THE NORTHERN TERRITORY OF AUSTRALIA

Copy No. .....

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CABINET DECISION

No.....5266.....

Submission No.: 4518

Title: NORTHERN TERRITORY SPACEPORT FEASIBILITY REPORT

Cabinet -

(a) noted the detailed feasibility study undertaken by the Working Party;

(b) decided to take no further action on this project; and

(c) noted that the Department of Industries and Development will be investigating appropriate associated industry oppotunities.

A. G. MORRIS
Secretary to Cabinet.

8 September 1987

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6-201/1

THE NORTHERN TERRITORY OF AUSTRALIA

Copy No: 1

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FOR CABINET

SUBMISSION No: 4518

Title:	NORTHERN TERRITORY SPACEPORT FEASIBILITY REPORT
Minister	HON MARSHALL PERRON, MINISTER FOR INDUSTRIES AND DEVELOPMENT
Purpose:	TO REPORT TO CABINET ON THE OUTCOME OF THE PRELIMINARY FEASIBILITY STUDY INTO THE ESTABLISHMENT OF A SPACE VEHICLE LAUNCHING FACILITY IN THE NORTHERN TERRITORY
Relation to existing policy:	RELATES TO CABINET DECISION NO. 4863
Timing/ legislative priority:	NIL
Announcement of decision, tabling, etc:	A DRAFT PRESS RELEASE IS AT ATTACHMENT A.
Action required before announcement:	NIL
Staffing implications, numbers and costs, etc:	NIL
Total cost:	WITHIN EXISTING BUDGET APPROPRIATION

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Department/Authority LAW

COMMENT ON CABINET SUBMISSION No.

TITLE: NORTHERN TERRITORY SPACEPORT PROPOSAL

COMMENTS:

In light of the recommendations, no legal comment is necessary. The proposed course of action is supported.

SIGNED: C.E. CROFT

DESIGNATION: SECRETARY, DEPARTMENT OF LAW

DATE: 3 JULY 1987

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Department/Authority: NORTHERN TERRITORY TREASURY

COMMENT ON CABINET SUBMISSION No.

TITLE: NORTHERN TERRITORY SPACEPORT FEASIBILITY REPORT

COMMENTS:

Treasury supports the Submission.

SIGNED: O ALDER

DESIGNATION: ACTING UNDER TREASURER

DATE: 7 JULY 1987 **CONFIDENTIAL**

6635.833 G. L. DUFFIELD, Government Printer of the Northern Territory

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Department/Authority.....CO-ORDINATION COMMITTEE

COMMENT ON CABINET SUBMISSION No.

TITLE: .....NT SPACEPORT FEASIBILITY REPORT

COMMENTS:

The Co-ordination Committee supports the Submission.

SIGNED: A.G. MORRIS

DESIGNATION: Chairman

DATE: 6.7.87

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Department/~~Authority~~ OF THE CHIEF MINISTER

COMMENT ON CABINET SUBMISSION No.

TITLE: NORTHERN TERRITORY SPACEPORT PROPOSAL

COMMENTS:

The Submission is supported.

SIGNED: L RICHARDSON

DESIGNATION: DEPUTY SECRETARY

DATE: 13.7.87

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6-49

CONFIDENTIAL

Department/~~Authority~~ LANDS AND HOUSING

COMMENT ON CABINET SUBMISSION No.

TITLE: NORTHERN TERRITORY SPACEPORT PROPOSAL

COMMENTS:

The Department of Lands and Housing supports the submission.

SIGNED: R. W. Brockman

DESIGNATION: HEAD OF SECRETARIAT

DATE: 7. 7. 87.

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Department/~~Authority~~ TRANSPORT AND WORKS

COMMENT ON CABINET SUBMISSION No.

TITLE: NORTHERN TERRITORY SPACEPORT PROPOSAL

COMMENTS:

The Submission is supported.

SIGNED: IAN GORDON

DESIGNATION: SECRETARY

DATE: 2 JULY 1987

CONFIDENTIAL

Department/Authority CONSERVATION COMMISSION

COMMENT ON CABINET SUBMISSION No.

TITLE: NORTHERN TERRITORY SPACEPORT FEASIBILITY REPORT

COMMENTS:

The Commission supports the Submission. In view of the recommendation, no action is required pursuant to the Environmental Assessment Act.

In the event that it was decided to further develop the proposal, action under that Act would need to be considered.

SIGNED: Anthony Thomas

DESIGNATION: Director of Conservation

DATE: - 2 JUL 1987

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ISSUES

1. To report to Cabinet on the outcome of the preliminary feasibility study into the establishment of a space vehicle launching facility in the Northern Territory.

BACKGROUND

2. On 14 October 1986, the former Minister for Business, Technology and Communications briefed Cabinet (Submission No. 4158) on the correspondence between Dr Pardoe (General Technology Systems Ltd (UK)) and the Chief Minister about a possible Northern Territory spaceport and Cabinet noted that his Department was convening a Working Party to study and report on the feasibility of such a spaceport (Decision No. 4863).

3. The Working Party (Attachment B) has now completed its preliminary study and this submission forms its report to Cabinet on the feasibility of a spaceport. The Working Party received considerable assistance from Dr Gordon Pike (Aussat Pty Ltd).

4. The Queensland consultancy study mentioned in the earlier submission has now been completed. The study included an in-depth investigation of a site adjacent to Weipa on Cape York Peninsula. The report recommended that this site is the most suitable for a launch site with respect to geostationary and space shuttle orbits to 54°S. The report did not adequately evaluate the risks to Central Australian communities including Alice Springs and Mt Isa arising from polar orbit launches.

5. A copy of the 1965 Department of Supply Report on <u>An Australian Study of a Launch Site for Equatorial orbits</u> (European Launcher Development Organisation Project Study 5.4) has been studied. The ELDO Report concluded that "the most suitable site is on the Australian mainland near Darwin and that this location has unique advantages over alternative sites".

6. The ELDO Report's conclusion has been overtaken by considerable population and socio-economic development in the Top End since 1965, and could be considered dated.

