Kees Zwaan (1928 – 1999) and JOSO

Rob Rutten
Sterrekundig Instituut Utrecht

Kees (officially "Cornelis") Zwaan died in his house in Doorn, The Netherlands, on June 16, 1999. Much too soon and unexpected — at least by me until his final deterioration; I had always thought that he would live as long as his parents, the more so when he had recoverated remarkably fast and well from major cancer surgery a year earlier. Most of this year he spent on completing *"Solar and Stellar Magnetic Activity"*, a book co-authored with Karel Schrijver that is now in print (Cambridge University Press). Kees' total dedication to that large effort made me expect the same as I witness in other officially retired but highly motivated curiosity-driven scientists: continuing interest into high age, with actually youthful enthousiasm and productivity.

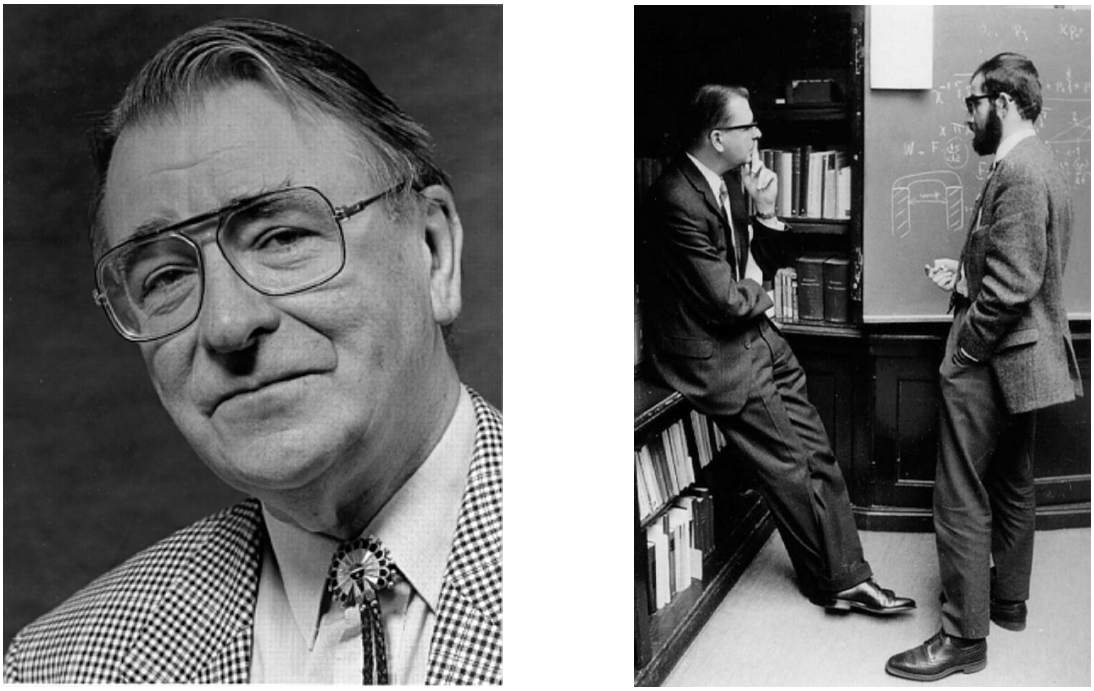

Figure 1. Cornelis Zwaan (1928 – 1999). Left: formal portrait taken in 1993 at the occasion of his retirement. Right: discussing fluxtubes with Hans Rosenberg (deceased 1992) at coffee time in the library of *"Sterrenwacht Sonnenborgh"*, around 1967.

Not so, alas. Having been Kees' first PhD student — in a sequence of which I am proud since it contains "quality names" as Henk Spruit, Aad van Ballegooijen, Karel Schrijver, Karen Harvey and Louis Strous, to name the ones active in solar physics — and having been Kees' lifelong colleague at Utrecht, I miss him deeply. I am certain that this feeling is shared by many others because Kees inspired and befriended an unusually large number of scientists, both in and outside Utrecht. His interest in the workings and role of stellar magnetism inspired efforts ranging from stellar polarimetry and stellar evolution to solar instrumentation, from fluxtube and dynamo theory to the morphology of solar activity, from NLTE and magnetic line formation to theories of field emergence and disappearance,

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from detailed analysis of small-scale solar features to HRD-wide overview of stellar magnetism. In these diverse activities he was first of all an inspirer, somebody whose name is found frequently in acknowledgements, less often as co-author, infrequently as first author[1]; moved less by personal ambition than by genuine curiosity into the workings of nature, and always ready to provide valuable insight to others of the same inclination.

An example: at the occasion of Zwaan's undesired but law-enforced formal retirement in 1993 Karel Schrijver and I organized a workshop on solar magnetism (*"Solar Surface Magnetism"*, at Soesterberg) that we proposed to NATO for funding as a regular Advanced Research Workshop rather than as a Kees Zwaan "Fest" — with his full support since he prefered a serious, productive workshop over an egocentric festivity. We found quickly, however, that just tallying up his major partners in solar physics around the world already filled the 50-attendant limit and we therefore had to be so selective that we even didn't distribute our announcement poster (except to NATO to show that there was one). This bears testimony to Zwaan's inspirational role to colleagues worldwide.

