Montreal / Ottawa Chapter

Chantal Boucher, Vice President, Americas

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Thuva Senthilnathan, Chapter President

Chapter Officers: Michel Dion, Guy Bernard, Andy Sayer, François Gagnon, Adem Turdogan

Wesley Reid, Chapter Vice-President

Ken Swartz, Chapter Publicity Director

Mathieu Béland, Chapter Education Director

Edith Richard, Chapter Treasurer

Jeremy Schembri, Chapter Secretary

Martin Landry, Chapter Membership Director

Maxime Lapalme, Chapter Web Director
Our Mission

Increase interest in vertical flight across Canada
Create a platform to facilitate networking & collaboration
Provide learning opportunities through exclusive conferences

Join us and reach out if you want to be more involved in the community!
Today’s Event: Vertical Flight Agricultural Operations

Ken Swartz, Senior Editor, Vertiflite magazine and the Electric VTOL News

Wesley Reid, Lead Product Manager, Dart Aerospace

Mozhdeh Shahbazi, Applied Science Manager and University Professor, Centre de géomatique du Québec

Gil Weisman, Technical Director, Drone DesChamps

Nicolas DesChamps, Founder, Drone DesChamps
Ken Swartz
Agricultural Rotorcraft in Canada
A Brief Visual History

By
Kenneth I. Swartz
Aeromedia Communications
VFS Board Member
VFS Senior Editor – Vertiflite Magazine
June 1, 2021
Canadian Aviation at a Glance

• Canadian Aviation Market Today
  • 36,873 registered aircraft (2nd largest fleet in world)
    • 29,604 Private
    • 7,121 Commercial

  • 2,878 registered helicopters (2nd largest fleet in world)
    • 1,737 Commercial
    • 1,063 Private
    • 67 State

• Aerial Application Industry
  • Approximately 500 aircraft (80%+ fixed-wing)
  • Commercial Operators
  • Aircraft manufacturers. (i.e. Bell, Diamond)
  • Technology Developers (AG-NAV, Dart, Forest Protection Ltd)
Agricultural Aviation in Canada
Historical Perspective

- First fixed-wing Forestry ‘dusting’ ops in 1920s
- First autogyro use in 1930s – Leavens Brothers
- First helicopter use in 1947
  - First seven imported Bell were for “agriculture”
  - Not a profitable business

- Modest Canadian Market
  - 20+ helicopters for agriculture (apples, corn, etc.)
  - 30+ helicopters for forestry on contract basis
  - Continual innovation – chemicals & technology
1931 - Fairchild Aircraft of Canada
Pitcairn PCA-2 CF-ARO
1932 - Leavens Brothers Air Service
Pitcairn PAA-1 Autogiro CF-ASQ
Helicopter History

• First Civil helicopters were certified in 1946
• Bell 47 marketed for aerial application use
  • Won large scale locust control contract in Argentina in 1947-1948
• First 7 Bell 47B-3s imported in 1947 had “ag kits”
  • Ontario, Manitoba & BC
  • Hazardous, short season and unprofitable
  • Quickly needed to find higher quality customers
• Primary Canadian helicopter use was in remote areas
  • More profitable but seasonal
  • Geological & topographic survey, mineral & petroleum exploration, forestry, construction, hydrographic.
Helicopter History

• First spray boom use was in BC in 1949 to melt lake ice

• Pioneering Market Segments
  • Powerline right-a-ways
  • Military bases (subsequent law suits)
  • Forest management (fertilizer, aerial seeding, pest infestations)
  • Agriculture (apples, etc.)
  • Mosquito control (Fraser River & Red River floods) & Moths (Gipsy Moth)

• Large scale Canadian budworm aerial spraying programs in 1950-70s
  • Up to 125 fixed-wing Stearman aircraft and only one SAR helicopter
  • Later Grumman Avenger and today Air Tractor AF-802

• High Power to Weight Operating Requirements
  • First turbine helicopter use was Alouette II in 1959
  • JetRanger, Hughes 500, Hiller FH1100, Alouette, Lama

