

ANALYSIS OF SOFTWARE DEVELOPMENT
METHODOLOGIES TO BUILD SAFETY
SOFTWARE APPLICATIONS FOR THE SATEX-II:
A MEXICAN EXPERIMENTAL SATELLITE

6th IAASS Conference-*Safety is not an
option*

McGill University, Institute of Air and Space law

PhD. Jorge Rafael Aguilar Cisneros

May 21th 2013

Content

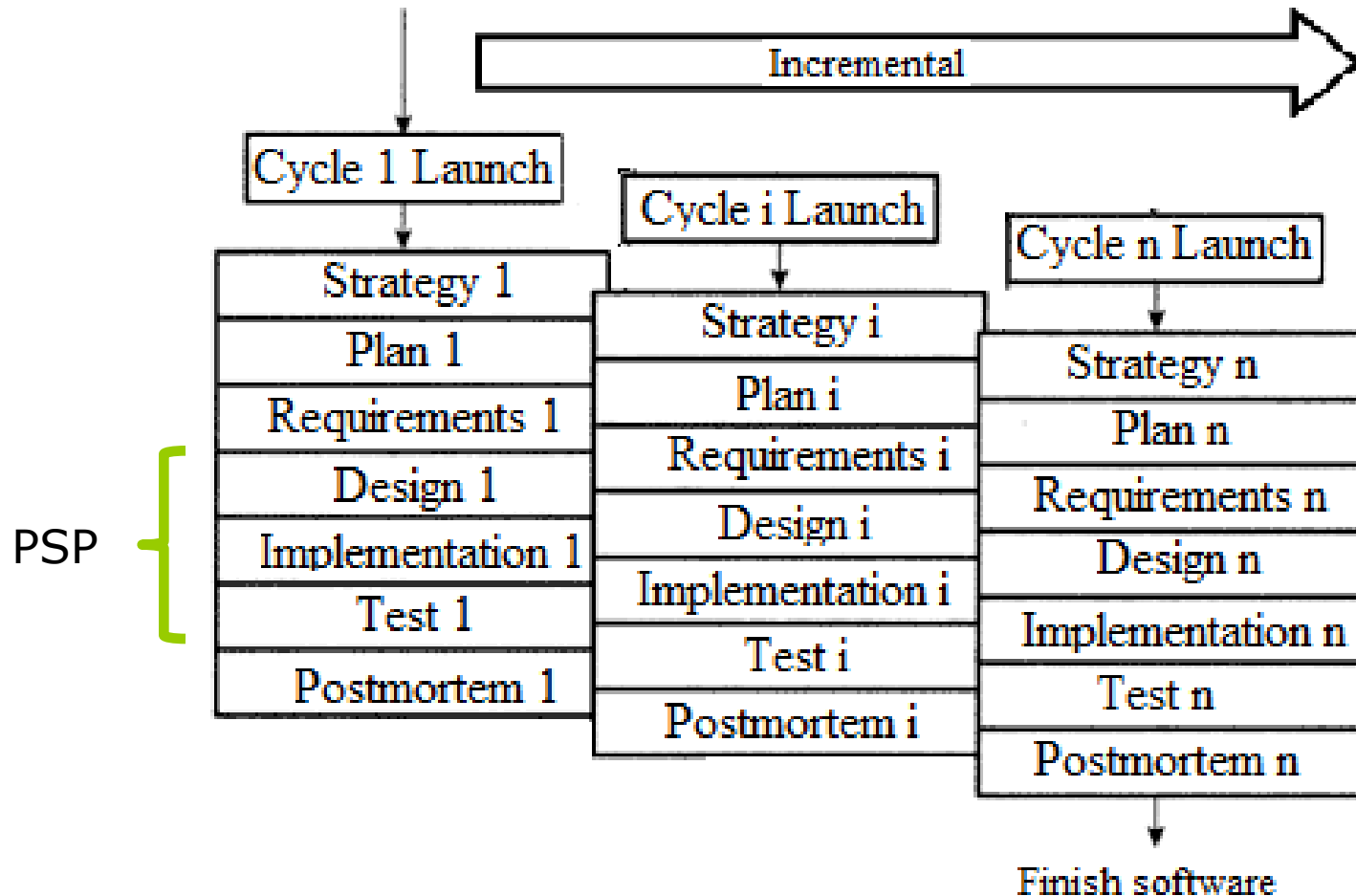
- Introduction
- Background
- Proposal Development
- Proposal Administration
- Conclusion

