Lessons Learned – When Good Projects Go Bad

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The Top 10 Benefits of Planning in Project Management

(With apologies to David Letterman)

10. Clear Objective
    Knowing what you’re aiming for creates the likelihood of reaching the destination. Without a clear objective, your project is doomed to fail. It will be difficult to determine milestones and even more difficult to prioritize tasks.

9. Risk Assessment
    Know what rocks the snakes are under. Careful project planning includes performing an assessment of risk. By knowing what's at stake, you can avoid being bitten.

8. Milestones
    You will be more likely to hit the important milestones because you have them scheduled and planned out. Missed milestones or forgotten steps can mean lost time – lots of lost time. Lost time equals lost money. Plan your milestones, determine how much time they require and schedule accordingly.

7. Resource Allocation
    You will know which resources have already been allocated and be able to plan accordingly. Already allocated or over allocated resources can cause major project stalling. Avoid having your project come to a standstill by planning ahead of time.
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6. Task Dependencies
   You will know what tasks have dependencies and be able to schedule accordingly. Not knowing tasks means you do not know task dependencies. Not being aware of task dependencies leads you to a surprise traffic jam when it comes to getting things done.

5. Communication
   Planning facilitates communication. Your team cannot know what needs to be done if it’s not written down. Moreover, important tasks and milestones will be missed and expectations will not be clear. Make things easy for your team.

4. Avoid Scope Creep
   You can help thwart overtime. Without proper planning, your schedule will creep to a standstill and overtime will be imminent when the team has to scramble to get things finished for a client on time.

3. The Bottom Line
   Your boss will appreciate that you have planned your project. Not only will he be aware of what the project consists of, precisely, but he will also know what your budget is, which resources you require, and when he can expect deliverables to be produced.
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2. Client Appreciation
   Your client will appreciate it. The client can be kept abreast of what to expect and when. He will recognize and appreciate your organization. He will know he is getting his money’s worth.

And the Number One Reason to Plan your Project:

1. Your team will know what’s going on and what is expected of them. With clear objectives, scheduled milestones and a detailed task list, there should be no confusion about who is to do what, why, where and when.
1. Poor Team Construction

Shelly heads a team of five people. Because there are two other company projects with higher priority, staff is limited. Mr. Owner assigns Shelly three rookie resources and two veteran resources have volunteered to take on some of her project tasks. The two veteran resources are primarily working on other projects. After a significant amount of time, only one team member has completed any of their tasks accurately or on time. The two who are involved in other projects have not completed any tasks. One of the remaining team members has done work, but not accurately. The final resource moves slowly. Her project appears to have run stagnant.

One way to avoid this problem is by executing effective team communication. There are many ways to do this: hold a daily Scrum, require weekly status reports, or utilize one of the many project management programs available. The more obvious way to avoid this problem is by building an effective team. Things to keep in mind while team building include: employee skill, experience, participation ability, the projects they are already working on (to avoid overallocation), and morale. Newer resources should be paired with mentors.
2. Unrealistic Scheduling

PM Andy is dismayed when he finds out that his team is weeks behind on a project that needs to be completed yesterday. His client convinced him to push the due date up by three months. His team currently works overtime at least three times a week to push forward on the new, hastened, deadline. Numerous absences and mistakes plague Andy’s project. Finally, the client drops his company and decides to go in a different direction.

Because Andy was flexible about deadlines and allowed the client to negotiate timing on the project, his project failed. With projects, it is important to set a realistic schedule and to stick with it. By overworking his resources, they burned out and stress caused health problems.
3. Unclear or Understated Objectives

PM Jill finds that she is completely disappointed with the outcome of her latest software project. Her team members produced a deliverable that did not stand up to the standards she had in mind. The graphics lacked quality, and the game’s storyline fell flat. When she tells the team she had hoped for something better, they shrug and say, “We just did what you told us to do.”

Had Jill clearly outlined the objectives for the software project, she would have received the quality she desired. Concrete, clear goal planning in project management cannot be emphasized enough. Without clear goals, a project will surely fail – and if it doesn’t fail, it will fall short of expectations.

By being aware of where projects fail, project managers can better use project management strategy to overcome these failures. Through using careful planning techniques, risk can be minimized.
In June 1997, Electronic Data Systems and SHL Systemhouse started work on a Canadian national firearm registration system. The original plan was for a small IT project that would cost taxpayers only $2 million – $119 million for implementation which was to be offset by $117 million in licensing fees.

But then politics got in the way. Pressure from the gun lobby and other interest groups resulted in more than 1,000 change orders in just the first two years. The changes involved having to interface with the computer systems of more than 50 agencies and since that integration wasn't part of the original contract, the government had to pay for all the extra work. By 2001, the costs had ballooned to $688 million, including $300 million for support.