• World Health Program – West Africa – River Blindness in 1980s
  • 20+ Canadian helicopters and fixed-wing aircraft on contract
1947 – Dusting Locusts – Argentina
Bell 47B-3
1947 - Photographic Survey Company
Bell 47B-3 – CF-FJA – Lemington, ON
1947 – Okanagan Air Service
Bell 47B-3 – CF-FZX - BC
1947 – Okanagan Air Service
Bell 47B-3 – CF-FZX - BC
1948 – Kaman Helicopters
K-225 Visits Toronto on Demo
1950 – Sikorsky
S-51 demo Forest Protection Ltd.
1950s
Hiller 360 – “Aerial Fogging”
1959 - Sud Aviation SE313 Alouette II
Ontario Hydro – Replace two Bell 47s
1960s - Okanagan Helicopters
Bell 47 & Hiller FH1100
1979 – Okanagan Helicopters
Bell 206B JetRanger
1970s – Bell 47 Conversions
Texas Aviation M74 Wasp
1980s – Okanagan Helicopters
Soloy-Hiller UH-12EJ3 (250-C20)
1980s – Soloy-Hiller UH-12EJ5 Allison 250-C20B Engine Installation
1989 – Canadian Helicopters
Bell 206B – Squamish, BC
1989 – Canadian Helicopters
Bell 206B – Squamish, BC
Canadian Aerial Agricultural Today
Fixed-Wing & Helicopter Aircraft – May 2021

• Air Tractor (all models) 194*
• Cessna 188 54
• Grumman G-164 11
• Pezetel M18 12
• Piper PA-25 69
• Piper PA36 7
• Thrush/Ayes S2R 74
• **Subtotal Fixed-Wing** 421
• Delete Firefighting -39
• **Total Fixed-Wing** 381
• Full Time Helicopters 50 12% of fleet
• **Grand Total** 431

*Includes 39 firefighting Air Tractor AT-802 & Fire Boss with Conair, Buffalo Airways & FPL
Canadian Market Segments

• Demand
  • Global demand and price of commodities
  • Apples, corn, wheat, soybean, potatoes

• Applications
  • Herbicides, Fungicides, Fertilizers, Pesticides, Biological bug-killing agents (larvicide), crop drying (fruit trees, i.e. cherry’s)

• Challenges
  • Maximum gross weight ops, High density altitudes, Unmarked Obstacles, Protected areas
  • Skilled manpower
  • Highly Regulated

• New Tools
  • GPS Guidance & Mapping Tools
2013 – Helico Service - Rougemont Bell 47G-4A – Apple Orchards
2013 – Helico Service – Rougemont
Air Tractor AT-802 – Apple Orchards
2013 – GDG Environnement Ltée
Bell 206B – BTI Mosquito Larvicide
2012 – Aerial Growth Management
Robinson R44
2012 – Aerial Growth Management
Robinson R44
2013 – Apex Helicopters
Robinson R44 - Fungicides
2013 – Apex Helicopters
Robinson R44 - Fungicides
2013 – Bi-Air Application Services
Hiller UH-12EJ3
2013 – Western Aerial Applicators
Hiller UH-12J3
2003 – Western Aerial Applicators SA 315B Lama - Forestry
2005 – Western Aerial Applicators
SA 315B Lama - Forestry
Bonus
Swiss SA 315B Lama

By
Pierre Gillard
2009 - Air Glaciers - Switzerland
SA315B Lama
2009 - Air Glaciers - Switzerland
SA315B Lama
2009 - Air Glaciers - Switzerland
SA315B Lama
2009 - Air Glaciers - Switzerland
SA315B Lama
Wesley Reid
AGRICULTURAL SPRAY SYSTEMS

75 Years of World leading performance
DART AEROSPACE
COMPANY OVERVIEW

Leader in Helicopter Mission Equipment, Parts & Tools

Founded in 1975

320+ employees

1,100+ STCs

7 Centers Of Excellence
SIMPLEX COMPANY OVERVIEW

- Founded in 1946 to develop Aviation Mission Equipment
- Acquired by DART Aerospace in 2019
- 6,000+ Certified Systems Operating Worldwide
  - ≈2/3 in spraying applications
- Largest fleet of Aerial Firefighting systems in operation worldwide
- 70% of Rotorcraft spraying market worldwide
- 90% of Rotorcraft firefighting market worldwide
- 95% of Rotorcraft firefighting of government agencies performing firefighting
### Spray System Pedigree