Introduction

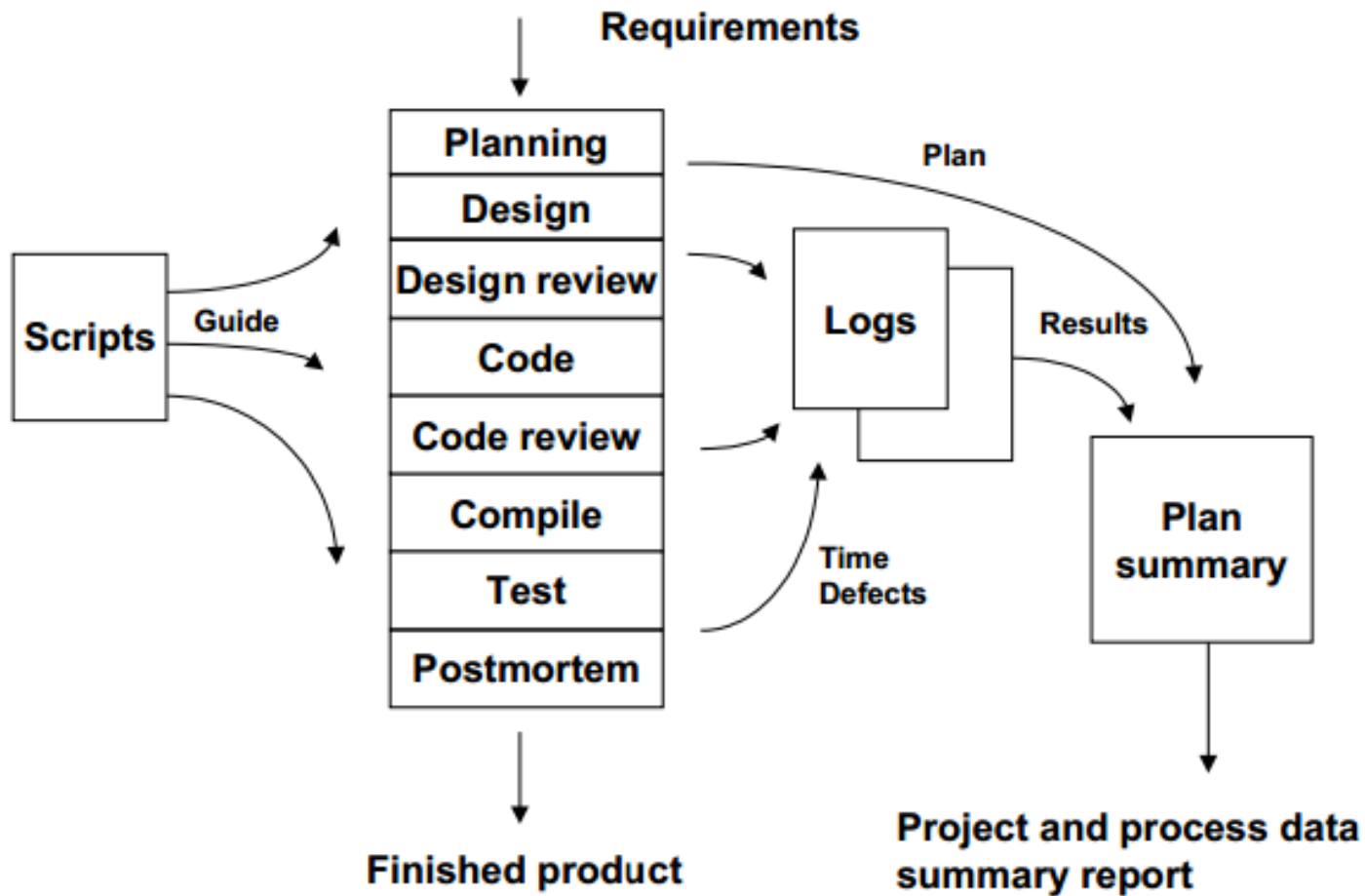
- Mexico is a country where the experience to build software for satellite applications is beginning.
- The SATEX-II (Mexican Experimental Satellite).
- Team On Board Computer
 - Developing On board Software.

