INCOSE Oil & Gas Workgroup: Standards Subcommittee

Moving Oil & Gas Industry Standards from Prose to Data

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May 5th 2017, TGCC Systems Engineering Conference, Houston

INCOSE International Council on Systems Engineering

INCOSE TGCC TEXAS GULF COAST CHAPTER

INCOSE Oil & Gas Workgroup: Standards Committee

- Robert Perry, Chair *(TechnipFMC)*
- Robert McAfoos, Co Chair *(Barrios)*
- Abe Hudson *(Barrios)*
- Jason Baker *(Transocean)*
- John Daniel Friedemann *(GE)*
- Kerry Stout *(TechnipFMC)*
- Kiran Krishna *(Shell)*

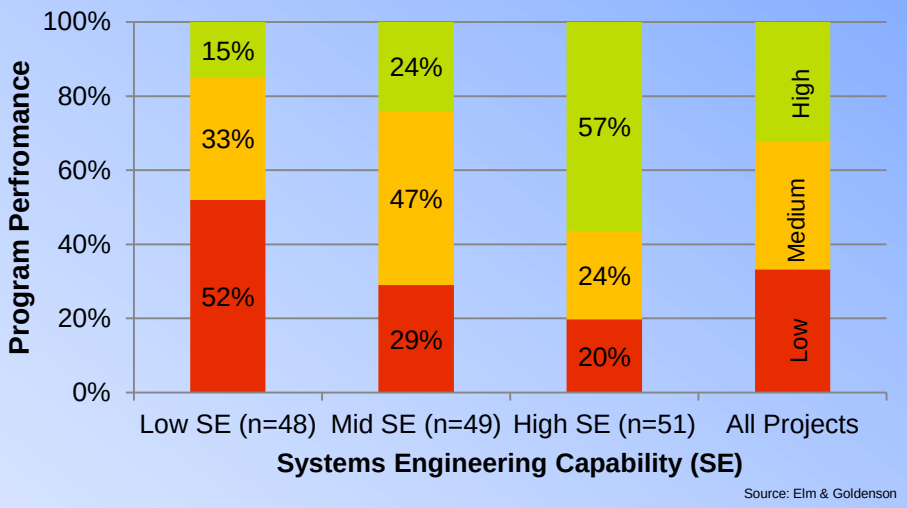
Objective

- Influence standards bodies (API, ISO, ASTM, etc.) to modify the format and structure of their requirements documents to separately identify:
  - The requirement (shall statement)
  - Rationale or history
  - Verification

Why Systems Engineering?

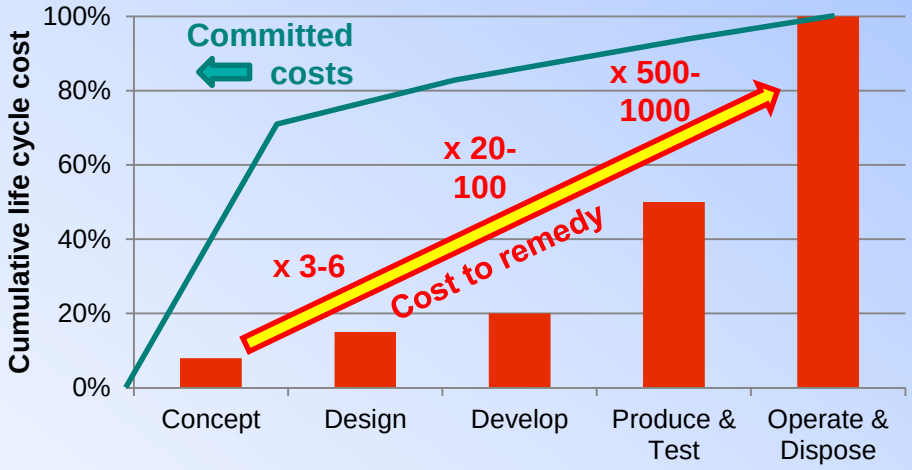
Systems Engineering improves complex system project performance:

