
Much Ado about Argument

(and a bit about other stuff)

DASC 2024 Tutorial

C. Michael Holloway

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The purposes of argument for us are to

provoke careful thinking

&

promote effective communication

ARGUMENT

your attempt to convince others to BELIEVE a CONCLUSION
through REASONING from one or more PREMISES

ARGUMENT

your attempt to convince others to **BELIEVE** a **CONCLUSION**
through **REASONING** from one or more **PREMISES**

BELIEVE

accept as true

ARGUMENT

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CONCLUSION

the statement you want your audience to **BELIEVE**

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A COGENT ARGUMENT
rationally justifies
BELIEVING its
CONCLUSION to the
required standard of
confidence

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A **BINDING** associates
a term used in an
ARGUMENT and the
real-world
information to
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CONCLUSION

the statement you want your audience to **BELIEVE**

PREMISE

a statement you think your audience **BELIEVES**

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accept as true

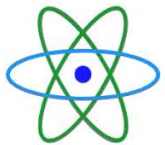


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A **BINDING** associates a term used in an **ARGUMENT** and the real-world information to which that term refers.



An **ATOMIC ARGUMENT** consists of a single **CONCLUSION** together with its immediate **REASONING**, **PREMISES**, and **BINDINGS** (if any).

CONCLUSION

the statement you want your audience to **BELIEVE**

PREMISE

a statement you think your audience **BELIEVES**

REASONING

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BELIEVE

accept as true

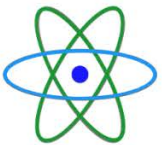


A **COGENT ARGUMENT** rationally justifies **BELIEVING** its **CONCLUSION** to the required standard of confidence

ARGUMENT

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A **BINDING** associates a term used in an **ARGUMENT** and the real-world information to which that term refers.



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CONCLUSION

the statement you want your audience to **BELIEVE**

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a statement you think your audience **BELIEVES**

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BELIEVE

accept as true



A **COGENT ARGUMENT** rationally justifies **BELIEVING** its **CONCLUSION** to the required standard of confidence



A **COMPOUND ARGUMENT** is an **ARGUMENT** consisting of more than one **ATOMIC ARGUMENT**.

ARGUMENT

your attempt to convince others

to BELIEVE

accept as true

a CONCLUSION

what you want your audience to BELIEVE

through REASONING

why you think the PREMISES should cause your audience to BELIEVE your CONCLUSION

from PREMISES

statements you think your audience BELIEVE

A COGENT ARGUMENT rationally justifies BELIEVING its CONCLUSION to the required level of confidence

Believing

Conclusion

is $\left\{ \begin{smallmatrix} \text{justified} \\ \text{required} \end{smallmatrix} \right\}$ by applying

Reasoning

to these premises

Premise-1

. . .

Premise-p

[with these bindings

word/phrase: definition

reference: link

. . .]

[unless

Defeater-1

. . .]

Believing

Conclusion

is $\left\{ \begin{smallmatrix} \text{justified} \\ \text{required} \end{smallmatrix} \right\}$ by these premises

Premise-1

. . .

Premise-p

[with these bindings

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. . .]

[unless

Defeater-1

. . .]

Presuppositions
predetermine
plausibility.

You need argument
only when
you need argument.

Certainty is
certainly not
possible.

All arguments
are local.

Evidence is
not special.

Arguments
are not trees.

Numbers
are evil.

a bit about OPs & OPRAs

foundational principle

Given a sufficient set of properties the possession of which ensures a system is safe enough to be approved ...

then

deciding whether to approve a system requires **only** determining whether the system possesses those properties.

The Overarching Properties
were created
to constitute
such a set.

Overarching Properties

Intent

The *defined intended behavior* is correct and complete with respect to the *desired behavior*.

Correctness

The *implementation* is correct with respect to its *defined intended behavior*, under *foreseeable operating conditions*.

Innocuity

Any part of the *implementation* that is not required by the *defined intended behavior* has no *unacceptable impact*.

See *Understanding the Overarching Properties* (NASA/TM-2019-220292)

<https://bit.ly/Ut0Ps>

Overarching Properties

Intent: The *defined intended behavior* is correct and complete with respect to the *desired behavior*.