CONSIDERATION OF THE ISSUES

7. The Working Party in assessing the validity of the conclusions of the ELDO Study Report and the feasibility of a Northern Territory spaceport focussed on:

- site selection criteria and infrastructure needs;
- range safety issues;
- likely market requirements for launch services.

8. Darwin incorporates all of the general infrastructure requirements for a spaceport (Attachment C) and sites within 200 km would be able to make effective use of this existing infrastructure. Nhulunbuy already has some of the infrastructure necessary and like sites near Darwin, is at a low latitude. On this basis, the Working Party selected sites at:

- Darwin
- Point Stuart
- Nhulunbuy

for study.

9. Range safety and the location of the impact zones where used rocket hardware lands are critical issues. Ideally, drop zones must be in totally uninhabited areas or over ocean and it is undesirable for launch trajectories to be over populated areas. With the assistance of Dr Pike (Aussat), the Working Party commissioned a map set to allow accurate identification of the trajectories and impact zones for all common rockets for the three chosen sites and others if necessary. Details are provided in Attachment D together with sample maps for the Chinese and Japanese rockets.

10. As all of the common trajectories for geostationary, polar and space shuttle orbits traverse populated areas and most of impact zones occur in inhabitated localities including cities, towns and communities, the Working Party has reluctantly drawn the inevitable conclusion that none of the studied sites is suitable for a commercial spaceport.

11. Accurate information on commercial and Governmental launch service demand has proved difficult to obtain. Best estimates (Attachment E) indicate declining demand to a level of 20 or

less launches per annum. This may be just sufficient to justify a new facility if US policy does not change and Ariane does not expand their operations in French Guyana to capture the service demand. To be successful a facility would need to cater for a majority of launch trajectory requirements and need to secure commitments from foreign Governments e.g. China and Japan concerning usage of facilities. France has indicated that it has no interest in a Northern Territory facility and Japan has publicly turned down collaboration with Queensland.

12. The investigations have highlighted several industry development possibilities including:

- space launch vehicle manufacturing and support services (relevant if Queensland's spaceport proceeds);

- search and rescue satellite communications services;

- remote telemetry, tracking and sensing services;

- satellite high frequency communications design and expert services.

The Department of Industries and Development will be assessing the opportunities in the usual manner.

OPTIONS

13. Cabinet might decide to:

(a) take no further action; or

(b) decide to commission a full feasibility study.

Option (a) is recommended on the basis of the Working Party's findings.

PUBLIC IMPACT

14. A decision not to proceed with further feasibility studies into the spaceport will have little direct public impact.

FINANCIAL CONSIDERATIONS

15. The present study has been completed within existing resources and has cost less than $5000.

CO-ORDINATION AND CONSULTATION

16. This Submission has been considered by the Co-ordination Committee.

PUBLICITY

17. A draft press release is at Attachment A.

RECOMMENDATION

18. It is recommended that Cabinet:

(a) note the detailed feasibility study undertaken by the Working Party;

(b) decide to take no further action on this project; and

(c) note that the Department of Industries and Development will be investigating appropriate associated industry opportunities.

DATED: 11.8.87

.....

MARSHALL PERRON

ATTACHMENT A

DRAFT PRESS RELEASE

NORTHERN TERRITORY SPACEPORT PROPOSAL

Mr Marshall Perron, Minister for Industries and Development said today that Cabinet had considered a confidential report on the Northern Territory spaceport proposal. He said the report addressed all of the key issues relating to the establishment of a spaceport, including launch infrastructure requirements, launch types and demand and the key question of range safety.

As sites close to the equator are the most suitable for commercial space launches, Top End sites near Darwin, Port Stuart and Nhulunbuy were considered. It is clear, he said, that Darwin does incorporate all of the general infrastructure requirements such as a port, airport and engineering facilities to support an adjacent launching facility.

However, it has become apparent from the detailed information gathered during the study that commercially relevant launches would involve traversing inhabited areas in the Northern Territory and elsewhere. He went on to explain that current expendable launch vehicles jettison large components such as tanks and fairings during their flight. These fall and impact the earth in "drop" zones. These drop zones for the sites studied generally occur over or near towns

and communities in the Northern Territory and elsewhere in Australia. The question of launch failures must also be considered.

From this information, Cabinet has reluctantly concluded that the establishment of a Northern Territory spaceport would involve unacceptable risks and has decided not to proceed with any further work on this proposal. Cabinet's initial caution, he added, in not proceeding with a fully funded consultancy in 1986 has been vindicated.

Mr Perron also said that his Department would continue to monitor space developments elsewhere, including the proposal being considered by the Queensland Government, and would be vigorously seeking to capitalise on any industrial or development opportunities which arise.

ENDS

ATTACHMENT B

SPACEPORT WORKING PARTY

Mr Geoff Chard (Chairman), Department of Industries and Development
Mr Ian Prince, Department of Industries and Development
Mr Ian Gordon, Department of Transport and Works
Ms Jane Large, Northern Territory Treasury
Ms Kate Race, Northern Territory Treasury
Mr Sam Durland, Department of Industries and Development (representing Nortrade)
Ms Barbara Singer, Conservation Commission of the NT
Mr Ken Ward, Department of Lands and Housing
Mr Graham Bailey, Department of Lands and Housing

Assistance to Working Party

Aussat Pty Ltd (Dr Gordon Pike)

CSIRO (Office of Space Science and Applications - Dr Ken McCracken)

Department of Industry, Technology and Commerce

Department of Science

ATTACHMENT C

SUMMARY OF SITE SELECTION AND INFRASTRUCTURE NEEDS

The Working Party identified the following parameters as relevant:

equatorial site (within 12-15% of the equator)
land available (> 500 km^2)
good communications facilities
stable political system
community and accommodation, housing facilities
meteorological services
air traffic control and radar services
industrial support infrastructure
power, water,
airport (Boeing 747 capable)
port facilities with modern transfer capabilities
sealed roads
recreation and education facilities
suitable weather conditions mainly related to wind and lightning
range and impact zone safety

ATTACHMENT D

Summary of Impact Zone Data

1. Maps 1-4 in this attachment show the four commercially relevant launch trajectories for the selected Northern Territory sites and Weipa and the approximate impact zones for Japanese H2 and Chinese Long March 2 and 3 rockets.

