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COMPACT IGNITION TOKAMAK DESIGN STUDIES

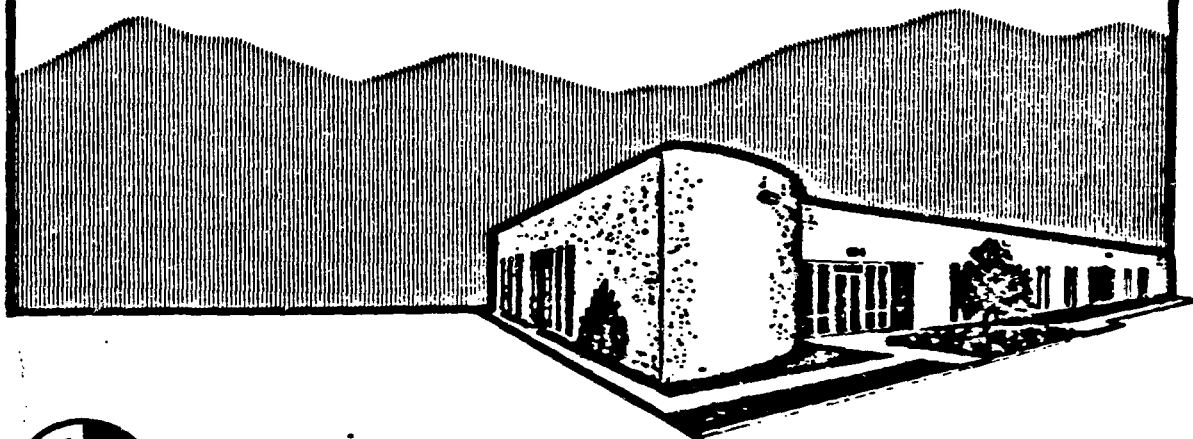
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Presentation To Ignition Technical Oversight Committee

***University of Texas
Austin, TX
January 20, 1986***



FUSION ENGINEERING DESIGN CENTER

OAK RIDGE NATIONAL LABORATORY

Operated by MARTIN MARIETTA ENERGY SYSTEMS, INC.

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FUSION ENGINEERING DESIGN CENTER

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FUSION ENGINEERING DESIGN CENTER

INITIAL COST PROJECTIONS OF CIT DEVICE OPTIONS

AUSTIN ITOC MEETING

JANUARY 20, 1986

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OBJECTIVE

DEVELOP PRELIMINARY COST PROJECTIONS OF RANGE OF "MINIMUM COST"
COMPACT IGNITION DEVICES ASSUMING SITING AT PPPL SITE



APPROACH/METHODOLOGY

DESIGN INPUT FROM COGNIZANT ENGINEERS AND COST DATA FROM FEDC COST DATA BASE INPUT TO COST ESTIMATION SPREADSHEET WHERE ESTIMATE PERFORMED AND CATALOGED.

PACE COST CALCULATED IN SPREADSHEET

-HARDWARE COST CALCULATED FROM UNIT COSTS, COST ALGORITHM, OR COMPONENT TAKEOFF COSTS

-ENGINEERING AND INSTALLATION COST CALCULATED AS PERCENT OF HARDWARE COST

-INDIRECT COST CALCULATED AS PERCENT OF DIRECT COST



COST ELEMENT DEFINITIONS

PACE Cost (Plant and Equipment) is defined as the total expense of constructing the plant and placing it into operation

