

Standardization training program E-60 discipline: Control

Agenda

Standardization
training program
E60 discipline:
Control

- 10:05 - 10:15: **E60 overview**
- 10:15 - 10:35: **Control engineering handbook** (ECSS-E-HB-60A)
- 10:35 - 11:20: **Control performance, ESA Pointing Error Engineering Handbook, and ESA Pointing Error Engineering Tool** (ECSS-E-ST-60-10C, ESSB-HB-E-003, PEET)
- 11:30 - 12:00: **Star sensor terminology and performance specification** (ECSS-E-ST-60-20C Rev. 2)
- 12:00 – 14:00: **Lunch BREAK**
- 14:00 – 14:30: **Gyro terminology and performance specification** (ECSS-E-ST-60-21C)
- 14:30 – 15:00: **Satellite AOCS Requirements** (ECSS-E-HB-60-30C)
- 15:00 – 15:30: **Final Discussion, Q&A**

Standardization training program

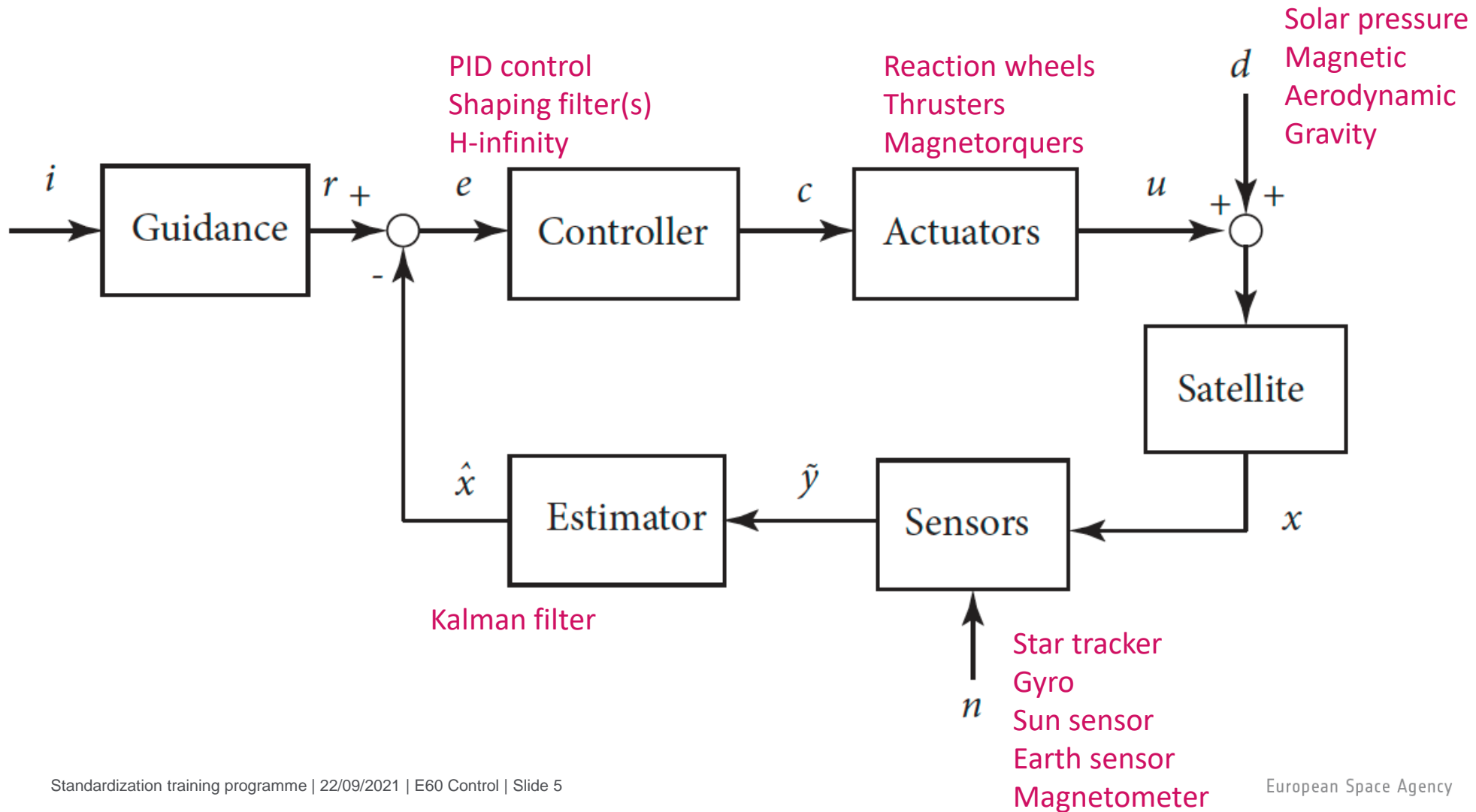
E-60 discipline: Control

Overview

- E60 branch was conceived as engineering standards and handbooks for **all systems involving control** (i.e. “feedback control” including e.g. thermal control, but not “ground control”)