#### Federal Aviation Agency

<table>
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<tr>
<th>Supplemental Type Certificate</th>
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<tr>
<td><strong>1. Name and Address of Applicant</strong></td>
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<tr>
<td>Simplex Manufacturing Company</td>
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<tr>
<td>2924 N.W. 12th Avenue</td>
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<td>Portland, Oregon</td>
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<td><strong>2. Supplemental Type Certificate Applied For:</strong></td>
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<td></td>
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<tr>
<td><strong>3. Description of Change</strong></td>
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<tr>
<td>Installation of 1 ½-inch Simplex Spray Pump in accordance with Simplex Manufacturing Company Installation Instructions No. SMC-II-2 dated December 15, 1960.</td>
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**Limitation of Applicability:** This approval should not be extended to other specific helicopters of these models on which other previously approved modifications are incorporated unless it is determined that the interrelationship between this change and any of those other previously approved modifications will introduce no adverse effect upon the airworthiness of that helicopter.

Certification Basis: CAR 8.

#### Bell-47 STC Issued in 1960 – Market Leading Product for 50+ Years

Tanks in service up until @ least 2018
Over 4000 spray systems in operation worldwide
Covering 40 models
CURRENT MODELS & AIRCRAFT COMPATIBILITY

Agricultural Spray Product Line

Model 204 ....................................................... Bell 212
Model 208 ....................................................... Bell 407
Model 210 ....................................................... Airbus 350 & 355 Series, H125
Model 244 ....................................................... Robinson R44
Model 266 ....................................................... Robinson R66
Model 4900 ....................................................... Bell 206 A&B Garlick OH-58 Series
Model 5100 ....................................................... Airbus 350 B, C, D
Model 7900 ....................................................... Bell 206 L Series
Model 8500 ....................................................... Hughes 369 Series, MD 500 N
Model 1090 ....................................................... Ka-32
Figure 1: Model 266 Spray System Installation
FEATURES & BENEFITS

- Certified systems and parts
  - FAA, EASA, TCCA, JCAB, DGAC, etc…
- Systems designed for quick installation and removal (30 minutes)
- Ground fill provisions built into tank
- Safety features include emergency jettison dump doors and pump stop controls
- Aerodynamic design results in low drag
- High capacity
- GPS and Flow Control system compatible
TANK ASSEMBLY

- Constructed of light-weight, high-strength, carbon or glass fiber composite
- Corrosion and fatigue resistant, built to last
- Internal baffles reduce ‘sloshing’ and CG shifts
- Aerodynamic design results in low drag
- Aviation grade hardware
- Access panels provide easy accessibility for quick cleaning and maintenance
What makes a good spraying machine?

- **Payload**
  - MTOW – Empty weight – tank/pilot/fuel = chemical capacity

- **Ground clearance**
  - Space required for certification
  - Need thickness for a tank + booms

- **Compatibility with existing operations**
  - Can be transported by truck
  - Can be refilled on a trailer

- **Economics**
  - AG spray is a very competitive business
  - Aircraft acquisition cost
  - Aircraft operating cost

- **Fleet size**
  - Large installed fleet → lower cost + larger market
THANKS FOR YOUR ATTENTION
Mozhdeh Shahbazi
Precision agriculture & Visual intelligence

Mozhdeh Shahbazi, PEng, PhD

Photogrammetry Tech-Access Center- CGQ
About CGQ
Main Mission

Facilitating geospatial innovation in enterprises and organizations via applied research-and-development

- A Quebecois CCTT specialized in geomatics, affiliated with Cegep de Chicoutimi
- A Canadian Tech-Access Center specialized in Photogrammetry, Computer Vision, Hydrography and Remote Sensing
Precision Farming