Background [TSP]

Requirements business

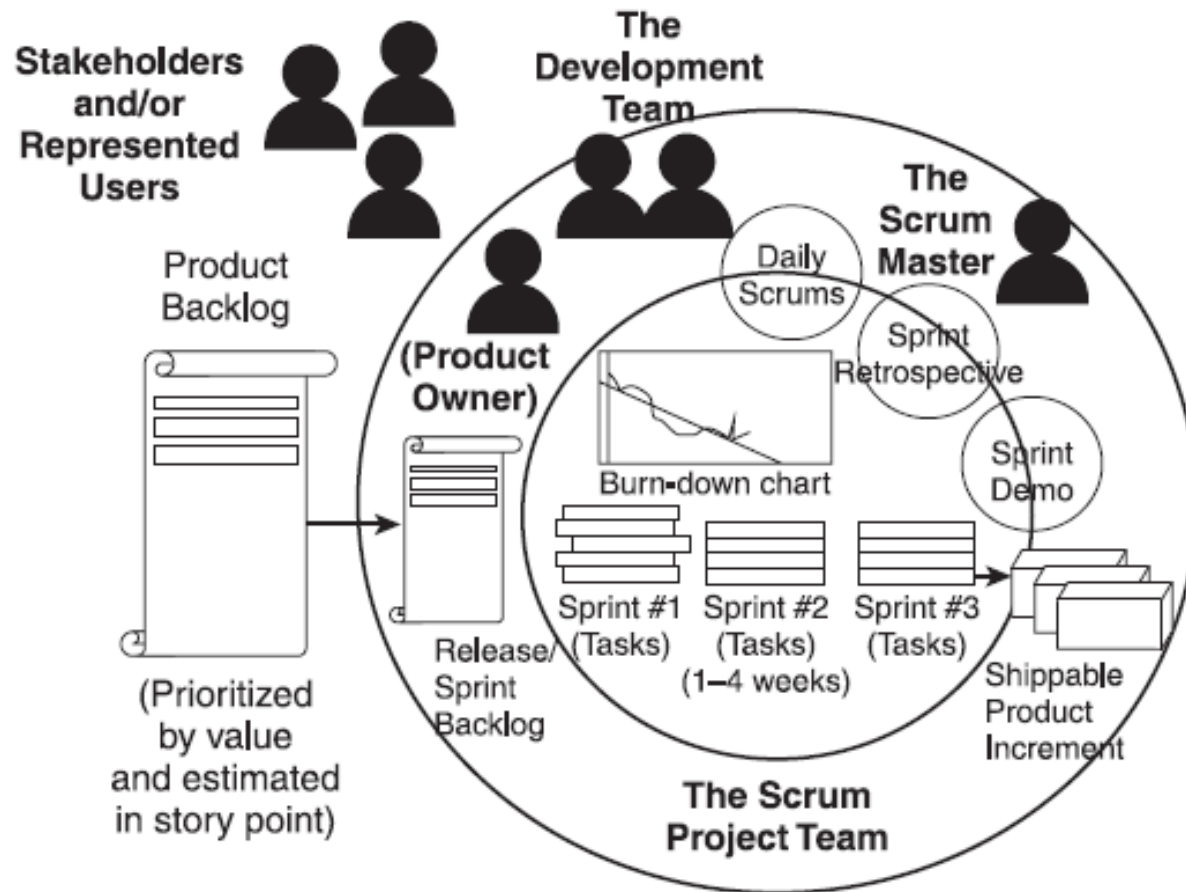


Background [PSP]



Humphrey, W. S., (2005)

Background [SCRUM]



Background [ESA PSS-05-0]

- Describes the software engineering standards to be applied for all deliverable software implemented for the European Space Agency (ESA).

