

# MPF 1993

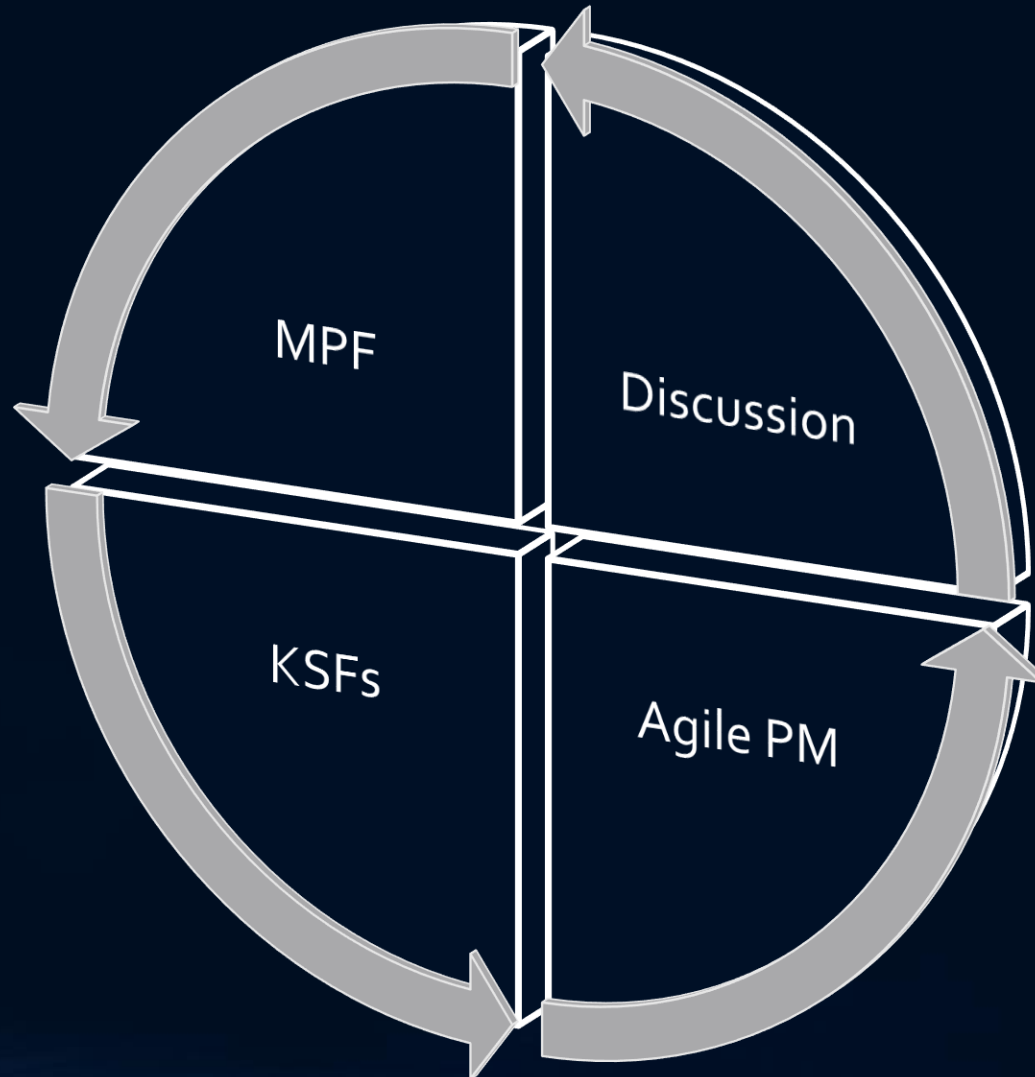
HOW AGILE PROJECT MANAGEMENT SAVED SPACE EXPLORATION

BY JOHN KHATEEB, BSC, PMP®, ACP®, RMP®, SP®

# NASA – Dream, Innovate, Build, Discover.

- <https://youtu.be/WcoiKgTRleA>

# Schedule



# John Khateeb (Homam Al Khateeb)

- Project Management, Agile Practitioner and Business Analyst
- More than 10 years of project management and business analysis experience.
- More than 5 years of training, career coaching and mentoring experience.
- Industries:
  - Animation.
  - Manufacturing.
  - Management Consulting.
  - Software Development.
  - ICT.

