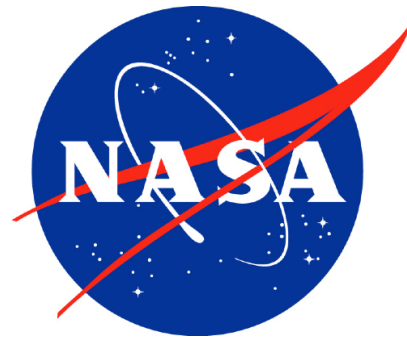# SnowEx Aircraft Selection Overview
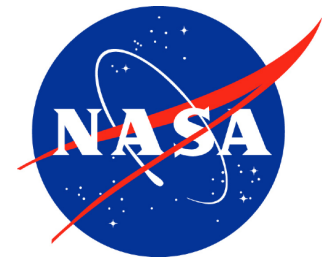
E. De Marco

March 28, 2016
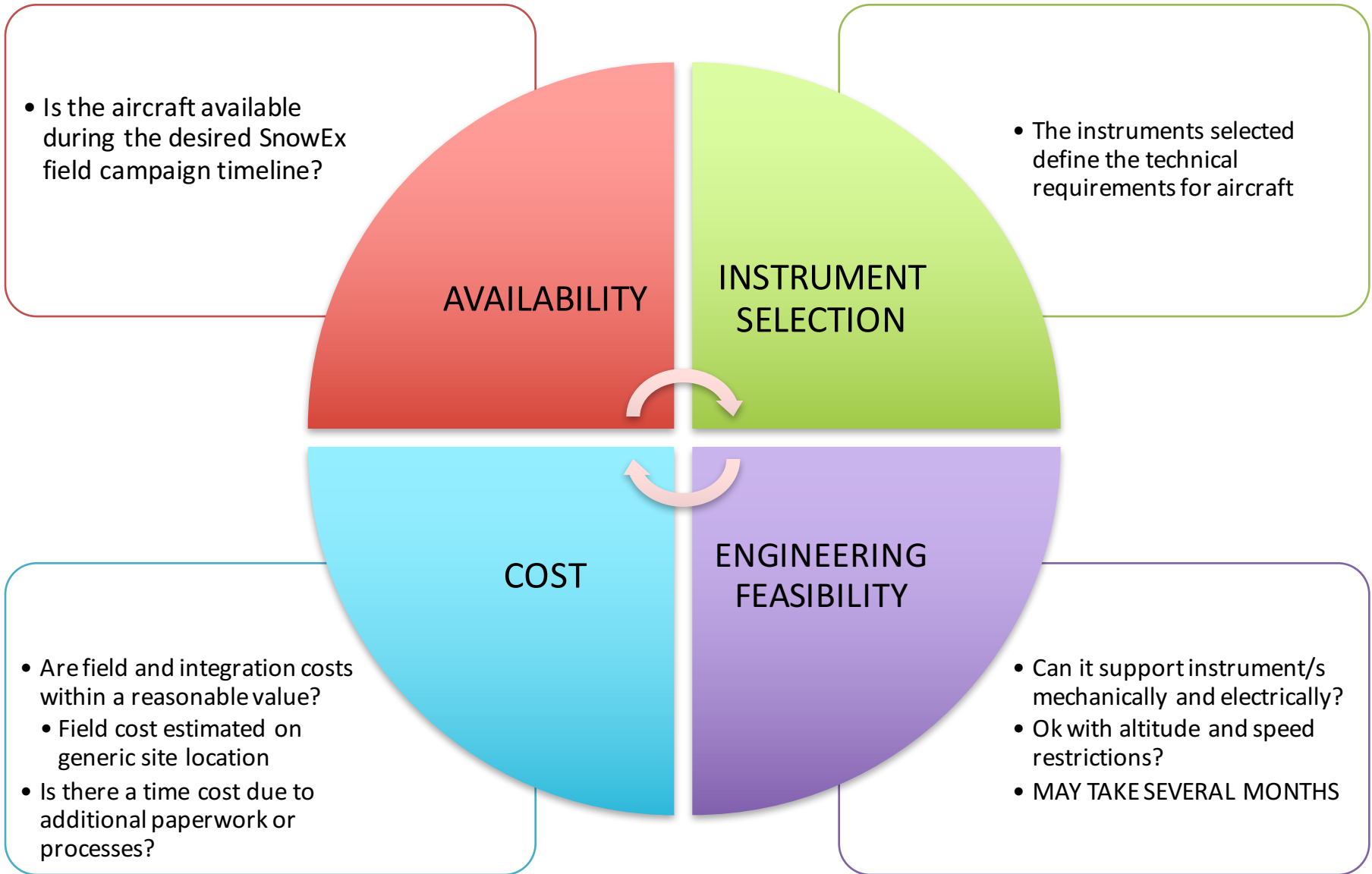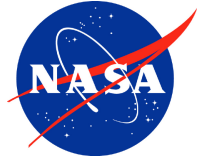
SnowEX WINTER 1