- More high performing projects
- Less train wrecks



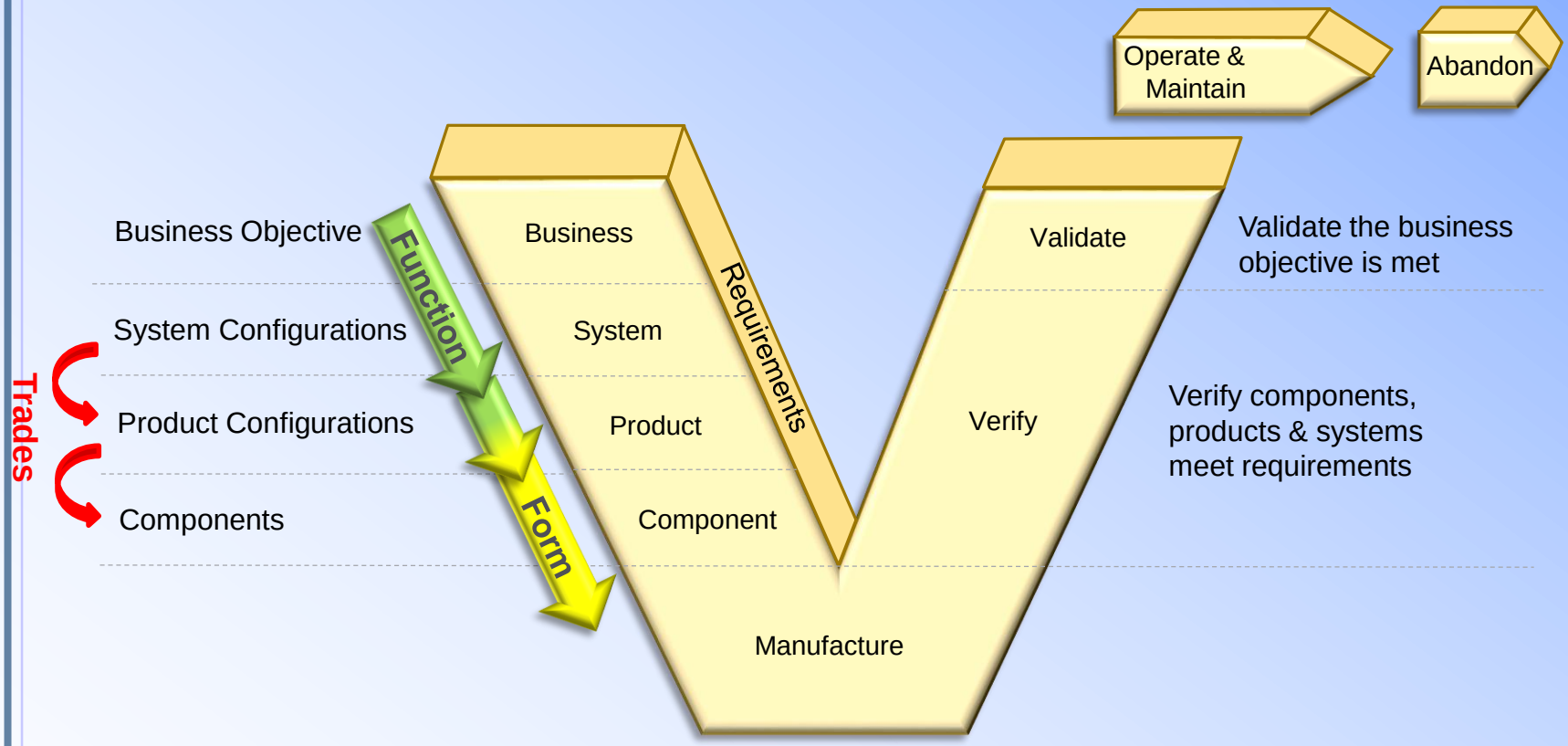
SE identifies busts early, rather than late:

- Earlier issue detection is considerably less costly to remedy



What is Systems Engineering?

