



UNIVERSITY OF
SASKATCHEWAN

Briefing Document

Institute of Space and Atmospheric Studies

A Research Unit within Department of Physics
and Engineering Physics

University of Saskatchewan

www.artsandscience.usask.ca/physics/isas

2012/13

Updates Alan Manson ISAS Exec-Sec
E.g. Items may be new or gone

Nov 22, 2012

Station
300
Shuttle
200
Sounding Rocket
Aurora
Meteor
100
Noctilucent Clouds
Balloon
50
10
Airliner
Mount Ev

MF

Institute of Space and Atmospheric Studies (ISAS)

Providing National and International Leadership in Research

“Atmospheric Environment”¹

Atmospheric Processes: radiation, chemistry, dynamics, **global coupling**

“Climate Change” : Anthropogenic and Solar Forcings

“Space Environment”²

Solar-Terrestrial Coupling Magnetosphere-Ionosphere

Geospace Knowledge: “Space Weather” “Space Climate”

Programs guided by CSA Workshops/Events of 2005-12: Reports;

“10 Year Outlook for Solar Terrestrial & Atmospheric Sciences” [~2008]

Professors 1 Ted Llewellyn [E] Alan Manson [E] Doug Degenstein Adam Bourassa

2 George Sofko [E] Sasha Koustov Glenn Hussey Kathryn McWilliams

1 & 2 Jean-Pierre St.-Maurice CRC

ISAS Community

Activities guided by:

MISSION STATEMENT

- ◆ Research Local/Regional National /Continental Global/Planetary
- ◆ Knowledge Understanding Technology (“hard” “soft”)
- ◆ Training Students PDF/Scientists Engineers Collaborative
- ◆ Technology Transfer People Ideas CSA-contracts/-Space Technology
- ◆ Communications Papers [peer review] CSA/NRCan/EC Media Community
- ◆ Linkages Collaborations
CSA-SS EC-AS&T **EC-MS** GSC-NRCan NSERC

ADVISORY COMMITTEE

- ◆ Govt Agencies and Depts, Local Space Industry, UofS Admin

• Space Environment / Solar-Terrestrial Science

Ionosphere Thermosphere Magnetosphere

- Solar variability and solar wind
- Magnetospheric responses and processes, space plasmas
- Linkages with the ionosphere and thermosphere: ionospheric velocity and electric field patterns, voltage maps, aurora

Geospace Monitoring

- *Ground-based observations* full temporal resolution networks
- *Space-based observations* full global coverage limited temporal resolution
- *Models, data assimilation*

Space Weather and Climate: Influences upon space vehicles; communications and remote sensing; ground-based energy distribution systems; solar influences upon climate; presence in the Arctic

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Atmospheric Environment/Science

Lower and Middle Atmosphere (2-100km)

- Global distributions of Green Houses Gases (GHG) eg. ozone, minor constituents, and aerosols
- Sources and sinks of atmospheric constituents: chemical, thermal and dynamical processes
- Dynamical processes: winds and planetary, gravity and tidal waves
- Linkages between chemistry and dynamics; **Teleconnection-processes**

Observations Monitoring

- | | | |
|------------------------------------|--------------------------|-----------------------------|
| • <i>Ground-based observations</i> | full temporal resolution | networks |
| • <i>Space-based observations</i> | full global coverage | limited temporal resolution |
| • <i>Models, data assimilation</i> | | |

Atmospheric Processes of Climate and its Change:

changes to biosphere, urban and agricultural environments; anthropogenic effects; solar forcings; Canadian Arctic [presence and environment]

ISAS Resources: 1. Personnel

6 Professors ¹ - Principal Investigators + 3 Research Professors (Emeritus)

2 Adjunct Professors

9 Research Staff: 4 Research Associates and 5 Research Engineers

6 PhD Graduate Students

5 MSc Graduate Students

ISAS Support Staff

Bill Marshall

Technician: optics /electronics lab. supervision, system/site maintenance, system development

Cindy Jelinski

Clerical: personnel, web manager, text-graphics, communications...Plus

Admin: stores, accounts, space, conferences

1 Including CRC Chair in "Environmental Sciences"; **not including** salary-line for Prof Manson

PEP-ISAS Resources: 2. Professors

3 Emeritus 2 “senior” 2 “middle-”, 2 “early-career”

* Expertise match **PEP undergraduate needs**

- Engineering Physics
- Honours (Math- Physics, Comp- Physics)