Background [Small Software]

- Factors to identify software size:
 - A. Project development cost.
 - B. Number of people required to develop the software
 - C. Amount of software to be produced

- Example
 - A. Less than two man-years of development effort is needed.
 - B. Five people or less is required
 - C. Less than 10 KLOCs

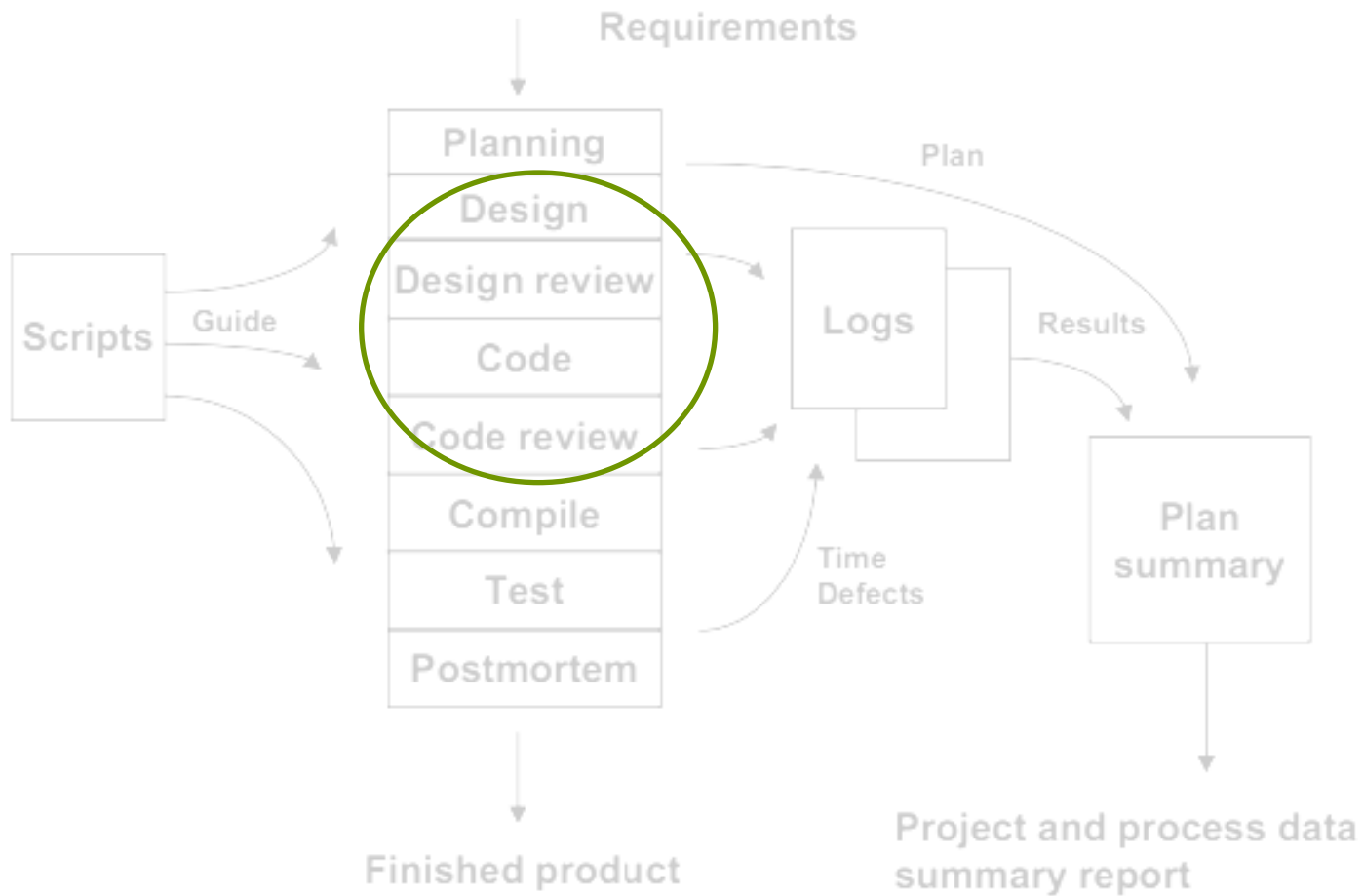
Background [Safety Software]

