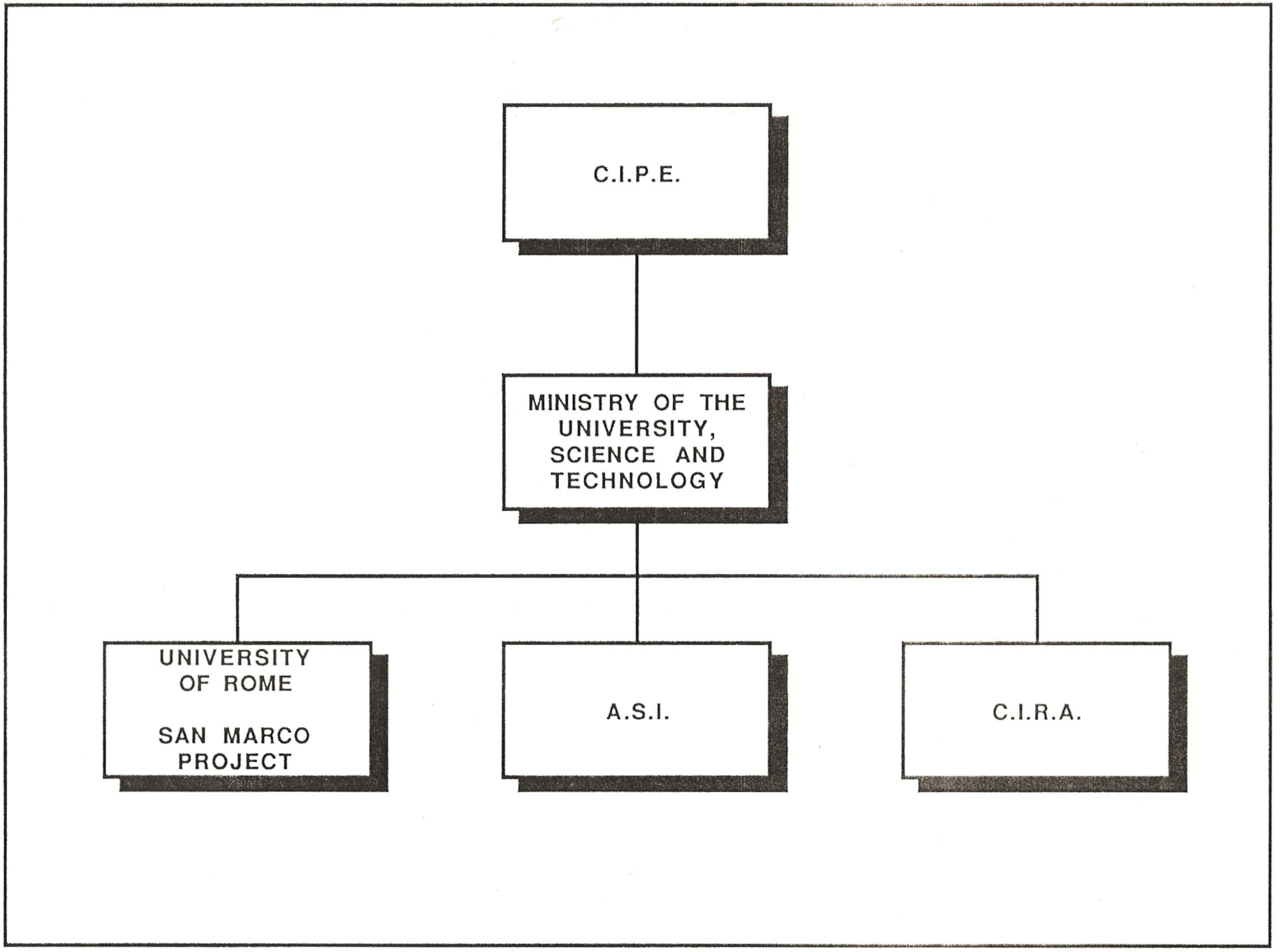
SAN MARCO PROJECT

(UNIVERSITY OF ROME)

PRESENTATION TO NASA HEADQUARTERS

PROFESSOR L. BROGLIO
SEPTEMBER 11, 1990


C.I.P.E.
MINISTRY OF THE UNIVERSITY, SCIENCE AND TECHNOLOGY
UNIVERSITY OF ROME
SAN MARCO PROJECT
A.S.I.
C.I.R.A.

