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**DEVELOPMENT PLAN  
ROBOTIC APPLICATIONS CENTER**

**JANUARY 1982**

**ROBOTIC APPLICATIONS CENTER  
EXPERIMENTAL SCIENCES DIVISION  
SCIENCE APPLICATIONS, INC.  
1710 GOODRIDGE DRIVE  
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## **OUTLINE OF PLAN**

**PURPOSE OF THE PLAN**

**GOALS OF THE RAC**

**BACKGROUND DEVELOPMENTS IN ROBOTICS AT SAI**

**WHY COMPANIES NEED AUTOMATION**

**FOCUSING ON A BUSINESS TARGET**

**FINANCING THE RAC**

**PLAN OF ACTION**

**DECISIONS REQUIRED**



## **PURPOSE OF THE PLAN**

- **DEVELOP A VIABLE SAI ROBOTICS CAPABILITY TO SERVE INDUSTRY AND GOVERNMENT**
- **OBTAIN RAPID LEVERAGE IN A FAST PACED HIGH TECHNOLOGY MARKET**
- **TO CREATE A BUSINESS BASE OF COMMERCIAL SERVICES, AND TO EXPAND GOVERNMENT BUSINESS**
- **TO DIVERSIFY AND OBTAIN HIGHER THAN AVERAGE FEES**
- **TO ESTABLISH SAI AS A LEADING FIRM IN THE ROBOTICS AND FACTORY AUTOMATION ARENA**
- **PROVIDE A VEHICLE FOR PRIVATE INVESTMENT IN SAI TALENT**



**GOALS OF THE SAI  
ROBOTIC APPLICATIONS CENTER**

- **BECOME ONE OF THE TOP ROBOT CONSULTING FIRMS - WORLD WIDE**
- **TO DEVELOP A FACTORY AUTOMATION SYSTEM INTEGRATION FOCUS WITHIN SAI**
- **TO ACQUIRE KEY TALENTS IN THE ROBOT FIELD AND BECOME A CENTER OF EXCELLENCE IN SELECTED HIGH TECHNOLOGY AREAS OF ROBOTS**
- **SET UP A "ROBOT LAB" WHERE CLIENTS' MANUFACTURING PROBLEMS CAN BE SOLVED**
- **ORGANIZE A COMPREHENSIVE DATA BASE OF PERTINENT INFORMATION TO SERVE CLIENTS**
- **DEVELOP KEY "ANALYSIS TOOLS", AND "APPLICATIONS PACKAGES" THAT HAVE WIDE USE IN INDUSTRY**
- **TO AID THE US IN A RECAPITALIZATION OF ITS MANUFACTURING BASE**



## BACKGROUND DEVELOPMENTS - 1975-1981

- SAI HAS PROVIDED CONSULTING AND STUDIES IN ROBOTICS AND MANUFACTURING TECHNOLOGY FOR A WIDE VARIETY OF CLIENTS:

NSF, NAVAIR, NAVELEX, FEMA, NRL,  
OUSDRE AND PRIVATE FIRMS (~ 15)

could lowry  
help

- TOTAL SALES CROSSED THE HALF MILLION MARK AT THE END OF 1981 AND ARE EXPANDING RAPIDLY AS A RESULT OF INCREASED INTEREST IN ROBOTS
- DURING 1975-1980 WE KEPT PACE WITH THE MARKET; BY 1981 WE BEGAN TO PULL AHEAD. KEY MILESTONE WAS A MONTH OF RESEARCH IN JAPAN ON FACTORY AUTOMATION
- IN OCTOBER OF 1981 SAI SPONSORED A SEMINAR ON "PRODUCTIVITY, AUTOMATION AND ROBOTICS IN JAPAN"; 50 PERSONS ATTENDED
- IN 1982 WE BEGAN TWO NEW STUDY CONTRACTS AND ANTICIPATE PUBLISHING A MAJOR STUDY OF JAPANESE ROBOTS
- AT THIS TIME WE ARE MANPOWER AND FACILITIES LIMITED

The logo for SAI, consisting of the letters 'S', 'A', and 'I' in a stylized, italicized, outlined font.

