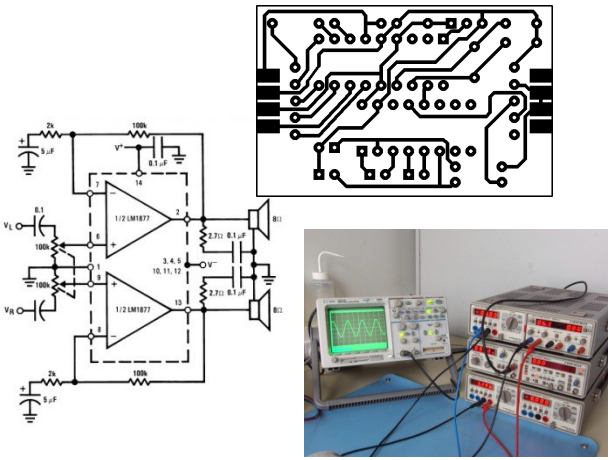
INCOSE
International Council on Systems Engineering

My first steps in SE

Andrea Angelini

Rome, 29/11/2012

Who am I?
background

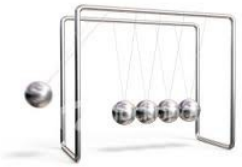


$$\nabla \cdot \mathbf{E} = \frac{\rho_v}{\varepsilon} \quad \text{(Gauss' Law)}$$

$$\nabla \cdot \mathbf{H} = 0 \quad \text{(Gauss' Law for Magnetism)}$$

$$\nabla \times \mathbf{E} = -\mu \frac{\partial \mathbf{H}}{\partial t} \quad \text{(Faraday's Law)}$$

$$\nabla \times \mathbf{H} = \mathbf{J} + \varepsilon \frac{\partial \mathbf{E}}{\partial t} \quad \text{(Ampere's Law)}$$



- Technical expert in Electronics & Telecommunications (2003)
  - Theory
  - Electronic circuit design and testing
  - Microcontroller programming

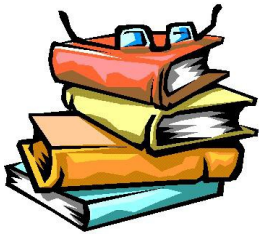
- Second level degree in Applied Physics (2009)
  - Theory
  - Laboratory tests on thick PZT film
  - Transducers prototype development

- Work experience at Tec Eurolab (2006)
  - Industrial metrology
  - Material Analysis

Texas Blues Man - SRV
Eric Dee

- Musician (since fourteen)
  - Acoustic/Electric guitar player
  - Harmonica
  - Ukulele

Who am I?
after the University

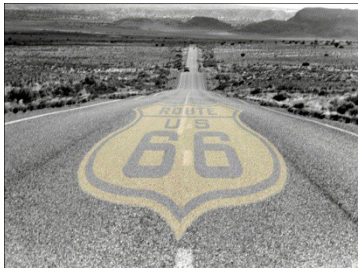


Maintenance of the GhiraIndina Tower, 2009 Modena.

Universität Stuttgart

"Think partner" by Hans-Jörg Limbach, 1980, Stuttgart.

which direction?



"Nothing behind me, everything ahead of me, as is ever so on the road."
Jack Kerouac, On the Road

What do I do?
today

vCard

Andrea Angelini
Position: Global Expert Advisor C
Functional Area: Science & Engineering
CV - System Engineering V,
Tetra Pak Packaging Solutions S.p.A.
Phone: +39059898646
ipPhone: 3918646
Mobile:
Andrea.Angelini@tetrapak.com

System Engineer Validation at Tetra Pak

- From Requirements to Product Release
  - Requirements consolidation and validation
  - Risk analysis and FMEA
  - Verification and Validation activities
- Test Methods & Statistical Analysis
  - Test Methods Development
  - Statistical Data & Signal Analysis
  - Probabilistic risk assessment

more information on LinkedIn

First (real) work experience
the Impact

- Specific knowledge not enough — study & homework still there
- Complex work environment — teamwork & power games
- Be always in rush — the days before the exams
- Shot time deliverables Vs. Quality — the exams
- Somebody forgot the scientific method — calssmates

First (real) work experience
what is the System?

