



Forum della Ricerca Sperimentale e Tecnologica in INAF
Bologna, 22-24 giugno 2022

Lesson learned: errori nel Project Management e System Engineering nel progetto SKAlow*

* durante l'epoca consortile

Sessione: System Engineering al Project
Management

Speaker: Jader Monari

Istituto di Radioastronomia

G. Brunetti



G. Bianchi



J. Monari* (*low)



PON
PILLOLE
E INNOVAZIONE

ASSE II
Progetti tematici

AZIONE II.1
Potenziamento delle
Infrastrutture di Ricerca

Potenziamento del Sardinia Radio Telescope per lo studio dell'Universo alle alte frequenze radio

REGIONE
Sardegna

BENEFICIARIO
Istituto Nazionale di Astrofisica (INA)

RISORSE
18.683.000,00

DURATA
30 mesi

UNIONE EUROPEA
FONDO EUROPEO DI SVILUPPO REGIONALE

A photograph of the Sardinia Radio Telescope, a large parabolic dish antenna, set against a dark night sky with stars and a nebula.

D. Fierro

SKA1 LOW - the SKA's low-frequency instrument

The Square Kilometre Array (SKA) will be the world's largest radio telescope, revolutionising our understanding of the Universe. The SKA will be built in two phases - SKA1 and SKA2 - starting in 2018, with SKA1 representing a fraction of the full SKA. SKA1 will include two instruments - SKA1 MID and SKA1 LOW - observing the Universe at different frequencies.



Location: Australia



Frequency range:
50 MHz to 350 MHz



~130,000
stations spread between
500 stations

Total collecting area:
0.4km²



Maximum distance between stations:
65km



Total raw data output:
157 terabytes per second
4.9 zettabytes per year



Enough to fill up
35,000 DVDs
every second

5x
the estimated global internet traffic in 2015
(source: Cisco)

Compared to LOFAR Netherlands, the current best similar instrument in the world



25% better resolution
8x more sensitive
135x the survey speed

www.skatelescope.org | Square Kilometre Array | @SKA_telescope | The Square Kilometre Array

SKA1-mid - the SKA's mid-frequency instrument

The Square Kilometre Array (SKA) is a next-generation radio astronomy facility that will revolutionise our understanding of the Universe. It will have a uniquely distributed character: **one** observatory operating **two** telescopes on **three** continents. Construction of the SKA will be phased and work is currently focused on the first phase named SKA1, corresponding to a fraction of the full SKA. SKA1 will include two instruments - SKA1-mid and SKA1-low - observing the Universe at different frequencies.



Location: South Africa



Frequency range:
350 MHz to 15.3 GHz
with a goal of 24 GHz



197 dishes
(including 64 MeerKAT dishes)

Total collecting area:
33,000m²



OR
126 tennis courts



Maximum distance between dishes:
150km



Data transfer rate:
8.8 Terabits per second

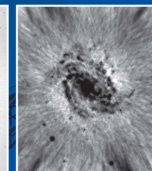
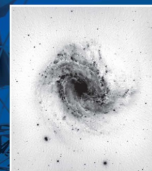


Image quality of SKA1-mid (left) versus the best current facility operating in the same frequency range, the Jansky Very Large Array (JVLA) in the United States (right). SKA-mid's resolution will be **4x** better than JVLA.

Compared to the JVLA, the current best similar instrument in the world:



4x
the resolution

5x
more sensitive

60x
the survey speed

www.skatelescope.org | @SKA_telescope | SKATelescope | ska_telescope | Square Kilometre Array | ska-organisation



