

**COMPUTER PROGRAM IN
BASIC DESIGN****JGS 210-120-1-15E**

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1. SCOPE

This document provides an outline of the computer systems including hardware, network and applications which are applicable to basic design of process plants, and the users may use this document as a "road map" to arrive at the appropriate computer systems. The manuals and instructions of each system should be referred to for the detailed functions and how to use them.

2. WORK PROCEDURE

2.1 User Registration

Server/Clients type network (CATHY network) together with stand-alone PCs are applicable to run the application softwares. All the users who access the network must be registered with a dedicated application form by the system administrator.

2.2 Validation of Software

All the systems including application softwares which are listed in this document are validated periodically. The users should check and make sure of the input and analyze the output for their use.

2.3 Basic Design Activities supported by the Softwares

Application softwares for basic design are spread over the following activities. The most suitable software should be adopted, depending on the engineering work and the job conditions.

- (1) Feasibility study and economics
- (2) Process modeling
- (3) Process analysis
- (4) Design of equipment
- (5) Drafting with CAD
- (6) Information management

3. SYSTEM PORTFOLIO

3.1 Hardware and Network

Server/Clients type network using SUN Work Stations (EWS) known as the CATHY network is available to run the application softwares. See Fig. 3.1. The network is configured for basic design related disciplines to be grouped, and it is linked to the network of other disciplines such as those related to detailed design. The current operating systems of SUN Workstations are mixture of SUN Solaris and SUN OS. PCs are also available connected to the network or stand-alone. Operating systems of PCs are a mixture of Windows 95, 3.1 and DOS.

3.2 Application Software

Major application softwares which are applicable for the various activities are described below. Refer to Table-3.2 for the related software, their names and brief explanation of the functions. The software marked with # are subsystems in JAPETS of JGC running on EWS.

3.2.1 Feasibility Study and Economics

- (1) The discounted cash flow analysis is supported with JGC's software named A493, which is running on EWS.
- (2) Cost estimation of equipment and bulk materials for feasibility study is supported by Icarus Project Manager (IPM) of ICARUS, running on PC. Detailed cost estimation, however, should be consulted with the dedicated disciplines.

3.2.2 Process Modeling

- (1) Physical properties estimation softwares are available for approximately 20 kinds of properties of more than 500 components and petroleum fractions based on the API Technical Data Book. The physical properties of mixtures including non-ideal systems are also estimated from those of pure components using various estimation methods. Process flow simulators also support estimations of the physical properties.
- (2) Some kinds of unit operations are modeled with dedicated software, such as the reactions for which equilibrium constants or conversion rates are provided, distillation including non-ideal system and batch operations, phase equilibria, extraction, membrane separation and compression/expansion.
- (3) General purpose steady state process flow simulators such as PRO-II of SimSci, Aspen-Plus of AspenTech, HYSIM of Hyprotech, DESIGN II of WinSim may be used for process flow modeling of a wide range of processes. Steady state flow simulators for special processes, such as SHELL Sulfinol process, SCOT process, sour water stripping process, gasification processes, etc, may also be used for modeling such processes.
- (4) Heat exchangers network simulators may be used to model the heat recovery systems. HEXTRAN of SimSci and JGC's in-house simulators are available for such purposes. Combined with HTRI heat exchanger rating software, heat recovery systems may be simulated rigorously.
- (5) For the steam distribution simulations, STEAM of Linnhoff March, Excel base software, may be used.
- (6) Dynamic simulation tools for the various processes are available. Some typical some processes have been already packaged, such as distillation columns, pipe line fluid transients, depressuring/compressurizing, etc. Also, the users may model their own processes using the simulation languages.

3.2.3 Process Analysis

- (1) Pressure balance simulation and hydraulic analysis of gas, liquid and mixed flow for piping systems are supported by JGC's in-house software with almost all available equations. Piping network including flare systems are also supported by the software. PIPEPHASE of SimSci is also available for such purposes.
- (2) Pinch analysis for heat flow of the processes and process integration using Pinch Technology is supported by SUPERTARGET of Linnhoff March, which also may handle H/E network analysis and distillation column targeting. Combining with STEAM, steam distribution and power generation scheme in the factories may be analyzed.
- (3) For simultaneous analysis of thermal and hydraulic limitation of the distillation columns, JUMP column analysis package is available, which is especially useful for debottlenecking of the columns.
- (4) JGC's in-house packages are available for predictions, analysis and prevention of noise in plants.

3.2.4 Design of Equipment

- (1) Tower internals such as trays and packings may be designed using the dedicated softwares. KOCH design method is followed for the valve type tray, and FRI design methods are mainly followed for the sieve type tray, bubble cap tray and the various types of packings.
- (2) For design of the shell and tube heat exchangers, HELEN of JGC is available, which contains the latest version of HTRI and HTFS design software. JGC's standard tube layout may be referred to in the software. HTRI and HTFS software also may apply for check of air cooler performance.
- (3) Tower and vessel design and skeleton preparation are supported by TED and VESTA of JGC respectively, which include standard assemblies of accessories, such as nozzles, baffles, etc.
- (4) For the miscellaneous materials, such as steam tracing, insulation, restriction orifices, etc, dedicated softwares are available.

