

Visit to Sony, July 1

Background

This visit was arranged by Lynda Strupp, a US-born member of Sony FA (Flexible Automation) marketing staff. She is bilingual and helps with US marketing. Sony people present were

Mr Yoshihiro Tsukamura, Deputy General Manager, FA Group

Mr Yunosuke Hayakawa, General Manager, Planning Div FA

Mr Tohru Fujimori, General Manager, Robotics Products FA

Mr Hiroyuki Segawa, Engineer

Mr Junichi Kuzusako, Assistant Manager, CAD/CAM, Product Technology Group

Mr Tsukamura is the most senior person among these, quite experienced in design methods, although he joined FA only a year ago.

Ms Strupp has communicated with me before and stressed that Sony is very protective of its CAD and design methods, as well as of its manufacturing methods for the most advanced and competitive products, such as Handicams. The purpose of this visit was for Sony to determine if there was enough for them to learn from me that they should open up. Apparently this was a successful visit because they decided to host me for further meetings with Mr Fujimori and Mr Kuzusako. (See next report.)

Business of the FA Group

The FA group makes and sells robots and assembly automation equipment, including circuit board assembly machines, both inside and outside Sony. In both markets it competes with other vendors. There are now several hundred Sony robots inside Sony (the number is not clear, or they did not want to quote a precise number, so perhaps it is as few as 150 or as many as 450), mostly at the Koda plant where VCR's and Handicam's are made. In the US they have had a hard time selling robots or complete systems. This has been true for as long as the FA division has existed, which is about 6 years. Their best US customer bought 24 robots in a complete "turn-key" system about two years ago and recently bought about 40 more. This customer will make all the tooling and do all the programming and system integration for the new 40 themselves, a major achievement.

The FA group's promotional video attempts to leverage FA products off of Sony's own high tech products. The challenge is to make smaller and lighter products with better performance. This requires production technology that only Sony can deliver, etc. Examples given are assembly robots, surface mount circuit board assembly machines, wire bonders, semiconductor manufacturing equipment, and so on.

Ms Strupp says that Sony's biggest competitors are Seiko and ADEPT. Both have better programming systems, which attracts customers. This annoys Sony since the best controller is often not needed. ("Only Motorola wants the best of everything.") Sony often has better accuracy or payload and has much more experience with product redesign for robot assembly and system integration. They want more of this kind of business but can't get it, often because they are short of people. This is in contrast to most robot makers who are also system integrators, since it is usually more profitable to sell naked robots than to do the engineering necessary to tailor a system to a customer's product.

Sony will even sell robots and systems to direct competitors such as Hitachi. I asked if this might result in the transfer of Sony's product design for assembly know-how and was told that Sony sells only naked robots to such customers since they already know how to design the tools and do the programming and system integration. In this sense, Hitachi or other Japanese customers are typical, and European companies also commonly have such capabilities. US companies normally do not, and this fact makes the above-mentioned customer's capability especially unusual.

The Sony people were surprised to learn that Nippondenso has 2600 robots (as of 1990) of which they made 90% in house. Nippondenso does not bother to try selling robots outside and does not buy many either, since they get better service from their own engineers and in any case domestic robot manufacturers are saturated with orders and cannot deliver fast enough.

Sony Product Design Practices

Sony regards itself as especially skilled in mechanical design, less so in electronics and software. This is important because mechanical design practices and the usefulness of new CAD tools were the focus of the visit. It is Sony's impression that they do not need help in mechanical CAD but do in electronics. Yet when I showed them our feature-based design software video they asked immediately whether it would be available commercially and when.

According to Mr Fujimori, Sony's mechanical designers consider assembly right during design, including assigning tolerances and considering assembly sequence. In fact, sequence is determined first and then tolerances are decided, which is the correct method. "Good designers consider both the sequence and the type of equipment that will be used. They start doing this right from the beginning of design, when there are no parts and you must imagine the final assembly." (See next report where this statement was made clearer.)

