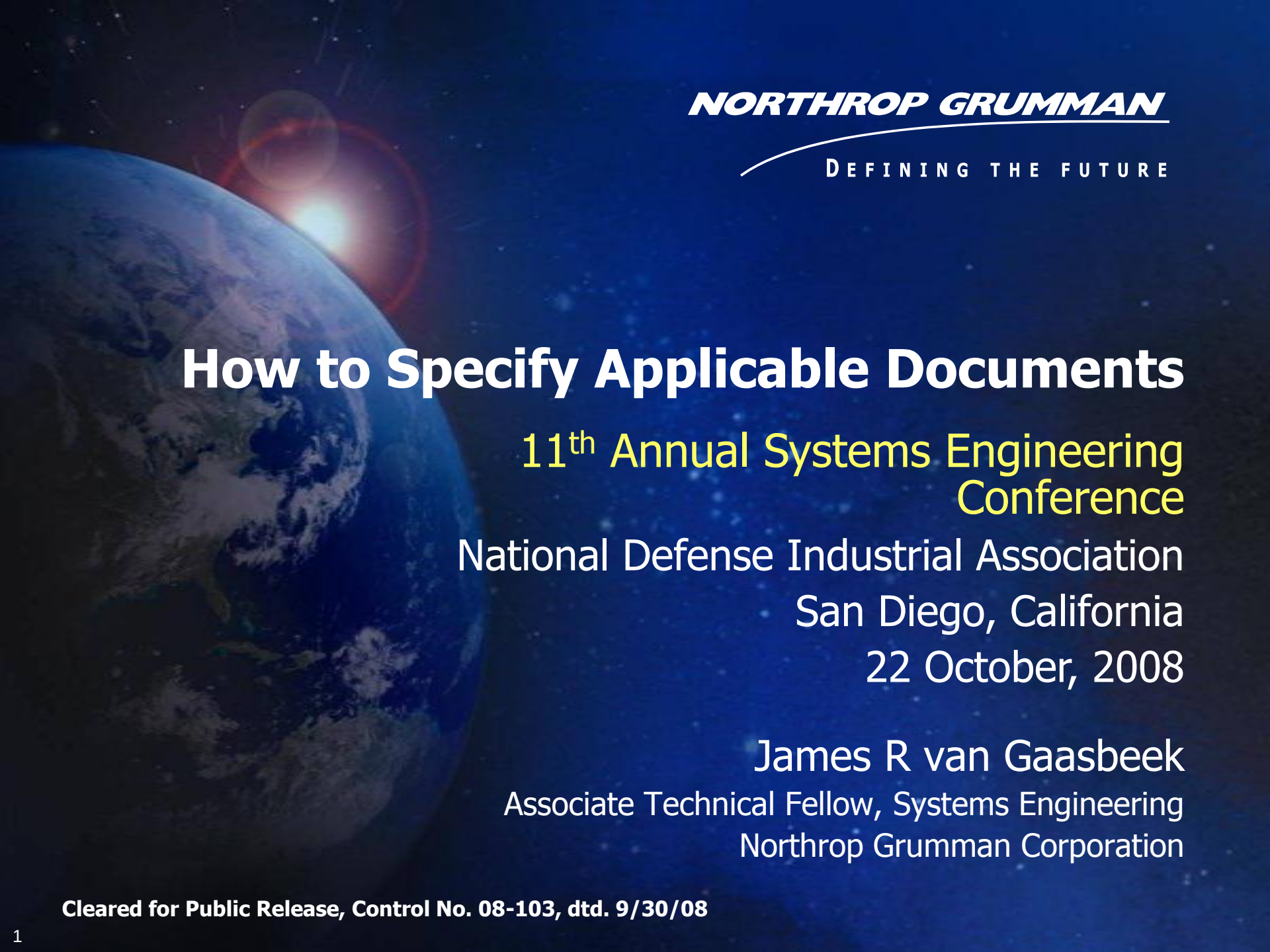


How to Specify Applicable Documents

11th Annual Systems Engineering Conference

National Defense Industrial Association

San Diego, California

22 October, 2008

James R van Gaasbeek

Associate Technical Fellow, Systems Engineering

Northrop Grumman Corporation

Agenda

NORTHROP GRUMMAN

- **Abstract**
- **Context and Definitions**
- **Disclaimer**
- **Citation in Sections 3, 4 or 5**
- **Citation in Section 2**
- **Precedence**
- **Tiering**
- **Flowdown to Subcontractors**
- **References**
- **Biography**