3.2.5 Drafting with CAD

- (1) For the PFD/P&ID preparation, IRENE of JGC is available. IRENE is the intelligent type CAD system, where the attributes, such as piping size, flow rate, equipment dimensions, etc in the database are linked to the symbols in the drawings. Standard symbols and sets of the symbols are stored in the database in the reusable forms. Skeletons generated with TED and VESTA may be imported into IRENE. It may generate non-intelligent AutoCAD drawing files.
- PDS of Intergraph is available as an intelligent type CAD system as well.
- (2) AutoCAD, Microstation and Micro CADAM are available to prepare non-intelligent PFD/P&ID drawings.

3.2.6 Information Management

- (1) Stream data from simulators, attributes in the intelligent P&ID database, piping lines data and instrument data are related to each other, and they are the information source to the line lists and the instrument datasheet. Line and instrument database, LINDA of JGC, is available to manage such data. LINDA may be used either linked to PRO-II and IRENE or independently.

3.3 Integrated Use of Applications

JGC's application systems related to project execution are mainly composed of three systems, namely, CATHY for basic design, ACTES for detailed design and PMS Mark-II for project management. All applications may be used as stand-alone, and further some applications may be used in integrated form both in each system and between the systems by exporting and importing the files. Fig. 3.2 shows links among the applications in CATHY and to those in ACTES. Major links are;

- (1) Heat/weight balance and stream data are exported from PRO-II to IRENE and LINDA.
- (2) Skeleton data from TED and VESTA are exported to IRENE in both PFD mode and P&ID mode.
- (3) Connectivity data of equipment and piping are exported from PFD mode to P&ID mode in IRENE.
- (4) Various standard data, such as vessel/tower accessories, PFD/P&ID symbol and its blocks, heat exchanger tube layout, etc are referred to in each software.
- (5) Products of basic design activities from HELEN, TED, VESTA, IRENE and LINDA are delivered to appropriate applications in ACTES for further engineering.

4. ABBREVIATIONS

ACTES ;	Advanced Computerized Total Engineering System
CATHY ;	Computer Aided THinking sYstem
CAD ;	Computer Aided Drafting
EWS ;	Engineering Work Station
FRI ;	Fractionation Research, INC.
HELEN;	Heat Exchanger totaL ENgineering system
HTFS ;	Heat Transfer and Fluid flow Service
HTRI ;	Heat Transfer Research, INC.
IRENE ;	Integrated REpresentation for basic Engineering
JAPETS ;	JGC's Advanced Process Engineering Total System
LINDA ;	Line and INstrument DAtabase
PDS ;	Plant Design System
TED ;	TowEr Design system
VESTA;	VESSel and TAnk Design System

Table 3.2 List of Application Softwares for Basic Design

Remarks; EWS: running on SUN Work Station
 DOS: running on DOS PC, WIN: running on Windows PC
 #:..... Subsystem of JAPETS

1. Feasibility Study and Economics

Software Name	Licensed By	Running On	Functions
A493	JGC	EWS	Discounted cash flow analysis
IPM	ICARUS	WIN	Plant cost estimation for feasibility study

2. Process Modeling

Software Name	Licensed By	Running On	Functions
Physical Properties Estimation			
#PP/BASE	JGC	EWS	Generation of basic physical properties, such as MW, Sp.Gr., TBP, Tc, Pc, Vc, Zc, ω .
#TBPCUT	JGC	EWS	TBP cutting and generation of basic physical properties for petroleum fractions from crude assays.
#PP/PURE	JGC	EWS	Generation of physical properties, such as enthalpy, density, thermal conductivity, viscosity, heat capacity and surface tension, for pure substances
#KIJD TM	JGC	EWS	Determination of kij parameter for equation of state by vapor-liquid equilibrium data of multi-component system
#VLE-P	JGC	EWS	Determination of interactive parameters for estimating activity coefficients by Wilson, modified Van Laar and NRTL methods
#VLE-G	JGC	EWS	Draw graph of vapor/liquid equilibrium data for binary system
#PP/MIX	JGC	EWS	Prediction of physical properties of mixture for multi-component system
#PP/CODE	JGC	EWS	Calculation of physical properties of a library component
#PP/METH	JGC	EWS	Selection of the estimation methods for physical properties used in process simulation
#PP/PARA	JGC	EWS	Preparation of a table which shows binary interaction data
#PP/GET	JGC	EWS	Retrieving the physical properties of process streams
#PP/FLAG	JGC	EWS	Indication of existence of components in the component library
#PP/FIT	JGC	EWS	Calculation of factors for curve fitting of physical properties
#PP/FILE	JGC	EWS	Management of files for physical properties
#PP/SCR	JGC	EWS	Display of the physical properties of process streams on the screen
#PP/STD	JGC	EWS	Registration of the physical properties as standard data
#PP/TAB	JGC	EWS	Printing out of the physical properties in the file