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A Chandran was with the Vikas team working in Toulouse, S.F.P.

He had a nice sense of humour & excellent in aesthetics. In

fact VS & AC were the persons who decided on the aesthetics of ISRO Annual Reports ~~the~~ which ~~the~~ were unique in those days.

In addition AC was very fluent in French, another person ~~in~~ than KSP. Also AC was very familiar with the etiquettes of French & also that of other European countries.

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His skills of him was very useful for our international relations.

Whenever we ~~to~~ looked friends from CNES, DFVLR, <sup>ESA</sup> ~~Rhe~~ <sub>in</sub> ek

• AC was a great asset. ~~Right~~ from selecting the menu to having good social talks, he was very useful.

• He was very useful in LV project monitoring as well. But his relations with AEM was not great, unlike ~~that~~ the situation of Setty with VRG.

AC was a soft spoken person, ~~some~~ in some ways

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unfit to the ~~the~~ aggressive  
styles of the ISRO HR colleagues!

Now the attention to  
ISAC. Right from the (Aryabhata)  
ISSP days, SD had worries  
about the unduly flat structure  
which URH had! He wanted  
to be every where!! Somehow  
SD was able to convince URH  
especially after the formation of  
ISAC, ~~to be~~ and him having  
larger role in INSAT-1 SSPO etc  
to be little away from the details

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and to help grow the second tier. He was reluctant but then came up with a structure.

~~I had~~ SD had asked for my views. Hence a detailed note as to how ~~the~~ ISAC can be organised into Groups, Divisions etc in the mode of VSSC, which had been done by BOP (his method - came from BARE!)

The note is follows; it speaks for itself.

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STRICTLY CONFIDENTIAL

Chairman-ISRO

Y S Rajan

December 4, 1980

Reorganisation of ISAC

Chairman had given me a note on the re-organisation of ISAC as in flag A. The present structure of ISAC is as in the Office Order in flag B. The organisational structure in a pictorial form is in flag C. The proposed structure, and a possible alternative are in flags D and E respectively.

I consider that most of the reorganisation should be utilised as a tool for selecting between 'men' and 'boys', while also keeping functional elements in mind. This will ensure evolution of a better ~~paramaks~~ pyramidal structure needed for suitability and also most importantly select and reward the meritorious. Viewed from this angle, very little has been the change in the proposed reorganisation, except naming the Heads of Divisions as Group Directors, and in one case changing a Project Director into a Group Director. Probably, one of the two persons -- Dr S P Kosta or Shri R Ashiya -- (depending upon who becomes the Group Director) may be chosen to be the Project Director for the Rohini series. Thus very little has been done in terms of selectivity and of persons except for Patki, who is put under Vasagam. I think that ISAC could do with three groups, namely, Telemetry, Tracking Communication & Power Group, Spacecraft Dynamics & Mission Planning Group, and Facilities & Integration Group.

The Mission Planning which is currently proposed to be under the Systems Planning & Integration Group, better fits in the Spacecraft Dynamics Group which is much more of an analytical group and mission operations involves considerable control manoeuvres, attitude determination etc. The integration is more an engineering management and facilities & integration really go together. If such a restriction to three Groups is done, then one of the two -- Tarsem Singh or Prakasa Rao -- may be rendered surplus and may be one between Dr Kosta and Ashiya. I would think that better person for Integration & Facilities Group would be Tarsem Singh, who is more calm in his approach and would be a better person to service the projects than Prakasa Rao. Between Dr Kosta and Ashiya, in terms of growing people, Dr Kosta has definitely a better edge.

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Thus one has to see between Ashiya and Prakasa Rao as to how they can be accommodated. I would think that it is best to try for a deployment of both these persons out of ISAC by trying to put them in PSLV Project at VSSC. At best one of them could be accommodated as Rohini series Manager for which perhaps Prakasa Rao may be more suited especially in view of his Space Science background that may be useful in dealing with scientific management.

Thus I would think that the purpose of reorganisation would be better served if ISAC has three groups rather than four groups as proposed by Prof Rao.

This is placed to Chairman for further action, if any.

Regards.

enc.

Y S Rajan

daK

PROPOSED REORGANISATION  
(A FOUR-GROUP ISAC)

TELEMETRY, TRACKING, COMMUNICATION  
AND POWER GROUP

SPACECRAFT DYNAMICS GROUP

SYSTEMS PLANNING & INTEGRATION GROUP

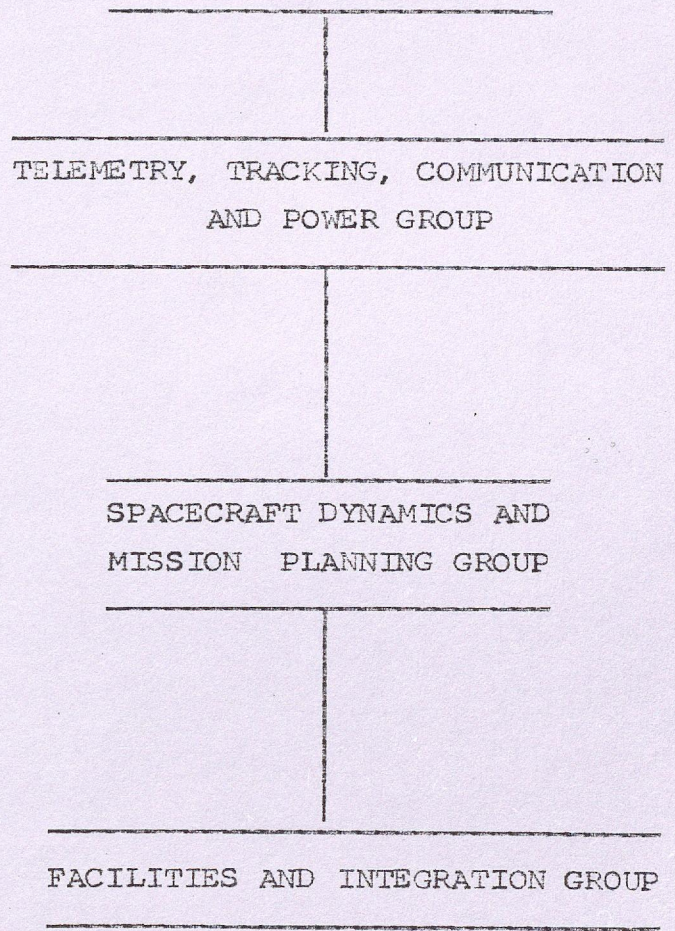
FACILITIES GROUP

+ Projects 3  
+ PPEG 1  
+ QA 1

Total Direct Reporting 9.

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PROPOSED REORGANISATION  
(ALTERNATIVE)  
(A THREE-GROUP ISAC)

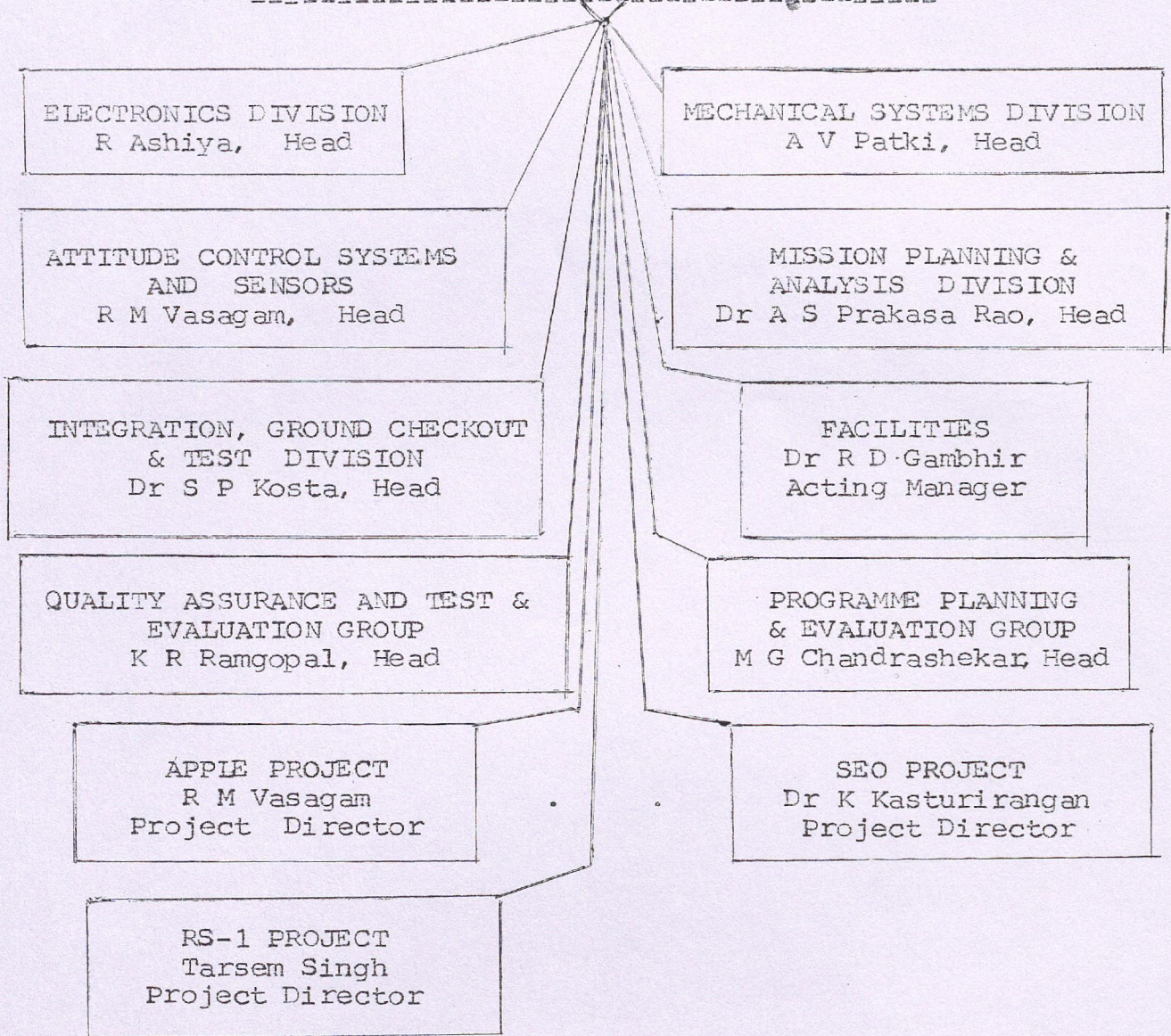


Projects	4	SE0
		APPLE
		RS <del>4</del> Sens
PPEG	1	IRS
QA	1	

Total Direct Reporting = 8

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PRESENT ORGANISATIONAL STRUCTURE OF ISAC



Total Direct Reports = 11

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I had not included in this a details of all the Flaps of ISAC reorganisation ~~at~~ which is ~~at~~ with me — the earlier orders etc ... ~~It was~~ What I had added was to give a glimpse. I don't recall what was finally accepted as the reorganisation.

Another critical reorganisation issue was ~~to~~ vis a vis SAC.

The ~~only~~ <sup>three</sup> pages of the note Dec 11, 1980 is available which is attached → ~~314-315~~  
314-316

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CHAIRMAN, ISRO

YS RAJAN, ISRO HQ

DEC 4, 1980

3 pages

1. Chairman had discussed with me about some options concerning the organisation at SAC in view of Prof Yash Pal's departure to UN. One of the aspects considered was to have 2 or 3 Groups or Units with full powers of Directors, summed up (or integrated) in a Board or Committee or Council composed of those Units Heads and also persons like Prof U R Rao, Col Pant and Dr SC Gupta. In this context, Chairman also desired me to have some comparison about the powers as delegated by the Department to the Centres and also to the Groups Directors by Directors. A copy of such a compilation is in FLAG A. The delegation from the Director to the Group Directors is not always uniform in all the Centres. The present data concerns SAC. There is no need for an uniformity since these delegations are done suited to a particular situation and/or a few individuals.
2. As I have mentioned to Chairman by and large it is not the powers that makes the difference between Directors and the Group Directors. In fact many of the daily administrative chores for the Centres such as writing off losses, maintenance, repairs, etc are delegated to the Controller who really will exercise these powers in many cases. Many crucial elements like travel sanction, approval of items not specifically mentioned in the budget etc can be done by Group Directors also to a very great extent. What really makes a difference between the Group Director and the Director is the general overall authority which is more really the myth of power than the reality. But the myth has a strong connotation of real power since it helps to keep the discipline. It gives the Director a lot of say in matters of adjudication when there are conflicts between programmes, facilities or individuals; the Director's words as far as the Centres are concerned are final. It is not so vis-a-vis with Area Chairman or Group Directors. It is really this subtle point which has to be kept in mind in any organisation where sharing of resources etc between Units at the same location is an important feature.

