

A Guide to Working with Engineering Consultants

Ten things to know when working with consultants

By Sean O'Leary

Dear Engineering Manager:

My name is Sean O’Leary. I own Celtic Engineering Solutions LLC, a consulting company for engineering services. I have a master’s degree in electrical engineering and over two decades’ experience working for a handful of companies. I have worked in mining, aerospace, defense and medical R&D. In addition to working as a full time employee I have consulted on the side for nearly as long. I have also worked with many consultants through the years.

I wrote the “A Guide to Working with Engineering Consultants” to help the engineering manager understand the benefits of working with consultants as well as to warn about some of the pitfalls and how to avoid them. Establishing a good relationship with a consulting agency can be of great benefit to a company and can be one that lasts for years or decades. But, choosing the wrong consultants to work with or not understanding the various pitfall of working with outsiders can lead to delays and wasted money.

Having been on both sides of the fence, I understand both the desire to have an expert come in and help out when and where needed and the reluctance to have someone you don’t really know jump in and see the products you are working on. Will they overcharge me? Will I get the value I seek? Can they be trusted to deliver what they promise on time? These are just a few of the questions that you must ask when deciding if and which consultants to choose.

Over the years I have found there are typically two motivators to search outside help. The first is a lack of specific knowledge. Engineering is a big field and you may not have the expertise in house to solve a specific problem, it might be a small but important part of a project. You can spend time and money educating your people to become experts in that area or you can pay someone to come in and do it for you. “Time is money,” and “If you are working on it your competition probably is as well,” are two sayings that apply to this situation.

The second motivator is not having enough resources to do a job. Let’s face it, if you have people sitting around you are probably overstaffed. There are always more projects we would like to work on. Sometimes work flow is cyclical. Do you staff up when work is pouring in just to lay people off when it slackens? Sometimes it makes more economic sense to hire someone to complete a specific task than to go through the pain of hiring additional employees.

This guide talks about the ins and outs of working with consultants. What things should you do or ask to make things go smoothly. Most importantly, how do you choose a reliable company to work with? One that will meet your needs and treat you with the responsiveness you seek?

If you have any questions, or if something is unclear please don’t hesitate to give me a call at olearyds@celticengineeringsolutions.com or you can call me at 801-414-9597. We are here to help you succeed.

Sean O’Leary

A Guide to Working with Engineering Consultants

Ten things to know when working with a consultant

What is in this guide:

Why work with a consultant anyway?

Top 10 questions/doubts about working with a consulting agency

What should I talk to a potential consultant about?

What should I do next?

Why work with a consultant anyway?

Before we jump into the 10 questions, I want to make a case for why you should consider working with a consultant or consulting agency. A consultant works alone, while a consulting agency will put together a team of consultants to address your project. This team may work for the consulting agency directly or they may be subcontractors to that agency.

But why consider working with an outside agency in either case? I am clearly biased in this matter. I own a consulting agency and so I clearly think it is a benefit to my clients that they work with us, otherwise I would not be in business. And that is the key reason someone should consider working with a consulting agency, it is beneficial to their company.

1. They bring talent and experience – Consultants bring additional talent and experience to your company to get your project done and that gets you to market faster, increasing your bottom line.
2. You don't have the knowledge in house to complete the project – A common reason to hire a consultant is because your team lacks the required knowledge to complete the task. Sure you have them acquire the knowledge, but it is usually more cost effective and time efficient to hire someone to do the work now.
3. Your people are too busy working on other projects – This is by far the most common situation. Your people have their plates full but you have additional work that you want to get done. Sometimes work is cyclical, or a project gets dumped in your lap unexpectedly. Having a resource to draw on to augment your full time staff is a great resource.
4. Stir the pot – You have probably heard the analogy that a business is like a stew. People settle in to their comfortable spot and that is neither a good way to cook a stew nor an efficient way to run a business. Having people come in from time to time to work on a

project helps stir things around. Your staff are exposed to new ideas and new ways of doing things. They, and you, may be surprised at how faster things get done than you thought and that can help put a fire under your employees.

5. Consultants are in the spotlight – Consultants don't get comfortable in their positions. Whatever they do is in the spotlight. They know they are there to do a job and will leave when they are done. They want your return business and they know they will only get that if they do an exceptional job.

These are just a few of the many benefits of working with consultants. I have heard many people say they are concerned about working with a consultant or have had bad experiences in the past. The next section addresses ten questions and doubts people have about working with consultants.