# John Khateeb

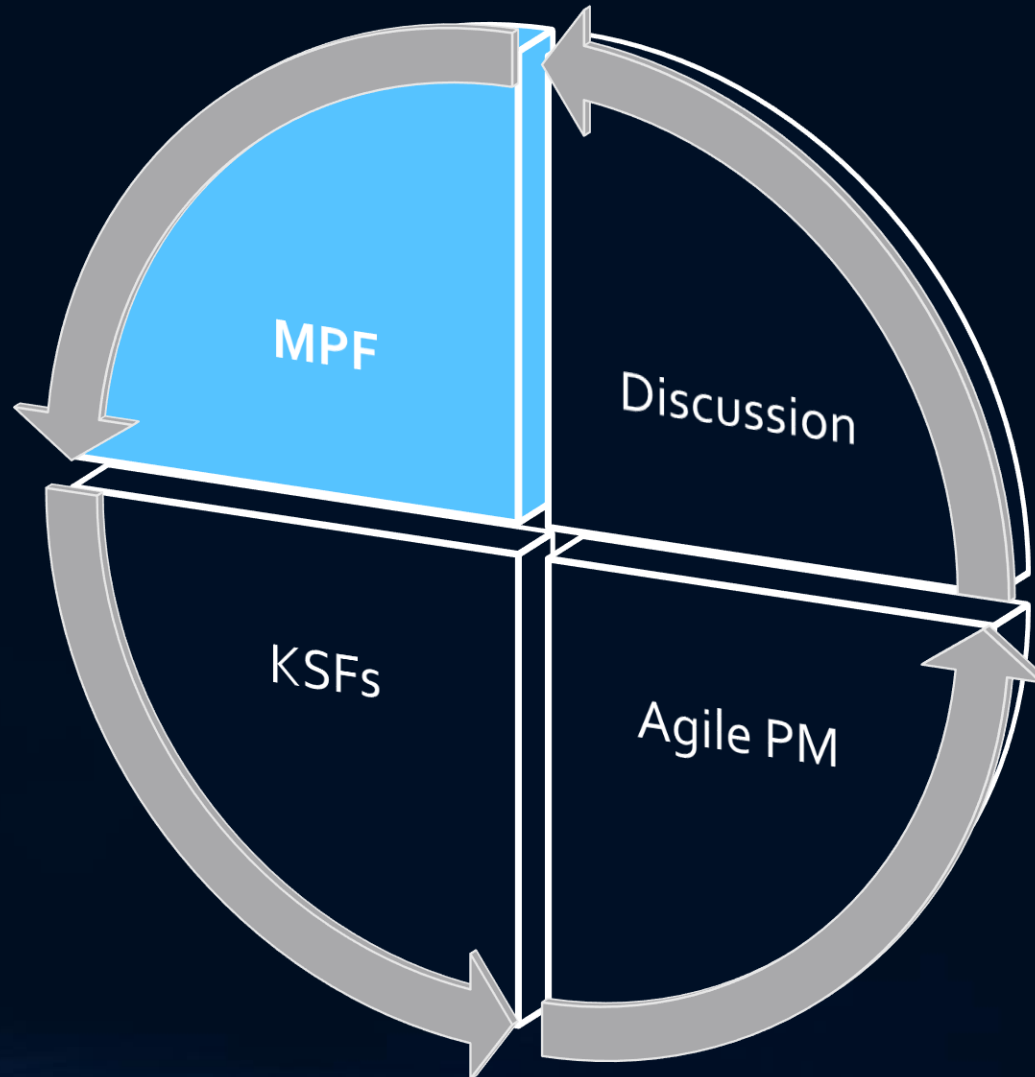
- PMI:
  - The PMBOK 5<sup>th</sup> Edition (English, Arabic).
  - The Standard for Program Management (2<sup>nd</sup>, 4<sup>th</sup> Edition).
  - The Standard for Portfolio Management (3rd Edition).
  - PMI-SP® review panel.
  - Many Online Courses.

# John Khateeb

- Education & Certification:
  - Bachelor Degree in Engineering, Damascus University, Syria.
  - Master of Science in Strategic Planning, Heriot-Wat University, UK, (In Progress).
  - Master of Project Management, UniSA, (In Progress).
  - Project Management Professional, PMI-PMP®.
  - Agile Practitioner, PMI-ACP®.
  - Risk Management Professional, PMI-RMP®.
  - Scheduling Professional, PMI-SP®.
  - Professional in Business Analyst, PMI-PBA® (In Progress).



# Schedule



# The Discovery Program

- The Discovery Program goal is to achieve outstanding results by launching many smaller missions using fewer resources and shorter development times. The main objective is to enhance our understanding of the solar system by exploring the planets, their moons, and small bodies such as comets and asteroids. The program also seeks to improve performance through the use of new technology and broaden university and industry participation in NASA missions.



# MPF 1993

| Domain        | Objectives   |
|---------------|--|
| Technological | New inexpensive system for cruise, entry, descent and landing on Mars. |
| Scientific    | Investigate and study Martian atmosphere, surface and geology.         |