SAN MARCO PROJECT STATUS

- THE MINISTRY OF THE UNIVERSITY AND SCIENCE IS ACTING THROUGH THREE INDEPENDENT BODIES:
  - 1. THE ITALIAN SPACE AGENCY (A.S.I.).
  - 2. SAN MARCO PROJECT FOR SMALL SATELLITE AND SAN MARCO RANGE
  - 3. THE ITALIAN AEROSPACE RESEARCH CENTER (C.I.R.A.) FOR GROUND TESTS INTERESTING THE AEROSPACE INDUSTRIES

- THE FUNDING FOR SAN MARCO PROJECT COMES FROM THE INTERMINISTERIAL COMMITTEE FOR ECONOMICAL PLANNING (C.I.P.E). (ITALIAN GOVERNMENT)

- FUNDING APPROVED BY C.I.P.E. ON MAY 24, 1990 FOR A PROGRAM: "TO UPGRADE THE LAUNCH CAPABILITY OF THE SAN MARCO PROJECT"

- APPROXIMATELY $25 MILLION/YEAR FOR 1991, 1992 AND 1993. TOTAL $75 MILLION

- PROGRAM RESPONSIBILITY AND FINANCIAL RESOURCES MANAGEMENT HAVE BEEN ASSIGNED TO THE UNIVERSITY OF ROME, WHICH HAS COMPLETE RESPONSIBILITY FOR THE SAN MARCO PROJECT AND THE SAN MARCO RANGE

- THE $75 MILLION ALLOCATION IS PROVIDED FOR THE FOLLOWING TWO GOALS:
  - DEVELOPMENT OF THE SAN MARCO SCOUT VEHICLE
  - UPGRADING OF THE SAN MARCO RANGE TO LAUNCH THE SAN MARCO SCOUT VEHICLE

SAN MARCO SCOUT VEHICLE

- SAN MARCO SCOUT VEHICLE PROPOSED BY PROFESSOR L. BROGLIO IN SEPTEMBER, 1977(ATTI/C.R.A. n. 52)
- SAN MARCO PROGRAM AWARDED A FEASIBILITY STUDY CONTRACT TO LTV CORPORATION OF DALLAS IN 1978
- RESULTS OF THE FEASIBILITY STUDY ARE CONTAINED IN VOUGHT 23-DIR 2070 REPORT DATED AUGUST 22, 1978
- ACCORDING TO THE FEASIBILITY STUDY, THE SAN MARCO SCOUT VEHICLE HAS A RELIABILITY VERY CLOSE TO THE ONE OF THE STANDARD SCOUT, THEREFORE, NO TEST FLIGHT IS CONSIDERED NECESSARY
- THE SAN MARCO SCOUT ACCURACY IS VERY HIGH SINCE ALL STAGES ARE GUIDED AND CONTROLLED
- THE SAN MARCO SCOUT PERFORMANCES ARE ABOUT THREE TIMES THOSE OF THE STANDARD SCOUT (AS SHOWN IN THE FOLLOWING PAGES)
- NASA/LaRC SCOUT OFFICE INDICATED IN LETTER TO C.R.A. ATTACHED TO VOUGHT 23-DIR 2070 THAT THEY FORESEE "NEITHER MAJOR NOR DIFFICULT" PROBLEMS IN DEVELOPMENT OF THE SAN MARCO SCOUT VEHICLE

- THE FEASIBILITY STUDY INCLUDED TWO VERSIONS OF THE SAN MARCO SCOUT VEHICLE

  - SAN MARCO SCOUT - (4 STAGES) OPTIMIZED FOR LOW ORBITS

  - SAN MARCO SCOUT - 1 - (5 STAGES) OPTIMIZED FOR HIGH ELLIPTIC ORBITS

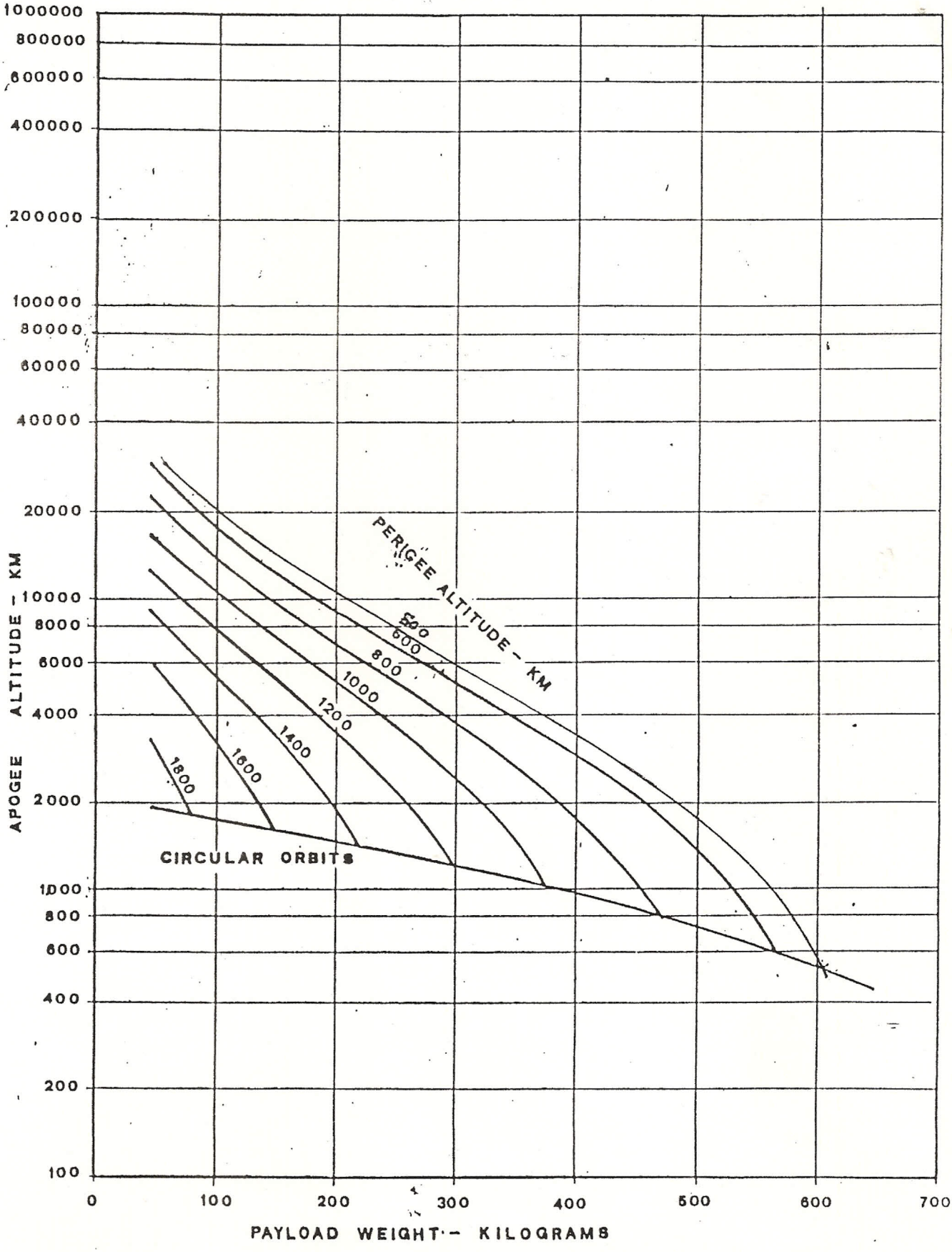
SAN MARCO SCOUT VEHICLE (SMS)

