

RESUME FOR ROBERT J. LANO

Mr. Robert J. Lano has over 45 years of experience in the field of system engineering. He was a pioneer in the distributed processing concepts that dominate the system architectures of today. He has performed system analysis and design activities for a large variety of system types and users; ranging from military command and control, NASA programs, spacecraft support, and intelligence systems to nuclear effects, ASW, FAA, photographic reduction, crash recorders, automatic teaching, and modern office automation systems. He has written several books on system engineering activities (Operational Concept Formulation, Requirements Analysis, and the N² Chart interface definition technique), and has conducted over 30 seminars and courses entitled "Requirements Analysis and Specification" to contractor, customer, and user personnel both in the US and in Europe. He has patent disclosures registered in digital conversion techniques and phasolver principles, and has established corrections to the National Bureau of Standards documents concerning the propagation of sound in sea water as well as expanded levels of angular measurement techniques.

Since retiring from TRW in 1993, Mr. Lano has been working on his System Engineering book and participating in various system engineering consultant activities.

Mr. Lano was employed by Volt Information Sciences as the System Engineer consultant for TRW on the Warfighter Information Network - Tactical (WIN-T) requirements definition and architecture development phase of the program. WIN-T is a global, mobile, survivable, secure internet like tactical communications network. It consists of stationary, sheltered, vehicle imbedded, and remote entry units, augmented with wired and wireless telephone type elements. Linkages between these units consist of satellite (MILSTAR, DISCS, and commercial), microwave (HCLOS), Over the horizon (OTH), fiber optics, land lines, laser, and software radios (spread spectrum, frequency hopping, transec encrypted). Mr. Lano led the requirements definition and architecture development activities for TRW.

As a change of pace, Mr. Lano consulted for the City of Anacortes in an effort to re-do their computer network. Their existing network consisted of a central batch processing CPU and a few software experts. Mr. Lano started with a detailed analysis of how the City operates, what data bases were involved, how data flowed throughout the system, and what political structures were involved. He used his famous set of Structured Design, N Squared Chart (N² Chart), Requirements Networks (R-Nets), and Data State Design tools to show the City how its operations could be improved. He then architected a new system (which was implemented) using PCs, multiple local area networks, State discounted hardware, and software developed for other cities.

Mr. Lano was employed by Main Stream Engineering as the Ground System Engineering Consultant for TRW on the EDOS, LDOS, and IMCSAS proposal efforts. EDOS (Earth Observing System (EOS) Data and Operations system) is a distributed processing system to acquire, calibrate, format, back up, network, store, distribute and control scientific satellite information between the Earth Observing Satellites, the Tracking Data Relay Satellite System (TDRSS), the EOS Distributed Active Archive Centers (DAACs), the NASA institutional systems, and the distributed scientific user community. On

this assignment, Mr. Lano developed and documented the overall system engineering methodology including operational concept formulation, requirements analysis, interface definition and control, trade-off analysis, performance modeling, conceptual system design, requirements allocation, design review, and development support. TRW won this contract. Mr. Lano performed similar duties on the Landsat Data and Operations System (LDOS). This contract was canceled due to a failed satellite launch. On IMCSAS (International Military Communications Satellite Architecture Study), Mr. Lano was the ground system leader to formulate a process for designing a new common satellite ground communications system and integrating this system with existing multiple European and US satellite and ground stations. TRW won this contract.

Mr. Lano's final activities at TRW were devoted to the ground system engineering and design in the ROCSAT and Odyssey study efforts. The Republic Of China scientific Satellite system (ROCSAT) study involved the requirements definition, design, and procurement planning for the new and existing ground system components, from launch support to on orbit operations. Mr. Lano developed the TT&C concept of operations document, the ground system requirements document, the Resource Satellite Receiving Station (RSRS) utilization report, the ground system architecture document, and the ROCSAT TT&C procurement plan. The study involved the utilization of ground components in Taiwan, the United States, South Africa, Australia, and Canada.

Odyssey was a TRW conceived commercial global satellite cellular communications system which employs multiple orbiting satellites; thousands of handheld wireless telephone sets, centralized ground control stations, and globally distributed traffic management centers. During the initial Odyssey study, Mr. Lano generated the concept of operations, ground system requirements, ground system architecture, ground system design, and ground system planning documents. Many trade-off and analysis activities were also performed concerning the detailed control of user/satellite traffic switching and centralized vs distributed satellite and international network control.