But that wasn't the worst part. By 2001, the annual maintenance costs alone were running $75 million a year. A 2002 audit estimated that the program would wind up costing more than $1 billion by 2004 while generating revenue of only $140 million, giving rise to its nickname: "the billion-dollar boondoggle."

**The Lesson Learned:** Define your project scope and freeze specifications before the requests for changes get out of hand. Learn the how to control scope creep by utilizing change management.
Report: FBI wasted millions on 'Virtual Case File'

FBI Director Robert Mueller promised a Senate panel late Thursday that he will decide within two months whether to scrap special computer software for FBI agents after a report sharply criticized the program. Whatever his decision, Mueller told senators he believes FBI agents will have the software they need within one year. Facing unusual grilling by previously supportive senators -- armed with the report by the Justice Department's inspector general -- Mueller vowed to inform the lawmakers "two months from today" on whether any portion of the $170 million Virtual Case File (VCF) software program can be salvaged.

He also promised to tell them at that time how much additional money would be needed to complete the project. Mueller testified that if a current test shows the project has to be scrapped, he estimates the loss to taxpayers at $104 million. "I do not take that lightly," Mueller said. "I am tremendously disheartened." The computer program was aimed at providing field agents with an efficient tool to quickly organize, analyze and communicate data on criminal and terrorism cases.

But the much-anticipated 81-page report by Inspector General Glenn Fine indicated the project was on the verge of being a complete loss. "After more than three years and $170 million expected to be spent developing the Virtual Case File, the FBI has not provided a clear timetable or prospect for completing the VCF," the report said. "In the interim, the critical need to replace the FBI's obsolete case management system remains," concludes the 81-page report.

The FBI had recently admitted the Virtual Case File technology, which had been delivered by contractor Science Applications International Corp. (SAIC), had failed to meet the bureau's requirements and that much of the time and effort invested had been lost. Mueller said the FBI and the contractor shared the blame. Lawmakers and the contractor agreed that the intense pressure to get a product out to FBI agents following the terrorist attacks of September 11, 2001, contributed to the problem.

"This was both SAIC and the FBI all going to the sounds of the gun with our heads down on a very ambitious, high risk, highly concurrent project," SAIC Executive Vice President Arnold Punaro told reporters. Punaro will testify before the Senate panel at a later date. The FBI has established a short-term project in its New Orleans office to determine whether any portion of the VCF project can be salvaged. In the meantime, the FBI is continuing to explore with outside consultants the prospecting of purchasing commercially available off-the-shelf software.

Lessons Learned for the costly problems: the change in the FBI's prime mission from criminal investigations to preventing terrorism, poor management decisions early in the project, and inadequate oversight for the continuing costly problems. The FBI's much-documented technology shortcomings have been viewed by FBI executives, lawmakers, and outside experts as a critical problem since the attacks. Critics say the FBI fails to analyze and communicate counterterrorism data efficiently.
Horror Story #3

• In 1993, FoxMeyer Drugs was the fourth largest distributor of pharmaceuticals in the U.S., worth $5 billion. In an attempt to increase efficiency, FoxMeyer purchased an SAP system and a warehouse automation system and then hired Andersen Consulting to integrate and implement the two in what was supposed to be a $35 million project. By 1996, the company was bankrupt; it was eventually sold to a competitor for a mere $80 million.

• The reasons for the failure are familiar. First, FoxMeyer set up an unrealistically aggressive time line -- the entire system was supposed to be implemented in 18 months. Second, the warehouse employees whose jobs were affected -- more accurately, threatened -- by the automated system were not supportive of the project, to say the least. After three existing warehouses were closed, the first warehouse to be automated was plagued by sabotage, with inventory damaged by workers and orders going unfilled.

• Finally, the new system turned out to be less capable than the one it replaced: By 1994, the SAP system was processing only 10,000 orders a night, compared with 420,000 orders under the old mainframe. FoxMeyer also alleged that both Andersen and SAP used the automation project as a training tool for junior employees, rather than assigning their best workers to it.

• In 1998, two years after filing for bankruptcy, FoxMeyer sued Andersen and SAP for $500 million each, claiming it had paid twice the estimate amount only to get the system in a quarter of the intended sites. The suits were settled and/or dismissed in 2004.

• The Lesson Learned: A risk assessment is critical to the success of a project. Project Risk identification helps organizations identify significant risks, estimate their probability of occurring and evaluate the impact in terms of cost and time. Risk Management can help you avoid a horror story like FoxMeyer's.
Sainsbury's, the British supermarket giant, was determined to install an automated fulfillment system in its Waltham Point distribution center in Essex. Waltham Point was the distribution center for much of London and southeast England. The new barcode-based fulfillment system would increase efficiency and streamline operations. If it worked, that is.