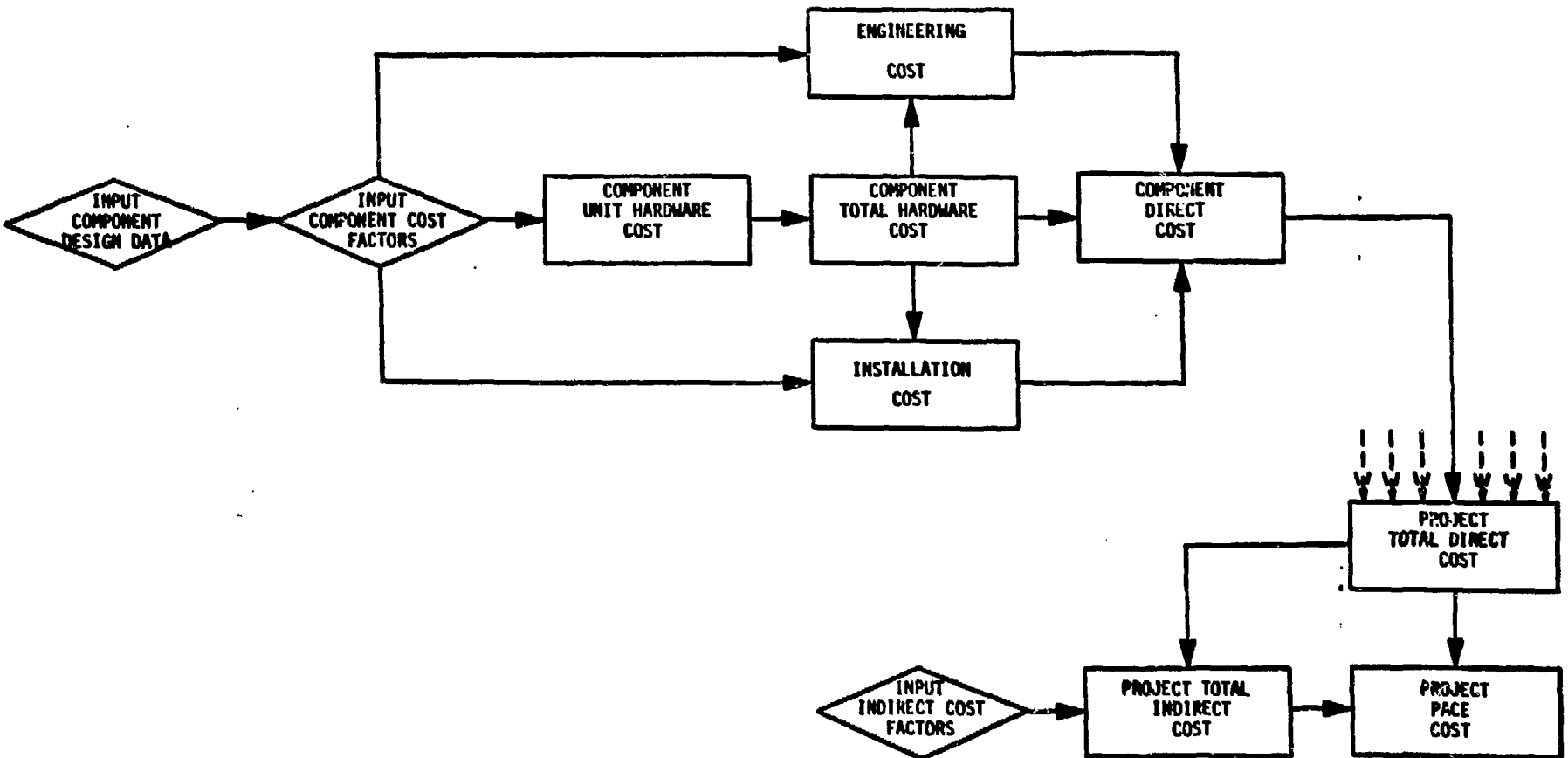
Direct Costs are specifically identified with a permanent plant component, subsystem, or facility, and include

- ***Engineering Cost***
- ***Hardware Cost***
- ***Installation Cost***

Indirect Costs are costs not specifically identified with a permanent plant component, subsystem, or facility but are incurred by the project as a whole



COST ESTIMATING METHODOLOGY





ASSUMPTIONS/GUIDELINES

- PACE COST***
- FY-1986 DOLLARS***
- PPPL LAB SITE***
- CONTINGENCY NOT ADDRESSED***
- PRIME CONTRACTOR RESPONSIBLE TO
LAB FOR ENGINEERING, PROCUREMENT,
AND CONSTRUCTION***



