INTERMODULAR SEMICONDUCTOR SYSTEMS*

1. Initial Problem Specification

The Special Products Division of Intermodular Semiconductor Systems has received a Request for Quotation from Allied Intercontinental Corporation for 100 deep sea semiconductor electrotransponders, a specialized instrument used in testing undersea engineered structures. While Intermodular Semiconductor Systems has never produced deep sea electrotransponders, they have manufactured subsurface towed transponders, and it is clear that they could make an electrotransponder that meets Allied s specifications. However, the production cost is uncertain due to their lack of experience with this particular type of transponder. Furthermore, Allied has also requested a quotation from the Undersea Systems Division of General Electrodevices. Intermodular Semiconductor Systems and General Electrodevices are the only companies capable of producing the electrotransponders within the time frame required to meet the construction schedule for Allied s new undersea habitat project.

Mack Reynolds, the Manager of the Special Products Division, must decide whether to bid or not, and if Intermodular Semiconductor Systems does submit a bid, what the quoted price should be. He has assembled a project team consisting of Elizabeth Iron from manufacturing and John Traveler from marketing to assist with the analysis. Daniel A. Analyst, a consulting decision analyst, has also been called in to assist with the analysis.

Analyst: For this preliminary analysis, we have agreed to consider only a small number of different possible bids, production costs, and General Electrodevices bids.

Reynolds: That s correct. We will look at possible per-unit bids of $3,000, $5,000, and $7,000. We will look at possible production costs of $2,000, $4,000, and $6,000 per unit, and possible per-unit bids by General Electrodevices of $4,000, $6,000, and $8,000.

Iron: There is quite a bit of uncertainty about the cost of producing the electrotransponders. I d say there is a fifty percent chance we can produce them in a volume of 100 units at $4,000 per unit. However, that still leaves a fifty percent chance that they will either be $2,000 or $6,000 per unit.

Analyst: Is one of these more likely than the other?

Iron: No. It s equally likely to be either $2,000 or $6,000. We don t have much experience with deep sea transponders. Our experience with subsurface towed transponders is relevant, but it may take some effort to make units that hold up to the pressure down deep. I m sure we can do it, but it may be expensive.

Analyst: Could you do some type of cost-plus contract?

Reynolds: No way! This isn t the defense business. Once we commit, we have to produce at a fixed price. Allied would take us to court otherwise. They re tough cookies, but they pay their bills on time.

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* Material in this case is adapted for the Positronics analysis in P. McNamee and J. Celona, *Decision Analysis for the Professional, with Supertree*, Scientific Press, Redwood City, CA, 1987

Iron: I want to emphasize that there is no problem making the electrotransponders and meeting Allied s schedule. The real issue is what type of material we have to use to take the pressure. We may be able to use molyaluminum like we do in the subsurface towed units in which case the cost will be lower. If we have to go to molyzirconium, then it will be more expensive. Most likely, we will end up using some of each, which will put the price in the middle.

Analyst: What is General Electrodevices likely to bid?

Traveler: They have more experience than we do with this sort of product. They have never made deep sea electrotransponders, but they have done a variety of other deep sea products. I spent some time with Elizabeth discussing their experience, and also reviewed what they did on a couple of recent bids. I d say there is a fifty-fifty chance they will bid $6,000 per unit. If not, they are more likely to bid low than high there is about a thirty-five percent chance they will bid $4,000 per unit.

Analyst: So that means there is fifteen percent chance they will bid $8,000.

Traveler: Yes.

Reynolds: Suppose we had a better handle on our production costs. Would that give us more of an idea what General Electrodevices would bid?

Iron: No. They use graphite-based materials to reinforce their transponders. The cost structure for that type of production doesn t have any relationship to our system using moly alloys.

2. The Value of Additional Information

Analyst: Would it be possible to get a better handle on production costs before making the bid?

Iron: As I said earlier, the main issue is what it will cost to reinforce the electrotransponders to take the pressure. We could make up some material samples and borrow the high pressure chamber over in the Submersible Systems Division to do some tests. We d get some information out of that, but there would still be a lot of uncertainty. Also, it would be expensive I would have to put people on overtime to meet the bid schedule.

The main problem is that we don t have time to do very extensive testing before the bid is due. We could make up a rack of samples from materials we have in stock and take some measurements under pressure, but these materials aren t exactly the same as what we would use in the actual electrotransponders. Because of this, we would still not know for sure what we will have to do to make the electrotransponders work.

[This option was discussed at some length. Following this discussion Analyst summarizes as follows.]

Analyst: As I understand it, the result of doing material tests would be an indication that the production will either be expensive or inexpensive. If molyaluminum is going to work, it is more likely that you will get an inexpensive result while if you have to use molyzirconium you are more likely to get an expensive result.

Iron: Yes. In previous cases when we have done tests like this and molyaluminum ultimately worked, then four times out of five we had gotten an inexpensive

indication. On the other hand, when it has worked out that we needed molyzirconium, then ninety percent of the time we had gotten an expensive indication.

Analyst: What about if a mixture worked?

Iron: We haven t gotten very much useful information in those cases. In cases where a mixture has worked, sixty percent of the time we had gotten an inexpensive indication and forty percent of the time it came out expensive.

Analyst: Based on our earlier discussion, I understand that if molyaluminum works the production costs will be $2,000 per unit, if molyzirconium is needed the costs will be $6,000 per unit, and if a mixture works the costs will be $4,000.

Iron: That s correct for the 100-unit quantity we are discussing here.

Reynolds: How much would the material tests cost?

Iron: There will be a lot of hand labor. I ll go talk with my people and get a figure back to you in a couple of hours.

[Iron leaves the meeting and later reports that it would cost $7,000 to conduct the material tests.]

3. The Time Value of Money

Analyst: So far, we have been talking as though the cash flows for this would all occur at the same time. What are the delivery terms that Allied specifies?

Reynolds: We have to deliver twenty-five of the electrotransponders in six months and the other seventy-five in twelve months. They will pay on delivery.

Analyst: What about the schedule for your costs?

Reynolds: A lot of the work would be subcontracted out, and we wouldn t have to pay for it until we get paid. I d say as a first approximation that you can assume that the costs and revenues will occur at the same time twenty-five percent in six months and the other seventy-five percent in twelve months. When you analyze this, use our usual fifteen percent per year discount rate.

4. Attitude Toward Risk Taking

Analyst: What about the risks associated with this contract? Are they significant?

Reynolds: Elizabeth said we wouldn t have any problem meeting the delivery terms, so the only risk is the possibility of losing money on the deal. This job would generate about ten percent of the Division s gross revenues for the year if we take it on. We project that the Division will generate about twenty percent of Intermodular Semiconductor Systems s gross revenue for this year. Our net revenue usually runs about thirty percent of the gross, so I don t see the risks on this as too bad. I m sure Corporate Headquarters would say I should play the odds on something this size. On the other hand, they will still put me through the wringer if we lose money on it. When you do your analysis, let me know if risk attitude changes the results. If so, I will give it some more thought.

Craig W. Kirkwood
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