- We need a Safety software, when, it can lead to injury, death, destruction, loss of vital equipment, damage to the environment, etc.
- Furthermore, safety software must respond quickly to potential problems.

Proposal

- Spending a significant amount of time in early software phases (design, design review, code, and code review).
- Using software qualities metrics [PSP].
- Managing projects with TSP or SCRUM.

Proposal



Proposal [Software development]

- We must do this activities:
 - Design Review
 - Code Review
- We are looking to reach **yields** of about **85 or 95 %**

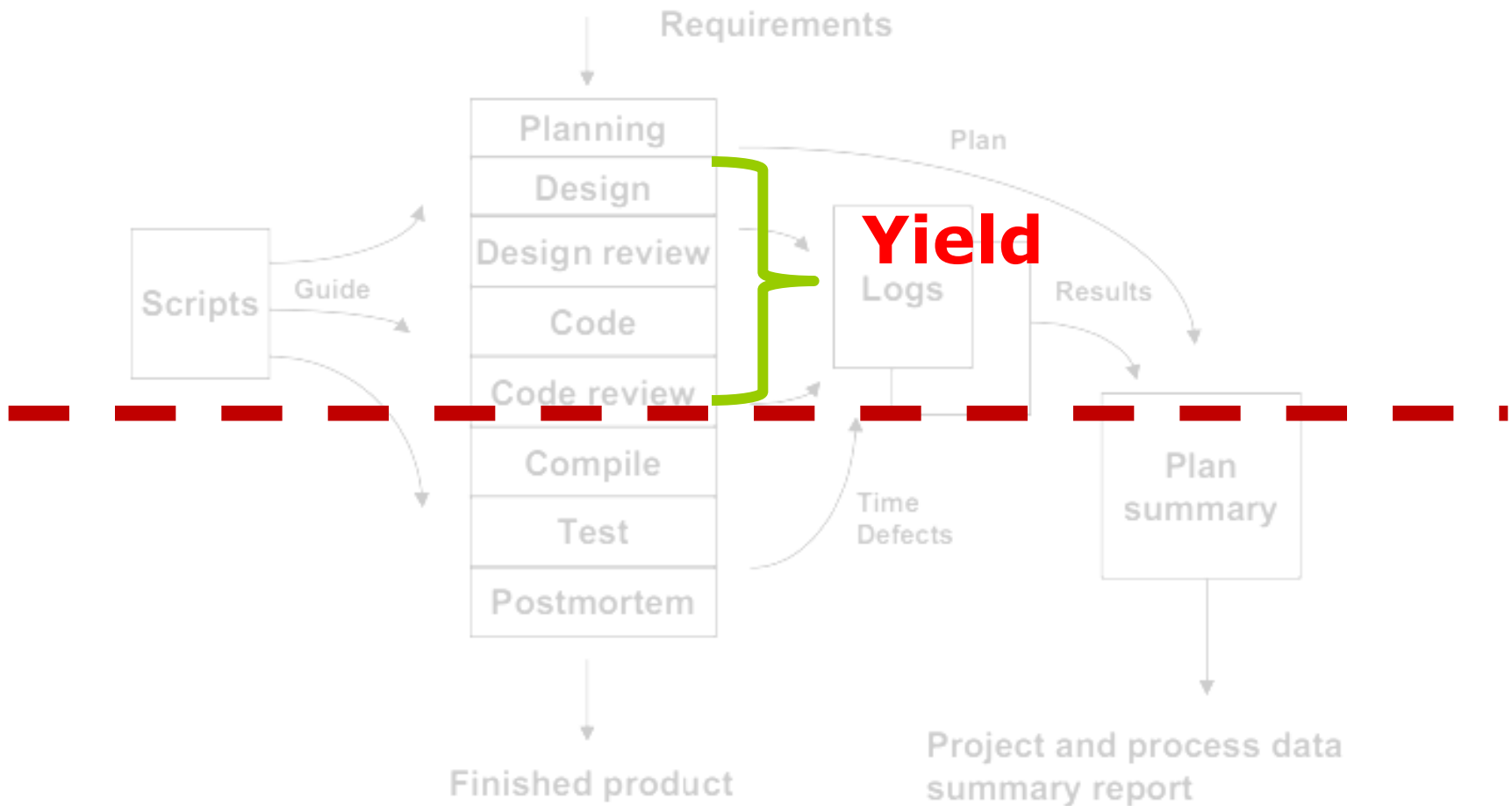
$$Yield = 100\% \frac{drbc}{drbc + decp}$$

