Establishing Globally Applicable Standards

– Little by Little by Little & then All-at-once

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- Development of ISO Standards
- Establishing Global Standards for Offshore Oil & Gas
  - Example
  - Learnings [how to achieve success]

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Development of ISO Standards for Offshore Oil & Gas industry

- 1990: Strategic decision to develop ISO Standards for O&G industry [ISO TC67 formed (re-activated)]
  - Initiated by major O&G producers (Shell, BP, Exxon, Chevron)
  - Supported by key National Standards Bodies [US, Norway, Canada, UK, Netherlands]
- Vision: International Standards used locally worldwide
  - As required by the industry (meet needs)
  - Adopted by Standards bodies of: Brazil, USA, Canada, EU, Norway, China, Korea
  - Recognised and accepted by Regulators

Development of ISO Standards for Offshore Oil & Gas industry

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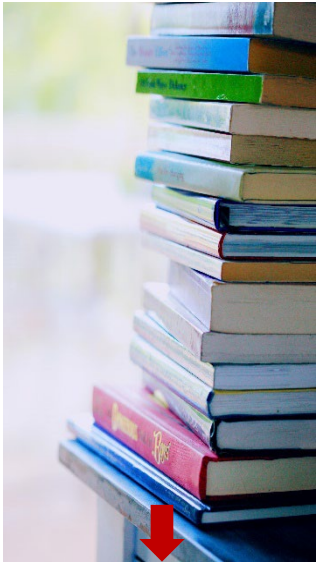
DRIVERS :

- **Establish Level Playing Field** (establishing common safety, integrity, environmental requirements – common understanding between asset owners & reg)
  - Industry became **global** but standards remained **national** in few countries [potential for misuse]
- **Reduce burden** of establishing and maintaining national standards [by many countries]; minimize need for company standards & specs [a huge burden on Asset Owners & Designers]
- Regional **environmental** and **soil** characteristics
  - Hurricane (GoM), tropical cyclones (Australia, China)
  - Winter storm (N Sea), Squalls (W Africa), Calcareous soils
  - Arctic
  - Seismicity



Replace by single ISO

ISO Standards for O&G Offshore Structures
TC67 SC7 [adopted by EU as European Standards]

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✔	ISO 19900	General requirements for offshore structures
	ISO 19901	Specific requirements for offshore structures
✔	19901-1	Metocean design and operating conditions
✔	19901-2	Seismic design procedures and criteria
✔	19901-3	Topsides structure
	19901-4	Geotechnical & foundation design considerations
	19901-5	Weight Management
	19901-6	Marine operations
✔	19901-7	Station keeping systems for offshore structures
	19901-8	Marine Soil Investigations
✔	**19901-9**	**Structural Integrity Management**
✔	ISO 19902	Fixed steel offshore structures
	ISO 19903	Fixed concrete offshore structures
✔	ISO 19904	Floating offshore structures
✔	ISO 19905	Site specific assessment of mobile offshore units
✔	ISO 19906	Arctic offshore structures

FIXED
FLOATING
MODUs

Design
Construction
Installation
Reassessment

ACTIONS
waves, winds, currents, seismicity, arctic

Establishing Global Standards – Example

Extreme storm loading on fixed platforms – ISO 19902 , (WG3)

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- Prior existing standards 1993 – API RP 2A, NORSOK N03, UK Guidance …

	Gulf of Mexico	North Sea	Concern
Return Period	100 yrs	100 / 50 years	No check at ALS (survival level, 10000 yr)
Wave Theory	Regular (Stokes 5th)	Regular (Stokes 5th)	Sea is random
Current	Little or no current	Independent 10-50yr	Should be based on joint statistics
Drag coeff,Cd	0.6	0.7	1-1.2 for rough members
Deck Elevation	100 yr crest + 1.5m	100 yr crest + 1.5m	Should match RP at ALS (e.g. 10000yr crest)

- Concern for different practices and missing elements
- Very different perspectives among:
  - **Academics v asset owners v designers**
  - US (long history, evacuated) v Europe (less history, permanently-occupied)

Addressing the challenges - Extreme storm loading

SC/7 WG3 (ISO 19902, ISO 19901-1)

