E.C. JORDAN CO.

CONSULTING ENGINEERS

COMPUTER AUTOMATION MASTER PLAN:

FINAL REPORT

NOVEMBER 20, 1984

COMPUTER STEERING COMMITTEE:

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David Worth, Marketing
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Ann Amoroso, Administrative Assistant
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SECTION 2

EXECUTIVE SUMMARY

Many goals have been reached toward a comprehensive Computer Automation Master Plan. The following milestones have been reached:

- Identified work functions that should be implemented first (see Tables 1a and 1b).
- Begun software specifications, which will soon be sent to software suppliers.
- Selected Intergraph as the vendor for a computer-aided design and drafting (CADD) system, and identified a cost-effective system configuration for implementation over a two-year period, in four stages (see Table 2a and Figure 1):
  - An Intergraph 751 (VAX-11/750) with one workstation, delivered as soon as possible for technical applications.
  - Four additional workstations to implement CADD functions, in the second quarter of 1985.
  - Additional workstations in the fourth quarter of 1985.
  - An additional Intergraph 751 and more workstations in 1986.
- Selected an IBM System/38 as an upgrade to our data management system, and identified a cost-effective configuration to begin implementation (see Table 2b and Figure 1).
- Performed a cost analysis indicating that a good return on investment is possible, given a strong commitment to implementation and support (see Tables 3a and 3b).

There is a possibility, as with most successful computer systems, that the addition of more functions and higher levels of usage of identified functions will accelerate our two-year plans for revenue production and equipment needs. Automated Systems (ASD) is prepared to respond to the equipment needs by expanding central computer equipment or adjusting system priorities to satisfy company goals. ASD is also prepared to suggest and support alternatives, as addressed in Section 7. In any event, budgets for 1985 could include allowances for accelerating second-year purchases (up to an additional $500,000), as described in Section 7.

Additional work is necessary to complete a Master Plan for implementation of these systems. Serious discussions of all recommendations and decisions should take place as soon as possible, and should include all Division Managers, Department Heads, and ASD management personnel. Discussions would be in large- and small-group work sessions, and where appropriate, would include potential graphics workstation operators and key terminal users.

RECOMMENDATIONS BY CONSULTANT, KENTON JOHNSON

Communications, cooperation, and strong guidelines are necessary to make new computer systems work. With the increased availability of personal computers at home and in-house, comes a hope that these powerful small computers can be used effectively, independent of computer professionals and central computer resources. All the rhetoric in the world will not convince anyone otherwise, but increased awareness and services will. Therefore, I recommend the following:

- Immediately act on bringing in a central computer systems or timesharing, announcing firm schedules as well as guidelines on how to acquire the use of the new facilities.

- Fill all open ASD requisitions at a high priority, and be prepared to raise the level of ASD salaries to bring in top people from around the country.

- Take time at all weekly staff meetings to hear brief reports from Steering Committee representatives and provide feedback directly to the ASD Manager, or through Steering Committee members, to bring about increased awareness at all levels.

- Support brown-bag informational sessions on CADD, personal computers, and general computer applications.

- Aggressively support training sessions and coordination meetings during normal work hours.

- Standardize spreadsheet, database, and word processing software on IBM PCs with an eye toward conversion to central computers.

- Strongly urge Department Heads who must select or develop IBM PC software, to make sure that it is easily convertible to central computers.

There is a large investment made, both personal and corporate, into any computer system and software package. This investment is, at most, 25 percent salvaged when moving software from one computer to another, unless they both have the same software operating system. The more database and procedures creation, and re-learning time there are, the less the investment is salvaged.

There is a natural reluctance on management and worker alike to change systems, because of the disruption of productive time and the loss of comfortable computer skills. Even in view of the potential gains from conversion, applications are usually left where they are first implemented. Sometimes they are abandoned in favor of new, higher-production or easier-to-use software. Only for central MIS systems, or in the absence of the old computer, are applications converted.

Since PCs and VAXs or System/38s do not run the same operating system, and removing or downgrading PCs will be very difficult, you will find that almost

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all current PC applications will be either abandoned or never converted. Therefore, the implementation cost will be 75 to 100 percent lost.