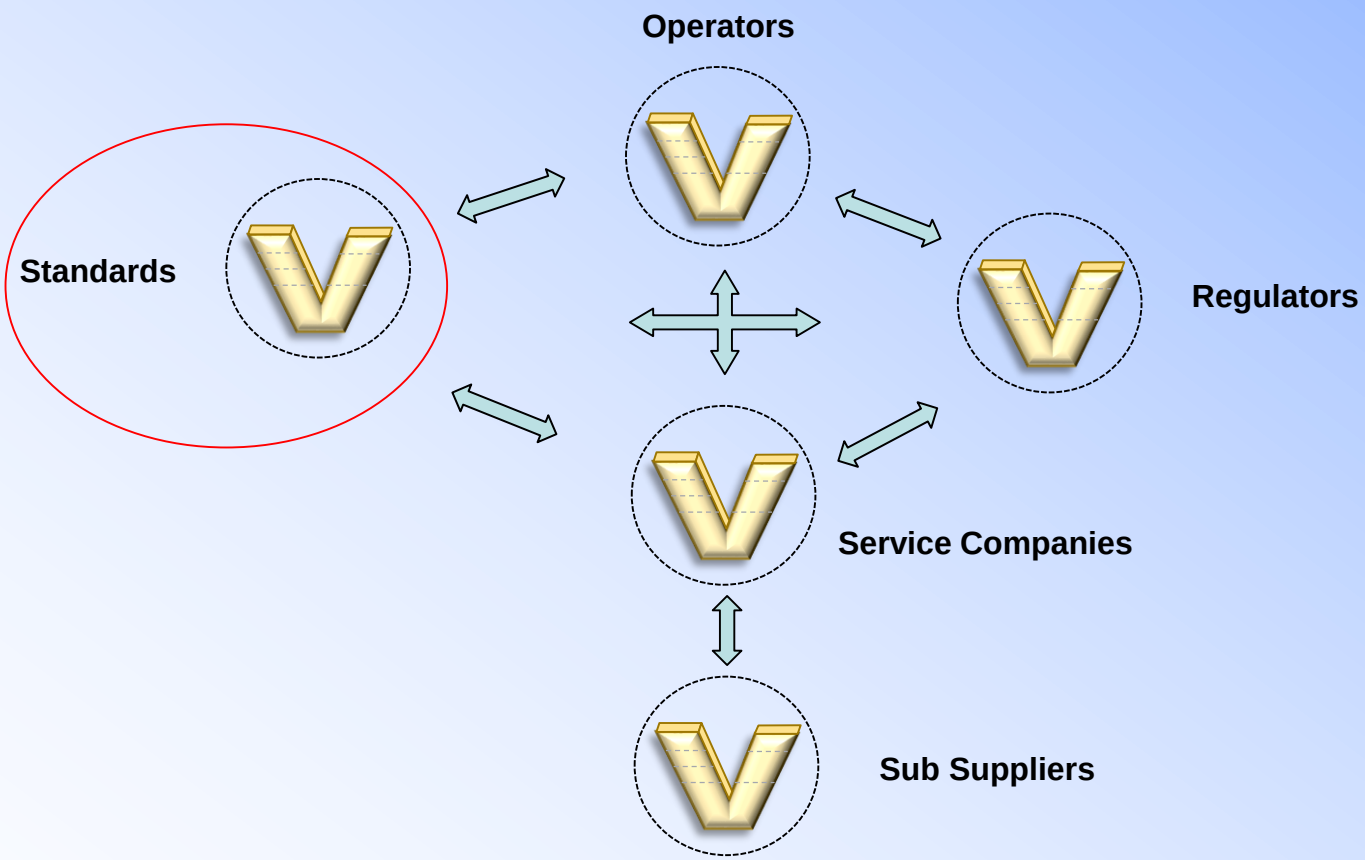
Rigorous System Engineering:



Requirements are the backbone to Systems Engineering…

Requirements Universe

Standards & Codes make up some requirements:



Requirements: Spot the Requirement

- Example:

MACHINE ALARM AND SHUTDOWN FUNCTIONS

Machine safeguarding shutdown functions ("trips") are required on rotating equipment to prevent serious failures resulting in potential hazards to personnel or the environment or in extended process unit downtime. All machine trips require a pre-alarm prior to a shutdown in order to give Operations a chance to take action to prevent a trip.