As a Senior System Engineer for TRW's Software Development Division (SDD), Mr. Lano designed, developed and deployed the desk-top computer SDD Office Automation Project (over 1400 users at TRW's Space Park facility). His project related activities included architectural formulation tasks for large systems (i.e., DSCS Follow-on study in the Satellite Control Element [SCE] and Network Control Element [NCE] areas), Pre-contract system engineering activities (i.e., SNCS, ATDRSS, EOSDIS/ECS, GBI-X, Short- Hop, and AMOS), project reviews, automated proposal tools generation, and the development of a Computer Aided Requirements Traceability (CART) methodology (HyperCART) for use in a distributed processing desk-top computer environment.

As Manager of Engineering Planning for TRW's Software and Information Systems Division (SISD), Mr. Lano was responsible for the generation and control of all division design standards and procedures, and for maintaining the design integrity of all SISD projects. His activities included system engineering and design functions on such things as the Joint Tactical Fusion Program (JTFF) and the NASA Space Telescope Scientific Operational Ground System (SOGS). The JTFF assignment included the requirements definition, architectural design, and detailed system design of joint (Army/Air Force)

mobile tactical intelligence centers. These systems are excellent examples of truly distributed computer architectures, and exhibit the “modularity” and “flexibility” attributes emphasized in Mr. Lano’s books and course materials. On SOGS, Mr. Lano was the TRW Business Manager, Proposal Manager, and Chief System Architect. SOGS is a six- computer VAX network that performs mission planning, target acquisition, image processing, and off-line data processing for the NASA GSFC Space Telescope program. This project, awarded to TRW in late 1981, was completed ahead of schedule and under cost. Prior to this assignment, Mr. Lano was Advanced Systems Manager of the Hardware and Integration Systems Operation of the System Engineering and Integration Division (SEID). During this period, Mr. Lano performed system engineering duties on the following programs: The Tracking and Data Relay Satellite (TDRS) System, the Advanced Westar Satellite Communications system, Project 5120, AFSCF Data System Modernization (DSM) program, The AF Telemetry Integrated Processing System (TIPS), Army intelligence systems (CEWI/ EWIOC/ CCIS/ ASACAC/ BETA), Classic Wizard, and other classified systems. His duties included customer coordination, operational concept definitions, conceptual design, requirements analysis and specification, system architecture design, implementation review, integration, test, operational deployment, training, operational certification, and operational support. On the TDRSS project, Mr. Lano was responsible for the initial operational concepts and designs of the TDRSS Ground Station and its interfaces with NASCOM and the scientific user network.

Earlier, as manager of the systems staff in the System Integration Laboratory, Mr. Lano supervised and participated in the system engineering functions involved with the DSP Simplified Processing System, the Space Shuttle Mission Operations System, the Space Lab program in France, the TIDAS system in Sweden, the Advanced Airborne Command Post (AABNCP), the 427M NORAD Cheyenne Mountain Complex system, the Voyager program, the Reentry Measurements Instrumentation Project (RMIP), the Space Ground Link Subsystem (SGLS), and several other large classified ground systems.

Before joining TRW (1965), Mr. Lano was the manager of the systems engineering section of Whittaker Electronics (Telecomputing). In this position, Mr. Lano was the Project Engineer for the Air Traffic Control Beacon Interrogation system, the AJOY project (photographic ELINT), the BEEF project (NAVY ASW), and the NAVY SQA-8 (shipboard range and range rate system). Other system engineering duties included the design, integration, and test of the Askania Cinetheodolite system for Edwards Air Force Base, the Identification Friend or Foe (IFF) transponder system for Litton Industries, and the angle transducing phasolver system for Orbiting Astronomical Observatory (OAO). Other technical design activities at Whittaker included commercial auto-teaching systems, sonar systems, RF systems, nuclear affects measurement systems, optical reduction systems, aircraft crash recorder systems, data reduction systems, and total ground systems developments (structures, antennas, electronics, command, control, procedures, logistics, operations, and support).