DESIGNING THE

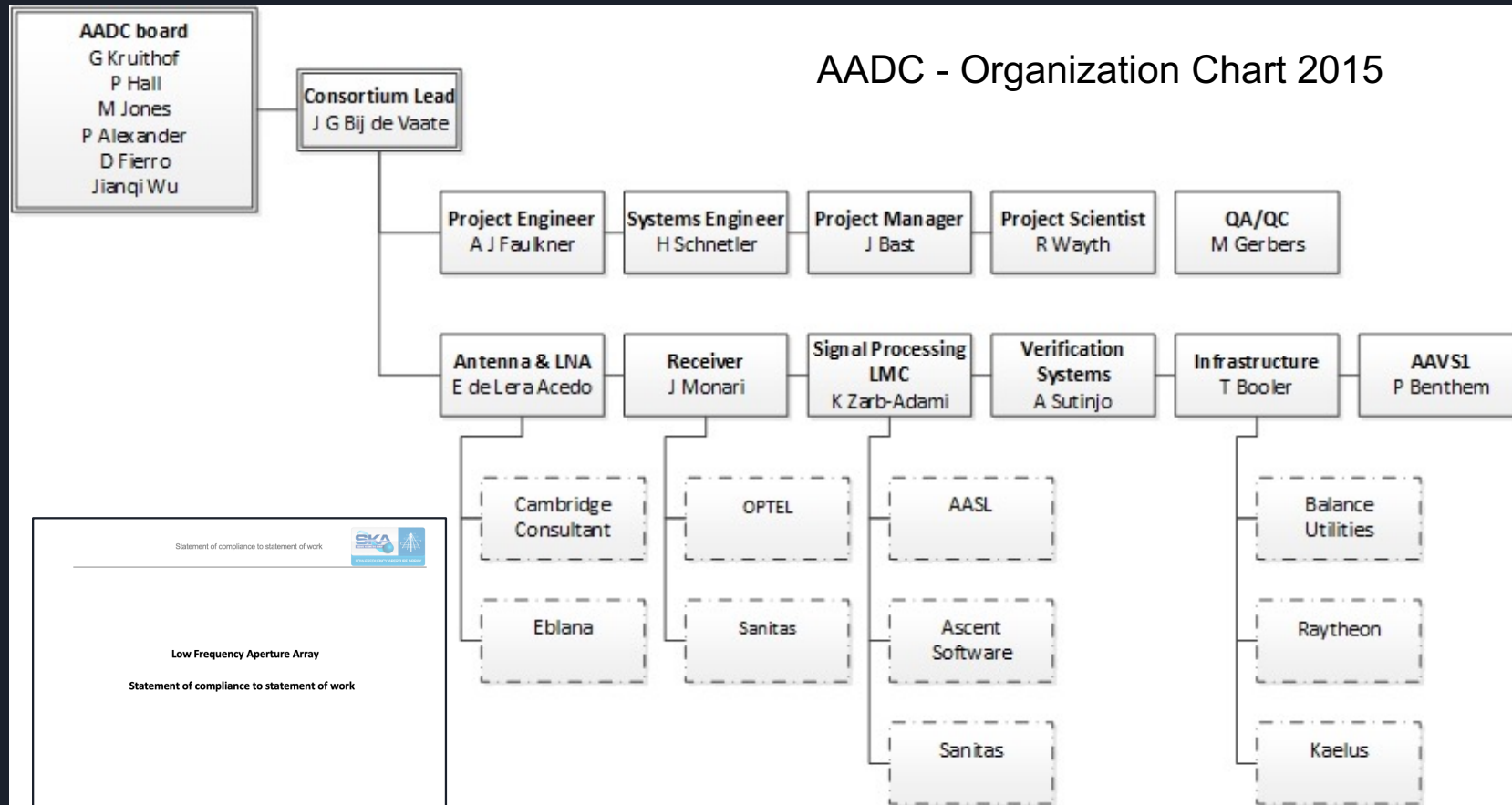
Square Kilometre Array




SKA Home



AADC - Organization Chart 2015



Management Plan 

Low Frequency Aperture Array

Management Plan

Reference : AADC-TELLFAA.MGT-AADC-MP-001
 Issue - Revision : 2 - 0
 Date : 2013-06-18
 Author(s) : J.G. Bij de Vaate


Checked : A.J.J. van Es
 P. Hall
 Approval : M. Gerbers
 Authorisation : J.G. Bij de Vaate
 Customer Approval : N.A.

Reference : AADC-TELLFAA.MGT-AADC-MP-001
 Issue - Revision : 2 - 0
 Date : 2013-06-18

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Statement of compliance to statement of work 

Low Frequency Aperture Array

Statement of compliance to statement of work

Reference : AADC-TELLFAA.MGT-AADC-PL-001
 Issue - Revision : 3 - 0
 Date : 2015-09-27
 Author(s) : J.G. Bij de Vaate

Checked : A. Faulkner
 P. Hall
 J. Bast
 Approval : M. Gerbers
 Authorisation : J.G. Bij de Vaate
 Customer Approval : N.A.

Reference : AADC-TELLFAA.MGT-AADC-PL-001
 Issue - Revision : 3 - 0
 Date : 2015-09-27

Page 1 of 3

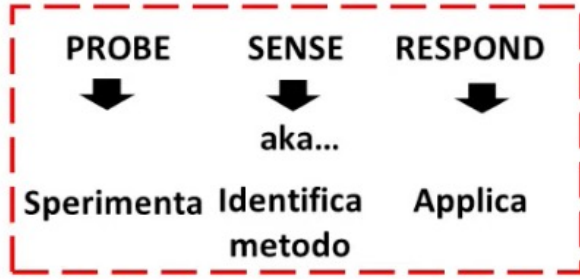
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Mapping di scenari di progetto con il framework Cynefin



Relazioni causa-effetto note solo a posteriori



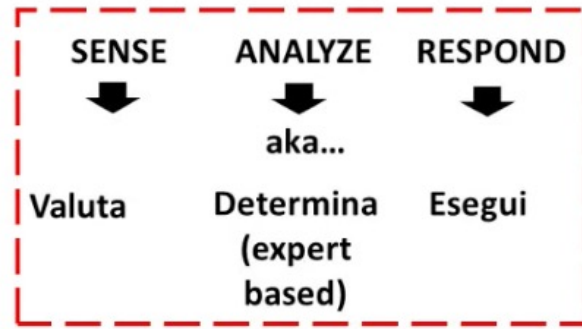
Progetto high-risk, agile



Pratiche emergenti in esperimenti controllati



COMPLESSO (inconoscibile)



Relazioni causa-effetto non evidenti ma identificabili

Progetto high-risk, hybrid



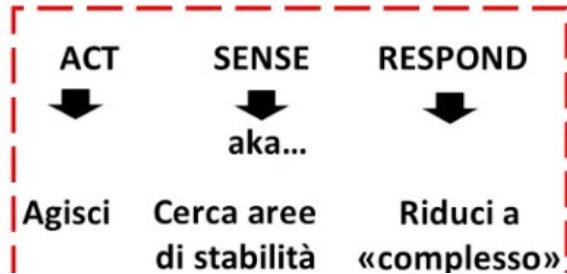
Buone pratiche (non ci sono chiare best practice)

COMPLICATO (conoscibile)

CAOTICO (inconoscibile)



Nessuna relazione causa-effetto



Attività codificabili (procedure, best practice)



SEMPLICE (conosciuto)