## CONSIDERATIONS

- SAI IS ONLY ADDRESSING THE "FRONT END" PLANNING STUDIES, BUT THE TOTAL MARKET POTENTIAL IS VERY LARGE
- HARDWARE INVOLVEMENT IS NEEDED TO EXPAND SCOPE
- THE PROFIT POTENTIAL FOR THE COMMERCIAL ROBOT BUSINESS IS WELL ABOVE AVERAGE

↳ 250 vendors

## CONCLUSIONS

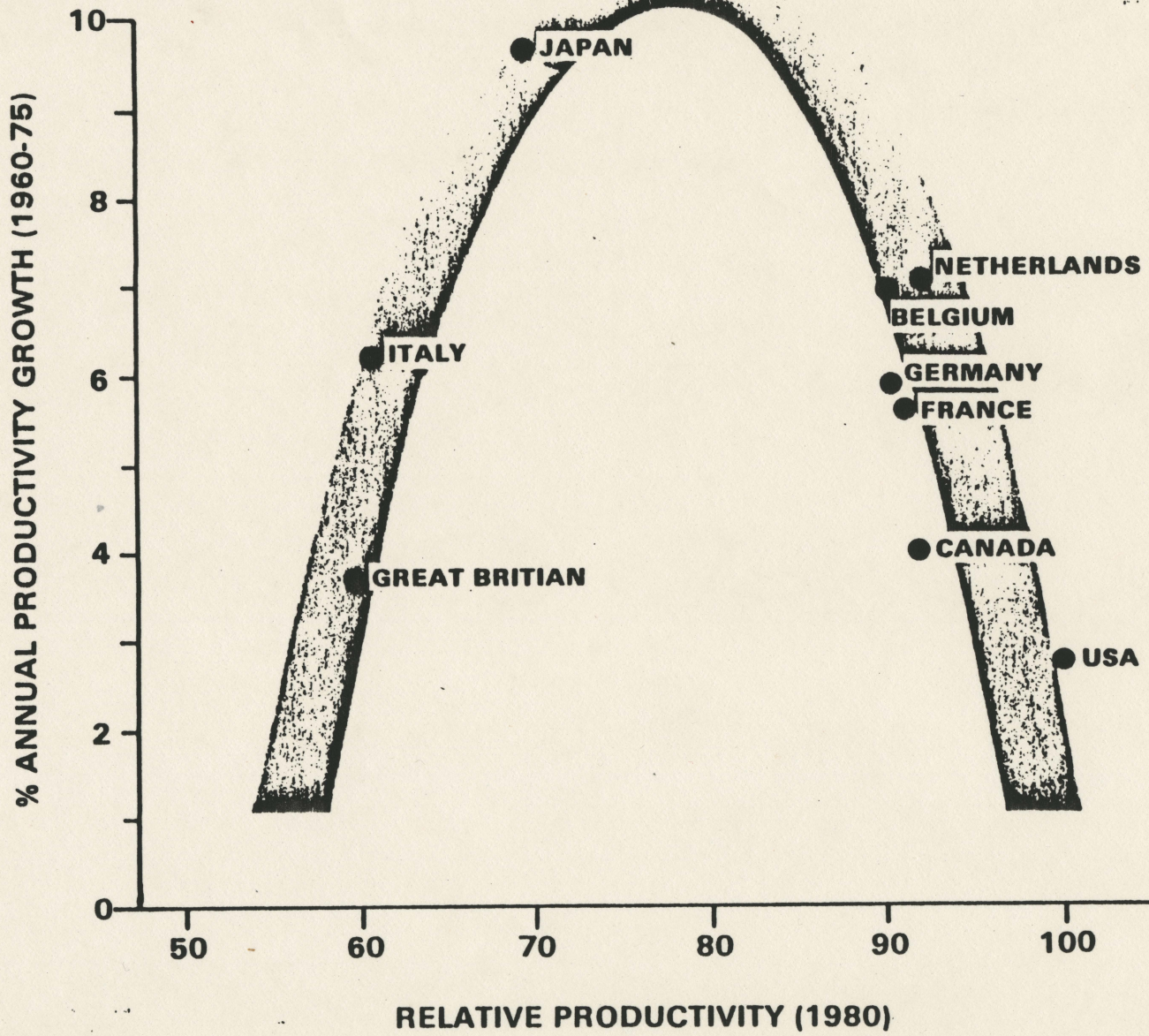
- FOCUS
- FINANCE
- GROW



## WHY COMPANIES/NATIONS NEED AUTOMATION

- **PRODUCTIVITY OF MANUFACTURING SECTOR IS A KEY INDICATOR OF NATIONAL HEALTH - IN THE CASE OF THE USA THERE IS CAUSE FOR CONCERN**