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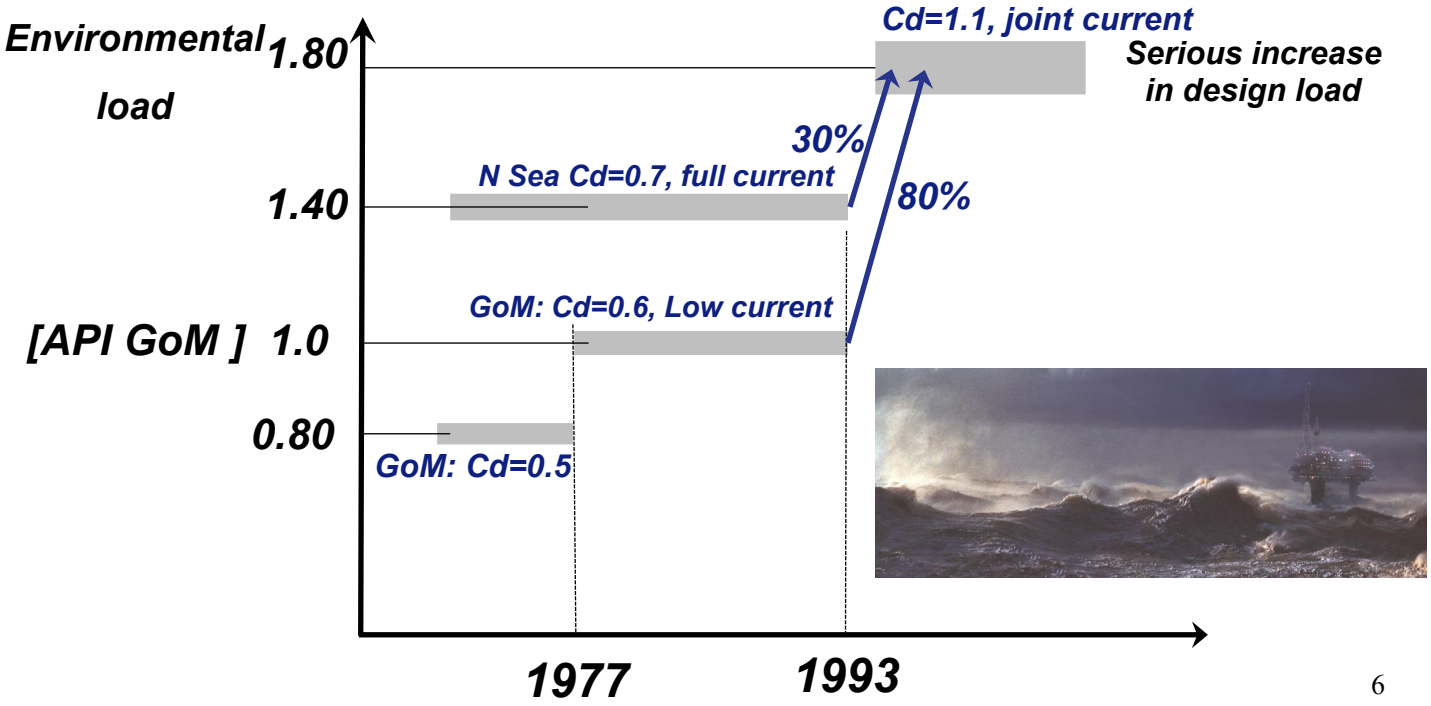
- Initial indications of where we may be heading
  - Increase Cd from 0.7 to 1.1 for members below water increases total loads by ~40%
  - Current speed based on joint probability is high in GoM and low in North Sea



Addressing the challenges - Extreme storm loading

SC/7 WG3 (ISO 19902, ISO 19901-1)