Shutdown function design shall be based on an SIL Assessment, shall comply with this standard and shall take into consideration the recommendations of the original equipment Manufacturer (OEM).

The methodology specified in this standard is intended to avoid unnecessary machine trips. The related Informative shows sample trip voting and instrument redundancy that avoids unnecessary trips based on a generic SIL analysis. In some processes it is safer to keep the machine running in order to carry out an orderly process shutdown. In these cases, the shutdown system should be sequenced to do so automatically so that the process is returned to a safe situation before the machine is shut down.

API Std 670 has traditionally required relays be used as the output from the machinery protection rack to the IPS, and that voting be carried out in the machinery protection rack. This approach may limit flexibility in the IPS implementation for some applications. As an alternative approach, 4-20 mA outputs on the machinery protection rack may be directed to the IPS where voting and other logic can be implemented in that system. However, either relays or 4-20 mA signals are satisfactory input to the IPS. If relays are used, the most configurable relay system available should be selected in order that flexibility in the design of voting logic is available. Care should be taken to assure that NOT OK and BYPASS conditions are considered when voting in the IPS, either with relays or 4-20 mA outputs. By choosing to vote in the IPS instead of in the machine protection rack, some desired functionality around OK and BYPASS conditions that are part of the machine protection rack design may be overridden in the IPS. This functionality will then have to be included in

Requirements: Spot the Requirement

- Example:

Content	Requirement Type	Informative Text	Selection	Selection Raitionale
MACHINE ALARM AND SHUTDOWN FUNCTIONS	-		Selected	
Machine safeguarding shutdown functions ("trips") are required on rotating equipment to prevent serious failures resulting in potential hazards to personnel or the environment or in extended process unit downtime.	inf		Selected	
All machine trips shall be provided with a pre-alarm prior to a shutdown to allow Operations sufficient time (typically minimum 15 minutes) to take action to prevent a trip.	shall		Selected	
Shutdown function design shall be based on an SIL Assessment.	shall		Selected	
Shutdown function design shall incorporate the recommendations of the original equipment Manufacturer (OEM).	shall		Selected	
In cases where it is safer to keep the machine running to allow a process shutdown, the shutdown system should be sequenced to do so automatically so that the process is returned to a safe situation before the	should		Selected	

Requirements as data in a database allows users to:
segment data, classify data, select data, annotate data, attribute data, filter data, etc.

Requirements: Vision

- Requirements (example format)

#	Subject	Verb	Requirement	Condition(s)	Verification	Rationale
1.	The system	shall	contain a pressure of 10,000psi	when installed in the operating environment	Verified by….	Because….

Good Requirement:
Identifier, Necessary, Implementation independent, Unambiguous, Complete, Singular, Achievable, Verifiable, Conforming, Complete, Consistent, Feasible and Affordable, Bounded

- Vision:
  - Standards bodies provide requirements to oil and gas industry in data format (ReqIF/XML) rather than PDF's and prose
  - Updates and revisions are traceable to a specific requirement

Overall Project Approach

- Identify which standards, codes and organizations are most relevant:
  - API was identified as the most leveraging organization to start