   Impact zones are statistical probability zones (three or 99.74%) where rocket hardware is likely to land. They are normally elliptical however for ease of plotting these maps show similar size rectangles to illustrate zone location and dimensions.

2. Full size maps with impact zones and trajectories overlays have been prepared to allow all common launching rockets and a variety of Territory sites to be studied.

3. A summary sheet which lists the impact zone locations and the communities, towns and cities likely to be affected has also been included.

ATTACHMENT D

SUMMARY SHEET

LOCATIONS IN THE IMPACT ZONES

DARWIN

H_2	SSO	B	Port Keats, Daly River, Tipperary
		F	Gibson Desert, Giles Meteorological Station
		1	Esperance
	GTO	B	Maningrida, Milingimbi, Elcho Island
		F	Coral Sea
		1	Santa Cruz
	28.5°	B	Roper Bar, Mainoru
		F	Ingham, Townsville, Ayr, Charters Tower
		1	Pacific Ocean
	57°	B	Pine Creek, Kath, Mataranka
		F	Simpson Desert, Birdsville, Betoota
		1	Cobar, Cootamundra, Wagga Wagga
LM2-4L			
	SSO	1	Timber Creek, Newry, Rosewood
		2	Southern Ocean
	GTO	1	Gulf of Carpentaria
		2	Solomon Island Group
	28.5	1	Sir Edward Pellew Group
		2	South Pacific
	57°	1	Daly Waters, Down Stuart Highway to Banka Banka
		2	Tasman Sea
LM-3	SSO	1	Timber Creek, Victoria River
		2	Esperance, Norseman, Gibson
	GTO	1	Elcho Island, Nhulunbuy
		2	Santa Cruz
	28.5	1	Roper Bar, Limmen Bight
		2	South Pacific
	57°	1	Daly Waters, Newcastle Waters
		2	Cobar, Cootamundra, Canberra
ARIANE			
	SSO	B	Daly River
		1	Newry, Victoria River
		F	Great Sandy Desert
		2	Coonana, Cundeelee
	GTO	B	Jabiru, Pt Stuart
		1	Milingimbi, Ramingining, Nhulunbuy
		F	Weipa, Wenlock, Coen
		2	Louisiade Archipelago
	28.5°	B	Annaburro
		1	Roper Bar, Ngukurr, Numbulwar
		F	Normaton, Blackbull, Karumba
		2	Mackay
	57°	B	Pine Creek
		1	Larrimah, Daly Waters
		F	Barkly Homestead
		2	Thargomindah, Bourke