CIT DEVICE OPTIONS PARAMETERS

	<u>ISP 1212</u>	<u>FEDC A109</u>	<u>LITE R4</u>
MAJOR RADIUS (M)	1.35	1.09	1.42
MINOR RADIUS (M)	0.42	0.42	0.5
FIELD-ON-AXIS (T)	10.8	10.9	9.9
PLASMA CURRENT (MA)	10.0	10.0	10.0
BURN TIME (s)	4.0	3.5	4.5
TF CURRENT DENSITY (A/CM ²)	5670	9600	4900
OH CURRENT DENSITY (A/CM ²)	4140	9900	7860
WALL LOADING (MW/M ²)	12.8	11.1	10.5
FUSION POWER (MW)	496	400	500
VOLT-SECONDS	28	23.0	33



CIT DEVICE OPTIONS
COST RELATED PARAMETERS

	ISP 1212		FEDC A109		LITE R4	
	<u>LIM</u>	<u>DIV Δ</u>	<u>LIM</u>	<u>DIV Δ</u>	<u>LIM</u>	<u>DIV Δ</u>
TF WEIGHT (TONNES)	141	18	44	4	167	
PF WEIGHT (TONNES)	44		33		51	
MACH. STR. WEIGHT (TONNES)	650	43	52	4	150	
EXT. STR. WEIGHT (TONNES)	60		350		30	
VACUUM VESSEL AREA (m ²)	71	6	52	4	82	
FIRST WALL AREA (m ²)	36		29		44	
DIVERTOR AREA (m ²)		7.1		5.7		7.5
TOTAL TF/PF ENERGY (GJ)	3.4	0.4	4.8	0.7	5.3	
TF PEAK POWER (MVA)	660	82	510	60	340	
PF PEAK POWER (MVA)	190	24	430	55	370	
RF EXTR. POWER (MW)	25		25		25	



CIT DEVICE OPTIONS COST PROJECTION SUMMARY
FY 1986 M\$ - NEW FUNDS

	ISP 1212		FEDC A109		LITE R4	
	<u>LIM</u>	<u>DIV Δ</u>	<u>LIM</u>	<u>DIV Δ</u>	<u>LIM</u>	<u>DIV Δ</u>
CORE MODULE	81.2	12.5	28.6	6.5	54.9	6.0
ELECTRICAL	9.9	1.1	13.6	4.8	13.2	
AUXILIARY HEATING	39.3		39.3		39.3	
OTHER	<u>95.4</u>	<u> </u>	<u>90.6</u>	<u> </u>	<u>92.9</u>	<u> </u>
 DIRECT COST	 225.8	 13.6	 172.1	 11.3	 200.3	 6.0
 INDIRECT COST	 <u>29.6</u>	 <u>1.8</u>	 <u>22.2</u>	 <u>1.5</u>	 <u>27.0</u>	 <u>0.8</u>
 TOTAL PACE	 255.4	 15.4	 194.3	 12.8	 227.3	 6.8



CIT DEVICE OPTIONS - INITIAL COST PROJECTIONS
FY 1986 M\$ - NEW FUNDS

	ISP 1212		FEDC A109		LITE R4	
	<u>LIM</u>	<u>DIVΔ</u>	<u>LIM</u>	<u>DIVΔ</u>	<u>LIM</u>	<u>DIVΔ</u>
FACILITIES	34.8		29.4		33.1	
REACTOR STRUCTURES	51.7	9.4	19.1	5.9	20.4	6.0
MAGNETS	31.4	3.1	12.0	0.6	35.6	
RF	39.3		39.3		39.3	
VACUUM	6.9		6.9		6.9	
HEAT TRANSPORT	2.0		2.0		2.0	
ELECTRICAL	9.9	1.1	13.6	4.8	13.2	
FUEL HANDLING	9.7		9.7		9.7	
I&C	13.9		13.9		13.9	
MAINTENANCE	<u>26.2</u>	—	<u>26.2</u>	—	<u>26.2</u>	—
DIRECT COST	225.8	13.6	172.1	11.3	200.3	6.0
INDIRECT COST	<u>29.6</u>	<u>1.8</u>	<u>22.2</u>	<u>1.5</u>	<u>27.0</u>	<u>0.8</u>
PACE COST	255.4	15.4	194.3	12.8	227.3	6.8