

CHAIRMAN
ISRO

Immediate

o Rajan / Sridharan.

→ a very good effort!

- Have a few problems of display to fit the 10 year profile so ~~that~~ the last profile
- the 5 year plans + the new one along with the 2 year over lap period - all fit. - programmatically AND in the Budgetary sense
- pl. discuss. Chava

ISRO HEADQUARTERS

STAFF OFFICE TO SECRETARY, DOS AND CHAIRMAN, ISRO

Chairman to see:

IMMEDIATELY please

In connection with the note for PM, Chairman desired possible depiction of a 10-year profile 1980-90. Instead of changing the document submitted to the Space Commission, which can serve as an Appendix, I thought it is better to generate the profile separately & place it also to PM. It also contains budget figures which is in basic

FROM: harmony with the S/c note.Sudasan & myself generated a draft
DATE: for chairman's consideration. A good

P.T.O

(2)

Column chart earlier seen
by Chairman can go with
the Profile.

~~Earlier profile copy~~
~~also is attached for info.~~

I feel the Profile 80-90,
& S/c note can go as
appendices to PM's note.

I am separately
generating the terms of reference
for Secy's committee which
will do follow up after
Cab. approvals.

Regards.

Ray
12/2/80.

THE INDIAN SPACE PROGRAMME PROFILE
(SCIENCE & TECHNOLOGY SECTOR)
1980 TO 1990

INDIAN SPACE RESEARCH ORGANISATION
(HEADQUARTERS)
BANGALORE-560009

FEBRUARY 1980

1.0 INTRODUCTION & BACKGROUND

A 10-year perspective plan for Space Research and development activities in India was approved by the Cabinet Political Affairs Committee in 1970. Its principal objectives were:

PRINCIPAL
OBJECTIVES OF
TEN YEAR PROFILE
(1970-1980)

- o To develop indigenously sounding rockets, satellite launch vehicles of SLV-3 class, and satellite technology oriented to communications and remote sensing applications.
- o To develop space applications technology relevant to India, i.e. satellite communications and remote sensing for natural resources management; and conduct related applications experiments.
- o To establish a National Satellite Launch & Rocket Test Range.
- o To assist Government in establishing a national domestic satellite system - INSAT, with indigenous ground systems to the maximum extent feasible.

1.1 The progress and status of the Space Programme ^{were} was reviewed by P.M. and Cabinet in July 1977. The review showed that a viable, coherent and good quality programme had been established with a relatively modest outlay and many benefits had accrued. Among the important points noted are:

PM/CABINET REVIEW
OF SPACE PROGRAMME
IN 1977

- o ^{Through} The firm adherence to Indian objectives, collaboration with Indian Industrial and R&D organisations and effective use of international cooperation have resulted in at the relatively low cost incurred ~~in the~~ useful practical demonstrations of Space Technology and Applications. [↑]
- o The country is now in a position to design, develop and fabricate sounding rockets, ~~and~~ ^{and rockets/satellites} satellites ~~and~~ and would shortly be able to place spacecraft in orbit using Indian launchers.
- o In the coming years, Indian use of outer space can be expected to significantly help national efforts for the solution of three major national problems - eradication of mass illiteracy and ^{Country wide} enhancement of adult and non-formal education, efficient survey and management of natural resources and efficient telecommunications.

- 1.2 With a successful SLV-3 second experimental flight (around ^{mid} July 1980), all the specific objectives of the 10-year Space profile would be fulfilled or exceeded. The present status is summarised below:

PRESENT STATUS
OF THE INDIAN
SPACE PROGRAMME

o Sounding Rockets:

The RH-300, Centaure, RH-560 and Menaka-II ^(Mark I and Mark II) Sounding Rockets along with their payload instrumentation have been developed at VSSC. More than 1000 rockets have been launched from Thumba ^{and Balasore} and SHAR ranges for scientific, technological and meteorological studies. The Menaka-II (Mark-II) ^{was the workhorse rocket for the MONEY programme}, RH-300B, RH-560B & RH-560S sounding rockets are in an advanced stage of development.

o Satellite Launch Vehicles:

A firm ~~indigenous~~ ^S base has been established ^{in India} for development and fabrication of Satellite Launchers complete with the solid propellants, rocket motor propulsion systems, control & inertial systems, electronics, test and check-out system. The first experimental flight of SLV-3, India's

first satellite launch vehicle, was partially unsuccessful due to malfunction of a component in the second stage control system. Efforts are ~~being~~ ^{currently} geared for a successful second experimental flight around ~~July~~ ^{mid.} 1980.

