

## George Goddard

- 1 A System is a set of components that work together to deliver what the customer requires. on their own the components can't deliver what the customer wants. Inputs are taken and turned into outputs.

Human presses  
button on remote

Input



remote sends signal  
to turn on TV



TV starts  
up



TV shows picture  
and sound

Output  
satisfied  
customer

- 2 Assignable variation is variation in a process that can be detected and dealt with. Such as new process operators or a new batch of material. Chance cause variation can also be predicted however it falls within the tolerances of the process.

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3 Operational requirement - detail essential requirements

Functional - written as noun verb must be clear  
eg cut grass, manoeuvre mower

non functional

implementation, performance and system

|   |                     |      |                                                                               |                                                                                                                   |
|---|---------------------|------|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| 4 | Customer excitement | high | Expressed<br>important requirements<br>the customer tells<br>you. More = good | Delight<br>unspoken requirements.<br>The customer doesn't know<br>they exist or they need them<br>not over design |
|   |                     | low  | Basic<br>unspoken so basic<br>they are often missed<br>need to be captured    | Assumed<br>unspoken can be taken<br>for granted and need<br>to be captured                                        |
|   |                     |      | Low                                                                           | high                                                                                                              |

Customer Satisfaction

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Too Much - Composition is over mixed

Too little - Composition is under mixed

not at all - Composition isn't mixed

intermittent - Composition is intermittently mixed

unintended - composition is mixed when it shouldn't have been

6 A failure mechanism is the physical process that causes failure. For example bending a paper clip multiple times in the same place will cause the metal to fail. The bending is the failure mechanism.

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7 use case - See use case sheet

operational requirement - To safely screen a tank from the enemy for the required time.

Functional flow diagram - See sheet

( Functional FMEA is used to make the system more robust. It does this by identifying additional design features or functionality into the system. FMEA should be done as a group exercise looking at how functions could fail. Looking at failure mode, the effects of failure and the potential causes. This information is put into a table as shown. The severity of failure, occurrence and detection are given a score between 1-10. These numbers are multiplied to give a risk priority number (RPN). The final column of the FMEA is for ideas and suggestions on how to improve the system. The failure modes with high RPN numbers need to be looked at to reduce the chance of failing. Identifying issues at this stage helps ensure the customer is satisfied. Getting this right at the start can stop expensive redesigns at the end.

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# Use Case for L8 smoke grenade

Use Case: A clear verb/noun or actor/verb/noun that communicates the scope of the use Case  
**Use case for 8 smoke grenade**

| Author | Issue - | Reviewed | Date |
|--------|---------|----------|------|
|--------|---------|----------|------|

Actors:-

- The system
- The user
- The manufacturer
- The maintainer

To safely screen a tank from the enemy for

Pre-conditions:-

- The tank is fit for purpose
- The housing has been cleaned
- The grenade has been stored appropriately
- The grenade is loaded correctly
- The user is fully trained or under supervision
- The weather conditions are within the grenades operating tolerance

Post-Conditions:-

- The tank and housing are not damaged
- The user is not hurt
- The tank has been screened