* Research themes match **Canadian priorities**

- CSA/EC/NRCan/**CRC-gone** \$ bridging opportunities

* Research activities match **Graduate Student & Career Development Needs**

- Information Technology and Telecommunications
- Space Research / Technology
- Environmental Science / Technology

Strong Professorial strength in ISAS is appropriate

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Airliner
Mount Ev (6.35 km)

ISAS Resources: 3. Systems

A. Existing

General Equipment (test, laboratory)		\$ 290K
VHF radar (Sapphire)		\$ 500K
HF radar (SuperDARN)		\$1200K
SuperDARN (PolarDARN) [Geospace Monitoring]	CFI	\$1200K
Network for Northern Studies (CANDAC- PEARL)	CFI	\$ 8M+
MF radar systems (4) plus Eureka-Meteor Radar		\$1200K
Odin-OSIRIS Satellite		\$ 25M+
Computer systems (incl. work stations)		\$ 300K

	TOTAL	\$4690K+\$M

NB Other infrastructure Odin software systems: 2013
 \$2000K invested (CSA contracts)

B. Future (will appear in NSERC grant applications, or within CSA programs)

- ◆ Second generation "OSIRIS" systems \$ M
- ◆ Atmospheric Sciences Global Change Missions \$ M
- Upgrade to ISAS test equipment \$50K

TOTAL \$ M

ISAS Resources: 4. Infrastructure

- Development Laboratories¹²³⁴
- Field Sites¹²³⁵ Park Site (MF radar); Kernen (SuperDARN radar); Physics Roof (Optical); Bakker's Farm (VHF radar); Rabbit Lake (Optical); Platteville, Colorado (MF radar); Tromsø, Norway (MF radar); Prince George BC (PolarDARN); Rankin In. & Clyde River⁵, Nunavut (2 PolarDARN); CANDAC-PEARL (SKiYMET radar), Eureka, Ellesmere Is
- Computers¹ PC Workstations (HP-C200, -7151; IBM; OSIRIS-systems²), Alpha-server 1000², SuperDARN Data-Copy Centre

- Support Staff Administration³
Finances³
Stores³
Technical¹³
¹NSERC ²CSA ³Uof S ⁴CFI ⁵RISR-C

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Airliner
Mount Everest (8.85 km)

ISAS Resources: 5. 2011/12 Grants / Contracts/CRC/In Kind:UofS

Station	NSERC	MRS (SuperDARN e-POP)	\$136 K	
		IPY-Collab	\$28 K	
Shuttle		Discovery Grants	\$323 K	<u>\$487 K (total)</u>
	CFCAS	CANDAC-PEARL	\$11 K	<u>\$ 11 K (total)</u>
	CFI	Optics Lab	\$190 K	
		RISR-Resolute Bay,	\$1,000 K	<u>\$1,190 K (total)</u>
Sounding	CSA	Odin-OSIRIS etc.	\$400 K	
Aurora		CGSM/PolarDARN	\$200 K	
Meteor		SSEP, FAST Grants	\$16 K	<u>\$ 616 K (total)</u>
	CRC	Chair (CRC, UofS, Sask)	<u>\$ K</u>	<u>\$ NA K (total)</u>
Noctilucent Clouds				<u>\$ 2,304 K (sub total)</u>
Balloon	Uof S	ISAS Budget (+ Contracts)	\$ 44 K (+\$15K)	
		Offices-Labs Infrastructure	\$414 K	
		6 Profs	\$676 K	<u>\$1,149 K (sub total)</u>
Airliner				<u>\$ 3.45 M Total</u>
Mount Ev				

ISAS Resources: 6. 2012/13 Grants / Contracts/CRC/In Kind:UofS

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NSERC

MRS
(SuperDARN e-POP)
IPY-Collab
Discovery Grants

\$136 K
-- Fini
\$225 K

\$361K (total)

CFCAS
CFI

CANDAC-PEARL
Optics Lab
RISR-Resolute Bay,
Odin-OSIRIS etc.