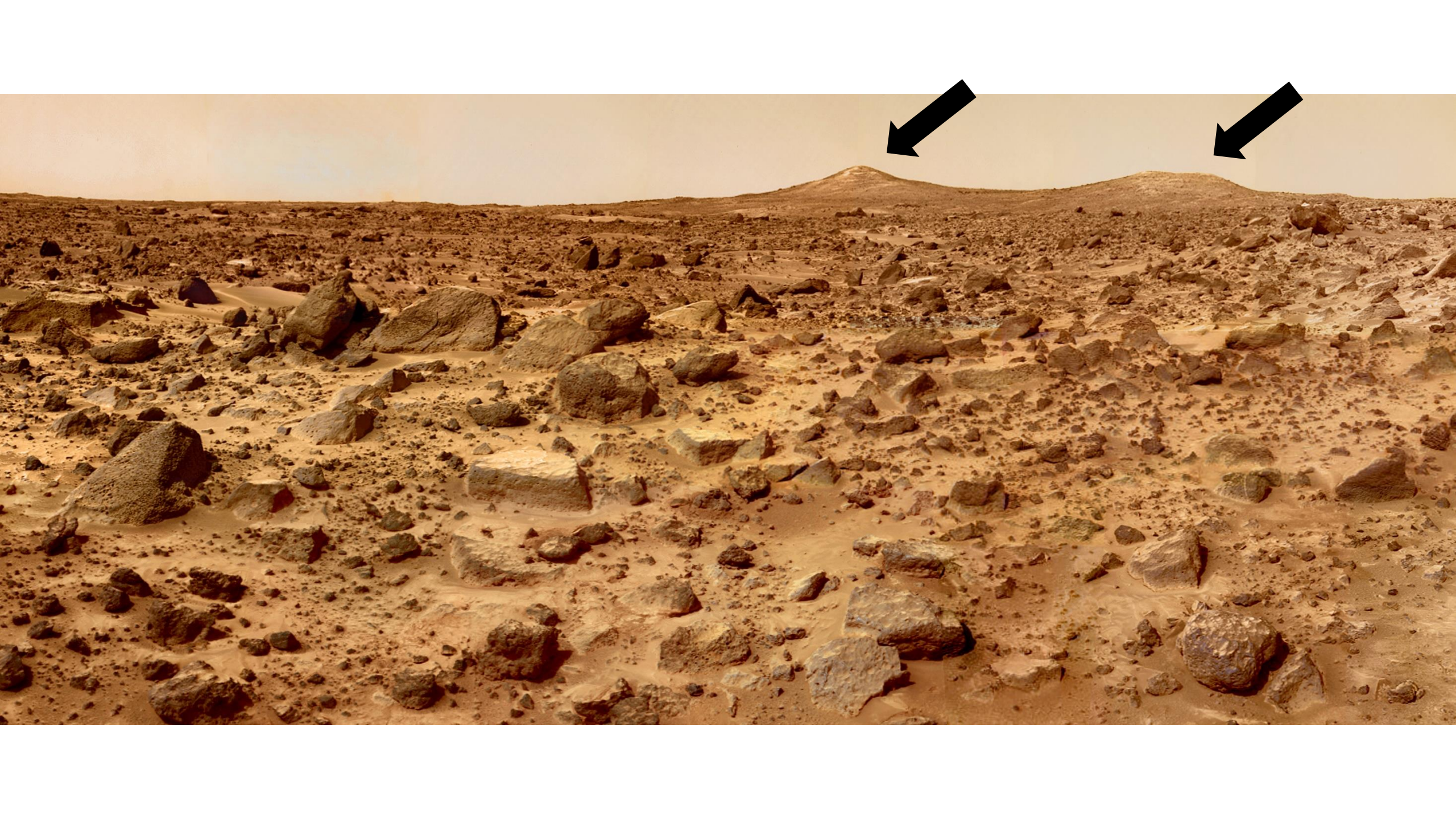
# MPF, 1998 project of the year award

- On 4<sup>th</sup> of July 1997, THE MARS PATHFINDER spacecraft successfully landed on the red planet.
- First spacecraft to visit the red planet since the Viking Missions in 1976.
- The Project of the Year award by the Project Management Institute, PMI® in 1998.

# MPF, 1998 project of the year award

- 2.6 gigabits of science and engineering data.
- Over 16,000 lander camera images.
- 550 rover camera images.
- 8.5 million individual temperature, pressure and wind measurements.
- 16 separate chemical measurements of Martian rocks and soil.
- The Viking missions to Mars had taken six years and a budget of \$1.5 billion (US). In contrast, MPF mission cost was an order of magnitude less than (1/10) and time was cut in half.
- Between 4<sup>th</sup> of July and 27<sup>th</sup> of Sep 2017.







# MPF 1993

| Date         | Milestone  |
|--------------|--|
| April 1993   | Team Assignment to the Project.  |
| October 1993 | Funding approval.  |
| Dec 1993     | "End-to-End" test was conducted, and the signal from Mars to Earth was simulated successfully. |
| Sep 1994     | Frist critical design review.  |
| April 1995   | Landing and entry test conducted.  |
| June 1995    | System assembly begins.  |
| Dec 1996     | Launching.   |
| July 1997    | Entry, landing and signal transmission to Earth.   |
| Sep 1997     | End of Mission.  |

# NASA – Dream, Innovate, Build, Discover.

| Year | NASA Budget \$billion | Total US Fed Spending<br>\$billion | NASA as % of US<br>Spending | President    |
|------|-----------------------|------------------------------------|-----------------------------|--------------|
| 1990 | 12.429                | 1,253                              | 0.99                        | George Bush  |
| 1991 | 13.878                | 1,324                              | 1.05                        | George Bush  |
| 1992 | 13.961                | 1,381                              | 1.01                        | George Bush  |
| 1993 | 14.305                | 1,409                              | 1.01                        | Bill Clinton |
| 1994 | 13.695                | 1,461                              | 0.94                        | Bill Clinton |
| 1995 | 13.378                | 1,515                              | 0.88                        | Bill Clinton |
| 1996 | 13.881                | 1,560                              | 0.89                        | Bill Clinton |
| 1997 | 14.360                | 1,601                              | 0.9                         | Bill Clinton |
| 1998 | 14.194                | 1,652                              | 0.86                        | Bill Clinton |
| 1999 | 13.636                | 1,702                              | 0.8                         | Bill Clinton |
| 2000 | 13.428                | 1,789                              | 0.75                        | Bill Clinton |



