[Meeting Title] 1st NG Meeting With Pete

MINUTES [CLICK TO SELECT DATE] 9/14/15 [MEETING TIME] 5:00 [MEETING LOCATION] A329

MEETING CALLED BY	Scott Nicewonger
TYPE OF MEETING	Conference call with Pete from NG
FACILITATOR	
NOTE TAKER	
TIMEKEEPER	
ATTENDEES	

Agenda topics

[TIME ALLOTTED] 5 minutes [TOPIC] Introductions [PRESENTER]

DISCUSSION			
CONCLUSIONS	All introduced. ME from NG name is Pete.		
ACTION ITEMS	~~All introduced. ME from~~	PERSON RESPONSIBLE	DEADLINE

[TIME ALLOTTED] 10 min [TOPIC] Meeting Time [PRESENTER]

DISCUSSION	Monday @ 5:00, email for impromptu questions tuesdays or so. Monday, Tuesday or Wednesday. Depending on when what topics are discussed		
CONCLUSIONS	When electricals and mechanicals are needed		
ACTION ITEMS		PERSON RESPONSIBLE	DEADLINE

[TIME ALLOTTED] 15 min [TOPIC] Separation of Teams [PRESENTER]

DISCUSSION	Separate budgets for both teams. Where is budget held?
CONCLUSIONS	Prototype testsing together. Cost reduction. Mechanical Set of goals needed. ME's on ECE team for component box. $10k for each department.

ACTION ITEMS	PERSON RESPONSIBLE	DEADLINE

[TIME ALLOTTED] 15 min [TOPIC] Budgetary Info/Materials, [PRESENTER]

DISCUSSION	Who actually supplies budget? Components? Laptops/equipment.
CONCLUSIONS	$10K each department. Materials mainly from mechanical? Check for fabricator/vendor we like. Last year's fabricator was cheapest, but not happy with them. Laptops issue was CMS. Xilinx or whatever VHDL we use. w/ FPGA we need. ADEPT was w/ FPGA min.

ACTION ITEMS	PERSON RESPONSIBLE	DEADLINE
Get laptops, xilinx, Project Key	Olivier, Jordan	SOON
↳ Microsoft Project		

[TIME ALLOTTED] END OF Meeting [TOPIC] Plan, Structure [PRESENTER]

DISCUSSION	Plan moving forward, Structure concerns. More Equipment.
CONCLUSIONS	Weekly meeting on Plan with Pete with feedback. JB Welded? Horn Placement. Adjustable bolts, is rickety. May need to reduce weight. Equipment w/ 2 sources coming from Pete. (Spectrum Analyzer) Technical issues, in notes.

ACTION ITEMS	PERSON RESPONSIBLE	DEADLINE
Pract Plan (Critical Path in Project) - Send to Pete	Team	SOON
Calenders on Google	Both Teams	ASAP!!

OBSERVERS	
RESOURCE PERSONS	
SPECIAL NOTES	Get info from ME team. Separate Discussion on Top Down Design

Mid to late October with Pete to go over how radar works.
↳ last week (26-30)

Early October NG recruiters.

Sept. 22nd - EE Top Down Meeting at 5:00
↳ Block Diagram Bring at least Luke and our ME's

Matt
Cammuse (Power Supply)

Sponsor Meeting

[Meeting Title] Top Down Design Review

COE-A229

MINUTES [CLICK TO SELECT DATE] 9/22/15 [MEETING TIME] 5:00 [MEETING LOCATION]

MEETING CALLED BY	Pete Strenger
TYPE OF MEETING	Technical Review
FACILITATOR	Scott
NOTE TAKER	Jordan
TIMEKEEPER	Jordan
ATTENDEES	

Agenda topics

[TIME ALLOTTED] 40min [TOPIC] Block Diagram [PRESENTER]