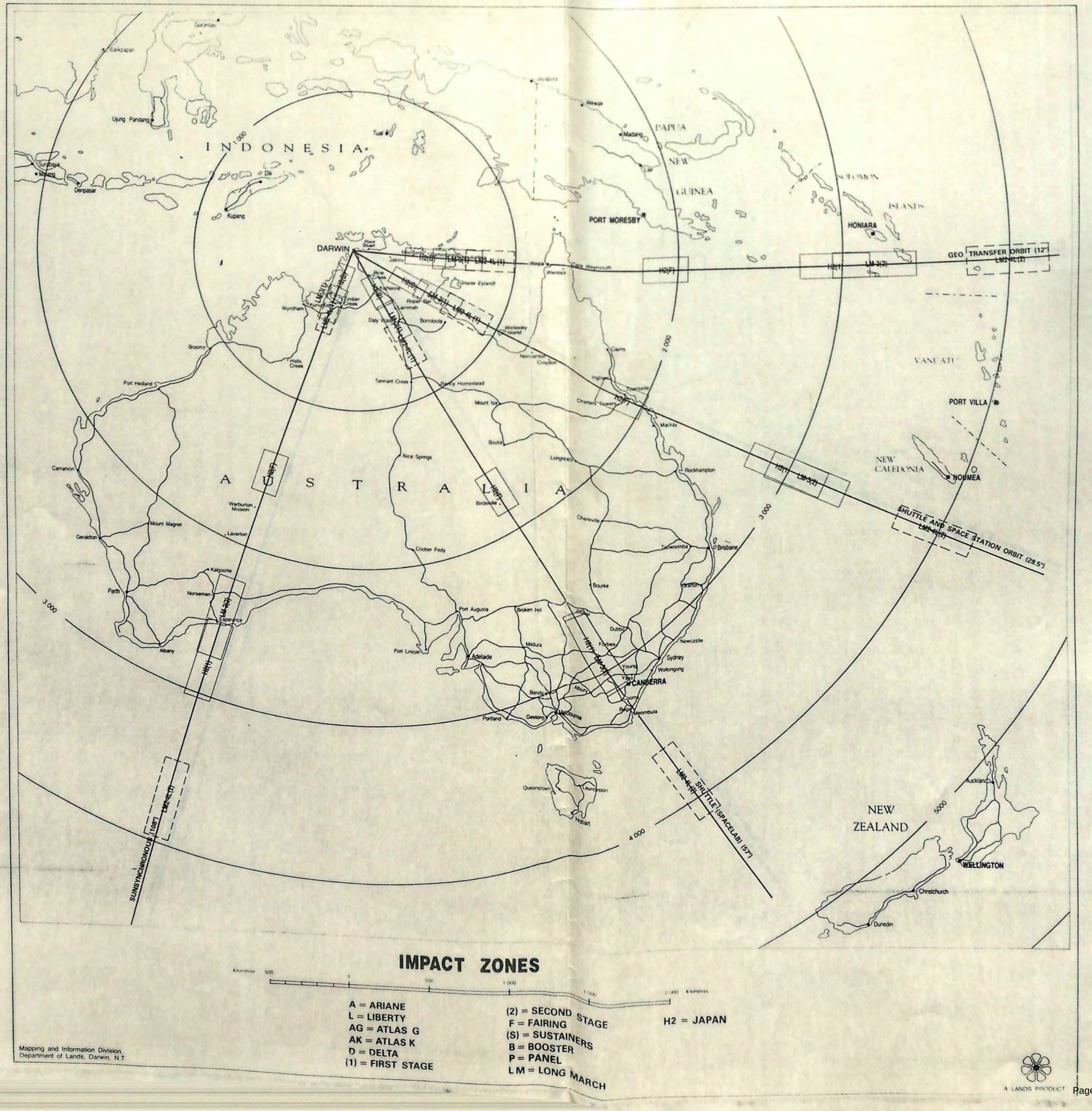
PT STUART

H_2	SSO	B	Pine Creek, Dorisvale, Tipperary
		F	Gibson Desert
		1	Orleans Farms
	GTO	B	Milingimbi, Ramingining, Nhulunbuy
		F	South Pacific
		1	Santa Cruz
	28.5	B	Numbulwar, Arnhem Land
		F	Townsville, Ayr, Proserpine
		1	South Pacific
	57°	B	Mataranka, Elsey, Larrimah
		F	Bedourie, Betoota
		1	Forbes, Young, Yass, Canberra
LM2-4			
	SSO	1	Timber Creek
		2	Southern Ocean
	GTO	1	Gulf of Carpentaria
		2	Pacific
	28.5	1	Wellesley Islands
		2	South Pacific
	57°	1	Eva Downs, Brunette Downs
		2	Tasman Sea
LM3	SSO	1	Timber Creek
		2	Balladonia Motel
	GTO	1	Nhulunbuy
		2	Solomon Islands Group
	28.5°	1	Numbulwar, West Island
		2	South Pacific
	57°	1	Larrimah, Anthony Lagoon
		2	Forbes, Young, Yass, Canberra
ARIANE			
	SSO	B	Adelaide River, Hayes Creek, Daly River
		1	Timber Creek
		F	Great Sand Desert
		2	Coonana, Cundeelee
	GTO	B	Jabiru, Maningrida
		1	Nhulunbuy
		F	Weipa, Wenlock
		2	Louisiade Archipelago
	28.5°	B	Jabiru
		1	Numbulwar
		F	Normaton, Karumba, Blackbull, Croydon
		2	South Pacific
	57°	B	UDP, Bamyili
		1	Larrimah, Daly Waters
		F	Lake Nash, Urandangi
		2	Wanaaring, Cobar