Abstract

Abstract

It is a common practice to refer to applicable documents in both programmatic and product-specification documents in contracted development. The practice permits inclusion of a vast amount of lessons-learned and best practices can be referenced without the need to include the information directly in the document, nor to maintain the referenced information. Product requirements documents often specify interfaces and interoperability characteristics by reference to interface control documents included in the list of applicable documents. Benefits accruing to the product from the use of applicable documents are reduced overall cost, better products and better interoperability. Costs accruing to the product development effort are the cost of maintaining visibility on changes to applicable documents outside the control of the Program and the cost of verification of all included requirements.

Experience on many Programs and with several customers has shown that there is a wide variation in the manner in which applicable documents are incorporated in product specifications. The observed differences fall into several broad categories, such as: the method of citation of applicable documents; the difference between compliance and reference documents; the methods of referencing the documents in the requirements statements; and the approach to sub-tiering of the applicable documents.

This paper will discuss the different approaches to utilizing applicable documents within product documents and the issues and risks that arise, illustrated with examples. Using lessons learned across the program and customer experience, a robust, standardized approach is recommended that should increase the benefit of using applicable documents while reducing the cost.

Cleared for Public Release, Control No. 08-103, dtd. 9/30/08

Context and Definitions

Context and Definitions

NORTHROP GRUMMAN

- Typical specification formats utilized in US Department of Defense contracting provide for the citation of applicable documents.
- "Judicious referencing of other documents in specifications is a valuable tool that eliminates the repetition of requirements and [eliminates the repetition of] tests adequately set forth elsewhere. However, unnecessary or untailored referencing of other documents can lead to increased costs, excessive tiering, ambiguities, and compliance with unneeded requirements." (MIL-STD-961E, 4.19)
- Method for incorporating lessons learned in the field
- Method for including commercial standards and practices

Context and Definitions (Concluded)