Installed in 2003, the system promptly ran into what were then described as "horrendous" barcode-reading errors. Regardless, in 2005 the company claimed the system was operating as intended. Two years later, the entire project was scrapped and Sainsbury's wrote off $265,355 million in IT costs, enough to buy a lot of groceries.

**The Lesson Learned:** It is important to address problems as soon as they appear. With proper planning, project managers can handle problems as they arise, thus avoiding project failure.
The Big Dig – Central Artery

1930’s – Adapt street system “to the motor age”
• Proposed an elevated expressway
• Acknowledgement of impact to quality of life
• Tunneling would interfere with sewers, utilities, and rapid transit subways

1940’s – Great Depression and WWII halted ops

1950’s – Started to build the Central Artery
• Hideous green steel
• Vivisected Boston
• Barred pedestrians from the water
• Overwhelmed low rise areas with noise, traffic, shadow
• Displaced 573 businesses, hundreds of families, historic markets
The Big Dig – Central Artery

PHASE 1
The Central Artery

1960’s - Scarred Boston – physically and psychologically
• Designed for 70,000 cars – soon was carrying 170,000
• Accident rates 4 times national average (too many downtown exits)

1970’s – had displaced another 4,000 families
• Businesses bricked over windows facing the artery
• Many businesses fled to the suburbs
• Negative feelings on CA killed planned inner belt – part of the integrated system – making congestion worse
The Big Dig – Deal Formation

1980’s – planned for obsolescence by Massachusetts politicos (Tip O’Neill, Ted Kennedy)
• Tapped “free” federal money to complete “Interstate Highway System”
• Reagan veto overidden
• Project cost estimates and scope not a concern since Massachusetts had proven it was more powerful than the President

1990’s – Mitigation Plan key to securing Go-Ahead
• Everything from Environmental Protection to Business Continuity
• 1/3 of the total project cost
• Soundproof windows, no-strike clauses with guaranteed union hiring, firm mattresses, air conditioning, CA to become parks and open space, moving underground utilities, excavated dirt to transform Boston Harbor island from toxic dump to beachfront park
1991 – Construction starts
- Innovations – Slurry Wall
- 7.5 miles of highway, 6 interchanges, 200 bridges
- Jacked up Central Artery and removed underpinings
- Froze ground to withstand construction
- Only 3 deaths vice 40 as predicted by insurance company
- Built underground bridges and dams
- Threaded tunnels above and below subway tunnels
The Big Dig – Construction

• Over the next 2 decades, price waxes and Massachusetts influence wanes
• $2.6 Billion climbs to $15 Billion
• 90 cents federal and 10 cents taxpayer turned to 50 - 50
• Contractors Bechtel and Parsons have virtually no oversite by the government – and no risk
The Big Dig – Disaster

• Roof panel breaks free and crushes car, killing a 39 year old woman
• Panels held by anchors embedded in a high strength epoxy
• Root Causes – cost overruns drove decision to go with a cheaper panel (much heavier)
• Root Causes – fast set epoxy (to speed up schedule) not meant for long term load bearing application
• Inspections not performed over 2 years or it would have been noticed panels were coming loose
• Bechtel had no risk since they were “consultants” on the project
The Big Dig – Project Management

- Work started on pieces before design complete
- New work added as project progressed ($1B extra to remake Zakim Bridge)
- “Get things done and ask questions later” Philosophy
- Unexpected mitigation costs not accounted for (work stoppage to appease archeologists when Revolutionary War relics discovered, Indian artifacts)
- Inflation not accounted for
- Money woes covered up as well as shady accounting practices
- Integrated project organization didn’t gel until project almost complete
- Who’s in charge?
The Big Dig – Project Management Lessons Learned

• Partnering requires focus on determining the root cause of problems, not assessing blame

• Subcontractors should be included in the partnering sessions; they can be crucial to the success of the project and help balance the teams

• Risk should be shared jointly to foster innovation and continuous improvement where technology is new, risks are unknown, and stakes are high

• Teaching problem-solving skills is a major benefit of partnering

• Partnering should never replace independent and rigorous oversite of the project
The Big Dig – Project Management Lessons Learned

• Project Integration is critical to success

• Goals and incentives must be mutual

• Continuous improvement and rigorous oversight are both essential

• Doing things as they have always been done does not work for complex projects that require constant innovation and a culture of collaboration
The Big Dig – Wrong Lessons

