

## Ethics in Software Development

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  - You are Paul's peer...
  - Paul is *your* boss...



## Chemical Company: What If...

- Employee "Paul Lotion" is ordering his subordinates to illegally dump chemical sludge in a nearby stream.
  - You are Paul's boss...
  - You are Paul's peer...
  - Paul is your boss...
  - Paul owns the company!



## Topics & Tasks

- ↳ **Characterizing ethical concerns**
  - Historical examples of "whistle-blowing"
  - The software development process
  - A personal experience
  - Recognizing and surviving trouble
  - Conclusions

## Individual Ethics

- **Examples**
  - Software piracy
  - Incomplete testing
  - Blatant falsifications
  - Embezzlement



## Individual Ethics

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- **Motivation & Characterization**
  - Concrete and clear motivations
  - Easily characterized



## Group/Organization Ethics

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- **Examples**
  - Poor development practices
  - Deliberate obsolescence
  - Deliberate monopolization
  - Informal cooperative agreements



## Group/Organization Ethics

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- **Motivation & Characterization**
  - Difficult to characterize or recognize
  - Complex multiple motivations



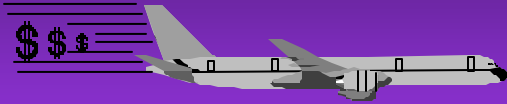
## Topics & Tasks

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- Characterizing ethical concerns
- ➔ **Historical examples of "whistle-blowing"**
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## Budget Over-runs

- **1968, Ernie Fitzgerald**
  - Told Congress that the Pentagon's C-5A transport plane was two billion dollars over budget. (One of the most famous whistle-blowing cases.)



*"committing the truth"*

## War-Related Sickness

- **1977, Maude DeVictor**
  - First called attention to ill effects of "Agent Orange", fought for VA recognition



## MV-22 Osprey

- **January 12, 2001**
  - Anonymous letter and audio tape to Secretary of the Navy accuses Lt. Col. Odin Fred Leberman of instructing subordinates to falsify Osprey maintenance records.
  - Quoted as saying "The reason we need to lie or overstate the facts is because you want to call it, is that this program is a success." [CNN]
- **One week later (approx.)**
  - CNN reports that Leberman admits to his superiors that he asked for maintenance records to be falsified to make the reliability of the controversial aircraft look better than it really is.
- **January 24**
  - Under pressure from Congress the Marine Corps turned over its investigation to the Pentagon's inspector general.

## How NOT to Draw Attention

- **1979, Bill Kuykendall**
  - Sabotage to raise awareness
  - The big story?
    - » Bill and co-worker were convicted and sent to prison for their actions



## "True" Stories as Entertainment

- **A Civil Action (book and movie)**

- 1970's, Woburn, MA, concentration of Lukemia
- Update
  - » Little is known about Lukemia causes in general
  - » EPA unable to blame contaminated water
  - » 20 years of legislation & safeguards
- January 31, 2001
  - » New lawsuit against WR Grace concerning asbestos-contaminated vermiculite ore mining conducted over 60 years in Montana mine



John Travolta and Robert Duvall

- **The Insider (movie)**

- Struggle to publicize the truth
  - » Jeffrey Wigand, former tobacco executive
  - » Lowell Bergman, Producer "60 Minutes" (CBS)
- Addictive nature of tobacco
  - » Conceal awareness, increase addiction



Al Pacino and Russell Crowe

## Topics & Tasks

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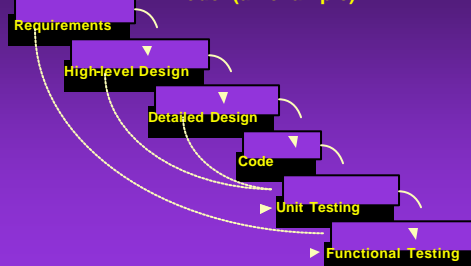
## Software Development

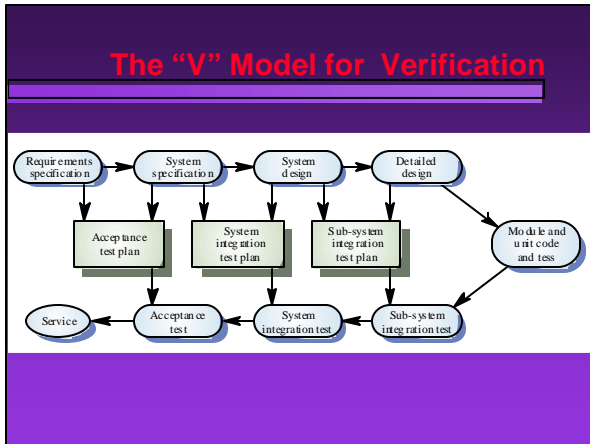
- **Formal Method**

- "A focused, prescribed series of operations that generate a well-defined engineering product."
- **Not** a substitute for knowing *what* to build (requirements) or knowing *how* to build it (design, implementation)