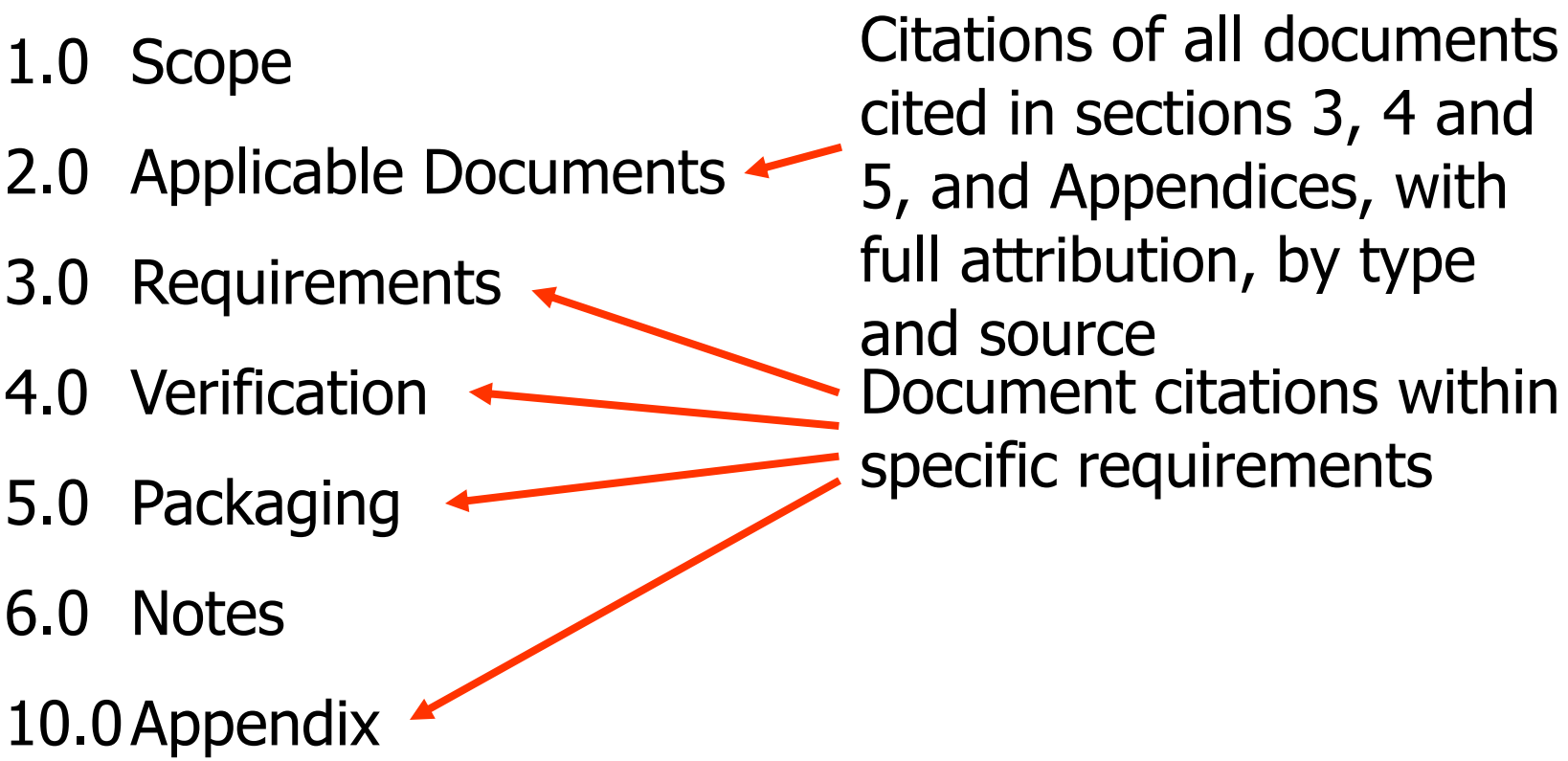
NORTHROP GRUMMAN

- The applicable documents are of two types:
  - **Compliance – the cited document contains requirements included in the citing document by reference**
  - **Reference – the cited document provides data or information useful in enhancing the understanding of the citing document**
- Documents can be referenced in product specifications and in programmatic documents (e.g., Statement of Work). This presentation will address citation in product specifications only.
- Compliance documents can be found in functional, performance, interface, environmental and design and construction requirements. Reference documents can be found throughout Sections 3, 4 and 5 and Appendices.

Applicable Document Utilization

NORTHROP GRUMMAN

- **Various standard specification formats exist (MIL-STD-490A, MIL-STD-961E, JSSG-2000A, various DIDs). A typical format is:**



Areas of Confusion

NORTHROP GRUMMAN

- Citation of a reference document as a compliance document
- Citation of a compliance document as a reference document
- Unnecessary citation of a complete document
- Incomplete citations in Section 2
- Failure to state precedence
- Failure to address tiering
- Failure to flowdown applicable documents to subcontractors

Disclaimer

Cleared for Public Release, Control No. 08-103, dtd. 9/30/08

Disclaimer

NORTHROP GRUMMAN

- The author has found no discussions of the use of applicable documents in the literature.
- Some examples of requirements that can be improved are given in this presentation. There is no intent to criticize the original author, as there is no standard way to handle applicable documents.

Citation in Sections 3, 4 or 5

Citation of Incorrect Document in a Requirement

NORTHROP GRUMMAN

The <System> shall limit orbital debris generation in compliance with NSS1740.14, Guidelines and Assessment Procedures for Limiting Orbital Debris.

- NSS1740.14 defines parameters for assessing a design to determine the minimization of orbital debris generation.
- This could be a programmatic requirement inadvertently included in a product specification.
- Alternatively, one can derive several product requirements from the Guidelines, in which case the requirement should be stated as:

The <System> shall limit orbital debris generation using NSS1740.14, Guidelines and Assessment Procedures for Limiting Orbital Debris for guidance.

