



**Carnegie Mellon**  
**Software Engineering Institute**

---

Pittsburgh, PA 15213-3890

# Programming Can Be Fun

Watts S. Humphrey  
Software Engineering Institute  
Carnegie Mellon University  
Pittsburgh, PA 15213-3890

**Sponsored by the U.S. Department of Defense**  
**© 2005 by Carnegie Mellon University**



**Carnegie Mellon**  
**Software Engineering Institute**

# What Makes Work Fun?

Challenge: interest and excitement

Ownership: responsibility and autonomy

Commitment: a motivated and cohesive team

Winning: consistent success



**Carnegie Mellon  
Software Engineering Institute**

# Work Can Be Fun: Challenge



Challenge

Ownership

Commitment

Winning



# The Submarine *Scorpion* -1

May 1968: *Scorpion*  
was lost at sea.

Navy knew its last  
reported location.

Vague idea of

- heading
- speed
- problem



Problem: Loaded with nuclear missiles and secret gear.

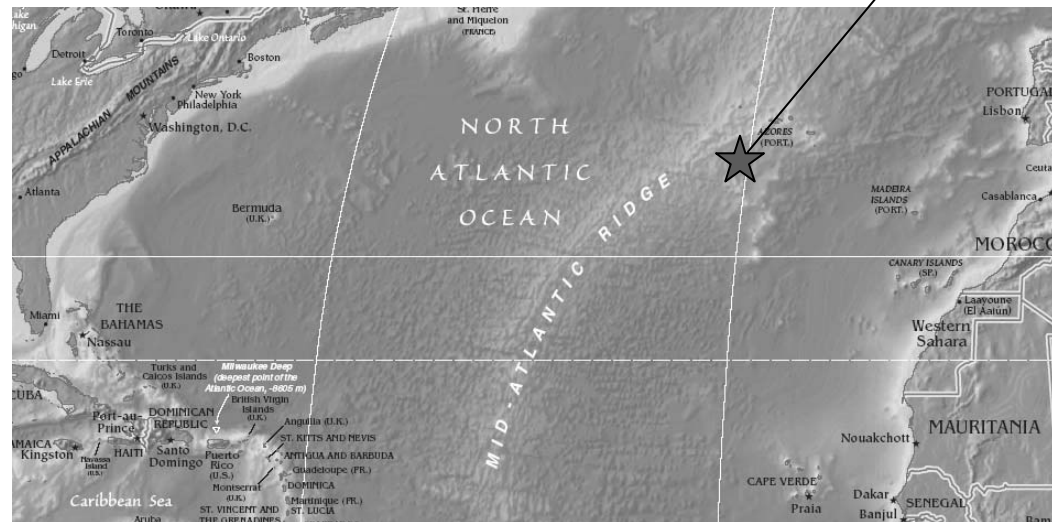


# The Submarine *Scorpion* -2

500 square miles of deep ocean

Where to start?

Last known location





**Carnegie Mellon**  
**Software Engineering Institute**

# The Submarine *Scorpion* -3

Group of specialists

- submariners, mathematicians
- submarine specialists, salvage experts
- others

Mathematical model



**Carnegie Mellon**  
**Software Engineering Institute**

# The Submarine *Scorpion* -4

Model parameters

- when the sub ran into trouble
- how fast it was going
- its heading
- its rate of descent when sinking
- many other parameters