- The Package
- The Filling Machine
- The Packaging Line
- The Package at the Supermarket

First (real) work experience
what is a System Engineer?

- An engineer with a full knowledge of the System
- An engineer able to design the whole System
- An engineer that has a extraordinary experience on the System

- An orchestra conductor (cit.)

- A wizard that use magic ingredients to make thinks work

To be or not to be…
an Engineer

An **engineer** is a professional practitioner of engineering, concerned with applying scientific knowledge, mathematics and ingenuity to develop solutions for technical, social and economic problems. Engineers design materials, structures and systems while considering the limitations imposed by practicality, safety and cost.[1][2] The word *engineer* is derived from the Latin roots *ingeniare* ("to contrive, devise") and *ingenium* ("cleverness").[3][4]

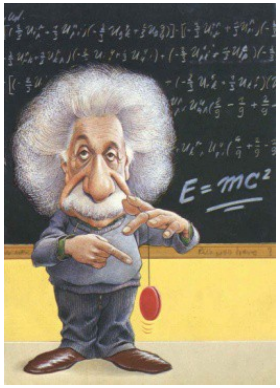
Cit. Wikipedia

Kitty Joyner, electrotechnical engineer at Langley Research Center,1952.

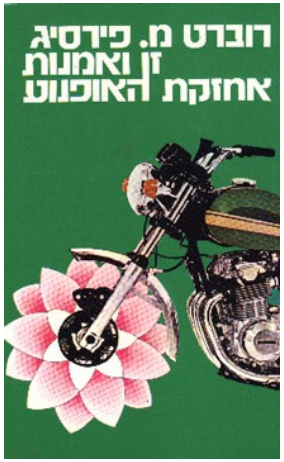
A **scientist**, in a broad sense, is one engaging in a systematic activity to acquire knowledge. In a more restricted sense, a scientist is an individual who uses the scientific method.[1] The person may be an expert in one or more areas of science.[2] This article focuses on the more restricted use of the word. Scientists perform research toward a more comprehensive understanding of nature, including physical, mathematical and social realms.

Cit. Wikipedia

"Henri Poincaré: the unlikely link between Einstein and Picasso"
Arthur I Miller



Classic or Romantic
between logic and instinct



***Zen and the Art of Motorcycle Maintenance* 1974**
Robert M. Pirsig

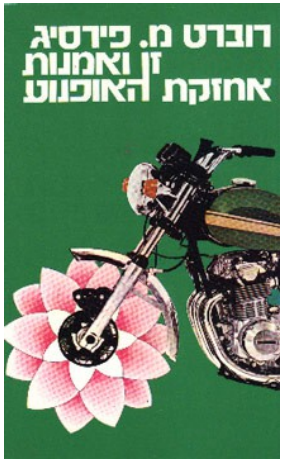
- Although motorcycle riding is romantic, motorcycle maintenance is purely classic.
- Logic presumes a separation of subject from object; therefore logic is not final wisdom. This is Zen. This is my motorcycle maintenance.

- The number of rational hypotheses that can explain any given phenomenon is infinite.
- The law of gravity and gravity itself did not exist before Isaac Newton ...and what that means is that that law of gravity exists nowhere except in people's heads! It 's a ghost!
- The solutions all are simple... after you have arrived at them. But they're simple only when you know already what they are.

- Talk about rationality can get very confusing unless the things with which rationality deals are also included.

Cit. Wikiquote

Classic or Romantic
only pieces of steel?



***Zen and the Art of Motorcycle Maintenance* 1974**
Robert M. Pirsig

- That's all the motorcycle is, a system of concepts worked out in steel. There's no part in it, no shape in it, that is not out of someone's mind
- The motorcycle is primarily a mental phenomenon. …steel can be any shape you want if you are skilled enough, and any shape but the one you want if you are not.