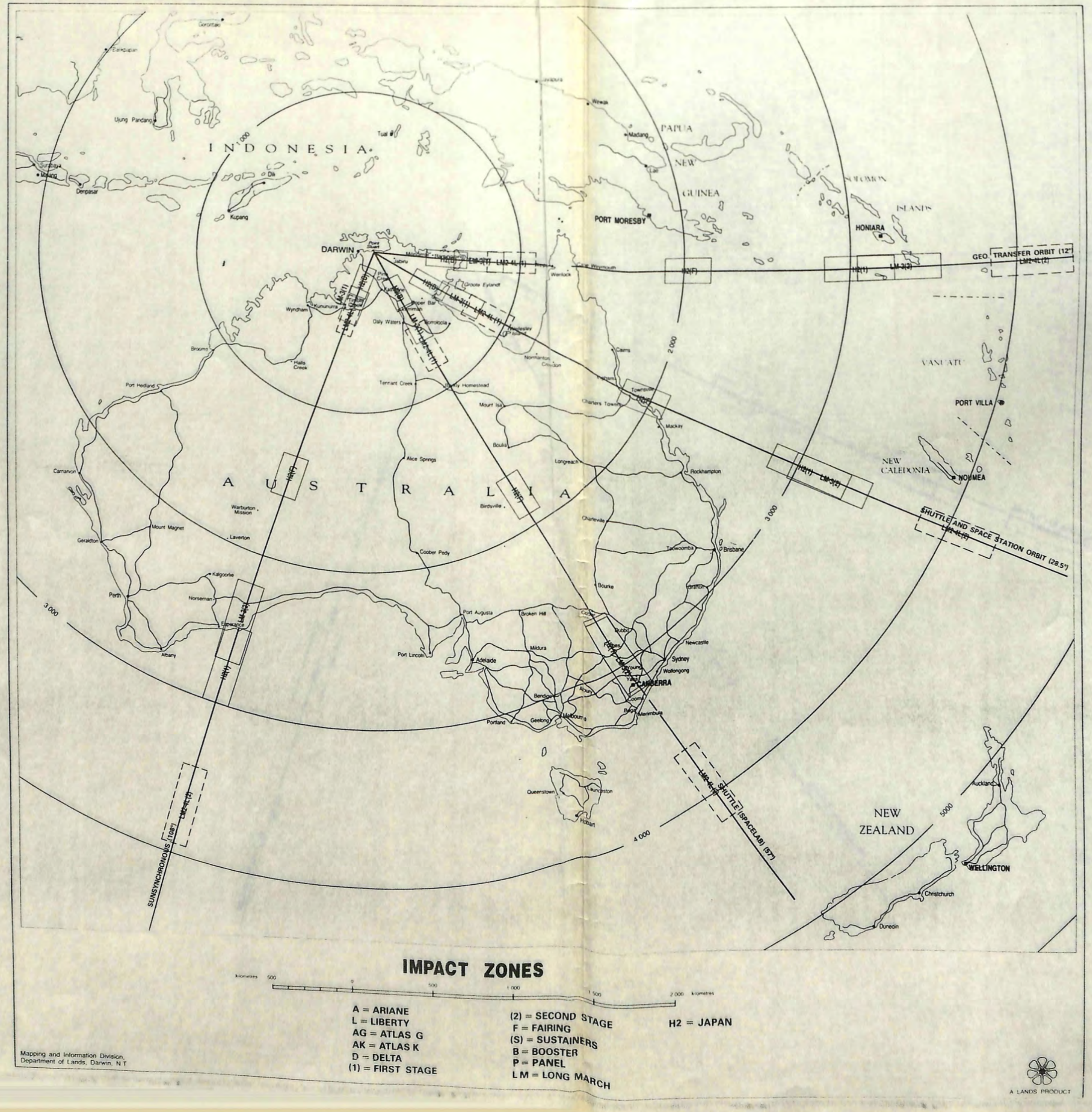
NHULUNBUY

H_2	SSO	B	Groote Eylandt, Numbulwar
		F	Angas Downs, Curtin Springs
		1	Great Australian Bight
	GTO	B	Weipa
		F	Louisiade Archipelago
		1	Solomon Islands Group
	28.5°	B	Gulf of Carpentaria
		F	South Pacific
		1	South Pacific
	57°	B	Gulf of Carpentaria
		F	Charleville, Blackall
		1	Taree, Port Macquarie
LM2-4			
	SSO	1	Borroloola, Nathan River
		2	Southern Ocean
	GTO	1	Coral Sea
		2	South Pacific
	28.5	1	Laura, Hopevale
		2	South Pacific
	57°	1	Wellesley Island, Burketown
		2	Tasman Sea
LM-3			
	SSO	1	Borroloola
		2	Eucla Motel
	GTO	1	Weipa, Iron Range
		2	South Pacific
	28.5	1	Edward River, Kowanyama
		2	South Pacific
	57°	1	Wellesley Islands
		2	Taree, Port Macquarie
ARIANE			
	SSO	B	Groote Eylandt, Numbulwar
		1	Sir Edward Pellew Group, Borrolo
		F	Tennant Creek, Wauchope, Barrow Alleron
		2	Eucla Motel
	GTO	B	Gulf of Carpentaria
		1	Weipa, Wenlock
		F	Coral Sea
		2	Santa Cruz
	28.5°	B	Gulf of Carpentaria
		1	Edward River, Kowanyama
		F	Cairns
		2	South Pacific
	57°	B	Gulf of Carpentaria
		1	Wellesley Islands
		F	Hughendon, Richmond
		2	Glen Innes, Inverell, Armidale

MAP 1 DARWIN


INDONESIA
PAPUA NEW GUINEA
SOLOMON ISLANDS
VANUATU
NEW CALEDONIA
NEW ZEALAND
AUSTRALIA
DARWIN
PORT MORESBY
HONIARA
PORT VILLA
NOUMEA
CANBERRA
WELLINGTON
GEO TRANSFER ORBIT (12°)
SHUTTLE AND SPACE STATION ORBIT (28.5°)
SHUTTLE (SPACELAB) (57)
SUNSYNCHRONOUS (108°)
1 000
2 000
3 000
4 000
5000
IMPACT ZONES
A = ARIANE
L = LIBERTY
AG = ATLAS G
AK = ATLAS K
D = DELTA
(1) = FIRST STAGE
(2) = SECOND STAGE
F = FAIRING
(S) = SUSTAINERS
B = BOOSTER
P = PANEL
LM = LONG MARCH
H2 = JAPAN
Mapping and Information Division,
Department of Lands, Darwin, N.T.
A LANDS PRODUCT

MAP 2 PT STUART



MAP 3 NHULUNBUY

IMPACT ZONES

kilometres 500 0 500 1 000 1 500 2 000 kilometres

A = ARIANE
L = LIBERTY
AG = ATLAS G
AK = ATLAS K
D = DELTA
(1) = FIRST STAGE

(2) = SECOND STAGE
F = FAIRING
(S) = SUSTAINERS
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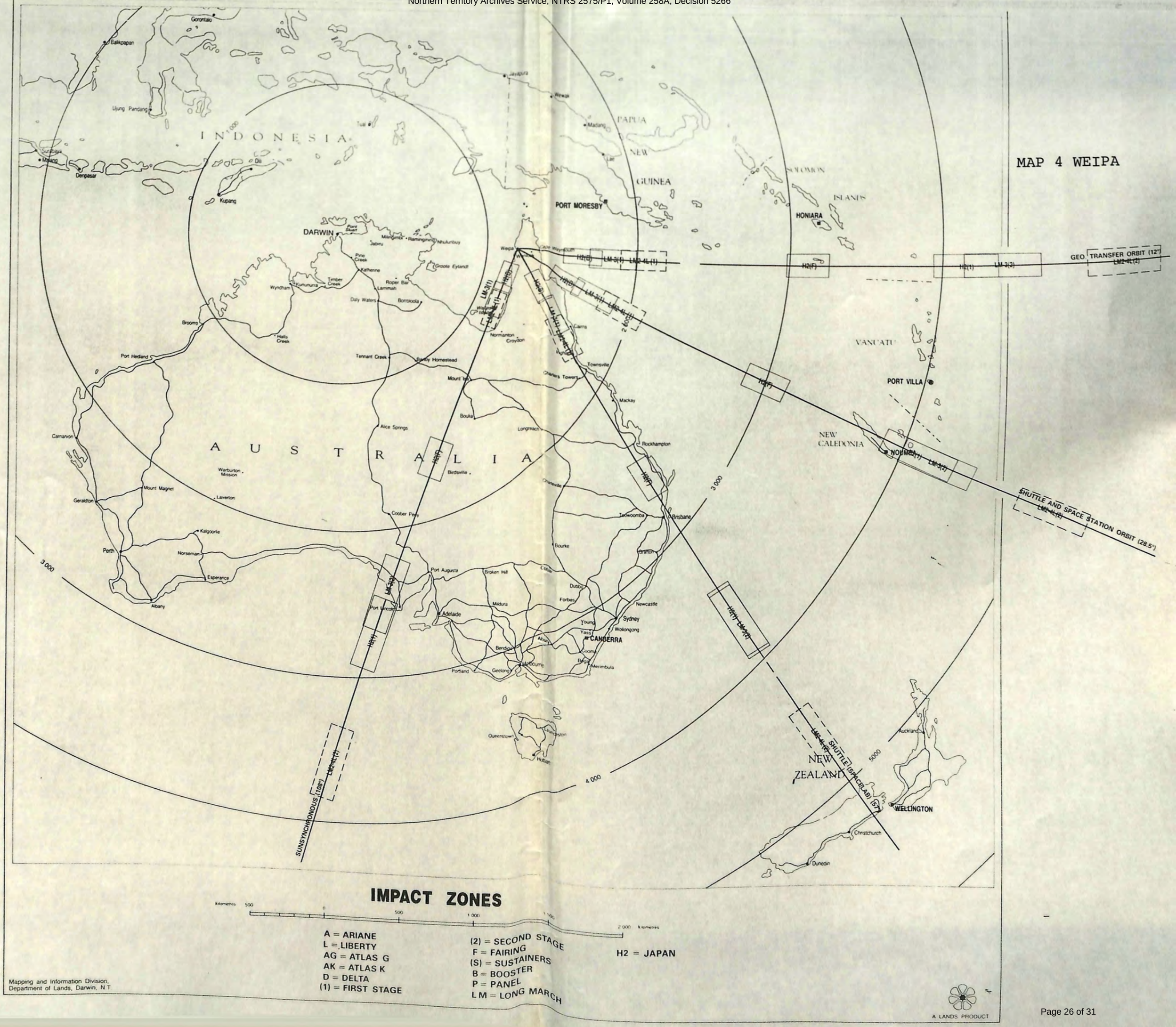
Mapping and Information Division,
Department of Lands, Darwin, N.T.