o Satellites:

After the launches of ARYABHATA and BHASKARA, the Rohini spacecraft technology development series (to be launched by SLV-3) and the geostationary, 3-axis stabilised spacecraft, APPLE, ~~for~~ ^{Capable of} communications experiments are at an advanced stage of development, to be launched during 1980. Bhaskara II

with an improved TV payload will go into orbit in 1981

o Space Applications:

Satellite Instructional Television Experiment (SITE) using the NASA ATS-6 and Satellite Telecommunication Experimental Project (STEP) using the Franco-German Symphonie satellites were successfully completed. SITE has firmly established the feasibility of rural developmental audio-visual transmissions using satellites; while STEP conducted in cooperation with P&T, has readied

the country for domestic satellite telecommunication services. Through aerial surveys ^{and ground experiments,} remote sensing applications for management of natural resources have progressed significantly ^{in cooperation with user agencies.} The microwave radiometers on Bhaskara are providing useful meteorological and oceanographic data. Efforts to switch on ^{the} TV cameras are being made based on the results of elaborate ground simulation exercises conducted on the prototype model of Bhaskara.

o Test & Launching Facilities:

Apart from the sounding rocket ranges at Thumba and Balasore, ^{satellite launch vehicle} a full-fledged operational testing and launching range has been established at Sriharikota. A national satellite and rocket telemetry ^{telecommand} and tracking network (ISTRAC) has come into being.

o INSAT:

The INSAT system, combining the three major national services of telecommunications, meteorology and developmental TV, is progressing towards establishment ^{during} ~~by~~ 1981. While the space segment is initially being

imported, the ground segment will utilize to the maximum extent indigenously developed earth station and communications technology.

1.3 Programme transition from 1970-80 to 1980-90:

PROGRAMME
TRANSITION
FROM THE 70'S
TO THE
80'S.

During the past decade ^{Research} the Indian Space Organisation ~~was essentially utilised to~~ ^{was created and} establish the technology base and infrastructure for a long-term self reliant space programme relevant to national developmental needs. ^{was firmly established.} The SITE, STEP, Bhaskara & APPLE projects were ~~nonetheless~~ crucial to establish technological capability towards practical applications and operational systems. The major thrust in the next ^{10 year} profile period (1980-90) must logically be to hasten the transition of the national/programme from competence building ^{towards full} to the realisation of operational and semi-operational systems for specific practical applications. Thus the programme for the eighties lays stress on the development of indigenous ~~and~~ operational satellite systems for national communications, meteorology and natural resources management; and ^{Indian} ~~independent~~ launch capability especially for the remote sensing satellites.

The Coming decade

For ~~these tasks~~ and beyond the required continuum in technology development, improvement and space research ~~needs to be~~ ^{must} ^{Steadily} maintained. Also potential ^{future} application areas such as ~~power~~ generation, from space platforms, which are emerging in the space technology horizon, ^{need} detailed study and ~~possible~~ experimentation at ^{towards} ~~least in~~ the later periods of the ¹⁹⁸⁰⁻¹⁹⁹⁰ profile.

The Exploration & utilisation of Ocean resources for India

And Solar Energy including power

The first generation INSAT system would ~~need~~

^{require} replacement by an indigenous system in the late 80's or early 90's, ^{and this would necessitate} ~~requiring~~ an intermediate test and developmental phase for a

^{Indian built} semi-operational ^{Space} system.

The technological challenges and spin-offs of the Indian Space Programme have already yielded benefits to industry/- this process will experience a natural growth ^{during} in the current decade, ^{resulting in greater benefits & lowering programme costs} Effective transfer of ISRO technologies for industrial exploitation ^{and utilisation of the industrial base} will necessitate ^{innovations towards} appropriate and responsive organisational mechanisms.

It is envisaged that by the end of the new profile period 1980-1990, space technology ^{& utilisation} ~~and~~ applications ^{with its} would have truly come of age in India.

- in materials, chemicals precision fabrication technology, electronics & reliability engineering

1.4 The principal aim of the Space Programme in 1980-1990 would be to operationalise as many space applications systems as possible, utilising the technology base and infrastructure established in the country during the previous 10-year profile period. Further, adequate planning and efforts ~~should~~ ^{would} be continued to ^{explore,} develop and improve essential technologies for applications ~~even~~ beyond the ~~10~~ 10-year profile period.