# NASA – Dream, Innovate, Build, Discover.

## NASA SPACE BUDGET

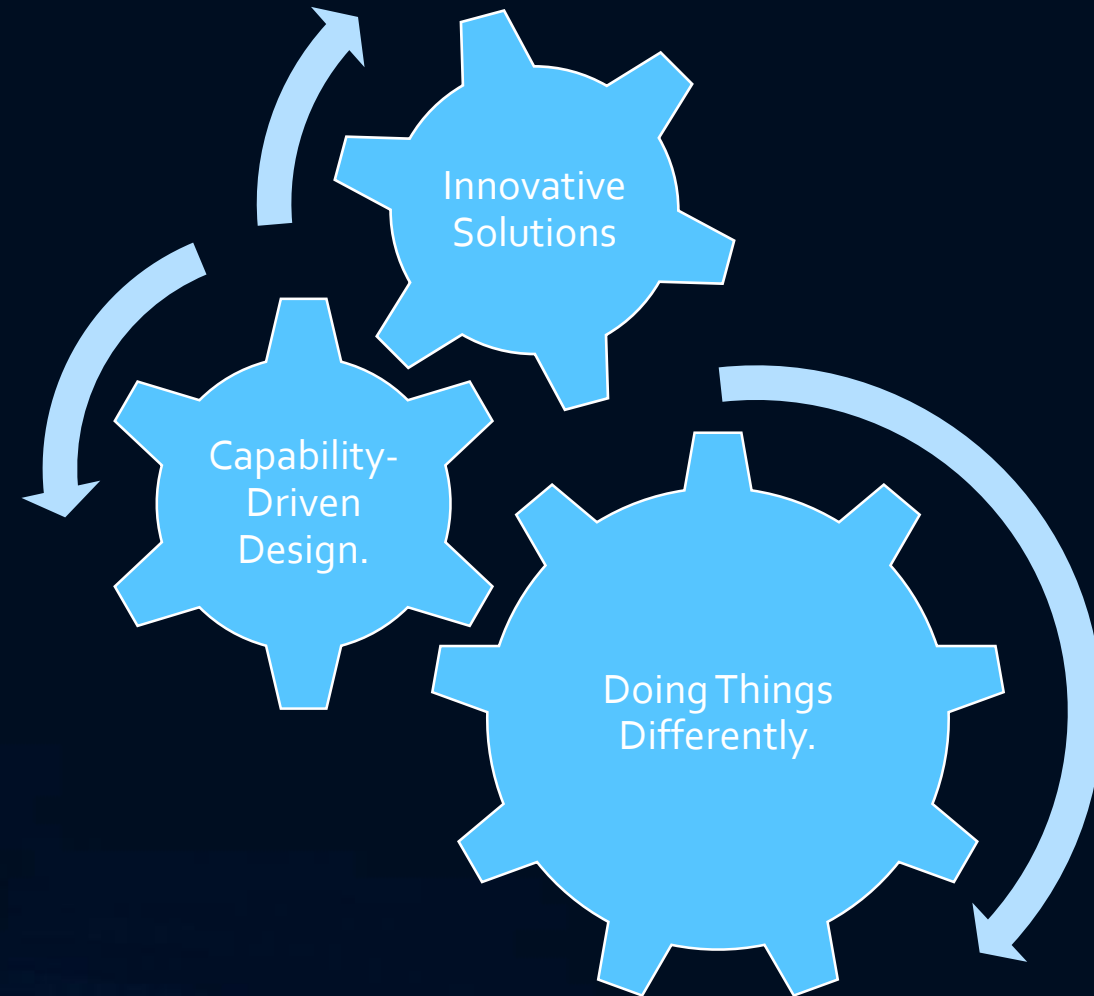
—◆— Total —■— NASA Space



# Faster, Better, Cheaper

- “We have problems that are so unique, no one else in the world is working on them,”
- “There are no consultants that we can hire to solve our problems, so we had to learn to be innovative or we wouldn't get our rocket ships to fly.”

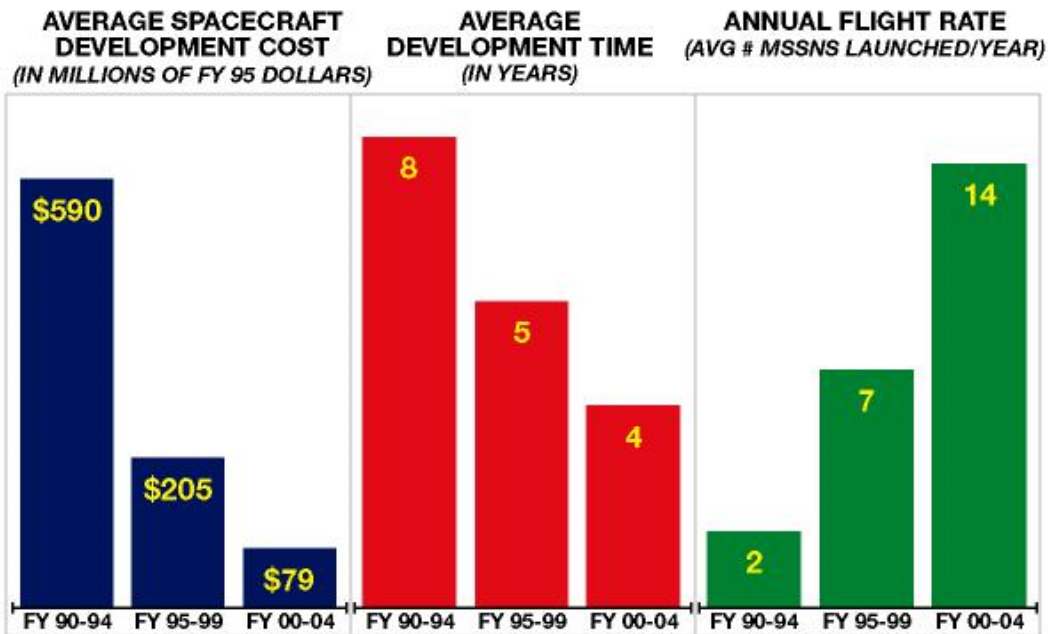
Wayne Hale, deputy associate administrator for strategic partnership at NASA's Space Operations Mission Directorate