When I asked if redesign was needed for robot assembly, I was told Yes. This seemed paradoxical in view of the earlier statement. When pressed for examples, they cited the need to add chamfers around holes if the tolerances could not be tightened. This is an especially trivial change to make and indeed to include in the original design. Thus the discussion did not seem productive and I could not get a better definition

of the situation, except for the remark that not every designer has the skills of the best one. I also could not get them to agree that software to help calculate tolerance stackups would be useful.

The latter comment recurs in many of my visits: the hosts are proud of the CAD and CAE software they have and know how useful it is. But they often see no need to have anything better even when they agree that doing some design task manually is either tedious or is even skipped due to its difficulty.

Mr. Hayakawa noted that in 1986 top management launched a campaign called "innovate 86" whose aim was (and still is) to improve product design, industrial engineering, and automation. When we note that a company the size of Sony has only a few hundred robots, it is evident that a lot of assembly is still being done manually. Since several of the items being assembled by robots (VCR mechanisms, Handicams, etc) are very complex and demanding, it is not a lack of robot technology that accounts for this fact. It may well be a sheer lack of robot system design engineers, a fact cited in other areas and other companies repeatedly. Or it could be that many products are assembled in low labor cost countries.

Products are designed by teams of engineers, typically 20 to a team. The product design cycle comprises four prototypes called Research, Function, Manufacturing, and Preproduction. These appear on about 4 to 6 month centers. Cost and manufacturability are considered after the functional prototype achieves the required performance. Manufacturing engineers and FA engineers join the design project at that point. A new product will take 2 years to pass through this cycle, whereas a modification of an existing product can be accomplished in one year by a team of 5 engineers. Projects are run by an engineer with 10 years of experience. He may run more than one project at a time but not usually. Previous designs are scrutinized carefully to determine applicable tolerances and assembly methods.

An example given was the optical pickup for a CD player, where tolerances are in the microns. Several people from different disciplines join a discussion about how to best achieve the specifications. Sometimes an adjustment method is used rather than aim for a perfect result in the first place. At various points in the design process there are design reviews, a typical practice in many industries. At Sony it is common for engineers from other projects to attend and make suggestions for improvement or warn of possible problems with the current design.

Uses for Computers in Design

Sony buys most of its CAD software. The commonly used packages are CATIA and CADAM, both supported by IBM. Sony also has an inhouse freeform surface program called FRES DAM that creates very realistic views of the exterior of a camera, say, using a Silicon Graphics terminal. Recently they acquired a robot motion simulation program from a US company, Silma. However, the database of part designs and tolerances, plus information about robot tolerances, does not exist

so full advantage of this software cannot be had. "Japan is weak in robot simulation software."

They do not have any solid modeling software. Instead they model exterior surfaces in FRES DAM with Bezier's formulation. No analysis can be performed in this software. In a few cases, the surfaces are transferred to SDRC's solid modeler, from which a plastic mold flow analysis is often done. FRES DAM has recently been linked with a stereolithography system.

What do they want in the future? Mr Kuzusako says that feature-based design (FBD) sounds like a good idea but solid modelers are too hard for designers to interface with right now. (Many hosts said this.) Mr Kuzusako also said that FBD would be the most help if it were connected to information databases such as for materials properties and costs. Designers should be able to create their own features. This would be useful for robot programming as well as for design.

Currently they have no organized system for keeping track of previous designs in software or of reusing them. Mr Kuzusako felt (unless he misunderstood the question) that it is more important for all the designers of the current product to be able to access a common database about IT. This is logical if one realizes that many Sony products are quite different from their previous versions, due to extreme size reductions or performance changes.

What about the need for or usefulness of software to calculate tolerances or make fabrication and assembly cost analyses? Mr Kuzusako allows that this might be useful but he has no plans to start in this direction, only a hope. He has no experience in this area.

Mr Tsukamura, the senior man and most experienced, said that his top priority, based on inputs from the designers, would be for software that accomplishes or aids end-to-end design of circuit boards and their manufacturing processes. Such software exists commercially, I said. Sony has a mix of home-grown and bought, and they are not satisfied with it. His judgement was based in part on the valid observation that the opportunity for using computers is greatest where design is the most routine or uses (or reuses) the most standardized shapes. This characterizes electronics design, not mechanical design.