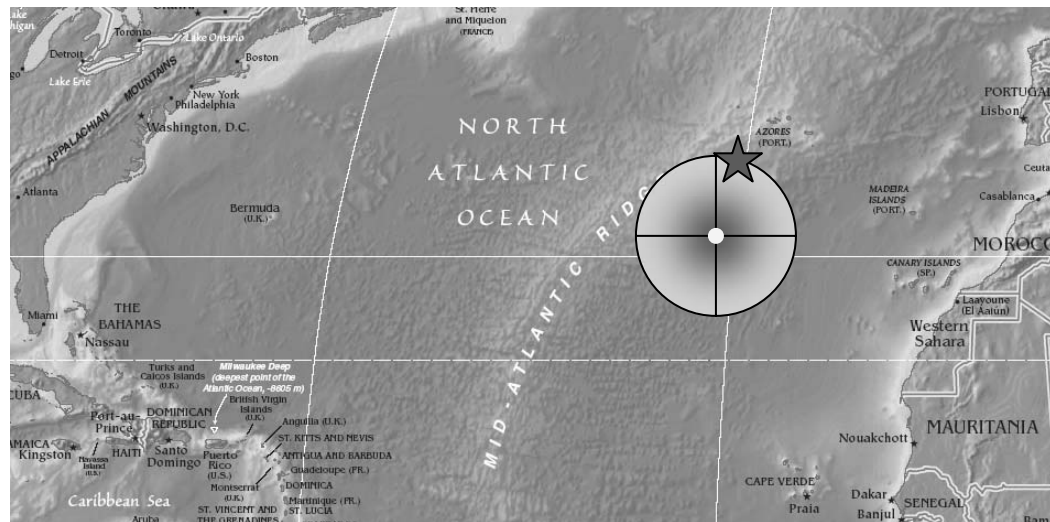


**Carnegie Mellon**  
**Software Engineering Institute**

# The Submarine *Scorpion* -5

Specialists made judgments and ran the model.

Navy salvage vessel found wreckage 220 yards away.





**Carnegie Mellon**  
**Software Engineering Institute**

# What Made This Team Successful?

Expert knowledge

Mix of disciplines

Effective leadership



# Is That Enough?

Lots of teams have

- experts
- multiple disciplines
- leadership

Since many of these teams still fail, this must not be enough.

What is missing?



**Carnegie Mellon**  
**Software Engineering Institute**

# The Problem

Ever been on a team where you are told how to do the job?

You don't own the job, it owns you.

Such jobs no fun.

They often fail.



**Carnegie Mellon  
Software Engineering Institute**

# Work Can Be Fun: Ownership

Challenge



Ownership

Commitment

Winning



**Carnegie Mellon**  
**Software Engineering Institute**

# The Meeting



November 20, 1963

- Vin Learson, Senior VP for Marketing and Engineering
- Frank Carey, President, IBM Marketing Division
- George Kennard, President, IBM System Development Division
- Watts Humphrey, Engineering Manager, Advanced Systems Marketing



**Carnegie Mellon**  
**Software Engineering Institute**

# The FAA Proposal

U.S. en-route air traffic control computer system

Due January 1, 1964

Largest contract in IBM history: \$100 million

Design issues





**Carnegie Mellon  
Software Engineering Institute**

# The Team

Clear goal

Ran our own show

Settled issues openly

Management trusted us





**Carnegie Mellon**  
**Software Engineering Institute**

# The Best Jobs

Important, high-pressure, and exhausting

Memorable and rewarding

A great team

Fun



**Carnegie Mellon  
Software Engineering Institute**

# The FAA Contract



Forty years later, an enhanced version still controls U.S. airspace.



**Carnegie Mellon  
Software Engineering Institute**

# What Made This Team Successful?

Expert knowledge – again

We ran the job

Management trusted us



# Is That Enough?

Other teams have

- experts
- multiple disciplines
- leadership
- ownership
- trust

Since some of these teams still fail, this must not be enough.

What is missing?



# The Problem

Ever work on a job where you must meet an arbitrary and unrealistic schedule?

You start out in trouble and generally end up in trouble.

Such jobs usually fail.



**Carnegie Mellon  
Software Engineering Institute**

# Work Can Be Fun: Commitment

Challenge

Ownership



**Commitment**

Winning



**Carnegie Mellon**  
**Software Engineering Institute**

# A War Story -1

IBM: new line of computers

- hardware being delivered
- software schedules slipped three times
- director of software was fired
- the teams had no plans



**Carnegie Mellon**  
**Software Engineering Institute**

## **A War Story -2**

I got the job to lead the software group.

My software group had:

- 4,000 people
- 15 laboratories
- 6 countries



**Carnegie Mellon**  
**Software Engineering Institute**

## **A War Story -3**

Needed realistic commitments

- teams made own plans
- I reviewed all plans

It worked.

Met all dates for 2½ years.



**Carnegie Mellon**  
**Software Engineering Institute**

# What Made This Team Successful?

Expert knowledge – again

Teams made their own plans

Defended these plans

The teams were publicly committed



# Is That Enough?

Other teams have

- experts
- multiple disciplines
- leadership
- ownership
- trust
- public commitment

Since some of these teams still fail, this must not be enough.

What is missing?