# Faster, Better, Cheaper



## TOTAL NASA EARTH AND SPACE SCIENCE FASTER, BETTER, CHEAPER



## NASA Restructuring Progress FY 1993 - FY 2000

### THEN - FY 1993

Civil Serv.: 24,900  
Supv Ratio: 5.4:1  
HQs Staff: 2,200  
\*SSC: 1,344

### DECEMBER 1997

Civil Serv.: 19,187  
Supv Ratio: 9.6:1  
HQs Staff: 1,022  
\*SSC: 610

### FUTURE - FY 2000

Civil Serv.: 17,818  
Supv Ratio: 11:1  
HQs Staff: 954  
\*SSC: 600

23%  
Reduction

7%  
Reduction

### WHAT:

### TOOLS:

## STREAMLINING PLAN

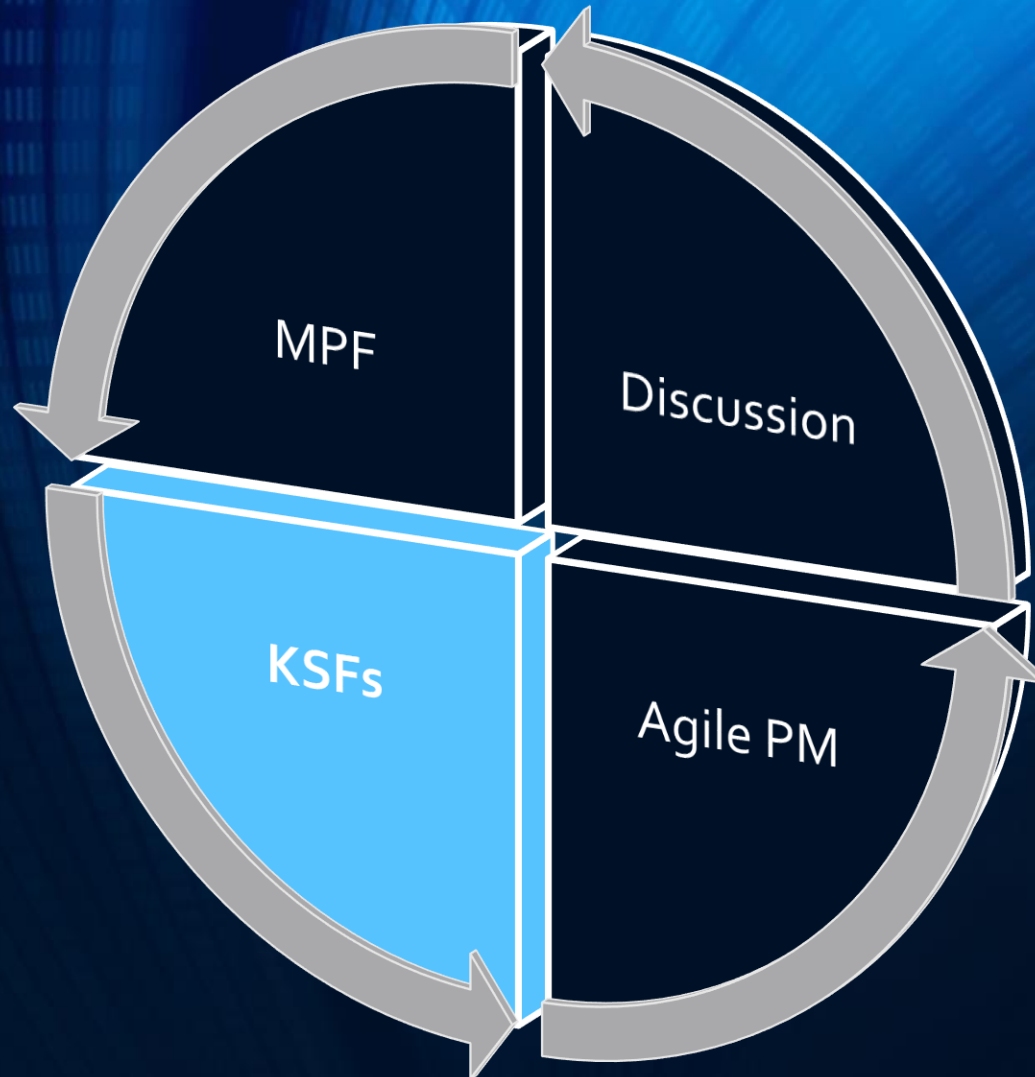
Buyouts;  
Hiring Freeze;  
Restructure;  
Redeployment

Buyouts;  
Consolidation;  
Privatization;  
Outplacement;  
Redeployment;

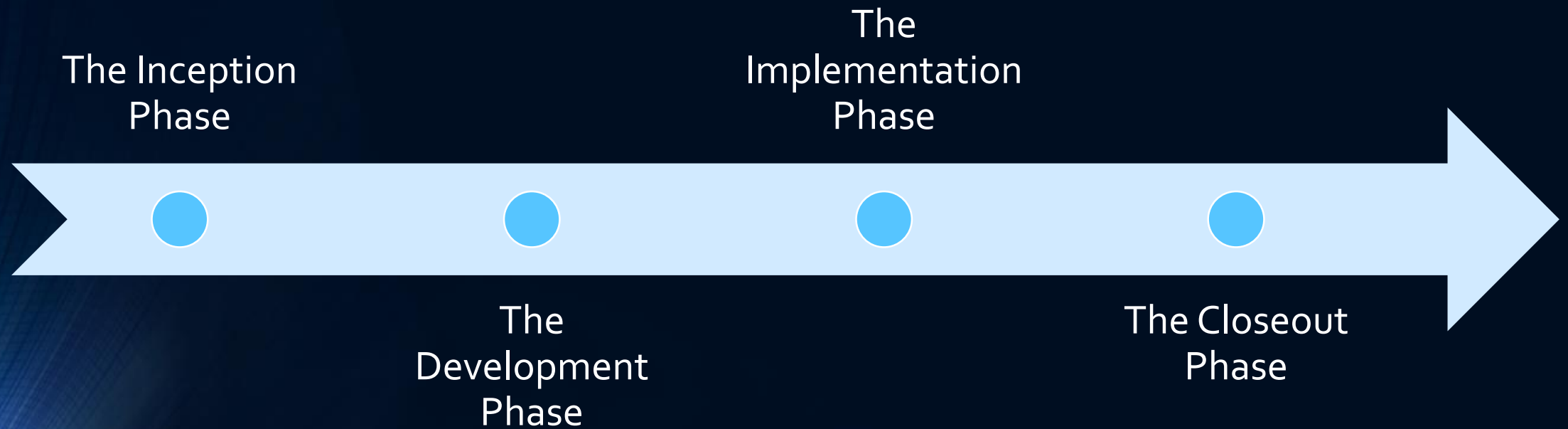
Does not include the NASA Office of Inspector General

Figure 1

# Schedule



# Project Life cycle:





# The Inception Phase

|                  |  |
|------------------|--|
| Scope Management | <ul style="list-style-type: none"><li>• Objectives were clearly defined early in 1992. The project was part of larger frame under NASA Mantra of Faster, Better, Cheaper.</li><li>• Capability-Driven design instead of mission-driven development.</li><li>• The use of existing technologies and off-the-shelf hardware and software components.</li></ul> |
| Time Management  | <ul style="list-style-type: none"><li>• Missions can't exceed the tight schedule of 36 months.</li><li>• Nonnegotiable.</li></ul>  |



# The Inception Phase

|                           |  |
|---------------------------|--|
| Cost Management           | <ul style="list-style-type: none"><li>• Missions can't exceed the tight budget of \$150 million (US).</li><li>• Nonnegotiable.</li></ul>                                   |
| Quality Management        | <ul style="list-style-type: none"><li>• Each member of the team should be personally responsible for quality.</li><li>• Critical success factor.</li></ul>                 |
| Human Resource Management | <ul style="list-style-type: none"><li>• Recruitment took place from internal (JPL) and external resource pool.</li><li>• The best level of expertise was needed.</li></ul> |

# The Inception Phase

|                          |  |
|--------------------------|--|
| Communication Management | <ul style="list-style-type: none"><li>• Team was co-located in one site.</li><li>• An atmosphere of sharing information.</li></ul>   |
| Risk Management          | <ul style="list-style-type: none"><li>• Proactive risk management approach.</li><li>• Cost and schedule constraints.</li></ul>   |
| Procurement Management   | <ul style="list-style-type: none"><li>• Redesigning the procurement processes.</li><li>• Strict systems for controlling, measuring, updating and solving procurement issues.</li><li>• Monthly procurement meeting<br/>“Procurement Planning Summary”.</li></ul> |