DISCUSSION	5 GHz on VCO → Amp → SPDT Switch. Top Multiplier x2. TX Antenna located near horns (At end of arms) (4 way) FPGA Board sets the Switch. Transmit Path (30 ns) Pulse 20ns wide. South multiplier. Pulse = ns/foot. Fixed receive
CONCLUSIONS	Get a Switch that Switches in nanoseconds. (BW of about a Gigahertz.) Impedence Matching. Relieving and transmitting signal mix in IQ demod in Phase (LO and RF) I Q = Negative of I Q. Read on travelling wave domain

ACTION ITEMS	PERSON RESPONSIBLE	DEADLINE

[TIME ALLOTTED] 40 min [TOPIC] Mechanical Scope [PRESENTER]

DISCUSSION	How to hold horns. 4 on Structure. 2 on Component box. Structural analysis? Weight to be Fixed. Stability. Frequency of Structure. Stiffen Structure. Find Natural Frequency.
CONCLUSIONS	Error w/in 5% or less. Document all options Considered. Mobile? Let's try for transportation. Holding the horns. Device to align angle of horn. (before RF) Horn locking mechanism. No interference w/ waveguide adapters. Low cost (instead of steel) testing)

ACTION ITEMS	PERSON RESPONSIBLE	DEADLINE
Find thermal analysis? [redacted]		
Condensation Coating?		

[TIME ALLOTTED] 5 min [TOPIC] Needs Analysis for EE team [PRESENTER]

DISCUSSION	Getting Actual Physical goals.
CONCLUSIONS	Needs for 1) Transmit & 2) Recieve. On notes. (Get From Scott)

ACTION ITEMS	PERSON RESPONSIBLE	DEADLINE

[TIME ALLOTTED] 5 Min [TOPIC] Final Thoughts [PRESENTER]

DISCUSSION	Needs Analysis. Goals?
CONCLUSIONS	Achieve Same Performance w/ Stationary Parts and electronically

ACTION ITEMS	PERSON RESPONSIBLE	DEADLINE
Statement of Work	Team	SOON

[TIME ALLOTTED] [TOPIC] Next meeting [PRESENTER]

DISCUSSION	Signal Processing
CONCLUSIONS	Monday @ 5. 9/28/15

ACTION ITEMS	PERSON RESPONSIBLE	DEADLINE

OBSERVERS	
RESOURCE PERSONS	
SPECIAL NOTES	

Meeting Minutes - Faculty Meeting 10/9/2015 11:00 am

Attendees: Dr Foo, Dr Bernadin, Dr Gupta, Dr Hooker
Jordan, Scott, Olivier, Keegan
↗ Scott took lead.

Project Overview: Going over basics, advisors have seen Project. Purpose for metal detection at a distance. Went over goal.

What we want to do: Test signal Path, every component, every wire. Major Software task: test FPGA, run everything on board.

3 working groups: 1st Group - Electrical System (First Phase of testing)
Group 2 - Component Box (Integration btwn ME and ECE team)
Feed horns easily adjustable, improve mounting apparatus.

Question: Dr Gupta: What degree of range will you change horns?
Discussion on no moving parts.
Pass on to ME's → Dr Gupta: markings on setup for fine tuning for mech. angles? ☆
Need to find lasers.
Question on team structure? Working in Parallel with ECE / ME
Clarification on Parallel team responsibility.

Make adjustments to box.
FPGA (MyRio)? We have ref Doc's for FPGA. ↗ winner
LOOK UP ☆ May have to replace switches (Mechanical or Solid State?)
50 MHz operational frequency
Specs on Switches, Dr Gupta can help with information.

Question on advisement/assistance?
☆ Testing log for lab. Collaborating/line of comm open.
↳ keep track of who is doing what tasks

Focus on task, one group doesn't get ahead of the other.
Microsoft Project being used for communication.
Come to Dr Hooker and Dr Gupta for any issue between 2 different teams.

Redesign being implemented, electrical system running before mechanical testing.

Communication on specs / parameters MUST be given to ME team so they can start on design.
Biweekly Meeting with both teams. (Friday Suggestion)
(Get google invites out)

Save for next year

What is going on with the industrial dept?
Signal Processing? Last team had issues w/ VHDL.
Send Dr Benmadin email for meeting w/ Jordan & Olivier for Signal Processing & VHDL.
Admin issues, go to Dr Foo.

