I was deeply saddened by the news that Tihiro Ohkawa had passed away last year, a remarkable fusion power scientist and advocate. I would like to contribute to the Established web page in his memory that will be hosted on the General Atomics website.

I recall the employment interviews at General Atomics with: Tamano Teruo; John Gilleland; Fred Puhn; Ed Hubbard, Torkil Jensen; and others, whom all wanted me to the join their D-III team; and Charlie Baker who wanted me to work on advanced fusion reactors in 1974. I also recall an underlying pervasive interview theme was the desire of this management team to enlist experienced aerospace or laboratory engineers with large integrated systems projects, particularly those who showed enthusiasm to take on a breakthrough challenge in fusion with the D-III Tokamak. It was to be a second generation, beyond PLT, PDX, and be designed and constructed by industry. With a subsequent employment offer, I resigned from Boeing Company to join the team.

Ohkawa's science management and leadership with Gilleland's project management leadership D-III engineering was very innovative, engineered with advancing designs, based on sound R&D, that have proven to be crucial in it being the remaining operating U.S. Fusion Program Tokamak. It continues to provide exciting research results for the U.S. Program and ITER.

At that time our team's designs were challenged by the laboratory-based fusion community as being beyond the state of the art fusion engineering practice. Some design innovations were specifically challenged: demountable outer leg of the Toroidal Field coil, with a "finger joint" , allowing for the future upgrade to D-IIID; In-situ winding/insulating of the central solenoid, using a surplus 40MM Navy gun mount; using the Field Shaping coils to be the structural load path for the vacuum vessel and the coil system(s); corrugated sandwich vacuum vessel with internal cooling in the structure, mid-plane suspended, from imbedded supports in the coil system; and all coils were structurally designed to react the many load cases provided by John Wesley's physics department, without the community practice of a enclosing them in metal cases. The later required we develop through R&D methodology for analysis of composite copper coils and turn-to-turn voltage insulating epoxy system, and then modify this generation of finite element analysis codes to integrate within our R&D results, and subsequently predict mechanical performance, against physics requirements. The implementation of the electrical switching system and the motor generator for pulse power were also innovating for the time period.

The vacuum vessel design was very unique for the fusion community and they raised issues of survivability under a range of plasma disruption loads. Presentation of the underlying design philosophy was that: external applied loads that were much less than the order of the time constant of sound in the material, was just a static load; and if it was on the same order, dynamic amplification could ensue; but if the applied load time application was much shorter than the material properties could respond, the load was impulsive and the structure would not need to accommodate these. I proposed and was granted permission to hire Boeing Co. as an independent organization whose experiences and analysis codes were within the range of our designs. Their team verified our design criteria for this loading and our vacuum vessel would indeed perform to all requirements.

Also the D-III Physics Department required that all coils individual magnetic center be exactly spatially positioned at their required locations, which would be a problem if enclosed in a coil case. A Boeing technique we used, of epoxy-filled-fiber shim bags was employed to satisfy these requirements. These and many other engineering innovations were fully supported by the Fusion Division Management led by Tihiro and John. They insisted on engineering excellence, and we gave it to him.

Tihiro being a globally recognized fusion scientist, encouraged the engineering staff to publish in fusion and technology journals the results of our R&D, designs, analysis, and performance, to enhance our fusion engineering reputations.

I continue to work part time at Leidos, which was spun out from SAIC, as Technology Solutions Leader, and continue working closely with UCSD on company R&D activity.

I am quite thankful for the General Atomics D-III technologically innovative experiences, as they enhanced my lucrative career at SAIC, after leaving PPPL/Ebasco TFTR, and now at Leidos.

THANK YOU TIHIRO!

Maurice M. Sabado

Leidos Technology Solutions Leader