.... /

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3. Coming now to the actuality of situation in a theoretical sense and also considering some of the personalities one could divide SAC into 3 Groups or Units, namely,

- Remote Sensing Unit
- Communication Unit
- Microwave Sensor Development Unit

To a good extent, Remote Sensing Unit can be independent except for sharing of Workshop, Library and general administration and all of the payload fabrication and testing facilities with others.

4. Communication and microwave Groups are organically linked even in terms of technical facilities; if they are split requirements for test equipment, manufacture etc will go up as is always the reality in any management situation.

5. As regards microwave remote sensing again the remote sensing unit and the microwave unit have to develop linkages which can become difficult added independent status of these units. It should be noted that even in the present unified structure one finds it difficult to evolve such linkages.

6. How to service these units in terms of Workshop centralised administration, etc is an important element. It may well be that for such common facilities and administration one other unit with Unit Head can be formed. The four independent Unit Heads can be summed up (or integrated) in a Board chaired by a person of the ranking of the Director as Dr Brahm Prakash was doing for SHAR. One should not be unaware of the conflicts that could generate in such a situation without having a Director to control directly but only a Chairman of a Board operating only through a Board. However, administratively such a situation is workable since the powers of the Director can be delegated to the Chairman of the Board as also some of the few elements just to keep the Chairman of the Board a shade above the Unit Heads in power.

7. Another way would be to have all these Unit Heads have the powers of Directors themselves in which case they would all be separate bosses; my own assessment is that 3 separate Units have to be formed with 3 separate administrations for themselves with very little sharing of facilities. How to do it in one campus is the big

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3

management question since management style of the individuals would be different. In such a case a separate common facility Unit Head is not required.

8. One other option is to have a senior ISRO person named as Centre Director either full-time or part-time depending upon the situation and have the existing 2 senior persons declared as Deputy Directors looking after 2 areas as they are presently, namely, Communication Area and Remote Sensing Area and some other lit-bit items divided between them (e.g. common facilities, payload fabrication, etc could be placed under one of the Deputy Directors and some other items like software group etc under other Deputy Director). One of the Deputy Directors could himself be incharge of the administration in an overall sense. Centre Director and these two Deputy Directors, can form a troika as it is in some sense with the IRS Project though, of course, it should be made very clear that the Director's word will be final. It appears to me that this solution will have far less perturbations since the present mode of Area Chairman etc can still be retained with Area Chairman reporting to the Deputy Directors. For example, the present Communications Area Chairman could report to the concerned Deputy Director and the present Co-Chairman of the Remote Sensing Area can himself be made Chairman of the Remote Sensing Area reporting to the Deputy Director concerned. Except for the present Area Chairman of the Communication Area for all others it will be some elavation of the role. If the present Controller continues he may feel little bad reporting to one of the Deputy Directors. However, if there is a change there would not be any problem since both the persons who are presently there at SAC to qualify for Deputy Directors are very senior persons of ISRO.

Submitted to Chairman as desired.

(Y S Rajan)

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SAC reorganisation had its own complexities. Since YP did not want to ~~to~~ take the responsibilities of the process of Director (Head of Dept) he did not even want to talk to IFA. It was (is) crucial in exercising the limit process. By and large ISRO IFA's were very good. Also Director had the authority to overrule ~~them~~ an IFA but had to write the reasons for it in file. The work could proceed

15/0000/Imp

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on that basis. But the report  
of ~~the~~ such overruling will  
come to the Dept of Space (Addl.

Secy in Charge of Finance.)

~~So~~ There ~~is no~~ was no  
immediate action. But the

accumulated overruling  
would show a pattern on

which DOS could question

the Director.

YP did not want to  
have any of it. So he asked  
his Controller (S.R. Thakore —  
who was the right hand budget

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man for VAS) to deal with ~~the~~ <sup>it</sup>.

It is not allowed under GOI  
~~the~~ rules. Controller cannot

overrule IFA. SRT had

told me many time. "Rajan

Kya Karega, Yash Pal saab

ko bolta hoon, sunkte nahin

hai. Thakore tum kuch karo...

So to keep things moving

I wrote an order that Direct

discusses with Director SAC

and he ordered like this...

mein sign karta hoon...

mera naam bigadta hai

DOS mein!"

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So the order was to take care of these. The SAC reorg order, I don't recall.

But poor SRT had to be sidelined ~~after~~ (even before

YP went <sup>to UN</sup>) as a fall man! The conflict between SAC & DOS Sect 4 (AS & JS) was too high because YP did not follow the ~~the~~ Govt rules (which were very good then!)

We thus enter ~~the~~ into

1981 coming out of 1980...

Now we switch gears!

Not just gears but also the direction; a diversion taken, or new exit or new light way! Though I do not

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have the papers immediately at hand  
and also am lazy to find out  
from Google (nor was <sup>Dr. V.</sup> Jayaraman  
former Director NRSA was available  
on phone, when I just called),

I recall that somewhere around  
1980, NRSA — a Society under  
DST, which was created by the

visionary / <sup>first</sup> Secretary DST

Dr. Arcot Ramachandran.

I am leaving the next  
page for filling up with ~~data~~  
info to be given by VJ, whom  
I could contact finally.

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NRSA history as given by VJ:

2<sup>nd</sup> Sept 1974  
4<sup>th</sup> Dec 1980  
IIRS July 1976

NRSA was created on 2<sup>nd</sup> Sept. 1974 under DST as a Society, which was under Survey of India. IPI was merged with it (employees who were govt servants as they were with SOI) were given option to go to SOI or join NRSA (lean Govt Status). It was later named as IIRS ~~I think~~ <sup>during</sup> July 1976. I think it ~~came~~ was named IIRS as it did beyond mere photo-interpretation. NRSA came under DOS on 4<sup>th</sup> Dec 1980. Wg Ed K. R. Rao the first Director was from Feb 1975 to Jan 1982.

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During the initial years of formation it was fully focussed around reception of data from USA & NASA's ERTS later Landsat data. The data reception station ~~was~~ (free of earth change — except that the station and data processing centre was to be set up by the receiving country as also the regular running of it. Basically it was on the "no exchange of funds basis".

A.R. had formed NRSA under DST even before this project

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was to be pushed through. He had in mind ~~an~~ aerial photography as well. His visionary outlook foresaw many things ahead. When he got it formed and transferred the "sleepy"

IPI (Indian Photo Interpretation Institute) <sup>at Dehradun</sup> under it ~~from~~ transferred to NRSA in order to modernise it (IPI was under Survey of India - SOI - and DST was its controlling Govt Dept), nobody ~~of~~ notices its significance.

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~~But who~~

SD was magnanimous  
in forwarding the name of  
Wg Cdr K. R. Rao who was  
languishing under ISRO # Q  
to DST which called for applications.

Those were the draconian days  
for Govt servants, who cannot  
apply to jobs any where ~~at~~ without  
No objection Certificate (NOC) from  
his/her office. It was mostly  
under the whims & fancies  
of the ~~the~~ Boss — ~~to~~ Head of  
Dept. They can suddenly

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discover the importance of the person in the task given to him/her and the "public interest" of it. Hence deny! The Dept which asked for application cannot ~~and~~ consider the person without NOC, though the person may have ~~sent the~~ responded to the call for jobs with a rule "advance copy — ~~ca~~ NOC applies for".

AR would have noticed the greatness of Wg C S K R R ~~for~~ as a best fit for the job. Aircraft flights & Earth station to come!

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WgCdr was the first person to establish ESCES (first Satellite Comm<sup>n</sup>. Earth Station) funded by UN in India. First to build a 97 ft

Arri antenna — we had described in earlier. Had VAS been alive, ~~he~~<sup>Satellite</sup> KRR would have built Earth Stations for other countries in the world on a commercial basis — first Space Technology Export from India. Unfortunately that was out! With the formation of SAC with YP as head, KRR was shunted out.

He had the outlet through

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NRSA. Though SD was not much in "equation" with KRR. He saw his capability and forwarded his appl<sup>n</sup>. to DST. NRSA was built up in god-speed. Aerial flights (KRR was Wg Cdr) & an Earth Station.

When Landsat reception facility was under proposal MAK opposed it & brought up arguments of US espionage over India. ~~He~~ He was a great sensor of political winds in Delhi. He had seen the anti-US slant of Indira Gandhi (IG)

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SD went along with his friends  
M.G.K. - though passively. Any way

AR was also a great master  
of dealing in Delhi. He got from

IG the approval to set up  
~~lands~~ Landsat station in India. I  
had seen the "grumble" by SD.

Any way that NRSA with the  
experience to receive Landsat data,  
process it and disseminate to  
users was crucial for ISRO's  
future remote sensing satellites  
beginning with IRS.

As we were getting closer

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to defining the final shape of  
IRS satellite (starting from  
TARHANA studies in 1977), SD  
was worrying about the ~~use~~ utilisation:  
the users and how to service them.

One thing that was remarkable  
with SD (which I can emphatically  
say with so much of blind sight  
and having seen so many S&T  
administrators and policy "influencers")  
was that he was very much concerned  
about the end-use; how ~~can it~~  
can space activities be usefully  
deployed the requirements of India.

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~~Another~~ That is why right from

INSAT

Another aspect was

that how to deploy & useful

Space Technology (assuming that

users start liking it) on a

large scale: that brings Industry.

So he was very keen on these two fronts and not just confined

to getting funds for his own department, grow it and finish

your jobs. If ~~not~~ unutilised

blame the users; if ~~ca~~ it

cannot be scaled up blame Industry.

Unfortunately the Indian S&T

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departments ~~grow~~<sup>a</sup> grew up  
that way — even DAE & DRDO.

What made the difference  
for ISRO, was the meticulous  
care of SD — on end-use  
and large scale deployment of  
the useful products/services.

So for IRS programme  
to succeed, it was not just enough  
to demonstrate some end-uses  
with Landsat data ~~and~~ before  
launch and IRS data later. It  
had to be used by all potential  
users as a part of their regular world.

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That ~~to~~<sup>was</sup> the reason why he insisted on ~~the~~ SDO data Utilisation (through course) and built into it Landsat data use also.

Then came his worry about "Data distribution" on a large scale. ~~He~~ He knew that Satellite Remote Sensing data use was not as simple as INSAT-1 users who ~~the~~ ~~were~~ ~~for~~ could be reduced to three Ministries (Telecoms, I & B, Civil Aviation/IMD). For INSAT-1 an ICC (INSAT Coordination Committee) was enough. But IRS

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was different. Data dissemination was also very complex as one cannot just end in dumping <sup>satellite</sup> data to a User Ministry (the bureaucratic apex ~~the~~ Dept). NRSA had developed the experience of giving data to users (in a raw imagery form or in a thematic interpreted form). Though SAC had the capability in a technical sense, it ~~is~~ was nowhere near the scale that was being done by NRSA).

SAC persons could ridicule NRSA being without R&D but SAC ~~is~~ did not have the engineering and

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operational experience of NRSA.

SD had discussed these aspects with me. "How to use NRSA strengths and how to develop a coordination mechanism with NRSA for IRS data reception and dissemination?" was one of the key questions he used to discuss with me. He was unaware of the "tough KRR" who would insist on a contract. ISRO/SAC ~~was~~ was incapable of writing such a contract as the use of R&D data was ~~is~~ nebulous and evolving at that stage in India (@1980)

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With SD's friend Gokul (MGK) looking over the position of DST, it was easy for ~~SD~~ SD. They came to the conclusion of transferring NRSA from DST to DOS. It was a bold decision by MGK (as normally no ~~SD~~ S&T bosses — even other <sup>bureaucrats</sup> Dept bosses — would let go something!) to transfer NRSA to DOS. It was similar to the decision of moving Satellite Project from Trivandrum to Bangalore.

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So NRSA came under Dept of Space — not still a full part of ISRO. One could not transfer persons from ISRO to NRSA. Also NRSA was

an autonomous Society under DOS.