SPACE PROGRAMME
PROFILE
1980-1990

14 elements
can they be downgraded
compressed into fewer?
~ say about 10.??

The specific objectives and elements of the new 1980-90 decade profile are:

- o To ^{rapidly} improve the technology ^{and payload} capabilities of the SLV-3 launch vehicle and develop ^{its} other variants ~~of SLV-3~~ for enhanced application/technology/science payloads, and to conduct ^{the} relevant launch missions.
A crucial element of this objective would be to ~~make possible~~ with such vehicles.
- o To develop and qualify launchers which ^{would} ^(Indian Remote Sensing) place satellites of 600 kg class in polar sun synchronous missions from Indian ranges.
- o To ^{develop further} ~~expand~~ ^{existing} ~~establish~~ the minimum necessary facilities for developing the ^{required} above launchers ^{and Space Craft} with maximum participation of Indian industries ^{and national} ^{organisations}.

* insert from next page

Pl. retain the word 'developmental', otherwise interpretations could be damaging

① o To conduct further studies ~~to~~ launch vehicle ~~area~~ and initiate action to acquire launch capability for other missions necessitated by national ~~developmental~~ needs.

applications

o To develop and launch ^{quality an} Indian Remote Sensing satellite for effective utilisation of remote sensing technology and ^{The establishment of} promote a national natural resources survey and management system;

② o To organise efforts for indigenisation of the space segment of the Indian National Satellite System (INSAT) and conduct necessary experimentation ^{for} ~~before~~ ^{towards} replacing the imported space segment by indigenous spacecraft.

*could be omitted place on prepage at **

o To conduct science, applications, and technology experiments with ^{The} SLV-3 launcher ~~and~~ its variants.

③ o To intensify ^{R&D} ~~the~~ ^{research} ~~various~~ space applications ^{and} - especially in resources survey/management, communications, meteorology, geodesy, ^{explore} and new areas of space applications ^{in the national context.}

④ o To intensify the microwave remote sensing programme ^{and} ~~to realise~~ ^{develop and qualify} suitable payloads, ^{among others} ~~for~~ ^{The} second generation of Indian remote sensing satellites, ^{and indigenous} INSAT spacecraft.

and Support

- o To conduct ^{necessary} studies and ~~experiments~~ ^{So that India remains abreast with} experiments ~~towards understanding various~~ international developments in space technology, ~~with possible Indian applications;~~ this may include processing of special material in space and utilisation of space transportation systems.

- ⑨ o To energise ^{and evolve appropriate} ~~various~~ mechanisms for transfer and commercialisation of technologies developed in the space programme ^{and promote them} for applications in various national sectors.

- ⑧ o To enhance the capabilities ^{and utilization} of the ISRO telemetry, tracking and telecommand network (ISTRAC) ^{and national test & launch ranges} to meet the national space programme needs, This would include utilisation of space-borne ~~systems~~ ^{and utilization} and mobile tracking stations ^{and utilization}

establishment /

establishment in cooperation with other national agencies, new launch ranges, if necessary.

in Cooperation

- o To enhance the capabilities ^{and utilization} of national test ~~ranges~~ and launching ranges and establish ^{with other national agencies} new launch ranges, if necessary, to meet the programme objectives.

conduct
Plan and Support

- ⑩ o To ^{conduct} energise important space science ^{and} experiments that would give maximum scientific returns, ^{so that India remains abreast with international developments in space this field.}

1.5 The approximate outlay to realise the objectives of the above profile is given below:

BUDGET PROJECTION	(Figures in Rs crores)		
	<u>80-85</u>	<u>85-90</u>	<u>80-90</u>
1. Completion of ongoing schemes and maintenance of infrastructure support which includes the operations of the Space Centres.	163	218	381
2. IRS Project & post launch operations	32*	1	33
3. SLV-V (Polar Launcher & Augmented SLV) Project & Post-launch operations	41	10	51
4. Proto-INSAT Project & post-launch operations	21	27*	48
5. Tracking, ranging and other general facilities	45	9	54
6. Launchers & satellites related facilities	18	2	20
7. Misc support activities including support R&D and other projects	54	60	114
8. Follow on projects of IRS, SLV-V & Proto-INSAT including advanced system studies	1	97	98
9. Facilities related to follow on projects	1	50	51
10. Technology transfer & commercialisation	1	3	4
Total:	<u>377</u>	<u>477</u>	<u>854</u>

* includes external launch provision.