- **ONE KEY INDICATOR OF ADVANCED MANUFACTURING IS ROBOTICS--IT IS TIED TO INCREASED PRODUCTIVITY**
- **ROBOTS APPEAR CORRELATED TO CORPORATE MANUFACTURING PRODUCTIVITY--US/JAPAN COMPARISON**
- **ROBOTS PERFORM MANY USEFUL TASKS FOR WHICH HUMAN LABOR IS ILL SUITED--REPETITIVE, DANGEROUS, HEAVY, PRECISE, RAPID, ROUND THE CLOCK**







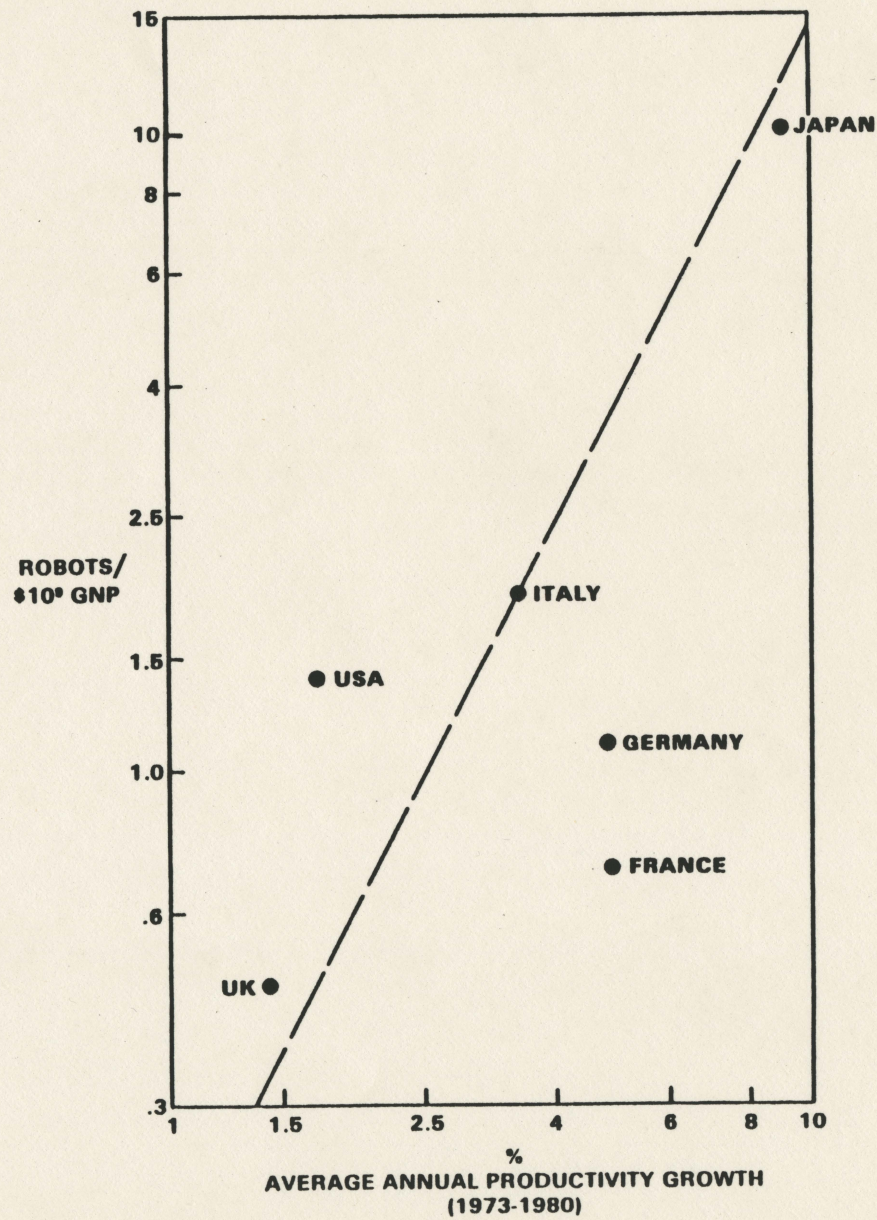
**THE WORLD WIDE POPULATION OF ROBOTS, RELATED TO THE  
ANNUAL GROWTH OF PRODUCTIVITY AND  
THE RATIO OF ROBOTS TO GNP**

