

# **NATIONAL AND REGIONAL CAPACITY BUILDING ACTIVITIES FOR THE ACQUISITION OF ROCKET LAUNCH CAPACITY AND THE ASSOCIATED INFRASTRUCTURE “NIGERIAN STRATEGY”**

**Paper presented by**

**O.A FASHADE**

**COORDINATOR,**

**CENTRE FOR SPACE TRANSPORT**

**AND PROPULSION,**

**EPE, LAGOS STATE.**

**NIGERIA.**

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INTRODUCTION:

It is very obvious that the development and deployment of satellites are of primary significance

for strategic and economic development of any nation, considering some areas of satellite

application such as:

1. Remote sensing/GIS.
2. Satellite communications.
3. Meteorology and weather forecast.
4. Basic space and atmospheric sciences.

The above are vital ingredients for National development.

Since satellite must be deployed into correct orbit to realize its potential, there is a need to employ a launch vehicle.

Presently, African countries are advancing in the technology of satellite with increasing capacity to design and construct satellites for various applications, and this has given rise to a more determined and serious effort on the part of African countries to focus on the acquisition of technology to develop launch vehicles in order to make African nations reasonably technologically independent in space science and technology (SST) for sustainable African growth.

The acquisition of the capability to design launch vehicles by African nations will definitely enable locally developed satellite to be launched with Rockets developed within the shore of Africa, thus

enhancing our security position. This status can be achieved by taking some far reaching decisions

and determined steps independently and collectively by African countries to establish Research

Centres for Space Transport and Rocket propulsion.

In Nigerian case, a pragmatic decision was taken to establish the “CENTRE FOR SPACE TRANSPORT AND PROPULSION” at Epe, Lagos State.

In establishing a centre of this dimension, whose activities involve high technology and heavy financial commitment, there is a need to consider and weigh various factors that may be instrumental to its successful establishment or militate against it.

The following are the DECIDING FACTORS:

1. Political will of the leadership.
2. Availability of knowledge capital.
3. Availability of relevant infrastructure.
4. Institutional frame work with pragmatic management.
5. Sustained funding which is devoid and insulated from the vagaries of the annual budgetary exercise.
6. Continuity of Research and Development programmes under changing National leadership.
7. Strategic Alliance with relevant agencies within and outside the country.

Other CRITICAL FACTORS that may have negative impact on the decision to embark on such

programmes, especially in African situation are:

- i. Low GDP and high external debts.
- ii. Lack of relevant basic infrastructures.
- iii. Limited number or lack of qualified manpower in Space Science and Technology (SST) programme.
- iv. Perennial brain drain due to lack of incentives.
- v. Huge cost involved in training the needed manpower.

Having considered the above factors, the following steps were taken :

1. Development of the policy frame work which involved the establishment of proper legislation on space programmes and the enactment of the funding for sustainability of the centre. This was achieved by sensitizing the policy makers at different levels of government to appreciate the importance of Rocket Development and Aerospace engineering in general, and by this, the programme was given the deserved legitimate and financial backing. After the policy formulation, the Road Map was developed and a decision was taken to come up with a holistic and realistic Space Programme with a time frame to achieve some specific targets of their established Road Map.
2. Creation of Institutional Framework to see to the establishment of the Research Centre for Space Transport and Propulsion.
3. Taking inventory of the available infrastructure and resources including the relevant Industries that have the potential and facilities to support various aspects of Research and

Development in Rocket Propulsion and related fields.

a) INVENTORY OF HUMAN RESOURCES AND CAPACITY BUILDING :

In the setting up of our Research Centre, some assessment were carried out to determine the number and level of experts needed to initiate some operations at the centre. A decision was taken to invite/recruit experts from within and in Diaspora .It is in this recognition that it was decided that some special incentive package must be provided to enhance their performance and stem the brain drain.

It is also recognized that the workforce in employment should be given some vocational training in their respective field on relevant projects within and outside Nigeria in collaboration with Identified Foreign Technical Partners.