A LANDS PRODUCT


MAP 4 WEIPA
INDONESIA
PAPUA
NEW
GUINEA
SOLOMON
ISLANDS
VANUATU
NEW
CALEDONIA
NEW
ZEALAND
AUSTRALIA
DARWIN
PORT MORESBY
HONIARA
PORT VILLA
NOUMEA
CANBERRA
WELLINGTON
Weipa
Cairns
Townsville
Mackay
Rockhampton
Brisbane
Sydney
Newcastle
Adelaide
Port Augusta
Perth
Kupang
Denpasar
Ujung Pandang
Balikpapan
Gorontalo
Madang
Port Hedland
Broome
Darwin
Alice Springs
Tennant Creek
Mount Isa
Longreach
Charleville
Bourke
Dubbo
Forbes
Young
Wollongong
Albury
Bendigo
Melbourne
Geelong
Portland
Mildura
Broken Hill
Port Lincoln
Esperance
Albany
Kalgoorlie
Norseman
Geraldton
Carnarvon
Mount Magnet
Laverton
Warburton Mission
Cooper Pedy
Birdsville
Boulia
Normanton
Croydon
Charters Towers
Tambo
Toowoomba
Grafton
Merimbula
Bairnsdale
Queenstown
Launceston
Hobart
Auckland
Christchurch
Dunedin
Kupang
Dili
Tual
Biak
Manokwari
Jayapura
Wewak
Madang
Lae
Port Moresby
Honiara
Noumea
Port Vila
Wellington
GEO TRANSFER ORBIT (12°)
LM2-4L(2)
SHUTTLE AND SPACE STATION ORBIT (28.5°)
LM2-4L(8)
SUNSYNCHRONOUS (108°)
LM2-4L(1)
SHUTTLE (SPACELAB) (57°)
LM2-4L(8)
H2(B)
LM-3(1)
LM2-4L(1)
H2(F)
LM-3(2)
LM2-4L(2)
H2(1)
LM-3(3)
H2(P)
LM-3(1)
LM2-4L(1)
H2(S)
LM-4(1)
LM2-4L(1)
H2(P)
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IMPACT ZONES
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LM = LONG MARCH
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Department of Lands, Darwin, N.T.
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ATTACHMENT E

Launch Service Market Estimates

1. Recent historical trends in launch and payload requirements have been tabulated by NASA/Battelle (Figure 4.1 and 4.2) and payload demand predications prepared (Figure 4.3).

2. Independent estimates of payload and launch demand have also been prepared by Martin Marietta/Satellite News) (Figure 4.4).