Take inventory on all current equipment, line items, etc.
Make a log for safety equipment / handle safety risk situations.
Will we canabalize design? Old antenna/structure will be spare
ME team will have natural frequency testing.
Budget flexibility? Any issues, maybe talk w/ NG.
$5k to start with Provide justification for extra budget
Justification, buying all items.

Friday's at 11:00am best for all advisors

Meeting Minutes - Pete Meeting 10/13/15

Logistics Questions:

Changing lengths of cables? Path length can affect RF. Pete not happy with changing cable length. Possibly reasonable. Will sacrifice Noise (SNR) level. Develop rationale why one option is the best. Possibly pull 16 way switch out of box closer to antenna. Run calc on all three options.

Replacing horns? Quantify dimensions of existing horns first. Call manufacturing Co. ask if any changes will affect performance. Maybe design Patch antenna array? (Probably Not)

Once out of a tutorial Phrase, 1 meeting ($\frac{1}{2}$ ME, $\frac{1}{2}$ ECE) 1 hr Monday or Tuesday for consistency. ☆ Emails to get set up.

ADC: 10 GHz sine wave for Tx 2ns for front edge to hit target / image scene. Trailing end ends at mouth of horn Rx is exact opposite. 20 ns to switch between Tx and Rx Rx Window time it takes for Tx to come back (leading edge) Rx Window = 40ns High is transmit. Low is recieve mode 60 ns for full cycle (20 tx + 40 Rx to come back and go through to FPGA) Mixer multiplies 2 signals. Btwn Tx and Rx, by time signal comes back, switch must switch to LO Port of demodulator in time. 20ns for demodulator to set up. Mixing Process needs to occur in a linear / repeatable manner. LO has fixed Phase, fixed cable length. When mixing 2 - 10 GHz Phase, they will come in as different Phase. $\tan^{-1}(\frac{Q}{I})$ = Phase difference between LO and Rcv signal. This is how you measure different angles of the scene. ↑ I, Q ↓ or inverse. Only two amplitudes to worry. DC component after mixing. I will have Pulse with DC voltage if in Phase, $\frac{1}{2}$ V Pulse every 20 ns, Q will have 0. DC Pulse train after demodulation. Rx window larger, more room to switch to Tx. Delay Tx Pulse however long we want, just means affecting SNR.

Spectral lines every $\frac{1}{T}$ over pulse train. Avg value of Fourier is the DC value. Catch pieces of amplitude & time of Square wave (samples) to convert to 12-bit word. Just grab DC component, then fed to A to D and sample DC voltage (AVG value of pulse train) Bc BW is so low (1/2 MHz), need enough pulses to come through. Time domain of filter (low-pass filter) Pulse = $\frac{1}{1/2\,MHz}$ = 2 μS = impulse response convolve with another time domain signal. At least 20 pulses to get to steady-state value, then will remain constant.
Once done, A to D sampling needs to be done.

☆Convolution in the time domain
All of thise is to measure difference between Phase centers.

LO is reference to measure Phase slope

Next meeting: 10/20/15 5:00 PM.
* Degrading lobes

NG Meeting 10/20/15 (Grading Lobes of Antenna)

Talk on the mechanical & electrical alignment of the horns. Worry about elevation from imager to target. (Ideal is flat)
Adjust while transmitting.

Mike / ME's maybe not needed for in Person. Confirm on this. Friday Oct 30th or Sat. Oct 31st

Degrading lobe. If horns are sufficiently close together, they will basically radiate as one. All will sum together. constructive adding the further apart antennas ~~are~~ are. Scatter at edge of scene, while Pointed at other end, leads to ambiguities. Apertures of 3λ apart, +- 20°, more ambiguity. Limit of unambiguous exent 10°. 2-Way effect ~~from Rx~~ to Tx. Because of this it scans +10°, -10°. Comes down to signal Processing. Because electrically, antennahorns Placed far away from each other, it can eliminate unambiguity issue.