## Software Development

- **The "Waterfall" model (an example)**





### The Toaster Project

- **Requirements (system)**
  - Must have two-slice capacity
  - Must be adjustable from LIGHT to DARK
  - Opening must accommodate bagels

### The Toaster Project

- **High-level Design (system)**
  - Software for toasting
    - » User interface
    - » Control
    - » Satellite communication
  - Satellite dish for software updates
  - Large cooking unit

### The Toaster Project

- **Detailed Design (software)**
  - User interface
    - » Graphical user interface
    - » Low-level input
  - Control
    - » Temperature
    - » Darkness
  - Satellite communication
    - » Satellite handshaking
    - » Downlink
    - » Performance uplink

## The Toaster Project

- **Code & Unit Testing**

- Garth Guidoer
  - » User interface



- CathyCodesalot
  - » Control

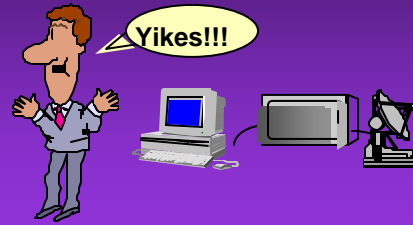


- Marvin Meanswell
  - » Satellite communication



## The Toaster Project

- **Delivery (system)**



## What Went Wrong?

- **Documentation**

- Not an afterthought—should be an integral part of all design phases (early)
- Serves to identify misunderstandings, confirm requirements, and temper unrealistic expectations

- **Checks & Balances**

- Documentation reviews
- Independent testing and oversight
- Customer involvement throughout

## Therac-25 (Lessons)

- **Computer accidents are seldom simple**

- Complex interactions between people and machines
- How many computers to turn on a light bulb?

- **“Single bug” fixes usually not sufficient**

- **Many contributions to problem**

- Management inadequacies
- Lack of procedures for problem tracking
- Over-confidence in the software
- Removal of hardware interlocks
- Poor software engineering practices



## Oversight and Standards

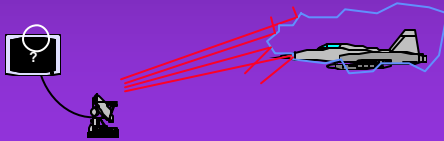
- **Overly strict standards can inhibit progress**
- **Delicate balance**
  - Public interests must be represented, as they may tend to be subsumed by corporate desires for profit, *however...*
  - Standards and regulations can undesirably lull people into thinking that legal and moral responsibility is fulfilled if such standards are followed
- **Alaskan Air accident**
  - Early knowledge and procedures

## Topics & Tasks

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- ➔ **A personal experience**
- Recognizing and surviving trouble
- Conclusions

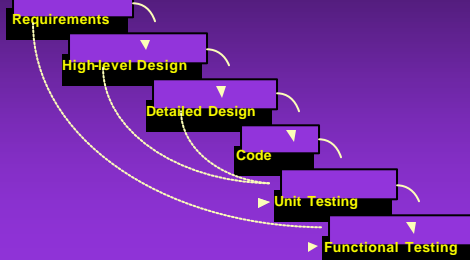
## A Personal Experience

- **The product**
  - "Radar jammer" (hardware & software) for USAF jet fighter
- **My role**
  - Senior Software Engineer
    - › Threat Acquisition
    - › Receiver-Transmitter Compatibility

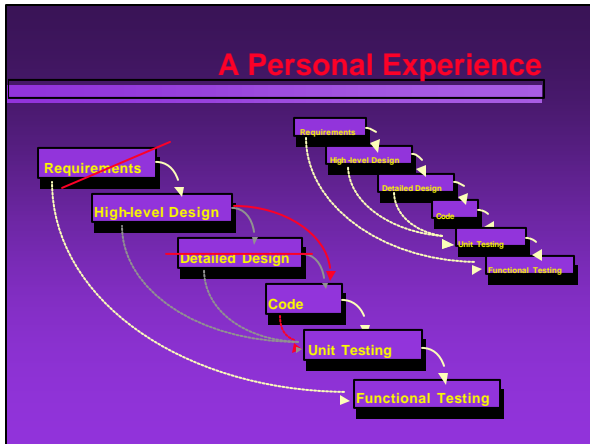


## Software Development (Review)

- **The "Waterfall" model (an example)**







- ### A Personal Experience
- **What was wrong?**
    - Procedures (DOD) not closely followed
    - Requirements not well documented
    - Costly down-stream errors
    - Ineffective testing procedures
  - **Initial reaction**
    - Disbelief
    - Attempts to rationalize methods
    - Confusion about what was required