Actual Total Launches Compared to OUPM Projections

Battelle

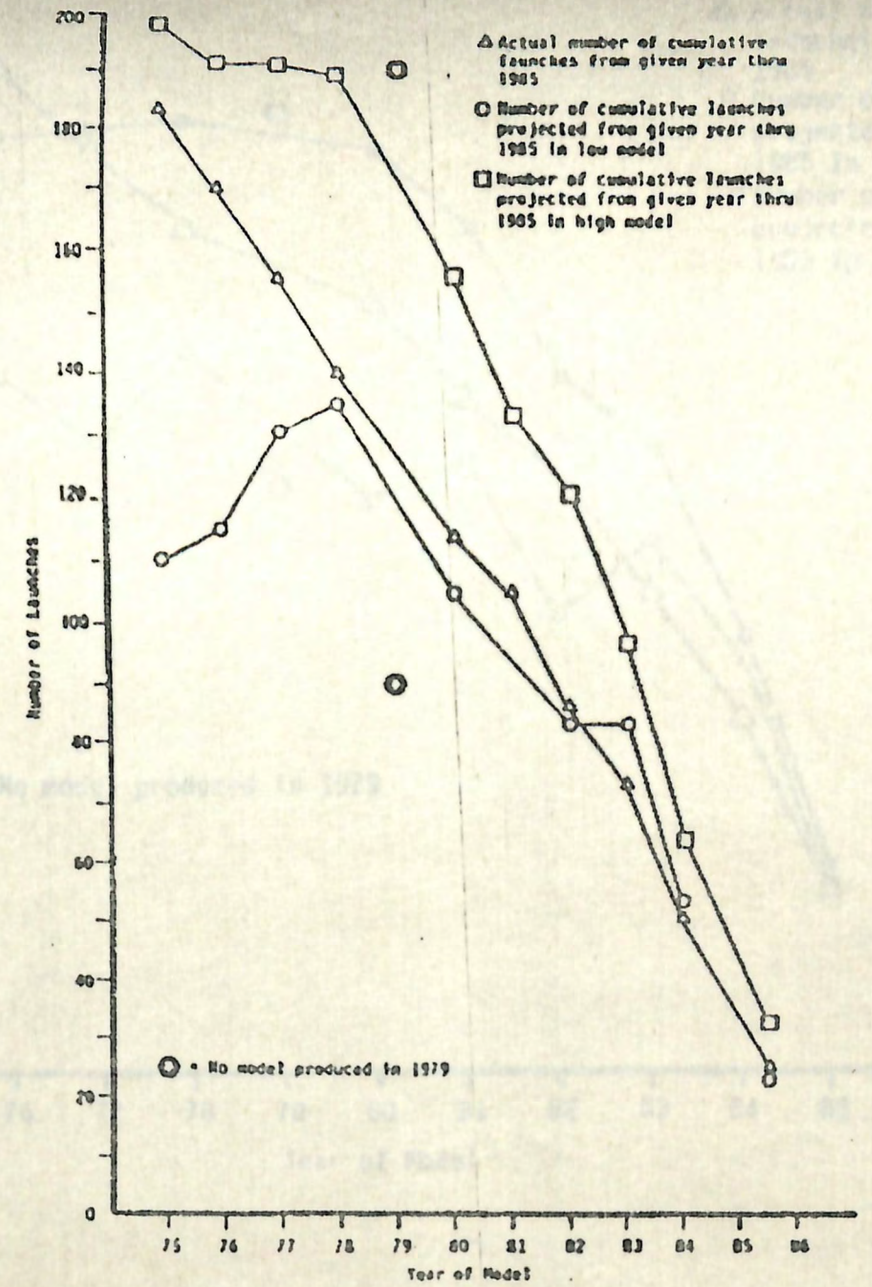


FIGURE 4.1

Actual Commercial Launches Compared to OUPM Projections

Battelle

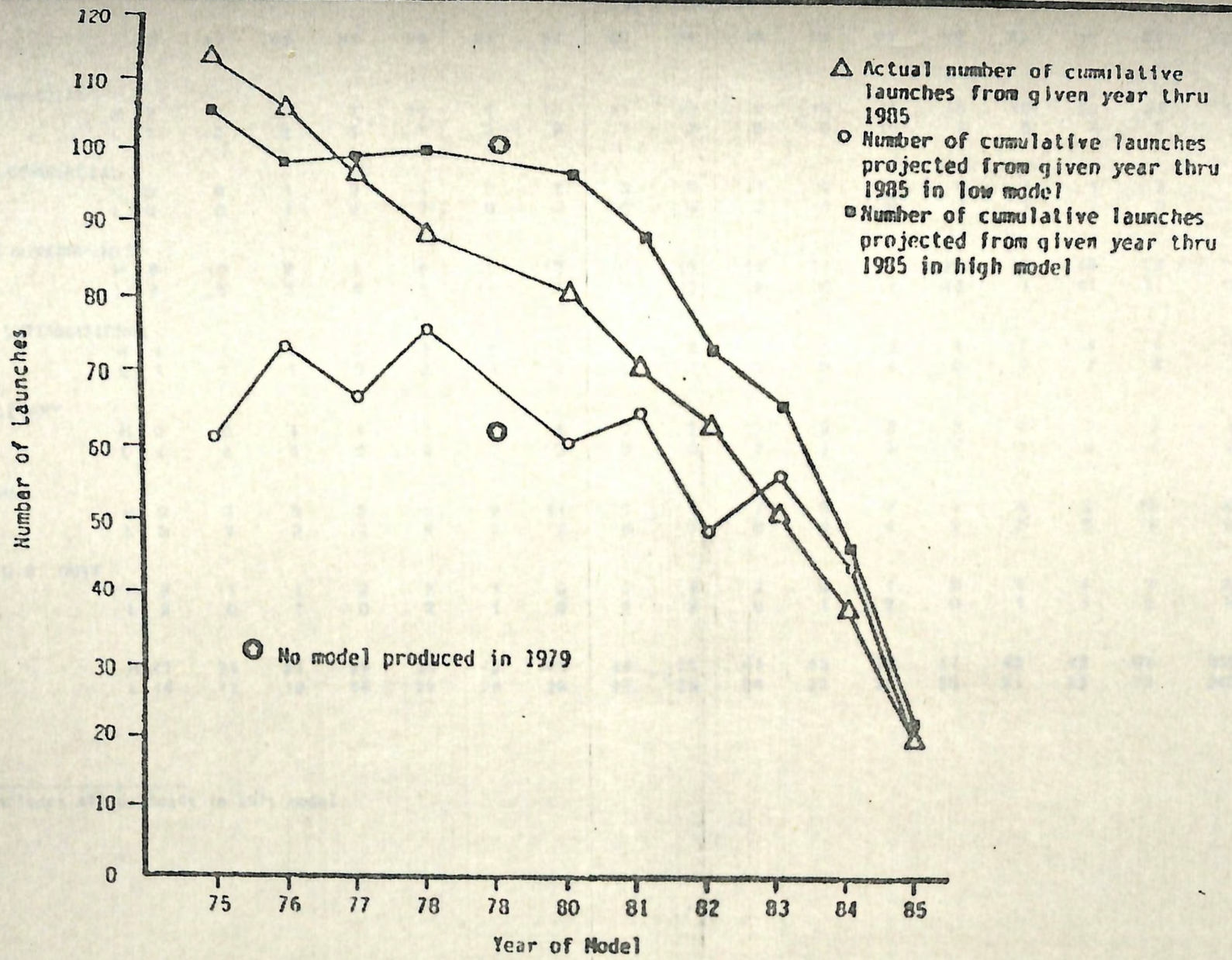


FIGURE 4.2

TABLE 5. PAYLOAD DEMAND BY SPONSOR TYPE(1)

		LAUNCH SCHEDULE																
		86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	TOTAL
C U.S. COMMERCIAL	H	2	3	3	7	11	8	10	11	13	9	15	11	10	18	20	23	174
	L	2	2	2	1	7	8	9	7	2	5	6	10	4	5	4	7	81
F FOREIGN COMMERCIAL	H	0	0	1	2	1	0	1	3	0	1	0	0	3	1	1	2	16
	L	0	0	1	2	1	0	0	0	0	2	1	0	3	2	1	2	15
G FOREIGN GOVERNMENTS	H	8	10	9	9	16	18	16	16	16	19	21	17	25	18	19	22	257
	L	8	5	8	4	9	11	7	7	13	8	10	14	13	7	11	11	148
I GLOBAL INTERNATIONAL	H	1	1	1	5	2	5	4	2	2	1	0	1	1	2	4	4	38
	L	1	1	1	3	2	3	4	2	1	1	0	1	0	3	2	3	28
M DOD/MILITARY	H	3	6	1	1	3	1	4	3	2	2	2	3	3	0	1	2	37
	L	1	2	3	0	4	3	3	3	0	2	1	3	1	1	0	2	29
R REGIONAL	H	0	3	5	3	4	9	11	7	4	7	5	3	5	4	3	12	85
	L	0	2	3	4	4	2	3	6	7	6	4	4	2	2	3	2	54
U OTHER U.S. GOVT	H	3	1	1	2	2	1	0	2	1	2	0	1	0	1	1	2	20
	L	2	0	1	0	2	1	0	2	2	0	1	2	0	1	1	0	15
TOTAL	H	17	24	21	29	39	42	46	44	38	41	43	36	47	42	49	67	625
	L	14	12	19	14	29	28	26	27	25	24	23	34	23	21	22	27	368

(1) Includes all payloads in this model.