VEHICLE DESCRIPTION

- 1ST STAGE - 4 ALGOL IIIA MOTORS
- 2ND STAGE - 1 ALGOL IIIA MOTOR
- 3RD STAGE - 1 CASTOR IIA MOTOR
- 4TH STAGE - 1 ANTARES IIIA MOTOR

SMS PERFORMANCE

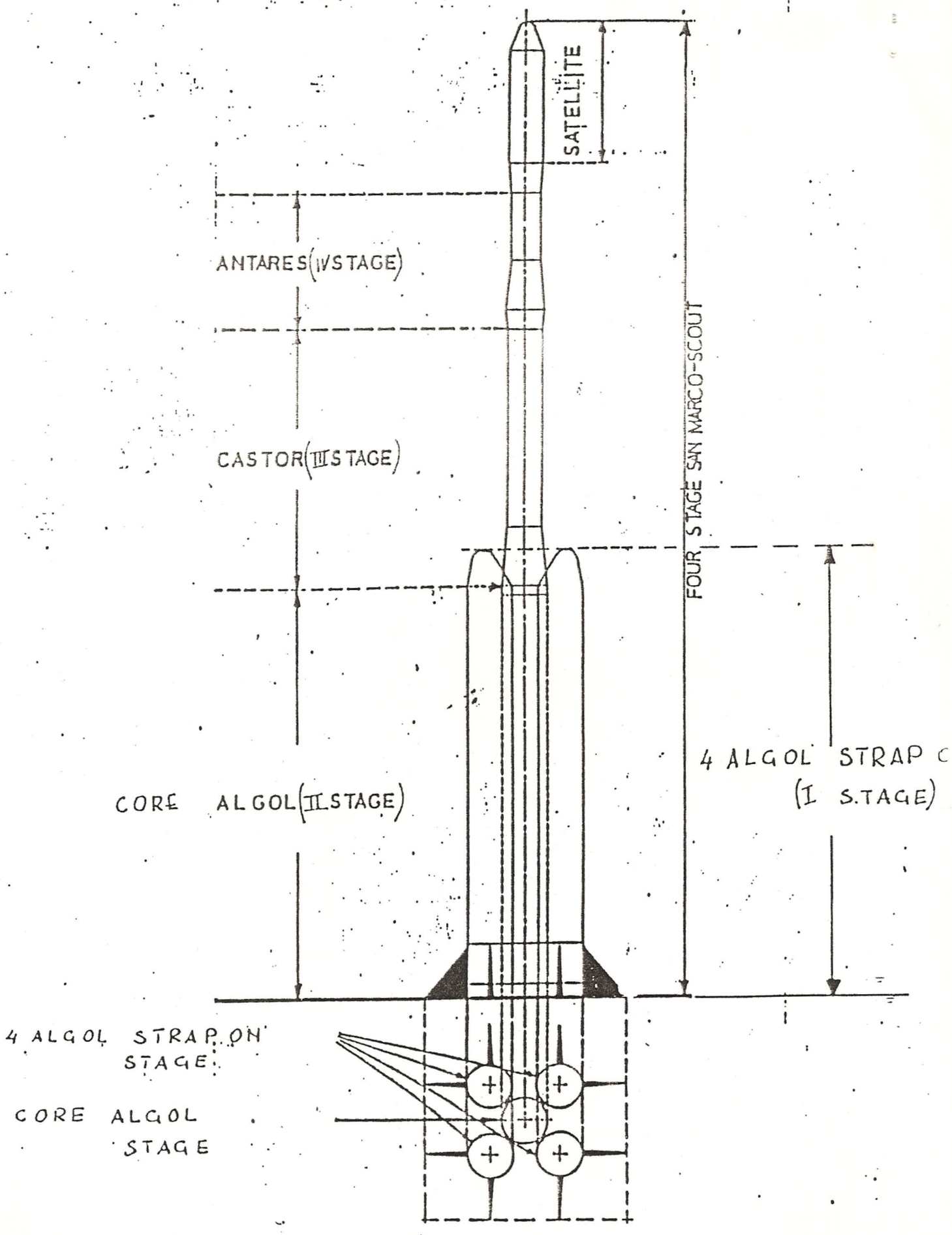
-	PERIGEE (KM)	500	800
-	APOGEE (KM)	500	800
-	INCLINATION (DEG)	2.9	2.9
-	PAYLOAD (KG)	600	470