Governed by a Governing Body — not coming day-to-day under Chairman ISRO. Yes, of course,

Secretary DOS was ~~the~~ overall boss; but for day-to-day references if any, it was Addl. Secy / JS / DySecy - DOS who mattered.

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It ~~B~~ was under these circumstances, SD was conceiving development of user segment of IRS - not just IRS satellite alone but for the overall Earth Observation Satellite programme of ISRO. He had already formed EOS office in ISRO HQ with me as Director EOS - it was an additional responsibility for me being also Sec. Secy ISRO.

He had several rounds of discussions with me about EOS ~~at~~ user interfaces.

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As desired by him, I had written a comprehensive note dated Feb 5, 1981.

When I read it now, I am happy that I was able to comprehend the breadth and depth of issues involved in space applications.

~~It~~ They were not merely technical but it was more closely tied up with the governance systems of the country. In those days, the Ministries had a grapple hold on executing technical departments. In cases like Telecom, it was monopoly — hence department decision ~~is~~ was crucially linked to acceptance of new projects. Fortunately some in

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~~DOT~~ Telecom Dept were helpful. It was because of the involvement of the Dept representatives right from the INSAT study days - preceding SD. TV Srinangan was with INSAT study (ISRO - MIT). We had explained about it earlier, at VAS time itself. I & B was recalcitrant - even for SITE (when it was actually executed post VAS demise viz 1975-76) relations with I & B was not good. Though occasionally some responsive persons like Krishnamurthy DG AIR(?) were there.

Still communication applications could be managed through the ministerial mechanism like ICC. Meteorology was very difficult. ~~Item~~ Firstly IMD was under a bureaucratic ministry - civil aviation - which had bigger issues; IMD was miniscule for them

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In addition being an oppressed slave,  
~~the~~ it was very much hierarchy

bound. Even on purely technical  
matters, scientists could not voice any  
~~of~~ opinion based on facts. Naturally  
there was lots of infighting though ~~was~~  
~~was~~ not visible outwardly . . . .

JPS did a good job in  
dealing DOT. With IMD which he  
wanted to monopolise, its hierarchical  
structure was convenient for him. For  
paper work for ICE (INSAT Coord Committee)  
& Space Commission could look clean. But  
in actuality there were a number  
of problems about the winds derived  
by IMD from INSAT-1 Data (later when  
it was launched)

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I had touched upon  
# Communication applications &  
IMD to some extent in my  
note, in order to emphasize the  
complexity of applications for resources  
management — then the whole set  
of details of what data meant,  
involvement of state govt / agencies.  
There is also mention of 'other'  
aspects of remote sensing data use.

~~In Order to~~

That brought in the  
question of SAC, NRSA etc interfaces.  
Remote sensing applications were  
not just about launching of  
satellites. One could see in  
this note elements of India specific  
application system, later called

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NNRMS (National Natural  
Resources Mgmt System).

We will see in the later  
papers about the initial elements  
specifically spelled out.

I was able to put  
up such a note because of the  
continuous challenges in terms of  
systemic concepts given by SD.

~~At the~~ I had a colleague in  
Chandra who could also conceptualize  
many of these - ~~probably~~ probably we two  
were the only two who could stand up  
to the continuing questions by SD.  
I am sure SD would have talked  
to ~~passive~~ senior persons in SAC  
- nothing much came from them.  
It is ~~was~~ one of the sad feature

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of ISRO's growth, that ~~also~~  
an overall systems approach was  
lacking in the executing centres / units —  
be it applications or hardware development  
of ~~sat~~ satellites / launch vehicles, etc.

In the emerging projects or for  
R&D projects or facility build up,  
things were looked at ~~as some~~  
as "my" small chunk of specialisation;  
"mine" — "ours", "his", "theirs" etc.

Naturally persons ~~in~~ will try to  
down play ~~their competing~~ technologies  
competing with them. Within the  
"ours" ~~aggreg~~ specialisation, there would  
be further superfine divisions coming  
upto "mine". On those items  
they were passionate.

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May be perhaps that is the way things worked for most people. In a way the Centre organisation system which BP introduced in VSSC (following the BARC system introduced by Bhabha) reflected this reality.

The small group of viable "units" were put together in a "Section". There was a Section Head. A number of Sections formed a Division — with Divisional Head. A number of Divisions into a Group with Group Director — sometimes a few divisions came under a Group Head who reports to Group Director & Even at the Group Director level, the concern, the "world-view" was ~~not~~ only around the Group — its survival and in fact expansion. They would not

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some aggression into other territories!

There was ~~an~~ supposed  
to be a PPEG (Program Planning  
& Evaluation Group) reporting to Director.  
This was a unique ISRO ~~innovation~~  
innovation (not existing in BARC then)  
This was due to SD effect ~~was~~

designing this form of ISROHQ at  
the Centre level. If I recall  
only under BP it worked ~~at~~ with  
a system's view, with some foresight  
without being coloured by the  
passions of individual Groups or  
the Projects which drew from the  
Groups in a matrix mode.

In SAC, ISAC & SHAR  
it worked differently; more as compilers



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PPEG more or less reflected the power-balance between the Director and the Big Power ~~pe~~ Camps in the Centre. ~~For~~ For example Liquid programme in VSSC suffered after BP's departure as the Director, ~~MS~~ & Group Directors ~~would~~ would gang up against AEM.

In ISAC Microwave Remote Sensing suffered because YP & Calla did not have good chemistry — that was partly because Calla & PPK had traditional rivalry. So it was easy for others including remote sensing persons to ~~to~~ gang up against

Calla (doesn't matter if a critical programme suffers!)

In such a process PPEG's in Centres could not take an

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~~An~~ independent systems view.

SAC to show that they  
they were ~~so~~ different used the  
terminology Area Chairman  
instead Comp Director. In practice  
there was little difference in  
hierarchy or functioning.

Some how I was somewhat  
surprised by such an attitude. Even  
when I was just with Cosmic Rays,  
I had learned quite a bit about  
ionosphere, aeronomy and other space  
physics items. — I knew the details  
of research: which is why I could  
face VAS's weekly sessions as to  
what I could do in ~~the~~ research in PRL

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We had touched upon it earlier in Chapter - 3.

Later when I got into Transponder, I did a lot of reading on various radars, tracking, microwave design, antenna design etc. Bulk of the MIT Radiation Lab Series ~~That helped~~ Later at ELDR) when I was in SSTC - TVR,

5 of us (P. Ramachandran, Russel, Shetty, Rengasamy & me) had produced a monumental work on ground stations for ISRO — overview of other country designs & what ISRO needs to do for L/u, S/c etc. It was a systems overview, beyond the limited work I was given.

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Such things were very useful for ISRO-MIT study, for which I ~~was~~ given ~~a~~ some independent portions.

Later at NASA ATS-F project. I was one of the key persons in project. There also I had learnt so

~~many~~ many things like Quality Assurance, Hi Rel parts, many Communication ~~Design~~ Satellite Design

Reports (incl. Military ~~and~~ ones) etc

"kink" in me, not to burrow into a hole. So Probably SD might have spotted this tendency or kink ~~in~~ in me. He put me into much softer aspects of policy, admin, finance, & DOS functions etc.

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But over view was limited only to a few. Even in ISROHQ ~~must~~ a good percentage got into ~~a~~<sup>ed</sup> one silo or another.

Thus I had very little to draw upon in defining linkages. But SD's methods of Projects, reviews etc gave the glue to the ~~"mines"~~ various narrow "mines" & "islands" to be together; even the "his" or "theirs" they did not like or hate.

Other national labs in ~~India~~ India especially CSIR, ICAR, and even large part of DRDO (then) went ~~to~~ to a largely ~~amo~~ "amoebic" mode. Even though they had divisions as aggregating hierarchy, S&T

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activities, ~~the~~ research etc → were  
total driven by the interests of  
individual scientists — which were  
often an extension of their own Ph.D  
work. ~~The~~ Head of Divisions & Directors  
of the labs had little application  
of mind as to what all they summed  
up in total. At their headquarters  
level, some ~~very~~ nice sounding  
phrases were put together to  
suit the Delhi atmosphere from  
time to time. Planning Commission  
scrutinizing which got into  
minutiae of budgets, approval etc  
— so numerous — ~~and over~~  
~~a~~ Annual reviews or mid-  
term reviews etc brought out little

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visibility of tangible outcomes  
and how they filter the national  
requirements or any specific end user.

Politicians were generally  
enamoured by the "nice words" of  
Nehru that "future belongs to  
those who make friends with science"  
I have written on these elsewhere  
in books & articles and hence  
not elaborating

When I am reviewing these  
notes, I am happy to see the  
processes ISRO had used to <sup>ensure</sup> ~~ensure~~  
<sub>deliveries</sub>  
that ISRO to specific end-uses  
and end-users in India, working  
with them well before projects are

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formulated. It was also keen to create appropriate mechanisms to continue the dialogue, joint work, regular feedback, mid-course corrections etc and such experiences also helping planning specific projects emanating from the Decade Profile. For him the Profile was a not a nice little document or a ~~thin~~ "thick" bureaucratic note to get Cabinet Approval.

We will pick up these threads later. One classic example or glimpse is provided in the ~~note~~<sup>5</sup> Feb 1981 note, Earth Observation Program <sup>of the</sup> Int. Space Program.

Attach

355-374, 374(a) & 374(b)

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FOR CHAIRMAN'S USE ONLY  
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CHAIRMAN,  
ISRO.

Y S RAJAN,  
ISRO HQ.

FEBRUARY 5, 1981

Earth Observation Programme of the  
Indian Space Programme.  
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1. As Chairman desired an overview on the matter especially in terms of programme direction, user interface development, advanced research, transfer of useful applications to the users (including State Government agencies), training courses, and planning for 'other' applications, I address all these issues comprehensively in this note - in sufficient detail to provide technical clarity and at the same time to keep the contents at sufficiently high level of (system) aggregation at which Chairman operates.
2. Though I can hairsplit the legal-bureaucratic wordstructures like ISRO, DOS, Secretariat, HQ, Programme Office, SAC, NRSA etc to complexify clear technical issues as is getting popular in some quarters nowadays, I have purposely refrained from doing so in view of the task enunciated in para 1 above. Nor have I taken a view that NRSA & ISRO programmes are different immiscible entities - though organisationally permeable walls have yet to develop between these two entities. There is however no excuse at the highest levels to consider SAC or NRSA foreign to the Indian Earth Observations programme though problems of personalities, histories and bureaucratic (rule based) maze may be real. Hence at the level of a policy paper, as a first approximation I have taken a "bird's eye-view" and pointed out a few of the "worms" eye-views" so that pointers for practical techno-managerial (political) decisions are feasible.

EXISTING SCENARIO

3. Under the term earth observations I am restricting the present note to those areas dealing with:
  - (a) Collection of imageries & data (in situ or otherwise) from space, aircraft, rocket, balloon & ground borne equipment.
  - (b) Analyses of these data & imageries in various forms such as visual, optical/electronic means etc.and (c) Using these analysed data with other collateral information required for various application of "resources management" and meteorology.

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In dealing with the above one has to necessarily deal with engineering equipment, data processing equipment & software, data dissemination to a wide range of users, logistics related to data collection/collateral data generation and the management/methodology of a system to provide for meaningful user interaction (which is not merely a Committee mode with ex-officio representation & views ratified on Ministries' basis, but also development of a system with some general consensus).

3.1 It would be useful to dwell a bit on this question of meaningful user interaction a little more in depth at this stage and note the significant differences between the other users of the Space Programme. For telecommunication - domestic or otherwise - there is a well developed Ministry to talk for users; though some of its targets for telephone expansion etc are bureaucratically fixed (i.e. not necessarily based on finance management/business etc) it is a fairly well working system. At best the Space Department can cite a few examples here & there, request their participation etc. In most cases they know their minds. In the field broadcasting the issues are very complex - tied with the entire political-ideological structure of the country - and therefore operational decisions would necessarily have to be 'nebulous' purely looked upon on the basis of number of direct <sup>reception</sup> sets etc. In this area the decisions are necessarily political & therefore one has to go essentially by the "progress of papers" by the I&B Ministry. Even in this area earlier catalytic action by Space right from NASCOM days upto recent INSAT approval was of some value. (See Appendix-1 for further data). In connection with the Meteorological Department the situation is complicated; its research wing and activities being what they are, IMD is just able to say a few things on new operational aspects: but it lacks the courage to speak out; not does the bureaucracy sitting on its top, viz., the Ministry of Civil Aviation & Tourism in a position to grow it to modernity. In various aspects of satellite meteorology (not just the VHRR imagery utilisation but in aspects concerning data from Vertical Temperature Profile Radiometer, Earth Radiation Budget Monitors, Microwave Radiometers etc) they are very much backward. But they have a chief who has a desire to do new scientific things; Space can utilise that goodwill soon in a formalised way. ISRO & IITM have fortunately some nuclei which has done real research work in Satellite Meteorology.