As long as the potential gain exceeds the investment, all is well. However, if that investment is not brought out in purchase decisions, then economic, opportunity, and synergistic losses are highly possible. Recently, PC software purchasers have down-played these potential losses.

Also, PC software and hardware purchases made without proper ASD involvement is undermining the expensive efforts of the Steering Committee, study participants, software specifiers, and company officers.

There is a clean, fair process in place to help and guide all computerization. Please use it.

Annual Factors
Staff Person Cost = $ 75,000
Rate/Salary Increase = 1.05
Company Growth Rate = 1.25
Graphics Term Hours = 3,600
Other Term Hours = 1,800

Table 1a- Selected Functions Summary, Technical/Graphics
(Updated from "Master Plan: Initial Report," Table 2, Pg. 3 and
from "Master Plan: Intermediate Report," Table 1, Pg. 5)

Department/Division	Function	Type	Product (:1)	Lrng Curv (Mo)	Auto. Time (Hr)	Number of Terminals Data	Tech	Grph	Time Value ($)	Client Computr Charges ($)	Adjusted First Year Net ($)	Software Cost ($)	Modified First Year Net ($)	Impl. Staff (Num)	Impl. Cost ($)	Predicted First Year Net ($)	Spprt Staff (Num)	Support Cost ($)	Predicted Second Year Net ($)
RECOMMENDED FUNCTIONS- IMPLEMENTED IN FIRST SIX MONTHS																			
All Departments	Statistical Analyses	T	10	6	4,500	.25			118,800	15,000	95,190	20,000	75,190	.20	15,000	60,190	.10	7,500	150,176
Civil	DTM- Site Planning & Highway Design	T	5	6	2,500	.28			108,750		65,250	5,000	60,250	.50	37,500	22,750	.25	18,750	89,578
Civil	DTM- Site Planning & Highway Design	G	3	6	8,100		.75		139,320		69,660	37,500	32,160	.75	56,250	-24,090	.50	37,500	72,686
Civil	Runoff Calculations	T	5	3	1,250	.14			35,625		24,938	2,000	22,938	.20	15,000	7,938	.10	7,500	27,563
Hydro	Turbine Selection & Pwrhse Geometry	T	5	6	3,825	.43			166,388		99,833	2,000	97,833	.50	37,500	60,333	.20	15,000	155,019
Hydro	Stability Analysis	T	5	3	3,400	.38			149,600	10,000	114,720	500	114,220	.50	37,500	76,720	.20	15,000	150,518
Laboratory	Statistics	T	5	6	1,125	.13			47,250		28,350	1,000	27,350	.20	15,000	12,350	.10	7,500	39,769
Planning	Economic Feasibility Analysis	T	5	6	500	.06			25,245		15,147	2,000	13,147	.20	15,000	-1,853	.10	7,500	16,664
Water/Wastewater	Treatment Plant Mass Balance	T	10	6	100	.01			4,400		2,970	2,000	970	.30	22,500	-21,530	.10	7,500	-4,646
Water/Wastewater	Open Channel Flow	T	5	6	960	.11			42,240		25,344	500	24,844	.30	22,500	2,344	.10	7,500	34,508
Water/Wastewater	Sewer Design	T	10	6	1,500	.08			51,000		34,425	1,000	33,425	.50	37,500	-4,075	.10	7,500	50,400
Water/Wastewater	Treatment Unit Design	T	10	6	2,700	.15			118,800		80,190	1,000	79,190	.50	37,500	41,690	.10	7,500	130,489
Water/Wastewater	Weir/Flume Discharge	T	10	6	1,620	.09			72,900		49,208	500	48,708	.30	22,500	26,208	.10	7,500	76,269