FIGURE 4.3

FIGURE 4.4

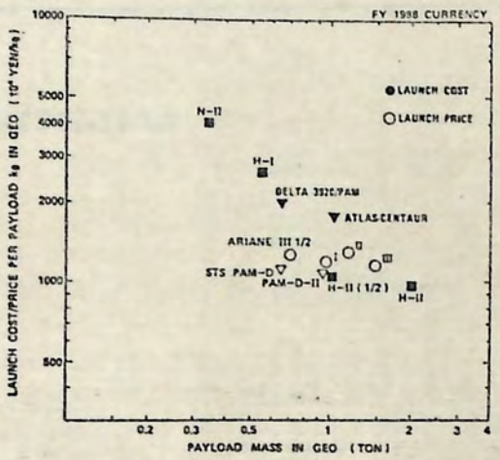
PAYLOAD DEMAND BY SPONSOR TYPE

LAUNCH SCHEDULE

		86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	TOTAL
U.S. COMMERCIAL	H	2	3	3	7	11	8	10	11	13	9	15	11	10	18	20	23	174
	L	2	2	2	1	7	8	9	7	2	5	6	10	4	5	4	7	81
FOREIGN COMMERCIAL	H	0	0	1	2	1	0	1	3	0	1	0	0	3	1	1	2	16
	L	0	0	1	2	1	0	0	0	0	2	1	0	3	2	1	2	15
FOREIGN GOVERNMENTS	H	8	10	8	9	16	18	18	18	18	19	21	17	25	18	19	22	257
	L	8	5	6	4	9	11	7	7	13	8	10	14	13	7	11	11	140
GLOBAL INTERNATIONAL	H	1	1	1	3	2	5	4	2	2	1	0	1	1	2	4	4	30
	L	1	1	1	3	2	3	4	2	1	1	0	1	0	3	2	3	28
DOD/MILITARY	H	3	0	1	1	3	1	4	3	2	2	2	3	3	0	1	2	37
	L	1	2	3	0	4	3	3	3	0	2	1	3	1	1	0	2	29
REGIONAL	H	0	3	3	3	4	9	11	7	4	7	5	3	5	4	3	12	85
	L	0	2	3	4	4	2	3	0	7	8	4	4	2	2	3	2	54
OTHER U.S. GOVT	H	3	1	1	2	2	1	0	2	1	2	0	1	0	1	1	2	30
	L	2	0	1	0	2	1	0	2	2	0	1	2	0	1	1	0	15
ALL	H	17	24	31	29	39	42	48	44	38	41	43	36	47	42	49	67	625
	L	14	12	18	14	29	28	26	27	25	24	23	34	23	21	22	27	368

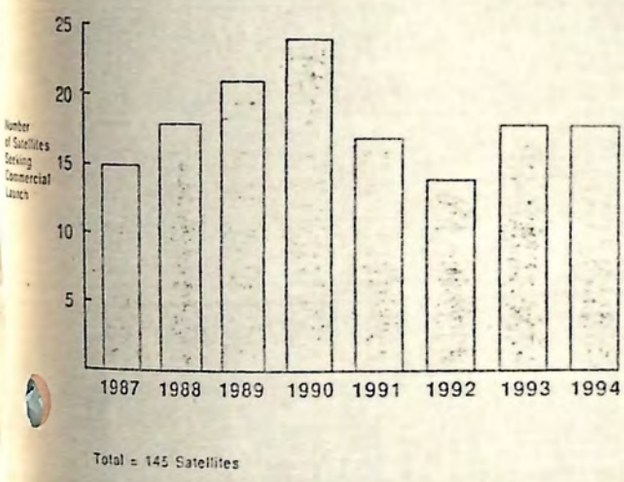
(NASA)

LAUNCH COST/PRICE COMPARISON



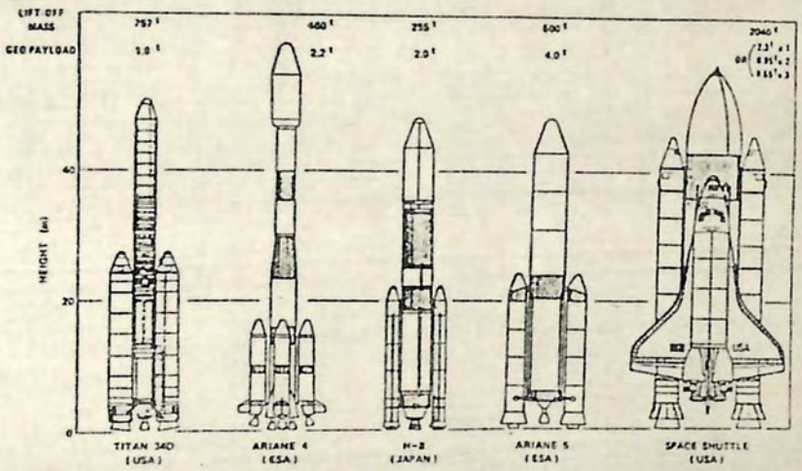
(National Space Development Agency of Japan)

COMMERCIAL LAUNCH DEMAND 1987-94



(Martin Marietta)

LAUNCH VEHICLES IN THE '90s



(National Space Development Agency of Japan)