• State’s shouldn’t bother with ambitious infrastructure
• Real worth will be measured over the next several decades
• Travel time through downtown at afternoon rush hour is down from 20 minutes to less than 3
• On other arteries travel times are ¼ to 2/3 shorter
• Average speeds up from 10 mph to 43 mph
• Airport trips are ½ to ¾ shorter
• 62% drop in hours spent on the new roads saves $200M annually in time and fuel
• Property values along the previous Central Artery have shot up
• Business owners are unbricking their windows
• Sidewalk cafes have reappeared
Characteristics of worst project managers

- They are bad communicators
- They have bad leadership skills
- They have no relevant knowledge when it comes to the project's industry, and no will to learn it
- They are not respected
- They love to procrastinate.
- They are unorganized, and their office is a mess.
- They are not diplomatic, and they try to "force" their own opinion on others.
- They worship one project management methodology.
- They treat resources as if they were slaves.
- They take most conflicts as personal, and they take sides when trying to resolve a conflict.
- They don't communicate with the stakeholders (Socialization).
- They lock themselves in their office, only to show up once or twice a day to "check on the work".
- They rarely, if ever, update the project schedule.
- They estimate projects without consulting with anyone.
- They prefer ad hoc budget management to EVM
- They don't care about the client or his needs.
- They are never considered to be a role model by any resource.
- They're pretty good at finding scapegoats.
- They backstab their own people.
- They are never available.
- They don't follow up on things (this goes back to them not being organized).
- They spend their day analyzing company politics.
1. There is no such thing as previously flown hardware, i.e., the people who build the next unit probably never saw the previous unit; there are probably minor changes; the operational environment has probably changed; and the people who check the unit out will in most cases not understand the unit or the test equipment.

2. Most equipment works "as built," i.e., not as the designer planned. This is due to layout of the design, poor understanding on the designer's part, or poor understanding of component specifications.

3. The source of most problems is people but damned if they will admit it. Know the people working on your project, so you know what the real weak spots are.

4. Most managers succeed on the strength and skill of their staff.

5. A manager who is his own systems engineer or financial manager is one who will probably try to do open heart surgery on himself.

6. One must pay attention to workaholics -- if they get going in the wrong direction, they can do a lot of damage in a short time -- it is possible to overload them, causing premature burnout, but hard to determine if the load is too much, since much of it is self-generated. It is important to make sure such people take enough time off and that the workload does not exceed 1-1/4 to 1-1/2 times what is normal.

7. NASA programs compete for budget funds -- they do not compete with each other, i.e., you never attack any other program or NASA work with the idea you should get their funding. Sell what you have on its own merit.

8. Contractors respond well to the customer who pays attention to what they are doing, but not too well to the customer that continually second-guesses their activity. The basic rule is: a customer is always right, but the cost will escalate if a customer always has things done his way, instead of the way the contractor had planned. The ground rule is never change a contractor's plans unless they are flawed or too costly, i.e., the old saying, "better is the enemy of good."

9. Never undercut your staff in public, i.e. don't make decisions on work that you have given them to do in public meetings. Even if you direct a change, never the responsibility for implementing away from your staff.

10. The project has many resources within itself. There probably are five-to-ten system engineers considering all the contractors and instrument developers. This is a powerful resource that can be used to attack problems.

11. Know who the decision makers on the program are. It may be someone on the outside who has the ear of Congress, or the Administrator, or the Associate Administrator, or one of the scientists -- or someone in the chain of command -- whoever they are, try to get a line of communication to them on a formal or informal basis.

12. You and the program manager should work as a team. The program manager is your advocate at NASA HQ and must be tied in to the decision-making and should aid your efforts to be tied in too.

13. A project manager should visit everyone who is building anything for his project at least once, should know all the managers on his project (both government and contractor), and know the integration team members. People like to know that the project manager is interested in their work, and the best proof is for the manager to visit them and see first hand what they are doing.

14. Never ask management to make a decision that you can make. Assume you have the authority to make decisions unless you know there is a document that states unequivocally that you cannot.

15. Wrong decisions made early can be salvaged, but "right" decisions made late cannot.
Lessons Learned - Continued

16. Never make excuses; instead, present plans of actions to be taken.
17. Never try to get even for some slight by another project. It is not good form -- it puts you on the same level as the other person--and often ends up hindering the project getting done.
18. If you cultivate too much egotism, you may find it difficult to change your position -- especially if your personnel tell you that you are wrong. You should instill an attitude on the project whereby your personnel know they can tell you of wrong decisions.
19. One of the advantages of NASA in the early days was the fact that everyone knew that the facts that we were absolutely sure of could be wrong.