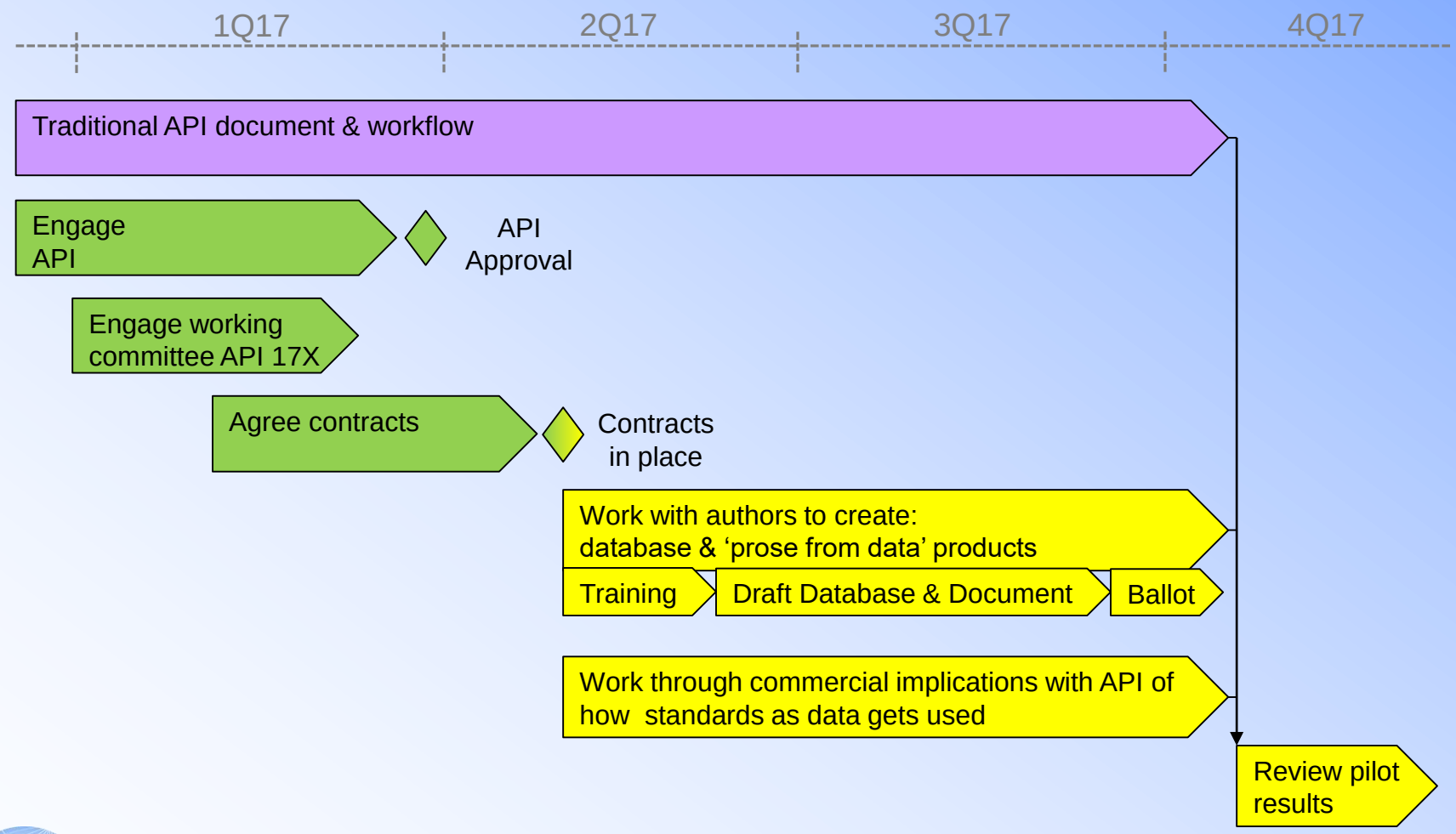
Project plan:

- Approach API to provide rationale and project proposal
- Undertake a pilot with API on a single relevant standard
- Learn from pilot and roll out further:
  - to other API standards
  - to other standards and codes organizations