ELLIPTICAL ORBIT PERFORMANCE

SAN MARCO

4 STAGE ALGOL STRAP-ON CONF.



- SMS
(Four stages)

SAN MARCO SCOUT-1 VEHICLE (SMS-1)

VEHICLE DESCRIPTION

- 1ST STAGE - 4 ALGOL IIIA MOTORS
- 2ND STAGE - 1 ALGOL IIIA MOTOR
- 3RD STAGE - 1 CASTOR IIA MOTOR
- 4TH STAGE - 1 ANTARES IIIA MOTOR
- 5TH STAGE - 1 ALTAIR IIIA MOTOR OR NEW MOTOR

SMS-1 PERFORMANCE (ELLIPTICAL ORBITS)

-	PERIGEE (KM)	420	270
-	APOGEE (KM)	27,400	35,786
-	INCLINATION (DEG.)	2.9	2.9
-	PAYLOAD (KG)	230	220

JOINT VENTURE SAN MARCO SCOUT VEHICLE PROGRAM

NASA/CRRES PROGRAM

- IF PROPOSED COOPERATIVE PROGRAM IS APPROVED AND NASA PROVIDES A STANDARD SCOUT VEHICLE, THE SAN MARCO PROJECT (UNIVERSITY OF ROME) WILL FUND THE VEHICLE DEVELOPMENT, SHIPPING AND LAUNCH SERVICES. THE SATELLITE WILL CONTAIN THE CRRES MISSION PAYLOAD AND THE SAN MARCO TECHNOLOGICAL AND SCIENCE PACKAGE.

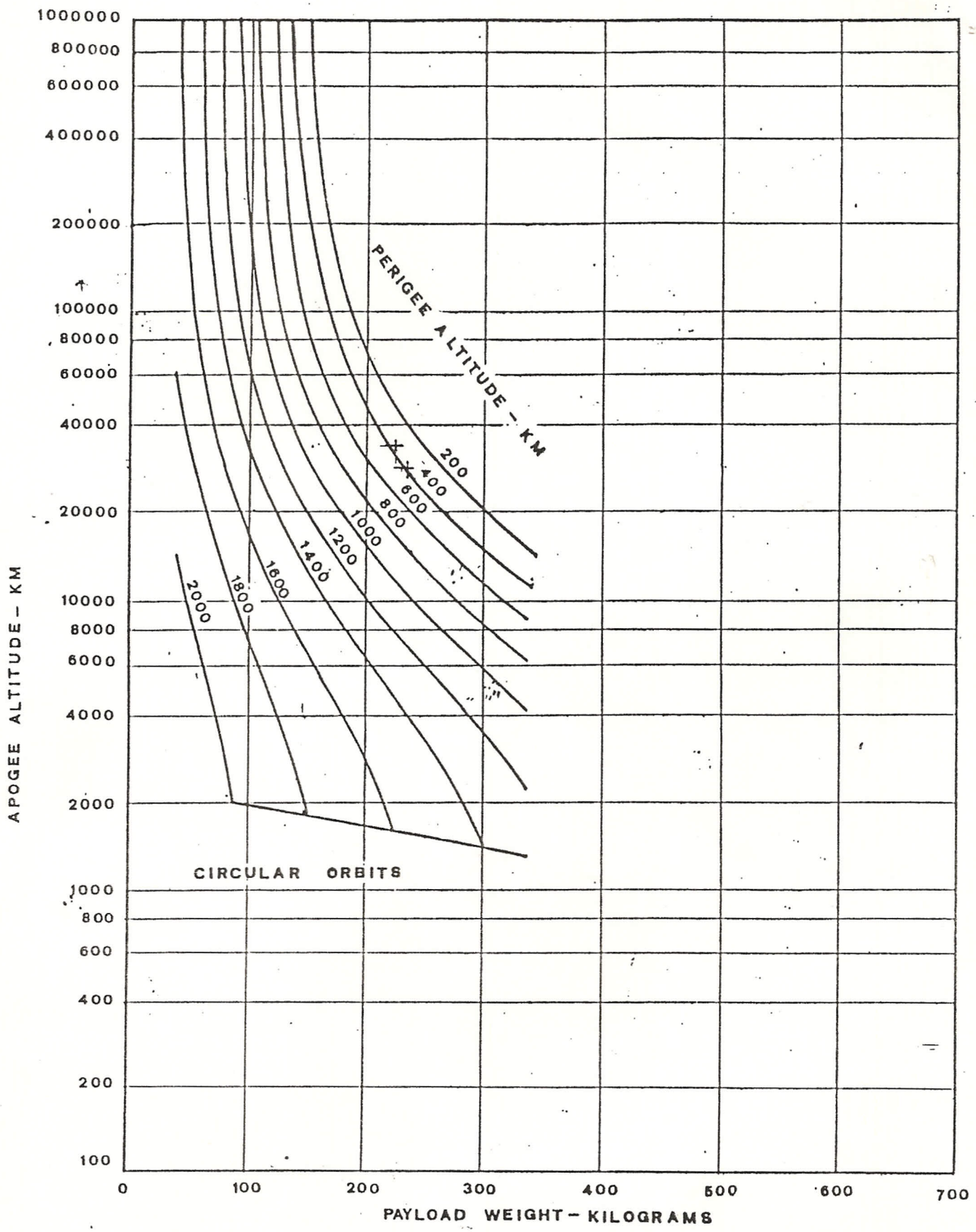
- EXPECTED BENEFITS ARE:

  - FULL TEST OF THE SAN MARCO NEW LAUNCH CAPABILITY, IN A REAL SCIENCE MISSION

  - A NEW START FOR THE NASA CRRES MISSION USING THE SAN MARCO SCOUT VEHICLE

  - ENHANCEMENT OF THE CRRES MISSION POTENTIAL BY EXPLOITING THE LARGER CAPABILITIES OF THE NEW ROCKET (>WEIGHT, >ACCURACY)

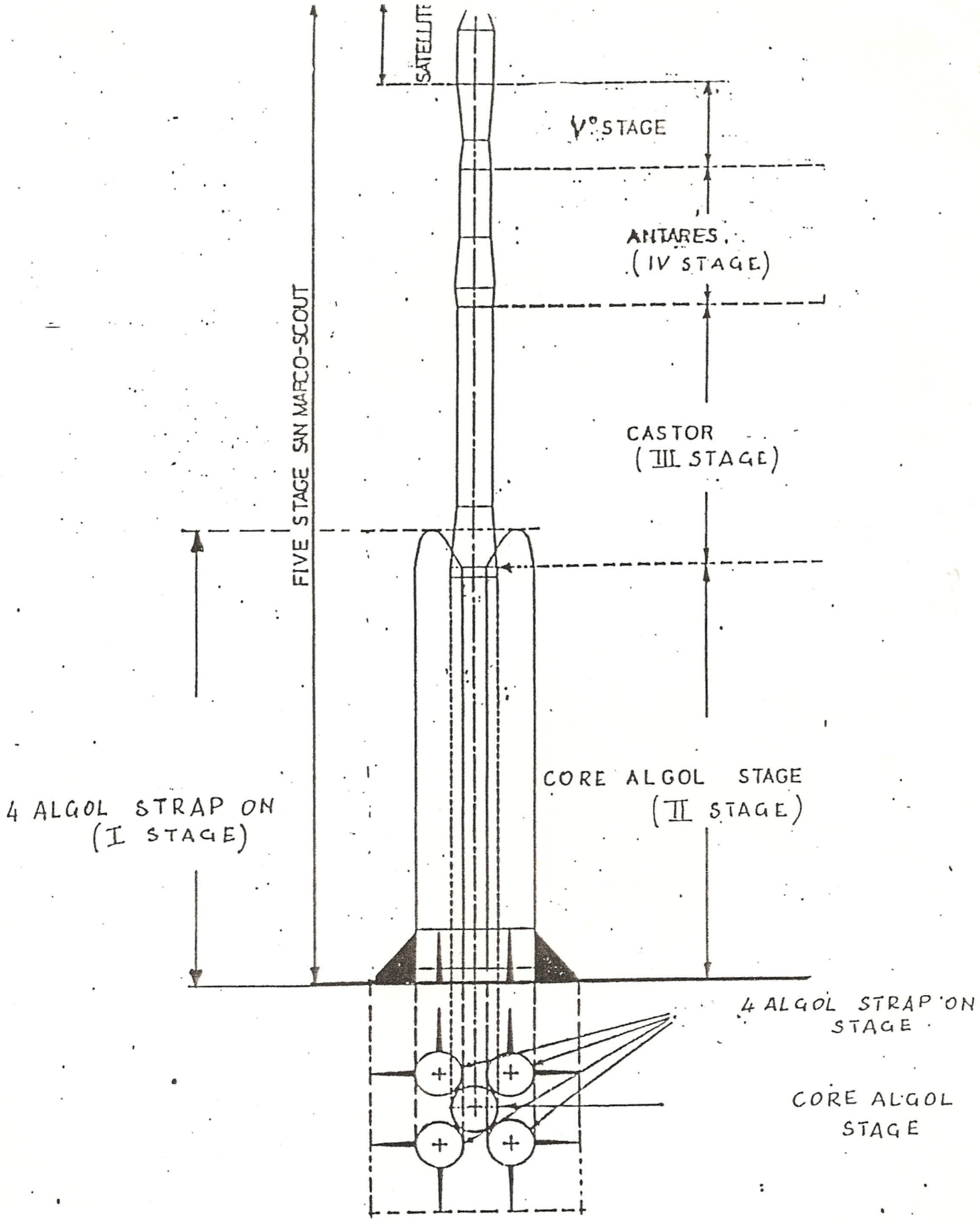
  - ENLARGEMENT OF SCIENTIFIC OBJECTIVES BY MEANS OF AN ITALIAN AND A NASA ADDITIONAL CONTRIBUTION TO THE SCIENCE PAYLOAD.