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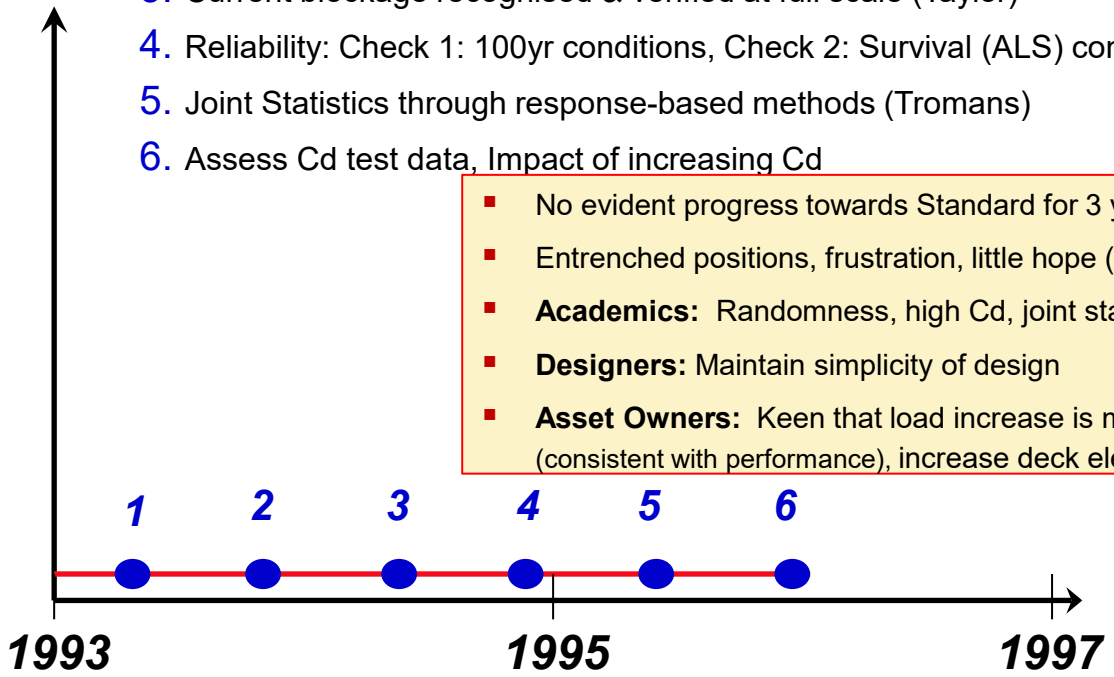
Progress towards a Global Standard

1. **Random** 3-D wave load simulations compared to **regular**
2. Data & models for directional **spreading** (Ewans, Forristall)
3. Current blockage recognised & verified at full scale (Taylor)
4. Reliability: Check 1: 100yr conditions, Check 2: Survival (ALS) conditions
5. Joint Statistics through response-based methods (Tromans)
6. Assess Cd test data, Impact of increasing Cd

- No evident progress towards Standard for 3 yrs
- Entrenched positions, frustration, little hope (3,2)
- **Academics:** Randomness, high Cd, joint statistics
- **Designers:** Maintain simplicity of design
- **Asset Owners:** Keen that load increase is modest (consistent with performance), increase deck elevation