--
No New Prof
\$1,000 K

Fini-Govt

\$1,000 K (total)

CSA

CGSM/PolarDARN
FAST Grant

\$400 K
\$200 K
\$158 K

\$ 758 K (total)

CRC

Chair (CRC, UofS, Sask)

\$ K

\$ NA K (total)

Uof S

ISAS Budget (+ Contracts)
Offices-Labs Infrastructure
6 Profs_{MF}

\$ 44 K (+\$15K)
\$414 K
\$676 K

\$ 2,119K (sub total)

\$1,149 K (sub total)

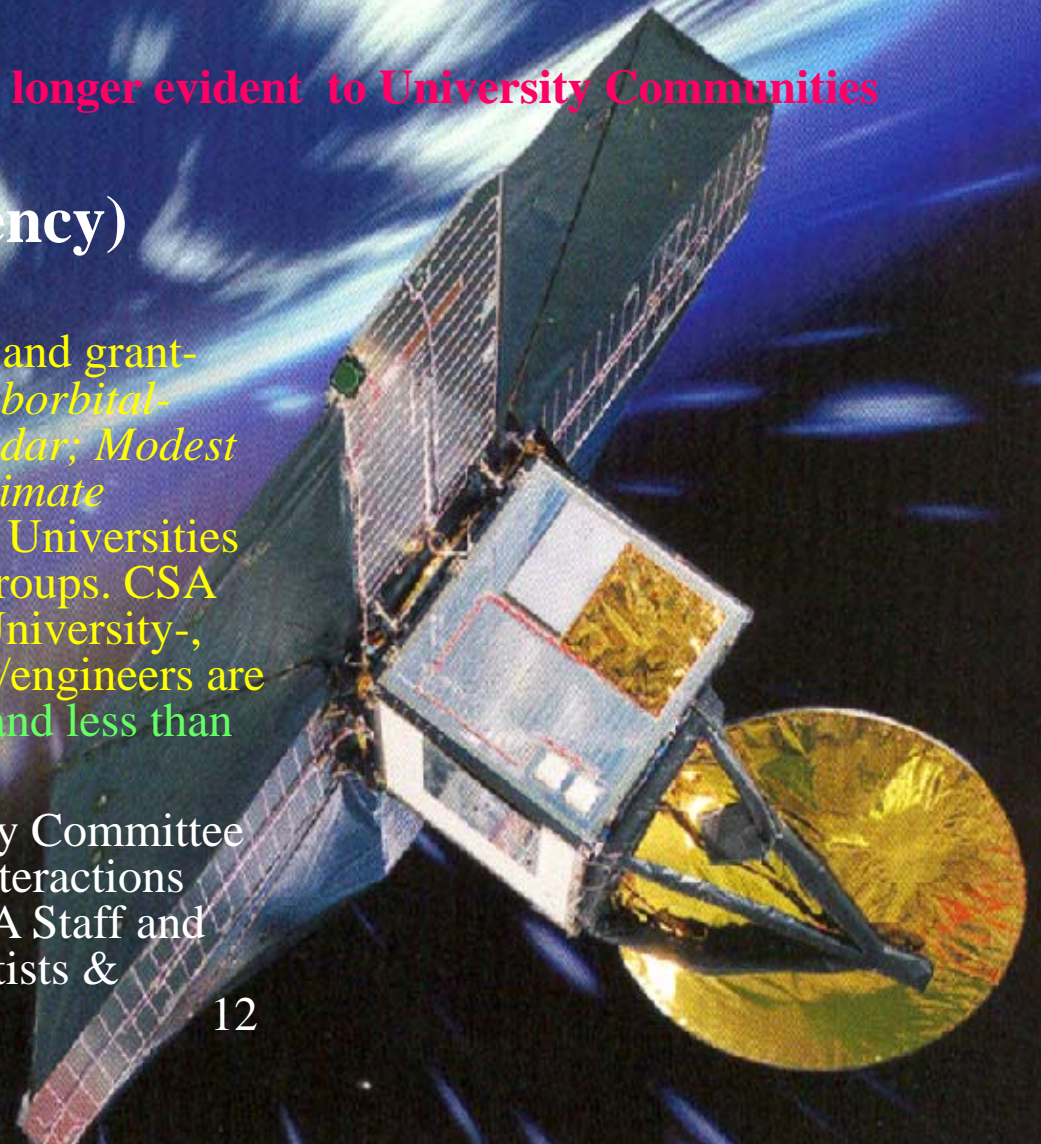
\$ 3.27M Total

NSERC (Natural Sciences and Engineering Research Council)

- Provides a variety of Programmatic/Grant-like opportunities...beyond DG Grants, scientific-goals, methodology, now set by Federal Govt in concert with any existing Govt Agencies/Depts.
- Collaborations with the CSA no longer evident to University Communities

CSA (Canadian Space Agency)

- Provides a modest variety of contract and grant-like opportunities: *System-Studies; Suborbital-systems/studies; ISR (US-Canada) Radar; Modest systems on International Missions, Climate Processes Missions*. Interactions with Universities modest; but effective with Mission-Groups. CSA events [information, discussion] for University-, Space Company- and Govt- scientists/engineers are provided. Budget for CSA is modest and less than community capability.
- Some of above resulted from Advisory Committee (1990-2007) recommendations and interactions (community workshops) between CSA Staff and University/Industry Professors, Scientists & Engineers.