20. Managers who rely on the paperwork to do the reporting of activities are known failures.
21. Not all successful managers are competent and not all failed managers are incompetent. Luck still plays a part in success or failure, but luck favors the competent, hard-working manager.
22. If you have a problem that requires the addition of people to solve, you should approach recruiting people like a cook who has under-salted, i.e., a little at a time.
23. A project manager must know what motivates the project contractors, i.e., their award system, their fiscal system, their policies, and their company culture.
24. Other than original budget information prior to the President's submittal to Congress, there is probably no secret information on the project -- so don't treat anything like it is secret. Everyone does better if they can see the whole picture, so don't hide any of it from anyone.
25. Know the resources of your center and if possible other centers. Other centers, if they have the resources, are normally happy to help. It is always surprising how much good help one can get by just asking.
26. Contractors tend to size up their government counterparts, and staff their part of the project accordingly. If they think yours are clunkers, they will take their poorer people to put on your project.
27. Documentation does not take the place of knowledge. There is a great difference in what is supposed to be, what is thought to have been, and what the reality is. Documents are normally a static picture in time which is outdated rapidly.
28. Remember who the customer is and what his objectives are, i.e., check with him when you go to change anything of significance.
29. In case of a failure:
   a. Make a timeline of events and include everything that is known;
   b. Put down known facts -- check every theory against them;
   c. Don't beat the data until it confesses, i.e., know when to stop trying to force-fit a scenario;
   d. Do not arrive at a conclusion too rapidly. Make sure any deviation from the norm is explained--remember the wrong conclusion is prologue to the next failure;
   e. Know when to stop.
30. Remember the boss has the right to make decisions, even if you think they are wrong. Tell the boss what you think but, if he still wants it done his way, do your best to make sure the outcome is successful.
31. Redundancy in hardware can be a fiction. We are adept at building things to be identical so that if one fails, the other will also fail. Make sure all hardware is treated in a build as if it were one of a kind and needed for mission success.
32. Don't be afraid to fail or you will not succeed, but always work at your skill to recover. Part of that skill is knowing who can help.
33. Experience may be fine but testing is better. Knowing something will work never takes the place of proving that it will.
34. People have reasons for doing things the way they do them. Most people want to do a good job, and if they don't, the problem is they probably don't know how or exactly what is expected.
35. The boss may not know how to do the work, but he has to know what he wants. The boss had better find out what he expects and wants, if he doesn't know. A blind leader tends to go in circles.
36. A puzzle is hard to discern from just one piece, so don't be surprised if team members deprived of information reach the wrong conclusion.
37. Reviews are for the reviewed and not the reviewer. The review is a failure if the reviewed learn nothing from it.
38. The amount of reviews and reports are proportional to management’s understanding, i.e., the less management knows or understands the activities, the more it requires reviews and reports. It is necessary in this type of environment to make sure the data is presented so that the average person, slightly familiar with activities, can understand it. Keeping the data simple and clear never insults anyone’s intelligence.

39. In olden times, engineers had hands-on experience, technicians understood how the electronics worked and what it was supposed to do, and layout technicians knew too—but today only the computer knows for sure, and it’s not talking.

40. Not using modern techniques like computer systems is a great mistake, but forgetting the computer simulates thinking is still greater.

41. **Management principles are still the same. It is just the tools that have changed. You still should find the right people to do the work and get out of the way so they can do it.**

42. It is mainly the incompetent that don’t like to show off their work.

43. Whoever you deal with, deal fairly. Space is not a big playing field. You may be surprised how often you have to work with the same people. Better they respect you than carry a grudge.

44. Mistakes are all right, but failure is not. Failure is just a mistake you can’t recover from; therefore, try to create contingency plans and alternate approaches for the items or plans that have high risk.

45. You cannot be ignorant of the language of the area you manage or with that of areas with which you interface. Education is a must for the modern manager. There are simple courses available to learn computerese, communicationese, and all the rest of the modern ese's of the world. You can’t manage if you don’t understand what is being said or written.

46. Most international meetings are held in English. This is a foreign language to most participants such as Americans, Germans, Italians, etc. It is important to have adequate discussions so that there are no misinterpretations of what is said.

47. NASA Management Instructions (NMIs) are written by another NASA employee like yourself; therefore, challenge them if they don’t make sense. It is possible another NASA employee will rewrite them or waive them for you.

48. **A working meeting has about six people attending. Meetings larger than this are for information transfer.**

49. Being friendly with a contractor is fine -- being a friend of a contractor is dangerous to your objectivity.

50. The old NASA pushed the limits of technology and science; therefore, it did not worry about “requirements creep” or over-runs. The new NASA has to work as if all are fixed price; therefore, “requirements creep” has become a deadly sin.

51. Many managers, just because they have the scientists under contract on their project, forget that the scientists are their customers and many times have easier access to top management than the managers do.

52. Most scientists are rational unless you endanger their chance to do their experiment. They will work with you if they believe you are telling them the truth. This includes reducing their own plans.