AIRCRAFT SUMMARY

E. De Marco

Aircraft Selection Process

- Is the aircraft available during the desired SnowEx field campaign timeline?

AVAILABILITY

INSTRUMENT SELECTION

- The instruments selected define the technical requirements for aircraft

COST

ENGINEERING FEASIBILITY

- Are field and integration costs within a reasonable value?
  - Field cost estimated on generic site location
- Is there a time cost due to additional paperwork or processes?

- Can it support instrument/s mechanically and electrically?
- Ok with altitude and speed restrictions?
- MAY TAKE SEVERAL MONTHS

Aircraft Criteria

- For each campaign, the following scenarios were considered:

1. **_FOR FALL:_**

    a. An aircraft that could fly up to two instruments (a LiDAR and a SAR) with a range of 3 - 4 hours at 10kft or higher.
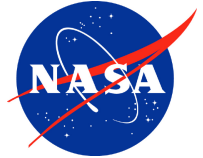
1. **_FOR SPRING:_**

    a. One large aircraft that could accommodate an instrument in the nose (CAR), one looking nadir (LiDAR), another looking nadir but outside the fuselage (AESMIR), and a side-looking port for the SAR. In addition, the aircraft should have close to an 8 hour range and be able to fly at various altitudes.

    b. Two aircraft, each holding two instruments. One holding the LiDAR and SAR (can be the same as the one used in the fall) and another holding CAR and AESMIR. Both aircraft should have a range of about 4 hours at various altitudes.

Aircraft Providers

- An extensive search for possible available aircraft has been conducted. The following providers were contacted with respect to their various aircraft:

    1. NASA (WFF, LaRC, AFRC, GRC)
    2. NOAA
    3. NCAR / NSF
    4. NRL
    5. Dynamic Aviation
    6. Ken Borek Air
    7. Twin Otter International

- Requirements used to qualify each aircraft were mostly driven by the (potential) instruments themselves (operating altitude range, speed range, power requirements, mechanical interfaces, FOV's ,etc) .

Fall ConOps Assumptions and Aircraft Options

FALL 2016						
ASSUMPTIONS						

Timeframe:	Oct-Nov 2016	**Risks:**			**Risk Severity**	
Science Hours	~50 (hours subject to change)	1. Aircraft Availability			L = low	
Time in Field	~4 weeks (duration subject to change)	2. Aircraft Engineering Complexity			M = medium	
Base of Operation	TBD, but somewhere in the US; assume Colorado for now; TBD location (THIS IS A PLACE SETTER ONLY. A final decision on location has NOT been made yet)	3. Aircraft Engineering Cost 4. Aircraft Field Deployment Cost 5. Aircraft Range			H = high	
Instruments	Science team is down-selecting, but the options are: 1.LVIS and/or ASO 2.SnowSAR					

AIRCRAFT SUMMARY							

AIRCRAFT	**AVAILABILITY**	**RISK GRADES**					
		1	**2**	**3**	**4**	**5**	
LaRC B-200	Yes; UC-12B is available	L	**L** (LVIS only) **H** (SnowSAR)	**L** (LVIS only) **H** (SnowSAR)	waiting on cost	good	
Dynamic Aviation (multiple aircraft)	In work - TBD	L	waiting	waiting	waiting on cost	good	
LaRC Cesna 206	Yes, specifically for SnowSAR. Looking into tech specs.	L	TBD	TBD	TBD		
TOI Twin Otter	Yes, may not work with all instruments	L	? -they didn't say	L	L	good	