Correctness: The *implementation* is correct with respect to its *defined intended behavior*, under *foreseeable operating conditions*.

Innocuity: Any part of the *implementation* that is not required by the *defined intended behavior* has no *unacceptable impact*.

Definitions

- a. *Desired behavior*: Needs and constraints expressed by the stakeholders (this includes those needs and constraints identified by the *safety assessment* and those mandated by regulations).
- b. *Defined intended behavior*: The record of the *desired behavior*.
- c. *Implementation*: *Item* or combination of inter-related *items* for which acceptance or approval is being sought.
- d. *Item*: "A hardware or software element having bounded and well-defined interfaces." (from ARP 4754A)
- e. *Foreseeable operating conditions*: External and internal conditions in which the system is used, encompassing all known normal and abnormal conditions.
- f. *Unacceptable impact*: An impact that compromises the *safety assessment*.
- g. *Safety assessment*: The systematic identification of *failure conditions* and classifications in an operational context, evaluation of the architecture against safety objectives arising from these hazards, evaluation of potential common modes and threats, defining additional intended behaviors to support claims within these evaluations and showing that the safety objectives are satisfied by the *implementation*.
- h. *Failure condition*: "A condition having an effect on the aircraft and/or its occupants, either direct or consequential, which is caused or contributed to by one or more failures or errors, considering flight phase and relevant adverse operational or environmental conditions or external events." (from AMC 25.1309)

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Requisites required for showing possession of the Overarching Properties

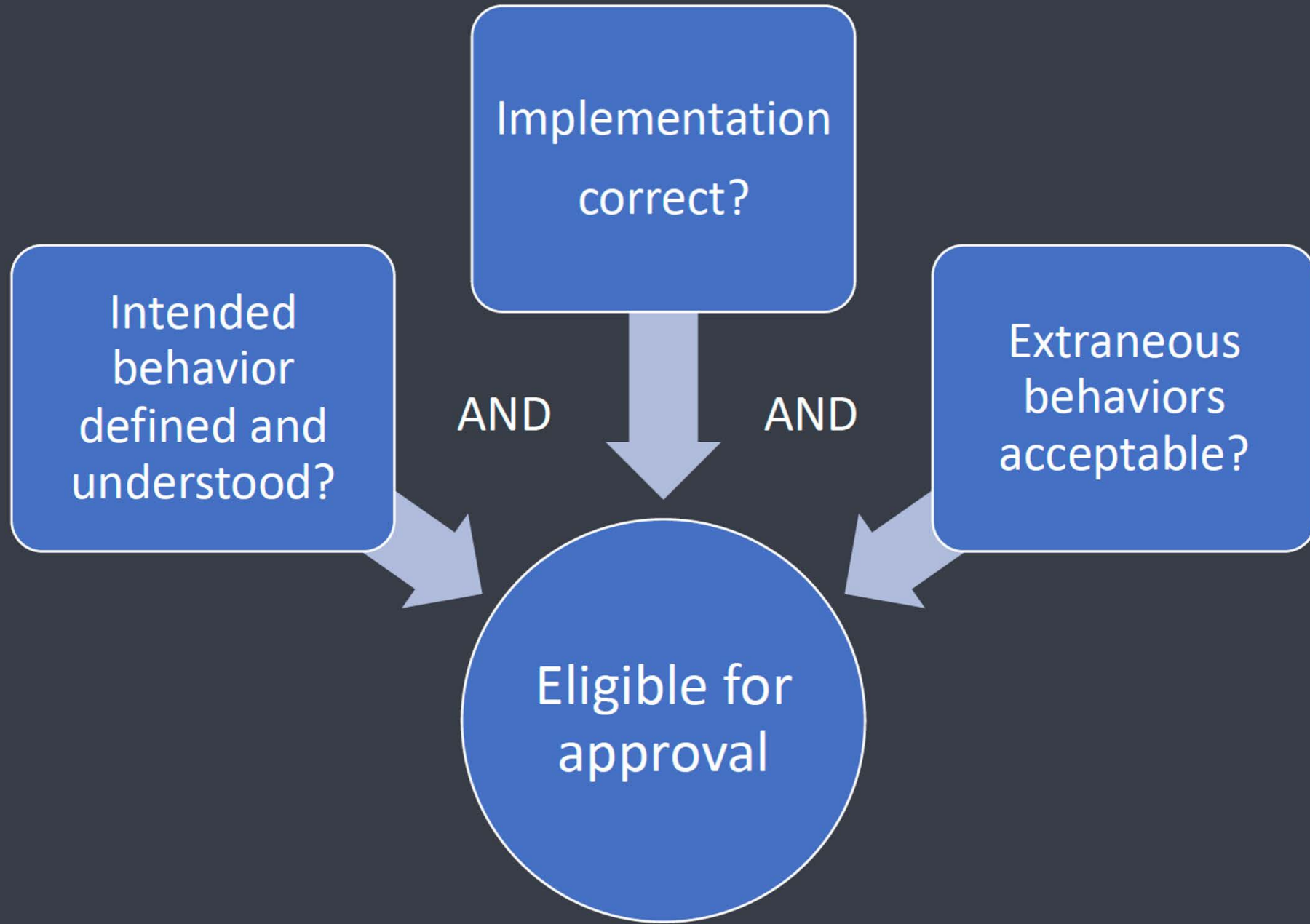
- a. *Defined intended behavior* exists.
- b. *Failure conditions* are defined.
- c. Development Assurance Levels (DALs) are assigned using the *failure condition* classifications.
- d. The record of the *foreseeable operating conditions* exists.
- e. The *implementation* exists.
- f. The *safety assessment* exists.