- NSS1740.14 should then be listed in the "Reference Documents" section.

Citation of an Entire Document in Requirements

NORTHROP GRUMMAN

The <System> shall meet MIL-STD-1472 for all 1-g human-machine interfaces.

The <System> shall meet NASA-STD-3000 for all micro-g and 0-g human-machine interfaces.

- Both requirements are valid product requirements.
- Both MIL-STD-1472 and NASA-STD-3000 contain some explicit requirements ("shalls") and numerous implicit requirements in the form of design guidance.
- It has been estimated that each of the documents may contain approximately 3000 requirements. By inclusion of the entire document, all the cited requirements will have to be verified.
- Should only cite a complete document if the intent is to include all of its requirements. Otherwise, cite specific sections.

Citation of an Incorrect Document in an Incorrect Location

NORTHROP GRUMMAN

The <System> shall operate after temperature and humidity diurnal cycling During transportation and storage as defined in MIL-STD-810F, Method 507.

- MIL-STD-810F is not a product requirements document – it addresses methods for environmental testing.
- The requirement should be rewritten as a product requirement for Section 3 and a verification requirement Section 4:

The <System> shall operate after temperature and humidity diurnal cycling During transportation and storage in the natural environment defined in MIL-HDBK-310.

Verification of the <System's> operation after temperature and humidity diurnal cycling during transportation and storage using Method 507 in MIL-STD-810F.

- Both MIL-STD-810F and MIL-HDBK-310 should then be referenced in the "Reference Documents" section.

Citation of Incorrect Document in an Incorrect Location

NORTHROP GRUMMAN

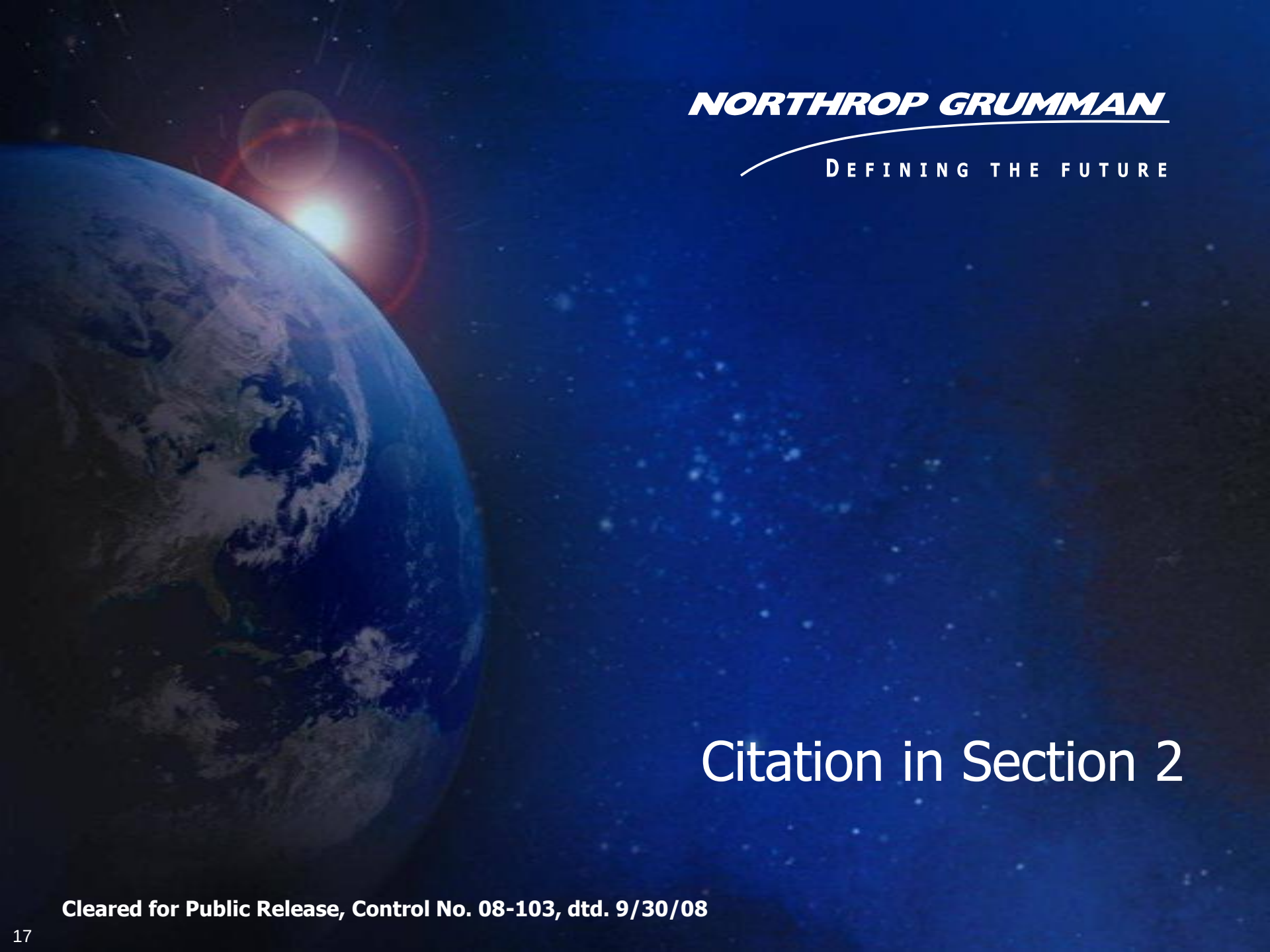
The <System> shall operate during and after exposure to rain at a rate of 100 millimeters (mm) per hour for a 1 hour duration at +24 degrees Celsius (C) and with a 64-knot wind as defined in MIL-HDBK-310.