# The Development Phase

|                        |   |
|------------------------|---|
| Scope Management       | <ul style="list-style-type: none"><li>• <b>Single String Design: Using only one of everything wherever possible.</b></li><li>• <b>Scenario Planning and ongoing testing.</b></li></ul>  |
| Time & Cost Management | <ul style="list-style-type: none"><li>• Product-oriented work breakdown structure (PBS).</li><li>• Three year schedule.</li><li>• \$131 million (US) development baseline, \$25 million (US) reserve.</li><li>• Due to the orbital relationship between Earth and Mars, there was a 30 days window for launching.</li></ul> |

# The Development Phase

|   |  |
|---|--|
| <b>Procurement&amp; Risk Management</b> | <ul style="list-style-type: none"><li>• 70% of the major procurements were contracted under a fixed-priced contract.</li><li>• Creating a long-term vendor relationship.</li><li>• Developing partnership in the process of developing a cutting-edge technology.</li><li>• Sharing risks.</li></ul> |
| Quality Management                      | <ul style="list-style-type: none"><li>• Thousands of simulations were performed.</li><li>• Mechanical integration and environmental testing started early in the project.</li><li>• Repeating cycles of design, build, test, detect errors, correct, modify and start again.</li></ul>               |

# The Development Phase

|                                  |   |
|----------------------------------|---|
| <b>Human Resource Management</b> | <ul style="list-style-type: none"><li>• Empower the team.</li><li>• Challenge the traditional hierarchical structure.</li></ul> |
|----------------------------------|---|

# The Development Phase

<https://youtu.be/-TWabN3qVjo>



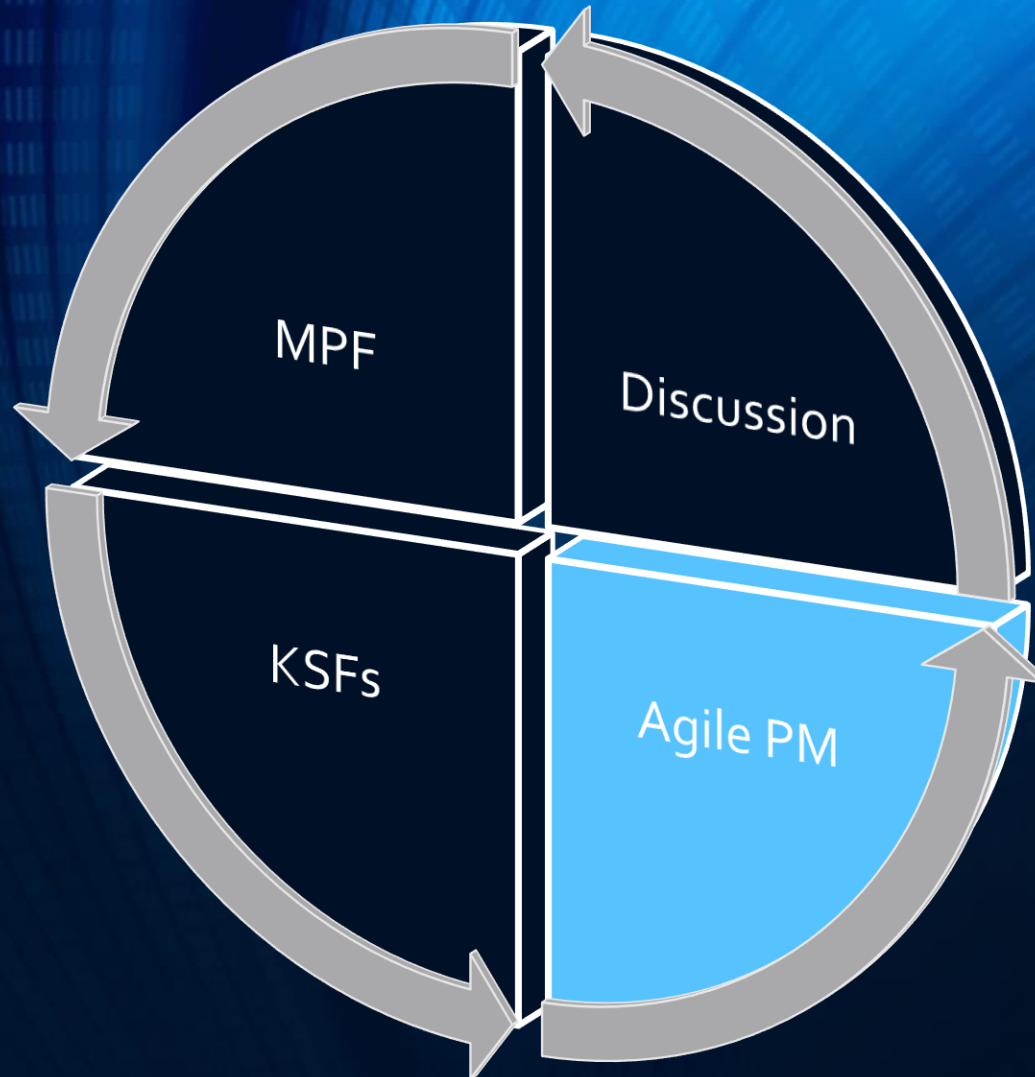
# The Implementation Phase

|                        |   |
|------------------------|---|
| Integration Management | <ul style="list-style-type: none"><li>• Progressive elaboration.</li><li>• Meet tactical deliverables that supports the strategic goal.</li><li>• Team leaders ensured that processes are in place, and everyone is focused on Faster, Better, Cheaper mentality.</li></ul> |
| Quality Management     | <ul style="list-style-type: none"><li>• More than 100 peer-review were conducted.</li><li>• Open discussions and</li></ul>  |

# The Implementation Phase

|  |   |
|--|---|
| <b>Conflict<br/>Management and<br/>Problem Solving</b> | <ul style="list-style-type: none"><li>• <b>Communication and team leadership.</b></li></ul> |
|--|---|