ISAS Research: Future Systems/Programs

Profs inputs...Nov 19 2012

ATMOSPHERIC Chemistry Dynamics Thermodynamics Pollution

- **Odin-OSIRIS (2001)** & Terra-MOPITT Satellites⁴, Operations-Science^{2,4} 2008-13
- MOPITT campaigns / **ground - based OSIRIS^{2,4}** 2006-13
- CSA's SCI-SAT **ACE (2003)^{4,2}** collaborations **validations** 2008-13
- **CMAM atmospheric model, DAS^{2,3,4,5}** (data assimilation, modeling) **limited.**
- NASA TIMED (2001) satellite + ground-based programs² 2008-13
- **Chinook SWIFT-ARGO Mission^{2,4}** Possible Delayed
- Canada's Contribution to **SCOSTEP's CAWSES (Climate And Weather of Sun-Earth System) II** [2009 – 2013+ ²¹] and CEDAR² **Profs with NSERC-DG**
- **“Polar Environment Atmospheric Research Lab”^{6,5,2,3,4}**, CANDAC at Eureka, 80N, with SKIYMET VHF radar 2006-13, Hemispheric collaborations/**CCAR ?**
- **STEP-APOCC (Atmospheric Processes of Climate and its Change, 2006-15)^{4,2,5,3}** Mission Concept Study ^{7,8} 2008/9 **Possible Joint Missions Delays**

² NSERC

³ EC (AS&T & MSC)

⁴ CSA

⁵ CFCAS-Gone 2012

⁶ CFI

⁷ GSC-NRCan

⁸ Bristol Aerospace other Companies

Cont'd.

ISAS Research Futures (Continued)

AHM+ KMcW comments...Nov 19 2012

GEOSPACE Ionosphere Magnetosphere Aurorae Solar
Processes

- SuperDARN operation and growth^{2,4,6} 2006-13
- GeoSpace Monitoring/ SuperDARN (+PolarDARN)^{6,4,2,7} / CADI^{2,4} 1999 – 2012 [Dec]
- Operations of “RISR-C” at Resolute Bay^{2,4,6} 2010-2014
- CSA e-POP satellite^{4,2} 2006-14
- ESA-SWARM⁴
- THEMIS (gb CSA) Kuafu ‘ORBITALS’^{4,2} 2012 No \$ “New Management”
- ILWS Program unknown

² NSERC

³ EC (AS&T)

⁴ CSA

⁶ CFI+Sask

⁷ NRCan

Challenges and Opportunities for 2012-2013

➤ **Enrich and expand scope of “Solar Terrestrial and Atmospheric Science” Research (ISAS)** *Comments in Green from briefed -ALanM March 3, 2013*

- Department, College and University levels; inherent multi-/inter-disciplinarity
- Engagement with the SENS and GIWS; Global Change...
- Agency linkages: CSA EC[MSC-AS&T] NRCan-GSC CRC-gone Defence R&D
- Linkages with Canadian Universities, Communities and Space-Industries

➤ **Optimize activities with CRC Chair:** “Solar-Terrestrial Environment”; “Atmospheric Environment”; Environmental Research within UofS, GIWS and SENS.

- “Space Weather” and “Processes of Climate and its Change”
 - Links with Biology, Geological Sciences, Geography, Agriculture, Engineering
- Ongoing

➤ **Professors, the heart of ISAS**

- Hire an Atmospheric Science Professor ~2016 [no salary line for Prof Manson]
- Consistency with Department (Physics and Engineering Physics) and College.

➤ **Response to Serendipity** *Cont...but some trends are not good*

Appendix 1 ISAS Resources (Summary)

Personnel 33: 6 (+1) Professors, 3 Emeritus/ISAS Research Professors, 2 Adjuncts, 9 RA/Res. Engineers, 11 Grad Students, 2 Support-Staff

Systems Radars (MF, HF, VHF, UHF) Odin-OSIRIS Satellite
Optical-systems (ground, atmosphere) Computers
SuperDARN PolarDARN SKiYMET RISR \$4700K+\$ M

Infrastructure Field sites: Saskatchewan, Canada, International
Development Laboratories Computer-systems

Financial \$ 2.36 M 2011/12 NSERC CSA UofS Grants/Contracts
\$ 2.18 M 2012/13