

INDIRECT COAL LIQUEFACTION PROGRAM

Overview

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INDIRECT LIQUEFACTION

Objective

**TO DEVELOP TECHNOLOGIES USING SYNTHESIS GAS PRODUCED FROM
COAL FOR THE PRODUCTION OF MARKETABLE LIQUID FUEL AT A COST
COMPETITIVE WITH \$25-30 / BBL CRUDE OIL BY 1995**

PROGRAM STRUCTURE

Fischer-Tropsch Synthesis

Oxygenates Synthesis

Process Support / Engineering Evaluations

**FUNDING PROFILES FOR THE INDIRECT
LIQUEFACTION PROGRAM (\$K)**

Activity	FY90	FY91 Proposed
Proof-of-Concept Operations	3,257	4,700
Fischer-Tropsch Technology	2,458	3,565
Oxygenate Synthesis	1,596	2,573
Process Support/Engineering Evaluations	321	683
TOTAL	7,632	11,521

FISCHER-TROPSCH SYNTHESIS

Objective

To develop technologies to economically convert coal-derived synthesis gas to liquid hydrocarbon fuels

Areas of Investigation

New or Modified Catalysts

- **Poison Tolerant**
- **Enhanced Activity**
- **Long Life**
- **Improved Selectivity**
- **Scaleup**

**Catalyst / Wax Separation
Novel Conversion Technologies**

PROGRAM PARTICIPANTS

Existing Contracts

<u>Contractor</u>	<u>Subject</u>
Massachusetts Institute of Technology	Co Plus Water Gas Shift
Pittsburgh Energy Technology Center	Fe-based Slurry Catalysts
Sandia National Laboratories	Novel Catalyst Development
Texas A&M University	Fe-based Slurry Catalysts
University of Kentucky	Mossbauer Analyses
UOP, Inc.	Co-Ru Slurry Catalyst
UOP, Inc.	Fe F-T Catalyst Development

Pending Contracts

University of Kentucky Research Foundation	Fe F-T Catalyst Development
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OXYGENATES SYNTHESIS

Objective

To develop technologies for the conversion of coal-derived synthesis gas into marketable oxygenated fuels, chemicals, or chemical feedstocks such as:

**Methanol
Mixed Alcohols
Mixed Ethers
Olefins**

PROGRAM PARTICIPANTS

Existing Contracts

<u>Contractor</u>	<u>Subject</u>
Air Products and Chemicals, Inc.	Dimethyl ether
Altamira Instruments, Inc.	Ethers
Lehigh University	Ethers
North Carolina State University	Alcohols / Ethers
Texas A&M University	Isobutylene

Pending Contracts

Air Products and Chemicals, Inc.	DME, Mixed Alcohols, Hydrocarbons
Union Carbide Corporation	Mixed Alcohols
UOP, Inc.	Isobutylene
Amoco	Olefins via Selective Cracking of F-T Products

PROCESS SUPPORT / ENGINEERING EVALUATIONS

Objective

To perform engineering and process related studies to provide information that complements several indirect liquefaction programs:

- Development of slurry phase reactor technology
- Evaluation of process economics and process sensitivities
- Provide research guidance

PROGRAM PARTICIPANTS

Existing Contracts

Contractor

MITRE

Viking Systems, Inc.