# Schedule



# Agile Project Management

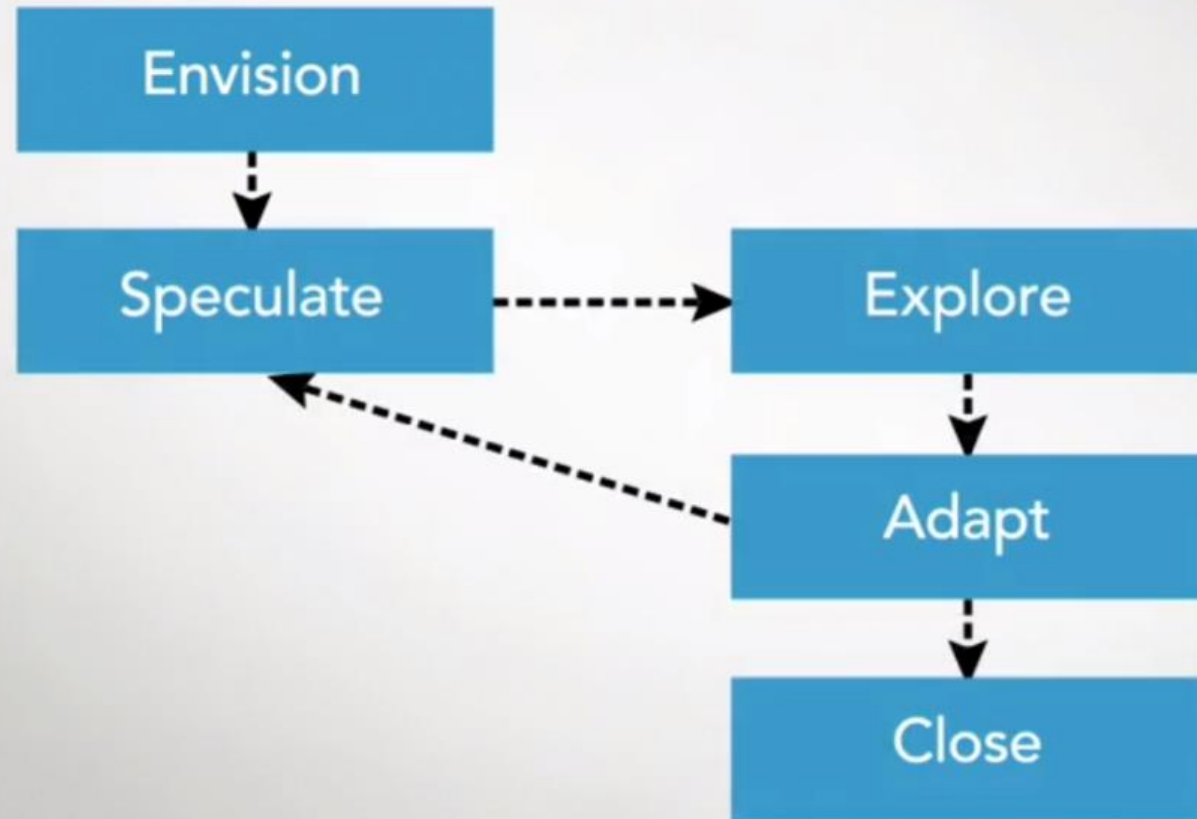
- Agile project management is the approach by which projects are planned and executed by small chunk of work, and it focus on delivering value to the sponsoring organisation through continuous and early delivery.
- With Agile projects, outcomes are created by a small logical chunks of work named iteration or sprints.
- The ultimate purpose is to receive product benefits earlier.

# Agile Project Management

| <b>Metric</b>        | <b>Waterfall</b> | <b>Agile</b> |
|----------------------|------------------|--------------|
| Planning             | Long-term        | Short-term   |
| Customer             | Contract         | Relationship |
| Time to deliver      | Long             | Short        |
| Focus                | Specification    | Value        |
| Responding to Change | Low              | High         |
| Problem Solving      | Slow             | Fast         |