Progetto low-risk, predittivo

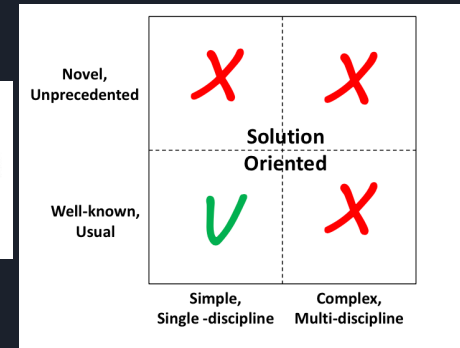


Relazioni causa-effetto, chiare predicibili e ripetibili

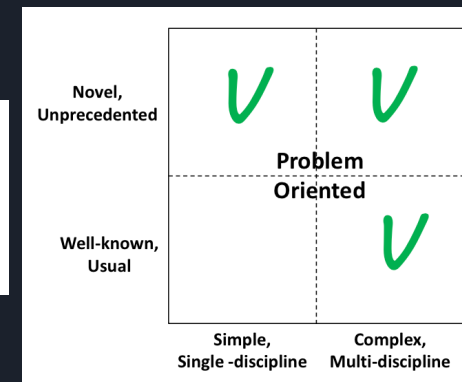
...design approach

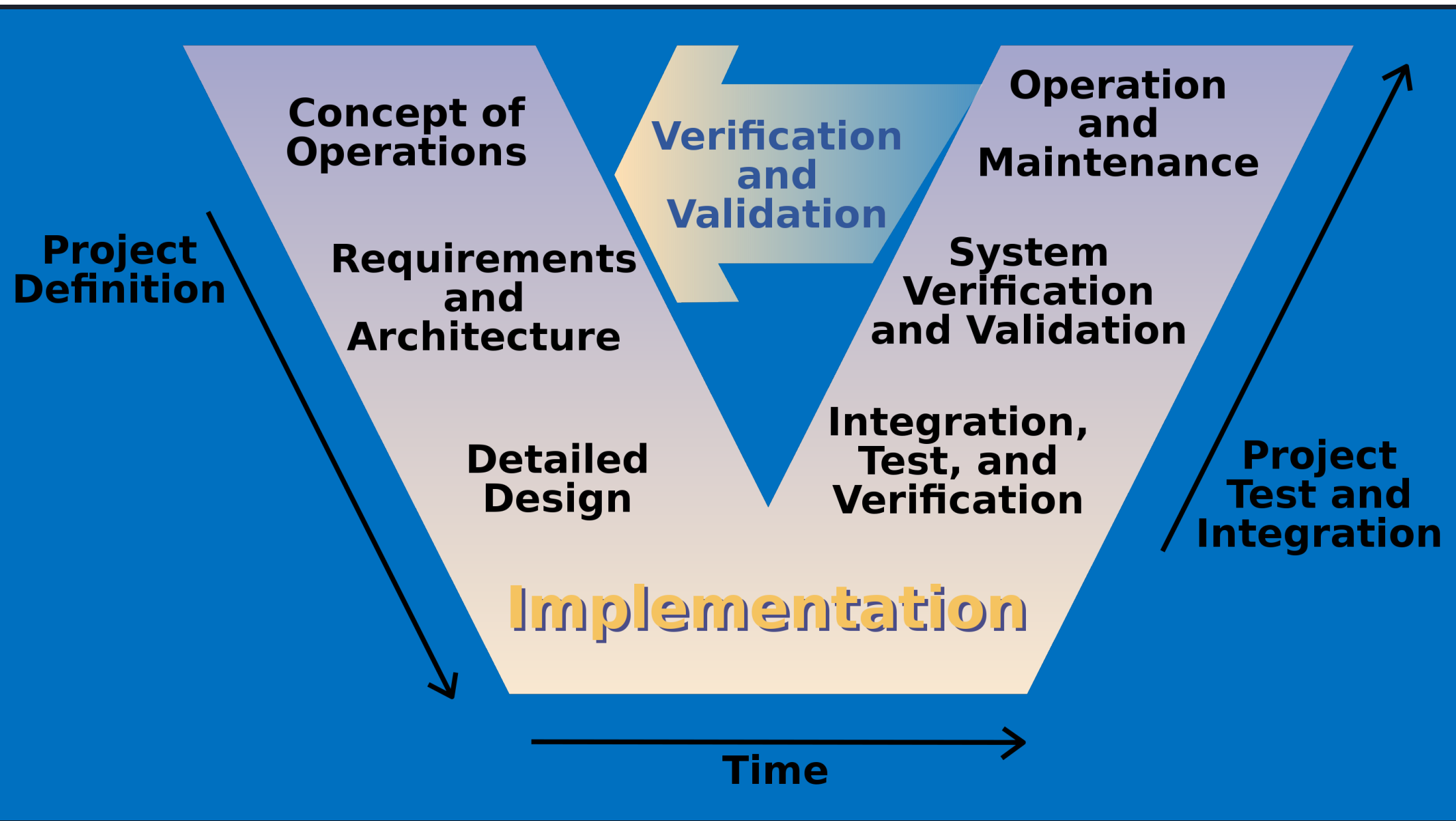
Solution-oriented approach: an *initial solution* is proposed, analysed and then *repeatedly modified* as the design space and requirements are explored together.

Problem-oriented approach: the emphasis is placed upon *abstraction* and *thorough analysis of the problem* structure *before* generating a *range of possible solutions*.



No traceability





Time



Implementation

Design
Detailed

Verification
Test, and
Integration,

Integration
Test and
Project

Architecture
and
Requirements

and Validation
Verification
System

Definition
Project

Operations
Concept of

Validation
and
Verification

Maintenance
and
Operation





LEADERSHIP

GOAL

MOTIVATION

TRAINING

TEAM BUILDING

COACHING

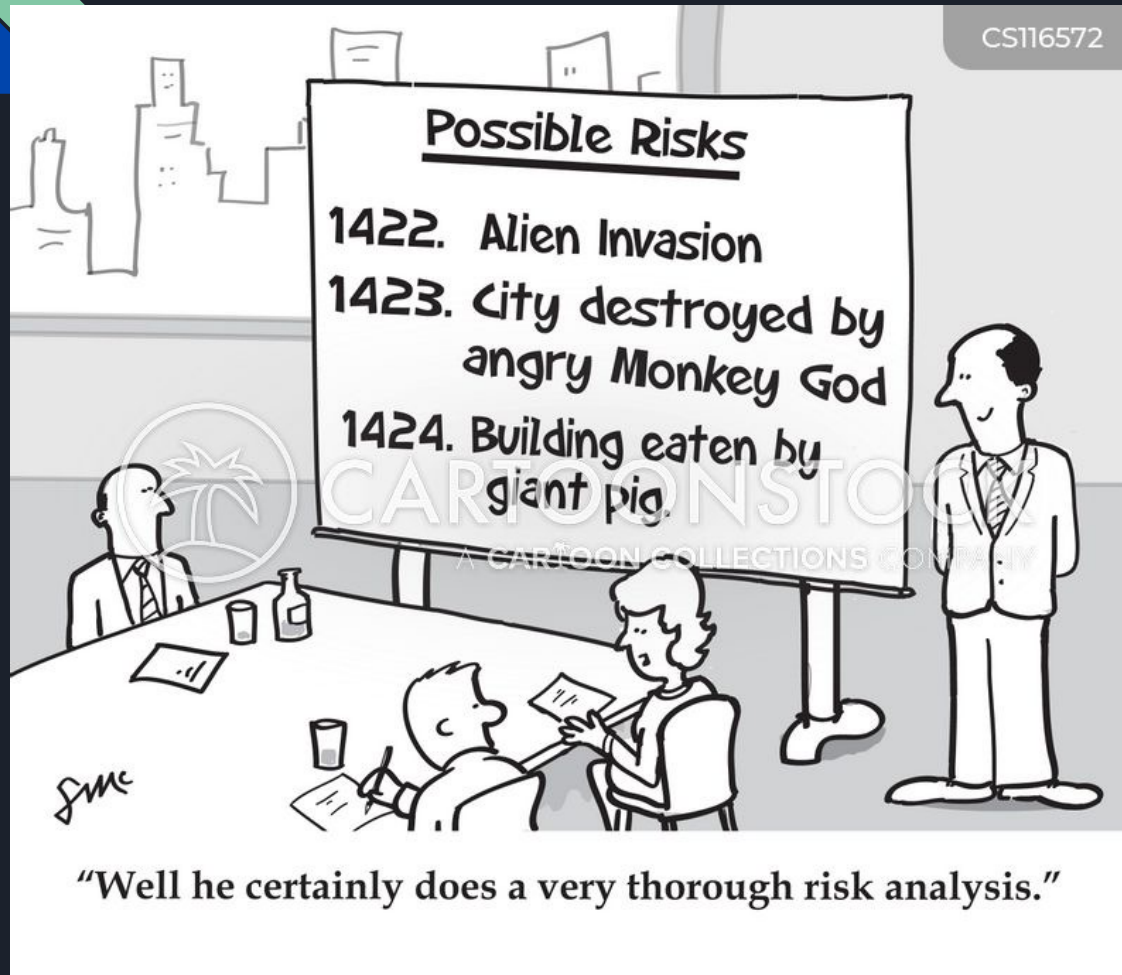


COMMUNICATION

COOPERATION

COLLABORATION

Risks without risk management



The five-step risk management process



Identify the risks.