Basic Flow:-

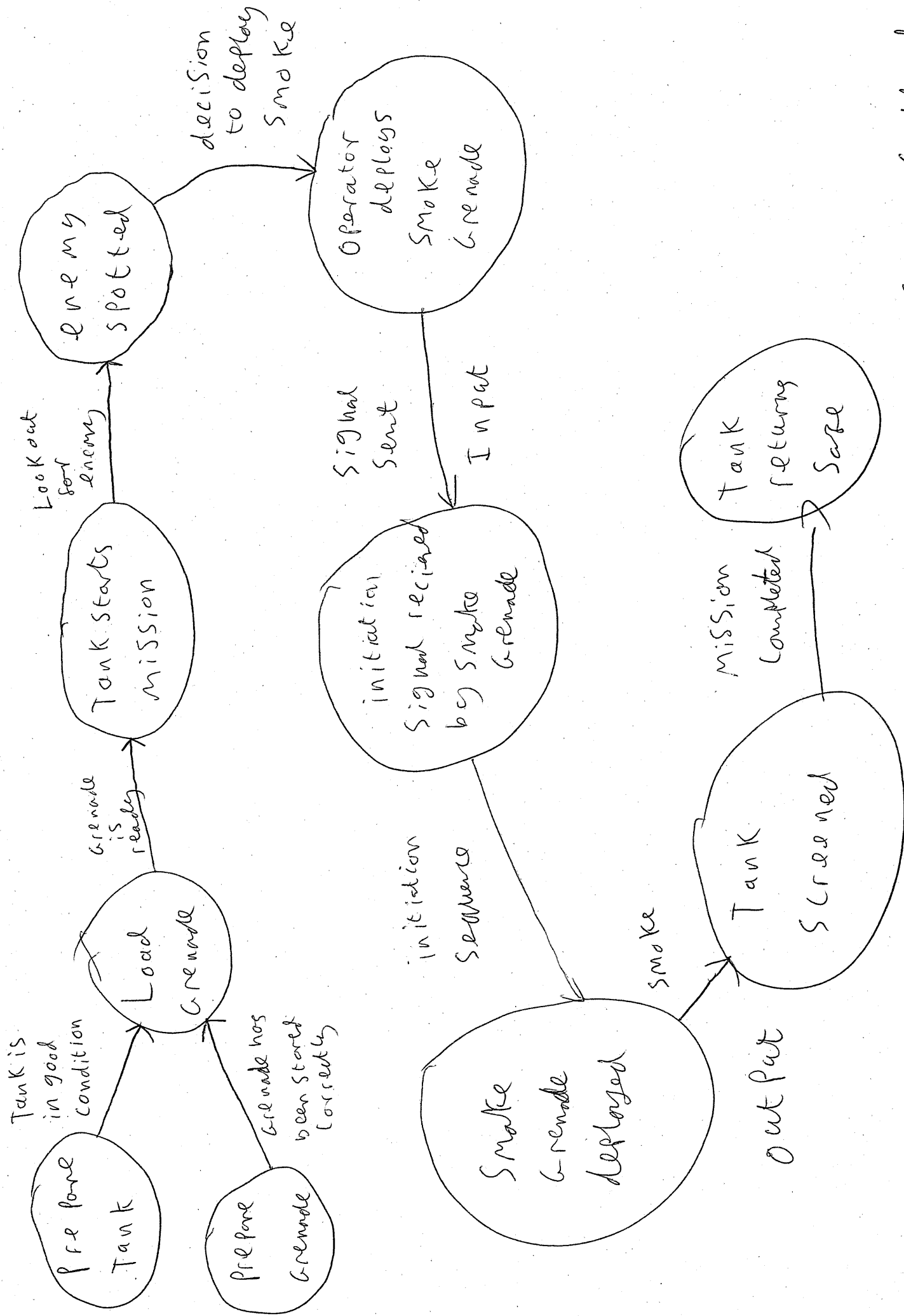
- Load grenade into launcher
- Start tank mission
- Operator launches smoke screen when required
- Tank is screened
- Tank returns undamaged

Alternative Flow:-

- Smoke is deployed at incorrect place
- Smoke is deployed during too much wind

Exception Flow :-

- Smoke not deployed
- Smoke catches fire
- Tank catches fire
- Tank is hit



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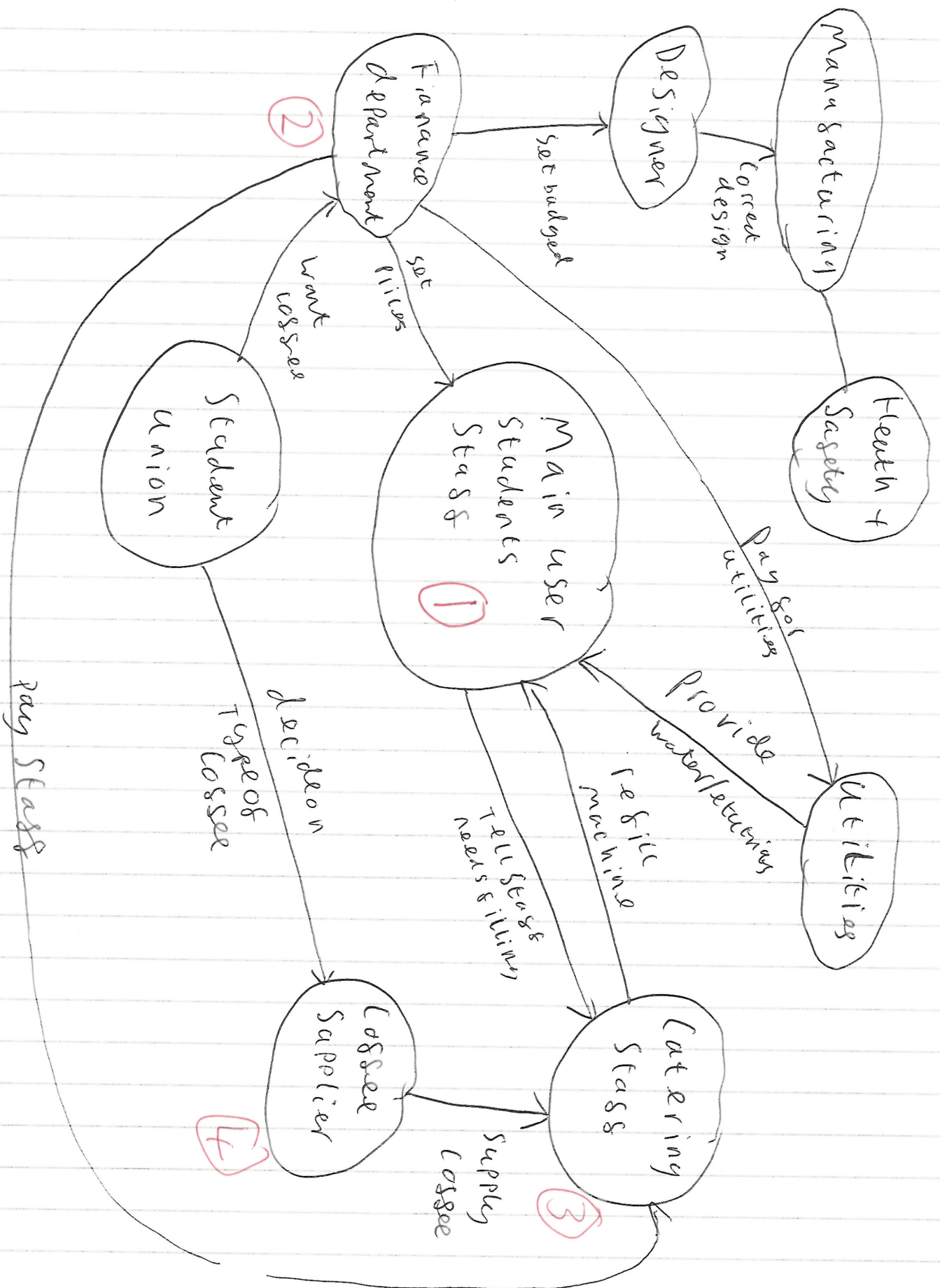
| System effect      | Effect Seen by user | Severity | Cause                                | Mechanism                  | OCC | Detection prevention | Pect | RPN | ideas/suggestions |
|--------------------|---------------------|----------|--------------------------------------|----------------------------|-----|----------------------|------|-----|-------------------|
| Smoke Not deployed | No Smoke            | 9        | Failure of Grenade                   | Assembly error             | 3   | Correct storage      | 6    | 162 |                   |
|                    |                     |          | Signal not sent                      | Tank Firing system failure | 1   | None                 | 7    | 62  |                   |
|                    |                     |          | Grenade not <del>tested</del> loaded | Human error                | 4   | None                 | 2    | 72  | 2 person check    |