**Carnegie Mellon**  
**Software Engineering Institute**

# The Problem

Even with the best designs and plans, you can still fail.

While committed teams can often do extraordinary work, teamwork is not magic.

If you don't use sound methods, you are likely to fail.



**Carnegie Mellon  
Software Engineering Institute**

# **Work Can Be Fun: Winning**

Challenge

Ownership

Commitment

**➔** Winning



# Vicarious Visions -1

The electronic game industry is a good example of modern software challenges.

Game developers contract with game distributors.

Game distributors provide two kinds of payment.

- progress payments for development
- royalties for game sales



## Vicarious Visions -2

Because new games are often late and defective, distributors have tough contracts.

Penalty provisions

- Late deliveries incur penalties
- Royalty cut for every defect



For their new Spiderman game, Vicarious Visions used the Team Software Process.<sup>SM</sup>

<sup>SM</sup> Team Software Process and TSP are service marks of Carnegie Mellon University.



# Vicarious Visions TSP Results

	<u>Spiderman</u>	<u>Typical</u>
Delivery date	On schedule	On schedule
Functionality	Planned	Reduced
System test defects	12	30 to 60
Acceptance test defects	8	30 to 60
Post-delivery defects	0	Some





# What Made This Team Special?

This team had

- experts
- leadership
- ownership
- trust
- commitment

In addition, they knew how to

- consistently meet commitments
- routinely produce quality products



# Team Practices

The members of this team

- used a defined and measured process
- planned and tracked their work
- measured and managed product quality

This enabled them to consistently

- meet commitments
- deliver quality products



**Carnegie Mellon**  
**Software Engineering Institute**

# Management Trust -1

To earn and retain management trust, teams must

- make responsible commitments
- regularly report status
- do what they say they will do
- deliver quality products



**Carnegie Mellon**  
**Software Engineering Institute**

## Management Trust -2

With management's trust, teams can

- make their own plans
- manage their own work

Then, if they do quality work, the job will be fun.



**Carnegie Mellon  
Software Engineering Institute**

# **PSP<sup>SM</sup> and TSP**

The Personal Software Process (PSP) applies scientific principles to a developer's personal work.

The Team Software Process (TSP) applies these scientific principles to development teamwork.

While the PSP concepts are simple, they are not easy.

The problem is consistently working the way we know we should.

**SM**

**PSP and Personal Software Process are service marks of Carnegie Mellon University.**



# PSP and TSP Success

Thousands of developers have been PSP-trained

PSP and TSP show developers how to

- measure their work
- plan and track their projects
- deliver quality products

Self-directed TSP teams

- share common goals
- define their own processes and plans
- run their own show
- consistently meet their commitments



**Carnegie Mellon  
Software Engineering Institute**

# TSP Users

Some of the organizations using the TSP include

ABB	Lockheed
AIS	Microsoft
Bechtel	NASA Langley
Census Bureau	Raytheon
DFAS	Samsung
EDS-SDRC	Teradyne
Erickson	TI
Honeywell	USAF: Hill AFB
IBM Japan	USN: NAVAIR
Intuit	Xerox



# Adoption

Organizations using, piloting, or preparing to pilot the TSP.

ABB  
ABC Informatica  
Advanced Information Services  
Advanced Maturity Services, Inc.  
Alan S. Koch Consultants  
Ambient Consulting  
**AMCOM\***  
Boeing  
Centre De Investigacion En  
Matamaticas  
**Census Bureau\***  
CQG, Inc.  
CRSIP / STSC / DRAPER  
Davis Systems  
DOE / Los Alamos  
DOE / Naval Reactors  
DPC Cirrus  
Dynamics Research Corp.  
EDS  
Halex Associates  
Heath Solutions, Inc.  
**Helsana\***