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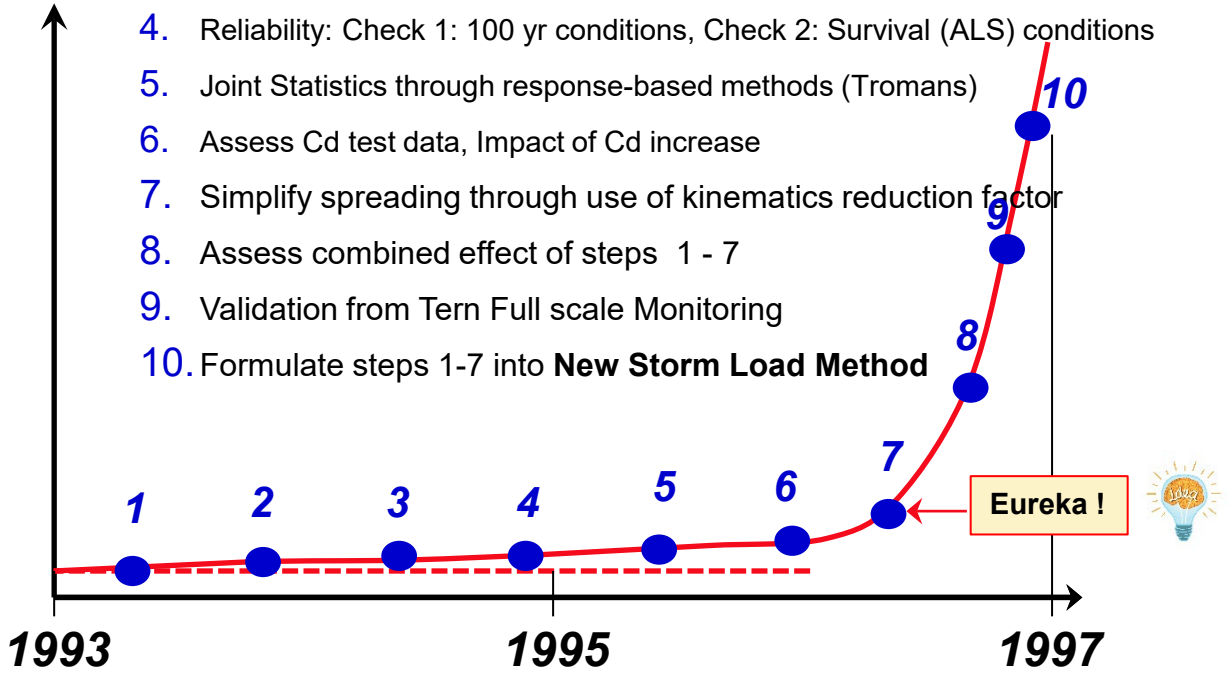
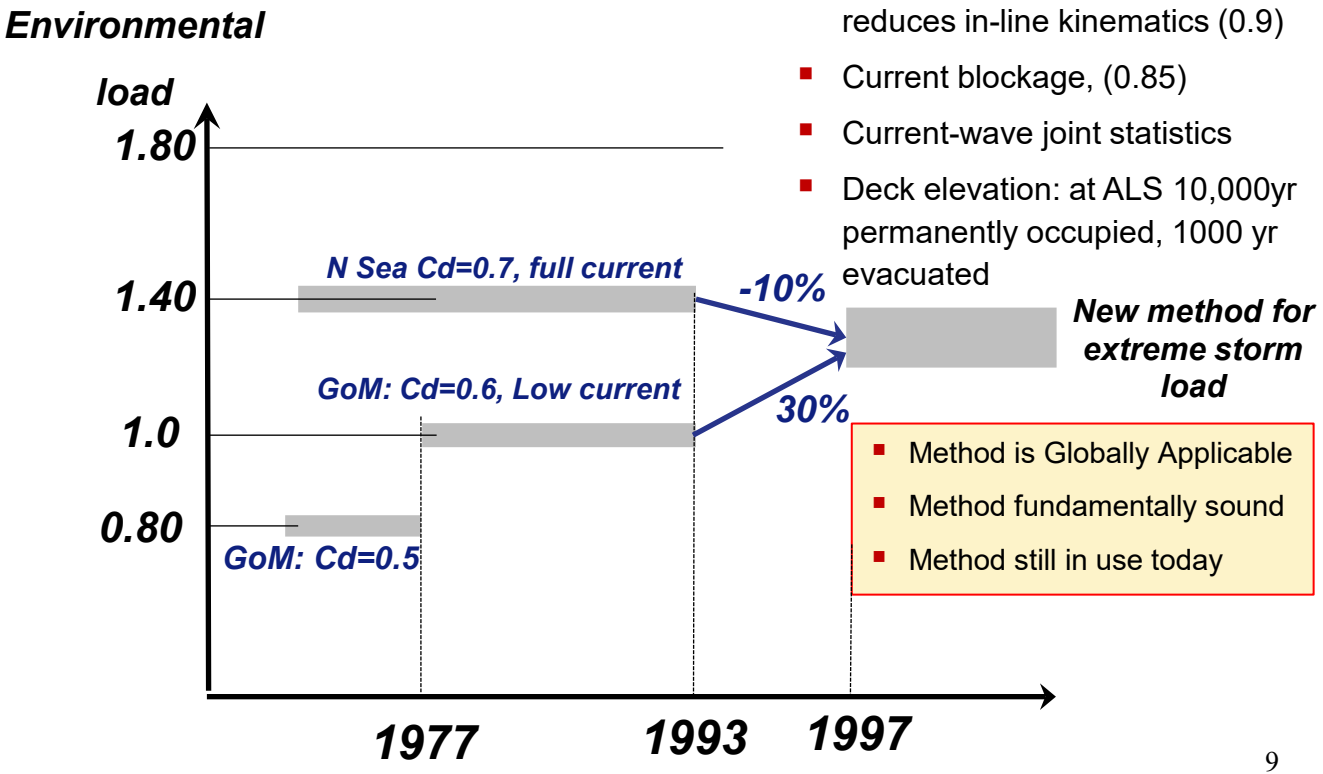
4. Reliability: Check 1: 100 yr conditions, Check 2: Survival (ALS) conditions
5. Joint Statistics through response-based methods (Tromans)
6. Assess Cd test data, Impact of Cd increase
7. Simplify spreading through use of kinematics reduction factor
8. Assess combined effect of steps 1 - 7
9. Validation from Tern Full scale Monitoring
10. Formulate steps 1-7 into **New Storm Load Method**