API Pilot Project Approach

- ✓ Discuss with API our vision and obtain broad support
- ✓ Identify one API document entering the ballot phase where the chair is open to the new approach (API 17X)
- ✓ Brief and obtain support from member companies that have voting members for that document
- ✓ Send formal request to API
- ✓ Approval to proceed from API
- ❑ Contracts in place with API
- ❑ Provide requirements training / coaching to the voting members for that document
- ❑ Provide requirements authoring assistance to the committee chair
- ❑ Develop in parallel
  - Database “document” with requirement attributes (ReqIF / XML)
  - Database driven MS Word / PDF requirements document
  - Compare against traditional API style prose document

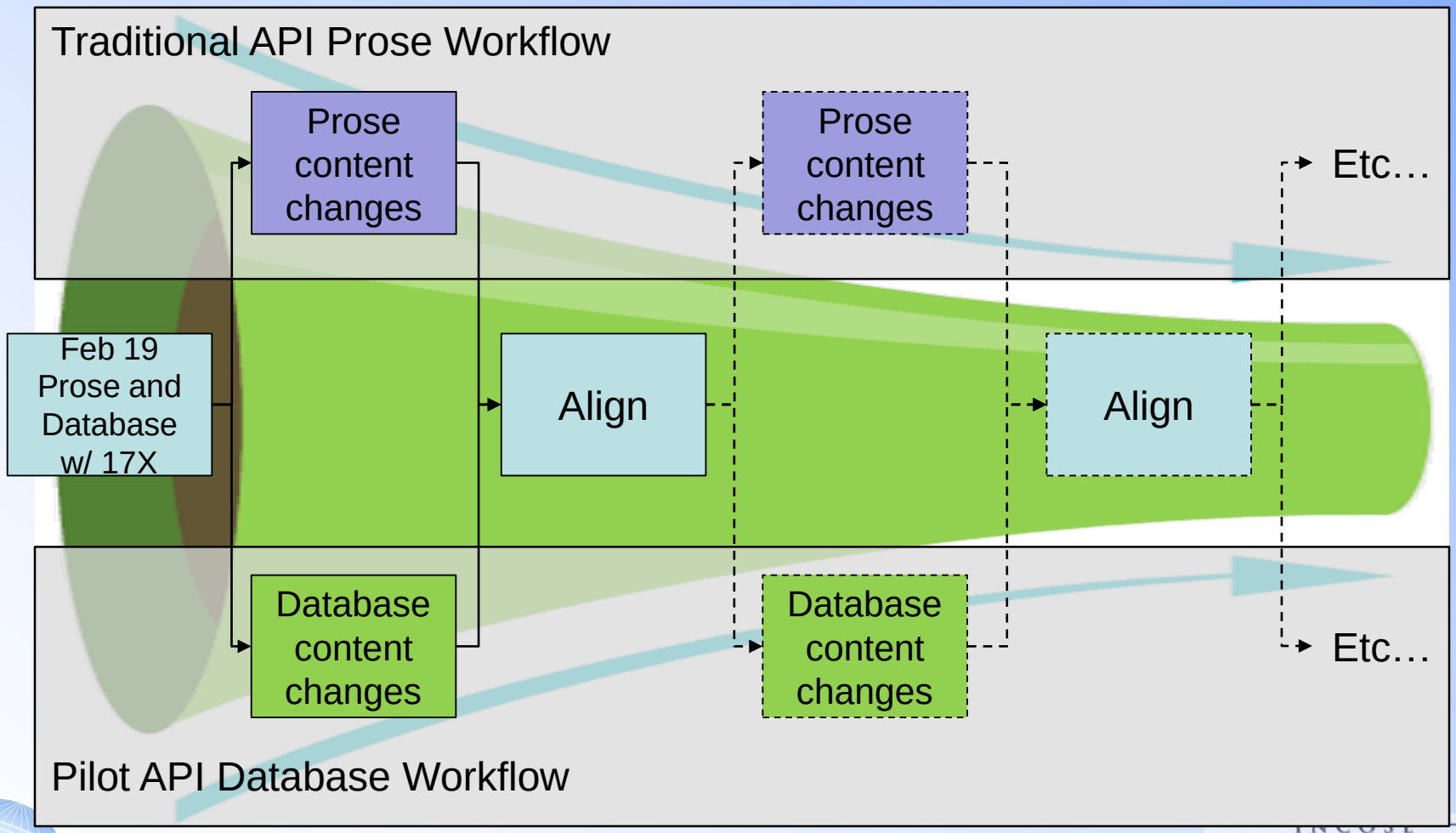
API Pilot Timeline



API Pilot Project Considerations

- Run pilot in parallel with usual API process for creating a standard
- Conversion from prose to requirements data:
  there needs to be content specific alignment discussions – this is not a simple translation function:
  - relevant stakeholders need to be engaged on content as we go
- Consistent prose & data formats:
  there will continue to be a near term mix of standards customers needing prose and/or data standards:
  - consistency between prose and database will be critical: create a database and a prose document derived from the database
- Commercial implications for standards and codes as data:
  need to consider for how standards are distributed and used (commercial models, Intellectual Property protection etc):
  - in parallel with creating the work products, also work through the commercial implications

Content Alignment:
API document to Database Products



Prose Document Derived from Database

Day	Date	Year	Meeting	Start Time	End Time	Session Type	MtgDescription
Saturday	Jan. 4	2017	Systems Thinking Round Table	7:00 AM	8:00 AM	Open/Working	An open forum round table discussing relevant ideas.