Instrumentation	Loop Drawings	G	3	6	7,290		.68		240,570		120,285	CADD	120,285	.50	37,500	82,785	.10	7,500	200,655
Piping	Piping and Instrumentation Dgrms	G	2	3	6,336		.88		183,744		80,388	21,000	59,388	.40	30,000	29,388	.20	15,000	100,895
Structural	Structural Drafting	G	3	6	13,500		1.25		256,500		128,250	25,000	103,250	.50	37,500	65,750	.20	15,000	204,750
Structural	Simple Span Beam Analysis	T	3	6	7,200	1.33			316,800		158,400	1,000	157,400	.25	18,750	138,650	.10	7,500	267,356
Structural	Structural Analysis	T	10	12	5,850	.33			257,400	40,000	155,830	10,000	145,830	.25	18,750	127,080	.20	15,000	336,866
Structural	Structural Element Design	T	3	6	12,636	2.34			555,984	20,000	297,992	20,000	277,992	.25	18,750	259,242	.20	15,000	493,049
Earth Sciences	Groundwater Model- Segol- 2-D & 3-D	T	10	6	500	.03			16,500	50,000	61,138	2,000	59,138	.50	37,500	21,638	.10	7,500	75,272
	Recommended Sub-Totals		122	117	85,392	6.11	3.56		2,907,816	135,000	1,707,506	154,000	1,553,506	7.60	570,000	983,506	3.15	236,250	2,667,835
	Recommended Sub-Averages		6	6	4,270	.38	.89		145,391	27,000	85,375	8,105	77,675	.38	28,500	49,175	.16	11,813	133,392
FOLLOW-ON FUNCTIONS- IMPLEMENTED IN SECOND SIX MONTHS																			
Hydro	Hydraulic Transient Analysis	T	10	3	600	.03			23,400		18,428	500	17,928	.20	15,000	2,928	.10	7,500	17,798
Architectural	Details	G	5	6	1,440		.08		28,800		17,280	CADD	17,280	.50	37,500	-20,220	.20	15,000	10,553
Architectural	Plans and Elevations	G	2	6	900		.13		18,000		6,750	20,000	-13,250	.30	22,500	-35,750	.10	7,500	1,969
Electrical	Elementaries	G	3	6	1,620		.15		42,120		21,060	10,000	11,060	.50	37,500	-26,440	.20	15,000	17,168
Electrical	Electrical Plans & Elevations	G	4	6	2,700		.19		70,200		39,488	15,000	24,488	.30	22,500	1,988	.10	7,500	59,259
Electrical	Lighting Plans & Elevations	G	4	6	2,700		.19		70,200		39,488	CADD	39,488	.30	22,500	16,988	.10	7,500	59,259
Instrumentation	Equipment Location	G	2	6	960		.13		30,720		11,520	CADD	11,520	.50	37,500	-25,980	.20	15,000	473
Instrumentation	Installation Details	G	2	3	180		.03		4,680		2,048	CADD	2,048	.50	37,500	-35,453	.20	15,000	-16,616
Instrumentation	P&ID's	G	2	6	120		.02		5,280		1,980	CADD	1,980	.50	37,500	-35,520	.20	15,000	-16,223
Mechanical	Details	G	3	6	2,700		.25		51,300		25,650	CADD	25,650	.40	30,000	-4,350	.10	7,500	35,044
Mechanical	Layouts and Arrangements	G	3	6	2,700		.25		64,800		32,400	CADD	32,400	.40	30,000	2,400	.10	7,500	46,856
Piping	Equipment Layouts	G	2	6	7,150		.99		207,350		77,756	CADD	77,756	.40	30,000	47,756	.10	7,500	126,230
Piping	Pipe Stress Analysis	T	2	6	250	.07			9,000	20,000	23,375	5,000	18,375	.20	15,000	3,375	.10	7,500	22,313
Piping	Plans and Elevations	G	2	6	6,885		.96		179,010		67,129	10,000	57,129	.30	22,500	34,629	.10	7,500	107,632
Piping	Sections and Details	G	2	6	6,885		.96		179,010		67,129	CADD	67,129	.30	22,500	44,629	.10	7,500	107,632
Piping	System Isometrics	G	2	6	446		.06		11,596		4,349	CADD	4,349	.30	22,500	-18,152	.10	7,500	-2,234