53. Cooperative efforts require good communications and early warning systems. A project manager should try to keep his partners aware of what is going on and should be the one who tells them first of any rumor or actual changes in plan. The partners should be consulted before things are put in final form, even if they only have a small piece of the action. A project manager who blindsides his partners will be treated in kind and will be considered a person of no integrity.

54. All problems are solvable in time, so make sure you have enough schedule contingency -- if you don’t, the next project manager that takes your place will.

55. The number of reviews is increasing but the knowledge transfer remains the same; therefore, all your charts and presentation material should be constructed with this fact in mind. This means you should be able to construct a set of slides that only needs to be shuffled from presentation to presentation.
56. Just because you give monthly reports, don’t think that you can abbreviate anything in a yearly report. If management understood the monthlies, they wouldn’t need a yearly.

57. Abbreviations are getting to be a pain. Each project now has a few thousand. This calls on senior management to know a couple hundred thousand. Use them sparingly in presentations unless your objective is to confuse.

58. Occasionally things go right—the lesson learned here is: Try to duplicate that which works.

59. Running does not take the place of thinking. For yourself, you must take time to smell the roses. For your work, you must take time to understand the consequences of your actions.

60. Sometimes the best thing to do is nothing. It is also occasionally the best help you can give. Just listening is all that is needed on many occasions. You may be the boss but, if you constantly have to solve someone’s problems, you are working for him.

61. We have developed a set of people whose self interest is more paramount than the work or at least it appears so to older managers. It appears to the older managers that the newer ones are more interested in form than in substance. The question is are old managers right or just old.

62. One problem new managers face is that everyone wants to solve their problems. Old managers were told by senior management -- “solve your damn problems; that is what we hired you to do.”

63. Remember, it is often easier to do foolish paperwork than to fight the need for it. Fight only if it is a global issue which will save much future work.

64. Know your management -- some like a good joke; others only like a joke if they tell it.

65. Integrity means your subordinates trust you.

66. You cannot watch everything. What you can watch is the people. They have to know you will not accept a poor job.

67. Next year is always the current year with adequate funding and schedule -- next year arrives on the 50th year of your career.

68. **The first sign of trouble comes from the schedule or the cost curve. Engineers are the last to know they are in trouble. Engineers are born optimists.**

69. External reviews are scheduled at the worst possible time: therefore, keep an up-to-date set of technical data so that you can rapidly respond. Having to update business data should be cause for dismissal.

70. Hide nothing from the reviewers. Their reputation and yours is on the line. Expose all the warts and pimples. Don’t offer excuses -- just state facts.

71. NASA is establishing a set of reviewers and a set of reviews. Once firmly established, the system will fight to stay alive, so make the most of it. Try to find a way for the reviewers to work for you.

72. Knowledge is often confounded by test. Computer models have hidden flaws, not the least of which is poor input data.

73. Today one must push the state of the art: be within budget, take risks, not fail, and be on time. Strangely, all these are consistent as long, as the ground rules, such as funding profile and schedule, are established up front and maintained.

74. Most of yesteryear’s projects overrun because of poor estimates and not because of mistakes. Getting better estimates may not lower cost but will improve NASA’s business reputation. Actually, there is a high probability that the cost of getting better estimates will increase cost and assure a higher profit to industry, unless the fee is reduced to reflect lower risk on the part of industry. A better reputation is necessary in the present environment.

75. A scientific proposal takes about 9 months to put together. It takes NASA HQ about 9 months to a year to select the winning proposals. Then, it takes 3 to 4 years to sell the program. This means 5 to 6 years after the initial thoughts, the real work starts. Managers, for some strange reason, do not understand why a scientist wants to build something different than proposed. Managers are strange people.

76. There are rare times when only one man can do the job. These are in technical areas that are more art and skill than normal. Cherish these people and employ their services when necessary as soon as possible. Getting the work done by someone else takes two to three times longer, and the product is normally below standard.

77. Software now has taken on all the parameters of hardware, i.e., requirement creep, high percent-age of flight mission cost, need for quality control, need for validation procedures, etc. It has the added feature that it is hard as hell to determine it is not flawed. Get the basic system working and then add the bells and whistles. Never throw away a version that works even if you have all the confidence in the world the newer version works. It is necessary to have contingency plans for software.

78. History is prologue. There has not been a project yet that has not had a parts problem despite all the qualification and testing done on parts. Time and being prepared to react are the only safeguards.
79. Award fee is a good tool that puts discipline both on the contractor and the government. The score given represents the status of the project as well as the management skills of both parties. The Performance Measurement System (PMS) should be used to verify the scores. Consistent poor scores require senior management intervention to determine the reason. Consistent good scores, which are consistent with PMS, reflect a well-run project, but if these scores are not consistent with the PMS, senior management must take action to find out why.