The <System> shall be sealed to prevent water incursion as defined in MIL-STD-810F, Method 506, Section 2.2.2b (Water Tightness).

- The first requirement is a good example.
- The second requirement should be rewritten as a product and a verification requirement:

The <System> shall be sealed to prevent water incursion (Water Tightness).

Verification that the <System> is sealed to prevent water incursion shall be conducted using Method 506, Section 2.2.2b of MIL-STD-810F.



Citation in Section 2

Citation in Section 2

NORTHROP GRUMMAN

2.0 APPLICABLE DOCUMENTS

2.1 APPLICABLE DOCUMENTS
The following documents are applicable to the <Item> requirements:

2.2 REFERENCE DOCUMENTS
The following are reference documents:

- The first problem is the use of the same title for sections 2.0 and 2.1. Section 2.1 should be called "COMPLIANCE DOCUMENTS".
- The introductory text in Section 2.1 places no restrictions on the cited documents – if a document is updated at some point during the product life cycle, then the product must be updated to agree with the compliance documents.

Citation in Section 2 (Continued)

NORTHROP GRUMMAN

2.0 APPLICABLE DOCUMENTS

The documents listed in this section are specified in sections 3, 4, or 5 of this document. This section does not include documents cited in other sections of this document 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 document, whether or not they are listed here. Failure to include a cited document in this section does not mean that it is not included in this Document. Inclusion of a document in this section without a citation in the text does not include that document in this Document.

2.1 APPLICABLE DOCUMENTS

The following documents of the exact revision and date listed below form a part of this specification to the extent specified herein.

2.2 REFERENCE DOCUMENTS

The following documents of the exact revision and date listed below are referenced herein.