Subject

Process Technology Evaluations

Slurry Reactor Modeling

Pending Contracts

TBD

TBD

Generic Indirect Liquefaction PDU

Baseline Design of an F-T Facility

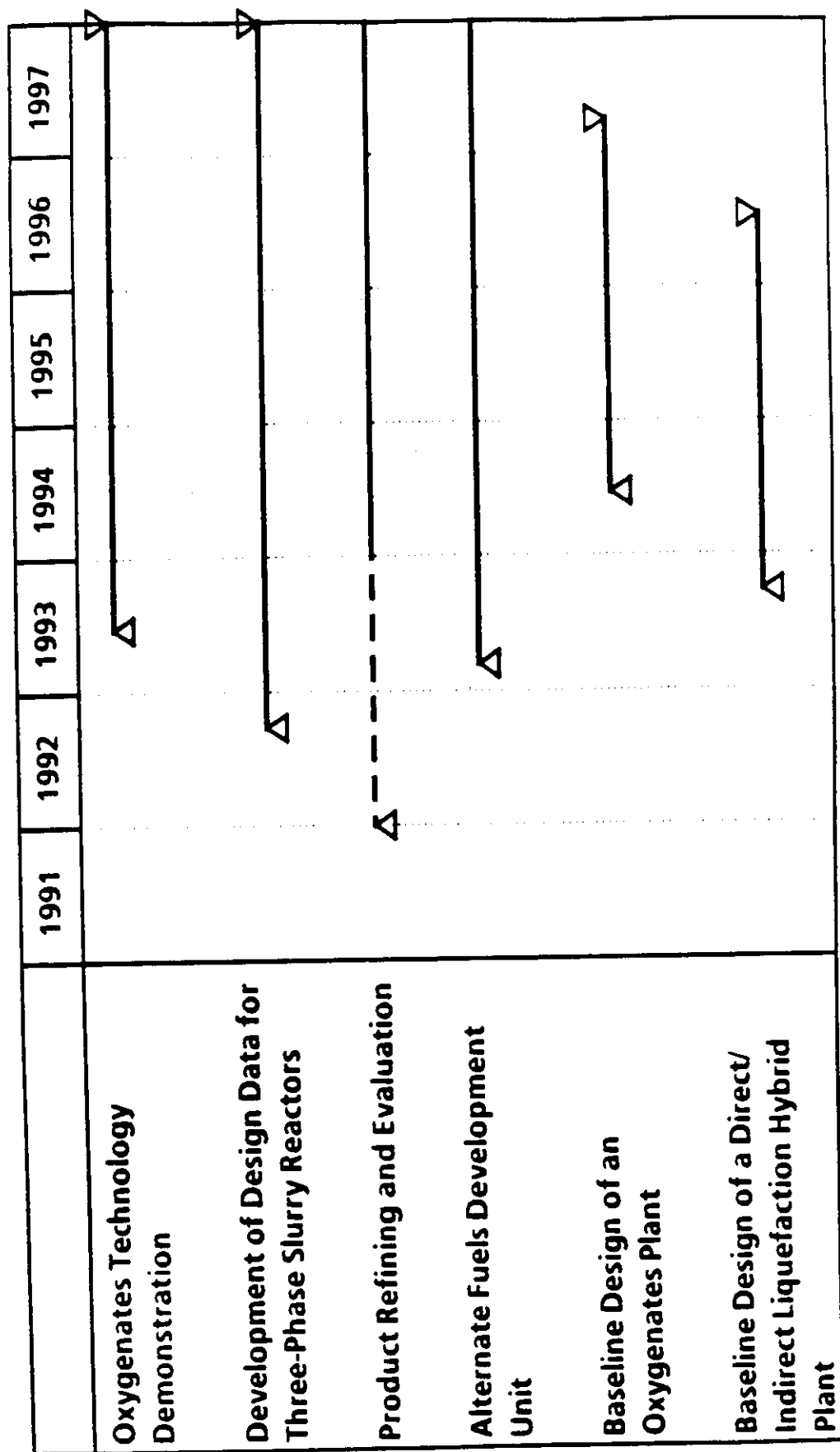
FUTURE PROGRAMS

Fischer-Tropsch Synthesis

	1990	1991	1992	1993	1994	1995	1996	1997
Technology Development for Cobalt Fischer-Tropsch Catalysts		Δ				▽		
Catalyst / Wax Separation		Δ		Phase I		▽	Phase II	
Development of Molecular Sieve Catalysts for Indirect Liquefaction			Δ		Phase I	▽	Phase II	
Advanced Fischer-Tropsch Processing			Δ					▽
Catalyst Supply for PDU's				Δ				
Novel Catalysts / Process Research				Δ				▽