3.2 Coming now to the Resources Management aspects of Remote Sensing, we have already touched on one vital element viz meteorology. Other uses practically span all departments of the Government and apply to various situations: the limitations are only the imagination on the part of scientists and more importantly

the desire and will to get into nitty-gritty technical details to establish methods of useful application by hard empiricism. (Special stress is given to the word "methods of useful applications"; not just useful applications. The fact that remote sensing can be useful for various applications ranging from agriculture to geodesy is well accepted even among Indian 'user scientists', technocrats & administrators from these agencies. To make a point about this has no longer any meaning. What is required at this stage is to find out methods of using remotely sensed data in quantitative or qualitative form in the information system available to the decision makers - be it some data on snow cover or crop yield or ground water potential. Some risk taking is involved on the user side and some sympathetic consideration of cost & efforts to be put in (by users) are involved on the part of Remote Sensing scientists.) It can thus be seen that the all-pervasive-applications of remote sensing need to be developed empirically and by dint of hard technical work by the scientists/managers and mere administrative flats would not help the situation. So some method(s) by which (i) the hard work by scientists can be ensured in a direct & sustained manner (with some broadly fixed targets monitored objectively both for technical realisation & time targets) and (ii) also provide for administrative okays by the power-that-be, Can be blended at a national apex level is (are) required for evolution & implementation of remote sensing application to various aspects of national resources management.

3.3 Specifically the organisations/agencies which will be involved in the use of Remote Sensing are:

- Ministry of Agriculture (including irrigation)
  - o Its scientific agencies like ICAR Institutes, IARI, National Bureau of Soil Surveys
  - o State Agricultural departments.
- Ministry of Petroleum
  - o ONGC
- Dept of Mines etc
  - o GSI
- Central Ground water boards
- Snow cover studies with IMD & Min of Agriculture
- Forest departments of States
- DST : Ocean studies  
Environment

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- Dept of Environment  
Environment studies
- Other smaller agencies with specific interests
- Planning Commission & State planning boards.

#### 4. DATA GENERATION

4.1 As regards technology development for reception of data/imagery for remote sensing viz., conduct of aerial flights, reception of data from foreign satellites & Indian satellites, construction of aerial sensors & satellite sensors including their platform instrumentation, the two agencies who are equipped well to handle this are SAC & NRSA - the former having capability in onboard sensor development also. Some limited capability in ground system for Earth Observation exists at DEAL, Dehra Dun & for onboard sensor (at least for System Engineering) at ADE. Experience with Microwave imageries/data however is very limited.

#### 4.2 Data interpretation:

Both NRSA & SAC/SHAR have capability in data product generation of remotely sensed data: VTRR, imageries etc. As regards software for thematic interpretation of imageries, many agencies besides SAC, NRSA/ IPI in the country like NBSS (ICAR), GSI, ONGC, IISC, University groups & many others including State Govt agencies have capability in visual interpretation of aerial/satellite imageries as can be seen in a few publications (Ref 1, 2, 3). This capability in visual interpretation is vital to the remotely sensed resources management system since this is going to be the bread-and-butter of the system and probably one of inexpensive tools of interpretation. This form of interpretation is predominantly a science-based-skill tempered with field experience. However the published works, & reports from the Indian scientists do not show an orientation to quantify the effectivity of such visual interpretation in terms of accuracy of the tool for further applications to resources management nor does it show orientation in terms of operational procedures for day-to-day utilisation. Attempts at standardised keys for whole or part of India are lacking. (Standardised key may also give a fillip to standardised equipment).

In the area of computer based interpretation system, the efforts are more or less limited to NRSA & SAC. Some attempts are being made by ONGC. Quite a few

university groups & user agencies have shown interest in computerised processing techniques. Probably these desires have not materialised due to expenses involved, computer procurement delays and perhaps more importantly due to lack of formation of viable multidisciplinary groups with specialities ranging from computer hardware engineering to knowledge in user oriented disciplines. Such an interaction of human skills & experience with interactive computer systems are required to develop useful packages.

On the side of mastering of computer software & hardware one can reasonably assume a high level of skill both at SAC & NRSA. The comments regarding limitations of not-attempting to quantify the accuracy of interpretation, orientation to an operational etc are all the more relevant here since the costs involved in computer based information system are quite high - at least initially. Considerable thought should also be given as to what should be an optimal mix with visual interpretation systems & conventional techniques. Otherwise we may be unleashing an Frankenstein of information processing on us with no tangible output.

#### 4.3 User interface development:

But for the limitations of scientific/technical methodology in terms of its orientation to actual uses as observed in paras 4.1 & 4.2 above, considerable progress has been done by SAC & NRSA in terms of user development. The former has been more successful in doing joint projects with the users as ARISE, Idukki landuse planning etc (Ref 2, 3, 4 ). However it is to be analysed & understood as to why some of these techniques are not being pursued by the user agencies as a routine (albeit supplementary) tool for their applications.

But an important plus point to be noted is that over the past decade a reasonably good group of scientists in universities, user (scientific) agencies, SAC, NRSA/IPI etc have been developed with some experience in the application of remote sensing techniques to certain limited aspects of resources management and these groups are interested in pursuing these activities further. However, since investment in these activities are increasing and also since the skills/experience have increased considerably it is time to channelise at least some of these talents to focussed uses. Really the task ahead is no longer user development but use development.

#### 4.4 Specific use identification:

With the above background one can clearly see that the national efforts on identification of specific uses are not particularly satisfactory. Here the term use is used in the context of ultimate use. For example, some good prediction on snow cover from NOAA imageries are being sent to IMD etc by NRSA; how well these are used in flood prediction/control or weather prediction or irrigation? Why not the ARISE type data not even been experimented on a major scale by ICAR/Min of Agriculture for crop identification? What happens to the various thematic maps produced by SAC, NRSA etc? Well the important aspect of R&D in remote sensing techniques & ~~being~~ curve for users etc are not underestimated.

But the question to be posed for answer is that whether remote sensing techniques are being blended (or being used ab initio) in tackling national problems of vital interest (in resources management)? Years pass by with droughts & floods with interesting suggestions in scientific forums (by higher level authorities & active scientists) about the usefulness of remote sensing? Few sporadic proposals are written and vanish in the humdrum of scientific activities. So it happens on pollution monitoring; fisheries & so on.

An attempt at least was made recently by GSI & others in putting together various elements relating to the hydrological and snowcover studies (Ref 5). Even this document lacks precise definition of goals & objectives in an operational sense.

In the context of present ~~situation~~ situation in the country in terms of resources management especially using earth observation systems it would be most useful to spell out a few sub-projects with clear definition of objectives and goals which can be measured later after the conduct of studies/experiments/analyses etc done with specific time targets. This issue is discussed in some detail in a subsequent para of this note (See para 6, Task-2).

#### 4.5 Training Programmes, Transfer of Technology etc:

Training programmes are being conducted by NRSA, SAC, IIT-Bombay, IISc etc in terms of Seminar, Workshops, organised courses etc. These are good generally to percolate the techniques of remote sensing interpretation. Mostly these courses have been confined to visual based interpretation. Though in a general way such training

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programmes are very fruitful, concentrated efforts should be made to train user scientists/managers working on identified sub-projects or who have potentials for the same. Such an orientation will have the effect of accelerating specific uses in an operational sense.

Technology transfer can be thought in two forms: one the experience transfer including software packages and two in terms of transfer of technology to industry/agencies of specific equipment developed for remote sensing such as colour additive viewer, spectral radiometer etc.

Regarding the former at least between the Government or Government aided agencies in the country there should be minimum restrictions, if any, of information or software package(s) flow. Regarding the hardware the usual processes of technology transfer can be applied. However in the interest of maximising indigenous products in this promising area of commercial marking some pro-acting as against reactive mode of transfer would be useful.

4.6 'Other' areas of application:

The national security aspects of earth observations are well known & some studies have been done by relevant agencies. While the potentials for this technology are well appreciated and desires expressed to realise such systems indigeneously it appears that the following areas which have direct impact on data utilisation of such observations systems appear to be grossly underestimated;

- (i) Collection of ground truth regarding objects of interests (including the camouflage considerations)
- (ii) Tracking of satellites doing such observation as ephemeris generation with such fast changing orbits are not easy to produce with very small reaction times.

This area is addressed elsewhere in a separate note.

4.7 Advanced research:

This can pertain to advanced sensor system, newer bands of electromagnetic spectra being utilised for remote sensing, newer data processing models and so on. While one does not underestimate the role of advanced research it should be noted that in the present context after about

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a decade of efforts by various agencies with remote sensing techniques, immediate efforts need to be given to operationalising some identified uses - probably some of the best minds should spend their energies in this so that there is a base for investment for future. Presently there is nothing going on in the country which can be named advanced research. Probably some identified sub-projects will trigger off new ideas.

##### 5. BUDGETARY LEVELS

ISRO budget for remote sensing & meteorology leaving aside the sensor development is about Rs.40 lakhs per annum. RESPOND remote sensing funding comes to about Rs.15 lakhs per annum. NRSA budget leaving aside the administrative overheads will be about Rs.150 lakhs. Miscellaneous expenditure by other agencies like DST, ICAR, State Government agencies, UGC etc will amount to about Rs.70 lakhs. Thus totally earth observation component of resources management system in the country has a direct expenditure of about Rs.3 crores per annum. Investment in the space segment for Earth Observations (i.e. Bhaskara, IRS etc) would amount to about Rs.6 crores per annum. It is very difficult to assess at this stage whether such an investment is commensurate with the benefits that will accrue from the remote sensing technology to the national resources management system. A very preliminary attempt (Ref 6 ) shows that this will be so even considering only a single application out of an Indian Remote Sensing Satellite. One should, therefore, infer that with multiply identified applications (for which plenty of scope seem to exist) for an IRS satellite and also utilising data from foreign satellites like NOAA, TIROS, Meteor, LANDSAT, SPOT etc & also making use of such an infrastructure (built for satellite imagery interpretation) for ~~utili-~~ sation of aerial imagery etc the benefits from the National Remote Sensing System to National Resources Management System (See Fig. 1) would indeed be manifold and benefits in the long run will pay off the investment done so far not merely in quantitative terms but also in qualitative terms (i.e. by raising the level of quality and timeliness of information available to the decision makers to a newer level).

With this scenario, it is more difficult to answer a question as to whether the present level of investment (i.e. about Rs.3 crores per annum in interpretative aspects and Rs.6 crores per annum in the space segment) for a country like our with immense potentials in resources and therefore having great many problems to solve in resources management. This is not just a

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rhetoric to justify more expenditure in remote sensing activities. This is a serious question worth answering soon: the country has lost its lead in various fields like electronics, atomic energy etc having had a head-start in these areas when they started elsewhere in the world. We need not repeat the same or similar mistakes in remote sensing applications too. Besides remote sensing is tied closely with various aspects of resources, knowledge about which is very vital to a developing country (why even for developed countries).

6. SOME TASKS AT HAND

Tasks at hand invariably relate to the needs of immediate future and have strong correlation (in terms of practical possibility) to what was done in the immediate past (and therefore the present capabilities). Some of the tasks projected at a fairly aggregated level can be seen in a recent report (Ref. 7). As can be seen in the referenced report, effectivity of the activities would really be judged from the thoughtfulness given to the micro-tasks and more importantly the care with which they are executed. Really the philosophical question (and therefore higher level operation question) is to see the forest in totality without losing sight of (care of) individual saplings. Some suggestion for this would be done in the following.