Where:

drbc.- Defects removed before compile

decp.- Defects escapes into compile and test

Proposal [Software development]



Proposal [Software development]

- We need to reach **A/FR** (eq. 4) **near to 2 or 3**, to achieve it, we need **high appraisals** (eq. 2) and **low failures** (Eq. 3).

$$\textit{Appraisal_COQ} = 100\% \frac{(\textit{drt} + \textit{crt})}{\textit{tdt}} \quad (2)$$

$$\textit{Failure_COQ} = 100\% \frac{(\textit{ct} + \textit{tt})}{\textit{tdt}} \quad (3)$$

$$\textit{A/FR} = \frac{\textit{Appraisal_COQ}}{\textit{Failure_COQ}} \quad (4)$$

Where:

drt = Design review time

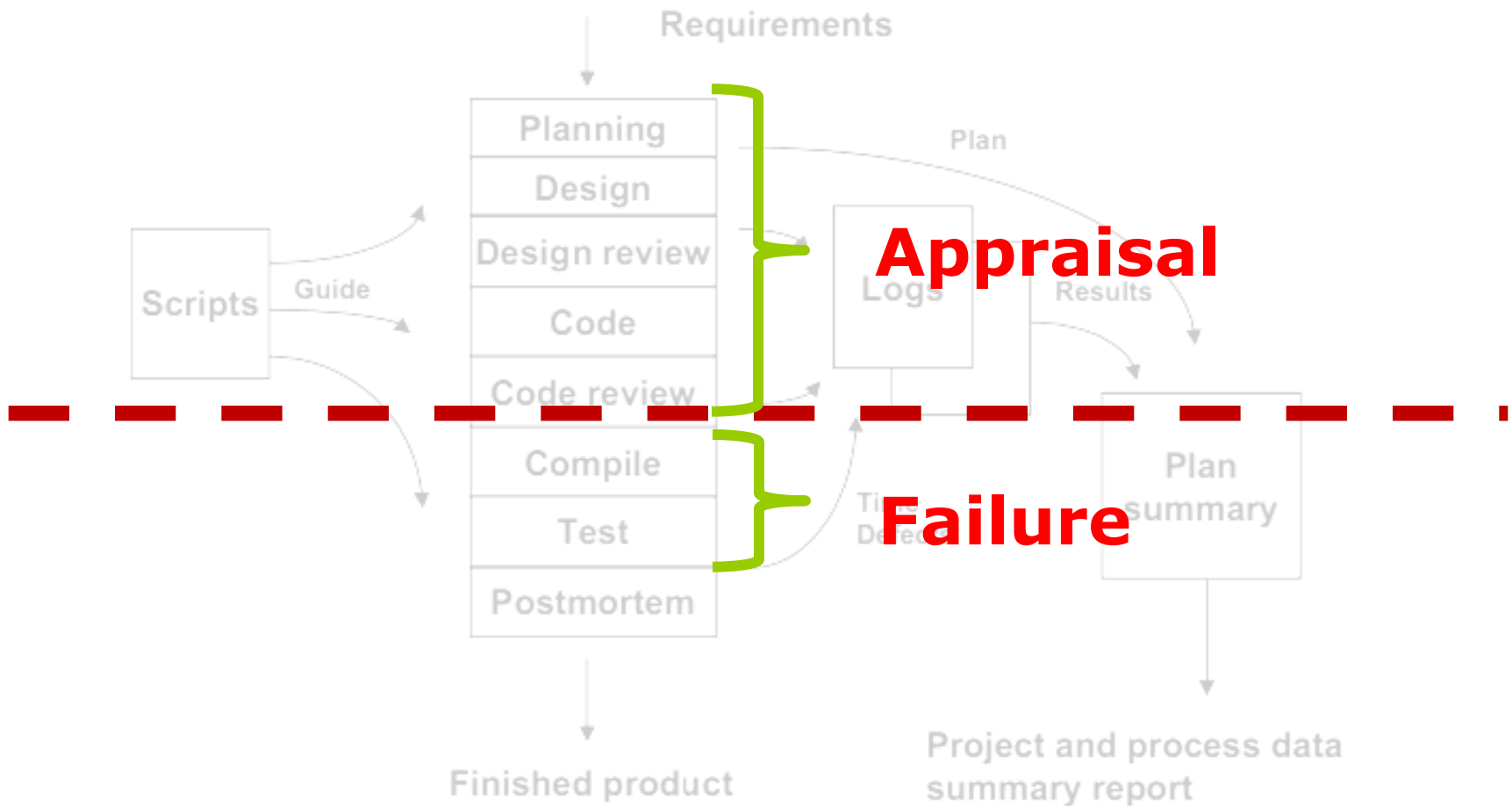
crt = Code review time

tdt = Total develop time

ct = Compile time

tt = Test time

Proposal [Software development]



Proposal [Administration project]

Task	ESA	SCRUM	TSP
User Requirements (UR)	✓	--	✓
Software requirements (SR)	✓	--	✓
Architectural design (AD)	✓	--	✓
Detailed design and production of code (DD)	✓	--	✓
Transfer of the software to operations (TR)	✓	✓	✓
Operations and maintenance (OP)	✓	--	--

Large projects

Proposal [Admisnitration project]

Task	ESA	SCRUM	TSP
Combine requirements and architectural design	✓	✓	X