Zwaan was a first-rate teacher too, as scores of Utrecht graduates can attest. The lecture notes that you may download from my website are very much Zwaan-inspired and demonstrate his teaching standard, an act that I find hard to follow. In addition, Zwaan played a key role in the introduction of stellar astrophysics into the Dutch high school physics curriculum during the seventies.

Zwaan's own thesis, started while he was a high school physics teacher, supervised by M.G.J. Minnaert, defended in December 1965, and titled *"Sunspot Models"*, is quite characteristic. On one hand, detailed analysis of how scattered light upsets sunspot spectroscopy and did upset many earlier conclusions in the literature, making Zwaan being cited as straylight expert for decades to come; on the other, scenarios of how sunspots assemble, speculations on their mass and energy balances, and even a sunspot-related flare mechanism using MHD waves excited by umbral field configuration changes. In between, extensive curve-of-growth studies in Minnaert fashion. Thus, a typical Zwaan mix of both meticulous detail and bold thinking. The combination made his later research both daring, in that he regularly attacked new topics, and solid, in doing so at depth.

I will not try to summarize Kees Zwaan's scientific legacy here; most who knew him do appreciate his share in their own field well enough. His overall thinking and style of thinking are well represented by many of his sections in *"Solar and Stellar Magnetic Activity"*. Instead, I will concentrate on Zwaan's partnership in JOSO during the early seventies. It led to only one formal Zwaan paper (Hammerschlag & Zwaan, *"An efficient wind shield for the protection of telescopes"*, PASP 85, 468, 1973) but also to a score of JOSO reports.

Let me briefly set the stage. K.O Kiepenheuer started JOSO in 1969 with a three-item to-do list:

(i) —Find the best location for optical solar observations in or near Europe;

(ii) —Move existing telescopes to that site and erect new national facilities there;

(iii) —Build a large international solar telescope there.

Item *(ii)* constituded the heyday of JOSO, Working Group I "Site Testing" chaired by Zwaan being its primary activity. About forty likely and less likely sites were inspected;

[1]Nevertheless, Zwaan's ADS citation record is one of the highest in solar physics.

a dozen sites were tested for some weeks at least. The very peak of the Teide was Kiepenheuer's fancy, but too impractical. Zwaan himself became the champion of low-level oceanic sites avoiding orographic effects whatsoever. He led ten campaigns to sandy islands off Portugal (Culatra, Barreta, Pecegueiro) and the tiny Ilha Selvagem Pequena, a low lonesome rock in the Atlantic north of the Canary Islands. The main excursion to a mountain above the inversion layer was to Madeira, where the rough orography produced such bad imaging that it strengthened Zwaan's emphasis on laminar air flow. The story is laid down in JOSO Reports SIT4, SIT5, SIT6, MET9, MET14, MET16, MET18, MET25, MET31, MET49, MET54, MET59, OPT7, SIT20, SIT26 and JOSO Annual Reports 1972, 1973 and 1974, of which many are authored by Zwaan.

These campaigns, as most JOSO site testing, were truly international. In these Portuguese-island ones there was much cooperation from the Portuguese meterologists and even the Portuguese Navy (to Ilhas Selvagem). The Oslo group shared in half the campaigns, the Meudon group on Madeira, the Freiburg group sampled air above Barreta by plane and the Florence group by radiosonde. Zwaan and Hammerschlag did so closer to the ground with simple wind meters (toilet paper was a JOSO standard) and by inspecting images from a Questar and a somewhat larger Popp telescope.