Analyze the likelihood and impact of each.



Prioritize risk based on enterprise objectives.



Treat or respond to the risk conditions.

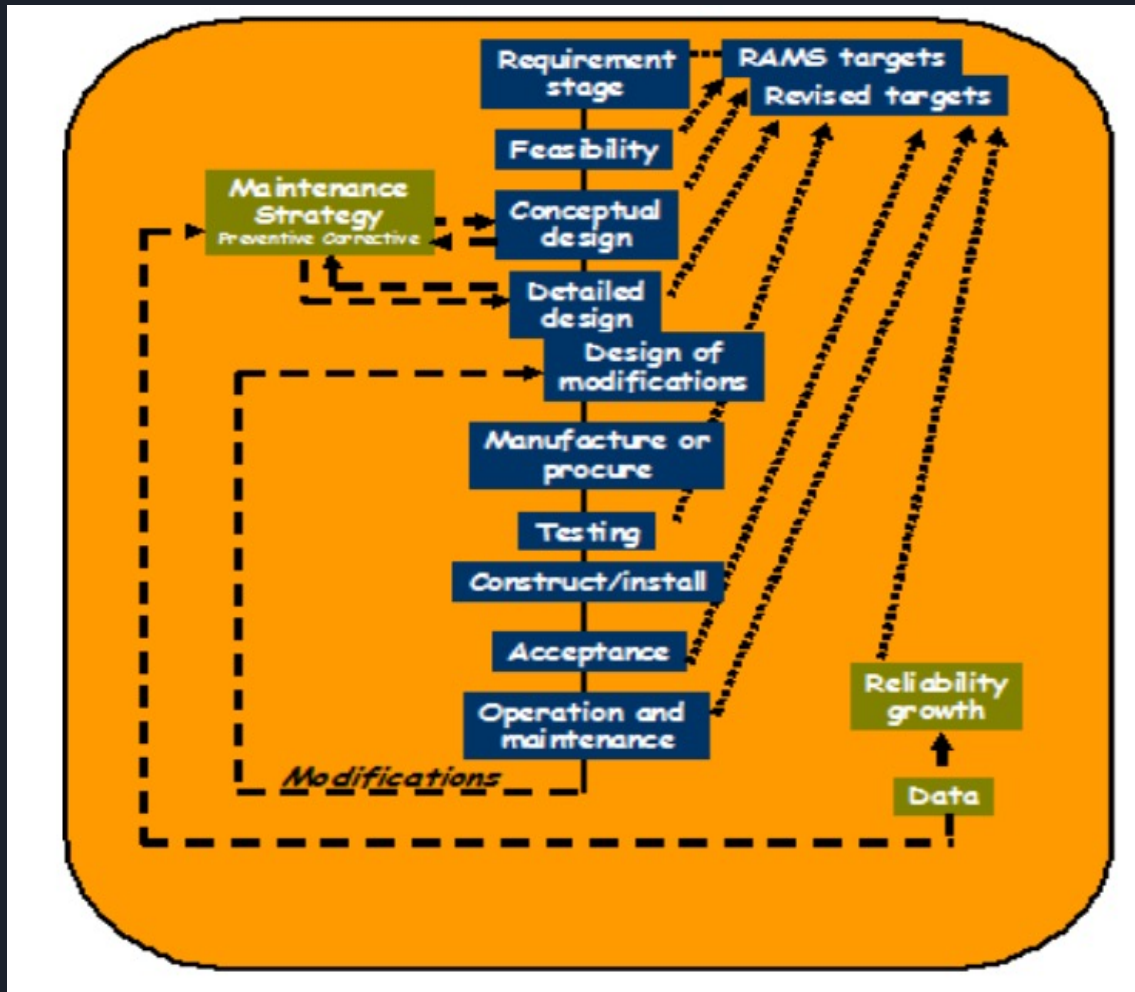


Monitor results and adjust as necessary.

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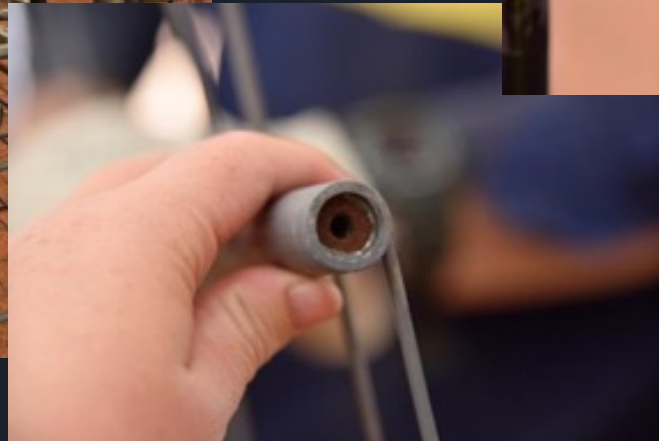
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RAM!



Huge costs impact on qualification of the components and procedures

Quality plan... what a mystery!