Top 10 questions/doubts about working with a consulting agency

1. Isn't it more expensive to work with a consulting agency than to just hire more staff?

Many companies think it is more expensive to hire a consultant. After all a consultant might cost \$75, \$100 or \$125 an hour. Even my best engineer doesn't make that much. Well it might not be as expensive as you think. Let's take a look at the charges for an employee. For social security its 6.2% up to \$118,500. Medicare is 1.45%. FUTA (Federal Unemployment TAX ACT) is 6% of the first \$7,000. The state unemployment tax varies by state, but is 5.4% max. Workers compensation is 1.85% on average. The average health insurance cost is 7.9%. Then there are cost that vary wildly by sector and company: 401K contributions, tuition reimbursement, overhead, training, setup cost of equipment (desk, computer, phone), recruitment cost, turnover costs, vacation, sick time, bonuses (the national average is 9.1%). The hardest to quantify is the cost of non-productive time.

This is not an all-inclusive list. However, it makes the point that employees are very costly assets. Making the decision to hire additional staff should not be taken lightly. The rule of thumb is you hire an employee when doing so will bring in 1.5x the cost of employing them.

Below I have put together an example of a senior engineer who makes \$110,000. The numbers change a little based on discipline and the location but I think the point should be clear. Most people will calculate the hourly rate of an employee based on base salary and the number of working hours in a year based on a 40-hour work week. That makes it look like a senior engineer makes about \$50/ hour. Seems reasonable, especially since that is how Finance would calculate it for paid overtime.

The truth is there are so many more costs associated with paying an employee. I have put what those costs are, and hopefully a reasonable estimate, in the example below.

That brings the approximate hourly rate up to \$85/hr. Still I am not considering costs associated with turnover. So to get the convenience of calling up and adding an employee almost instantly, it cost an additional \$15/hr. That is not so unreasonable.

Base Salary	\$ 110,000.00
Yearly hours	2080
Hourly rate	\$ 52.88
Social Security	6820
Medicare	1595
FUTA	420
State Unemployment	5940
Workers Comp	2035
Health Insurance	8690
401K	6600
Bonus	10010
Equipment	4000
Lost Time (hours)	130
Training (hours)	40
Sick time (hours)	40
Vacation (hours)	80
Total Comp	\$ 152,110.00
Total working hours	1790
Hourly rate	\$ 84.98

What is lost time? *Inc. Magazine* published an article, [How Much Time Do Your Employees Waste at Work Each Day?](#) By Jayson Demers Aug 2014, where they discuss the lost time at work. This includes time surfing the net, coffee breaks, personal phone calls, Facebook, emails, meetings. There are lots of ways to not be productive. If you misuse just 30 minutes a day (see paragraph 3 of his article), that adds up to 130 hours a year.

Most consultants would rather quote a job than be paid by the hour, but when they are, this is a reasonable comparison.

2. Am I going to get ripped off or taken advantage by them?

The short answer is *buyer beware*. But there are some things you can do to make sure that you get a good value for your investment. First, select the right consultant or consulting agency. You really want to do your homework here. Look at the projects the company has worked on. Look for recommendations of satisfied customers. Call the Better Business Bureau and see if any complaints have been filed against them that have not been resolved. Have a face to face meeting with the company representative and ask lots of questions. You should get a feeling that they know what they are doing and that they are being honest about answering your questions. Are they providing good customer service? Do they care about what is important to me? After you talk with the consultant you should have a good feeling that the consultant is concerned about you and helping to make you a success. If you feel that they are most concerned with being paid, and don't give you straight answers, keep looking.

Second, when you engage a consultant you want a clear and detailed statement of work. This is an important tool for both parties. It establishes from the very beginning what is wanted and expected. It is a tool for laying all the cards on the table, as it were, so you both know what you can expect from each other.

The statement of work leads directly into a good contract. A contract includes a statement of work. It also states the timeline for doing the work and the conditions of payment.

3. Why not just use my own employees?

You might ask, "Why don't I just use my own employees." This is a valid question. You may have all the resources you need at your own company. But are those resources available? If you have employees who have lots of bandwidth available, you are probably overstaffed. People who are not actively engaged in activities to make you money are a drain on your company.

So let's assume you have all your employees working at an appropriate level for your company culture. Now a new opportunity arises. You can have your people work on it, but only if you are willing to have them stop working on some of the projects they are currently working on.

A similar scenario arises when work comes in in cycles. You can either hire and fire, or overstaff to meet the peaks.

Sometimes you will find that the knowledge you need is not found in your employees. They are smart people and can probably acquire the knowledge if you give them time and the proper training.

In all of these scenarios hiring outside talent to temporarily cover your shortfall is an economically sound thing to do.

4. I want to keep the knowledge in house.

I have heard many managers say they don't want to have consultants work on their projects, especially their main products because they want to keep the knowledge in house. Every business wants to keep their core competencies in house because it is who they are, how their company is known. We believe our employees are ours and are happy and will never leave. The truth is there is an amount of turnover in your company that moves key employees away from you. They might leave because they got a better offer, did not like the corporate culture, felt slighted by a manager, or it might have nothing to do with your company. It could be they move away due to family issues or illness. The point is there is still a possibility that key knowledge will not be there tomorrow morning when you get to work.

