0	78.3	13.6	-19.8		
								12%	215	205	239	#D7CDEF	4	5	0	0	84.2	9.9	-15.3		
								7%	223	216	243	#DFD8F3	2	3	0	0	87.5	7.5	-12.4		
Foreshore Flats-Topo	Cyan + Black	N/A	N/A	Yes	No	No		N/A	139	180	204	#8BB4CC	31	0	0	12	71.2	-8.0	-16.7	4 0	5 0
Foreshore Flats-Hydro	Cyan + Black	N/A	N/A	Yes	No	No		N/A	161	189	208	#A1BDD0	21	0	0	12	75.1	-5.0	-12.8	4 0	5 0
Paper	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	94.6	1.5	-5.1	N/A	N/A

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GLOSSARY OF PRINT PRODUCT

This ANNEX list the print products cited in ANNEX A, which are defined the associated specifications below.

B.1 Department of Defense product specifications.

Product	Acronym	Specification
Joint Operations Graphic	JOG	MIL-J-89100
Littoral Planning Chart	LPC	MIL-PRF-89202B
Operational Navigation Chart	ONC	MIL-O-89102
Standard Nautical Chart	SNC	MIL-PRF-89201B
Tactical Pilotage Chart	TPC	MIL-T-89101

(Copies of these documents are available online at <http://quicksearch.dla.mil>)

B.2 NGA product specifications.

Product	Acronym	Specification
Bathymetric Navigation Planning Chart	BNPC	PS-2BA-011
Bottom Contour	BC	PS-2BO-040
Hull Integrity Test Site	HITS	PS-2DA-013
Joint Operations Graphic	JOG	JOG DPS v 1.0
MGCP Topographic Map	MTM	MTM DPS v 1.1
Operational Area Chart	OPAREA	PS-2DA-010
Topographic Map	TM	NGA.STND.0035, Parts 1, 2 and 3

(Copies of these documents are available upon request. All request should be directed to the National Geospatial-Intelligence Agency (NGA), or e-mailed to STMProductionOffice@nga.mil)

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CONCLUDING MATERIAL

Custodians:

Army – AV

Navy – NO

Air Force – 09

Preparing Activity:

NGA – MP

(Project GINT-2019-002)

Review Activities:

Army – CR, MI

Navy – CG, MC

Air Force – 33

DIA – DI

DISA – DC1

NSA – NS

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above by using the ASSIST Online database at <https://assist.dla.mil/>.