RESUME SUPPLIMENT

o BA degree in PHYSICS & MATHEMATICS at UCLA (1960)

o Graduate /additional courses in

Nuclear Reactor Construction	Digital Electronics	Communications Engineering
Computer Software	Military Standards	System Engineering

o Employed at TRW for over 27 years

o Inventor of various computerized SE tools and methodologies

o Author of the following books:

A STRUCTURED APPROACH FOR OPERATIONAL CONCEPT FORMULATION

A STRUCTURED APPROACH FOR COMPUTER AIDED REQTS. TABULATION

A TECHNIQUE FOR SOFTWARE AND SYSTEMS DESIGN (THE N² CHART)

COMPUTER AIDED PROPOSAL TRACEABILITY METHODOLOGY

Sections of the IEEE "System and Software Requirements Engineering"

SOAP - The SEID Office Automation Project PC computer tool software kit

THE PROPOSAL FACTORY - A Proposal automation software tool kit

HyperCART - A Macintosh computer aided requirements tabulation tool.

o Instructor of Software & System Engineering courses for:

TRW	ESL	NASA	NSA	AIAA (Boston)	TSMA (London)
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LSMC	LAC	TRIAD	Fujitsu	Ultra Systems	TSMA (Germany)
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Space Lab (French - Matra) [ESA]	SE Consultant for Matra on Space Lab
427M (Cheyenne Mountain) [AF]	System Engineer for Ground Systems
Voyager [NASA]	System Engineer for Ground Systems
DSP Upgrades [AF]	System Engineer for DSP Upgrades (Sim)
Mission Operations System (MOS) [AF]	System Engineer for STS Ground Opns.
System Engineering training [TRW]	Instructed System Engineering courses
System Engineering training [SEL]	Instructed System Engineering courses
DSM [AF]	System Engineer for Ground Systems
Telemetry Integrated Proc. System [AF]	System Engineer for Ground System
TDRSS [NASA]	System Engineer for original Gnd. System
ASACAC [Army]	System Engineer for mobile Gnd. Systems
Beta [Army]	System Engineering Consultant
Joint Tactical Fusion Center [Army/AF/other]	System Engineer for distributed Systems
Classified Job (04)	System Engineer for Ground System
System Engineering Training [Ultra Systems]	Instructed System Engineering courses
SEID Standards [TRW]	Manager and System Engineer for activity
SOGS [NASA]	Business/Proposal/SE Manager
NSA Software Training [NSA]	Instructed 25 SE Courses at NSA
Lockheed System Engr. training [LSMC]	Instructed System Engineering courses
SEID office automation (SOAP) [TRW]	Manager and System Engineer for SOAP
RMMS [FAA]	System Engineer for distributed Systems
AMPE [Army]	System Engineering Consultant
AMOS (Israeli Satellite system)	System Engineer for Ground System
System Engineering Training [TRIAD]	Instructed System Engineering courses
Proposal Factory [TRW]	Invented automated proposal factory tools
DSCS Follow-on [AF]	Manager/ System Engineer – Gnd. Systems
ATDRSS [NASA]	Ground System Engineering Consultant

AFSCN Follow-On [AF]	Consultant for IBM on the Blue Cube Rep.
EOSDIS/ECS [NASA]	System Engineering Consultant
HyperCART	Invented Requirements Traceability tool
SNCS [NASA]	System Engineering support activities
Odyssey [TRW commercial]	Mgr & System Engineer for ground systems
ROCSAT [Taiwan]	Mgr & System Engineer for ground systems

R. Lano Telecomputing Engineering experience (1960-1965)

Air Traffic Control Beacon Int. System [FAA]	Engineer for ground systems
Photogrammetric digitizing systems	Engineer for Digital products
Classified project Beef [Navy]	Engineer for Navy ASW system
Nuclear Effects systems [AEC]	Engineer for effects digitization
Digital Crash Recording system [FAA]	Physicist for flight system
Askania Cinetheodolite system [AF]	System Engineer for Ground System
Phasolver angle measurement [NASA]	System Engineer for OAO Space Syst.
Heart Function Analyzer [Corn.]	System Engineer for Medical System
SQR 9/SQA 18 Sonar systems [Navy]	System Engineer for Ship System
Sound propagation in Sea water [NBS]	Corrected NBS tables
Digital time to pulse conversion	Patent Applications for digital Tech.
Advanced ATCBI system [Germany]	Engineer for ground systems
Oral Roberts teaching system [Texas]	System Engineer for teaching System
IFF system [Litton Ind.]	System Engineer for Flight System
DSN Original Proposal [NASA]	System Engineer for ground System
Agema command timer system [AF]	Sub-System Engineer for Ground System
Classified project AJJOY [TRW]	Sub-System Engineer for Ground System
Telecomputing Engineering Manager	Managed all Project Engineers