The key to keeping knowledge around is good documentation. Whomever does the work should keep good enough records so that the next person (even if that next person is them a year from now) can look at what has been done and smoothly pick up and take the next steps.

What about our company secrets? There are some things you might not want to share with a consultant, or even with all your employees. For everything else there are NDA's. We rely on such agreements to keep people from sharing what we have worked hard to obtain. An ethical person, whether an employee or a consultant, will abide by those agreements and not divulge your IP (intellectual property).

5. Consultants don't care about my company – They just want to get paid.

I think this is a misconception that is spread far and wide. The truth is that a consultant gets most of his or her clients by word of mouth. Their reputation is of the utmost importance. Not only do they want to have you refer them to others but they want you to be a steady client for years to come. How is that achieved? They know that by doing a great job, by doing it accurately, timely and thoroughly, they will earn your business in the future. Your success means they have done a good job for you and you are likely to work with them in the future. In a way they are more loyal than an employee. I have seen many employees become complacent. The idea that if it doesn't get done today it will get done tomorrow or they next. That they are entitled to the job they have and the benefits you provide them is commonplace among employees but rare among consultants. They know they must work hard to ensure you succeed and that they will not be asked back in the future unless they have done exemplary work this time.

6. I want to create a culture in our company and an outsider can never be part of that culture.

Occasionally I have come across a company that is very proud of their corporate culture and feel that their success is tied to that culture. To be part of it you must be there every day, must interact with your coworkers must live in that culture. By doing so you both give and receive. You participate in what makes that company unique. You may think a consultant will never become part of the family in such a situation. In a family there are many different roles, some closer and more important than others. In this situation, I would consider the consultant a cousin. They are still part of the family but not as close as a brother or sister.

A good relationship with a consultant can stretch years or decades long. They come to know what you need, what is important to you and how you want your work organized and presented. They will be there for you when you need them the most. And that is what you really expect of family anyway, right?

7. I'm afraid they won't deliver on time.

We have all heard the horror stories about someone hiring a contractor to work on their house. The work gets started but then they have a hard time getting the contractor to come back and finish the job.

This goes back to making sure the consultant you choose has a good reputation. Check references and look for recommendations. This will make you feel much better about working with them. The second thing that is essential is to have a good contract. In the contract you want to specify what work will be done, what are the deliverables, when it will be finished, how much will it cost and possibly what penalties are there for late delivery. You might even put an incentive for early delivery, but only in very special cases where time is costing you a great deal of money.

8. I have never worked with a contractor before and it feels uncomfortable.

Before you jump in and start work with a consultant on a big project that your future hinges on, consider doing a small project to work out the bugs. Think of it as a getting to know one another project. There are plenty of opportunities for these kinds of projects. Find something small that could be done internally. You know how much time your employees would take if you asked them to do it (if not ask them first). Compare that to how the consultant performs. When you find the right person to work with, not only

will you be pleasantly surprised, you will have found a new tool in your corporate toolbox.

9. What you don't know can hurt you.

Some people are concerned that they will get shoddy or at least not thorough work. This can be a costly mistake. While this is true, it is not unique to consultants. The same can be said of any employee. This concern is more of a systems problem than a personnel problem. It is always good to have others check your work. When I worked in industry, we would have a design review before sending off a new board. In fact, we would have several design reviews. We would review an electrical design, then we would have a component placement review, followed by a completed board review. Sometimes these reviews would be first internal and then with the customer. The point is we would check each other's work. That is no different than working with a consultant. You will want to have your staff review their work just as you would any other employee. I have been called in to be part of a review team as a consultant. This is a very useful tool. It helps you get to know the consultant and puts another set of eyes on a problem.

10. I don't want there to be any misunderstandings.

Misunderstandings arise when we think others know what we want but we don't tell them directly. This is very easy to do. When you describe something and the other person seems to understand you think you are on the same page, that you understand one another. The fact is that what is important to one person may not be important to another. Unless you are clear about what is important to you, the other person will not know what you are most concerned about.

This is one of the reasons I always start with a clear statement of work. It would be great if my customers would hand me a specifications document that explains exactly what they want done. In practice that almost never happens. My first task, before we even enter into a contract, is to understand what my potential customer wants. I take careful notes, ask lots of questions and then I write up a statement of work. I then give that statement of work back to the customer to review. If you think about it, when you are talking to someone and you want to make sure you understand what they are saying, you listen and then tell them what you think you heard. If you got it right you move on, otherwise you have a chance to correct the understanding. That is exactly what the statement of work does.