80. **A project manager is not the monitor of the work but is to be the driver.** In award fee situations, the government personnel should be making every effort possible to make sure the contractor gets a high score, i.e., be on schedule and produce good work. Contractors don't fail, NASA does, and that is why one must be proactive in support. This is also why a low score damages the government project manager as much as the contractor's manager because it means he is not doing his job.

81. There is no greater motivation than giving a good person his piece of the puzzle to control but a pat on the back or an award helps.

82. Morale of the contractor's personnel is important to a government manager. Just as you don't want to buy a car built by disgruntled employees, you don't want to buy flight hardware built by them. You should take an active role in motivating all personnel on the project.

83. People who monitor work and don't help get it done, never seem to know exactly what is going on.

84. Never assume someone knows something or has done something unless you have asked them. Even the obvious is overlooked or ignored on occasion -- especially in a high-stress activity.

85. Don't assume you know why senior management has done something. If you feel you need to know, ask. You get some amazing answers that will dumbfound you.

86. If you have someone who doesn't look, ask, and analyze, ask them to transfer.

87. **Bastards, gentlemen, and ladies can be project manager. Lost souls, procrastinators, and wishy-washers cannot.**

88. A person's time is very important. You must be careful as a manager that you realize the value of other people's time, i.e., work you hand out and meetings should be necessary. You must, where possible, shield your staff from unnecessary work, i.e., some requests should be ignored or a refusal sent to the requester.

89. A good technician, quality inspector, and straw boss are more important in obtaining good products than all the paper and reviews.

90. The seeds of problems are laid down early. Initial planning is the most vital part of a project. Review of most failed projects or of project problems indicates that the disasters were well planned to happen from the start.

91. A comfortable project manager is one waiting for his next assignment or one on the verge of failure. Security is not normal to project management.

92. Remember, the President, Congress, OMB, NASA HQ, senior center management, and your customers all have jobs to do. All you have to do is keep them all happy.

93. Always try to negotiate your internal support at the lowest level. What you want is the support of the person doing the work, and the closer you can get to him in negotiations the better.

94. **Whoever said beggars can't be choosers doesn't understand project management. Many times it is better to trust to luck than to get known poor support.**

95. Remember your contractor has a tendency to have a one-to-one interface with your staff; so every member of your staff costs you at least one person (about a 1/4 of million) on the contract per year.

96. There is only one solution to a weak project manager in industry -- get rid of him fast. The main job of a project manager in industry is to keep the customer happy. Make sure the one working with you knows that "on schedule, on cost, and a good product" -- not flattery -- is all that makes you happy.

97. Talk is not cheap. The best way to understand a personnel or technical problem is to talk to the right people. Lack of talk at the right levels is deadly.

98. Projects require teamwork to succeed. Remember most teams have a coach and not a boss, but the coach still has to call some of the plays.
99. In the rush to get things done, it is always important to remember who you work for. Blindsiding the boss will not be to your benefit in the long run. Over-engineering is common. Engineers like puzzles and mazes -- try to make them keep their designs simple.

100. Never make a decision from a cartoon. Look at the actual hardware or what real information is available, such as layouts. Too much time is wasted by people trying to cure a cartoon whose function is to explain the principle.

101. An Agency's age can be estimated by the number of reports and meetings it has. The older it gets, the more the paperwork increases and the less product is delivered per dollar. Many people have suggested that an Agency self-destruct every 25 years and be reborn starting from scratch.

102. False starts are normal in today's environment. More than ever, in this type of environment, one must keep an ear open for the starting gun and be prepared to move out in quick and orderly fashion once it is sounded. In the past, too many false starts have resulted in the project not hearing the real starting gun or jumping off and falling on its face.

103. The pioneering phase of NASA is mostly done, if not actually by fiat. This means the difficult and more important work has started. This work requires more discipline, but there should still be room for innovation.

104. There are still some individuals who think important decisions are made in meetings. This is rarely the case. Normally, the decision-makers meet over lunch or have a brief meeting to decide the issue and then (at a meeting called to discuss the issue) make it appear that the decision is made as a result of this discussion.

105. In political decisions, do not look for logic -- look for politics.

106. Interagency agreements are hard to make even if there is no conflict in the responsibilities and the requirements do satisfy both parties. Conflict in these areas normally leads to failure no matter how hard the people involved try to make an agreement.

107. In dealing with international partners, the usual strategy is to go 1 day early, meet with your counterpart, discuss all issues to be brought up at a meeting, arrive at an agreeable response (or a decision to table the issue for later discussion), and agree not to take any firm positions on any new issues brought up at the meeting. This makes it appear to the rest of the world that you and your counterpart are of one mind and that the work is in good hands. All disputes are held behind closed doors with the minimum number of participants.