New agreed methodology for extreme storm loading

- Cd=0.65 smooth, 1.05 rough
- Wave directional spreading reduces in-line kinematics (0.9)
- Current blockage, (0.85)
- Current-wave joint statistics
- Deck elevation: at ALS 10,000yr permanently occupied, 1000 yr evacuated



- Method is Globally Applicable
- Method fundamentally sound
- Method still in use today

Learnings regarding development of globally applicable Standards – TC67 SC/7

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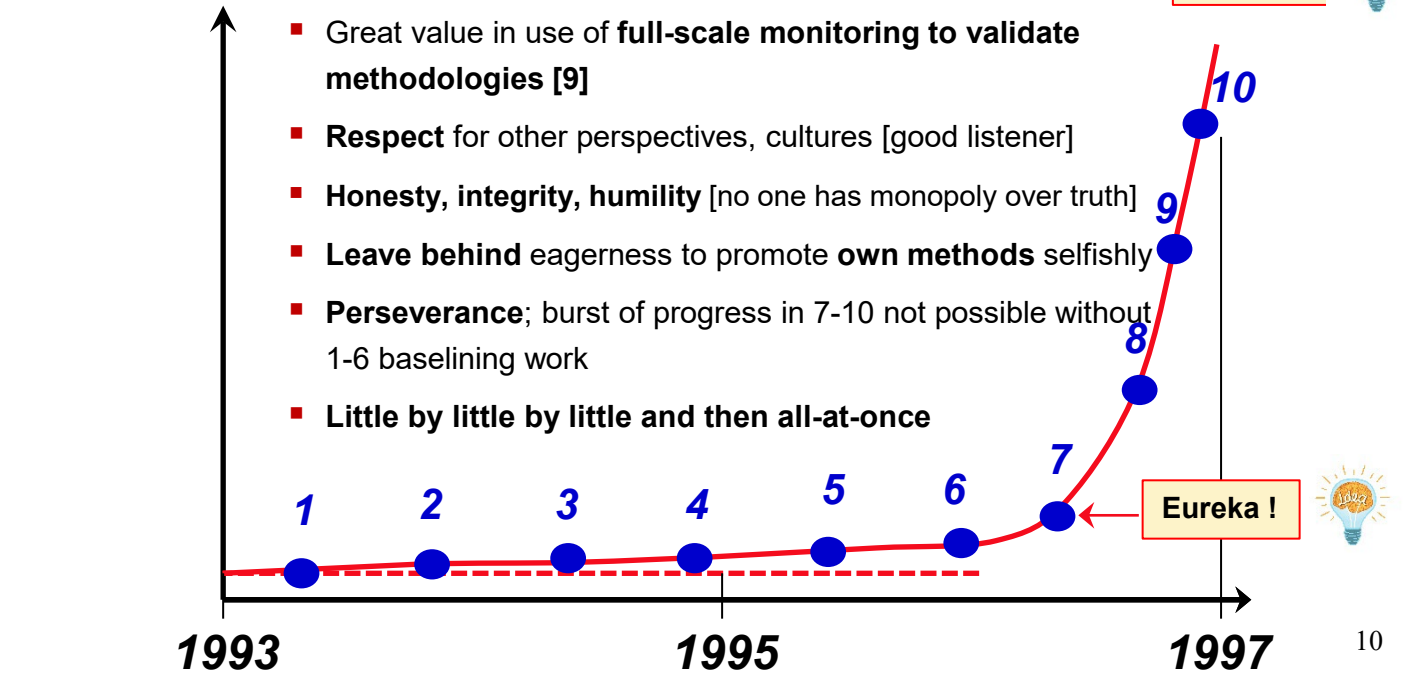
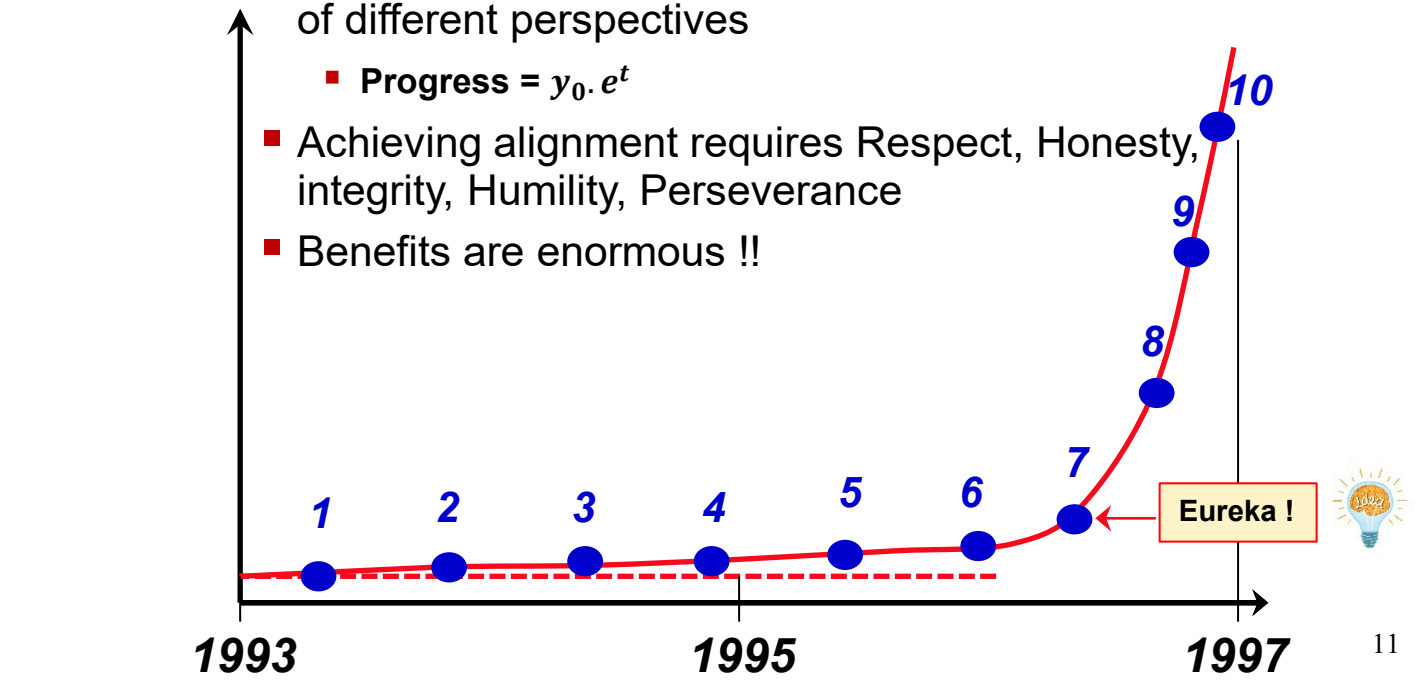
- Participation of **right parties** in WG – Asset Owners, Designers, Academics, Fabricators, Regulators
- Knowledge & experience: **in-depth, breadth**
- Great value in **simplifying** as far as possible **but no more [7]**
- Great value in use of **full-scale monitoring to validate methodologies [9]**
- **Respect** for other perspectives, cultures [good listener]
- **Honesty, integrity, humility** [no one has monopoly over truth]
- **Leave behind** eagerness to promote **own methods** selfishly
- **Perseverance**; burst of progress in 7-10 not possible without 1-6 baselining work
- **Little by little by little and then all-at-once**