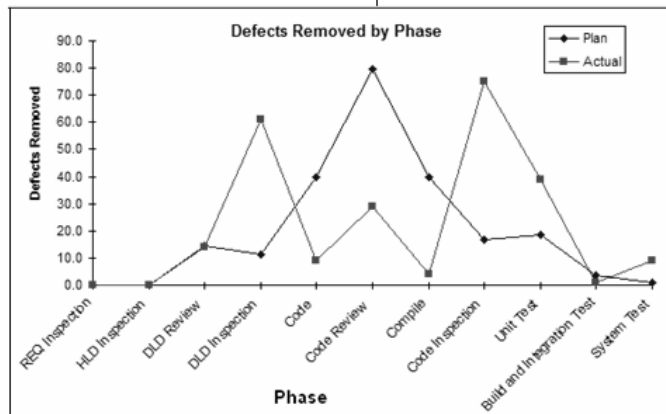
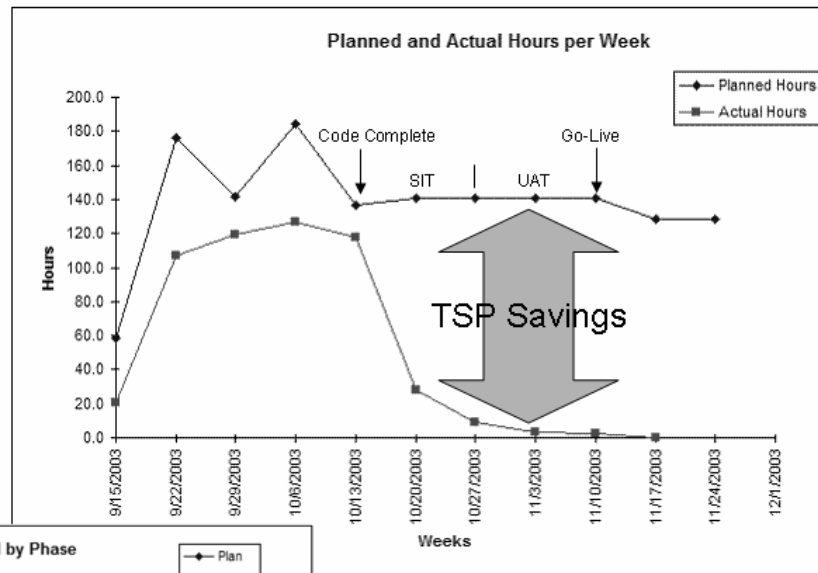
Honeywell  
IBM  
**Intuit\***  
Iomega  
I.Q. Inc.  
KPMG  
L. G. Electronics  
Lockheed Martin  
LogiCare  
Los Alamos National Laboratory  
M/A-Com Private Radio Systems, Inc.  
Microsoft  
Motiva  
NASA Langley  
NAVAIR  
**Naval Reactors\***  
**NAVOCEANO\***  
NUWC  
NCR/Teradata  
NCS Pearson  
Northern Horizons  
Northrop Grumman

NSWC / Keyport  
Prodigia S.A. de C.V.  
PS&J Consulting - Software Six  
Sigma  
QuarkSoft  
Respironics  
Rockwell Collins  
SAIC  
Samsung SDS  
Siberlink  
STPP, Inc.  
STSC  
Trilogy  
TYBRIN Corporation - Air Logistics  
University of Alabama / Huntsville  
University of Queensland  
**Vicarious Visions\***  
Xerox

**\*Organizations we are currently  
working with**



# TSP Productivity Gains



**4,255 New & Change LOC**

Defect Density

4 bugs in SIT	0.94 defects/KLOC
1 bug in UAT	0.23 defects/KLOC
0 bugs RTC	0



# Developers Like the TSP

“This really feels like a tight team.”

“Design time is way up but code time decreased to compensate.”

“Tracking your time is an eye opener.”

“Really good teamwork on this project.”

“I’m more productive.”

“Team really came together to make the plan.”

“I feel included and empowered.”



# Conclusions

For a job to be fun

- Managers must trust the developers.
- The developers must be worthy of that trust.
- They must use scientifically based development methods.

Programming is then fun.



**Carnegie Mellon  
Software Engineering Institute**

## **For More Information**

**Visit the PSP or TSP Web sites**

<http://www.sei.cmu.edu/tsp/psp.html>

**Contact SEI customer relations**

Software Engineering Institute, Carnegie Mellon  
University, 4500 Fifth Ave., Pittsburgh, PA 15213  
Phone, voice mail, and on-demand FAX: 412/268-5800  
E-mail: [customer-relations@sei.cmu.edu](mailto:customer-relations@sei.cmu.edu)

**See the books**

*Winning With Software: An Executive Strategy*, by  
Watts Humphrey, Addison-Wesley, 2002

*PSP: A Self-Improvement Process for Software  
Engineers*, by Watts Humphrey, Addison-Wesley, 2005