Task-1:

It is not possible to entirely deviate from the current stream of activities being executed by SAC and NRSA in terms of collection of aerial data, spacecraft imagery and certain joint experiments with the user agencies. Nor will it be desirable since one cannot wait for a new pattern to emerge but rather orient the existing stream of work towards a new pattern, which we are in a position to conceptualise now. The present aerial campaigns have all been oriented only towards visual interpretation in terms of techniques and they almost pervade all activities of applications ranging from agriculture soil survey to geology. Some experiments from these aerial flights can be selected to attempt quantified use levels, without seriously disturbing their current plans; also a few experiments can be selected from these to combine multiple data (such as satellite imagery, aircraft imagery & ground data) and also use of multiple techniques, (namely, computer processing, visual interpretation and also statistical models). What are the best ones to ~~be~~ experiment upon can be decided by detailed Working Committees. However a broad general guideline can be

given that as a minimum these experiments should compass the following end uses:

- (i) Agricultural yield type of experiment
- (ii) Agriculture crop identification experiment
- (iii) Water resources/drought type situation monitoring
- (iv) One experiment assessing the soil conditions quantitatively
- (v) One in forest monitoring in whatever form, and
- (vi) One for a geological/mineral type application.

If the above are attempted with full vigour with some user scientists and also some economists/statistician type of persons to evaluate critically the uses, good examples can be set up for future modelling for resources management, based on concrete Indian experimentation. I suggest that this is done by a Committee involving the Space programme Headquarters, NRSA, SAC and a few selected user scientists.

Task-2:

In addition to the above which are based on a little bit of tinkering with the existing mode of activities, 4 or 5 major experiments can be given a project mode almost in the same fashion in which NASA organised LACIE or snow cover experiments.

The suggested areas for such projected major experiment are the following:

- (a) Prediction of wheat crop in India: the utilisation of the remotely sensed imageries for this and comparison of analyses through actual experiments. The conclusion of the experiments should include evaluation of the effectivity of the various models and also determination of the cost factors and operational constraints in inducting these into the user system.
- (b) Monitoring of forest resources in the country in terms of growth, recycling and deforestation. Evaluation of models for the same (including cost factors/operational constraints).

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- (c) Development of a methodology for predicting ~~drought~~ drought in advance and also identification of likely water resources in drought prone areas. Utilisation of satellite imagery, aircraft imagery and other means of data collection through satellite should be specifically studied as to their role in such a monitoring system. Specific quantification in terms of possibility of prediction in advance and uncertainty should be brought out. Should end with a critical evaluation of the experiment.
- (d) Monitoring of the coastal lines and water bodies in the country especially from the view point of environmental pollution monitoring.
- (e) Utilisation of satellite imagery, aircraft imagery and other data for providing information to fishermen regarding fish availability in the coastal areas.
- (f) Utilisation of satellite imagery, aircraft imagery etc with other information for identification sources for mineral resources (which mineral it should be, can be determined in consultation with GSI and others).

Utilisation of IRS/Landsat etc can be weaved in suitably in the above - as these are only selected few.

The above six items are only examples. It may be specially noted that other than these broad aspects no specific quantifications or targets are defined in this note. This is best done by a group of scientists in the first instance and decided at a higher level by a group of top scientists and decision makers.

The above topics when identified in concrete terms would really become a few sub-projects of a Programme at a national level. If these are executed well, then the country will be ready with a mechanism not only in technical terms but also in managerial and operational terms, to deal with the question of national resources management in which remote sensing or earth observation will be a strong component. Then the system can become self-generating. For these selected experiments (sub-projects), it will not be fair to cut a slice from SAC or NRSA but it will be best raised as projects for which

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separate funding is provided by the Ministries concerned or by the Department of Space; perhaps these subprojects can be raised as Single Programme for which Cabinet approval can be obtained with separate sanctions as for MONEX. *(Each of the subproject will cost at the most Rs 2 Crores - about Rs 1 Cr per annum. 6 projects can be run for three years with about Rs 5 Cr. p.a. expenditure.)*

Task-3:

The third task would be to energise various State Government agencies and other agencies in the country to be aware of remote sensing techniques and utilise them wherever possible. This would also include training programmes in addition to the ones which are already on going with NRSA and SAC. These should be done in a more systematic fashion than had been done hitherto and also the list of agencies should carefully made not just because they are interested but because in certain areas activities need to be energised in the country. This may also include placing of a few persons from the Government Ministries with the appropriate State Government agencies to conduct joint experiments so that appropriate training and management culture imparted.

Thus the tasks ahead would essentially be three pronged as under:

1. Continue the activities of SAC & NRSA as such without disturbing them seriously but selecting a few of the on going experiments to orient them for concrete quantified operational goals. This need be done by a group of working scientists brought together through discussions with also injection of clear cut management inputs through economists, statisticians and general administrators.
2. Defining of some major sub-projects similar to LACIE etc at the national level and fund them separately at the National Level which can really generate the nucleus of the Resources Management System. (These experiments will be similar to SITE, STEP & ARVI for satellite communication but with a new dimension due to the complexity of the problem).
3. Even while the above two are taking place there has to be concerted attempt but more selectively for spreading the remote sensing technology & management culture into the various parts of the country.

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## 7.0 A MANAGEMENT MECHANISM

The above tasks will suggest that the tasks at hand are quite enormous involving various disciplines and more importantly various administrative Ministries, Agencies, etc. This would necessarily mean a good deal of technical coordination, technical analysis, 'jargon management' between various disciplines and more importantly getting commitments from the powers-that-be which will involve necessarily top level administrators. No doubt the agencies for data generation namely NRSA & SAC have to be involved at various levels since they will not only generate data from satellites and aircraft but also will have a capability to manipulate them in terms of visual interpretation, data processing etc. But they need be supplemented with user interests, the will to bend for user needs and also to introduce research component wherever needed while at the same time not go in an open ended part, are also the required features. This cannot be achieved by administrative fiat but only through a concerted work pressure by a group of scientists who are again kept under pressure by a top management-cum-administrative set up.

Thus the Indian space programme can have a nucleus structure with representatives from NRSA, SAC, ISAC, ISTRAC & IMD and Space Headquarters to plan and do technical analysis of various activities so that position papers or status papers can be created for various disciplines or applications. This along with the HQ direction of the space programme will form the nucleus for the programme generation. It will be best that this group is convened or chaired by a person in HQ to energise, activate and coordinate the activities. Of course details of the many of the execution responsibilities will vest with NRSA, SAC and other identified agencies but any 'interference' (if it may be termed so) at the planning and monitoring-in-between will have to be done by this core team and by HQ. For individual applications like agriculture soil management, geological applications etc, selected sub-committees with a greater predominance of users and certain statistician/economists would be necessary for detailed planning of user experiments/applications and also monitoring and evaluating the experiments. These user sub-committees will feed to the Core Committee. Here again, the Space Programme HQ will have a crucial role in terms of coordination and bringing together various persons. For the three tasks mentioned in para 6 will have to be overviewed by a committee made up of a top manager/scientist and some major agencies' chiefs - some at the level of Director-General level some at the level of Secretary, Govt of India.

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This top committee can perhaps be termed as National Space Resources Management Committee. The chairing of this should be done either by Secretary, DOS (preferably) or by a Member of the Planning Commission should he be an eminent scientist who can grapple with this multidisciplinary problems. At the present, it would appear that Dr M S Swaminathan would ideally fit this role. The other members for this committee could be:

Secretary, Agriculture  
Director-General, ICAR  
Director-General, GSI  
Director-General, IMD  
Director, NRSA  
Director, SAC  
Chairman of the Central Water Board  
Secretary, Department of Environment  
Secretary, DST  
Chairman, ONGC  
Chairman, UGC

and perhaps a few others (like Prof Pisharoty).

(See Fig. 2)

Since the top committee is fairly heavy the meeting of the Committee can take place only thrice a year. But at least three meetings in a year are required to have some control. It should be noted that the time scales of introducing remote sensing technology in the country are very small and frequent monitoring only will ensure that things are going on right path. The Space HQ can provide the secretarial support for this Top Committee. The core committee (with HQ, NRSA, SAC etc) will do lot of paper work some of which will be filtered carefully and raised to the Top Committee. The Convenor or Chairman of the core committee (HQ person) should also have some authority to correspond with the user agencies when necessary or getting some of the Directors to get together to produce status report, position papers etc for the Top Committee. The Top Committee will review the general progress and decide on few cases as the best course of action. While the corresponding Ministries and agencies cannot be totally bound by these decisions, there should be reasonable amount

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of authority vested to the Top Committee to enable these decisions to be implemented. The Space Programme secretariat should do the necessary job of this coordination. In some select ~~xxx~~ cases Chairman of the Top Committee and/or the Secretary, DOS might have to take a spot decision even in the intervening period when the Top Committee has not met. This may include conducting of a special experiment or certain emerging international opportunities and so on.

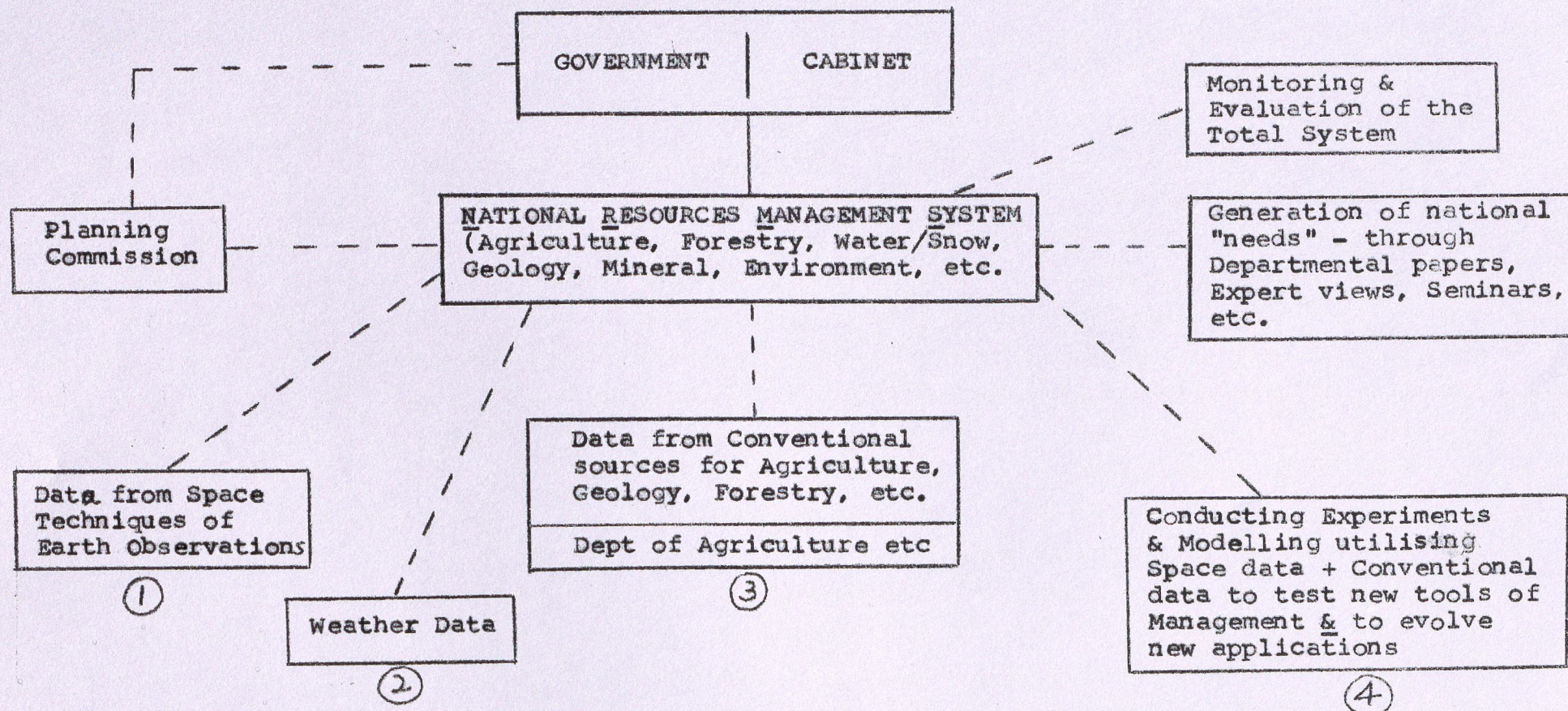
With regards,

(Y S Rajan)

Encl: as above.

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- Ref-7 : The ISRO Remote Sensing Programme (January 1979 Doc No ISRO:RS:01:79).