- APERTURE ARRAY VERIFICATION SYSTEM 1



A PROJECT WITHIN A PROJECT



No vision about the integrated system

<https://youtu.be/qUgxL8iYLfw>

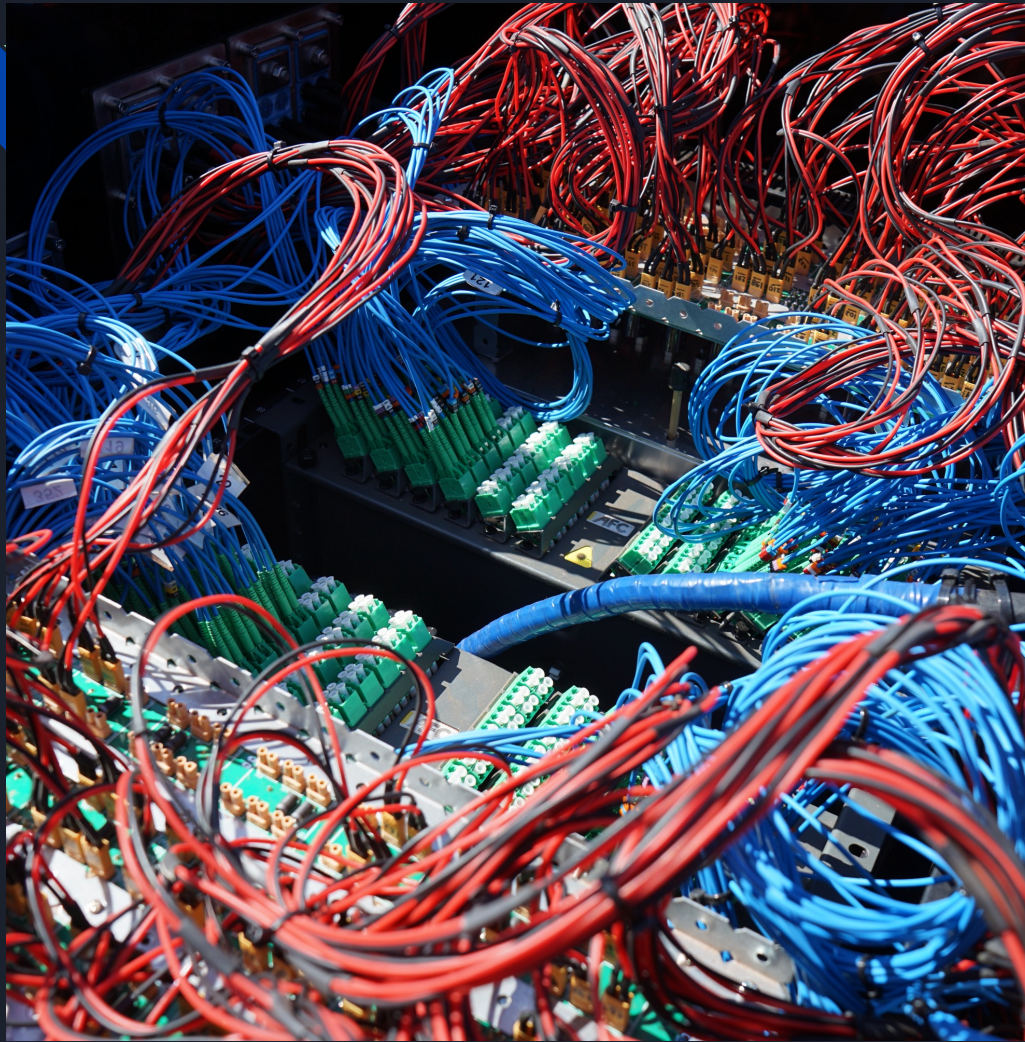


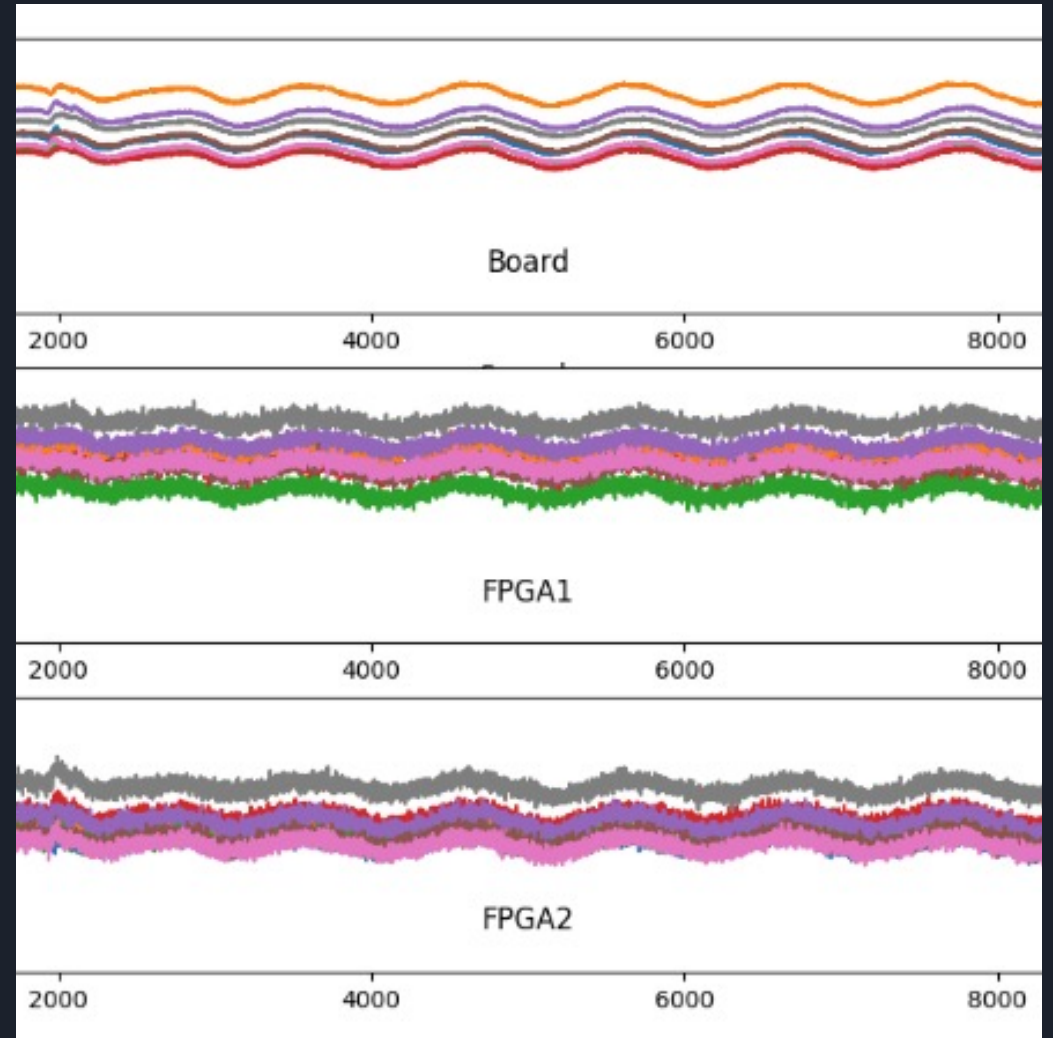
AADC-LFAA
SKA.TEL.LFAA.RX
Status on January 2015

Jochen Monari
INAF-IRA
Radioastronomia Centro del Nord
Email: jmonari@ira.inaf.it
Cambridge Meeting: 28th to 30th of January 2015