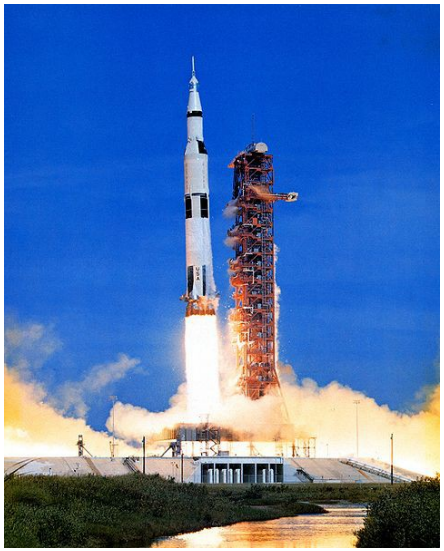
- Is it hard? Not if you have the right attitudes. Its having the right attitudes that's hard."

Cit. Wikiquote

"Art is anything you can do well. Anything you can do with Quality."
Robert M. Pirsig

What is Quality?
Procedures

- NASA called it the most successful manned flight ever achieved.
- First mission on which the Lunar Roving Vehicle was used.
- Checklists (Standard Mode) are the procedures to follow for a complete moon landing mission:



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

(JULY 26 LAUNCH)
APOLLO 15
CSM 112
CHANGE C

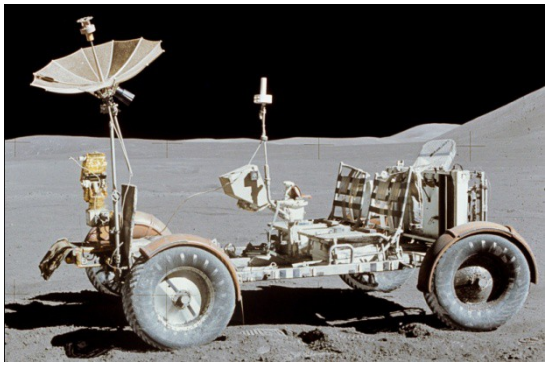
CSM LAUNCH
CHECKLIST

PREPARED BY

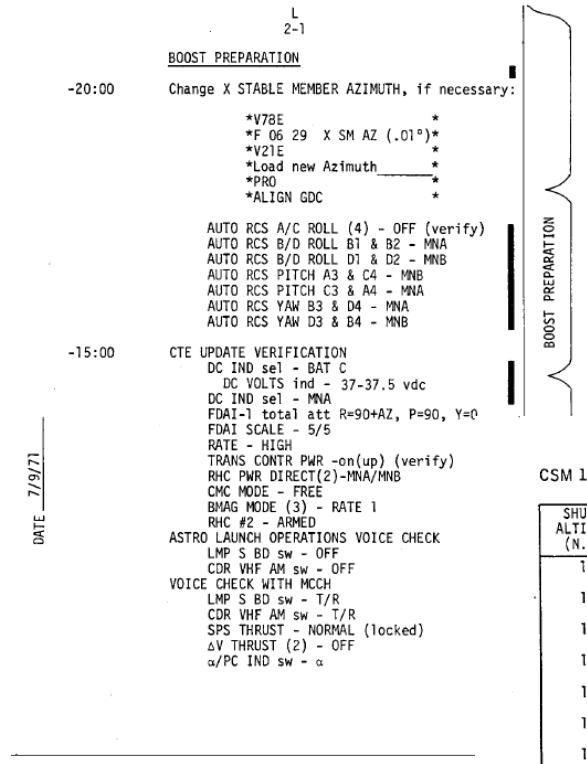
GUIDANCE & CONTROL PROCEDURES SECTION
SYSTEMS PROCEDURES BRANCH
CREW PROCEDURES DIVISION

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

JULY 9, 1971



What is Quality?
Procedures



L
2-1

BOOST PREPARATION

-20:00 Change X STABLE MEMBER AZIMUTH, if necessary:

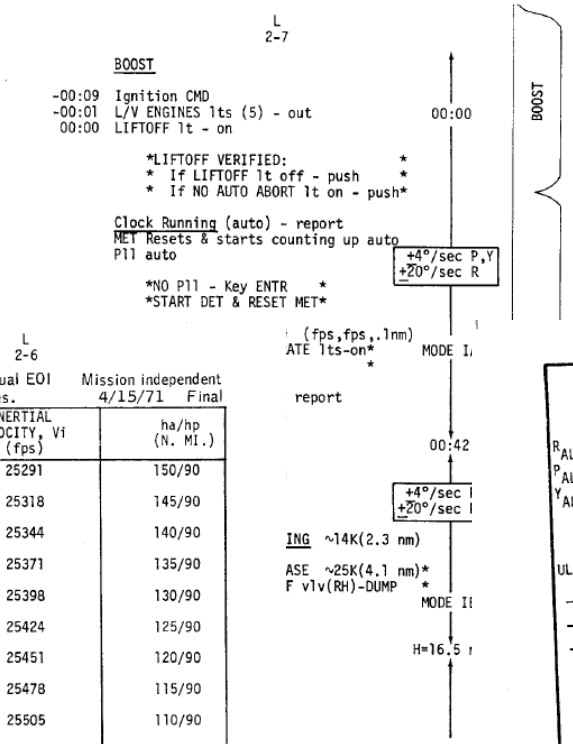
*V78E *
F 06 29 X SM AZ (.01°)
*V21E *
Load new Azimuth_____
*PRO *
*ALIGN GDC *

AUTO RCS A/C ROLL (4) - OFF (verify)
AUTO RCS B/D ROLL B1 & B2 - MNA
AUTO RCS B/D ROLL D1 & D2 - MNB
AUTO RCS PITCH A3 & C4 - MNB
AUTO RCS PITCH C3 & A4 - MNA
AUTO RCS YAW B3 & D4 - MNA
AUTO RCS YAW D3 & B4 - MNB

-15:00 CTE UPDATE VERIFICATION
DC IND sel - BAT C
DC VOLTS ind - 37-37.5 vdc
DC IND sel - MNA
FDAI-1 total att R=90+AZ, P=90, Y=0
FDAI SCALE - 5/5
RATE - HIGH
TRANS CONTR PWR -on(up) (verify)
RHC PWR DIRECT(2)-MNA/MNB
CMC MODE - FREE
BMAG MODE (3) - RATE 1
RHC #2 - ARMED
ASTRO LAUNCH OPERATIONS VOICE CHECK
LMP S BD sw - OFF
CDR VHF AM sw - OFF
VOICE CHECK WITH MCCH
LMP S BD sw - T/R
CDR VHF AM sw - T/R
SPS THRUST - NORMAL (locked)
ΔV THRUST (2) - OFF
α/PC IND sw - α

BOOST PREPARATION

DATE 7/9/71



L
2-7

BOOST

-00:09 Ignition CMD
-00:01 L/V ENGINES lts (5) - out 00:00
00:00 LIFTOFF lt - on

*LIFTOFF VERIFIED: *
* If LIFTOFF lt off - push *
* If NO AUTO ABORT lt on - push*

Clock Running (auto) - report
MET Resets & starts counting up auto
P11 auto

*NO P11 - Key ENTR *
START DET & RESET MET

+4°/sec P,Y
±20°/sec R

(fps,fps,.1nm)
ATE lts-on* MODE I
*
report

00:42

+4°/sec
±20°/sec

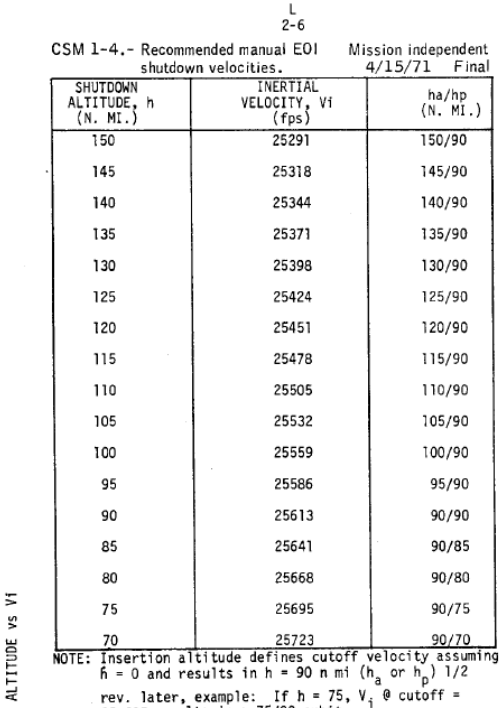
ING ~14K(2.3 nm)