ELLIPTICAL ORBIT PERFORMANCE

SAN MARCO

5 STAGE ALGOL STRAP-ON CONF.



- SMS I
(Five stages)

SAN MARCO SCOUT-A AND 1A VEHICLE

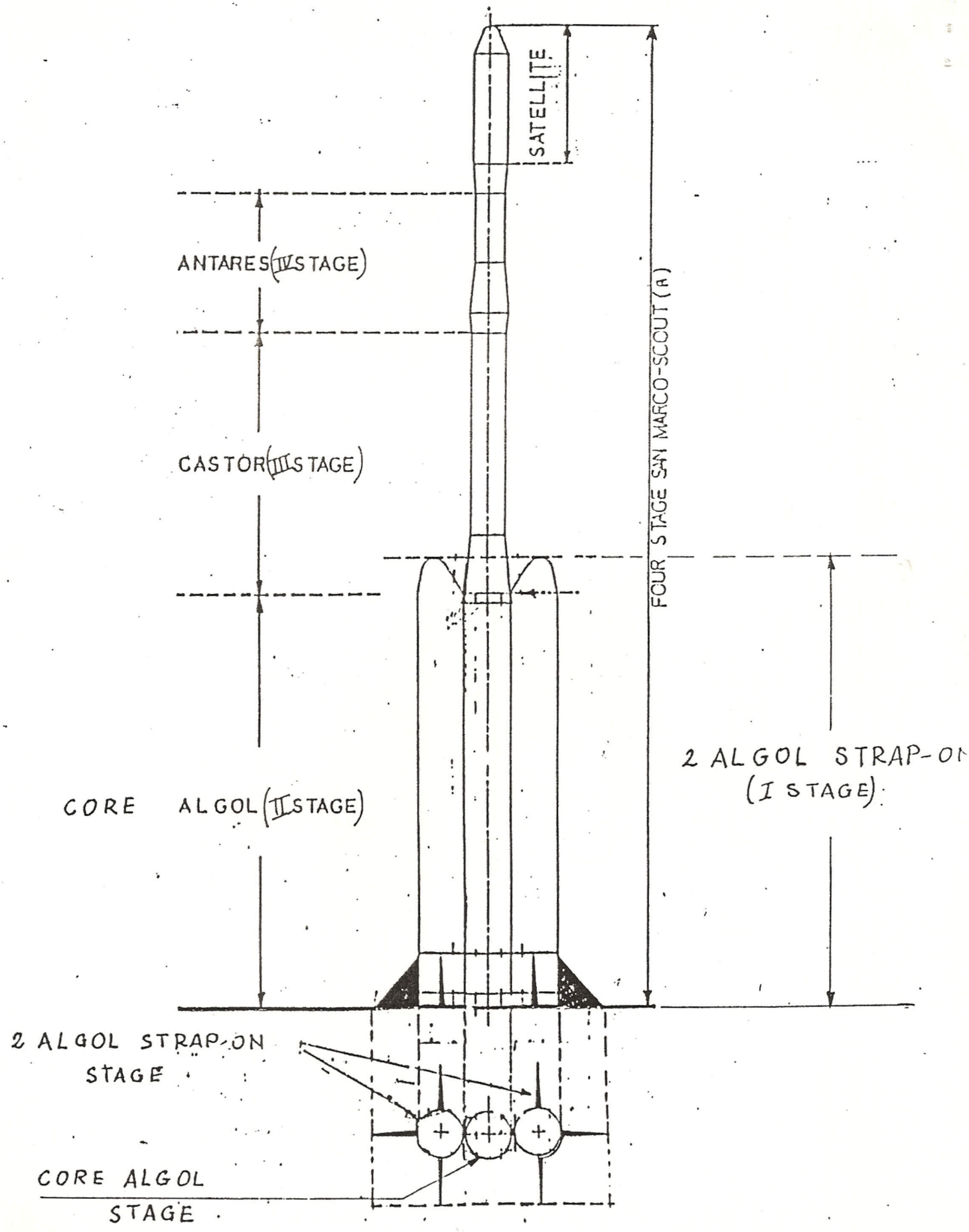
(SAN MARCO PROJECT FEASIBILITY STUDY HAS TO BE COMPLETED)