- ### A Personal Experience
- **Initial actions**
    - Quiet discussions with co-workers
    - Research DOD specifications and contracts
    - Memos, diary, weekly reports
    - Meetings with management
  - **Long-term actions**
    - The Project on Government Oversight
    - Avoiding martyrdom...
    - GAO Report, November 1994
      - › “Electronic Warfare: Most Air Force ALQ-135 Jammers Procured Without Operational Testing”
      - › <http://www.fas.org/man/gao/gao9547.htm>

- ### Topics & Tasks
- Characterizing ethical concerns
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  - A personal experience
  - ➔ **Recognizing and surviving trouble**
  - **Conclusions**

## Recognizing Trouble

- **What to look for, how to recognize**
  - Gut feelings
  - Contradictory instructions
  - Co-worker concurrence (carefull!)
- **Most people go-along to get-along**
  - “Don’t rock the boat”



## What to Do

- **Caution**
  - Prevent harm but preserve your career
- **Establish a clear technical case**
  - Do your homework!
  - Maintain a diary
  - Remain open to other views
- **Is it important enough?**
  - Loss of \$ versus loss of life
- **Remain professional**
- **Act ASAP**



## Where to Turn

- **Management**
  - Low-level first, hopefully last
  - Be clever, e.g. try disguising concerns as suggestions for improvements
  - Use diplomacy
- **Intra-company organization**
  - Hotlines
  - Anonymous vs. open (less common)

## Where to Turn

- **Independent (external) organizations**
  - The Project on Government Oversight
  - The Government Accountability Project
  - Private (non-profit) organizations
  - Inspectors General



## Where to Turn

- **The customer**
  - Extreme caution
  - Seek legal counsel
- **The news media**
  - Last resort (usually)
  - Work in cooperation with an independent external organization, and legal counsel



## Resignation

- **Making an exit vs. a statement**
- **Making a statement**
  - Public resignation says you are serious
  - Can disarm accusations of disloyalty
  - Resigning is better than being fired
- **However...**
  - Loss of control and observability
  - Degradation of right to dissent from within
  - Loss of pension, etc.

## Concluding Remarks

- **Form good habits early—bad habits can be a slippery-slope, leading to gray and eventually dark behavior**
- **Failure to act may haunt you later**



## Quotes

"...The men who create power make an indispensable contribution to the nation's greatness, but the men who question power make a contribution just as indispensable...for they determine whether we use power or power uses us." (John F. Kennedy)

"I don't want yesmen around me. I want people who tell the truth even though it costs them their jobs." (Samuel Goldwyn)

## Quotes

"The large organization wants its people to be ferocious competitors outside and docile followers inside." (anonymous)

"The nail that sticks up will be hammered down." (Japanese)

## WWW Sites

- **The Government Accountability Project**
  - [www.whistleblower.org](http://www.whistleblower.org)
- **The Project on Government Oversight**
  - [www.pogo.org](http://www.pogo.org)

## WWW Sites

- **ACM**
  - Code of Ethics and Professional Conduct
    - » [www.acm.org/constitution/bylaw15.html](http://www.acm.org/constitution/bylaw15.html)
- **IEEE**
  - Software Engineering Code of Ethics
    - » [www.ieee.org/committee/ethics/#Code](http://www.ieee.org/committee/ethics/#Code)
  - Guidelines for Engineers Dissenting on Ethical Grounds
    - » [www.ieee.org/committee/ethics/eth\\_guid.html](http://www.ieee.org/committee/ethics/eth_guid.html)

## WWW Sites

- **Courage Without Martyrdom: A Survival Guide for Whistleblowers**
  - Julie Stewart, Thomas Devine, and Dina Rasor
    - <http://www.whistleblower.org/www/Tips.htm>
- **A Civil Action UPDATE**
  - Chemical Manufacturers Association
    - W. R. Grace, "Beyond A Civil Update"
      - » [www.civil-action.com/](http://www.civil-action.com/)

## WWW Sites

- **Veteran Whistleblowers Advise...**
  - [http://www.the-scientist.library.upenn.edu/yr1995/may/prof\\_950515.html](http://www.the-scientist.library.upenn.edu/yr1995/may/prof_950515.html)
- **Other**
  - <http://trufax.org/research/dissent.html>
  - <http://www.disgruntled.com/linkswistle.html>

## References Books & Movies

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  - Kevin W. Bowyer, IEEE Press
    - » [www.computer.org/cspress/CATALOG/bp07130.htm](http://www.computer.org/cspress/CATALOG/bp07130.htm)
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- ***A Civil Action***
  - Book: Jonathan Harr
  - Movie with John Travolta and Robert Duvall
    - » <http://movies.go.com/civilaction/>
    - <http://www.geology.ohio-state.edu/courtroom/images.htm>
- ***The Insider***
  - Movie with Al Pacino and Russell Crowe
    - » [http://movies.go.com/insider/index\\_flash.html](http://movies.go.com/insider/index_flash.html)

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