Learnings regarding development of globally applicable Standards – TC67 SC/7

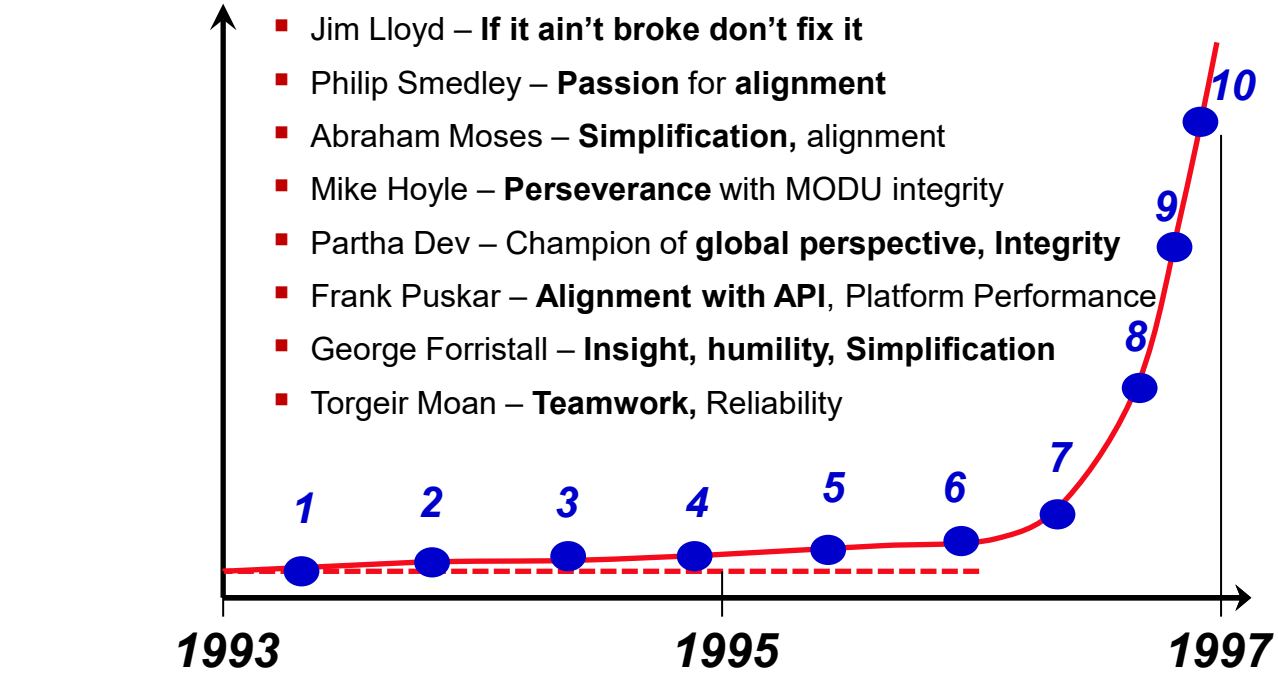
- Initial progress in harmonisation of different practices into a globally applicable standard **will always be slow**
- Need to invest in effort to bring about **alignment** of different perspectives
  - **Progress =** $y_0 . e^t$
- Achieving alignment requires Respect, Honesty, integrity, Humility, Perseverance
- Benefits are enormous !!



Development of globally applicable Standards – Legends of Standardisation

WG members and Conveners should possess & exhibit right **qualities & virtues**

- Jan Vugts – **Passion** for Global Standards & foresight to pioneer ISO O&G
- Neil Reave – **Respect for all** - Father-figure of TC67
- Richard Snell – Establishing a **level playing field**
- Jim Lloyd – **If it ain't broke don't fix it**
- Philip Smedley – **Passion** for **alignment**
- Abraham Moses – **Simplification,** alignment
- Mike Hoyle – **Perseverance** with MODU integrity
- Partha Dev – Champion of **global perspective, Integrity**
- Frank Puskar – **Alignment with API**, Platform Performance
- George Forristall – **Insight, humility, Simplification**
- Torgeir Moan – **Teamwork,** Reliability



ISO Standards for Subsea & Riser Systems

[adopted by EU as European Standards]

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✔	ISO 13624	Marine Drilling Riser Systems
	ISO 13628-1	Subsea Production Systems
✔	ISO 13628-2	Subsea Flexible Pipe Systems
	ISO 13628-4	Subsea Wellhead and Tree Equipment
	ISO 13628-5	Subsea Control Umbilicals
	ISO 13628-6	Subsea Production Controls
	ISO 13628-7	Subsea Completion/Workover Systems
	ISO 13628-8	ROV Interfaces on Subsea Systems
	ISO 13628-9	RO Tool Intervention Systems
✔	ISO 13628-10	Bonded Flexible Pipe
✔	ISO 13628-11	Flexible Pipe Systems for Subsea & Marine Applications
	ISO 13628-15	Subsea Structures and Manifolds

SUBSEA
UMBILICALS
RISERS
FLOWLINES
[SURF]

Development of globally applicable Standards - Little by Little by Little and then All-at-Once

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Thank you !!

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