The statement of work is a very important tool in making sure that there are no misunderstandings. The other tool is the contract. A contract does not have to be complicated, in fact, it should be clear and easy to understand. It should specify:

- a. What is to be done - the statement of work.
- b. Who is going to do the work - usually the consultant, but sometimes there are things you as the customer must do to enable the consultant to complete their work.
- c. What will the consultant give you when they are done - the deliverables.
- d. When will they finish their work - This can be a hard or soft deadline depending on the nature of the work and the planned interaction. If there are interdependencies and internal deadlines or handoffs, you might opt for an estimated delivery date.
- e. How much will they be paid for the work.
- f. How will they be paid. If it is a big job, or you have not established a relationship with the consultant, they may require 50% down and 50% due on completion of the work. Other common terms are Net 15 and Net 30, meaning you have 15 or 30 days respectively to pay from the date of delivery or completion.

Those are the essentials that should be in every contract, but there are other things that can be added as needed, like penalties for late delivery or incentives for early delivery. Your attorney should review the contract before you sign it and they will always add much more to keep you out of trouble.

What should I talk to a potential consultant about?

1. Will the product be error free, perfect, the first time through?

I hear this from my customers who have not had much experience with the design process. They believe that there will not be any missteps along the way and if there are, then something is wrong. If you ever hear that the design will be perfect when the first prototype that is made, you can be sure you are being lied to.

If you are going to send a man to the moon and must have it work the first time through, you will spend about 100x more time and at least 100x more money than a conventional design. Normally you trade-off perfection for lower costs and faster finish times. That is not to say that you are willing to accept sloppy work. Even high quality work will have surprises that will require a rethink. The goal is to get a product to market as quickly as possible. That means you do good work, check your design, design a robust circuit or robust firmware, but won't be surprised if you missed something the first run through.

When a board is made, you check out all the functions, test it thoroughly. When you have fixed all the problems and have it working or have identified errors that cannot be fixed without a board spin you are ready to make the next board. Fixing a problem on a development board means over board wires and dead-bug chips. When you spin a new board after identifying all those errors, that board should be clean and error free.

By not trying to make sure that the board is error free the first time around you save a lot of time because no matter how much you try there is probably going to be some small problem. Rather than agonize over it, move through the design cycle quickly. The goal is to get a product to market fast not get there without a single error.

2. What is the next step once this part of the project is done?

That depends on where you are in the design cycle. I will talk more about that in the next section. But typically there are 4 sections and a contract will cover one of those sections. You move through that phase of the product design and then move onto the next phase. It is inefficient to contract with a consultant to do the entire design at once. Pick out a specific goal that is appropriate for the part of the design cycle that you are in and work through that portion. Then move to the next portion.

3. What is the Design Process?

The design cycle can be broken down into 4 parts: Ideas, designs, prototypes and products. In the idea phase you decide what you want to make. There you will engage in market analysis. This is where you see who your competitors are and what kind of potential market there is for your idea. You build the business case for the potential product.

The design phase is where you specify circuits, define a bill of material and work out the mechanical appearance of the product. You are trying out different concepts, looking at the pros and cons, costs, delivery dates.

The prototype phase is when you start building things. The first prototypes will not have the form factor of the final product. A useful tool is to make a circuit that has all the parts on one side of a board and is not as densely packed as the final product will be. This is a development board and is an early prototype. The purpose is to test out circuit design, try specific parts and provide a platform for the development of firmware and software. Doing this is cheap and fast. The end of the prototype phase should be a device that is very closely aligned with what the final product will look like, shape, size even color. The idea is to make something and try it out.

The final phase of the design cycle is products. This is often called pre-production. Injection molds are designed, documentation is laid out for the production process, and qualification testing is being done. This is the time to get everything lined up for a smooth transfer into production.

4. Can you show me an example of your work?

Understanding what is going to be done is often best explained by example. Not only does this help clarify the type of work that will be done, but it also gives the consultant the ability to show the type and quality of work they do. It is easy to see if someone really knows what they are doing if you can ask them questions about a specific project they worked on.

What should I do next?

If you are reading this guide it is likely you have some work you are considering having done by a consultant. Consulting is largely done by recommendation and word of mouth. You can ask other businesses you know if they have a recommendation for a consultant they have worked with. Give one a call and ask if they would be willing to discuss your needs and show some of their work.

Of course we would be glad to answer any questions you have at Celtic Engineering Solutions. You can check out our website at: www.celticengineeringsolutions.com. Be sure to check out the Team page. There are links under team member names to take you to their LinkedIn site where you can read recommendations for current and former clients. Or we can be reached at 801-414-9597

The author of this paper is Sean O’Leary, owner and President of Celtic engineering solutions. He has a master degree in Electrical Engineering from the University of Utah and has over 20-years’ experience as a design engineer working on projects in mining, aerospace, defense and medicine. He has worked on project for NASA and DARPA.