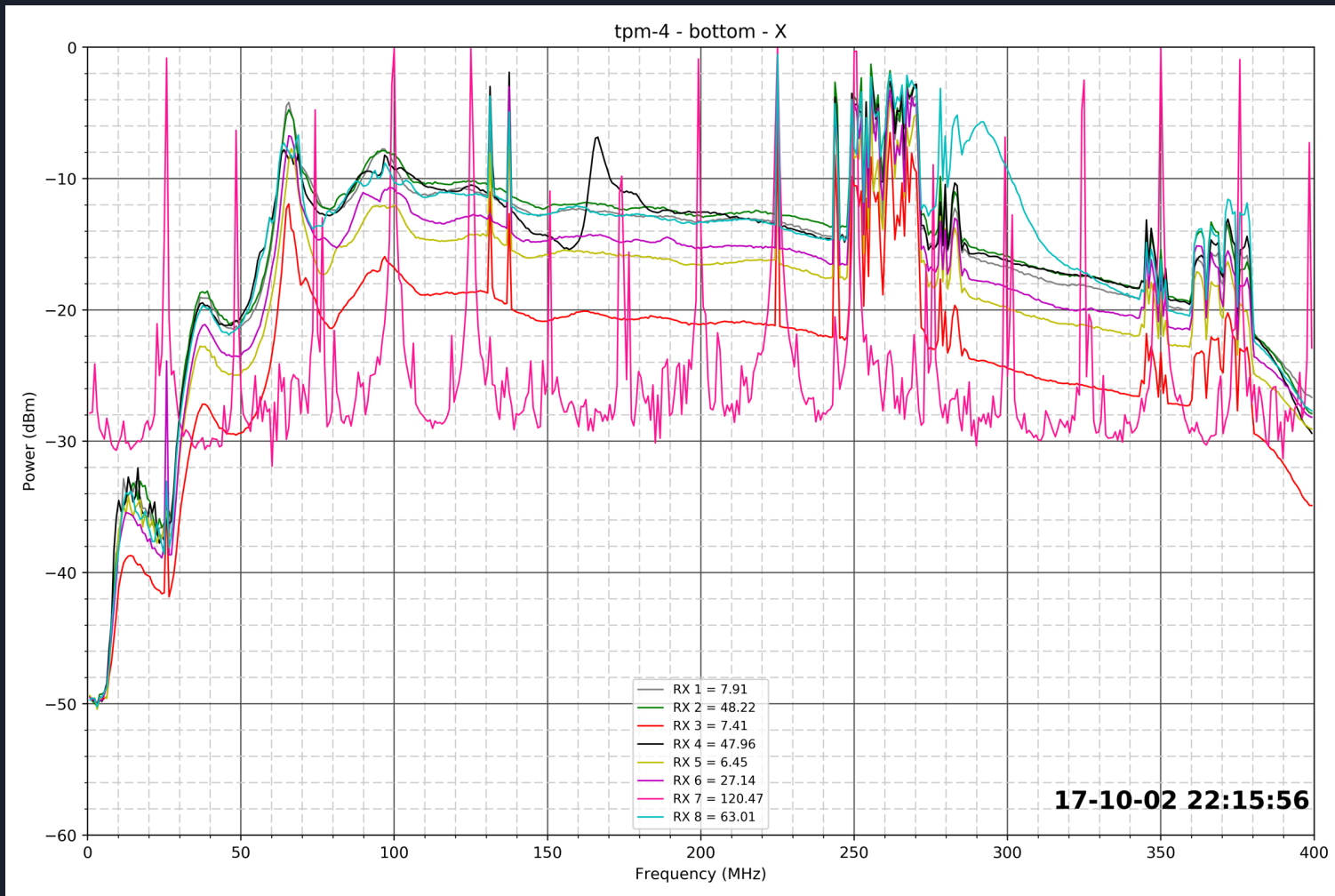


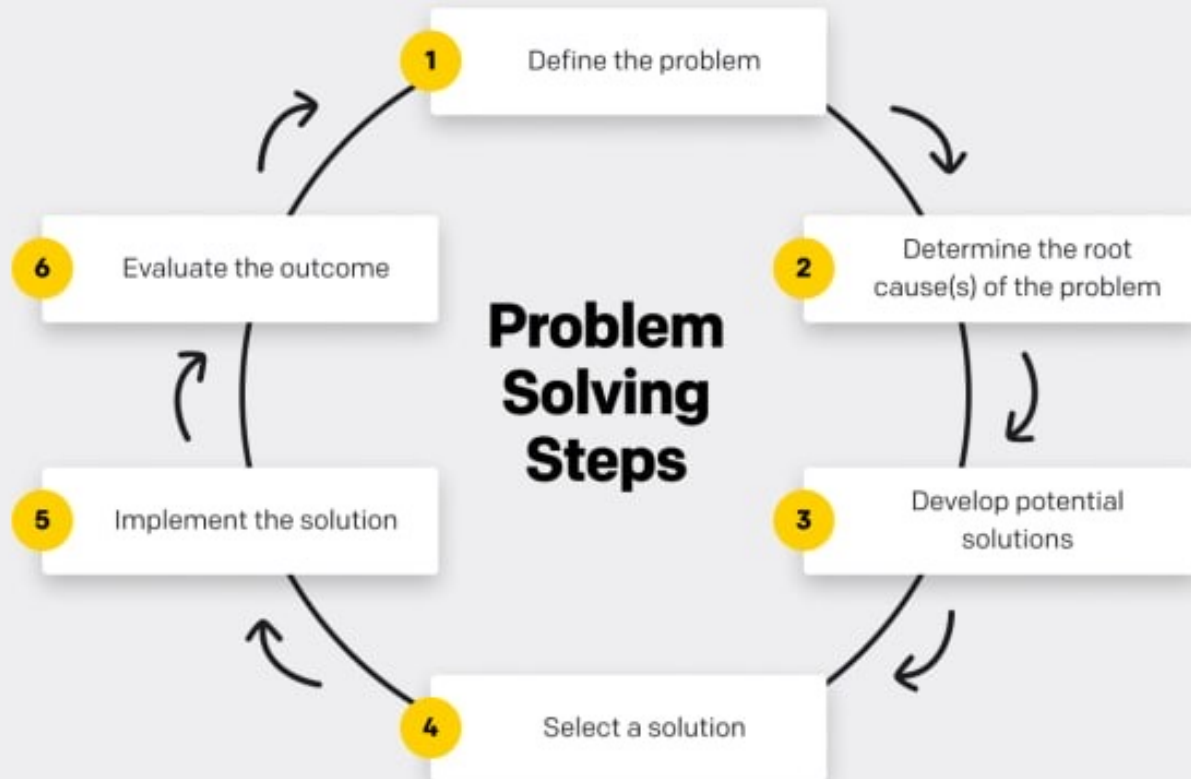
Poor communication