Simplify documentation	✓	✓	X
Simplify Plans	✓	✓	X
Reduce the reliability requirements	✓	--	X
Use the system test specification	✓	✓	✓

Small projects

Proposal [Admisnitration project]

Plans	ESA	SCRUM	TSP
Software Project Management	✓	✓	✓
Software Configuration management	✓	X	✓
Software Verification an validation	✓	✓	✓
Software quality assurance	✓	✓	✓

Software development plans

Conclusion

- Although, we are going to develop **small on board software projects** and SCRUM fits with small projects. Perhaps, **we shall use TSP** because **we need a detailed documentation** and we are not going to join any phase of life-cycle software development.

Conclusion

- To build a safety on board software, **we need to use the quality metrics** showed above and those metrics are used with PSP and TSP.

Conclusion

- Finally, we need to develop safety on board software with high quality then **we need to use a formal method like TSP** to satisfy this requirement

ANALYSIS OF SOFTWARE DEVELOPMENT
METHODOLOGIES TO BUILD SAFETY
SOFTWARE APPLICATIONS FOR THE SATEX-II:
A MEXICAN EXPERIMENTAL SATELLITE

Thank you.

PhD. Jorge Aguilar Cisneros
jorge.aguilar@upaep.mx
(222) 2299400 ext 7447
UPAEP