**Fig. 1:** National Resources Management System with stress on Space Components.

**Note:** While National Resources Management is a Big Task, a Space related Top Committee can ensure some 'integration' of ①, ②, ③, ④ & ⑤ to give working packages - at least good operational examples - to the National System.

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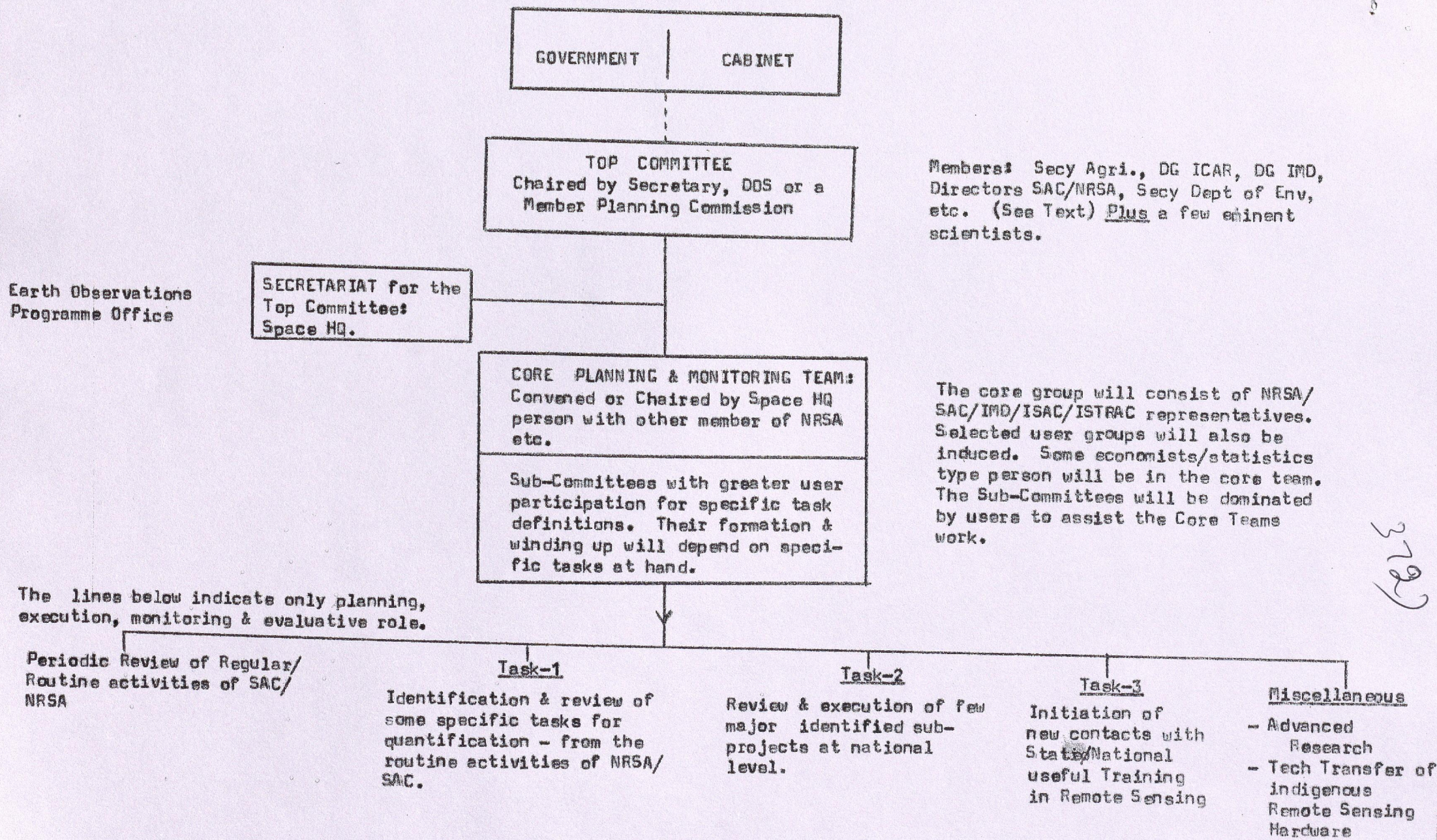


FIGURE 2: THE NATIONAL "ORGANISATION" OF RESOURCE MANAGEMENT WITH SPACE TECHNIQUES

APPENDIX - 1

USER DEVELOPMENT FOR SPACE APPLICATIONS

(A Brief Overview)

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Satellite communication user interaction -  
from the beginning to INSAT Coordination  
Committee

Remote Sensing User Communication  
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1. In the early days of space programme around 62-63 satellite communication especially direct broadcasting television was conceived as an important application though generally user ministries were not so responsive.
2. Experimental Satellite Communication Earth Station (ESCES) was built under UNDP assistance by ISRO to gain experience in satellite communication technology. User participation was almost nil. Again as a follow-up ARVI was built in the country with some indigenisation with fairly stiff resistance from users.
3. In the same period a national satellite communication study group (NASCOM) was formed mainly to define SITE type of experiment.
4. Krishidharshan experiment was formed around 65-66 with some user involvement but mostly scepticism.

1. Remote sensing in India was conceived as an application only in the later part of 60s. The major documentation from the then Chairman-ISRO was for the UN conference for Space in 68.
2. In 1970 experimentations did start. There were also some user interactions but rather weak.
3. 74-75 witnessed some joint experiments such as ARISE.
4. SEO utilisation experiment energised some user participation but mostly from the academic community and not from big user agencies.

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Satellite communication user interaction -  
from the beginning to INSAT Coordination  
Committee  
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Remote Sensing User Communication  
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5. Around 67 NASA-DAE agreements proceeded on SITE with some involvement of users but still with user scepticism.

6. Studies with user participation for INSAT system with GE, Hughes and Lincoln Lab were initiated.

7. SITE continues to proceed with user interaction on software, etc.

8. A National Seminar was arranged by ISRO on various satellite applications and Space Research in August 72.

5. Joint Experiments Programme was initiated around 77 following the formal presentation by Secretary, DOS to various user ministries/departments. These have picked-up somewhat well.

6. Various user comments on the profile indicating Indian Remote Sensing Satellite have been very positive and has led to general broad programme profile for Indian Remote Sensing Satellite.

7. The user interaction for NRSA also has been by and large good in terms of technical products. However, there has been a general lacuna both from ISRO and from NRSA side regarding the actual utilisation of the products to the ultimate users. This has been partly due to the nature of the technology itself and not always due to the administrative mechanisms.

8. On the satellite meteorology side some activities have been done at IITM and SAC though general interface with IMD on satellite meteorology utilisation has been poor. Quite a bit of theoretical aspects of algorithm and software generation need to be energised since remote sensing or rescurces management are coupled closely.

See next two pages

50  
2  
f

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Satellite communication user interaction -  
from the beginning to INSAT Coordination  
Committee  
-----

Remote Sensing User Communication

9. Planning Commission Study Group on  
INSAT formed around 72-73

9. In view of the formation of IRS Project which  
is a major investment, and operation of the  
ground station of NRSA, and also a fairly  
good investment at SAC and NRSA for remote  
sensing generation, it will be most appro-  
priate now to have a higher level coordinati-  
on committee or coordination mechanism for inte-  
grating the remote sensing efforts in the  
country programmatically. Also some of the  
user agencies like Ministry of Agriculture,  
ONGC and GSI have built in considerable  
expertise and/or also interested in it.  
It is time now to optimise the national  
investment to utilise the infrastructure  
and expertise built with Users & Space.

10. INSAT generally turned down by Planning  
Commission. Various studies continued.

11. Around 75-76 formally Working Groups of  
Planning Commission were energised to  
define INSAT system resulting in a  
Cabinet decision in 77.

In the meanwhile, major satellite communication  
experiment namely SITE & STEP successfully  
conducted. These experiments did to some  
extent pave way.

12. INSAT Coordination Committee was formed.

328(A)

This rough comparative chart will give some idea about the path followed on two major applications of Space, namely, satellite communication and satellite remote sensing though the content and context are different.

(32810)

✓ #1 tin  
Lake atter  
385-374, 374(a)  
374(b)

(375)

I did not stop at sending the note on EOS applications and links. As I ~~knew~~ knew SD was keen on ~~sanction~~ actions including creating practical mechanisms to enable interconnected (almost synchronised actions). One of the high points of international innovations done by SD was the creation of NNRRMS, which also got international recognition as we will see later.

The initial beginnings of it was through the note

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I had sent to SD dt Feb-17, ~~1981~~ <sup>1981.</sup>

Before that a mention of a few other items would be in order. SD believes in historical continuity to the extent possible.

He was not the one who would like to say that History starts with me: <sup>Such Approach</sup> ~~this~~ had destroyed many politicians and there were plenty of such persons in the S&T leadership because of which India has a poor performance in S&T even in terms of originality or in terms of ~~useful~~ useful.

~~378~~ (377)

applications to the society,  
industry, ~~defence~~ Commerce,  
defence or security.

SI) accepted VAS  
decade profile & vision and  
worked upon it to improve  
and also to capture new opportunities  
which fitted within that framework.  
Similarly he did not want  
to lose some excellent work  
done before in SET policy,  
"foresight" etc before in India

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One of the major work  
was ~~that~~ the reports of the  
National Council of S & T (NCST)  
which was chaired by C. Sin  
C. Subramaniam (CS) the  
father of Indian Green  
Revolution.

~~It~~ I was aware  
of it and had read the  
NCST's seminal report

"Approach to S & T Plan" (1971)

I had a personal copy. VS(S/S)

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had worked on it before  
he joined ISRO.

SD desired me to  
read ~~to~~ the NCST reports  
on Natural Resources. Having said  
it was not an easy job.

The ~~to~~ copies of <sup>were</sup> it in several  
volumes ( I don't remember  
the number - I ~~think~~ recall  
~~if~~ they were more than 10 )  
were not easily accessible.

Not even in Planning Commission  
which was the host institution

(380)

which conducted the studies. Because of my contacts with several ministries / department in Delhi I was able to get all the reports. Mostly they were dusty in a literal sense! Though I was prone to asthmatic attack by such dust, I had to deal with ~~the~~ them. Have ~~they~~ them dusted and ~~see~~ read some parts and scanned through all volumes to look for natural resources.

Natural resources management was only ~~a~~ in one volume and

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it addresses mainly aerial surveys. There was no mention of emerging satellite based remote sensing (That is the best of memory I have now). ~~The~~ The report recommends an agency like NRSA.

Noting that these reports preceded the existence of DST (Dept dedicated to promotion of SET in all sectors, disciplines etc) ~~they were~~ ~~it~~ was a remarkable set of reports. ~~The~~ These reports recommended formation of DST in 1971.

A. Ramachandran as the first Secy DST in (1971), ~~for~~ get

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NRSA established in 1974....

There was, of course, Planning Commission which was responsible for every activity in the country — except for planning defence, intelligence & security.

But till 1981 no system for Natural Resources Management was formed. There was a rudimentary NDRMS in DST with no serious effort (Later when I went to DST, I helped that Division to do concrete ~~act~~ projects in GIS)

Even within ISRO, the SAC application of Remote Sensing data was more looked at as a

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~~the~~ research activity. SAC had little contact with NRSA except for procuring Landsat data (imagery and tapes).

Thanks to the push by SD, we at ISRO HQ started thinking of and planning NNRMS. ~~The~~ Addition of NRSA under DOS was a strength in this job. They had done lots of contract work for users, that was paid for by the user. They were thematic maps, <sup>derived</sup> interpreted aerial survey, information etc.

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How to have it done ~~as~~  
for a national scale ~~was~~ was not  
given a serious thought by  
NRSA. While Wg Cdr KRR was  
a great project manager, his  
approach was that of technical  
consultant/trader: "Let user ask  
me to a particular job, I will  
study and quote for him. If <sup>he</sup> pays  
I will start the work!" It assumes  
that users knew what they wanted;  
and all ~~x~~ r's applications  
were mature to give off-the-shelf  
contract-consultancy. If it cannot be

(385)

done at that time, NRSA ~~would~~  
would not spend time in doing  
R&D. "Say Sorry" & send of  
the client! As an agency  
it perhaps made ~~set~~ sense.  
But for ~~at~~ not for SD who  
was the apex Govt person to  
plan and serve whole of India,  
to solve problems for people,  
States, municipalities etc whether  
they paid or not at that time.  
~~He was~~ If the issue was of  
~~no~~ national importance in terms of  
social or economic impact, and

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if it was amenable to application of space technology, then DOS/ISRO was duty bound to do some efforts.