Assumptions which need only be stated, not justified

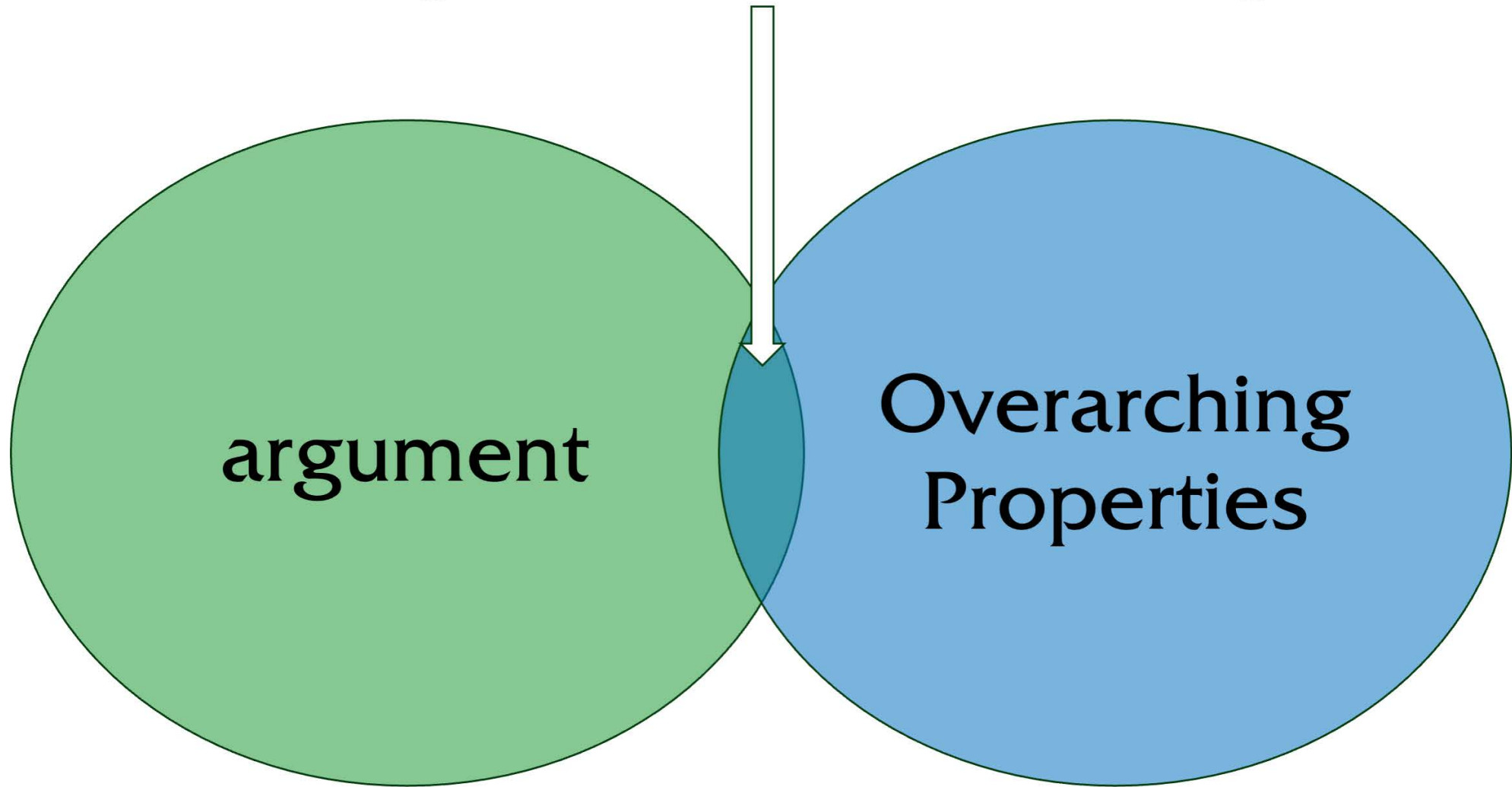
- a. Stakeholders have the knowledge to express the *desired behavior*.
- b. Performing *safety assessment* is not covered by these Overarching Properties.