VEHICLE DESCRIPTION

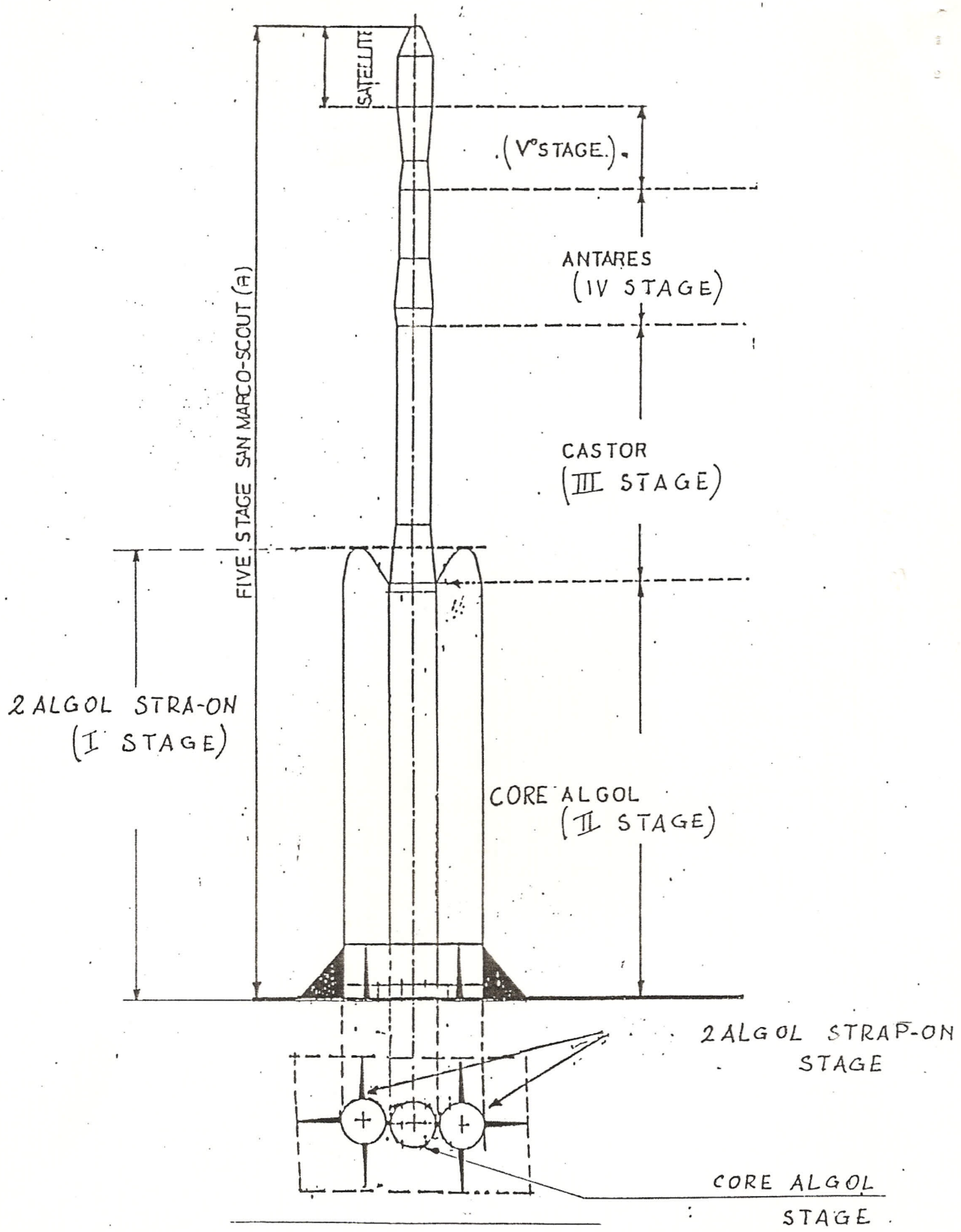
- 1ST STAGE - 2 ALGOL IIIA MOTORS
- 2ND STAGE - 1 ALGOL IIIA MOTOR
- 3RD STAGE - 1 CASTOR IIA MOTOR
- 4TH STAGE - 1 ANTARES IIIA MOTOR
- 5TH STAGE - 1 ALTAIR IIIA MOTOR OR NEW MOTOR

PERFORMANCES∏ (MORE ACCURATE CALCULATIONS ARE IN PROGRESS)

	SMS-A 4 STAGE VEHICLE	SMS-1A 5 STAGE VEHICLE
- PERIGEE (KM)	500	270
- APOGEE (KM)	500	35786
- INCLINATION (DEG.)	2.9	2.9
- PAYLOAD (KG)	380	120



- SMS (A)
(Four stages)



- SMS(1A)
(Five stages)

SAN MARCO SCOUT DEVELOPMENT

- THE SAN MARCO PROJECT HAS REQUESTED THAT LTV DO A COST QUOTATION LAST JULY

- A LETTER SIGNED BY DR. FENTER, LTV CORPORATION, DATED AUGUST 9, 1990, GIVES THE ASSURANCE OF LTV'S INTEREST IN DEVELOPING THE SAN MARCO SCOUT VEHICLE UNDER THE RESPONSIBILITY OF THE UNIVERSITY OF ROME.