<b>COUNTRY</b>	<b>ROBOT POPULATION</b>	<b>% ANNUAL GROWTH OF PRODUCTIVITY *</b>	<b>ROBOTS PER \$10<sup>9</sup> GNP</b>
<b>JAPAN</b>	<b>12000</b>	<b>7.2</b>	<b>12</b>
<b>USA</b>	<b>3200</b>	<b>1.7</b>	<b>1.4</b>
<b>USSR</b>	<b>2000**</b>	<b>N/A</b>	<b>N/A</b>
<b>WEST GERMANY</b>	<b>850</b>	<b>4.8</b>	<b>1.1</b>
<b>ITALY</b>	<b>500</b>	<b>3.5</b>	<b>1.9</b>
<b>FRANCE</b>	<b>400</b>	<b>4.9</b>	<b>0.70</b>
<b>UNITED KINGDOM</b>	<b>185</b>	<b>1.4</b>	<b>0.46</b>

**\*1973-80 AVERAGE**

**\*\*ESTIMATED**





<u>COUNTRY</u>	<u>FIRM</u>	<u>CURRENT ANNUAL SALES (\$B)</u>	<u>SALES PER EMPLOYEE (\$K)</u>	<u>CURRENT # ROBOTS</u>	<u>ROBOTS/ SALES (PER \$B)</u>
USA	GM	58	77	1200	21
	FORD	37	87	300	8
	CHRYSLER	9.2	99	100	11
	AMC	2.6	122	?	?
JAPAN	TOYOTA	14.7	317	500	34
	NISSAN	13.4	317	650	48
	HONDA	6.0	261	300	50
	TOYO KOGYO	4.5	168		
	MITSUBISHI	4.5 (EST)	200	44	
	ISUZU	3.1	184	50	16
	FUJI H. I.	2.1	158	100	48
	SUZUKI	2.0	229	100	50



ROBOT USAGE: USA 1980\*

<b>WELDING</b>		<b>36%</b>
<b>SPOT WELDING</b>	<b>30%</b>	
<b>ARC WELDING</b>	<b>6%</b>	
<b>TRANSFER</b>		<b>20%</b>
<b>MACHINE TOOL LOADING</b>	<b>12%</b>	
<b>PRESS LOADING</b>	<b>8%</b>	
<b>FOUNDRY</b>		<b>20%</b>
<b>DIE CASTING</b>	<b>14%</b>	
<b>FORGING</b>	<b>4%</b>	
<b>INVESTMENT CASTING</b>	<b>2%</b>	
<b>SPRAY PAINTING</b>		<b>13%</b>
<b>PLASTIC FABRICATION</b>		<b>5%</b>
<b>INSPECTION</b>		<b>2%</b>
<b>ASSEMBLY</b>		<b>1%</b>
<b>MISC</b>		<b><u>3%</u></b>
<b>TOTAL</b>		<b>100%</b>

\*BASED ON SURVEY OF ABOUT 4500 UNITS, SOURCES: RIA, TANNER ASSOCIATES, SAI ESTIMATES



## EXPANDED STUDIES BASE 1982

- **ACQUIRE KEY TALENT TO ATTRACT STUDIES AND RESEARCH CONTRACTS FROM GOVERNMENT AND INDUSTRIES**
- **MARKET MAJOR INDUSTRIAL FIRMS THROUGH AN ASSOCIATES PROGRAM**
- **GOVERNMENT SUPPORT OF ROBOTICS IS EXPECTED TO EXPAND THROUGH SUCH AGENCIES AS DARPA, ONR, ARMY RESEARCH LABS, USAF ICAM PROJECT AND OTHERS**
- **ESTABLISH A ROBOTICS RESEARCH LAB AS PART OF THE ROBOTICS CENTER**