The lists of Nigerians, home and abroad that have relevant experience in Space Transport and Propulsion are to be compiled and contacted for their participation in the programme at various levels. The collaborative potentials of science and engineering staff in tertiary institution are also being exploited through giving of Research Grants or direct participation in various related projects.

b) INVENTORY OF LABORATORY AND MANUFACTURING FACILITIES:

Efforts are being made to document the list of the existing laboratories and manufacturing industries that have the potential to contribute and play major roles in the Research and Development activities of Rocket Propulsion systems. The performance data and relevant technical information on these institutions are being compiled to assess their viability :

i. Private industries and their capabilities.

ii. Armed forces workshop and laboratory facilities across the country.

It is always in the national interest to develop a symbiotic relationship between the Military Research and Development division and the Research Centre for Space Transport and propulsion to enable easy accessibility to facilities and infrastructure on both sides, thus avoiding the expensive duplication of equipment.

iii.Public facilities (State owned industries).

4. ASSESMENT OF THE POTENTIALS OF THE AVAILABLE INFRASTRUCTURE NATION WIDE:

It was recognized that the establishment of our Centre for Space Transport and Propulsion would require a well developed industrial based environment at National level to source its Technology, Materials and Components, hence the need for the assesment of the relevant industries in

the country, which are:

- i. Iron and Steel industries.
- ii. Aluminium industries.
- iii. Petrochemical industries.
- iv. Machine tool industry.
- v. Foundry industries.
- vi. Chemical and allied products industries.
- vii. Electrical power industries.

These industries as listed above are crucial to sustain the various operations at our Research Centre but essentially, they need to be expanded and modernized. There is also the need to tailor and make them relevant to the needs at the Research Centre.

#### 5. CREATION OF ADDITIONAL INFRASTRUCTURE:

having assessed the various relevant infrastructure on the ground, a decision was taken based on expertise recommendation and going through the experience of some advanced nations that it is a requirement to have the following for operational purposes:

- a. Launch site.
- b. Mobile launch pad.
- c. Permanent launch pad.
- d. Operation and control centre with Radar Tracking System for Control, Data gathering and processing.
- e. Operational craft such as Boats, Aircrafts, Helicopters, and Vehicles for after launch recovery of the payload and Rocket debris.
- f. Ground receiving station and Teleports.

#### 6. GLOBAL AND LOCAL SURVEY :

A decision was taken to carry out global and local survey of where and how to source for the following vital ingredients essential for the development of Rocket Propulsion.

- i. Solid fuels.
- ii. Liquid fuels.
- iii. Rocket components.
- iv. Other relevant materials for rocket development.

#### 7. DEVELOPMENT OF RELEVANT SPACE EDUCATION PROGRAMMES AT ALL LEVELS.

As part of the measures to develop HUMAN RESOURCES for present and future continuity of intensive Research and Development in Rocket Propulsion, it was decided that : Space related programmes must be encouraged right from primary to tertiary institution in terms of space education for capacity building, and to achieve this, some academic curricula should be developed to include the following:

- a) Elementary study of rocket propulsion with cardboard modeling.
- b) Elementary study of solar system and other stars with provision of simple

telescope for observation.

c) Design and construction of simple rockets.

d) School competition on design and construction of simple rockets at local and national levels, with rewards for the best designers.

e) Computer science and Information Technology.

f) General science.

The Nation's Educational Authority should as part of its commitment identify some few universities

(about 2-3) and declare them for special funding. they should be equipped to specialize in rocket

propulsion and aerospace engineering. The curricula should include some related courses such as:

i. Aeronautics.

ii. Rocket Propulsion and Aerospace Engineering.

iii. Computer Science and Engineering.

iii. Manufacturing technology.

iv. Artificial Intelligence and Robotics.

v. Chemical Thermodynamics.

vi. Cryogenic.

vii. Hydraulics, Pneumatics and Automatic control.

viii. Gas dynamics.

ix. Telemetry and Tele command control systems.

x. Astrodynamics and control Engineering.

xi. Material science and structural Engineering.

xii. Electronic Circuit Design and Printing Technology.

In the specialized universities, the Nation should put premium on rigorous and aggressive Research and

Development at Postgraduate levels (M.Sc and PhD).

## 8. ESTABLISHING COLLABORATION WITH LOCAL AND INTERNATIONAL PARTNERS.

By considering the high technology involved and the associated enormous financial outlay, It will not be difficult

to recognize the fact that, there is a need to collaborate with foreign partners, especially the advanced

countries of the world. Presently, Nigeria is taking dynamic steps to establish long term partnership with some

highly experienced and developed countries while serious efforts are also being made to reach out to some

other advanced countries that may be interested in the partnership for mutual benefit.