- LTV IS PROCEEDING TO PROCESS THE EXPORT LICENSE APPLICATION FOR THE VEHICLE

- THE UNIVERSITY OF ROME WILL PROVIDE A LETTER OF CREDIT TO LTV IN THE TERMS THAT WILL BE AGREEDED BY THE PARTS. IT IS FORESEEN THAT THE LETTER OF CREDIT WILL FORWARD FROM ROMA AT ABOUT THE MIDDLE OF DEC., 1990

- DEVELOPMENT PLAN AND COSTS INCLUDE THE FOLLOWING MAJOR ITEMS:

  - WIND TUNNEL TEST
  - DETAIL DESIGN DEFINITION AND ANALYSIS
  - TEST AND ACCEPTANCE
  - PRODUCTION
  - SHIPMENT
  - OPERATION SUPPORT
  - SPARES
  - PROJECT OFFICE

UPGRADING OF THE SAN MARCO RANGE

- INCREASE (FROM 600 TO 1200 METERS) OF THE SAFETY DISTANCE BETWEEN THE CONTROL AREA AND LAUNCH AREA BY RELOCATION OF THE SANTA RITA PLATFORM, LEAVING THE SAN MARCO PLATFORM IN THE PRESENT POSITION

- CONSTRUCTION OF A LARGER RADAR PLATFORM ADJACENT TO THE SANTA RITA PLATFORM.

- CONNECTION BY SUBMARINE CABLE OF THE CONTROL AREA WITH THE LAUNCH AREA AND WITH THE POWER PLANT SECTION (MICOPERI PLATFORM STILL IN THE PRESENT LOCATION)

- CONNECTION OF THE SANTA RITA COMMUNICATION (CENTER TO THE INTERNATIONAL NETWORK BY MEANS OF A MICROWAVE LINK TO IMPROVE THE PRESENT EXTERNAL COMMUNICATION SYSTEM OF THE RANGE.

SAN MARCO TELEMETRY STATIONS

- A TELEMETRY GROUND STATION IS LOCATED AT THE BASE CAMP. IT OPERATES IN S, L, X BAND FOR SATELLITE DATA ACQUISITION AND COMMAND.

- IT IS PLANNED TO ACQUIRE ANOTHER STATION SIMILAR TO THE ABOVE. IT WILL BE LOCATED ON THE NEW RADAR PLATFORM NEXT TO THE RELOCATED SANTA RITA PLATFORM.

PROGRAM MILESTONES

1.	CONTRACT DEFINITION	ENDING MARCH 1991
2.	VEHICLE DETAIL DESIGN & DEFINITION	STARTING JANUARY 1991
3.	WIND TUNNEL TEST	STARTING MARCH 1991
4.	VEHICLE PRODUCTION	STARTING OCTOBER 1991
5.	G.S.E. DETAIL DESIGN & DEFINITION	STARTING SEPTEMBER 1991
6.	E.G.S.E. UPGRADING	STARTING SEPTEMBER 1991
7.	M.G.S.E. UPGRADING	STARTING APRIL 1992
8.	SANTA RITA RELOCATION	STARTING MARCH 1991
9.	NEW RADAR PLATFORM CONSTRUCTION	ENDING NOVEMBER 1991
10.	RADARS RELOCATION	STARTING NOVEMBER 1991
11.	NEW COMMUNICATION SYSTEM	STARTING SEPTEMBER 1991
12.	LOGISTIC AREA UPGRADING	ENDING SEPTEMBER 1991

SAN MARCO (UNIVERSITY OF ROME)

TECHNOLOGICAL AND SCIENTIFIC PACKAGE

- EXPECTED S/C OVERALL WEIGHT FOR THE BASIC CRRES ORBIT (CIRCULAR, 500 KM, 19 DEGREES INCLINATION) IS ABOUT 550 KG TO BE CONVENIENTLY SHARED BETWEEN NASA AND SAN MARCO

- POSSIBLE MODIFICATIONS OF THE ORIGINAL CRRES S/C MEET THE FOLLOWING CONCEPTS:

  - MINIMUM PERTURBATION OF THE BASIC CRRES DESIGN FROM THE ADDITIONAL PARTS

  - SIGNIFICANT PART OF THE SAN MARCO P/L DEDICATED TO THE SAN MARCO SCOUT VALIDATION

  - EXPLOITATION FOR ADDITIONAL SCIENCE OF THE OPERATIONAL LIFE OF THE SATELLITE AFTER COMPLETION OF CRRES EXPERIMENT

SAN MARCO PROGRAM PARTICIPATION IN THE S/C CAN BE:

- o PARTICIPATION TO THE GENERAL DESIGN OF THE MISSION AND S/C
- o DESIGN AND FABRICATION OF THE STRUCTURE
- o DESIGN AND FABRICATION OF THE HARNESS
- o DESIGN AND FABRICATION OF THE SAN MARCO TECHNOLOGY AND SCIENCE PACKAGE
- o INTEGRATION OF COMMON USERS EQUIPMENT AND INSTRUMENTS