Optimization, Monitoring, Automation
- IT
- AI,
- sensors,
- robotics,
- drones,
- automated geo-localization,
- telematics
Sensors to perceive

Real-time processing / logging

Multi-spectral, Multi-dimensional Data Collection + Precise Navigation
Sensors to perceive
Sensors to perceive
Platforms for Data Collection
Vision-based navigation

@CGQ, UoF, INRS
Laser scanning and imaging

@CGQ, UofC, INRS
Laser scanning and imaging

@CGQ, UofC, INRS
Ground filtering

<table>
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<tr>
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<td>accuracy</td>
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<tr>
<td>sensitivity</td>
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<tr>
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<td>85.7</td>
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<tr>
<td>precision</td>
<td>19.5</td>
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</table>

@UoFC
Fuse data to solve problems

@Micasense
Fuse data to solve problems

- No-action composite image
- Simple-Shift composite image
Fuse data to solve problems

- Homography-based composite image
- Trifocal-based composite image
Fuse data to solve problems
Precision Agriculture

Plant counting using density regression network
Precision Agriculture

Plant counting
Precision Agriculture

Plant counting

@CGQ, Drone des Champs, UMoncton
Precision Agriculture

Leaf semantic segmentation

@CGQ, Drone des Champs, Ferme du domaine 2000 inc
Carte de la température des poireaux en relation avec le modèle numérique d’élévation.

Légende

Température des poireaux (deg C)
- 21
- 23.73
- 25
- 25.88
- 29

Modèle numérique d’élévation (m)
- 50
- 55

Données acquises et traitées par Mozhdeh Shahbazi
Utilisation de IA pour la segmentation
carte créée par Nathalie Thériault, 2021
Centre Géomatique du Québec (CGQ)
Precision Agriculture

Leaf-level thermal mapping

@CGQ, Drone des Champs, Ferme du domaine 2000 inc
Precision Agriculture

Map of chlorophyll index mNDblue over a DEM; only showing leek pixels of a healthy area.

Map of chlorophyll index mNDblue over a DEM; only showing leek pixels of a stressed area.
Prediction tools

Online tool for predicting favorable sites for picking wild blueberries
Other Environmental Studies

Macroalgae Classification
Other Environmental Studies

@ CGQ, Microdrones

White-tailed deer detection
Nicolas DesChamps
&
Gil Weisman
Drone Des Champs
Drone technology serving farmers
Our main business

Agri/environment

Construction – R&D

• Data collection and processing
• Liquid and solid spraying
• Dedicated application
A 360° business model for farmers
Spraying operations in Sri-Lanka

3 months mission.
Spraying fertilizer above tea plantations

Goal: replace backpack spraying.

Spraying operations in Costa-Rica

1 year mission,
spraying pesticide above
bananas, sugar cane, pineapple and other fruit trees.

Goal: to spray where planes cannot go (close to rivers, villages, road)
DRONE IN AGRICULTURE Pros & Cons

Many economical and ecological gains:
- Cheap
- Easy to implement
- Ideal for hard-to-reach areas
- Ideal for operations requiring lot of manpower
- Ecological (targeted spraying)

Few technical or legal hurdles:
- Technical challenges necessitate a lot of planning and organization (Battery life, flight time)
- Low daily workload
- Complex regulation (airspace, environnement, etc)
- Customer's lack of knowledge of the drone potential
Regulation in Canada

**Federal**

Transport Canada

Regulation for all Drone operations

Santé Canada

ARLA / PMRA Pest Management Regulatory Agency
In collaboration with the product manufacturer

**Province**

Québec

Application rules (ie: MELCC in Quebec)
New topics:

- BVLOS long distance operations
- BVLOS autonomous drones
- drone swarm
Pesticide application framework

All pesticides must be:

- authorized by Health Canada
- Used according to the instruction label
Pesticide application framework

Permit and certificate regulations:

• Permit and certificate regulation for sales and use of pesticide
• Pesticide management code

<table>
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Foreign experience

Sri-Lanka, Latin-America, other developing countries

Specific in Switzerland
THANK YOU

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