Earth Sciences	Ground Water Model-Konikow-Bredehft	T	2	6	250	.07			8,250	7,000	10,094	1,000	9,094	.20	15,000	-5,906	.10	7,500	4,758
Earth Sciences	Ground Water Model-R&D-Prickett	T	2	6	300	.08			9,900	10,000	13,713	1,000	12,713	.20	15,000	-2,288	.10	7,500	9,778
Earth Sciences	Ground Water Model-Trescott-Larson	T	2	6	350	.10			11,550	8,000	12,331	1,000	11,331	.20	15,000	-3,669	.10	7,500	8,236
Industrial Process	Flow Diagrams	G	2	3	3,000		.42		120,000		52,500	CADD	52,500	.75	56,250	-3,750	.25	18,750	54,141
Industrial Process	General Arrangements	G	2	3	1,875		.26		61,875		27,070	CADD	27,070	.75	56,250	-29,180	.25	18,750	15,996
Industrial Process	Block Diagrams	G	5	3	675		.04		27,000		18,900	CADD	18,900	.30	22,500	-3,600	.10	7,500	18,506
Industrial Process	Heat Balance	T	10	6	640	.04			37,120	4,000	29,056	1,000	28,056	.20	15,000	13,056	.10	7,500	39,254
	Follow-On Sub-Totals		75	123	45,326	.39	5.09		1,271,161	49,000	619,491	64,500	554,991	8.50	637,500	-82,509	3.10	232,500	727,779
	Follow-On Sub-Averages		3	5	1,971	.06	.30		55,268	9,800	26,934	6,450	24,130	.37	27,717	-3,587	.13	10,109	31,643
EXISTING FUNCTIONS - CURRENTLY IMPLEMENTED IN-HOUSE (WILL BE CONVERTED TO THE NEW SYSTEM)																			
Civil & Environmental	Cvl/Hyd/Srvy/WsteWt/WtrWste- 9 Pgms	T	5	3	7,200	.80			137,250	41,000	137,075	0	137,075	1.00	75,000	62,075	.50	37,500	148,706
Earth Resources	Geotech and Sold/Haz Waste- 4 Pgms	T	2	3	260	.07			3,870	6,500	8,193	0	8,193	.50	37,500	-29,307	.25	18,750	-13,538
RECOMMENDED FUNCTIONS- CURRENTLY IMPLEMENTED IN-HOUSE (WILL BE CONVERTED TO THE NEW SYSTEM, WHEN PRACTICAL)																			
Survey	COGO with plotter output	T	10	3	400	.02				10,000	10,000	2,000	8,000	.30	22,500	-14,500	.10	7,500	3,281
Electrical	Ld/Relay/Shrt Crct/Grnd Mat Pgms	T	7	3	840	.07			33,600		25,221	5,000	20,221	.40	30,000	-9,779	.20	15,000	18,144
HVAC	Heat/Cool Loads	T	5	3	400	.04			18,000		12,600	1,000	11,600	.50	37,500	-25,900	.20	15,000	-788
Scheduling	Schedules	T	2	12	4,050	1.13			165,645		41,411	2,000	39,411	.60	45,000	-5,589	.20	15,000	89,017
Industrial Process	Process Calculations	T	2	6	900	.25			36,000		13,500	2,000	11,500	.50	37,500	-26,000	.25	18,750	-984
Industrial Process	Pumping Systems	T	10	3	1,200	.07			44,400		34,965	500	34,465	.35	26,250	8,215	.25	18,750	27,838
	Implemented Sub-Totals		43	36	15,250	2.45			438,765	57,500	282,965	12,500	270,465	4.15	311,250	-40,785	1.95	146,250	271,676
	Implemented Sub-Averages		5	5	1,906	.31			62,681	19,167	35,371	1,563	33,808	.52	38,906	-5,098	.24	18,281	33,960
	GRAND TOTALS		240	276	145,968	8.95	8.64		4,617,742	241,500	2,609,963	231,000	2,378,963	20.25	1,518,750	859,213	8.20	615,000	3,667,290
	GRAND AVERAGES		5	5	3,309	.35	.54		112,723	21,645	66,083	7,289	60,196	.40	30,304	56,809	.17	12,707	105,833

OTHER FUNCTIONS WILL BE IMPLEMENTED AFTER THE SELECTED FUNCTIONS

Figure 1 – EQUIPMENT CONF URATION AND PLACEMENT