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## 9 Rank of stakeholders

- 1 - Students Staff - need coffee to study and teach  
keep people hydrated and awake
- 2 - Finance department - They are important as they  
set the prices, pay utilities and staff and  
set the budget for the new machine
- 3 - Catering Staff. They are needed to keep  
the machine safe and clean
- 4 - Coffee Supplier - without a coffee supplier  
you have no product from the machine

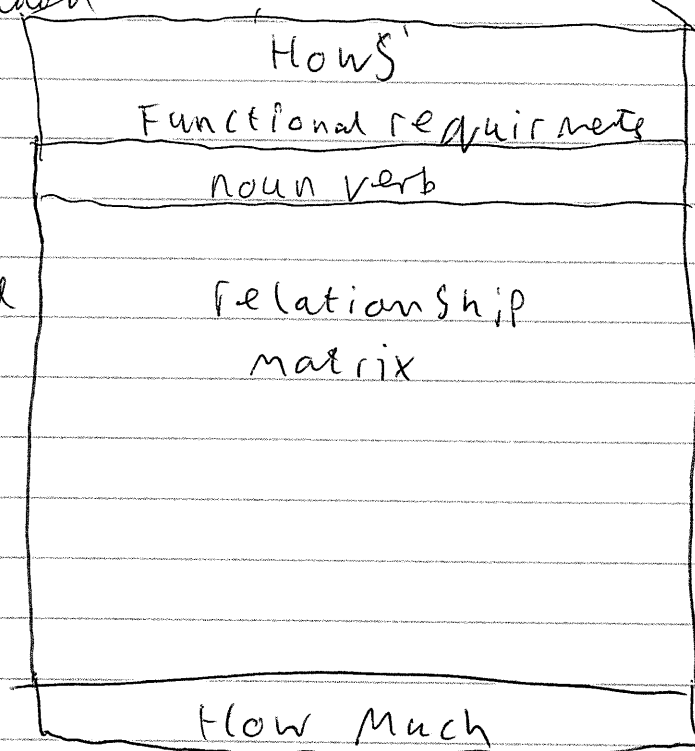
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- 9 QFD is a tool used to organise, capture and manage requirements through the design process. It is a matrix chart that assesses relationships ensuring completeness and consistency. The left column has the 'whats' the non functional system requirements. The top has the 'hows' the functional requirements. The NFR's are given a customer importance, at this stage usually 5. Relationships are then assessed in the matrix with either a 0, 1, 3 or 9 depending on how strong the relationship is. Over full rows are common in QFD. Over full columns show a critical function. QFD helps design the machine by identifying critical relationships. The trials and test program is developed along the bottom of the QFD. Metrics from QFD 1 are used to develop the trials program. The bottom of the QFD shows the how much figures. These figures show the important relationships in the matrix.

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'Whats'  
non functional  
System  
Requirements



target  
values

Trials and test