Spring ConOps Assumptions and Aircraft Options

SPRING 2017						
ASSUMPTIONS						

Timeframe:	Feb-Mar 2017		Risks:		Risk Severity	
Science Hours	~100 (duration subject to change)		1. Aircraft Availability		L = low	
Time in Field	~4-5 weeks (duration subject to change)		2. Aircraft Engineering Complexity		M = medium	
Base of Operation	TBD, but somewhere in the US; assume Colorado for now; TBD location (THIS IS A PLACE SETTER ONLY. A final decision on location has NOT been made yet)		3. Aircraft Engineering Cost 4. Aircraft Field Deployment Cost 5. Aircraft Range		H = high	
Instruments	Instrument List: 1. SnowSAR 2. AESMIR 3. CAR 4. LVIS and/or ASO					

AIRCRAFT SUMMARY						

| AIRCRAFT	AVAILABILITY	RISK GRADES				
		1	2	3	4	5
NOAA P-3	NOAA is checking availability; will know beginning of Feb.	**M**	**H**	TBD	**L-M**	very good
WFF C-130	Shows availability on ASP schedule (may need to move maintenance); BUT: WFF resources and manpower are limited	**H**	**H**	**H**	**M-H**	very good
J-31	TBD	TBD	TBD	TBD	TBD	TBD
NRL P-3	Yes	TBD	TBD	TBD	TBD	very good
KBA Basler (or Twin Otter combo)	KBA is checking	TBD	TBD	TBD	TBD	TBD

Current Status for Winter 1
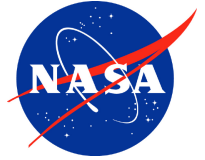
1. Fall 2016 (Oct-Nov)
   1. Still need to define aircraft. Cannot be done until:
      a. Commitment from LiDAR instruments is solidified.
      b. Engineering assessment for all fall instruments (SnowSAR / LVIS) must be completed before decision can be made. (ASO would fly on their own plane so assessment is not necessary).
2. Spring 2017 (Feb-Mar)
   1. Still need to define aircraft. Cannot be done until:
      a. Commitment from LiDAR projects can be obtained.
      b. Engineering assessment must be completed. For non-NASA aircraft options, interagency agreement paperwork must be completed in order to start the engineering assessment, which can take a couple of months.
3. DELAY IN FINAL INSTRUMENT SELECTION AND/OR COMMITMENT GREATLY INCREASES THE RISK OF NOT HAVING AN AIRCRAFT IN TIME. We are already at a moderate-high risk with this.
4. After all this is defined, NASA HQ needs to approve in order to lock in an aircraft/instrument configuration.

SnowEX WINTER 1

REFERENCE SLIDES

Aircraft Discarded
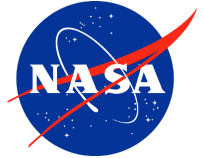
- The following is a detailed list of all aircraft that have been disqualified for SnowEX campaigns:

1. NASA:
    a. AFRC ER-2 (not big enough / too high altitude)
    b. AFRC Global Hawk (not big enough / too high altitude)
    c. AFRC Ikhana (not big enough)
    d. AFRC DC-8 (too expensive / availability not guaranteed)
    e. AFRC B-200 (possible mods needed, LaRC has better options on this)
    f. GRC Lear 25 (being retired)
    g. GRC Lear 35 (has no nadir ports)
    h. GRC Viking (not enough room for operators / major mods for instrument install)
    i. GRC Twin Otter (very limited power)
    j. WFF Sherpa (not enough support / high engineering effort)
    k. WFF P-3 (booked for the next 5 years)
    l. LaRC OV-10 (can only fit 1 instrument. Still haven't gotten them back from the Navy)

2. Others:
    a. Polar 5 and Polar 6 (not enough room)
    b. NCAR / NSF C-130 (needs new nose, cannot guarantee priority over NSF missions)
    c. Dynamic Aviation Dash-8 (No nadir ports. Requires major mods)