NNRMS was a catch-all basket to collect all such needs and also to do pro-actively things which may not be known to the user yet, but through ISRO/DOS demonstration to make them accept it so that country may benefit. It was our duty if one sincerely looked at the ~~Business~~ Allocation of Business of the Dept of Space.

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One could have narrowly interpreted it and take a position that it was the job of DOS/ISRO to do satellites & launch vehicles, relevant ground stations and demonstrate various applications and learn them to "appropriate" GoI agencies to do. Perhaps most of them would have been "happy" as there was no pressure on them! Even telecom dept did not ask for a communication satellite. Indonesia had got its ~~to~~ satellite launcher (designed, built and launched by a US company

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Hughes Corp in late 1970's itself.

(Well before INSAT-1 by India)

It did not move India's telecom

dept. They were happy with

cables / towers. Even creation of

posts depended ~~on~~ the number of  
towns and kms of cables! So

more of it, means more posts,

more higher posts to maintain

the hierarchy, more promotions!

ISRO was very different.

It pulled DOT inside as the user.  
It ~~was~~ had large number of competent engineers to take it  
on.

// But for remote sensing

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things were / (are) different.  
It cannot be (could & not have  
been) dealt with ~~by~~ through induction  
of one Ministry or department. These  
complexities had been described in  
the earlier note.

Also uses of remote sensing  
data ~~with~~ in Agriculture, Aerology... etc  
is not like plugging-in satellite  
based communication links into the  
traditional communication networks.

~~to~~ Nor like direct broadcast TV. ~~to~~

R.S. applications require integration  
of into basic info processing / decision  
making parts of the agency concerned

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Also many potential uses of RS' during 1980's were not mature to be integrated into their conventional ~~methods~~ works. They were at experimental phases. Without such experiments it would not be possible to use them.

Applications done abroad could not be used in a plugged-in. Every ~~a~~ adaption was an experiment.

Also without the participation of the domain experts, remote sensing (RS') could ~~a~~ not be used well. (This is the "ground ~~is~~ truth" - aspect)

Hence RS' applications to ~~area~~ natural resources <sup>management</sup> ~~was~~ requires ~~diff~~ ~~view~~ different

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Coordination / partnership mechanisms.  
In addition to the ~~usual~~ above  
technical aspects, there was (is)  
always the human aspects.

(Passionate adaptors to jealous  
opponents for personal reasons.)

Hence one had to develop excellent  
inter-personal relations with  
various levels — from top administrative  
levels to actual ~~of~~ implementing  
technical levels.

~~It is~~

Also to demonstrate the  
uses at such multidimensional  
levels, one had to look at stratified  
samplings. ~~to~~ ~~Just~~ ~~can~~ ~~to~~  
simple visual techniques. SAC was

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unwilling to do these. It was  
a leadership problem in SAC:  
"Leave it to us; we will do  
and transfer ~~we~~ We know R&D".  
Not all; but as a collective.

It was in this context  
that I had to put up a note  
to SD to accelerate the process  
of NNRMS, which he wanted to  
begin; the idea was under  
gestation as one could decipher  
from my earlier notes. Therefore  
I had to put a note ~~to~~ to SD  
that some technical strengths of  
actual applications to users had  
to be developed in ISRO HQ itself.

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It needed people. I could not do it alone with Chandra and a ~~couple~~ couple of others already in HR. It was not like the usual work of Program Offices in HR so far.

It might have been looked at as "empire building" by me by JPS! My small decision to have ISRO HR / ISRO was still valid for me. But till then and especially for IRS satellite to be useful.

See continuing notes of Feb 17, 1981 (typew): Certaini Achary regards - - - 394 - 397

INDIAN SPACE RESEARCH ORGANISATION

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HEADQUARTERS

U R G E N T  
C O N F I D E N T I A L

M E M O R A N D U M

TO BE OPENED BY THE ADDRESSEE  
ONLY

For : CHAIRMAN, ISRO

File / Ref :

From : Y S RAJAN, ISRO

Date : FEB 17, 1981

Subject : Certain actions regarding National Resources Management System and more specifically regarding ISRO/DOS activities in Remote Sensing and Meteorology (Earth Observations System)

-----

As desired by Chairman I have sent a fairly comprehensive note on earth observations programme. One of the key suggestions is regarding formation of a Top Committee for overseeing the inputs of the space systems into the National Resources Management System. The next few years will necessarily be an objective-oriented-experimental-phase as against free lance experimental phase that has existed so far.

Chairman had mentioned to me quite a few times that he has already discussed with Dr Swaminathan on the subject. Especially in view of the fact that NRSA is merged with the Department of Space with all its capabilities and potentials, it is very urgent that such a national system is energised in order to utilise NRSA very effectively. Hence time is of essence. Since much more coordination is involved in the formation of the Top Committee, things can begin at least with formation of a portion of the Top Committee. If something is initiated now, say in next 2-3 months at least one sitting of this Top Committee may be possible.

I am suggesting this mainly because of budget for 82-83 would be more or less frozen around September-December of 1981 (since the document will go to Space Commission, Planning Commission, etc and very little manoeuvring is possible beyond that period - especially so for other Ministries of Government where reappropriation procedures are not well evolved). Thus if one has to make some dent at least from a year from now in the Remote Sensing efforts, some direction for the various Ministries should come somewhere during August-September, 1981 to enable inclusion of items in the budget proposals of 82-83 (during FY 81-82 only planning of experiment is possible).

CHAIRMAN MAY THEREFORE CONSIDER ENERGISING OF THE TOP COMMITTEE AS SOON AS POSSIBLE PERHAPS BY TALKING TO VARIOUS CONCERNED PERSONS RAISING THROUGH SPACE COMMISSION IF NECESSARY OR TO PRIME MINISTER ETC AS THE CASE MAY BE.

.... /

- 2 -

Regarding the Core Working Team at Space HQ, it should be in position at the time when the Top Committee is formed. This team is relatively easy to put together since many of the persons concerned are directly under the Department of Space and Chairman could ask for nominations from the Centre Directors/NRSA, Director.

I feel that at least two members from NRSA, two from SAC, 2-3 recruited at HQ itself, one from IMD, one from Ministry of Agriculture, thus (coming to a total of) about 6-7 persons should be permanently placed at Bangalore in order to do detailed planning. Some of the important documents will be frozen for circulation after a presentation to Chairman-ISRO/Secretary-DOS which is the reason of having these persons located at Bangalore. Depending on the stress to be given to different disciplines we could rotate these persons in 2 to 3 years now depending on the changing disciplines/needs and also the growth of persons.

If Chairman wants to evolve a working system, even now Chairman may authorise having one person each from NRSA, SAC, IMD, Ministry of Agriculture just now to be placed at Bangalore so that many planning documents can be generated even now.

This is so far as the Top Committee and Core Working Teams are concerned.

Besides the above, there is a specific need to have a group of working scientists and visiting scientists working on remote sensing utilisation themes to give some direction to work in this area by actual studies/research work. As Chairman is aware, I was only hoping that the various suggestions which have <sup>been</sup> done by Chairman, Chandrashekar, Dr VR Rao and myself could be ploughed into SAC. Unfortunately it has not taken place despite the efforts during past 5 years. I am also quite sad that the Institute of Science linkage has not built up to any level in spite of the enormous energy spent by us in bringing 'the remote sensing cell'. So is the various efforts with UAS, ICAR, etc. Considering all these, I had come sometime ago to a conclusion that unless the small group of remote sensing scientists which could combine remote sensing expertise, certain sense of management-economics etc does itself some R&D work/analysis etc & ploughs it into the System we will not be able to show any examples other than merely talking and we cannot orient any work. Chairman is aware that many of the suggestions are repeated by us in quite many forums regarding sample studies, etc. Nothing somehow

....

gets done in spite of follow-up and Chairman is aware that finally one or two such unique studies get done by a few scientists who are associated at HQ. (Karnataka crop yield model, VRRao/Lalithat study on cloud cover and sampling for remote sensing). This group of scientists can also become a good focal point for drawing various visiting scientists who can do some work at Bangalore and thus allow for interaction of multidisciplinary groups. It is not envisaged that this group of scientists, economists and statisticians will necessarily have any laboratory. However, a limited visual interpretation facility, thematic map making facility will be required; and they will also have to procure computer compatible tapes. They could utilise the facilities at NRSA for any specific experimentation specific computer interpretation etc on a planned basis. Thus this group will need travel budget and material-equipment-purchase-budget. If Institute of Science groups build up these persons can also very effectively interact with the institute group and perhaps even help growing a programme there.

I envisage that 15 scientists/technicians and 4-5 support staff for such a nucleous cell. In some context while discussing the remote sensing activities, Dr Rangan also had to come independently to such a conclusion and he strongly recommended that I should try to initiate such a work. I am confident that between Dr Rangan and myself should be able to form such a group, energise it well so that the small group can do some good research-cum-analyses reports on various aspects of remote sensing and resources management.

Yet another important function of this small group/cell is to be a focal point for data (in tape & other forms) for meteorological (NOAA, TIROS-N etc) data from satellites with some rudimentary software to enable met. scientists to pursue research. Chairman is aware of the problems of obtaining such data with IMD. I discussed with Prof R Narasimha also. Such a cell can utilise the meteorological data for hydrology & agrometeorology & also give the tapes to interested scientists. (The 9 hour road journey to Hyderabad is all that is required to get the tapes plus of course the money).

If the Top Committee and Core Committee for the National Resources Management System is formed this group of scientists can very well offer immediate technical advice also. Chairman may please consider formation of such a technical cell. The floor available at Janardhana Tower which is about 3,000 to 4,000 sq ft would be adequate in forming this.

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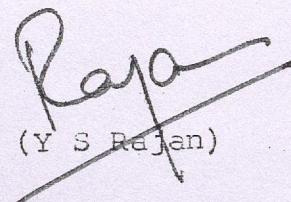
Administratively and managerially this cell can be made reasonably self-sufficient while the overall establishment, purchase matters etc can be handled by ISRO HQ.

May I request Chairman's advise on the above matters so that I could energise some action on these fronts?

Besides the above I would also request Chairman considering naming S Chandrashekar and Dr V R Rao with some suitable titles in the Earth Observations Programme Office. For Dr VR Rao, the title could be Principal Scientist, EOS. For Chandrashekar, I would request Chairman's suggestion and I feel it should be a fairly good title commensurate with his excellent capabilities. Dr TA Hariharan, Prof Deekshitulu and perhaps Dr Rangan could also be inducted as the Senior Advisors in EOS. Prof R Narasimha also can be associated, perhaps as a Chairman of a Programme Board for this Group/Cell which can oversee the Cell's scientific activities.

Chairman may please decide on these also.

Regards,

  
(Y S Rajan)

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Other routine but important matters - nitty gritty of ISRO HQ / DOS Sect. interface were to be attended to. ~~It was~~ It was concerning the method of dealing with NRSA. Strictly it was autonomous and nothing to do with ISRO HQ. Thus it would only write to DOS for budget etc.

TNS ~~who~~ was always very jealous guarding his territory. He had a tough time with INSAT-1 SSPO. While J ISRO HQ dealing with Chairman ISRO meant his grip was loose. Though we did involve him. CED (Civil Works) was tightly under DOS. The

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reported to Add. Secy or JS  
as the case may be.

In the side of NRSA also  
Wg Cdr K. R. Rao who had total  
autonomy under DST ~~may not~~  
might not have liked even the  
DOS ~~to~~ reporting which was  
tight. Much less so with ISROHQ.  
He would not have forgotten  
his languishing days in ISROHQ  
when we "youngsters" were  
flourishing.

So ~~is~~ the only link needed  
to keep ~~to~~ technical issues integrated  
was a physical presence in NRSA Gov. Body

A note on that Feb 17, 1981

↳ (400) attached next page

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only one page to be copied  
(400)

U R G E N T  
C O N F I D E N T I A L

TO BE OPENED BY THE ADDRESSEE ONLY

CHAIRMAN, ISRO

Y S RAJAN, ISRO HQ

FEB 17, 1981

NRSA Governing Body.  
-----

Chairman has spoken to me on this subject of Membership about 10 days ago. Subsequently, I checked with Shri Seshan. He could not immediately track the paper and he said that he will give subsequently. I had checked with him 2-3 times. Chairman's idea was that I should specially see the three names which Director-NRSA had recommended to be filled in.