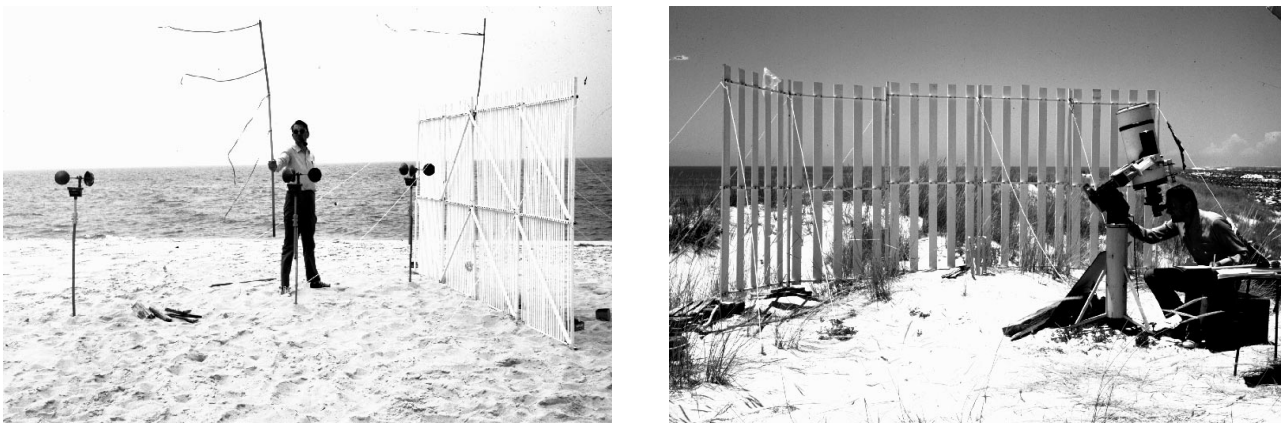

Figure 2. Zwaan site testing on Barreta. Left: demonstrating the effect of the semi-transparent wind screen. Right: monitoring solar image quality on the Kiepenheuer scale. From slides taken by R. Hammerschlag in 1973.

In the end, the sea-level disadvantage of sitting far below the inversion layer lost out to the Canary volcanoes which reach above the inversion most of the year. The 1979 German comparison between Roque de los Muchachos and Izaña led to preference for the latter site (JOSO Report 1980/1 by Brandt & Wöhl), whereas later on the LEST Foundation declared La Palma better without comparative testing. More recently, Beckers' scintillation monitoring has confirmed the advantage of mid-lake locations with respect to the seeing caused by solar heating of the near-surface boundary layer, but the issue which site is "best" worldwide remains open. Zwaan was a firm believer in the smooth Northern slopes of La Palma as the best thing next to water. Indeed, strong upslope winds from the North bring the best seeing to the SVST and the DOT, but the trade wind fails or blows from the wrong quarter rather too often, the erratic wind distribution in fact being the decisive factor against La Palma in the 1980 Brandt–Wöhl report. La Palma has fabulous seeing, but not too often. This makes "beating the seeing" through adaptive optics and/or numerical image restoration an important to-do item at present, now that computers finally get up to the task.

JOSO's to-do item *(ii)* of course led to the planned move of the GCT, now to become GREGOR, the long-planned installation of the VTT, the long-planned installation of THEMIS and DOT whose completion took even longer, and the unexpected but very fast installation of Scharmer's SVST, now to be revamped into the NSST at similar speed. The DOT tale is more a Hammerschlag story than a Zwaan one, not to be detailed here except that Zwaan started the project by suggesting to Hammerschlag that he might design a transportable 45-cm telescope for LEST site testing, and championed the project unendingly with total confidence and utter optimism through the long decades of its slow realization — another act that I find hard to follow but that is now proven correct by the impressive quality of Hammerschlag's product, still competitive even so many years since its conception.

JOSO's to-do item *(iii)* later developed into and split off as the ill-fated LEST Foundation, officially buried two years ago and leaving stacks of reports plus a hole in the ground on La Palma large enough to bury them in. Zwaan did not play any role in LEST. The Netherlands never became a LEST member, not because of ill-will but rather because the prosperity of the seventies had gone and the rapid cut-down of Utrecht astronomy had started, eventually halving the scientific staff, decimating the support staff including technical support, and leaving no funding other than our salaries. (Only now, with the Dutch economy booming, may we hope for better times although DOT funding remains in scary jeopardy.) However, Zwaan did take part in a similarly ill-fated large-telescope project: NASA's SOT–HRSO–OSL space mission, intended to be the Hubble-like flagship of solar physics but killed definitely by the Challenger shuttle explosion. During many years, Zwaan was the single non-US member of the project team, spending much time on co-defining science goals, instrumentation principles, and canvassing US government bodies and officials. SOT–HRSO–OSL was largely outside JOSO, but the close parallel with LEST is evident. Zwaan definitely fulfilled a Euopean role in that enterprise.

Zwaan's sharing in the JOSO site testing campaigns and their truly international character inspired him in 1974 to be a driving force behind ESMOC, the "European Solar Meeting Organization Committee" consisting of C. Chiuderi, M. Landini, A. Righini, C. Jordan, J.-C. Pecker, M. Pick, E.H. Schröter, W. Mattig, H.U. Schmidt, E. Schanda, A.D. Fokker (secretary) and C. Zwaan (chairman). It set up the First European Solar Physics Meeting at Florence in 1975, combining JOSO and CESRA, and there initiated the start of the Solar Physics Section of the EPS which later became a section of the EAS as well and has organized similar meetings every three years (Catania 1978, Oxford 1981, Noordwijkerhout 1984, Titisee 1987, Debrecen 1990, Catania 1993, Saloniki 1996, Florence 1999).

Zwaan's last act was to set up a foundation to support observational solar physics in Utrecht, bequesting a considerable sum to it. As seed money, it may help the DOT to survive the coming years. A characteristic act in the JOSO spirit.

Let me conclude by mentioning that Zwaan's widow Prisca and I, while going through his papers, have collected all of Zwaan's extensive JOSO site testing documentation and correspondence. It will be preserved at a national Dutch science history archive in Haarlem and there be available to future historians interested in how JOSO contributed to the founding of the Canary Island observatories.