Saturday	Jan. 4	2017	Opening plenary	8:00 AM	10:00 AM	Open	Opening Plenary of the International Worshop
Saturday	Jan. 4	2017	Human Systems Integration	10:00 AM	12:00 PM	Open/Working	a series of the HIS Working Group meetings will be held at IW 2017. Objectives are to further discuss the changes in HSI approaches, and suggest change write ups in both SE BOK and SE Handbook. They will follow up the INCOSE HSI workshop that was held at Flrida Tech on October 4-5, 2016.
Sunday	Jan. 5	2017	Systems Security Engineering	9:00 AM	5:00 PM	Open/Working	Systems Security Engineering working group all day workshop. Review work
Sunday	Jan. 5	2017	Critical Infrastructure	9:30 AM	6:00		
Sunday	Jan. 5	2017	Fellows Selection Committee	10:30 AM	12:00		

Systems Thinking Round Table

Saturday, Jan. 4, 2017, "Systems Thinking Round Table", will be from 7:00:00 AM to 8:00:00 AM. This session is a/an Open/Working session discussing the following:

An open forum round table discussing relevant ideas.

Opening plenary

Saturday, Jan. 4, 2017, "Opening plenary", will be from 8:00:00 AM to 10:00:00 AM. This session is a/an Open session discussing the following:

Opening Plenary of the International Worshop

Human Systems Integration

Saturday, Jan. 4, 2017, "Human Systems Integration", will be from 10:00:00 AM to 12:00:00 PM. This session is a/an Open/Working session discussing the following:

a series of the HIS Working Group meetings will be held at IW 2017. Objectives are to further discuss the changes in HSI approaches, and suggest change write ups in both SE BOK and SE Handbook. They will follow up the INCOSE HSI workshop that was held at Flrida Tech on October 4-5, 2016.

Systems Security Engineering

Sunday, Jan. 5, 2017, "Systems Security Engineering", will be from 9:00:00 AM to 5:00:00 PM. This session is a/an Open/Working session discussing the following:

Systems Security Engineering working group all day workshop. Review work done, work in process , and consider work to do.