 - a **satellite** (e.g. w.r.t. its attitude and orbit control, or w.r.t. active thermal control) or a cluster of satellites;
 - a space **vehicle during RVD or EDLS**
 - a **launcher rocket**;
 - a **pointing system**; a **robot arm system**, a **rover**;
 - an automated **payload or laboratory facility**;
 - **any other technical system** involving control.
- Consequently, high level documents are quite generic
 - Control engineering Handbook, Control performance Standard
- Lower level documents are specific to AOCS or to Pointing Engineering
 - AOCS Requirements, Star Sensor, Gyros
 - ESA Pointing Error Engineering Handbook,

Typical spacecraft attitude control system

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Examples of non space control systems

- Heating system

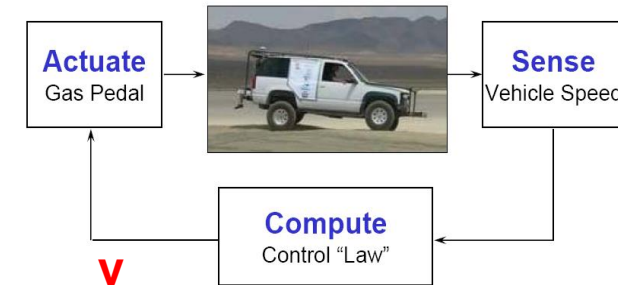
- Plant: room
- Output controlled : temperature
- Controller: heating system e.g. thermostat



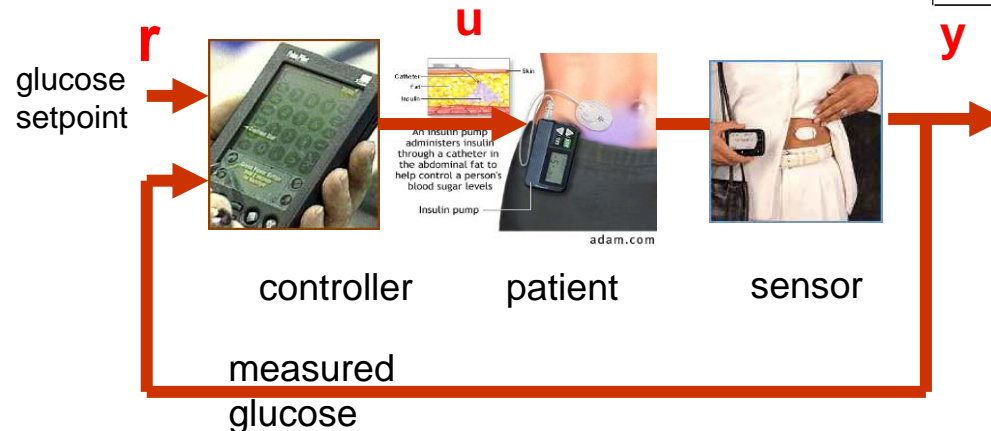
(Honeywell, 1953)

- Car cruise control

- Plant: car
- Output controlled : velocity
- Controller: driver or automatic cruise control system