.... /

NOTE: The costs of establishment & maintenance of Space Systems in operational sectors (for example INSAT in the Transport & Communications Sector) and other Space Systems that may be established in other operations sectors are not included in this profile, which addresses the R&D & technology development part of the Space Programme.

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PM/CABINET REVIEW
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IN 1977

- o Through firm adherence to Indian objectives, collaboration with Indian Industrial and R&D organisations and effective use of international cooperation have resulted in useful practical demonstrations of Space Technology and Applications at relatively low cost.
- o The country is now in a position to design, develop and fabricate sounding rockets, satellites and would shortly be able to place spacecraft in orbit using Indian launchers.
- o In the coming years, Indian use of outer space can be expected to significantly help national efforts for the solution of three major national problems - eradication of mass illiteracy and countrywide enhancement of adult and non-formal education, efficient survey and management of natural resources and efficient telecommunications.

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first satellite launch vehicle, was partially unsuccessful due to malfunction of a component in the second stage control system. Efforts are currently geared for a successful second experimental flight around mid-1980.

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PROGRAMME
TRANSITION
FROM THE 70'S
TO THE 80'S

During the past decade the Indian Space Research Organisation (ISRO) was created and the technology base and infrastructure for a long-term self reliant space programme relevant to national developmental needs was firmly established. The SITE, STEP, Bhaskara & APPLE projects were crucial steps to orient technological capability towards practical applications and operational systems. The major thrust in the next 10 year period (1980-90) must logically be to hasten the transition of the national space programme from competence building towards full realisation of semi-operational and operational systems for specific practical applications. Thus the programme for the eighties lays stress on the development of indigenous operational satellite systems for national communications, meteorology and natural resources management; and Indian launch capability especially for the remote sensing satellites.

For the coming decade and beyond the required continuum in technology development and improvement and space research must be steadily maintained. Also potential future application areas such as the Exploration & Utilisation of Ocean resources for India and Solar Energy including power generation from space platforms, which are emerging in the space technology horizon, need detailed study and experimentation towards the later periods of the 1980-1990 profile. The first generation INSAT system would require replacement by an indigenous system in the late 80's or early 90's, and this would necessitate an intermediate test and developmental phase for an Indian built semi-operation space system.

The technological challenges and spin-offs of the Indian Space Programme have already yielded benefits to industry - in materials, chemicals precision fabrication technology, electronics and reliability engineering - this process will experience a natural growth during the current decade resulting in greater benefits & lowering programme costs. Effective transfer of ISRO technologies for industrial exploitation and utilisation of the industrial base will

necessitate innovations towards appropriate and responsive organisational mechanisms.

It is envisaged that by the end of the new profile period 1980-1990, space technology with its applications and utilisation would have truly come of age in India.

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SPACE PROGRAMME
PROFILE
1980-1990

The specific objectives and elements of the new 1980-1990 decade profile are:

- o To intensify R&D efforts in space applications - especially in resources survey & management, communications, meteorology, geodesy, and explore new areas of space applications in the national context.
- o To develop and qualify an Indian Remote Sensing satellite for effective utilisation of remote sensing technology and promote the establishment of a national

natural resources survey and management system.

- o To organise efforts for indigenisation of the space segment of the Indian National Satellite System (INSAT) and conduct necessary experimentation ~~for~~ towards replacing the imported space segment by indigenous spacecraft.
- o To develop and qualify suitable payloads among others for the Indian remote sensing satellites and indigenous INSAT spacecraft.
- o To rapidly improve the technology and payload capabilities of the SLV-3 launch vehicle and develop its variants for enhanced application/technology/science payloads, and conduct the relevant launch missions. A crucial element of this objective would be to develop and qualify launchers which would place Indian Remote Sensing Satellites of 600 kg class in polar sun-synchronous missions from Indian ranges.
- o To conduct further launch vehicle studies and initiate action to acquire launch capability for other applications missions necessitated by national developmental needs.

- o To develop further the existing infrastructure and establish minimum necessary facilities for developing the required launchers and spacecraft with maximum participation of Indian industries and national organisations.
- o To enhance the capabilities and utilization of the ISRO telemetry, tracking and telecommand network (ISTRAC) and national test & launching ranges to meet the national space programme needs. This would include establishment/utilisation of space-borne and mobile tracking stations and establishment in cooperation with other national agencies new launch ranges, if necessary.
- o To energise and evolve appropriate mechanisms for transfer and commercialisation of technologies developed in the space programme and promote their applications in various national sectors.
- o To plan, conduct and support important space science and technology experiments that would give maximum returns, so that India remains at least with international developments in this field.

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