**RECOMMENDED FOCUS**  
**COMMERCIAL BUSINESS - 1983**

- **EXPAND CONSULTING ROLE TO THAT OF SYSTEM INTEGRATOR DURING 1983**
- **DEVELOP "ANALYSIS TOOL" TO LOCATE SPECIFIC APPLICABLE ROBOT SYSTEM:  
NEEDS MATCHED WITH SPECIFICATIONS, PRICE, DELIVERY**
- **INITIAL APPLICATION SHOULD HAVE A WIDE SPECTRUM OF SALES**
- **PROTOTYPE ROBOT SYSTEM**
  - SELECT APPLICATION (E.G., ELECTRONICS ASSEMBLY)**
  - SELECT HARDWARE COMPONENTS**
  - DEVELOP SOFTWARE**
  - DEVELOP USERS MANUALS**
  - TEST IN LAB ENVIRONMENT**
- **TEST, INSTALL 6 SYSTEMS--OBTAIN FEEDBACK--REFINE**
- **PENETRATION OF PRIMARY MARKET**
- **DEVELOP SECONDARY APPLICATIONS FOR SYSTEM**



## FOCUSING ON BUSINESS TARGETS

- MARKET FORECASTS FOR THE FACTORY AUTOMATION AREA

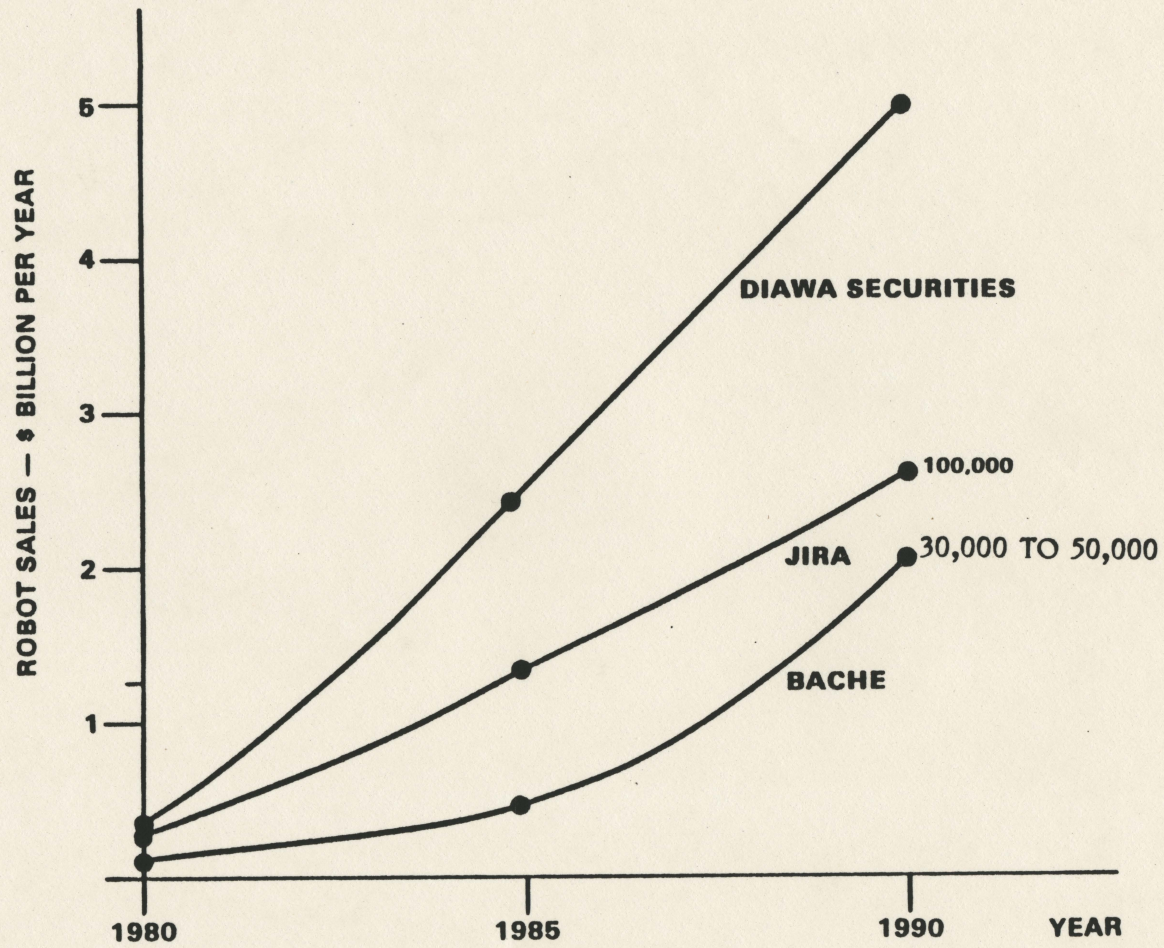
<u>AREA</u>	<u>CURRENT SALES</u>	<u>FORECAST GROWTH IN THIS DECADE</u>
NC MACHINE TOOLS	3-4B/YEAR	SLOW GROWTH
CAD/CAM SERVICES	500M/YEAR	30% ANNUAL GROWTH
ROBOTS	100M/YEAR	50% ANNUAL GROWTH
ROBOT SERVICES	1M/YEAR	? RAPID