- **The statements force exact attribution of the applicable documents and ensure that any update to an applicable document will force a formal explicit review and possible change to the specification.**

Citation in Section 2 (Concluded)

NORTHROP GRUMMAN

- **The format for Sections 2.0, 2.1 and 2.2 shown on the previous chart are the "short" form.**
- **MIL-STD-490 and MIL-STD-961 recommend listing the documents within Sections 2.1 and 2.2 by source.**
- **See Section 5.7.2 – 5.7.3 of MIL-STD-961E for an example of the "long" form. Note that it makes no distinction between compliance and reference documents.**

Sample Section 2 Citations

NORTHROP GRUMMAN

- **A standard format is to reference the documents (compliance and reference) in a tabular format, as follows:**

MIL-DTL-15090D 6 November 1996	**Detail Specification, *Enamel, Equipment, Light Gray, (Navy Formula No. 111)*, Department of Defense**
MIL-STD-1399-300A Notice 1 11 March 1992	**Military Standard, Interface Standard for Shipboard Systems, Section 300A, Electric Power, Alternating Current, Department of Defense**
MIL-STD-1472F Notice 1 5 December, 2003	**Department of Defense Design Criteria Standard, Human Engineering, Department of Defense**

- **Decide if the citation in the requirement statement should have the full attribution, or just the base number (i.e., MIL-STD-130M or MIL-STD-130). The full attribution must be provided in Section 2.**

Precedence

Precedence

- There can be conflicts between the cited documents and requirements in the citing specification.
- Add a subsection to Section 2 with the following text:

2.X Order of precedence
In the event of a conflict between the text of this specification and the references cited herein, the text of this specification takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

Quoted from JSSG-2000A, paragraph 2.5.