Constraints on how Overarching Property possession must be demonstrated

- a. The process to ensure possession of the Overarching Properties must be defined and conducted as defined.
- b. The means by which the *defined intended behavior* is shown to be correct and complete is commensurate with the DAL.
- c. Criteria for evaluating the artifacts are defined and shown to be satisfied individually and collectively.
- d. All artifacts are under configuration management and change control.
- e. When tiers of decomposition are used, the means of showing correctness among the tiers and to the *defined intended behavior* must be defined and conducted as defined.
- f. The *implementation* must be correct when functioning as part of the integrated system or in environment(s) representative of the integrated system.
- g. All design and manufacturing data to support consistent replication of the type design and instructions for continued airworthiness must be established.
- h. The *safety assessment* must address all of the *implementation*.



Overarching Property Related Arguments



OPRAs are ARGUMENTS that are related to the Overarching Properties

- consistency with OP definitions
- bindings for OP requisites
- acknowledgement of OP assumptions
- satisfaction of OP constraints

Questions?

A Primer on Argument.

<https://ntrs.nasa.gov/citations/20210019993>
C. Michael Holloway & Kimberly S. Wasson. 2021.

A Friendly Argument Notation (FAN).

<https://ntrs.nasa.gov/citations/20230004423>
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A Primer on Argument Assessment.

<https://ntrs.nasa.gov/citations/20210022807>
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Towards a Coherent View of Evidence in Safety Assurance.

<https://ntrs.nasa.gov/citations/20230003336>
Finlay McCardel, C. Michael Holloway,
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Mallory Graydon, Abel Peña, and Sarah Lehman. 2023.

Understanding the Overarching Properties.

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C. Michael Holloway. 2020.
(This document was officially approved by the Overarching Properties Working Group).

An Introduction to Constructing and Assessing Overarching Properties Related Arguments (OPRAs).

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Kimberly S. Wasson & C. Michael Holloway. 2022.
(This document was officially approved by the Overarching Properties Working Group).

False Beliefs About the Overarching Properties and Overarching Properties Related Arguments.

<https://ntrs.nasa.gov/citations/20220008513>
C. Michael Holloway. 2022.

Aggregating Confidence: A Problem and A Solution.

<https://ntrs.nasa.gov/citations/20230012813>
Stella Cohen, Rose Gotlieb,
C. Michael Holloway, Sarah Lehman. 2023.

The OPs &OPRAs: Part 1, Part2, & Part3

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<https://www.youtube.com/watch?v=TqcuXx0NISO&t=7s>
C. Michael Holloway. 2022.