- MARKET ASSESSMENT - ALTHOUGH TODAY ROBOT SALES ARE PRIMARILY OF "DUMB" ROBOTS FOR TASKS SUCH AS SPOT WELDING AUTO BODIES, THE CHARACTER OF THE MARKET IS CHANGING

INTELLIGENT ROBOTS,  
PRECISION ROBOTS FOR  
ASSEMBLY, INSPECTION TASKS

- VENDORS ARE VERY ACTIVE IN DEVELOPING NEW COMPONENT HARDWARE
- SLOWLY REALIZING THE ROLE OF THE SYSTEM INTEGRATOR
- MANY FIRMS ARE ENTERING THE CONSULTING AREA







ROBOTIC EQUIPMENT  
INDUSTRIAL SALES USA, 1979

FABRICATED METALS	21%
ELECTRICAL MACHINERY	20%
AUTOMOTIVE	19%
HEAVY MACH	15%
PRIMARY METALS	13%
AEROSPACE	5%
ELECTRONICS	2%
MACHINE TOOLS	2%
Misc	<u>2%</u>
TOTAL	100%



## PLAN OF ACTION FOR DEVELOPMENT OF "APPLICATIONS PACKAGE"

- **SELECT TARGET INDUSTRIES --**  
CRITERIA                      **HIGH LABOR COSTS**  
ECONOMIC EXPANSION      **SIZE OF MARKET**  
NEW TO ROBOTICS            **WIDE VARIETY OF PRECISION WORK PROCESSES**
- **SELECT TASK CANDIDATES**  
CENTRAL TO MANUFACTURING--HIGH VALUE ADDED  
REPETITIVE  
DEMANDING  
UNIFORMITY REQUIRED  
FREQUENT MODEL CHANGES
- **DEVELOP "ANALYSIS TOOL" TO LOCATE HIGH PAYOFF AREAS**  
QUESTIONNAIRE              **FEATURES WANTED**  
ROI FORMULA                 **RATING CRITERIA**  
INTANGIBLES
- **SPECIFY APPLICATIONS PACKAGE**  
COMPONENTS    INTERFACES    SOFTWARE
- **VENDOR MATCHUP**
- **DESIGN/BREADBOARD/DEVELOP SOFTWARE**
- **PROTOTYPE SYSTEM**
- **PICK HALF DOZEN TEST SITES--IMPLEMENT**
- **REFINE, BASED ON EXPERIENCE**
- **FULL SCALE DEVELOPMENT, SIGN OEM AGREEMENTS**
- **DEVELOP ALLIED APPLICATIONS**



## FINANCING THE RAC

- BEYOND GUIDELINES FUNDS (30K) TO ALLOW MARKETING, DEVELOPMENT OF BUSINESS PLAN, APPROACH TO VENTURE CAPITAL FIRMS
- OBTAIN 1 TO 1.5M IN VENTURE CAPITAL, IN A JOINT DEVELOPMENT PROGRAM ✓
- SAI HIRES KEY PERSONNEL TO EXPAND PRESENT BASE CONTRACT SALES AND EARN FEES
- SAI OBTAINS EQUIPMENT (ROBOTS, CAD/CAM SOFTWARE) TO DEVELOP APPLICATIONS PACKAGE
- EQUIPMENT SALES OFFSET DEVELOPMENT AND MARKETING COSTS
- BREAKEVEN ACHIEVED DURING THIRD YEAR

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**JOINT VENTURE  
FACTORS TO CONSIDER**

**RISK AVOIDANCE**

**SHORT TERM VS. LONG TERM GAIN**

**FAST START**

**DILUTION OF OWNERSHIP**



## DECISIONS REQUIRED

- **BEYOND GUIDELINES FUNDING APPROVED**
- **BUSINESS PLAN APPROVED**
- **FORM OF JOINT VENTURE DECIDED**
- **ACCEPTANCE OF VENTURE PARTNERS**
- **CHOICE OF KEY STAFF**