108. Gentlemen and ladies can get things done just as well as bastards. What is needed is a strong will and respect -- not "strong arm" tactics. It must be admitted that the latter does work but leaves a residue that has to be cleaned up.

109. Though most of us in our youth have heard the poem that states "for want of a nail the race was lost," few of us realize that most space failures have a similar origin. It is the commonplace items that tend to be overlooked and thus do us in. The tough and difficult tasks are normally done well. The simple and easy tasks seem to be the ones done sloppily.

110. In the "old NASA," a job done within schedule and cost was deemed to be simple. The present NASA wants to push the start of the art, be innovative, and be a risk taker but stay on schedule and cost. One gets the feeling that either the new jobs will be simple or that the reign of saints has finally occurred.

111. Meetings, meetings -- A Projects Manager's staff meeting should last 5 minutes minimum -- 1 hour max -- less than 5 minutes and you probably didn't need the meeting -- longer than 1 hour, it becomes a bull session.

112. Taking too many people to visit a contractor or other government agency puts them in the entertainment business -- not the space hardware or software business.

113. Too many engineers get in the habit of supporting support contractors and of using them as a crutch. In many cases it is getting to the point where one has to wonder who is who.

114. Reviews, meetings, and reality have little in common.

115. You should always check to see how long a change or action takes to get to the implementer -- this time should be measured in hours and not days.

116. Let your staff argue you into doing something even if you intended to do it anyway. It gives them the feeling that they won one! There are a lot of advantages to gamesmanship as long as no one detects the game.

117. Some contractors are good, some are bad, but they seem to change places over time, making the past no guarantee of the future; thus, constant vigilance is a project requirement.

118. It is rare that a contractor or instrumentor does not know your budget and does not intend to get every bit of it from you. This is why you have to constantly pay attention to the manpower they use and to judge their activities in order to assure that they are not overloading the system.
Lessons Learned - Concluded

119. People tend to ask for what they think they can get and not what they need. On GRO the specs for photomultiplier tubes were based on the engineering units performance on all parameters. One parameter, though made in the engineering tubes, was difficult to obtain in the flight tubes.

120. It was a meaningless parameter put in only because the engineering tubes met it. Finally, after about 9 months of sweat and tears, this was recognized and deleted so we could get the flight tubes.

121. Today one must get an honest bid -- one which is accurate to 15 percent. On GRO, with TRW the only bidder and with them knowing it, we all got what we believed to be an honest bid that was off by about 18 to 20 percent at the finish. The main area of overrun was the structure. TRW had never built one this large or heavy before. We estimated that the structure would require 600 drawings, multiplied this by 1.25 to get 750 and rounded to 800 to estimate the cost. It took 1,186 drawings. It is normally not the complex systems that get you, so beware when you estimate the cost -- especially if there is no experience base.

122. Too much cost data on a proposal can blind you to the real risks or forgotten items. On a project we thoroughly knew, we spent 6 months of government and contractor time validating the cost, had rooms full of data, and presented our findings to Headquarters. Two weeks later, the contractor found an "Oh I forgot" that costs $30 million. One should look at how past programs spent their money to try to avoid these traps.

123. On GRO we sort of estimated we needed about 20 percent contingency on previously flown subsystems and about 40 percent to 50 percent on new ones. The ratio was about right except the order was reversed.

124. There are some small companies that make the same subsystem correctly every time because the same people do it. There are some large companies that can never make the same unit correctly every time because different people do the work each time. Heritage should be questioned when the people doing the work all have peach fuzz on their faces.

125. Too many project managers think a spoken agreement carries the same weight as one put in writing. It doesn't. People vanish and change positions. Important decisions must be documented.

126. Make sure everyone knows what the requirements are and understands them. Much easier to say than do. On GRO we stated quite clearly that the scientific instruments had to take 18g in a specific axis. Everyone understood the requirement but until the mechanical test on EGRET no one stood up and said it was impossible to meet it. The thermal specification for the momentum wheels required that they run 5 degrees colder than normal limits to make the spacecraft thermal engineers life easier. No one stood up until after 9 months of failure in the test program to say that the grease used changes state if taken that cold, and would not recover when brought back to higher temperature. You have to have the right people look at requirements. A bunch of managers and salesmen nodding agreement to requirements should not make you feel safe.

127. Too many people at Headquarters believe the myth that you can reduce the food to the horse every day till you get a horse that requires no food. They try to do the same with projects, which eventually end up as dead as the horse.

128. The project manager who is the smartest man on his project has done a lousy job of recruitment.