Purpose is to eliminate hardware and cost, but can still be useful (i.e. image a Person)

SNR in key files (Pete will send this) * Key calculation

Faculty Meeting 11/3/15

-Discussing new testing procedures / goals
- Timing diagram for FPGA
- Talk on noise budget
- reworking where some components are housed relative to the horns
- FPGA vs Microprocessor
  Faculty: FPGA maybe best way to go.
  Talk to Dr Meyer - Base
- VCO?
  Has own software, a lot of goal
- Assignments over winter break
- Manufacturer has Application Node for VCO
- Mechanical Questions?
  - Thermal Analysis
  - Structure and hanging on wall
  - Wheels?
- Ordering Parts
  - Frame in mechanical dept.
  - Possible component repair on ECE dept.

NG Meeting Minutes 11/10/15

Reviewing Pete's comments on testing Plan:

- intensity control knob wasn't working 100%, find sweet spot using voltage control
- Four channels. Order Spare A to D's. Verify all four channels are actually working. Verify using Spare FPGA. Use 7-seg display. Connect analog to other A to D inputs, then verify. A/D are inventoried. Familiar with debouncing? Pushbutton runs a 1ms counter before going high or low, takes into account vibration of the button on initial Press.
  A/D Hooked up to $I, \bar{I}, Q, \bar{Q}$
- Make Display look like a voltmeter. Commanding Stripe of Pixels to move bar up and down given different voltage levels. Exercise for display code later on. Show that we know how to interface with the delay.
- FPGA Switching logic. Build off what was already done. Use LED's to test logic. Also test voltage levels. Sliders controlling all 16 Rx Paths & 4 Tx Paths. For SPDT. Make use of as many Ports as necessary.
- Defer Spectrum analyzer tests.
- SPDT Switching (manual) - Needs to be FAST. Send old switch back and get Failure report. (ACTION ITEM- JULIAN) - Minimize Soldering iron heat. (450°F) Hardware for VHDC must be ordered. DO THAT FAST. Check lower bound of the switch. Switch must be 3.5V. (More detail was explained on actual comments - Verify threshold for Switch. Need level Shifts (small circuit design, how off)
- PRIORITY: Buy hardware, especially VHDC connector.
- Test Fidelity of the Fast Pulse. Solderless ~~BREAD~~? Find the Vendor. (Research) Ask Matt Camuse for VHDC connector.

Nobody has this. - Stressed again, DO ALL PART ORDERING

- Delay line. Design and order (or just make own). Delay of about 40 ns and adjust for different Phase Centers. (Hooker, Arora, Kwon) Or use a delay line from length of looped coax cable. Delay Line, RADAR range Simulator
- Color Code inventory. Green = Good to Go; Red = Requires Action

Action Items: Presentation for NOV 19, Thursday 2:15-3:15

NG Meeting Nov. 17, 2015

- Dr Hooker popped in
- Can use display on Arora's Spec. An. (Maybe Not)
- Need quote for shipping from Fed Ex for Donna (Julian) Ground Service - Cheap Option. Have Julian contact Dr Hooker
- Talk on the delay line, how to design it. 50 Ω - Char. Imp. Need to impedence match it. Coax should be 40 ft / $\sqrt{\varepsilon}$ = length
- Creating different Phase Fronts. (different Path Lengths) $d\sin(\theta)$ for each. 180° length. 360° length. I channel to Q channel should FLIP. If it does this, you know it's working. Cable that is ½" and 1"
  ↳ 180° ↳ 360°
- Transmission Equation: Simulate the loss : $\frac{1}{r^4}$ Spreading loss, must attenuate
- What the Project will be about
- Implementing cos and Sin functions in Memory, could run into overflow. Separating im. and re. from 24-bit number. How fast does the calculation need to go? As much as we need! Faster frame rate! (Not necessary this year)
- Energy Scatter, how are the numbers added?
- Timing, Signals must be coordinated. 25 MHz clock.
- Event happens in time, latency exits. How long to show on screen. Want to know quickly.
- Contingency Plan: Think about what we have to do.