ASE ~25K(4.1 nm)*
F v1v(RH)-DUMP *
MODE II

H=16.5

BOOST

DATE 5/5/71



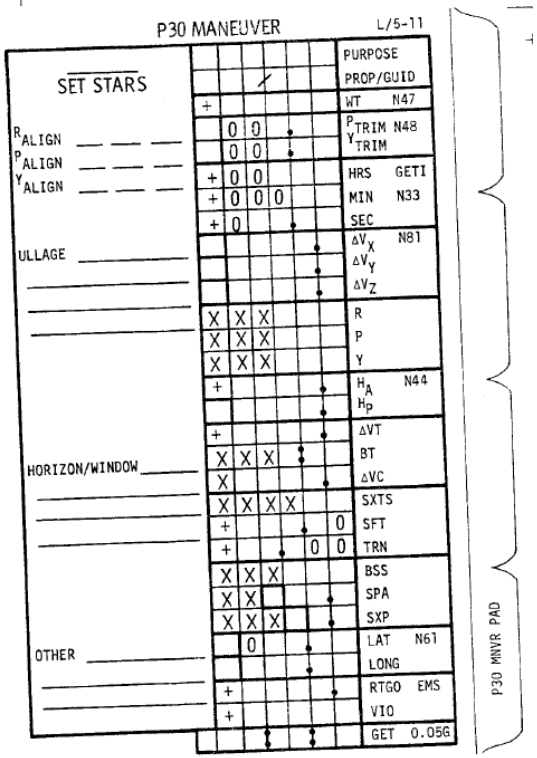
L
2-6

CSM 1-4.- Recommended manual EOI shutdown velocities. Mission independent 4/15/71 Final

SHUTDOWN ALTITUDE, h (N. MI.)	INERTIAL VELOCITY, Vi (fps)	ha/hp (N. MI.)
150	25291	150/90
145	25318	145/90
140	25344	140/90
135	25371	135/90
130	25398	130/90
125	25424	125/90
120	25451	120/90
115	25478	115/90
110	25505	110/90
105	25532	105/90
100	25559	100/90
95	25586	95/90
90	25613	90/90
85	25641	90/85
80	25668	90/80
75	25695	90/75
70	25723	90/70

NOTE: Insertion altitude defines cutoff velocity assuming ḣ = 0 and results in h = 90 n mi (h_a or h_p) 1/2 rev. later, example: If h = 75, V_i @ cutoff = 25,695 results in a 75/90 orbit.

ALTITUDE vs Vi



P30 MANEUVER L/5-11

SET STARS

RALIGN
PALIGN
YALIGN

ULLAGE

HORIZON/WINDOW

OTHER

PURPOSE
PROP/GUID
WT N47
PTRIM N48
YTRIM
HRS GETI
MIN N33
SEC
ΔVX N81
ΔVY
ΔVZ
R
P
Y
HA N44
HP
ΔVT
BT
ΔVC
SXTS
SFT
TRN
BSS
SPA
SXP
LAT N61
LONG
RTGO EMS
VIO
GET 0.05G

P30 MNVR PAD

DATE 3/29/71

- Actions
- Timings
- Notes

- Reference tables
- Report templates

Like our Internal Test Methods

What is Quality?

methodologies, experience and so on

In the role of SE
mindset and outlook

- Have the right aptitude:
  - managing complexity is needed, cannot scare
  - the System is all and nothing
- Gain knowledge, grow motivation
  - to build the pyramid from the base
- Learn Methodologies and Standards
  - summary of best practice
  - helps communication
- Look forward
  - status quo is sometimes easier

In the role of SE
personal learning

- Basics of System Engineering & Six Sigma methodologies
- Lot of Statistics
- More about Measurement System Analysis
- The importance of people

but:

- What is a System is still not clear
- System Engineers are different one from each other but they should have something in common…

INCOSE
International Council on Systems Engineering

Thank you for your attention!