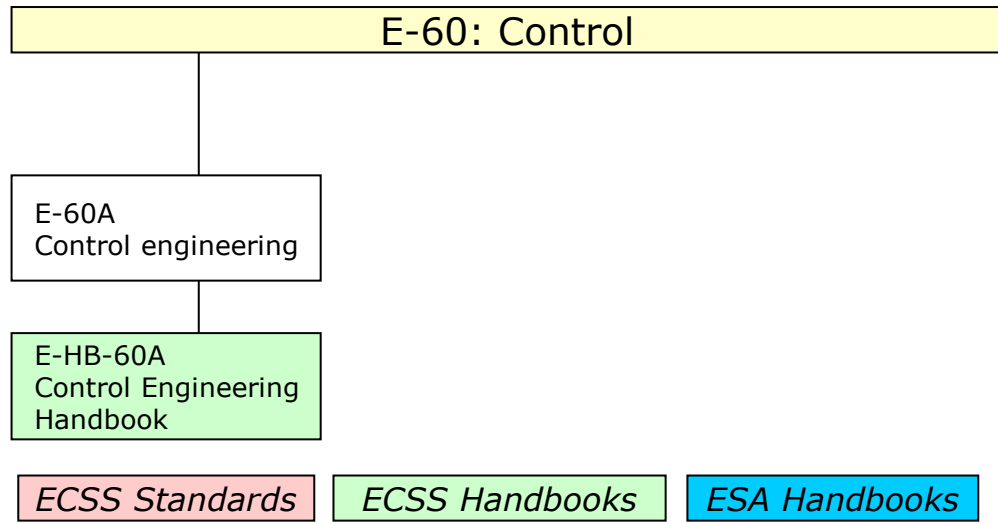


- Glucose control



ECSS-E60 history

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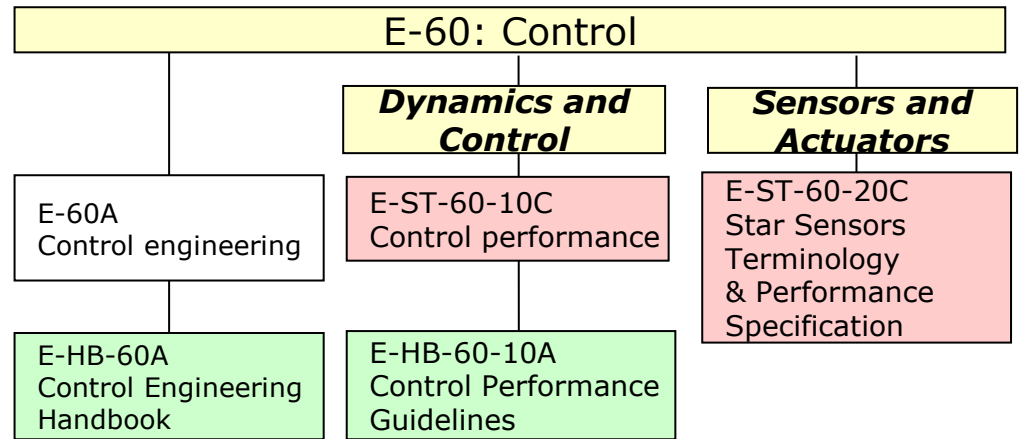


WG	Document	comments
ECSS WG 1 2001-2004	Control Engineering (Sept 2004)	<ul style="list-style-type: none"> • Level 2 document originally published as a standard • Introduces the control terminology • ECSS Task Force 2 did not recognize it as a standard (addressing engineering process rather than requirements) • Its normative DRD's covered by the AOCs requirements Standard
No WG	Control Engineering Handbook (Dec 2010)	<ul style="list-style-type: none"> • Adapted from the level 2 original standard by the E60 Discipline Convenor

ECSS-E60 history

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ECSS WG 3 2005-2008	Control Performance Standard (Nov 2008)
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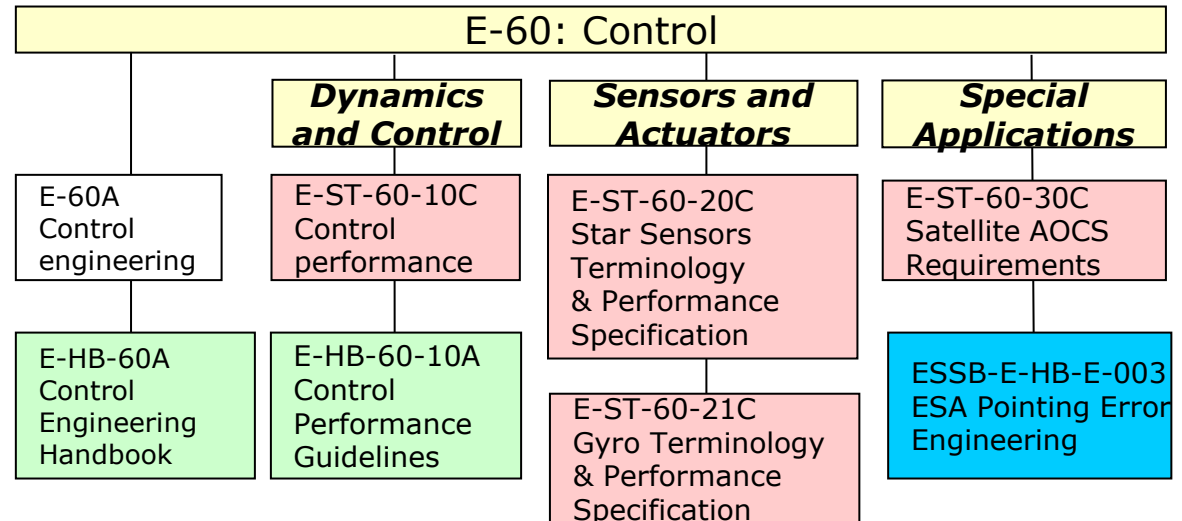


<ul style="list-style-type: none"> Objective was to harmonise STR terminology and performance metrics It suffered from the slow progress of // Control Performance WG
<ul style="list-style-type: none"> Original draft was much bigger. WG was requested to derive a short standard addressing stability and performance error
<ul style="list-style-type: none"> Adapted from the original draft above by the WG3 convenor, as a Handbook (210 pages) for control engineers (no public review)