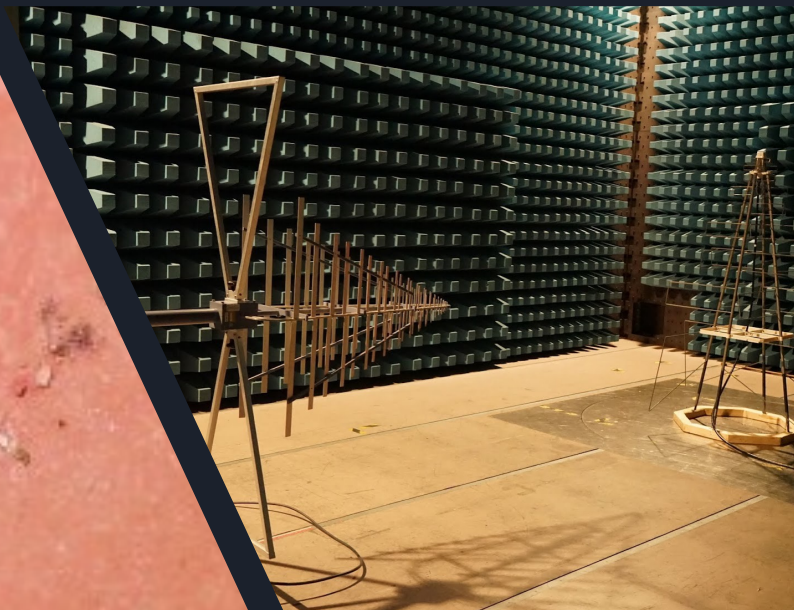


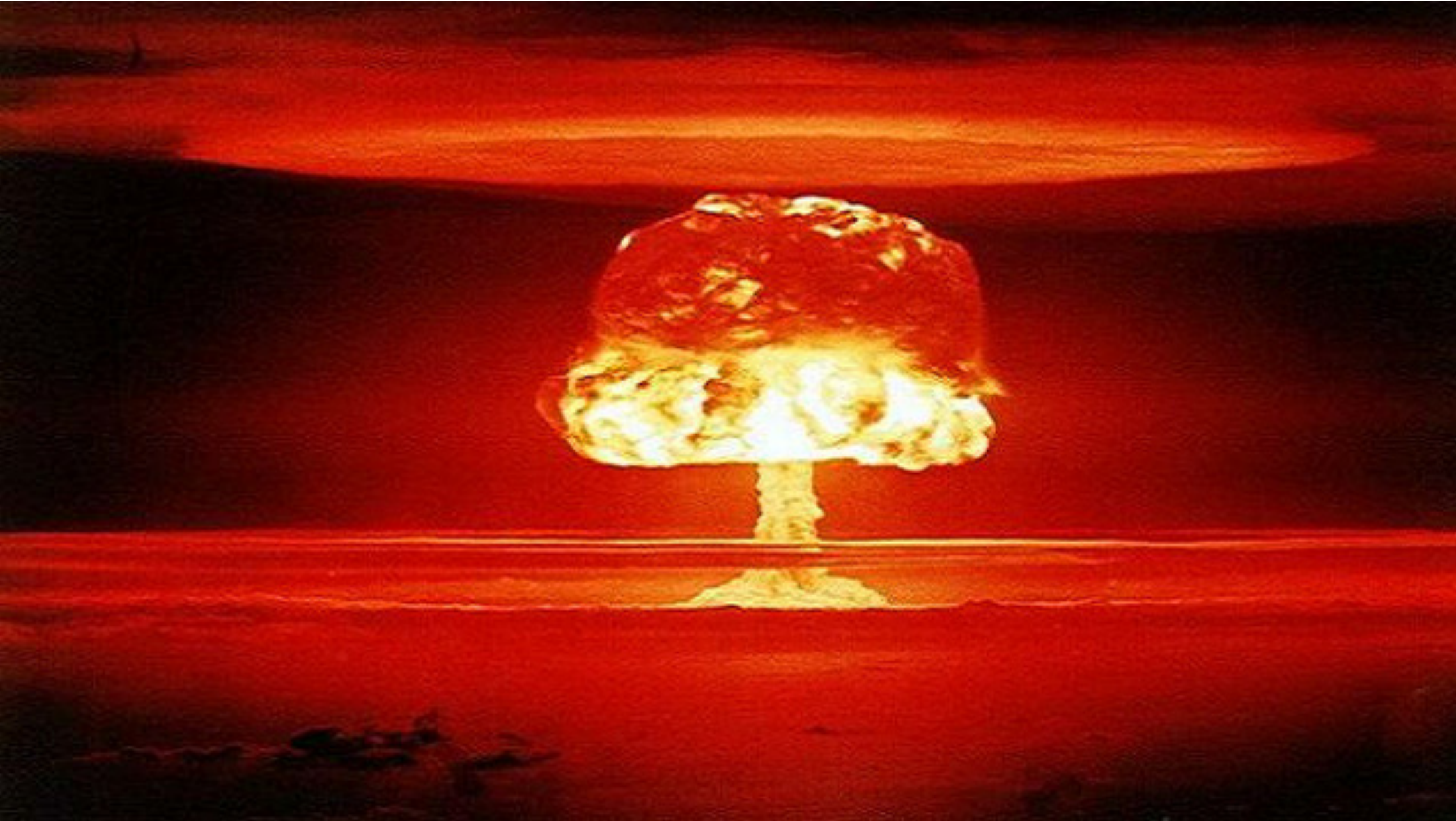
Houston..we got a problem!