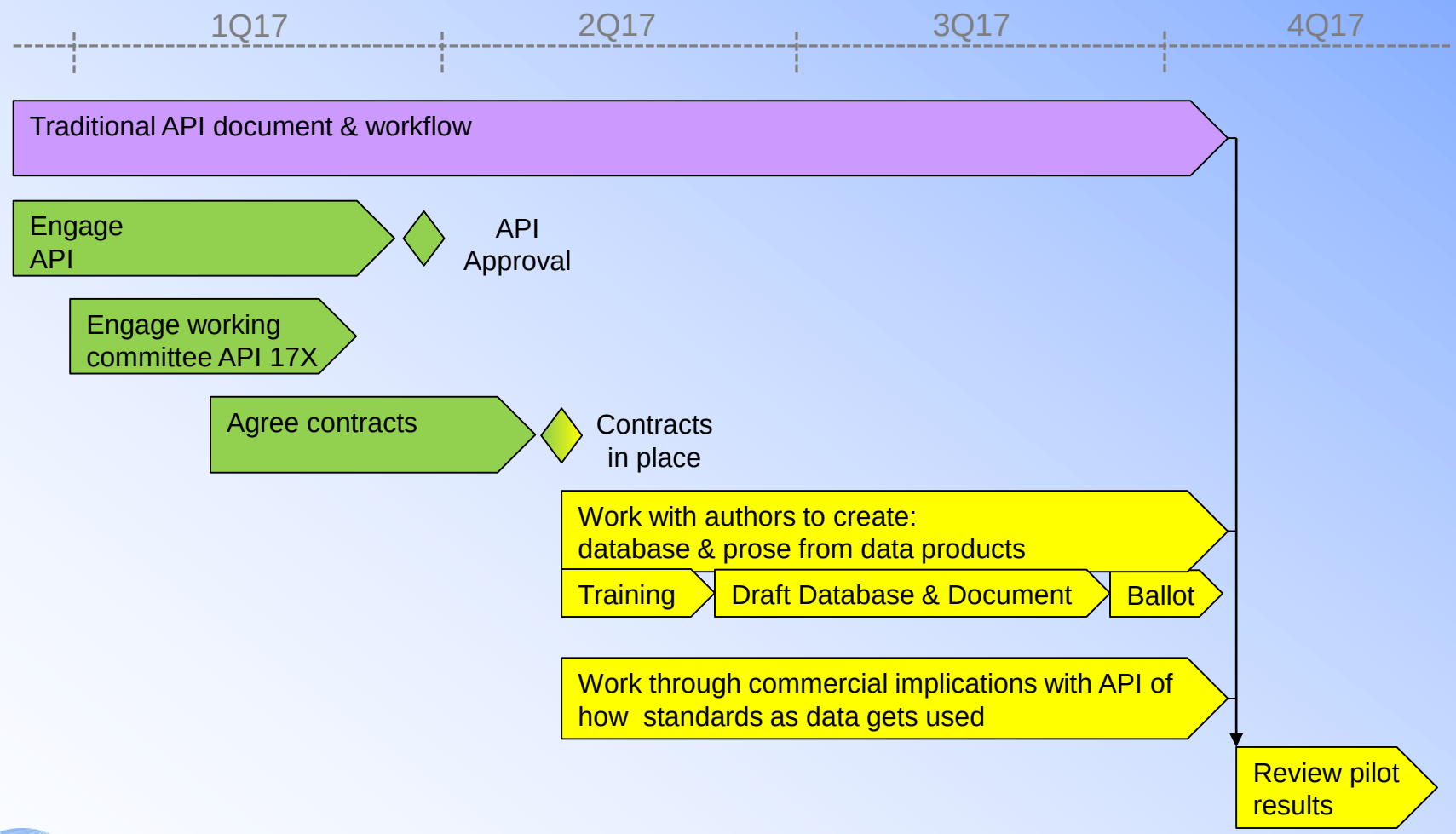
- Formatting and 'joining up' (conjunction) text to make the database read like a document

Commercial Implications for Standards as Data

Potential considerations could be:

- Sales and Distribution:
  Selling and distributing data versus full documents
- Retaining Ownership Control:
  Intellectual property considerations, derivative works, etc
- *etc*

API Pilot Timeline



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Thank You…

…Questions?