JPS at a later date mentioned to me that he had a discussion with Chairman on this subject and he had suggested that I should be one of the members of the Governing Body in the capacity of Director-EOS.

Apparently, Chairman had mentioned to JPS that this was a good idea in view of the linkage to be provided at HQ between SAC, IRS and NRSA. I am sending this note mainly as a reminder in case Chairman decides to have such an arrangement. In the NRSA context I particularly see an advantage of such a nomination of Director-EOS mainly because dealing officially with NRSA otherwise does pose problems.

Even today paper handling for NRSA is a little bit of problem since the formalisms for NRSA seem to be quite complicated and some papers do get struck in DOS (with Shri Seshan).

Chairman may please decide.

Regards.

  
(Y S Rajan)

usr\*/ysr

(401)

I was also getting overloaded  
so many of technical / managerial /  
Coord<sup>n</sup>. functions. Regular routine  
papers as Sec. Secy ISRO were  
becoming many especially  
ISRO HQ admin.

Also the way I worked  
was to have an alternate person  
from me trained - I was more  
an organisational person. I did not  
want them to be held with me.  
But the selection of the person who had to  
assist me, had to be done by me!  
Otherwise it would be another great  
shuddle. Hence the note...

→ 402, 403 . attached  
next page

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TO BE OPENED BY THE  
ADDRESSEE ONLY

CHAIRMAN, ISRO

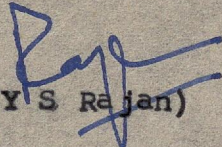
YS RAJAN, ISRO

Feb 16, 81

Chairman may please see placed below certain actions concerning EOS energising of Remote Sensing Cell etc. Irrespective of the decisions on this Chairman may please consider naming Assistant Scientific Secretary as he had mentioned quite a few times. Chairman is aware of my suggestions for the naming and we have discussed this aspect quite a few times.

Regards.

Encl: as above.

  
(Y S Rajan)

usr\*

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STRICTLY CONFIDENTIAL  
-----

CHAIRMAN, ISRO

YS RAJAN, ISRO HQ

MARCH 13, 1981

Assistant Scientific Secretary, ISRO  
-----

1. As discussed in the morning a draft order on the above subject is placed below with . . . . . in mind. As things proceed and once we gather experience in having such a system, further responsibilities can be added and/or some modified.
2. I have specifically drafted it as the tasks in the Scientific Secretary, ISRO's office. This is something like saying DOS Secretariat as it is difficult to specify each task individually and if such a restriction of Scientific Secretary, ISRO office is not put, the tasks can be all encompassing.
3. I have not written anything as to whom Assistant Scientific Secretary, ISRO will report to. Either it can be left vague "as is" in the draft or it can be explicitised.
4. Regarding the membership of Committees etc, things can remain as they are now. I would like to propose slightly later that . . . . . becomes a Member of Civil Works Scrutiny Committee, certain Admn personnel review committee etc. One can see how he takes the load & judge.

Regards.

Encl: as above.

(Y S Rajan)

usr\*/ysr

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The person in mind was  
Sreenivasa Selty. He knew  
the nitty-gritty of admin  
matters to run ISRO HQ. He had  
good relations with ~~all~~ most  
colleagues of ISRO HQ. Low  
profile. High integrity.

His addition would  
take load-off-me.

He was finally made  
— after some time. We will see an  
elaborate note later.

NRSA GB membership  
as Director EOS was done  
soon thereafter.

Then came other  
important operational issues

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concerning international cooperation  
by ISRO with other Space Agencies.

It was grows leaps and  
bounds, as ISRO ~~the~~ programmes  
themselves were growing and

ISRO personnel grow

to 4 digits. (Check actual  
figures in ISRO personnel

growth) - may be 2000+. When

I left ISRO in 1988 it was  
about 15,000 including NRSA. I

had seen through such a growth  
of ISRO in size in spite of

good deal of ~~work~~ emphasis done

for outsourcing work from ISRO  
to HAL, BEL and other companies)

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Powers for recruitment upto SD level had been delegates to the Centres. There needs be no representative from ISRO HQ / DoS Sect. Only sanctions for posts (that is addition of personnel) ~~are~~ were controlled strictly from <sup>ISRO</sup> HQ / DoS Sect, as ~~there~~ the salaries etc for personnel was a per long term liability for CoI. Just because there was a saving in Salary, ~~one~~ <sup>Centre</sup> could not use it for recruiting more people.

The sheer size itself was adding to the complexity of management of ISRO.

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Even so, it was possible to still hold the participative management style of ISRO. The presence of younger people in ISRO HQ allows for contact with "ground level" persons, even some new recruits. This was important for Chairman ISRO to get some feedback. For example, ~~I could~~ though in official position I was a very high level functionary, I could be in touch with new recruits; those who were performing remarkably well etc; Kiran Kumar ~~the~~ who ~~was~~ ~~was~~ joined ISRO in 1976 used

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to explain to me many technical details of engineering of remote sensing cameras & sensors. Thus I could recommend his name to a ESA Committee on Sensors which was a sub-set of ~~EOS~~

Committee of Law Observance System (CLOS)<sub>h</sub> of which I was a member.

They were so happy about his contributions and wanted him to continue.

There were many others I could learn from. But for managerial matters, I was careful not to disturb the power hierarchies of the centres; nor to take sides.

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In some difficult cases, I had ego used to give a "shoulder to cry"; in some cases suggest to them how to cope up and develop new routes. One such example Dr. T G K Menthay, a brilliant electro-optics engineer & innovator, referred to me by PS. PS had explained to me how badly he ~~was~~ was being treated in ISAC, between Avel, Alex etc. URR sides with them. T G K was shoves moves out spinooff applications

There are a number of such instances. In some

(410)

deserving cases, managed to give them some international exposure such as ISRO - DFVLR exchange programmes. ~~It~~ But for this I went mostly by the recommendations of the Centre Directors. Some times they used it purely as a reward for undeserving ~~cases~~ ~~who~~ persons who were their ~~for~~ favourites. In some cases one had to compromise though I was ISRO - DFVLR coordinator (inherited as SS from ~~PBB~~ PDB)

In one case, YP to

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avoid his problems ~~for~~ in  
SAC from a difficult engineer  
he desires to push him out for  
a ISRO - DAVLR exchange. I  
talked to him. YP in his  
~~the~~ disarming ~~style~~ style said  
"Arre yaar, Rajan Chod ~~do!~~ <sup>do!</sup>  
Hamara thoda relief chahiye!"

The difficulties the German's  
faces was ~~to~~ too many. He would  
refuse to work with any other  
German scientists. "I am the  
highest; I know all." ~~I will~~  
Finally he agreed to report to

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Dr. Ötth who was himself  
a microwave specialist. Dr. Ötth  
used to share with me the  
difficulties. I told him: "Dr. Ötth,  
I am sorry on this. Don't  
strain yourself. Don't try to  
create some work out of him.  
Let him come and go. Or even  
stay in his ~~at~~ hotel room. Let  
us finish the term & send him  
off!"

This person (I forget  
his name. He is some Dr. . . . )  
He used to write to Prime Minister of  
India, when Charan Singh took over,  
that he was the one - and - only

(413)

That Microwave Antenna engineer! We did not have such problems from persons from other Centres though some of them were of low calibre. But on the whole most of ~~the~~ them did very well. They learnt more. As the ISRO work was demanding we could not send the best ones as they ~~were~~ could not be spared for six months!

Indo-UK ~~co~~ cooperations need some elaboration. Its origin had a lot of interesting anecdotes.

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~~SD~~ While ISRO's beginning had international cooperation with USSR, USA & France, it added later Germany. (ISRO - DFVLR)

mostly as an aid: receiving German equipment and sending some persons for training. The links ~~of~~ VAS had with Japan

went away with Prof Itakawa. ESA was a new addition at SD's time resulting in APPLE, and later grew much more. There were little contacts

with UK. He had encouraged me to visit all European Space centres: ~~UK~~ in UK, Netherlands (NIVR), Italy, ~~etc~~ FRG, etc, nothing concrete was emerging

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from them; I had gained knowledge and a few contacts.

SD desired to increase  
\* ~~S&T~~ space related S&T  
contacts with UK especially knowing  
their academic depths. Of course  
ISRO bought equipment from  
UK. In fact a powerful  
Vibration Machine was bought  
from UK, an item embargoed  
by USA! TNS negotiated &  
got the best deal. Marconi  
had a number of cooperative  
arrangements with BEL. The difficulty

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was that UK did not have  
a nodal Space Agency let alone  
a department though they were  
active in aerospace through  
ESA, NASA cooperation.

So SD had hit upon  
the idea of having ~~a~~ contacts  
with a few Royal Society  
members who had interest in  
Space Research (not necessarily  
in space technology). "Let us  
have periodic meetings to explore  
how to go about a full  
fledged space cooperation which  
would naturally include

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technology & applications as well.

I think we had two such rounds of meetings with URR, VRG, and a few others. I was there on those meetings which lasted 3-4 days. We visited laboratories as well and held some in depth discussions to understand their work.

I had some interesting anecdotes from these. In Rutherford Appleton Lab, after all these detailed visit, I was discussing with one of the senior persons there about "Purchase Procedures" for the lab.

He explained. I asked him for a copy. He said it ~~was~~ <sup>had</sup> only a

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\$ for pages. I asked whether it had provisions for ~~central~~ referring to a central list as in our DGSD ~~contracts~~ rate contracts etc. He said, "Not exactly! We have some minimum guidelines as explained. A lot of it, is left to us. We may refer others ex. Left to us!"  
I realised that the basic <sup>rules</sup> procedure which he explained was similar to what we had in ISRO, almost like our Purchase Procedure Documents ~~was~~ crafted by TNS. Even GOI has <sup>same</sup> ~~sample~~

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type of principle. Unfortunately  
\* we in GOI had expanded  
it to an impossible situation.

At least during 1980's

ISRO was similar. (But when

I took up ISRO Strategy Group

Work in 2010 (when I returned

from Delhi to live in Bangalore)

the major complaint by ~~all~~ I

most ISRO active engineers / managers

etc was against ISRO Purchase

System! May be it had made

itself complicated following Indian

tradition of expanding the

bureaucracy!

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This reminds me about another group by Dr. J. J. Irani who was welcoming high level UK delegation in CII (mostly pre - 2000), ~~some of the~~ ~~relationships~~ probably

~~We had no~~  
in the context of ~~infra~~ infrastructure, railway etc.

" We in India, have not added many more miles to the railway tracks left by the British.

But in bureaucracy we have increased many thousands

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fold in terms of rules and procedures!

Another interesting item involves @ Kalam (who was just Kalam without the honorary Dr. addes!).

~~was~~ It was after 1980 successful launch when he did not have any special work. In fact he was ~~#~~ viling his time,

shuttling between VSSC & ISRO HQ when ~~#~~ he was ~~to~~ Director, ~~launch~~ Special Launch Servis.

SD desired that he also get some exposure.

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Between we had decided that we would go and see Tipu Sultan's rocket, which was only ~~in~~ ~~the~~ in UK (shame not in India.); had it been in India, it would have been lost!). Had it been in Germany or France, I could have got arranged a special trip by talking to ~~the~~ my counterpart. In USA through a person-to-person contact. Somebody would have done on their personal efforts, as their organisational (office) procedure would not have allowed it! (A terrible ~~the~~ bureaucracy in Federal Govt. Employees!)

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In UK ~~at~~ the organisation was too loose. It was arranged by Royal Society persons through a few labs. I was worried not to get into embarrassing situation by asking a host. Nor were any ISRO persons who were team members would be interested.

While Kalam could cut some meetings, I was to be there in all ~~other~~ of them, as a note-keeper. Others in the team were too high level persons, whom I could ~~not~~ ask to do my job!

So Kalam & I decided

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to go by ourselves after the meetings.

In my research by reading JBIS  
(Journal of British Interplanetary Society

— I was an elector fellow; I

later I could not afford to  
send fees for Journals & I  
stopped) etc, found out that

Tipu rockets were in ~~I~~ the

military ~~etc~~ museum in

~~Ilywich~~ Ilywich (to be

pronounced as Ilych — which

I learnt; otherwise no one

will understand in London). It

was some distance away and