# Agile Project Management

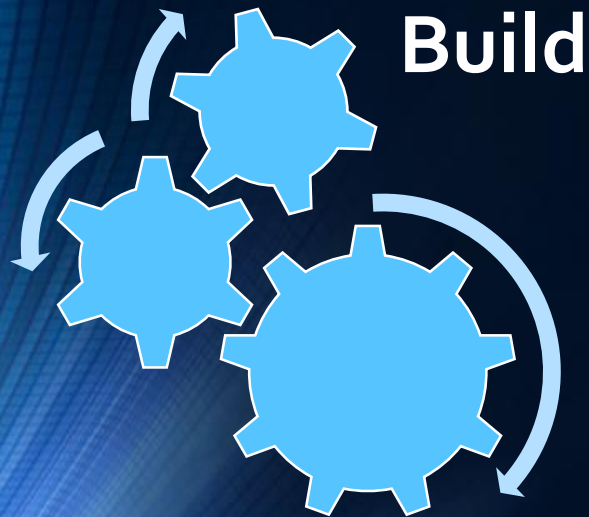
## Stages





# Agile Project Management

**Envision**



**Build**

**Team**



**Norms**



**Project Charter**

- **Scope.**
- **Objectives.**
- **Stakeholders.**

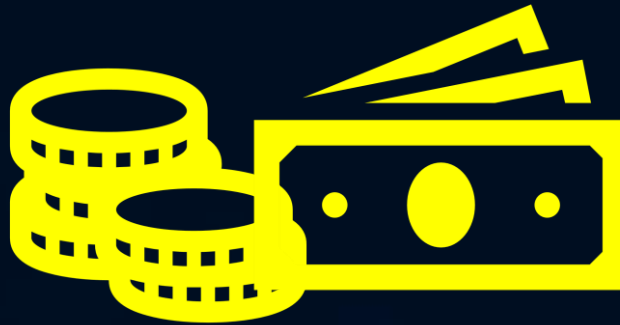
# Agile Project Management

**Speculate (Plan)**

**Feature  
Based  
Plan**



**Estimate**



**Risks**



# Agile Project Management

**Explore (Execute)**

**Peer-reviews**



**Daily Stand UP**



# Agile Project Management

**Adopt**

**Frequent Feedback**



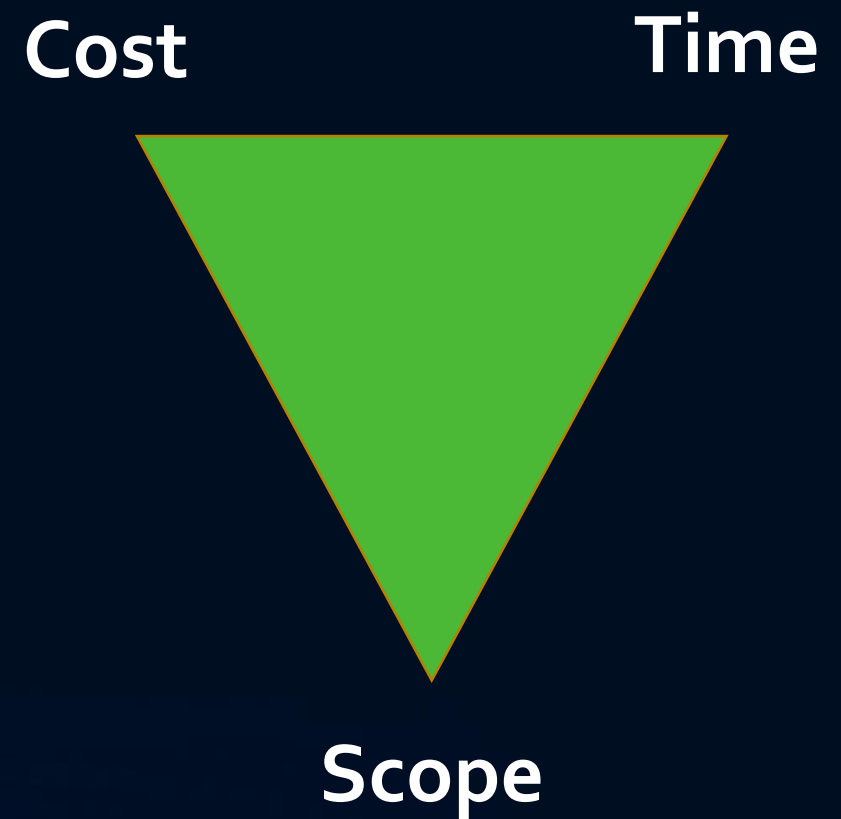
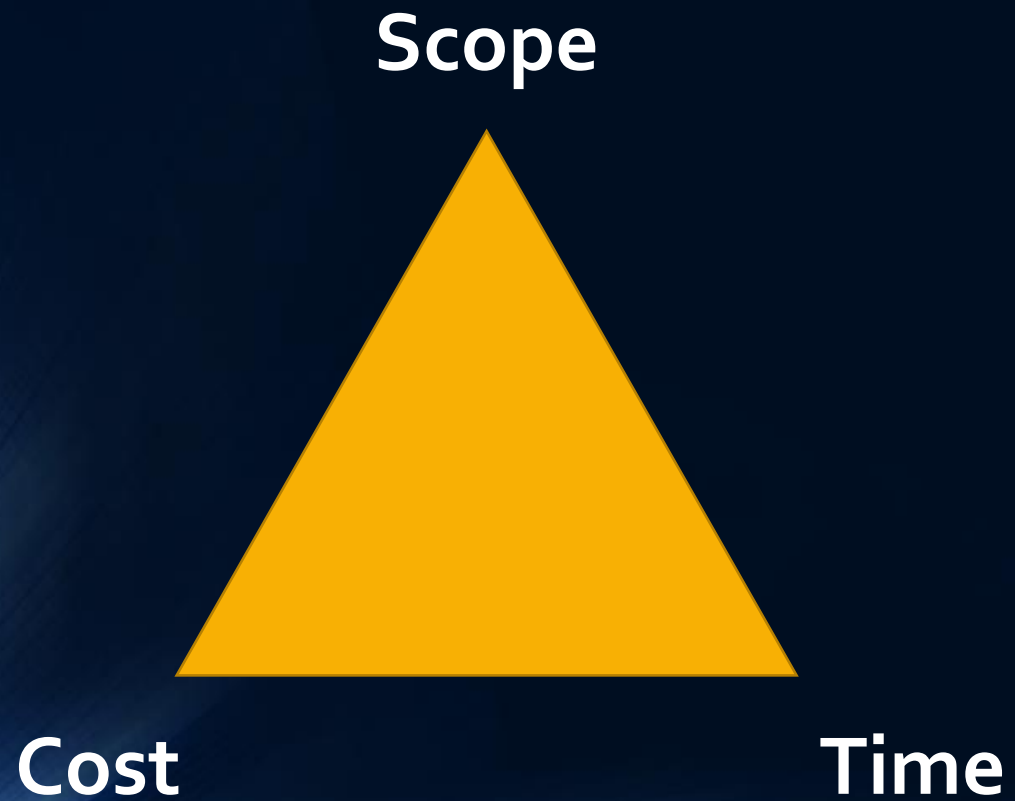
**Lesson learned**



**Documentation**



# The Paradigm Shift





# Agile Manifesto

- We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:
  1. **Individuals and interactions** over processes and tools.
  2. **Working software** over comprehensive documentation.
  3. **Customer collaboration** over contract negotiation.
  4. **Responding to change** over following a plan.

# KSFs

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## Do things differently.

Scope can be adjusted to meet objectives and performance in other areas.

Individuals were empowered to perform the job.

Servant Leadership.

Teams were co-located in one site.

## Empirical processes.

Capability-driven design.

Product oriented breakdown structure.

Early and frequent testing.

Value driven.

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# KSFs

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## Stand-up discussions and Procurement review documents.

Transparency at work, open and honest communication environment.

Information radiation

Prototype, simulation and demonstration.

Doing the right things

## Osmotic communication

Self-organised and directed team to accelerate delivery.

People over processes

Knowledge sharing

Vendor management and stakeholder engagement

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Thank You!