While efforts are being made on our own to forge ahead within our resources, our Research Centre,

nevertheless, will welcome the partnership for the establishment of the following facilities to give us a strong

base with some direction in our research efforts and to give the required training to our Engineers and

Scientists.

i. LABORATORIES AND WORKSHOPS.

a. Aerodynamics Laboratory equipped with both Subsonic and Supersonic Wind Tunnels.

b. Chemical Thermodynamics and Combustion Laboratory.

c. Hydraulic and Pneumatic Laboratory.

d. Metallurgy and Foundry Laboratory.

e. Machine and Sheet metal Workshop.

f. Metrology Laboratory.

g. Gas Dynamics Laboratory.

h. Robotics Laboratory.

i. Material Science and Structural Laboratory.

j. Modern Arc/Gas Welding Workshop.

k. Tool making Workshop.

l. Electronics, and Computer Laboratory.

m. Electronics, Instrumentation Control and Guidance Laboratory.

n. Dynamics and Vibration Laboratory.

ii. BUILDING OF A LAUNCH PAD IN AN APPROPRIATE AND STRATEGIC LOCATION IN THE COUNTRY.

iii. ESTABLISHMENT OF MANUFACTURING PLANTS AND STORAGE FACILITIES FOR ROCKET FUELS e.g.

a. Liquid Oxygen

b. Liquid Hydrogen e.t.c

iv. SETTING UP OF ROCKET PROPULSION AND AEROSPACE LIBRARY.

– To be stocked with relevant books and journals

COLLABORATION AMONG AFRICAN COUNTRIES:

The space fairing African Nations should appraise the current status of national space activities in each country

and work out modality of cooperation so as to optimize the utilization of the existing assets in Africa. The

Technological Developments indigenous to African nations including the existing capacity in the African

countries such as South Africa, Egypt, Algeria, morocco and Nigeria should also be exploited through

understanding and cooperation. The existing human and material resources among these African nations for

building and launching of Rockets should be harnessed.

BENCHMARKS:

The objectives as defined for the establishment of our Centre for Space Transport and Propulsion were

entrenched with benchmarks and deliverables at specified time on the Road Map. This creates the environment

to guide the implementation of the programme to achieve the defined targets.

The benchmark as established for

our research centre is to acquire some specific capability on target dates.

Within the first 5years of operation, the centre should be able to record up to about 40-50km altitude and in

10years time with collaboration and partnership with foreign Technical Partners, Nigeria should be in a position

to put Nigerian satellite in the orbit. The proximity of Nigeria to the equatorial region coupled with sincerity of the nation's leadership will be a great incentive hopefully, to attract the participation of foreign technical partners.

#### FUNDING OF THE CENTRE FOR SPACE TRANSPORT AND PROPULSION

The establishment and running of this centre is capital intensive and requires an enormous financial outlay for sustainability; hence the provision of funds must be Realistic, Justifiable and Sustainable. Adequate funding of this centre is very crucial recognizing its economic and security importance to the Nation, hence it is noteworthy to suggest the adoption of the following funding mechanisms:

- i. Statutory budgetary allocation to fund the centre, the percentage of which should be determined by each country.
- ii. In case of Nigeria ,it will be desirable to allocate certain percentage of the annual revenue generated from oil and gas.
- iii. A percentage of the tax revenue generated from organized private sector could also be allocated to fund these centres.
- iv. Covert funding mechanisms could also be put in place.

It should be noted that, funding on a predictable and continuous base remains a bedrock for the successful implementation of this program, hence appropriate legislation should be enacted on all the above to avoid the rigors of change in government leadership. This can also be adopted by other African Nations that are into Space Science and Technology.

#### CONCLUSION:

In conclusion, it is my believe that a well focused space programme with defined targets within a time frame will in due course position Nigeria and indeed Africa among other nations of the world. It should be noted that for any African country and Nigeria in particular to achieve this status, the development at our Research Centre must be based with emphasis on:

- i. Knowledge and skill development through capacity building.
- ii. Knowledge sharing through collaboration among African nations and beyond.
- iii. Joint participation among African nations in mutually beneficial projects.
- iv. Bilateral and international cooperation.

THANK YOU

DESIGN BY:

ameen inc.

+234-8024600493

babsameen@mail.com