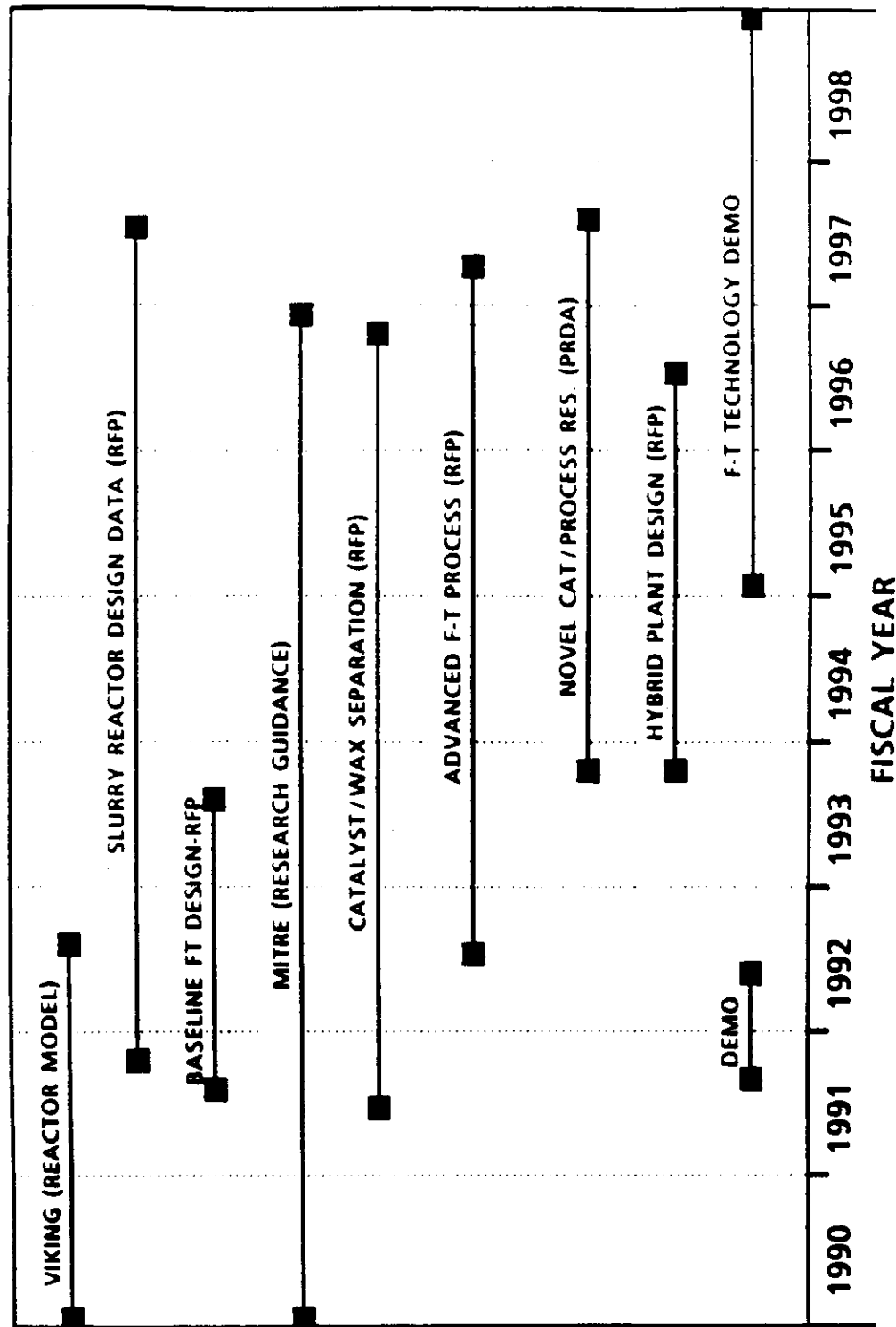
FUTURE PROGRAMS

Oxygenates Synthesis and Process Support / Engineering Evaluations



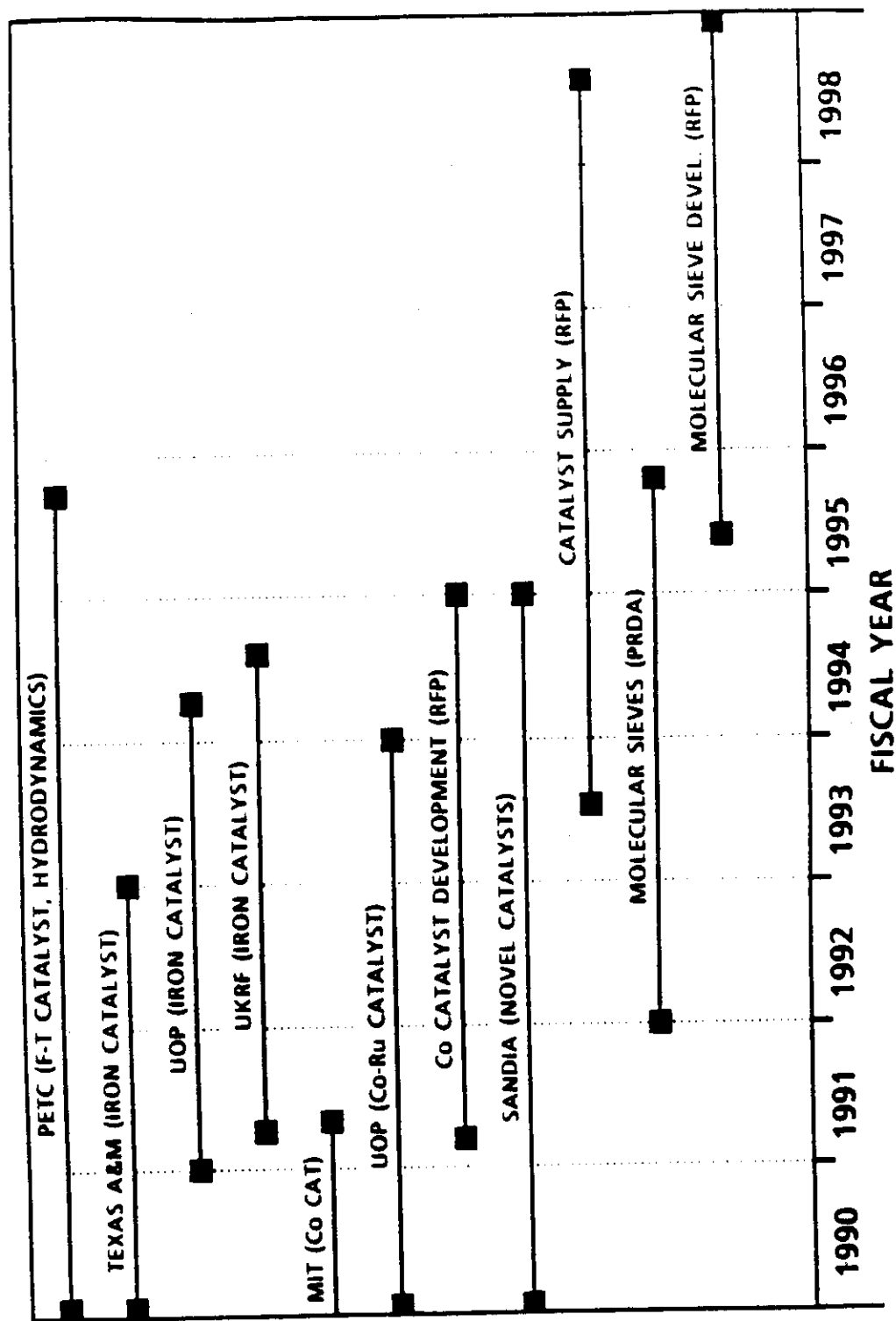
FISCHER-TROPSCH SYNTHESIS

Program Schedule



FISCHER-TROPSCH SYNTHESIS

Program Schedule



OXYGENATES SYNTHESIS Program Schedule