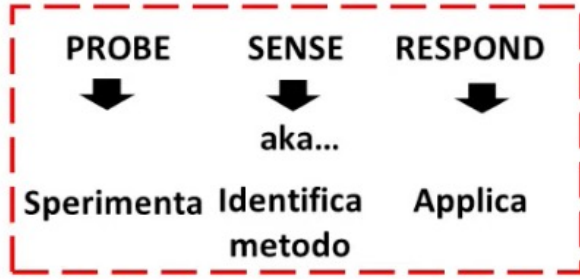




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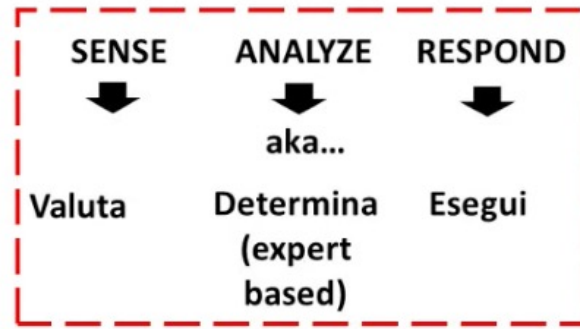
Progetto high-risk, agile



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COMPLESSO (inconoscibile)



Relazioni causa-effetto non evidenti ma identificabili

Progetto high-risk, hybrid



Buone pratiche (non ci sono chiare best practice)

COMPLICATO (conoscibile)

CAOTICO (inconoscibile)

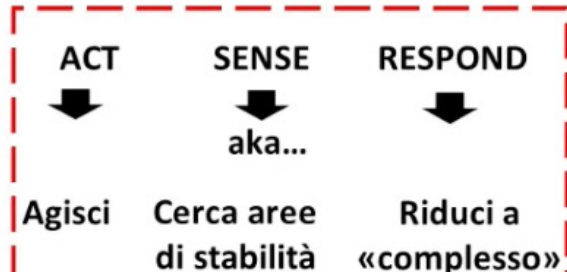


Attività codificabili (procedure, best practice)

SEMPLICE (conosciuto)



Nessuna relazione causa-effetto



Progetto low-risk, predittivo



Relazioni causa-effetto, chiare predicibili e ripetibili

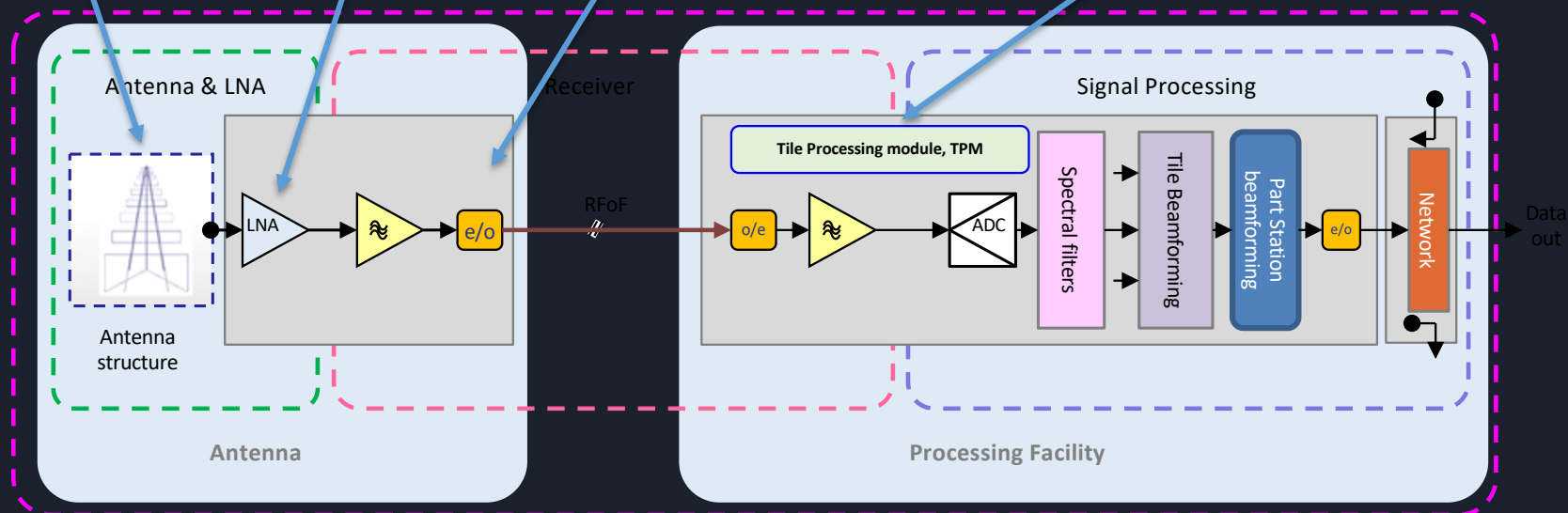
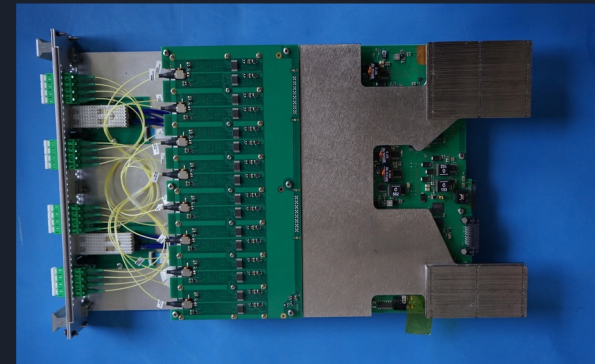
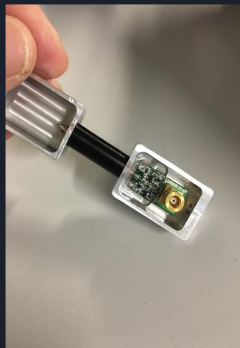
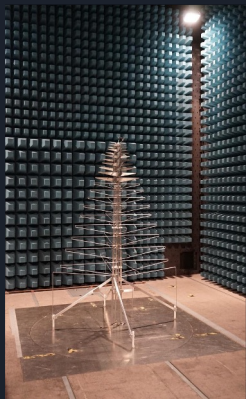




CRISIS

OPPORTUNITY

Receiver Chain Technology





LESSON LEARNED

- Cercare di contestualizzare bene il progetto individuando il dominio di lavoro.
- Navigare la complessità → suddividere il progetto in PI raggiungibili con le risorse a disposizione.
- Investire tempo nell'individuare rischi e mitigazioni nel progetto... saranno sicuramente utili!!
- In caso di imprevisti, un approccio «problem solving» può essere utile.
- Cercare di avere un team che non competa con se stesso.
- Contribuire migliorando il contesto di lavoro cercando di rimuovere impedimenti al team.
- Condivisione del buon lavoro e riconoscere i risultati del team (possibilmente premiandoli per i risultati che vanno oltre al richiesto).
- Non esagerare con l'impegno straordinario ed evitare il burn-out.
- Attuare strategie proattive. Non limitarsi a guardare il presente ma valutare gli scenari futuri.
- Le situazioni di caos e disordine si possono trasformare in opportunità

GRAZIE per l'attenzione



“Sviluppare prototipi è essenzialmente verificare che tutto il sistema funzioni. È un po' come dirigere un'orchestra, invece di suonare i singoli strumenti, è il momento di ascoltare la sinfonia”

Dott. Jader Monari
INAF