ECSS-E60 history

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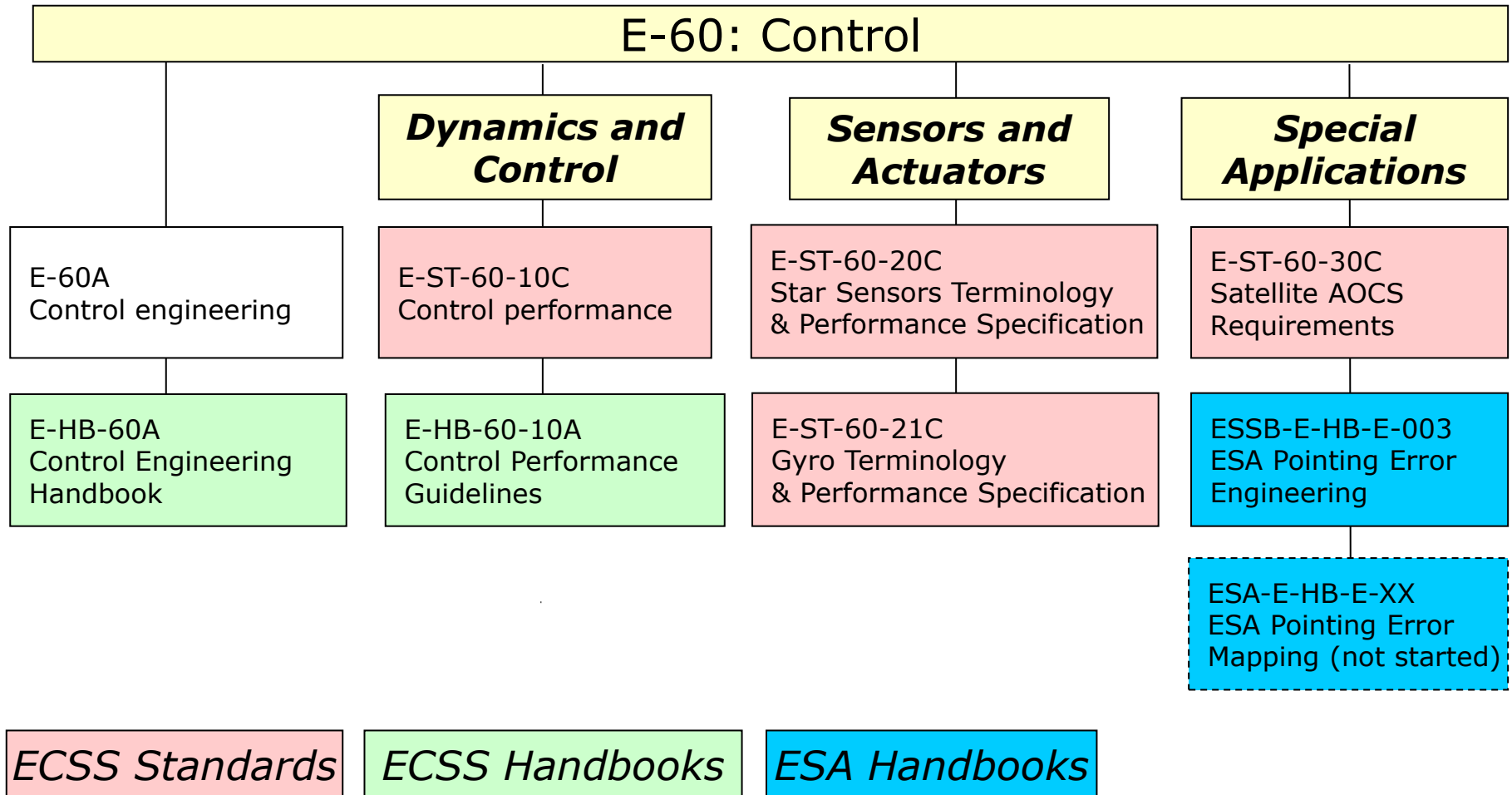
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ESA TEC-EC & NPI 2008-2011	ESA Pointing Error Engineering Handbook (July 2011)
ECSS WG 4 2007-2011	Satellite AOCS requirements Standard (August 2013)
ECSS WG 5 2012-2017	Gyro Terminology and Performance Specification Standard (February 2017)



- Objective was to specifically address Satellite Pointing Errors & clearly guide the error budget engineering process
- Standard set of AOCS requirements for satellites:
 - input for ESA MRD/SRD
 - normative requirements and documentation related to AOCS design and verification all along the satellite development
- Started 4Q2012
- Public Review 2015
- Published February 2017

The ECSS E60 branch

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ECSS-E60 full history

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ECSS WG 5 2012-2017	Gyro Terminology and Performance Specification Standard (February 2017)	<ul style="list-style-type: none"> • Started 4Q2012 • Public Review 2015 • Published February 2017

Document focal points

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