Tiering

Document Tiering

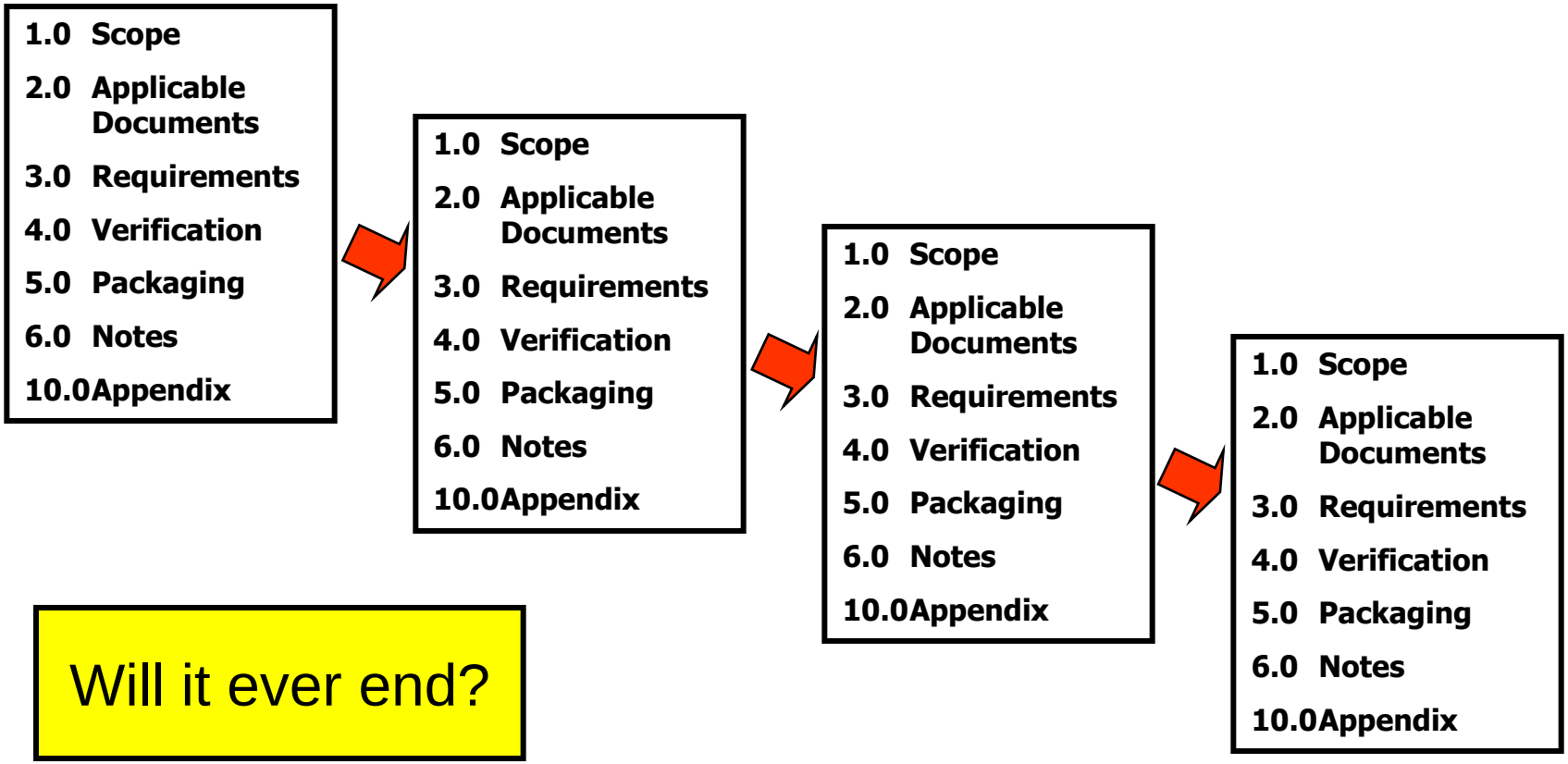
NORTHROP GRUMMAN

- **Control of document tiering has become a primary way of controlling contractual applicability of cited documents. Care must be taken to ensure that each cited document is appropriate to the first-tier references or compliance documents (including those references or compliance documents cited in the contract, which themselves would become first-tier references or compliance documents and, thus, their second tier would become contractually applicable as well).**
- **Exceptions to tiering applicability are generally defined by DoD policy. For example, in the Perry memo previously cited, the direction on tiering of specifications and standards includes, "Approval of exceptions may only be made by the Head of the Departmental or Agency Standards Improvement Office and the Director, Naval Nuclear Propulsion for specifications and drawings used in nuclear propulsion plants in accordance with Pub. L. 98-525 (42 U.S.C. fl7158 Note)."**

Based on JSSG-2000A, paragraph 2.4.

Tiering

- Cited applicable documents can, themselves, cite additional applicable documents which can, also, cite applicable documents:



Document Tiering Statement

NORTHROP GRUMMAN

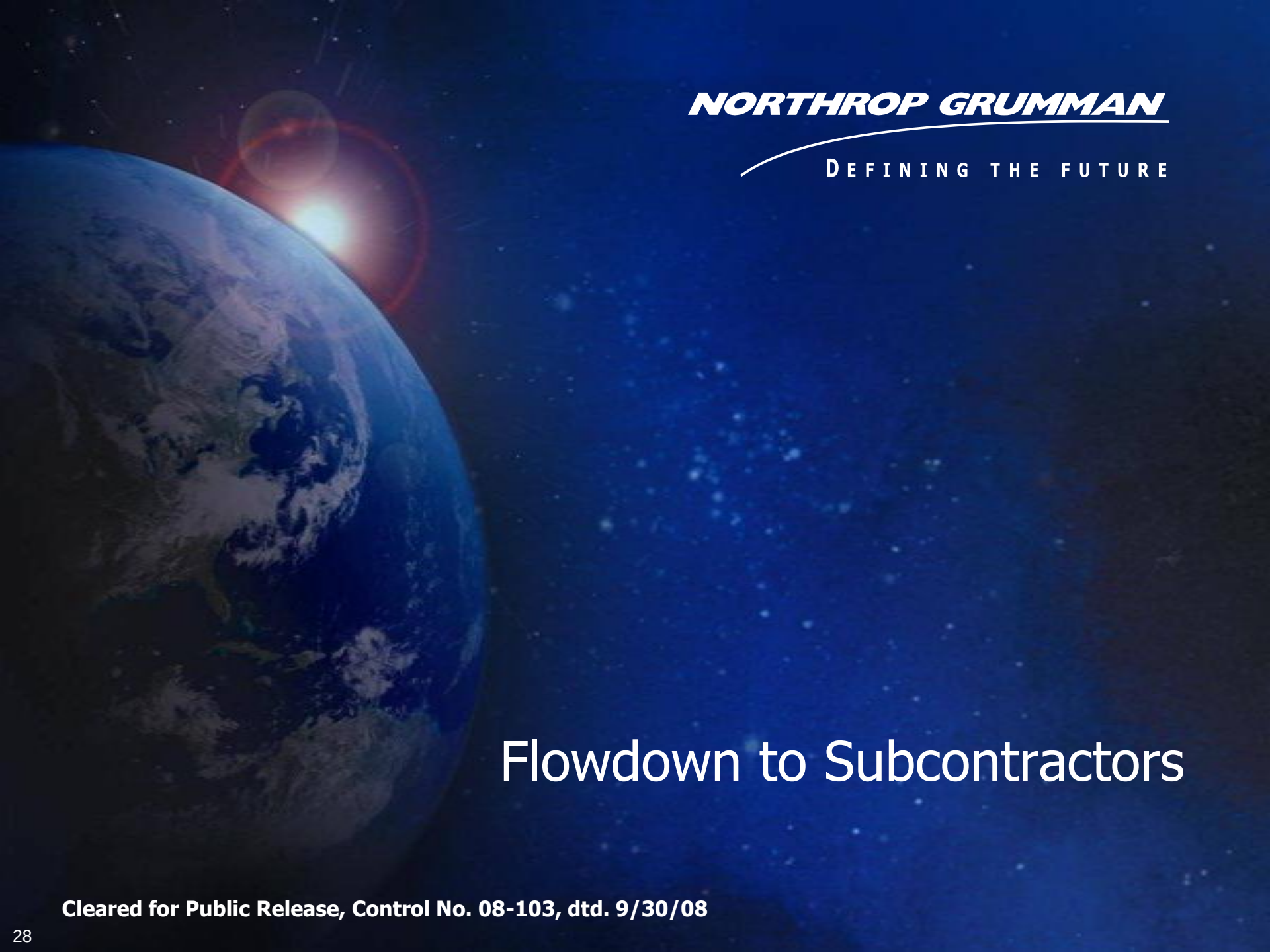
- Need to include a tiering statement such as:

When the <item> specification is directly referenced in the contract, it is a first-tier specification and is applicable. Documents referenced in the first-tier specification are applicable as follows:

a. Second Tier - All documents directly referenced in the first-tier specification are only applicable to the extent specified.

b. Lower Tier - All documents directly referenced in second- or lower-tier documents are for guidance only unless otherwise directed by the contract.

Based on JSSG-2000A, paragraph 2.4.



Flowdown to Subcontractors

Flowdown to Subcontractors

NORTHROP GRUMMAN

- The specifications provided to the subcontractors for the items that they are to provide should also contain a Section 2, and the flowed-down requirements should cite the portion of the applicable document in the parent document that corresponds to the flowed-down requirement

References

References - 1

- **MIL-STD-490A, Military Standard Specification Practices, 4 June 1985 (now cancelled)**
- **MIL-STD-961E, Department of Defense Standard Practice Defense and Program-Unique Specifications Format and Content, 1 August 2003**
- **JSSG-2000A, Department of Defense Joint Service Specification Guide Air System, 15 March, 2000**
- **MIL-STD-810F, Department of Defense Test Method Standard, Environmental Engineering Considerations and Laboratory Tests, 1 January 2000, Department of Defense.**
- **MIL-STD-1472F, Notice 1, Department of Defense Design Criteria Standard, Human Engineering, 5 December, 2003, Department of Defense.**
- **MIL-HDBK-310, Department of Defense Handbook, Global Climatic Data for Developing Military Products, 23 June 1997, Department of Defense.**

Biography

Author's Biography

NORTHROP GRUMMAN

- Jim van Gaasbeek has 35 years experience analyzing and developing rotary-wing and fixed-wing aircraft, launch vehicles and spacecraft, both in the United States and European defense environments. Beginning as a rotor aeroservoelastician, his career has progressed with experience in constructive and virtual simulation, accident investigation, vehicle-management system design and systems engineering, concentrating in risk management and requirements development, management and verification.

NORTHROP GRUMMAN

DEFINING THE FUTURE